BLACKSTONE
ENVIRONMENTAL

October 8, 2024

Mr. Michael B. Leat
Iowa Department of Natural Resources
Land Quality Bureau
Solid Waste Section
502 East 9th Street
Des Moines, Iowa 50319

RE: Industrial Monofill Permit Renewal Application
Continental Cement Davenport Plant CKD Landfill
301 East Front Street
Buffalo, Iowa
IDNR Permit #82-SDP-16-97P

Dear Mr. Leat:

Blackstone Environmental, Inc. (Blackstone), on behalf of Continental Cement Company, LLC (Continental) is pleased to present this Monofill Permit Renewal Application for the Continental Davenport Plant Cement Kiln Dust (CKD) Landfill. The landfill is operated under Iowa Department of Natural Resources (IDNR) Permit Number 82-SDP-16-97P, Revision #4, which was issued on May 1, 2023, and is the fourth revision to the permit issued on January 6, 2022 and is set to expire on January 6, 2025. This Renewal Application has been prepared in general accordance with 567 Iowa Administrative Code 115.

We appreciate your consideration of the attached. Please feel free to contact either of the undersigned if you have any questions or need further information.

Respectfully,
BLACKSTONE ENVIRONMENTAL, INC.

Maren Williams

Maren Williams, EIT	Kyle Kukuk, P.E.
Project Engineer	Senior Project Manager

Industrial Monofill Permit Renewal Application

Continental Cement Davenport Plant CKD Landfill
301 East Front Street
Buffalo, Iowa
IDNR Landfill Permit Number 82-SDP-16-97P

Prepared for:
Continental Cement
301 East Front Street
Buffalo, Iowa 52728

Prepared by:
Blackstone Environmental, Inc.
16200 Foster Street
Overland Park, Kansas 66085

October 8, 2024

INDUSTRIAL MONOFILL PERMIT APPLICATION
CONTINENTAL CEMENT DAVENPORT PLANT CKD LANDFILL
301 EAST FRONT STREET
BUFFALO, IOWA
IDNR LANDFILL PERMIT NUMBER 82-SDP-16-97P

Prepared for:
Continental Cement
301 East Front Street
Buffalo, Iowa 52728

Prepared by:

Maren Williams

Maren Williams, EIT
Project Engineer

Reviewed by:

Kyle Kukuk, P.E.
Senior Project Manager

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Site Location and Background

Continental Cement Company, LLC (Continental) is located at 301 Front Street in Buffalo, Scott County, Iowa (Site). Quarrying and manufacturing of Portland cement products have been conducted at the Continental facility since 1924 and other uses are not anticipated in the future. The cement manufacturing process includes the heating of limestone with silica, alumina, and iron minerals to form clinker. The clinker (nodules of sintered material) is ground into a fine powder and mixed with gypsum to form cement. As part of the manufacturing process, removal of particulate is required to control the composition of the cement product. This material is known as cement kiln dust (CKD). Continental operates an approximately 20-acre monofil for the disposal of CKD. The southern portion of the landfill has been filled to original grade and closed in general accordance with the requirements of the Iowa Department of Natural Resources (IDNR) Permit Number 82-SDP-15-96C. An active landfill disposal cell (Phase II) is operated under IDNR Permit Number 82-SDP-16-97P. The amount of CKD per day disposed at the landfill varies by day. Continental continues to operate with the overall goal of minimizing landfilled CKD and beneficially reusing material when able.

1.2 Site Activities

Placement of CKD material has continued in the Phase II area since issuance of the current permit. These activities are planned to continue until the Phase II area is to grade.

The Phase I landfill area was closed in late 2005.

1.3 Permit Renewal

A Completed Industrial Monofill Permit Application Form 50 is attached in Appendix A as well as required plans and specifications.

2.0 EXECUTIVE SUMMARY

2.1 Summary of Modifications to Approved Plans and Specifications

Modifications to the permit were approved on:

- Revision #1 – April 20, 2022
- Revision #2 – August 25, 2022
- Revision #3 – November 11, 2022
- Revision #4 – May 1, 2023

2.2 Summary of Permit Revisions

The following provides a summary of the permit revisions that have occurred since the permit issuance date of January 6, 2022. There has been a total of four (4) revisions to the permit with the most recent version issued on May 1, 2023, by IDNR.

2.2.1 Permit Revision #1

Permit Revision #1 was issued on April 20, 2022. A summary of the changes to the Special Provisions from that date are as follows:

1. Updated the Licensed Design Engineer to:
    a. Eric Sonsthagen, P.E.
    Blackstone Environmental, Inc.
    P.O. Box 540458
    Omaha, NE 68154
    Phone: 402/208-2014
    Iowa License Number: 248444
2. Special Provision No. 1 – No changes to the January 6, 2022, permit.
3. Special Provision No. 2 – No changes to the January 6, 2022, permit.
4. Special Provision No. 3 – No changes to the January 6, 2022, permit.
5. Special Provision No. 4 – No changes to the January 6, 2022, permit.
6. Special Provision No. 5 – No changes to the January 6, 2022. permit.
7. Special Provision No. 6 – No changes to the January 6, 2022, permit.

2.2.2 Permit Revision #2

Permit Revision #2 was issued on August 25, 2022. A summary of the changes to the Special Provisions from that date are as follows:

1. Special Provision No. 1 – No changes to the April 20, 2022, permit, Revision #1.
2. Special Provision No. 2 – No changes to the April 20, 2022, permit, Revision #1.
3. Special Provision No. 3 – No changes to the April 20, 2022, permit, Revision #1.
4. Special Provision No. 4b was modified. The revision stated, “The Groundwater Remedial Action Mitigation Plan (RAMP; doc #103289) dated May 31, 2022 and amended by the response letter dated August 12, 2022 (doc #103879), both submitted by Blackstone Environmental, was approved on August 25, 2022 and are incorporated into this permit. This plan has been designed to alleviate or reduce contamination to the fullest extent possible at site monitoring points MW-2CR, MW-3L, MW-4, MW-4L, MW-5, MW-7, MW-11, MW-12, MW-14, and MW-18 , in accordance with 567 IAC 115.26(9)”d” and as described in the IDNR letter dated September 9, 2020 (doc #98407). The RAMP includes ongoing evaluations of alternatives to the disposal of cement kiln dust in this landfill. The permit holder shall include updates of these evaluations in the semiannual engineering inspection reports required in the permit’s general provisions.”
5. Special Provision No. 5 – No changes to the April 20, 2022, permit, Revision #1.

6. Special Provision No. 6 was modified. The revision stated, “The permit holder shall close the landfill site in accordance with the Closure, Post Closure Plan (doc #103290) dated May 31, 2022, as submitted by Blackstone Environmental and approved on August 25, 2022.”
7. Special Provision No. 6a was removed from the April 20, 2022, permit, Revision #1 because the Closure, Post Closure Plan was updated (doc #103290). No. 6b-d from the April 20, 2022, permit, Revision #1 were relabeled as No. 6a-c, respectively.

2.2.3 Permit Revision #3

Permit Revision #3 was issued on November 21, 2022. A summary of the changes to the Special Provisions from that date are as follows:

1. Special Provision No. 1 – No changes to the August 25, 2022, permit, Revision #2.
2. Special Provision No. 2 – No changes to the August 25, 2022, permit, Revision #2.
3. Special Provision No. 3f was added and stated, “The UL Replacement CQA Certification Report, dated October 24, 2022 (doc #104643), as submitted by Blackstone Environmental was approved on November 21, 2022 and incorporated into the permit. This report documents the replacement of leachate piezometers UL-2 and UL-3, as a required component of the Remedial Action Mitigation Plan described in special provision #4b.”
4. Special Provision No. 4 – No changes to the August 25, 2022, permit, Revision #2.
5. Special Provision No. 5 – No changes to the August 25, 2022, permit, Revision #2.
6. Special Provision No. 6 – No changes to the August 25, 2022, permit, Revision #2.

2.2.4 Permit Revision #4

Permit Revision #4 was issued on May 1, 2023. A summary of the changes to the Special Provisions from that date are as follows:

1. Special Provision No. 1 – No changes to the November 21, 2022, permit, Revision #3.
2. Special Provision No. 2 – No changes to the November 21, 2022, permit, Revision #3.
3. Special Provision No. 3b was modified regarding updated landfill design plans. The revision stated, “The requirement to submit updated landfill design plans is placed on hold due to the permit holder’s ongoing evaluations of alternatives to disposal of cement kiln dust. IDNR shall reinstitute this requirement if we determine that either (1) insufficient progress regarding these evaluations is made, (2) the evaluation concludes that on-site disposal is the preferred management method, or (3) the groundwater remedial action mitigation plan (special provision #4b) goals are not met. If required, the revised design must include closure and/or hydraulic isolation of the current disposal area with a high performance final cover that minimizes infiltration, and for future cells to include a flexible membrane layer and more efficient leachate collection layer to improve overall liner efficiency.”
4. Special Provision No. 4 – No changes to the November 21, 2022, permit, Revision #3.

5. Special Provision No. 5 – No changes to the November 21, 2022, permit, Revision #3.
6. Special Provision No. 6 – No changes to the November 21, 2022, permit, Revision #3.

2.3 Summary of Permit Amendments

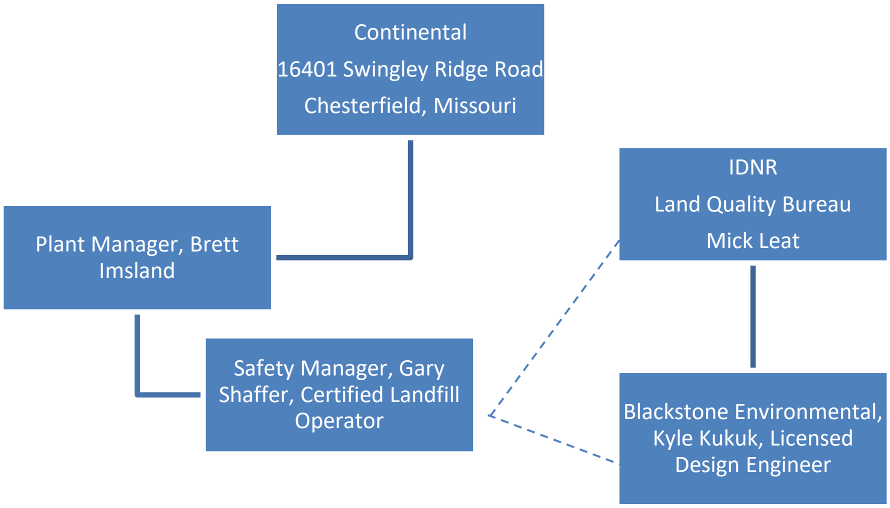
Permit Amendments have not been conducted since the issuance of the permit dated January 6, 2022.

3.0 SITE BOUNDARIES

The Site is shown on Figure 1 and is located approximately four miles west of Davenport, Iowa within Sections 14, 15, 22, and 23 of Township 77 North, - Range 2 East (Buffalo Township), Scott County, Iowa. The development fill area is located between N 1500 to N 2300 and W 300 to E 500. The facility has been in operation, under various ownership, from 1924 for the quarrying of limestone rock and the manufacture of Portland cement. The CKD landfill is located in an inactive portion of the quarry approximately 2,000 feet east of the active quarry area and comprises approximately 20 acres. Figure 2 is a map of the Continental facility that includes the zoning and land use, haul routes, homes and buildings within a half-mile, and section lines and legal boundaries. Airports or runways are not located near the Site. Figure 3 is the landfill location and layout which includes monitoring well locations and cell boundaries. Figure 4 is a wetland map of the area.

4.0 ORGANIZATIONAL CHART

The Site is owned and operated by Continental. Mr. Brett Imsland is the Plant Manager and is the landfill operator responsible for the overall operation of the Continental facility. The certified landfill operator is Mr. Gary Shaffer, Continental Safety Manager. Mr. Shaffer, as well as other personnel, report to Mr. Imsland. An organization chart is below.



The Licensed Design Engineer for Continental should be revised to:

Kyle Kukuk, P.E., Iowa License Number: 22790
Blackstone Environmental, Inc.
16200 Foster Street
Overland Park, Kansas 66085
913-495-9990

5.0 DISPOSAL PROCESS

The CKD area operates in a consistent and predictable manner because the source and nature of the CKD are known. Other waste materials are not allowed in the area.

The CKD is captured with air quality control equipment and stored in a silo located south of the landfill. When the silo is filled, the CKD is wetted to control dust and transported by haul truck to the landfill where it is dumped. End loaders and bulldozers level and push the piles as needed. In general, the landfill is raised uniformly over the surface. The CKD is placed by dumping the trucks onto the landfill working face. The placement is determined by the landfill operator on a weekly basis.

The CKD is hauled from the silo on an on-site gravel access road, across East Front Street, and then again on an on-site gravel access road to the landfill. The gravel access roads have speed limits and are wetted as necessary. East Front Street also has a speed limit. Continental personnel are responsible for maintaining the access roads in a suitable condition for traffic by vehicles.

Due to the cementitious nature of the conditioned CKD, the material tends to bind together when placed at the landfill forming a relatively uniform and solid deposit. The material is able to stand at a relatively steep angle of repose with negligible risk of slumping or slope failure. Further, the material is relatively impervious thereby reducing the likelihood of saturation which could reduce the shear strength and lead to slope instability.

Employees with duties associated with the storage, handling, transport, or disposal of CKD are trained to place CKD in a manner which will reduce the likelihood of slope failures, waste shifts, and waste subsidence. Transport vehicle drivers are instructed to place material at a safe distance back from the edge of the active cell to avoid surcharging the edge of the cell. Accumulated material is periodically pushed into the active cell with earthmoving equipment. The landfill is also inspected weekly so that situations which would lead to mass movement of waste are avoided or quickly corrected.

6.0 EQUIPMENT PLAN

Generally, end loaders and bulldozers are used for placement, compaction, and cover of CKD. Other equipment is available for the operators as needed from the maintenance building located south of the landfill.

6.1 Equipment

The table below details the equipment to be used, capacities, and expected loads.

Equipment	Capacity	Expected Loads
End loader	12 yards	12 yards
Haul trucks	60 tons	60 tons
Bulldozer	none	none
Leachate Pump	20 gallons per minute	20 gallons per minute

7.0 EQUIPMENT CONTINGENCY PLAN

In the event of equipment breakdown, the equipment is either repaired where it broke down or the CKD is removed from the equipment with an excavator and placed into another operating vehicle for disposal.

During maintenance downtime of equipment, Continental has other equipment stored in the maintenance building that will be used.

In the event of a fire in equipment or vehicles, the fire would be extinguished using fire extinguishers located in each vehicle. If the equipment is drivable and safe to be driven after the fire has been extinguished, the CKD will be disposed at the landfill. If the equipment is not drivable/safe, the CKD will be removed from the equipment with an excavator and placed into another operating vehicle for disposal.

8.0 PROOF OF OWNERSHIP

A copy of the legal description is provided in Appendix B.

9.0 HYDROGEOLOGIC INVESTIGATION REPORT/HYDROLOGIC MONITORING SYSTEM PLAN

A Hydrogeologic Investigation Report has not been prepared. Components of this document were included in the Hydrologic Monitoring System Plan (HMSP) and Revised HMSP referenced below.

An HMSP dated March 29, 2021 and Revised HMSP dated April 19, 2021 were prepared by Blackstone and submitted to IDNR. The IDNR approved the Revised HMSP in Permit Revision # 4 dated April 27, 2021. A copy of the Revised HMSP is included in Appendix C.

10.0 SITE OPERATIONS PLAN (SOP) AND DESIGN PLANS

An SOP dated August 27, 2021 and Revised SOP dated November 5, 2021 were prepared by Blackstone and submitted to IDNR. There have been no modifications to the SOP since that time. A copy of the November 5, 2021. Revised SOP is included in Appendix D.

Changes were made to the facility closure drawings and submitted with the Closure, Post-Closure Plan prepared by Blackstone and dated May 31, 2022. Copies of the facility development drawings from the previous permit and May 31, 2022, closure drawings are included in Appendix E.

11.0 CLOSURE/POST CLOSURE PLAN

Changes were made to the Closure/Post Closure Plan for the Site with the issuance of an updated Closure, Post-Closure Plan prepared by Blackstone on May 31, 2022. A copy of the Closure, Post-Closure Plan is included in Appendix F. The updated plan includes landfill closure design drawings.

12.0 EXPLOSIVE GAS CONTROL PLAN

An Explosive Gas Control Plan is not applicable to the Site.

13.0 EMERGENCY RESPONSE AND REMEDIAL ACTION PLAN (ERRAP)

Continental has updated the ERRAP as of September 2024. A copy of the updated ERRAP is included in Appendix G.

14.0 COMPREHENSIVE WASTE MANAGEMENT PLAN

Continental has a Comprehensive Waste Management Plan from June 1997. A copy of the Comprehensive Waste Management Plan is included in Appendix H.

15.0 **CERTIFICATION**

I hereby certify that this engineering document 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.

Kyle Kukuk, PE

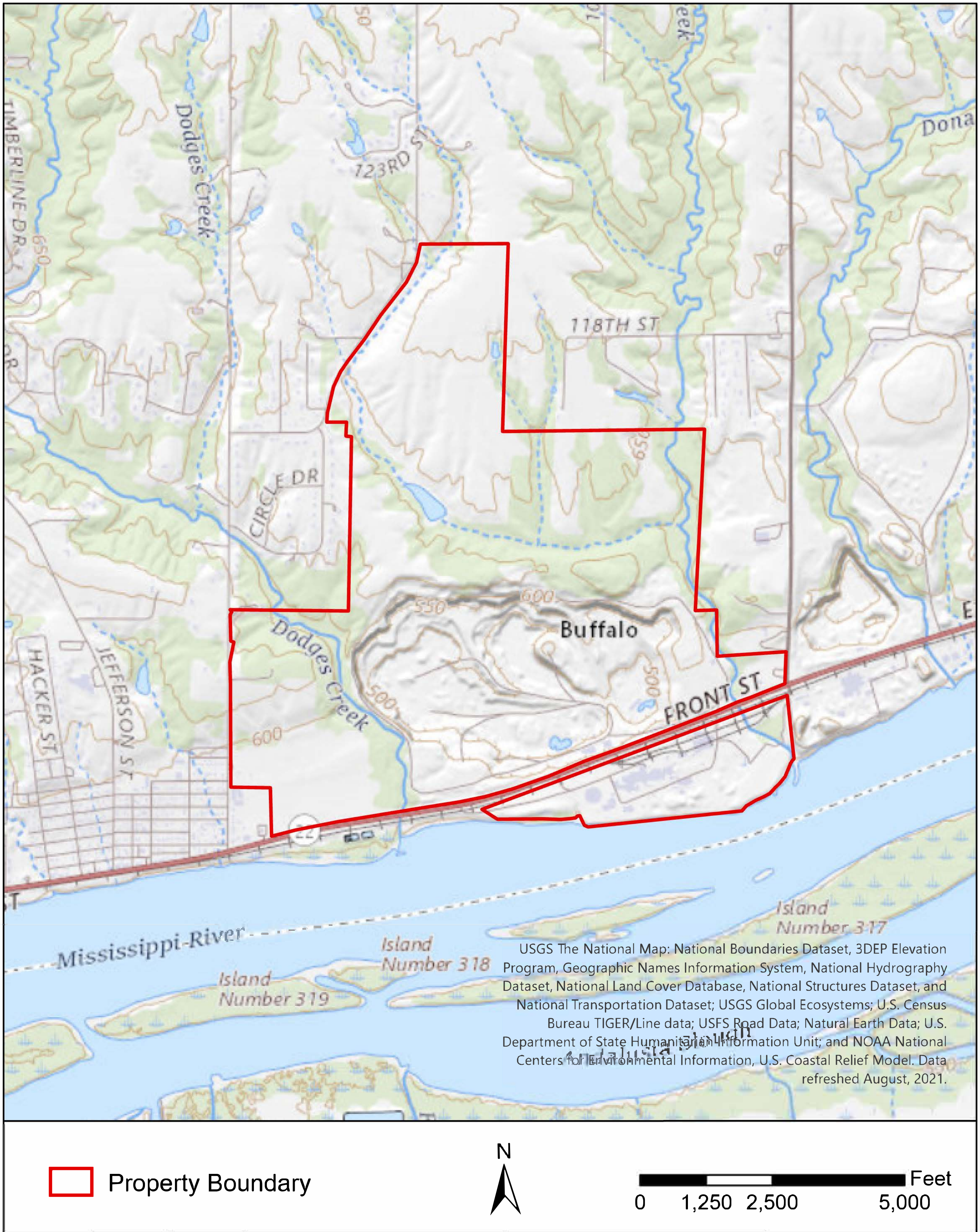
Date 10/8/24 Reg. No. 22790

My license renewal date is December 31, 2025.

BLACKSTONE ENVIRONMENTAL

FIGURES

Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental



USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed August, 2021.

FIGURE
1

Project Mgr. KK
Designed By: TS
Drawn By: TS
Checked By: LJ
Job No.: 3630

Date: June 2024
Rev.:
Rev.:
Rev.:
Rev.:

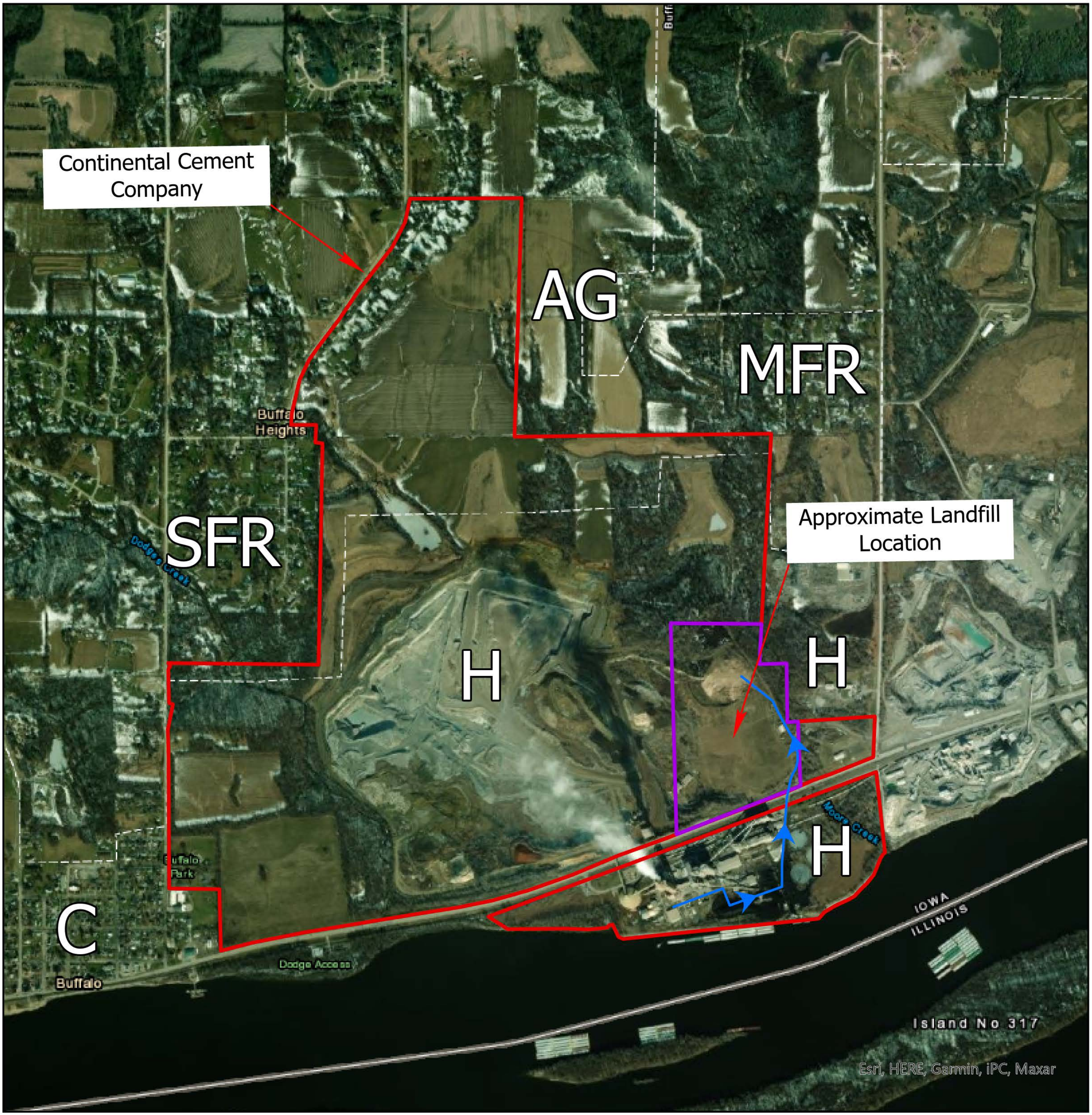
CONTINENTAL CEMENT

BUFFALO, IOWA

SHEET NAME
Site Topographic Vicinity Map
PROJECT NAME
Continental Cement Permit Renewal
PROJECT LOCATION
301 East Front Street Buffalo, Iowa

BLACKSTONE
ENVIRONMENTAL

Path: Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental\Continental.aprx



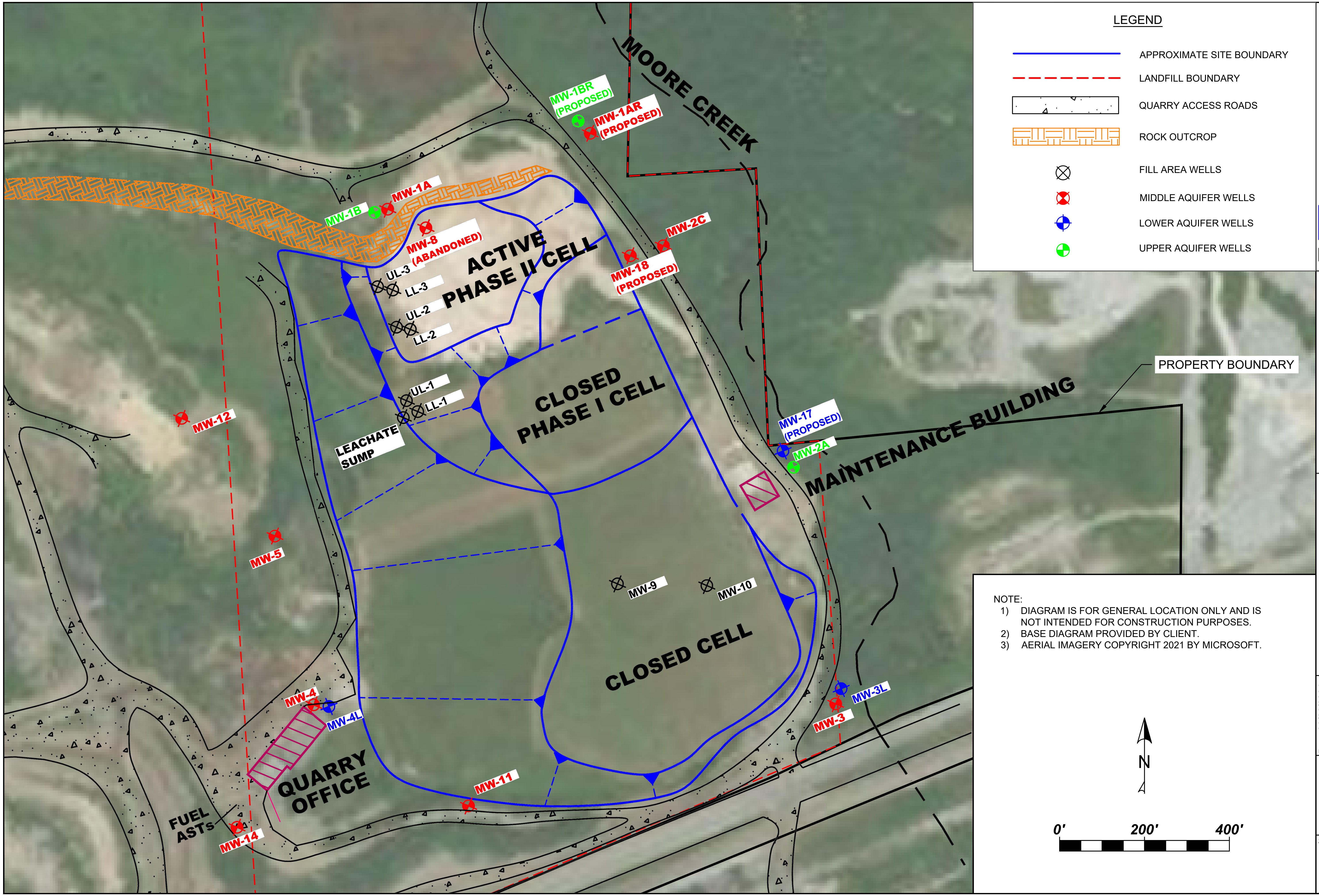
LEGEND

H	- Heavy Industrial	MFR	- Multi-Family Residence
C	- Two Family	SFR	- Single-Family Residence
AG	- Agricultural - General	→	- Haul Route

N

0 1,000 2,000 3,000 4,000 Feet

FIGURE 2	Project Mgr. KK	Date: June 2024	BLACKSTONE ENVIRONMENTAL	CLIENT NAME Continental Cement
	Designed By: ME	Rev.:		SHEET NAME Permit Renewal
	Drawn By: ME	Rev.:		
	Checked by: KB	Rev.:		PROJECT NAME AND LOCATION Site Operations Plan, Buffalo, IA
	Job No.: 3630	Rev.:		



LEGEND

▬	APPROXIMATE SITE BOUNDARY
- - -	LANDFILL BOUNDARY
▭	QUARRY ACCESS ROADS
▨	ROCK OUTCROP
⊗	FILL AREA WELLS
⊗	MIDDLE AQUIFER WELLS
⊕	LOWER AQUIFER WELLS
●	UPPER AQUIFER WELLS

NOTE:
1) DIAGRAM IS FOR GENERAL LOCATION ONLY AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES.
2) BASE DIAGRAM PROVIDED BY CLIENT.
3) AERIAL IMAGERY COPYRIGHT 2021 BY MICROSOFT.

BLACKSTONE ENVIRONMENTAL
16200 FOSTER STREET OVERLAND PARK, KS 66085
P: 913-495-9990 F: 913-648-2077

SHEET NAME: SITE MAP
PROJECT NAME: 2024 LANDFILL PERMIT RENEWAL
PROJECT LOCATION: CEMENT KILN DUST LANDFILL

CLIENT
CONTINENTAL CEMENT COMPANY
301 EAST FRONT STREET
BUFFALO, IOWA 52728

Project Mgr: KK	Date 06/26/2024
Designed By: ES	Rev.
Drawn By: EG	Rev.
Checked By: ES	Rev.
	Rev.

SHEET
1

File: Z:\Shared\Clients\Continental Cement\PROJECTS\3630 - CKD Landfill Permit Renewal Application\WORKING\Figures\Site Map-Spring 2022 Edited June 2024

U.S. Fish and Wildlife Service

National Wetlands Inventory

Continental Cement CKD Landfill

October 4, 2024

Wetlands

- 🟦 Estuarine and Marine Deepwater
- 🟦 Estuarine and Marine Wetland
- 🟩 Freshwater Emergent Wetland
- 🟩 Freshwater Forested/Shrub Wetland
- 🟦 Freshwater Pond
- 🟪 Lake
- 🟫 Other
- 🟦 Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

APPENDIX A

Industrial Monofill Permit Application Form 50

IOWA DEPARTMENT OF NATURAL RESOURCES

Municipal Solid Waste Landfill

PERMIT APPLICATION FORM 50

☐ **New Permit**
☒ **Permit Renewal (permit number)** 82 - SDP - 16 - 97 MLF
☐ **Closure Permit**

SECTION 1: PERMIT APPLICATION REQUIREMENTS

Owner of site

Name: Continental Cement Company, LLC Phone: 636-532-7440
Address: 16401 Swingley Ridge Road, Suite 320 Fax:
City, State, Zip: Chesterfield, MO 63017 E-mail: Brett.Imsland@continentalcement.com

Certified Operator Responsible for Operation at Facility

Name: Gary Shaffer Phone: 563-328-6204/563-328-6234
Address: 301 East Front Street Fax:
City, State, Zip: Buffalo, IA 52728 E-mail: Gary.Shaffer@continentalcement.com

Permit Applicant

Name: Continental Cement Company, LLC Phone: 563-328-6236
Address: 301 East Front Street Fax:
City, State, Zip: Buffalo, IA 52728 E-mail: Shawn.Mages@continentalcement.com

Design Engineer (PE)

Name: Kyle Kukuk Phone: 913-495-9990
Address: 16200 Foster Street Fax:
City, State, Zip: Overland Park, KS 66085 E-mail: kkukuk@blackstone-env.com
Iowa Engineer License #: 22790 Expiration Date: 12/31/2024

Responsible Official for the Facility

Name: Brett Imsland/Continental Cement Company, LLC Phone: 563-328-6236
Address: 301 East Front Street Fax:
City, State, Zip: Buffalo, IA 52728 E-mail: Brett.Imsland@continentalcement.com

Agency and Responsible Official of Agency Served (if any)

Name: Phone:
Address: Fax:
City, State, Zip: E-mail:

Facility

Name: Continental Cement Company, LLC
Address: 301 East Front Street City, State, Zip: Buffal, IA 52728
Legal Description:
See attached

Landfill is part of the following solid waste comprehensive planning area:

Planning Area Name: Continental Cement Davenport Plant CKD Landfill

Date of Last Approved Plan: 12/21/2021

Service area of the landfill (include unincorporated areas and out of state generators):
Continental Cement Plant CKD waste only

Population Served:

SECTION 2: PERMIT APPLICATION SUPPORTING DOCUMENTATION

PLANS AND SPECIFICATIONS

Checking the appropriate boxes below certifies that the documents submitted in conjunction with this application form are complete and in compliance with the applicable chapters of the Iowa Administrative Code. While some of the documents below may have been submitted previously, updated copies of each are required to be provided with each permit renewal application, unless a prior document remains current and is identified by Doc ID#, Section, and Page.

Required Plans and Specifications

☒ Executive Summary

An executive summary shall address the following:

- Summary of modifications, if any, to the approved plans and specifications that occurred during the current permit cycle.
- Summary of each special provision of the current permit to determine if it is to remain the same, be revised or be removed.
- Provide documentation and certification as required for new permit amendment requests, if any.
- Provide documentation and certification as required for equivalency review requests, if any.
- Provide documentation and certification as required for new variance requests from Iowa Administrative Code requirements, if any.

☒ An organizational chart in accordance with Iowa Administrative Code 567 paragraph 113.5(1)"b".

No Revision Required - See Doc ID#, Section, and Page: ____________________

☒ A site exploration and characterization report for the facility that complies with the requirements of subrule 113.6(4).

No Revision Required - See Doc ID#, Section, and Page: ____________________

☒ Design plans and specifications for the facility, and quality control and assurance plans, that comply with the requirements of rule 113.7(455B).

No Revision Required - See Doc ID#, Section, and Page: ____________________

☒ A development and operations (DOPS) plan for the facility, an emergency response and remedial action plan (ERRAP), and proof of MSWLF Operator Certification that comply with the requirements of rule 113.8(455B) .

No Revision Required - See Doc ID#, Section, and Page: ____________________

☒ An environmental monitoring plan that complies with the requirements of rules 113.9(455B) and 113.10(455B).

No Revision Required - See Doc ID#, Section, and Page: ____________________

☒ The project goals and time lines, and other documentation as necessary to comply with subrule 113.4(10) and other requirements of the Department if an RD&D permit is being requested or renewed.

No Revision Required - See Doc ID#, Section, and Page: ____________________

☒ Proof of financial assurance in compliance with rule 113.14(455B).

No Revision Required - See Doc ID#, Section, and Page: ____________________

☒ A closure and postclosure plan that complies with the requirements of rules 113.12(455B) and 113.13(455B).

No Revision Required - See Doc ID#, Section, and Page: ____________________

☒ Comprehensive plan requirements. Attach a copy of the most recent comprehensive plan approval or amendment letter.

No Revision Required - See Doc ID#, Section, and Page: ____________________

☒ Household Hazardous Materials (HHM) collection certification. If applicable, include a plan for HHM temporary collection and storage in accordance with IAC 567 Chapter 123 (455B, 455D, 455F).

No Revision Required - See Doc ID#, Section, and Page: ____________________

In addition to the documents required above, the permit holder shall comply with the implementation plan requirements of subrule 113.2(9), the public notice requirements of subrule 113.4(12), and the record-keeping and reporting requirements of rule 113.11(455B).

If the department finds the permit application information to be incomplete, the department shall notify the applicant of that fact and of the specific deficiencies. If the applicant fails to correct the noted deficiencies within 30 days, the department may reject the application and return the application materials to the applicant. The applicant may reapply without prejudice.

SECTION 3: APPLICANT SIGNATURE

Signature of Permit Applicant: **Date:** 10/8/24

Printed Name: BRETT IMSLAND **Title:** PLANT MANAGER

Applications for sanitary disposal projects must be accompanied by the plans, specifications and additional information required by the applicable solid waste rules under Iowa Administrative Code.

Send completed applications with attached information to the DNR project officer via email or file sharing platform.

For questions concerning this application contact Brian Rath at 515-537-4051, brian.rath@dnr.iowa.gov

APPENDIX B

Legal Description

CONTINENTAL CEMENT COMPANY, L.L.C.

ASSISTANT SECRETARY'S CERTIFICATE

May 9, 2018

The undersigned, being the duly appointed and acting Assistant Secretary of Continental Cement Company, L.L.C., a Delaware limited liability company (the "Company"), hereby certifies, as of the date hereof, on behalf of the Company, solely in such person's capacity as Assistant Secretary of the Company and not in such person's individual capacity, as follows:

1. Pursuant to that certain Asset Purchase Agreement, dated as of April 16, 2015, by and among the Company, Lafarge North America, Inc., a Maryland corporation ("Seller") and certain other parties, as guarantors for the Company, the Company purchased from Seller and Seller sold to the Company certain assets of Seller, including, among other assets, (a) a cement plant located in Buffalo, Iowa (the "Cement Plant"), (b) a quarry located in Davenport, Iowa (the "Quarry") and (c) a cement distribution terminal located in West Des Moines, Iowa (the "Terminal"), in each case more particularly described on the attached Exhibit A (collectively, the "Davenport Properties"), each of which are used in the business of (i) mining aggregates at the Quarry and (ii) producing, marketing, distributing and selling portland cement and related products at or from the Cement Plant and the Terminal (the "Transferred Business").

2. The Company owns all right, title and interest in and to the Davenport Properties used in connection with the Transferred Business.

[Signature page follows]

IN WITNESS WHEREOF, the undersigned has hereunto set his hand on behalf of the Company as of the date first written above.

By: __________________________
Name: Chris Gaskill
Title: Assistant Secretary

EXHIBIT A

Davenport Properties

WEST DES MOINES

THAT PART OF LOT ONE (1) OF THE WEST 854 FEET OF LOT F VALLEY FUNCTION; PART OF LOTS D, E, F AND THE VACATED STREET NORTH OF LOT E IN VALLEY JUNCTION, MORE PARTICULARLY DESCRIBED AS FOLLOWS;

A TRACT OF LAND LYING IN THE NORTHEAST QUARTER OF SECTION 15, TOWNSHIP 78 NORTH, RANGE 25 WEST OF THE FIFTH PRINCIPAL MERIDIAN, MORE PARTICULARLY DESCRIBED AS FOLLOWS. COMMENCING AT THE NORTHWEST CORNER OF LOT F OF THE RECORDED PLAT OF VALLEY JUNCTION, IOWA, WITH SAID NORTHWEST CORNER BEING ON THE LINE BETWEEN THE NORTH QUARTER CORNER AND THE CENTER OF SAID SECTION 15, AND HAVING AN ASSUMED TRUE BEARING SOUTH 0°00' WEST WITH ALL SUBSEQUENT BEARINGS REFERENCED THEREFROM; THENCE SOUTH 87°24' EAST ALONG THE NORTH LINE OF SAID LOT F, A DISTANCE OF 858.3 FEET; THENCE SOUTH 0°00' EAST, A DISTANCE OF 375 FEET; THENCE SOUTH 90°00' EAST, A DISTANCE OF 200 FEET TO THE POINT OF BEGINNING, SAID POINT ALSO BEING THE NORTHEAST CORNER OF PROPERTY DESCRIBED IN DEED DATED AUGUST 31,1953, FROM THE CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD COMPANY TO PENN-DIXIE CEMENT CORPORATION AND AS RECORDED ON PAGE 207, BOOK 2631 IN THE OFFICE OF THE RECORDER OF POLK COUNTY, IOWA; THENCE SOUTH 0°00' EAST A DISTANCE OF 1016.34 FEET; THENCE SOUTH 30°54' WEST, A DISTANCE OF 172.84 FEET TO A POINT OF INTERSECTION WITH A LINE 200 FEET NORTHWESTERLY OF, AS MEASURED AT RIGHT ANGLES TO, AND PARALLEL WITH THE CENTERLINE OF THE MAIN TRACT OF SAID RAILROAD COMPANY; SAID LAST TWO BEARING LINES BEING THE TWO NORTHERLY LINES OF THE EASTERLY BOUNDARIES OF THE PROPERTY DESCRIBED IN SAID DEED DATED AUGUST 31, 1953; THENCE NORTH 47°44' EAST ALONG SAID LINE PARALLEL AND 200 FEET NORTHWESTERLY FROM THE CENTERLINE OF SAID MAIN LINE TRACK, A DISTANCE OF 557.65 FEET TO THE WESTERLY LINE OF ELEVENTH STREET IN THE CITY OF WEST DES MOINES, POLK COUNTY, IOWA; THENCE NORTH 39°46' WEST ALONG THE WESTLINE OF SAID ELEVENTH STREET; A DISTANCE OF 51.7 FEET; THENCE SOUTH 50°14' WEST ALONG SAID WEST LINE OF SAID STREET, A DISTANCE OF 10 FEET; THENCE NORTHERLY ALONG SAID WEST LINE OF SAID STREET, A DISTANCE OF 251.25 FEET ALONG A 316.5 FOOT RADIUS CURVE CONCAVE NORTHEASTERLY AND TANGENT TO THE FOLLOWING COURSE; THENCE NORTH 0°00' EAST ALONG THE SAID WEST LINE OF SAID STREET, A DISTANCE OF 529.87 FEET; THENCE NORTHERLY ALONG SAID WEST LINE OF SAID STREET ON A 256.5 FOOT RADIUS CURVE CONCAVE SOUTHWESTERLY AND

TANGENT TO THE PRECEDING COURSE, A DISTANCE OF 3.2 FEET; THENCE NORTH 90°00' WEST, A DISTANCE OF 197.8 FEET TO THE POINT OF BEGINNING.

AND

COMMENCING AT THE NORTH 1/4 CORNER OF SECTION 15-T78NR25 WEST OF THE 5TH P.M., WEST DES MOINES, POLK COUNTY, IOWA, THENCE S 0°00 E, ALONG THE WEST LINE OF THE N.E. 1/4 OF SAID SECTION 15, 185.15 FEET, TO THE SOUTH RIGHT-OF-WAY LINE OF THE MINNEAPOLIS AND ST. LOUIS RAILROAD, AS II IS PRESENTLY ESTABLISHED, THENCE S 87°26' 1/2" E, ALONG SAID SOUTH RIGHT-OF-WAY LINE, 87.12 FEET. THENCE CONTINUING S 87°26' 1/2" E, ALONG THE SOUTH RIGHT-OF-WAY LINE OF THE MINNEAPOLIS AND ST. LOUIS RAILROAD, AND PARALLEL WITH AND 50.0 FEET NORMALLY DISTANT FROM AND SOUTH OF THE CENTER LINE OF SAID MINNEAPOLIS AND ST. LOUIS RAILROAD, 567.53 FEET, TO THE POINT OF BEGINNING, THENCE CONTINUING S 87°26 1/2' E ALONG SAID SOUTH RIGHT-OF-WAY LINE OF THE MINNEAPOLIS AND ST. LOUIS RAILROAD, 200.2 FEET, THENCE S 0°00' E, PARALLEL TO AND 854.0 FEET EAST OF THE WEST LINE OF THE NE 1/4 OF SAID SECTION 15, 375.0 FEET, THENCE N 90°00 E, 200.0 FEET, THENCE S 0°00' E, PARALLEL WITH AND 1054.0 FEET EAST OF THE WEST LINE OF THE NE 1/4 OF SAID SECTION 15, 1018.8 FEET, THENCE S 30°44' W 173.86 FEET, TO THE NORTHWESTERLY RIGHT-OF-WAY LINE OF THE CHICAGO-ROCK ISLAND AND PACIFIC RAILROAD, AS IT IS PRESENTLY ESTABLISHED, THENCE S 47°42 1/2' W, PARALLEL WITH AND 200.0 FEET NORMALLY DISTANT FROM AND NORTHWESTERLY OF THE CENTER LINE OF THE MAIN LINE TRACK OF THE CHICAGO-ROCK ISLAND PACIFIC RAILROAD, AND ALONG THE NORTHWESTERLY RIGHT-OF-WAY OF SAID CHICAGO-ROCK ISLAND AND PACIFIC RAILROAD 420.63 FEET TO A POINT ON SAID NORTHWESTERLY RIGHT-OF-WAY OF THE CHICAGO-ROCK ISLAND AND PACIFIC RAILROAD,THENCE N 0°00' W, PARALLEL WITH AND 654.0 FEET EAST OF THE WEST LINE OF THE NE 1/4 OF SAID SECTION 15,1834.21 FEET TO THE POINT OF BEGINNING.

ALL BEING AN OFFICIAL PLAT, NOW INCLUDED IN AND FORMING A PART OF THE CITY OF WEST DES MOINES. POLK COUNTY, IOWA (EXCEPT THAT PART PLATTED AS SCHRODER INDUSTRIAL PARK).

DAVENPORT (BUFFALO, IOWA):

CHAIN ONE AND TWO:

PARCEL NO. 1: PART OF THE NORTHEAST QUARTER OF SECTION 23 IN TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M., MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING ON THE NORTH LINE OF SAID QUARTER SECTION AT A POINT 15 CHAINS AND 40 LINKS WEST OF THE NORTHEAST CORNER OF SAID NORTHEAST QUARTER; THENCE RUNNING WEST 24 CHAINS AND 60 LINKS TO THE NORTHWEST CORNER OF SAID QUARTER SECTION; THENCE SOUTH 40 CHAINS

AND 55 LINKS TO THE NORTH BANK OF THE MISSISSIPPI RIVER; THENCE NORTH 66 DEGREES EAST, 1 CHAIN AND 43 LINKS TO A POINT ON SAID RIVER BANK; THENCE NORTH 84 DEGREES EAST, ON AND ALONG SAID RIVER BANK TO A POINT 24 CHAINS AND 1 LINK DISTANT; THENCE NORTH 37 CHAINS AND 47 LINKS TO THE PLACE OF BEGINNING.

EXCEPTING THEREFROM THE RIGHT OF WAY OF THE CHICAGO, ROCK ISLAND AND PACIFIC RAILWAY COMPANY; AND EXCEPTING PUBLIC HIGHWAYS.

PARCEL NO. 2: THE WEST ONE-HALF OF THE SOUTHEAST QUARTER OF SECTION 4, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M., SCOTT COUNTY, IOWA.

PARCEL NO. 3: LOTS 3 AND 4 OF THE SUBDIVISION OF THE ESTATE OF ELIAS MOORE, DECEASED, IN THE NORTHEAST QUARTER OF SECTION 23, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M. MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT A POINT IN THE EAST LINE OF SECTION 23 WHICH IS 8 CHAINS 59 LINKS SOUTH OF THE NORTHEAST CORNER OF SAID SECTION; THENCE RUNNING DUE WEST 15 CHAINS AND 40 LINKS; THENCE RUNNING DUE SOUTH 28 CHAINS AND 88 LINKS TO A STAKE STANDING ON THE BANK OF THE MISSISSIPPI RIVER; THENCE WITH THE MEANDERS OF THE SAID RIVER NORTH 84 DEGREES EAST 12 CHAINS AND 99 LINKS; THENCE WITH THE MEANDERS OF SAID RIVER NORTH 62 DEGREES EAST 2 CHAINS 82 LINKS; MORE OR LESS, TO A EAST LINE OF SAID SECTION; THENCE DUE NORTH ALONG THE EAST LINE OF SAID SECTION 26 CHAINS AND 13 LINKS TO THE PLACE OF BEGINNING, SUBJECT TO RAILROAD RIGHTS-OF WAY AND TO PUBLIC HIGHWAYS.

PARCEL NO. 4: THE EAST HALF OF THE SOUTHWEST QUARTER OF SECTION 14, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M. (DOES NOT INCLUDE PARCEL NO. 5 TRACT.)

PARCEL NO. 6: ALL THAT PART OF THE LAND INCLUDED IN THE PLAT OF THE ESTATE OF LEROY DODGE RECORDED IN PARTITION SUIT NO. 13437 IN THE DISTRICT COURT OF IOWA IN AND FOR SCOTT COUNTY, SAID PLAT INCLUDING LAND SITUATED IN SECTIONS 14, 15, 22 AND 23, TOWNSHIP 77 NORTH, RANGE 2 EAST, DESCRIBED AS FOLLOWS:

ALL OF LOT 1, ACCORDING TO SAID PLAT,

ALL OF LOT 2, ACCORDING TO SAID PLAT,

ALL OF LOT 3, ACCORDING TO SAID PLAT,

ALL OF THAT PART OF THE LOT 7, ACCORDING TO SAID PLAT, WHICH LIES SOUTH OF THE SECTION LINE BETWEEN SAID SECTIONS 15 AND 22,

ALL OF LOT 8, ACCORDING TO SAID PLAT, EXCEPT (A) THAT PART CONVEYED BY FRANK L. DODGE TO DAVENPORT PAVING BRICK & TILE COMPANY BY DEED

RECORDED IN BOOK 57 OF LAND DEEDS, AT PAGE 490, (B) THAT PART CONVEYED BY FRANK L. DODGE TO HORACE H. CASS BY DEED RECORDED IN BOOK 48 OF LAND DEEDS, AT PAGE 283, AND IN BOOK 49 OF LAND DEEDS, AT PAGE 288, (C) THAT PART CONVEYED BY FRANK L. DODGE TO DORMAN & MOOREHEAD BY DEED RECORDED IN BOOK 52 OF LAND DEEDS, AT PAGE 83, (D) THAT PART THERETOFORE CONVEYED BY FRANK L. DODGE TO THE CHICAGO, ROCK ISLAND & PACIFIC RAILWAY COMPANY FOR STATION GROUNDS, (E) THAT PART CONVEYED BY DEWEY PORTLAND CEMENT COMPANY TO BUFFALO, IOWA, INDEPENDENT SCHOOL DISTRICT NO. 1 BY DEED RECORDED IN BOOK 90 OF LAND DEEDS, AT PAGE 45, AND (F) THAT PART CONVEYED BY DEWEY PORTLAND CEMENT COMPANY TO IOWA-ILLINOIS GAS AND ELECTRIC COMPANY BY DEED RECORDED IN BOOK 243 OF DEEDS, AT PAGE 238.

ALL OF LOT 9, ACCORDING TO SAID PLAT.

EXCEPTING THEREFROM THAT PORTION THEREOF CONVEYED TO THE CITY OF BUFFALO, IOWA, BY QUIT CLAIM DEED DATED JULY 22, 1980 AND RECORDED AS DOCUMENT #7502-81 IN THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA.

EXCEPTING THEREFROM THAT PORTION THEREOF CONVEYED TO THE STATE OF IOWA BY DEED DATED AUGUST 3, 1982 AND RECORDED AS DOCUMENT #12944-82 IN THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA.

PARCEL NO. 7: THAT 8 ACRE PORTION OF THE BED OF THE MISSISSIPPI RIVER WHICH LIES ADJACENT TO THE IOWA BANK OF SAID RIVER AND ADJACENT TO THE SOUTHERLY LINE OF GOVERNMENT LOTS TWO (2) AND THREE (3) OF SECTION TWENTY-THREE (23) OF TOWNSHIP SEVENTY-SEVEN (77) NORTH, RANGE TWO (2) EAST OF THE FIFTH PRINCIPAL MERIDIAN, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHEAST CORNER OF SAID SECTION THENCE SOUTH 1740.10 FEET ALONG THE EAST LINE OF SAID SECTION; THENCE SOUTH 32 DEGREES 40 MINUTES WEST 1162.25 FEET TO THE NORTHEAST CORNER OF THE PRESENT SEA-WALL; THENCE ALONG THE FACE OF SAID SEA-WALL AND ALONG THE IOWA BANK OF SAID RIVER, SOUTH 33 DEGREES 48 MINUTES WEST 51.20 FEET; THENCE SOUTH 82 DEGREES 6 MINUTES WEST 455.70 FEET; THENCE SOUTH 81 DEGREES 39 MINUTES WEST 419.70 FEET TO THE WESTERLY END OF SAID SEA-WALL; THENCE SOUTH 85 DEGREES 16 ½ MINUTES WEST 310 FEET TO THE POINT OF BEGINNING; THENCE SOUTH 85 DEGREES 16 ½ MINUTES WEST 1100 FEET TO THE EASTERLY BANK OF A PRESENT CREEK OUTLET AT A POINT APPROXIMATELY 2930 FEET WEST OF AND 3000 FEET SOUTH OF THE NORTHEAST CORNER OF SAID SECTION; THENCE NORTHERLY ALONG SAID CREEK OUTLET BANK TO THE PRESENT IOWA SHORE LINE OF SAID RIVER AT ELEVATION OF 547 FEET ABOVE MEAN SEA-LEVEL; THENCE EASTERLY ALONG SAID SHORE LINE TO A POINT 1860 FEET WEST OF AND 2550 FEET SOUTH OF THE NORTHEAST CORNER OF SAID SECTION; THENCE SOUTHERLY 330 FEET ALONG THE WEST LINE OF THE

PREMISES OWNED BY DEWEY PORTLAND CEMENT COMPANY TO THE POINT OF BEGINNING.

EXCEPTIONS TO ALL THE ABOVE PARCELS

EXCEPT THAT PORTION DEEDED TO THE STATE OF IOWA BY DEED DATED AUGUST 31, 1982 AND RECORDED AS DOCUMENT NO. 12944-82 IN THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA, AND EXCEPTING THOSE LANDS CONDEMNED BY THE UNITED STATES OF AMERICA UNDER ORDER DATED AUGUST 11, 1939 AND RECORDED IN THE OFFICE OF THE SCOTT COUNTY, IOWA RECORDER AT BOOK 82 LAND DEEDS, PAGE 264 AND EXCEPTING THE TRACT CONVEYED TO THE CITY OF BUFFALO, IOWA BY DEED DATED JULY 22, 1980 AND RECORDED IN THE OFFICE OF THE SCOTT COUNTY, IOWA RECORDER AS DOCUMENT NO. 7502-81.

PARCELS NO. 10 AND 11: THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 14, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M. ALSO DESCRIBED AS LOT 4 IN THE PARTITION OF THE ESTATE OF LEROY DODGE.

ALSO PART OF THE SOUTHEAST QUARTER OF SECTION 15, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M., DESCRIBED AS COMMENCING AT THE NORTHEAST CORNER OF THE SOUTHEAST QUARTER OF SAID SECTION 15; THENCE WEST ON THE NORTH LINE OF SAID SOUTHEAST QUARTER OF SECTION 15, 15 CHAINS; THENCE SOUTH ON THE EAST LINE OF LOT 6, 20 CHAINS; THENCE EAST ON THE NORTH LINE OF LOT 1, 15 CHAINS; THENCE NORTH ON THE WEST LINE OF LOT 4, 20 CHAINS TO THE PLACE OF BEGINNING, WHICH REAL ESTATE IS ALSO DESCRIBED AS LOT 5 IN THE PARTITION OF THE ESTATE OF LEROY DODGE, DECEASED.

THE ABOVE DESCRIBED TRACTS OF REAL ESTATE ARE PARTICULARLY DESCRIBED BY SURVEY AS FOLLOWS:

BEGINNING AT THE NORTHEAST CORNER OF THE SOUTHEAST ¼ OF SECTION 15, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH PRINCIPAL MERIDIAN SAID POINT BEING ALSO THE NORTHWEST CORNER OF THE SOUTHWEST ¼ OF SECTION 14, TOWNSHIP AND RANGE AFORESAID, THENCE NORTH 89 DEGREES 52 MINUTES 14 SECONDS EAST ALONG THE NORTH LINE OF THE SAID SOUTHWEST
¼ OF SECTION 14 A DISTANCE OF 1331.0 FEET; THENCE SOUTH 0 DEGREES 42 MINUTES 49 SECONDS WEST 1331.34 FEET; THENCE NORTH 89 DEGREES 52 MINUTES 41 SECONDS WEST 2325.32 FEET TO THE SOUTHEAST CORNER OF LOT 44 DEVIL'S CREEK ESTATES ADDITION; THENCE NORTH 0 DEGREES 37 MINUTES 00 SECONDS EAST ALONG THE EAST LINE OF SAID DEVIL'S CREEK ESTATES ADDITION A DISTANCE OF 1325.43 FEET; THENCE SOUTH 89 DEGREES 52 MINUTES 53 SECONDS EAST 996.64 FEET TO THE PLACE OF BEGINNING. SITUATED IN BUFFALO TOWNSHIP, SCOTT COUNTY, IOWA.

CHAIN THREE:

PARCEL 12

THE NORTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 14; THE NORTH 16 ACRES OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 14; THE EAST 20 ACRES OF THE NORTHEAST QUARTER OF THE NORTHEAST QUARTER OF SECTION 15; EXCEPT THOSE PORTIONS THERE CONVEYED BY DOCUMENT NUMBERS 13993-82 AND 18202 83, RECORDS OF THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA.

ALSO, THE NORTH HALF OF THE SOUTHEAST QUARTER OF THE NORTHEAST QUARTER OF SECTION 15 EXCEPT THAT PART DESCRIBED AS COMMENCING AT A POINT ON SECTION LINE BETWEEN SECTIONS 14 AND 15; THENCE NORTH 20 FEET FROM CENTER LINE OF SOUTHEAST QUARTER OF THE NORTHEAST QUARTER OF SECTION 15; THENCE WEST 73 RODS, THENCE SOUTH 20 FEET; THENCE EAST 73 RODS TO THE PLACE OF BEGINNING, AND ALSO EXCEPTING THEREFROM THAT PORTION SOLD ON CONTRACT RECORDED AS DOCUMENT NUMBER 9033 75, RECORDS OF THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA, ALL IN TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH PRINCIPAL MERIDIAN.

CHAIN FOUR:

PARCEL 13

THE SOUTH 16 ACRES OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 14, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M. THE NORTH 8 ACRES OF THE SOUTH 24 ACRES, BEING LOT THREE OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 14, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M.

THE SOUTH 20 ACRES OF THE SOUTHEAST QUARTER OF THE NORTHEAST QUARTER OF SECTION 15, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M., EXCEPTING THEREFROM THE LAND INCLUDED IN LOTS 15 AND 16 IN BUFFALO HEIGHTS, AS APPEARS FROM THE PLAT OF SAID SUBDIVISION RECORDED IN BOOK 63 OF MISCELLANEOUS RECORDS, ON PAGE 291, IN THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA.

ALSO, A STRIP OF LAND COMMENCING AT THE NORTHWEST CORNER OF LAST TRACT ABOVE, THENCE WEST 73 RODS, NORTH 20 FEET, EAST 73 RODS, AND SOUTH 20 FEET TO THE PLACE OF BEGINNING.

EXCEPT THAT PORTION OF THE ABOVE DESCRIBED REAL ESTATE THAT WAS CONVEYED TO ALBERT VINER AND WINONA B. VINER BY THE QUIT CLAIM DEED DATED JANUARY 18, 1973, AND RECORDED AS DOC. #963-73 IN THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA.

CHAIN 5:

PARCEL 14

ALL THAT PORTION OF THE LAND INCLUDED IN THE PLAT OF THE ESTATE OF LEROY DODGE, RECORDED IN PARTITION SUIT NO 13437 IN THE DISTRICT COURT OF IOWA, AND SCOTT COUNTY, SAID PLAT INCLUDING LAND SITUATED IN SECTIONS 14, 15, 22 & 23 OF TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH PRINCIPAL MERIDIAN SCOTT COUNTY, IOWA, LYING SOUTH OF THE SOUTHERLY RIGHT-OF-WAY LINE OF IOWA STATE HIGHWAY 22 AND NORTH OF THE ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AS A POINT OF REFERENCE AT THE NORTHEAST CORNER OF SECTION 23, TOWNSHIP 77 NORTH, RANGE 2 EAST;

THENCE SOUTH 00°1'51" WEST 1139.58 FEET ALONG THE EAST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 23 TO A POINT ON THE SOUTHERLY RIGHT-OF-WAY LINE OF THE CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD SAID RIGHT-OF-WAY LINE BEING 50 FEET IN PERPENDICULAR DISTANCE SOUTHEASTERLY FROM THE CENTERLINE OF THE WEST-BOUND MAIN LINE (NORTHERLY OF TWO) TRACK (FOR PURPOSES OF THIS DESCRIPTION, THE SAID EAST LINE OF THE NORTHEAST QUARTER OF SECTION 23 IS ASSUMED TO BEAR SOUTH 00°1'51" WEST);

THENCE SOUTH 68° 24''17" WEST 3916.36 FEET ALONG THE SAID SOUTHERLY RIGHT-OF-WAY LINE OF THE CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD PARALLEL TO THE CENTERLINE OF THE SAID WEST-BOUND MAIN LINE TRACK, TO A POINT OF TANGENCY OF THE SAID RAILROAD RIGHT-OF-WAY LINE;

THENCE SOUTHWESTERLY 799.65 FEET ALONG THE SAID SOUTHERLY RIGHT-OF- WAY LINE OF THE CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD ALONG A
5799.58 FEET RADIUS CURVE, CONCAVE NORTHWESTERLY, PARALLEL TO THE CENTERLINE OF THE SAID WEST-BOUND MAIN LINE TRACK TO THE POINT OF BEGINNING (THE CHORD OF SAID CURVE BEARS SOUTH 77° 22' 03" WEST 79.03 FEET);

THENCE SOUTH 61° 13'53" EAST 307.06 FEET TO A POINT AT THE ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER;

THENCE ALONG THE FOLLOWING DESCRIBED MEANDER OF THE ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER;

NORTH 87° 50'58" WEST 418.37 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 80° 10" 32" WEST 325.68 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 76° 47' 55" WEST 293.01 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 6° 40' 17" WEST 351.51 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 4° 36'47" WEST 74.21 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 36° 24'29" WEST 191.26 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 6° 56'22" WEST 250.63 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 6° 24' 17" WEST 245.81 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE NORTH 88° 05'04" WEST 276.83 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE NORTH 88° 51' 27" WEST 254.28 FEET ALONG THE SAID ORDINARY HIGH WATER POINT OF THE MISSISSIPPI RIVER TO A POINT;

THENCE NORTH 88° 06' 32" WEST 422.12 FEET ALONG THE SAID ORDINARY HIGH WATER POINT OF THE MISSISSIPPI RIVER TO A POINT.

Ember
Stanley [illegible] Center

8161-83
83 MAY 24 P3:35
$43.00 [illegible]
FILED
[illegible]
SCOTT COUNTY, IOWA

SPECIAL WARRANTY DEED

Recording fee $ 18.00
Transfer fee $ 25.00

KNOW ALL MEN BY THESE PRESENTS:

That MARTIN MARIETTA CORPORATION, a corporation organized and existing under the laws of the State of Maryland, in consideration of the sum of one dollar and other valuable consideration in hand paid does hereby CONVEY unto Davenport Cement Company, an Iowa general partnership

The following described real estate situated in Scott County, Iowa:

Parcel No. 1: Part of the Northeast Quarter of Section 23 in Township 77 North, Range 2 East of the 5th P.M., more particularly described as follows:

Commencing on the North line of said quarter section at a point 15 chains and 40 links West of the Northeast corner of said Northeast Quarter; thence running West 24 chains and 60 links to the Northwest corner of said quarter section; thence South 40 chains and 55 links to the North bank of the Mississippi River; thence North 66 degrees East, 1 chain and 43 links to a point on said river bank; thence North 84 degrees East, on and along said river bank to a point 24 chains and 1 link distant; thence North 37 chains and 47 links to the place of beginning.

Excepting therefrom the right of way of The Chicago, Rock Island and Pacific Railway Company; and excepting public highways.

Parcel No. 2: The West one-half of the Southeast Quarter of Section 14, Township 77 North, Range 2 East of the 5th P.M., Scott County, Iowa.

Parcel No. 3: Lots 3 and 4 of the subdivision of the Estate of Elias Moore, deceased, in the Northeast Quarter of Section 23, Township 77 North, Range 2 East of the 5th P.M., more particularly described as follows:

Commencing at a point in the East line of Section 23 which is 8 chains 59 links South of the Northeast corner of said section; thence running due West 15 chains and 40 links; thence running due South 28 chains and 88 links to a stake standing on the bank of the Mississippi River; thence with the meanders of the said river North 84 degrees East 12 chains and 99 links; thence with the meanders of said river North 62 degrees East 2 chains 82 links, more or less, to the East line of said section; thence due North along the East line of said Section 26 chains and 13 links to the place of beginning, subject to railroad rights-of-way and to public highways.

chains and 13 links to the place of beginning, subject to railroad rights-of-way and to public highways.

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED

12,200.65

Parcel No. 4. The East Half of the Southwest Quarter of Section 14, Township 77 North, Range 2 East of the 5th P.M.

(This Deed does not contain a Parcel 5 tract.)

Parcel No. 6. All that part of the land included in the plat of the Estate of LeRoy Dodge recorded in partition suit No. 13437 in the District Court of Iowa in and for Scott County, said plat including land situated in Sections 14, 15, 22 and 23, Township 77 North, Range 2 East, described as follows:

All of Lot 1, according to said plat,

All of Lot 2, according to said plat,

All of Lot 3, according to said plat,

All that part of the Lot 7, according to said Plat, which lies south of the section line between said Sections 15 and 22,

All of Lot 8, according to said plat, EXCEPT (a) that part conveyed by Frank L. Dodge to Davenport Paving Brick & Tile Company by deed recorded in Book 57 of Land Deeds, at page 490, (b) that part conveyed by Frank L. Dodge to Horace H. Cass by deed recorded in Book 48 of Land Deeds, at page 283, and in Book 49 of Land Deeds, at page 288, (c) that part conveyed by Frank L. Dodge to Dorman & Moorehead by deed recorded in Book 52 of Land Deeds, at page 83, (d) that part heretofore conveyed by Frank L. Dodge to The Chicago, Rock Island & Pacific Railway Company for station grounds, (e) that part conveyed by Dewey Portland Cement Company to Buffalo, Iowa, Independent School District No. 1 by deed recorded in Book 90 of Land Deeds, at page 45, and (f) that part conveyed by Dewey Portland Cement Company to Iowa-Illinois Gas and Electric Company by deed recorded in Book 243 of Deeds, at page 238.

All of Lot 9, according to said plat.

Excepting therefrom that portion thereof conveyed to the City of Buffalo, Iowa, by Quit Claim Deed dated July 22, 1980 and recorded as Document #7502-81 in the office of the Recorder of Scott County, Iowa.

Excepting therefrom that portion thereof conveyed to the State of Iowa by Deed dated August 3, 1982 and recorded as Document #12944-82 in the office of the Recorder of Scott County, Iowa.

Parcel No. 7. That 8 acre portion of the bed of the Mississippi River which lies adjacent to the Iowa Bank of said river and adjacent to the Southerly line of Government Lots Two (2) and Three (3) of Section Twenty-Three (23) of Township Seventy-seven (77) North, Range Two (2) East of the Fifth Principal Meridian, more particularly described as follows:

Commencing at the Northeast corner of said Section; thence south 1740.10 feet along the East line of said section; thence south 32 degrees 40 minutes west 1162.25 feet to the northeast corner of the present sea-wall; thence along the face of said sea-wall and along the Iowa bank of said river, South 33 degrees 48 minutes West 51.20 feet; thence South 82 degrees 6 minutes West 455.70 feet; thence South 81 degrees 39 minutes West 419.70 feet to the Westerly end of said sea-wall; thence South 85 degrees 16 1/2 minutes West 310 feet to the point of beginning; thence South 85 degrees 16 1/2 minutes West 1100 feet to the Easterly bank of a present creek outlet at a point approximately 2930 feet West of and 3000 feet South of the Northeast corner of said section; thence Northerly along said creek outlet bank to the present Iowa shore line of said river at elevation of 547 feet above mean sea-level; thence Easterly along said shore line to a point 1860 feet West of and 2550 feet South of the Northeast corner of said section; thence Southerly 330 feet along the West line of the premises owned by Dewey Portland Cement Company to the point of beginning.

EXCEPTIONS TO ALL OF THE ABOVE PARCELS

Except that portion deeded to the State of Iowa by Deed dated August 31, 1982 and recorded as Document No. 12944-82 in the office of the Recorder of Scott County, Iowa, and excepting those lands condemned by the United States of America under order dated August 11, 1939 and recorded in the office of the Scott County, Iowa, Recorder at Book 82 Land Deeds, Page 264 and excepting the tract conveyed to the City of Buffalo, Iowa by deed dated July 22, 1980 and recorded in the office of the Scott County, Iowa Recorder as Document No. 7502-81.

ALL OF THE FOREGOING PARTICULARLY DESCRIBED PARCELS OF REAL ESTATE ARE CONVEYED SUBJECT TO THE FOLLOWING:

Subject to a certain Grant of Easement to the Town of Buffalo, Iowa, dated December 1, 1972 and filed for record in the Office of the Recorder of Scott County, Iowa, as Document Number 1100-73 on January 24, 1973 and a certain Lease Agreement between the Town of Buffalo, Iowa, as lessor, and Marietta Facilities, Inc., a Delaware Corporation as lessee dated December 1, 1972 and recorded in the Office of the Recorder of Scott County, Iowa, as Document No. 1101-73 on January 24, 1973 and a certain Indenture of Trust dated December 1, 1972 between the Town of Buffalo, Iowa, and Davenport Bank and Trust Company of Davenport, Iowa, as Trustee which Indenture of Trust is dated December 1, 1972 and is recorded in the Office of the Scott County, Iowa Recorder as Document No. 1102-73 on January 24, 1973; and

Further subject to the terms, provisions, covenants, conditions and restrictions contained in and rights and obligations created by a Lease Agreement dated May 21, 1971 and filed for record February 8, 1978 in the Office of the Scott County, Iowa Recorder as Document Number 2311-78 by and between Martin Marietta Corporation, Linwood Stone Products Company, an Iowa Corporation and Schwerman Trucking Company a Wisconsin corporation; and

Further subject to all other existing leases and rights of tenants in possession, existing railroad rights of way and depot grounds, easements, restrictions, reservations, or agreements of record, the rights of the public and the State of Iowa in roads and highways through the same, taxes and assessments, general and special, not now due and payable, and a certain boundary Adjustment Agreement between Grantor and the State of Iowa recorded on October 4, 1982 in the office of the Recorder of Scott County, Iowa as Document No. 12945-82, and TOGETHER WITH any easements appurtenant or of record for the benefit of the real estate herein conveyed; and

Further subject to any rights or claims of the United States of America in and to the subject premises acquired pursuant to a certain order vesting title entered in the United States District Court for the Southern District of Iowa, Davenport Division, dated August 11, 1939 and filed in the office of the Recorder of Scott County, Iowa on August 18, 1939 at Book 82 Land Deeds 264; and

Further subject to the rights of the United States of America, the State of Iowa, the City of Buffalo, Iowa, and the Public in and to that part of the subject premises falling in the bed of the Mississippi River; also rights of property owners in and to the free and unobstructed flow of the waters of said river.

THE GRANTOR HEREIN ALSO CONVEYS TO THE GRANTEE HEREIN THE FOLLOWING ADDITIONAL PARCELS OF REAL ESTATE SITUATED IN SCOTT COUNTY, IOWA:

Parcel No. 8: That part of the Southwest Quarter of the Southeast Quarter of Section 17, Township 77 North, Range 2 East of the 5th P.M., which lies West of the highway running through said quarter section as the same was located and established by Easement dated November 3, 1926 and recorded in Book 77 of Land Deeds at Page 235, records of the office of the Recorder of Scott County, Iowa.

Except that portion thereof included in the tract conveyed by Jacob Fridley and wife to Christ Kautz by Deeds dated June 14, 1862 and November 22, 1864 and recorded in Book 32 of Land Deeds, Page 150 and 159, respectively; and excepting the piece one rod in width conveyed by Jacob Fridley and wife to Conrad Appel by Deed dated March 12, 1872 and recorded in Book 43 of Land Deeds at Page 13, records of the office of the Recorder of Scott County, Iowa.

Also excepting that portion thereof conveyed to Scott County, Iowa by Quit Claim Deed dated April 29, 1964 and recorded in Book 278 of Deeds on Page 571 in the office of the Recorder of Scott County, Iowa.

Parcel No. 9: All of the Southeast Quarter of the Southwest Quarter in Section 17, Township 77 North, Range 2 East of the 5th P.M., excepting 3 acres, more or less, lying and being situated Northeast of the Blue Grass Road, which was conveyed to Stephen A. Collins by deeds recorded in Book 53 of Land Deeds, Page 626, and in Book 66 of Land Deeds, Page 601 in the office of the Recorder of Scott County, Iowa, and also excepting 3 acres, more or less, which was conveyed to Jack O. Phillips, et al, by deed recorded in Book 87 of Land Deeds, Page 352 in the office of the Recorder of Scott County, Iowa.

Except that portion thereof conveyed to Scott County, Iowa, by Quit Claim Deed dated April 29, 1964 and recorded in Book 278 of Deeds on Page 571 in the office of the Recorder of Scott County, Iowa.

Parcels No. 10 and 11: The Northwest Quarter of the Southwest Quarter of Section 14, Township 77 North, Range 2 East of the 5th P.M. Also described as Lot 4 in the partition of the Estate of LeRoy Dodge.

Also part of the Southeast Quarter of Section 15, Township 77 North, Range 2 East of the 5th P.M., described as commencing at the Northeast corner of the Southeast Quarter of said Section 15; thence West on the North line of said Southeast Quarter of Section 15, 15 chains; thence South on the East line of Lot 6, 20 chains; thence East on the North line of Lot 1, 15 chains; thence North on the West line of Lot 4, 20 chains to the place of beginning, which real estate is also described as Lot 5 in the partition of the Estate of LeRoy Dodge, deceased.

The above described tracts of real estate are particularly described by survey as follows:

Beginning at the Northeast corner of the Southeast 1/4 of Section 15, Township 77 North, Range 2 East of the 5th Principal Meridian said point being also the Northwest corner of the Southwest 1/4 of Section 14, Township and Range aforesaid, thence North 89 degrees 52 minutes 14 seconds East along the North line of the said Southwest 1/4 of Section 14 a distance of 1331.0 feet; thence South 0 degrees 42 minutes 49 seconds West 1331.34 feet; thence North 89 degrees 52 minutes 41 seconds West 2325.32 feet to the Southeast Corner of Lot 44 Devil's Creek Estates Addition; thence North 0 degrees 37 minutes 00 seconds East along the East line of said Devil's Creek Estates Addition a distance of 1325.43 feet; thence South 89 degrees 52 minutes 53 seconds East 996.64 feet to the place of beginning. Situated in Buffalo Township, Scott County, Iowa.

ALL OF THE FOREGOING PARTICULARLY DESCRIBED PARCELS OF REAL ESTATE ARE CONVEYED SUBJECT TO THE FOLLOWING:

Subject to existing leases and rights of tenants in possession, easements, restrictions, reservations, or agreements of record, the rights of the public and the State of Iowa in roads and highways through the same, taxes and assessments, general and special, not now due and payable, and TOGETHER WITH any easements appurtenant or of record for the benefit of the real estate herein conveyed.

Martin Marietta Corporation hereby convenants with said grantee, and successors in interest, to Warrant and Defend the said premises against the lawful claims of all persons claiming by, through or under it, except as may be above stated.

IN WITNESS WHEREOF said corporation has caused this instrument to be duly executed this 23rd day of May, 1983.

MARTIN MARIETTA CORPORATION

By ____________________
P.H. Serdel Its Vice President

By ____________________
James A. Kelly Its Assistant Secretary

STATE OF New York, New York COUNTY, ss.

On this 23rd day of May, A.D. 1983, before me, the undersigned, a Notary Public in and for said State, personally appeared Philip H Seidel a/k/a P.H. Seidel and Jane A. Kelly to me personally known, who being by me duly sworn, did say that they are the Vice President and Assistant Secretary, respectively, of said corporation; that the seal affixed thereto is the seal of said corporation; that said instrument was signed and sealed on behalf of said corporation by authority of its Board of Directors; and that the said Philip H Seidel and Jane A. Kelly as such officers, acknowledged the execution of said instrument to be the voluntary act and deed of said corporation, by it and by them voluntarily executed.

Edward S. Rosenthal

Edward S. Rosenthal

Notary Public in and for said State

EDWARD S. ROSENTHAL
Notary Public, State of New York
No. 31-4761304
Qualified in New York County
Commission Expires March 30, 1985

BLACKSTONE
ENVIRONMENTAL

APPENDIX C

Hydrologic Monitoring System Plan

Revised Hydrologic Monitoring System Plan

Continental Cement CKD Monofill Landfill
Buffalo, Iowa
IDNR Landfill Permit Number 82-SDP-16-97P

Prepared for:
Continental Cement
301 East Front Street
Buffalo, Iowa 52728

Prepared by:
Blackstone Environmental
514 17th Street, #206
Moline, Illinois 61265

March 29, 2021 (Revised April 19, 2021)

REVISED HYDROLOGIC MONITORING SYSTEM PLAN
Continental Cement CKD Monofill Landfill
Buffalo, Iowa
IDNR Landfill Permit Number 82-SDP-16-97P

Prepared for:

Continental Cement
301 East Front Street
Buffalo, Iowa 52728

Prepared by:

Lindsay E James

Lindsay E. James, R.G.
Senior Project Manager

Reviewed by:

Krista A. Brodersen
Senior Project Manager

Kyle Kukuk, P.E.
Senior Project Manager

TABLE OF CONTENTS

Section **Page**

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

This Revised Hydrologic Monitoring System Plan (HMSP) presents sampling and analysis procedures for the Cement Kiln Dust (CKD) Monofill operated by Continental Cement Company (Continental) and replaces the previous HMSP dated January 30, 2015.

The purpose of this document is to update the HMSP to address comments received in the Iowa Department of Natural Resources (IDNR) letters dated September 9, 2020, December 3, 2020, and January 29, 2021. The HMSP describes the hydrogeologic setting of the facility, the groundwater monitoring network, groundwater bearing zones, background and compliance monitoring parameters and frequencies, sampling procedures, groundwater flow characteristics, and statistical methodology. This document was prepared to meet the requirements of the Continental Cement Davenport Plant Operating CKD Landfill Permit Number 82-SDP-16-97P and the applicable regulatory requirements of Iowa Administrative Code (IAC) Chapter 115.

1.1 Site Location and Background

The Continental CKD Monofill (Site) is located within a portion of Continental's former rock quarry at the Continental facility located in the Southeast Quarter of Section 23, Township 77 North, Range 02 East, in Scott County, Iowa. The Landfill is located approximately 1.3 miles east/northeast of the City of Buffalo in Scott County, Iowa, and approximately 700 feet north of the Mississippi River.

The Site currently operates a monofill under IDNR Permit Number 82-SDP-16-97P. A portion of the monofill has been closed under Permit Number 82-SDP-15-96C. The monofill is used for the disposal of CKD resulting from cement manufacturing processes. A Site Plan showing the approximately 88 acres of the property with existing and closed CKD monofill landfill cells, the existing monitoring well network, and general site details are included as Figures 1a and 1b.

The quarry sump is used to control surface water runoff and to dewater active quarry operation areas. Water is pumped from the quarry sump and discharged to the Mississippi River under a National Pollutant Discharge Elimination System (NPDES) Permit.

1.2 Site Topography

The topography in the area of the Monofill consists of hilly terrain sloping generally southward toward the Mississippi River floodplain. As shown on Figure 1a, the base elevation of the quarry near the monofill is approximately 490 feet mean sea level (msl). Surface elevations of the closed and active portions of the monofill range from approximately 590 to 610 feet msl.

2.0 HYDROGEOLOGIC SETTING

The area around the Site consists of rolling hills characteristic of the Southern Iowa Drift Plain Physiographic Region and the valley floor of the Mississippi River floodplain. The area is dissected by southerly trending streams that flow into the Mississippi River.

Local stratigraphy consists of basin fill deposits from the Middle to Lower Devonian and Upper Silurian marine sequences. Some regions of Scott county also have Lower Pennsylvania outcrops. Regional dip of the strata is expected to be gently dipping to the southwest/west. Bedrock in the region of the Site consists of units of the Cedar Valley Group, Wapsipinicon Group, Gower Formation, and Scotch Grove Formation (in descending order). These strata are detailed below.

2.3 SITE GEOLOGY

2.3.1 Cedar Valley Group

At the Site, the Cedar Valley Group consists of the Lithograph City, Coralville, and Little Cedar formations in descending order (Day, 1994). The Lithograph City formation consists of dolomite with some interbedded argillaceous dolomite or shale members, while the Coralville and Little Cedar formations are dominantly fossiliferous limestone. The Cedar Valley Group is up to 500 feet thick (Horick, 1984). However, regionally, the Cedar Valley Group is approximately 80 feet thick (Terracon, 2020). The Cedar Valley Group underlies or is adjacent to CKD fill in the north/northeast portion of the Landfill. Due to quarry activities, the Cedar Valley Group is not present in the west/southwest portion of the Landfill (Terracon, 2020). Boring logs for piezometers set in the Cedar Valley Group indicate dominantly limestone bedrock with some shale bearing zones.

2.3.2 Wapsipinicon Group

The Wapsipinicon Group consists of the Pinicon Ridge and Otis formations. The Pinicon Ridge formation is dominantly fossiliferous limestones and unconformable dolomites lower in the formation with some associated argillaceous members. The Otis formation is dominantly coarsely to finely crystalline limestone (Hickerson and Anderson, 1994). In the vicinity of the quarry, the Otis Member of the Wapsipinicon reportedly forms a local confining bed separating the Devonian and Silurian age limestones (Terracon, 2020). The Wapsipinicon Group is approximately 100 feet thick locally (Terracon, 2020). According to boring logs of piezometers set within the Wapsipinicon Group, dolomitic limestone is the dominant rock present at the Site.

2.3.3 Gower Formation

Generally, the Gower Formation consists of non-laminated and stromatolitic laminated dolomite and limestone. The thickness of the formation at the Site is approximately 100 feet (Terracon, 2020)

2.3.4 Scotch Grove Formation

The Scotch Grove Formation consists of fossiliferous and less fossiliferous units of dolomite. The thickness of the formation on the site is approximately 120 feet. It was previously reported that the Silurian Groundwater zone is set within the Blanding Formation. However, review of the literature suggests that piezometers within the Silurian Groundwater zone are set within the Gower or Scotch Grove Formations (Hickerson and Anderson, 1994; Horick, 1984).

2.4 GROUNDWATER OCCURRENCE

The groundwater at the Site is contained within the regional Silurian-Devonian aquifer. This aquifer is confined by the Lime Creek Formation in the upper Devonian and the Maquoketa Formation in the upper Ordovician. In the east/northeastern portion of Iowa, the Lime Creek Formation has been eroded and the Silurian-Devonian aquifer is unconfined. Due to the Site being located within a river valley, the aquifer is locally expected to be mature with higher secondary porosity from carbonate chemical erosion and generally will have higher well yields and faster recovery. The aquifer is generally expected to drain into the Mississippi river.

3.0 GROUNDWATER MONITORING SYSTEM

The current groundwater monitoring system at the Continental Cement CKD monofill Landfill includes three Groundwater Bearing Zones (GBZs) identified as the Upper GBZ (Cedar Valley), Middle GBZ (Devonian), and Lower GBZ (Silurian). The Upper GBZ is reportedly present in limestone bedrock adjacent to the CKD fill areas but is not found in downgradient portions of the fill area; the Middle GBZ is located in limestone bedrock beneath the monofill area and at least partially contained by the cone of depression associated with the Quarry Sump; and the Lower GBZ is located in Silurian-aged limestone and dolomite bedrock beneath the Middle GBZ. The Otis Formation of the Wapsipinicon Group is also reportedly a local confining unit between the overlying Devonian strata and underlying Silurian strata (Komex International, 1996; Terracon, 2020). Evidence exists in the literature suggesting that the Otis Formation is considered a local confining unit (Horick, 1984, Komex International, 1996).

The current groundwater monitoring system for the Landfill consists of 18 groundwater monitoring wells, nine monitoring points, associated sumps, and a stope well. The groundwater monitoring network consists of MW-1A, MW-1B, MW-2A, MW-3, MW-3L, MW-4, MW-4L, MW-5, MW-7, MW-11, MW-12, MW-13, MW-14, MW-15, MW-16, MW-16L, MW-18, MW-19, and the Quarry Sump. The monitoring points of the closed CKD monofill consist of MW-9, MW-10, UL-1, LL-1, and the Leachate Sump. The monitoring points of the active CKD monofill consist of UL-2, LL-2, UL-3, and LL-3. The stope well MW-2CR is associated with a stope intercepted from the underground workings of the neighboring Linwood mine. Available boring logs and monitoring well construction diagrams for the monitoring wells are included in Appendix A. Monitoring System specifications are provided in Table 1. Gradient designations presented in Table 1 are based upon potentiometric surface maps prepared from groundwater level measurements collected in February 2021 (Figures 3-6) and are subject to change based on future observations.

Groundwater is monitored by wells in three GBZs on the site: The Upper GBZ, the Middle GBZ, and the Lower GBZ. The wells historically used to monitor these three zones are described below.

3.1 Upper Groundwater Bearing Zone

Monitoring wells MW-1B and MW-2A are screened within the Upper GBZ and will be monitored according to the procedures described in the sections below. Monitoring well MW-1B has historically served as an upgradient/background well.

3.2 Middle Groundwater Bearing Zone

Monitoring wells MW-1A, MW-3, MW-4, MW-5, MW-11, MW-12, MW-13, MW-14, MW-15, MW-16, MW-18, and the Quarry Sump are screened within the Middle GBZ and will be monitored according to the procedures described in the sections below. Monitoring wells MW-1A, MW-13, and MW-15 have historically served as upgradient/background wells.

3.3 Lower Groundwater Bearing Zone

Monitoring wells MW-3L, MW-4L, MW-7, MW-16L, and MW-19 are screened within the Lower GBZ and will be monitored according to the procedures described in the sections below. Monitoring well MW-7 has historically served as an upgradient/background well.

3.4 Leachate Monitoring

Monitoring points MW-9, MW-10, LL-1, UL-1, and Leachate Sump are screened within the closed cell and LL-2, LL-3, UL-1, UL-2, and UL-3 are screened within the active monofill. These monitoring points will be gauged monthly and purged if the water column is greater than 1 foot. Purged water will be discharged into the leachate sump. Monitoring points will be sampled according to the procedures described below. Monitoring points MW-9, MW-10, and UL-1 are historically dry.

3.5 Site Lithology and Groundwater Network

3.6 Groundwater Elevations

Groundwater elevations are measured monthly to determine groundwater flow direction within the GBZs. Monthly groundwater elevations from January 2020 through February 2021 are presented in Table 2. A hydrograph representing the past 12 months is presented in Figure 2. Groundwater potentiometric maps will be prepared for each month to evaluate the changes in elevations and flow direction throughout the year.

Groundwater flow direction within the Middle GBZ has historically been towards the west, southwest, south, and southeast. In 2010 or early 2011 there was reportedly a change in groundwater flow direction in the Lower GBZ of more towards the east, which appears to be seasonally influenced (Terracon, 2015).

The Lower GBZ contour map produced from February 2021 groundwater level measurements appears to show radial flow, with predominant flow in a southward direction toward the Mississippi River. Review of available information and literature appears to support that the Otis Formation may be acting as a leaky confining unit, allowing communication between what is currently being called the Lower GBZ and the Middle GBZ. Groundwater level data for the Upper, Middle, and Lower GBZs were plotted to produce a hydrograph (Figure 2) of groundwater elevations between January 2020 and February 2021. Although the hydrograph appears to have distinct groups of groundwater elevations within wells, the groupings are not split by formations in which they are screened, but instead are laterally grouped. Furthermore, contouring the Lower GBZ and Middle GBZ as a single zone results in contours that support the Lower and Middle GBZ as being a single Deep Zone (Figures 4-6).

Well data was compiled and put into the RockWare® RockWorks subsurface modeling software to produce graphic representations of the groundwater surface across the Site. Cross sections were produced for the monofill area (Figures 7-10), with well construction and groundwater level information plotted. A groundwater surface model (Figure 11) was also produced for the monofill area using available boring logs. The cross sections and groundwater surface model graphically support the independence of groundwater levels and the formations in which monitoring wells are screened in the monofill area. Groundwater levels were then used for the entire site including the Quarry Sump to produce a groundwater surface model showing the Lower GBZ and Middle GBZ wells as one Deep Zone. Figure 12 and 13 show the plan view of groundwater contours and the groundwater surface model as produced by RockWorks across the Site. A comment letter dated

February 3, 2021 from IDNR regarding the 2020 Annual Water Quality Report suggested that radial flow conditions may be present in the area of MW-4L. Based on this analysis it appears that groundwater flow across the site is radial, however flow is predominantly to the north and west towards the Quarry Sump.

3.7 Geochemical Data Evaluation

Time series plots were prepared for available major cations and anions including calcium, chloride, magnesium, potassium, sodium, and sulfate. Time series plots for chloride, potassium, sulfate, and sodium show obvious spatial variation in geochemistry with Lower GBZ well MW-4L plotting with Middle GBZ wells MW-4, MW-11, MW-14, and MW-18 (Appendix E). Furthermore, the remaining Lower GBZ and Middle GBZ wells plot together and show similar geochemistry (i.e. MW-16, MW-16L, MW-3, MW-3L, etc.).

3.8 Groundwater Monitoring System Observations and Recommendations

Based on review of groundwater potentiometric surface maps showing the Lower, Middle and Upper GBZ and the geochemical review, it appears that the Middle and Lower GBZ could be combined into one GBZ. Figures 6 through 13 support the comments from IDNR of radial flow existing at the Site. Further, geochemical comparison indicates that wells screened within the Middle and Lower GBZ are geochemically similar.

Although monitoring wells are screened at varying depths and stratigraphic units, it appears as though water levels are consistent and do not exist under confining conditions. In addition to similar groundwater levels, geochemical comparisons indicate that wells screened within the Middle and Lower GBZ are geochemically similar suggesting that they are monitoring the same waters.

Based on an analysis of the available data, Blackstone recommends that the Middle and Lower GBZ be treated as a single monitorable unit. The proposed Monitoring Network including gradient designations is shown on Table 1b.

4.0 GROUNDWATER SAMPLING PROCEDURE

The objective of groundwater sampling is to produce reproducible, representative, verifiable, and defensible groundwater chemical data. This section describes the specific tasks involved in sampling the groundwater monitoring system at the Landfill. Samples will be collected from the Landfill groundwater monitoring system by a field sampling technician fully trained in the required sampling procedures and protocols.

4.1 Field Information Forms

To provide documentation of each monitoring event, a detailed sampling record will be maintained. An example field sampling record form is provided in Appendix B. Blackstone will also record sampling information on the IDNR Groundwater Sampling Forms 542-1322 or 542-1324, as required. This form will allow documentation of the following information, at a minimum:

- Identification of the well.
- Date, time, sampler identification.
- Static water level measurement.
- Total depth of each well.
- Well integrity (condition of the well pad, protective casing, well casing, well identification, and locks).
- Numerical field data.
- Date and time of sample collection.
- Field observations (well recharge rates, equipment malfunction, sample odor and characteristics).

4.2 Decontamination and Equipment Preparation

All non-dedicated, sample-contacting equipment will be thoroughly decontaminated prior to use at the Site. Decontamination procedures will consist of the following steps:

- Wash with laboratory grade soap (Alconox).
- Rinse with distilled or deionized water.
- Air dry prior to use.

Wash and rinse fluids will be disposed of in an appropriate area segregated from the well.

Field sampling technicians who contact sampling equipment subsequent to decontamination will wear nitrile (or equivalent) gloves. Gloves will be replaced between each well or immediately if they become contaminated or torn. Measures will be taken to prevent surface soils from contacting sampling equipment.

4.3 Water Level Measurement

Static water level elevations provide information on the groundwater gradients, which in turn are used to predict the groundwater flow directions and velocities. Static groundwater levels will be measured prior to sampling activities each time the groundwater is sampled using a portable water level indicator with measurement accuracy of 0.01 foot. Groundwater elevations in wells which monitor the same solid waste disposal area shall be measured within a period of time short enough to avoid temporal variations in groundwater flow that could preclude accurate determination of groundwater flow direction. Water levels will be measured from least to most contaminated in order to limit potential cross-contamination. The following procedure will be used when measuring static water level elevations:

- Decontaminate the cable and probe of the water level indicator in accordance with the procedures specified in Section 4.2.

- Establish the measurement reference point (MRP), which is the top of the inner PVC casing.

- Lower the decontaminated probe into the well to the water surface until the meter gives an audible sound upon contact.

- Record the distance from the MRP to the water surface to the nearest 0.01 foot, and the date on the well sampling record.

- Decontaminate the probe and cable, as previously described, prior to measuring the next well.

Water levels will be compared with historic water levels whenever possible. If a significant difference in water levels from the previous sampling event is noted, the water level will be remeasured. If the remeasurement gives the same result, the inconsistency will be noted on the field form.

The water level measurements will be reported to the IDNR once a year in the Annual Water Quality Report (AWQR). Water level measurements will be provided on IDNR forms 542-1322 for the monitoring wells and IDNR form 542-1324 for the Quarry and Leachate Sumps.

4.4 Well Inspection and Maintenance

Prior to performing sampling activities, each monitoring well will be inspected to assess its integrity. The condition of each well will be evaluated for physical damage that may have been caused by operation of Site equipment or vehicle traffic. The security of each well will also be assessed in order to determine the potential for outside contamination being introduced to the well. Maintenance and security requirements will be detailed on the field sampling forms.

4.5 Sample Collection Procedures

The following sections describe sample collection procedures for groundwater and lysimeter samples. It should be noted that the mine stope, leachate, and sump samples will be collected as grab (no-purge) samples.

4.5.1 Groundwater Samples

Groundwater samples will be collected using HydraSleeve® groundwater samplers. The HydraSleeve® samplers collect a whole water sample from within the well screen, without mixing fluid from other intervals and without purging. Groundwater samples will be collected with a disposable polyethylene bailer or pump if insufficient water is not present to deploy or other issue arises where a HydraSleeve® cannot be used. Care will be taken to avoid placing clean sampling equipment on the ground or a contaminated surface. Wells will be sampled from least to most impacted to reduce the potential for cross-contamination. Nitrile gloves will be worn during all sampling procedures. Sample bottles will be filled in the order of the volatilization sensitivity of the parameters as follows:

1. Metals
2. Major Cations and Anions
3. Sulfate and Chloride
4. Nitrate and Ammonia

A new sampler will be deployed in each well during the previous monitoring event. The sampler will be deployed in each well until it is approximately centered within the screened interval of the monitoring well. The sampler will be left in place, allowing time for the well to equilibrate prior to collection of the groundwater sample. The samplers will be retrieved from each well during the next regularly scheduled sampling event and new samplers will be deployed. The HydraSleeve®

Field Manual is included in Appendix D. The manual provides specific procedures for assembly, deployment, and sample collection.

The groundwater samples will be collected by extracting the HydraSleeve® from the wells. The HydraSleeve® is equipped with a one-way reed valve that is opened by the force of pulling the sampler upwards. The sampler will fill during the first 24- to 48-inches of upward pull and once the sampler is full, the reed valve closes, preventing mixing of non-representative fluid during sample recovery.

The sampler will be punctured with a disposable plastic tube and the appropriate laboratory supplied sample containers will be filled. Sample volume will be retained for field measurements of pH, specific conductivity, temperature, and turbidity. Field measurements will be collected using a calibrated multi-parameter probe. Per 567 IAC, specific conductance and pH analyses will be conducted in the field for all groundwater and leachate samples. The samples will be labeled and collected in appropriate containers with the appropriate sample preservative as described in subsequent sections.

4.5.2 Lysimeter Samples

Samples will be collected from the lysimeters using a disposable polyethylene bailer or pump. Care will be taken to avoid placing clean sampling equipment on the ground or a contaminated surface. Nitrile gloves will be worn during all sampling procedures. Sample bottles will be filled in the order of the volatilization sensitivity of the parameters as follows:

1. Metals

2. Major Cations and Anions

3. Sulfate and Chloride

4. Nitrate and Ammonia

In accordance with Permit Special Provision #4b, the lysimeters will not be purged prior to sampling because it appears that the lysimeters may be located above the water table and collecting leachate that has percolated through the liner. Because of the slow percolation rates through the liner, purging of these points may result in a dry point that will not recharge in a timely manner. Additionally, successful purging of the lysimeter to remove stagnant, unrepresentative water would require purging of all water from the lysimeter (retained within the lysimeter basin and the well casing). Hydrasleeve or other no-purge sampling devices are not recommended for the lysimeters as they may not yield representative samples due to the lysimeter construction (i.e. with horizontal screens).

Sample volume will be retained for field measurements of pH, specific conductivity, temperature, and turbidity. Field measurements will be collected using a calibrated multi-parameter probe. Per 567 IAC, specific conductance and pH analyses will be conducted in the field for all lysimeter samples. The samples will be labeled and collected in appropriate containers with the appropriate sample preservative as described in subsequent sections.

4.6 Sample Labeling

A completed sample label will be affixed to each sample bottle indicating the sample number, date and time of collection, sampler's initials, and selected parameters.

4.7 Sample Preservation

Sample containers will be supplied by the laboratory for each sampling event. Each sample provided by the laboratory will be pre-preserved with the appropriate amount of preservative for the particular analysis. Alternatively, the laboratory may ship pre-measured amounts of preservative for addition to the sample in the field. Bottles will not be overfilled as this may cause loss of some of the sample preservative. Immediately after collection and labeling, the samples will be placed in a sample cooler with ice. Exposure of the samples to direct sunlight will be minimized as it can alter sample quality. The samples will then be transported to the laboratory in the sample cooler via overnight service. A sample temperature will be recorded when the sample container arrives at the laboratory to assure that the appropriate sample temperature was maintained during shipment. A summary of the appropriate sample preservation and holding times for each analytical method is shown on Table 3.

4.8 Chain-of-Custody Forms

Chain-of-custody procedures will allow for the possession and handling of samples to be tracked from the time of collection through laboratory analysis. A chain-of-custody form (COC) for each sample will be completed immediately following sample collection. The COC will be placed in the shipping container and accompany the samples from the time of collection through transportation to the laboratory. A copy of the COC will be maintained by the sampling personnel. An example of the COC is shown in Appendix C.

4.9 Monitoring Well Redevelopment

Redevelopment of monitoring wells should occur when more than 25 percent of the screen length is occluded. If the screen is found to be 25 percent or more occluded, the following procedure will be used to remove fine-grained material from the well and filter pack near the screen:

- Decontaminate all down-hole equipment prior to beginning redevelopment.
- Obtain an initial water level measurement.
- Collect an initial sample of water and measure for field parameters including pH, specific conductivity, and temperature. Note the color, odor, and turbidity of the sample.
- If using a bailer to redevelop the well, lower the bailer to the bottom of the well and return it to the top in a manner to cause gentle surging in and out of the well. The bailer should be brought to the surface and the water and sediment emptied. Repeat this process until a minimum of five well volumes have been removed, field parameters have stabilized, and the well screen is cleared of sediment.
- If pumping and surging to redevelop the well, surging will be accomplished by lowering the pump into the saturated interval and repeatedly raising and lowering the pump. Following surging, the well should be pumped until at least five well volumes have been removed, field parameters have stabilized, and/or the well screen is cleared of sediment.
- If the monitoring well purges dry during redevelopment, water should be allowed to recover within a reasonable amount of time (i.e. within 8-hours). Following recovery, the development procedures should be repeated until five well volumes have been removed, field parameters have stabilized, and the well screen is cleared of sediment.

5.0 GROUNDWATER ANALYSIS PROCEDURES

This section provides procedures for analysis of groundwater samples collected from the monitoring system at the Site. Analytical methodologies, as well as field and laboratory Quality Assurance/Quality Control (QA/QC) procedures are discussed in this section.

5.1 Sample Frequency

Semi-annual groundwater sampling will be conducted during the months of March and September of each calendar year. Sampling events must be six months apart. New wells will be sampled quarterly until a minimum of eight quarters of valid data are collected.

5.2 Instrument Calibration

Equipment and instruments used in the field will be calibrated using calibration standards and method-specified calibration criteria according to manufacturer's specifications. Standards will be purchased as certified primary solutions from reputable, commercial lab suppliers. The results of field instrument calibration will be documented in the AWQR.

5.3 Field Quality Assurance/Quality Control Samples

Field QA/QC samples collected during each regular sampling event at the Site will include:

- Duplicate Sample – A duplicate sample will be collected from one monitoring well during each sampling event. The sample will be collected by alternating filling a duplicate sample bottle and a regular sample bottle during sampling. The duplicate sample will be labeled as "Duplicate" on the Chain-of-Custody prior to sending to the laboratory for analysis.

5.4 Laboratory QA/QC Samples

A record of the laboratory sample receipt, storage, and analysis procedures will be kept for each sample received. The analytical laboratory will prepare blanks and spikes to assure analysis quality in accordance with the laboratory's QA/QC Control Plan.

Method blanks are blank solutions which are treated as a sample for the analyte being measured, including all preparation procedures and are analyzed in the same manner as the environmental samples in order to assess analytical accuracy and the potential for sample contamination. These blanks are used to ensure that the solvents or chemicals used in sample treatment are not systematically biasing environmental sample results.

Matrix spikes are samples in which known concentrations of analytes expected to be in the sample are added. The percent recovery of any spiked analyte is taken as a measure of the bias of the analytical method caused by the sample matrix. Surrogate spikes are samples in which known concentrations of analytes not expected to be in the sample are added.

Any internal control problem associated with the submitted sample/analyte will be identified on the data qualifier report included with the analytical report.

5.5 Laboratory QA/QC Evaluation

The following sections describe the procedures that will be performed to evaluate the acceptability of the data received from the laboratory.

5.5.1 Detection Limits

In order to meet the sampling objectives, analytical detection limits must be low enough to support a conclusion that contaminants are not present at concentrations above levels that define a specified risk to human health or the environment.

The analytical laboratory uses the procedures described in 40 Code of Federal Regulations (CFR) 136 to determine method detection limits (MDLs). Method specific upper and lower precision and accuracy limits are developed each year from historical matrix spike and matrix spike duplicate data. The laboratory performing the analysis will be requested to maintain established Practical Quantitation Limits (PQLs) with +/- 25% of their medial value.

The reporting limits will be equal to, or lower than, the Iowa Statewide Standards (SWS) for the Protected Groundwater Sources. Should the analytical laboratory not be able to meet specified reporting limits for certain parameters (i.e. lithium), results may be quantified (j-flagged).

5.5.2 Precision and Accuracy

Precision and accuracy measure the reproducibility of analytical results and the bias of a measurement method, respectively. Quality control limits for analytical precision and accuracy parameters are typically established by the laboratory in accordance with the specific analytical methods.

5.5.2.1 Precision

Precision of the analytical results can be measured by comparing the analytical results of primary samples with those of duplicate samples. The variation in the results is a measure of precision. It can be evaluated in both field and laboratory duplicate samples.

Variation attributable to analysis is detected by observing the discrepancies between the laboratory matrix spike (MS) primary and matrix spike duplicate (MSD) samples and laboratory control sample (LCS) and laboratory control sample duplicate (LCSD), if provided. Precision between primary and duplicate samples can be determined by the relative percent difference (RPD) as indicated in the following equation:

RPD = (PSR – DSR)/(PSR + DSR)/2 * 100

Where:

RPD = relative percent difference between the primary sample value and the duplicate sample value
PSR = primary sample results (detected concentration)
DSR = duplicate sample results

Precision goals for laboratory analyses are method-specific, but typically less than 20 percent if not otherwise specified. Precision for field duplicates should be less than 50 percent.

5.5.2.2 Accuracy

The average laboratory spike recovery results are examined to assess the accuracy of the analytical results. Spikes may include reagent spikes (LCS), surrogate spikes, and matrix spikes. A reagent spike is a synthetic matrix (usually organic free water or sodium sulfate) to which a known concentration of all or some of the method analytes is added. A surrogate spike involves adding compounds that are chemically similar, but not identical to, the compounds in the sample being analyzed. The surrogate is added to all samples, including the original sample matrix, and to blanks and reagent spikes. For a matrix spike, known amounts of standard compounds identical to the compounds present in the sample of interest are added to an aliquot of the sample matrix.

Spike recovery is determined by submitting the spiked synthetic matrix or sample aliquot for the same laboratory analysis as the original sample. Spike recovery is calculated using the following equation:

Percent Recovery = (SSR – SR)/SA * 100

Where:

SSR = spike sample results
SR = unspiked sample results
SA = spike concentration added to sample

The reagent spike is used to verify the method performance for each sample set. Acceptable accuracy ranges are identified by the laboratory in accordance with the analytical methods.

The surrogate spikes are typically added to all samples (except for those to be analyzed by gross non-chromatographic analytical methods). Surrogate results from blanks and reagent spikes are plotted by the laboratory to evaluate trends and variability with respect to corrective action.

Surrogate spike results for environmental samples are reviewed qualitatively in relationship to acceptance limits and results for blanks and reagent spikes to evaluate matrix effects and gross sample-processing errors.

The laboratory matrix spike is used to verify method performance by recovery of analytes in a particular matrix. Recovery reflects the bias from both the environmental sample matrix and normal method performance (as opposed to the reagent spike, which reflects the method performance only). Comparison with the reagent spike accuracy is used to assess whether the analytical process is in control (e.g., whether the matrix is biasing analyte recovery).

5.5.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent site conditions. The determination of the representativeness of the data is performed by:

- Comparing analytical results of field duplicates to determine the spread in the analytical results.

- Examining the results of quality control blanks for evidence of contamination.

These involve qualitative reviews. Quality control blanks include trip blanks and laboratory method blanks. The quality control blanks are used to quantitatively qualify data.

5.5.4 Comparability

Comparability is the confidence with which one set of analytical data may be compared with another. Comparability is maintained by being aware of previous sampling and analysis at the Site and through the use of standard operating procedures and analytical methods and detection limits. To facilitate comparability of databases, data will be generated using widely accepted sampling standard operating procedures and analytical methods and will be reported in units consistent with those used by other agencies and organizations reporting analytical data.

6.0 GROUNDWATER ANALYSIS PROCEDURES

Monitoring will be conducted in accordance with the approved facility permits on a semi-annual basis during the months of March and September of each calendar year.

Background samples will be collected quarterly for a minimum of two years following installation of new wells. The purpose of background sampling is to establish a range of ambient concentrations of the groundwater system being monitored. Ideally, the background data set should contain enough data points to perform the selected statistical method and incorporate seasonality and/or temporal variability.

Samples will be collected for laboratory analysis at each of the specified monitoring points. The semi-annual and background monitoring parameter list includes the following parameters:

- Indicator parameters – bicarbonate alkalinity, carbonate alkalinity, bromate, calcium, chloride, fluoride, nitrate, nitrite, phosphorus, total dissolved solids, and sulfate.

- Total metals – aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, lithium, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

The sample methods for the parameters are included in Table 3.

6.3 Reporting Requirements

A comprehensive Annual Water Quality Report will be submitted in November of each year. The report will contain the field data, analytical data, and results of the statistical analysis. A copy of this report will be maintained on-site. This report will identify statistically significant increases (SSIs) or statistically significant decreases for parameters. The report will include the following information:

- Sampling purpose – detection or assessment monitoring
- Copies of field notes, datasheets, and chain-of-custody documentation
- Significant deviations from the HSMP
- A discussion of the rate and direction of groundwater flow including piezometric surface maps and water level measurements
- Summary of laboratory analytical results
- Data validation
- A copy of the laboratory analytical results

- Summary of statistical results, statistical output, and identification of any statistically significant increases over background values
- Certification by an engineer registered in the State of Iowa

If an SSI of any monitored constituent is identified from the analytical results, confirmation re-sampling for those constituents will be conducted during the next scheduled semi-annual monitoring event unless otherwise directed by the IDNR.

7.0 GROUNDWATER STATISTICAL ANALYSIS PROCEDURES

This section outlines the statistical methodologies that may be used to evaluate whether a facility has negatively impacted groundwater quality. Statistical evaluation is employed to estimate typical behavior of groundwater data and manage uncertainty due to random/natural fluctuations in groundwater data. Despite sample fluctuations due to random variation, statistical analysis helps to determine if compliance concentrations are significantly higher, on average, than background groundwater concentrations and assists in separating natural fluctuations from increasing or decreasing patterns.

It is anticipated that the statistical approach for this facility will be multi-faceted and may use inter- and intrawell prediction limits for inorganic parameter compliance testing. Confidence intervals may also be constructed for select well-constituent pairs. Distributional analyses including outlier testing and time series plots will also be prepared for all wells to identify any apparent trends or excursions from normal ranges. Due to the complexities of this facility, specific statistical methods for the facility will be discussed and agreed upon by Continental and IDNR.

Statistical analysis will be completed using the Sanitas™ statistical software, or equivalent. No statistical evaluations will be performed for non-detect results or those detected below the PQL. The historical database for statistical analysis will be updated following each monitoring event. The statistical background dataset will be updated in accordance with United States Environmental Protection Agency (USEPA) Unified Guidance.

7.3 Outlier Determination

Data will be examined for outliers, anomalies, and trends that might indicate a release. Outliers and anomalies are values that can occur due to sampling, laboratory, transcription errors, or other unknown factors. Significant trends can indicate a source of systematic error, or an actual contamination occurrence, and must be evaluated. The inclusion of outlying or anomalous values in the historical dataset used for statistical analysis could cause misinterpretation of the data and results in an artificial increase in statistical limits. An artificial increase in statistical limits could increase the false negative rate (i.e. decrease the statistical sensitivity).

Statistical outliers will be determined using either Dixon's or Rosner's test, depending on the number of background observations.

If either Dixon's or Rosner's test identifies an observation as a statistical outlier, the measurement will not be treated as such until a specific reason for the abnormal value can be determined. Valid reasons might include contaminated sampling equipment, laboratory contamination of the sample, errors in transcription of the data values, etc. Based on this review, one of several actions may be taken:

- If an error in transcription, dilution, analytical procedure, etc. can be identified and the correct value recovered, the observation will be replaced by its corrected value and further statistical analysis done with the corrected value.

- If it can be shown that the observation is an error, but the correct value cannot be determined, the observation will be removed from the data set and further statistical analysis performed on the reduced data set. The removal of the observation and the reason for its removal will be documented in the report.

- If no error in the value can be documented, it will be assumed that the observation is a true but extreme value. In this case, it will not be altered or removed.

7.4 Interwell Prediction Limit Analysis

The interwell prediction limit analysis compares data collected from compliance (downgradient) monitoring wells with data collected from background (upgradient) monitoring wells. Data is used to calculate the interwell prediction limit and is used to determine if a single data point is statistically representative of a group of data points. If a data point exceeds the calculated interwell prediction limit, a statistically significant increase is noted.

Interwell prediction limit analysis will be prepared for monitoring wells screened within the individual GBZs. Pooled data from upgradient monitoring wells will be designated as background and downgradient wells will be designated as compliance wells.

Data distribution will be calculated using the Shapiro-Wilk test for normality. The Ladder of Powers will be applied for transformed data. If the data is determined to have normal or transformed normal distribution, a parametric prediction limit will be calculated. If the data is determined to have a non-normal distribution, a non-parametric prediction limit will be constructed.

Non-parametric prediction limits will be constructed for data sets containing 51-90% non-detect results. Interwell prediction limit analysis will be performed for the inorganic parameters detected in groundwater samples. Non-detect parameters will not be included in the interwell prediction limit analysis.

7.5 Intrawell Prediction Limit Analysis

Intrawell prediction limits compare concentrations of a constituent to historical concentrations (i.e. background) of that constituent within the same monitoring well. Significant upward changes in the concentration over time results in a statistical result above the prediction limit. As will be performed for the interwell prediction limits, data distribution will be calculated using the Shapiro-Wilk test for normality. The Ladder of Powers will be applied for transformed data. If the data is determined to have normal or transformed normal distribution, a parametric prediction limit will be calculated. If the data are determined to have a non-normal distribution, a non-parametric prediction limit will be constructed. Non-parametric prediction limits will be constructed for data sets containing 51-90% non-detect results.

Non-detect parameters will not be included in the intrawell prediction limit analysis.

7.6 Confidence Interval Analysis

Confidence intervals are constructed from sample data and are designed to contain the mean concentration of an analyte with a designated level of confidence. A minimum of four sample values are required for the construction of parametric confidence intervals and seven values are required for non-parametric confidence intervals. Because data can show either apparent or statistically significant trends, the number of constituents analyzed will be limited to the most recent eight sampling events.

For those well-constituent pairs screened that exceed the prediction limit and are confirmed SSIs, further evaluation using confidence intervals will be performed. Groundwater Protection Standards (GWPS) for parameters requiring confidence interval analysis will be proposed to IDNR for approval prior to use.

7.7 Data Distribution

Most statistical tests assume that the data comes from a normal distribution. The USEPA guidance recommends the Shapiro-Wilks Test to calculate normality of the data. Alternative procedures for evaluating groundwater contaminant distribution are available for use when data do not follow a normal distribution; these are termed “nonparametric” methods. Where normal methods use the mean and standard deviation of the data for analysis, nonparametric methods deal with other descriptors of the data for analysis (e.g., minimum, maximum, median, etc.).

The Shapiro-Wilks Test will be used to calculate normality of the data. Based on the results of this test, the type of prediction interval will be calculated. Prediction limits based on a normal distribution will be calculated for parameters that are normally distributed; and "non-parametric" or distribution-free prediction limits will be calculated for parameters that are not normally distributed. For samples that show evidence of non-normality, a normalizing transformation using the Ladder of Powers will be explored. These transformations not only include the natural logarithm, but also other mathematical transformations such as the square root, the cube root, the square, etc. If none of these transformations creates an adequately normalized data set, a non-parametric limit will be calculated.

7.8 Treatment of Non-detects

The amount of data below the detection limits plays an important role in selecting the appropriate method. As a general guideline, if 50 percent or fewer of the values were "not detected," they will be replaced with the method detection limit divided by two. If more than 50 percent of the values are reported as not detected, a nonparametric method of analysis will be used.

If more than 90 percent of the background data are less than the MDL, a Poisson distribution-based prediction interval will be computed. The Poisson distribution is a probability distribution modeled for rare events. The Poisson probability of a detection observation is rare unless there is an impact. The sum of the Poisson counts across background samples is computed by adding the number of parts per billion (ppb) across all observations for the well. Prior to any calculation, non-detects are set to one-half the PQL and all trace values are evaluated as an average of the PQL. To test the upper prediction limit, the Poisson count of the sum of the next k observations from the well is compared to the 99 percent upper Poisson prediction limit. If this sum exceeds the prediction limit, there is significant evidence of an impact.

7.9 Comparison of Groundwater Contaminant Concentration

Because the distribution of the data varies by constituent, both parametric and nonparametric forms of the Prediction Interval Method will be used for the statistical analysis. Prediction intervals are constructed to contain the next sample values from a population or distribution with a specified probability. An SSI is identified when the most recent reported sample value for a monitoring well is greater than its respective Upper Prediction Limit (UPL), calculated from historical data. Potential contamination is suggested, if one or more SSIs occur in monitoring wells identified as downgradient. When the historical data is not normally distributed and cannot be normalized through transformation, the nonparametric UPL will be determined by the maximum historical value.

All SSIs will be reviewed for potentially anomalous data including analytical errors, transcription mistakes, laboratory variation in the PQL or MDL, etc. Outlier tests and time-series graphs will also be reviewed to identify potentially anomalous data.

7.10 Verification Resampling

Verification resampling is an approach used to help balance the false positive and false negative rates in groundwater monitoring. If the initial groundwater observation is below the Upper Prediction Limit, no verification resampling is necessary.

In the event of an initial exceedance above the UPL, verification resampling will be conducted, and the statistical exceedance will be verified (i.e. an SSI) if the resampled value also exceeds the UPL. The data used to verify the initial exceedance will be collected at the next scheduled semi-annual monitoring event.

7.11 Time Series Graphs

Time series plots depict concentration versus time of sample collection and are useful for identifying a variety of temporal patterns including trends over time, sampling events that may signal a contaminant release, measurement outliers resulting in anomalous ‘spikes’ due to field handling or analytical errors, and cyclical/seasonal fluctuations in the data. Time series graphs for parameters with observed SSIs will be prepared and reviewed for potentially anomalous data points and constituents which exhibit trends.

Time series graphs to illustrate trends for the inorganic parameters in all wells, presented by GBZ, will also be prepared, and reviewed for potentially anomalous data points and constituents which exhibit trends.

7.12 Trend Analysis

In addition to reviewing the time series graphs, the Mann-Kendall upward trend test and the Sen’s test will be performed. These tests are non-parametric tests used for the detection of trend in a time series. These tests are widely used in environmental science because there are no distributional assumptions and missing data (i.e., non-detects) and irregularly spaced measurement periods are permitted.

The Mann-Kendall test can be performed at varied confidence intervals; however, a confidence interval of 95 percent will be selected. If an upward trend is identified from the results of the Mann-Kendall test, the Sen's test will be run since it is appropriate for a high percentage of non-detects and is not significantly affected by outliers.

The time series plots will be reviewed, along with the results of the trend analyses, and identified data trends will be evaluated.

7.13 Background

The most important quality of background data is that it reflects the historical conditions unaffected by the activities it is designed to be compared against. All detection monitoring tests involve comparison of compliance point data against background. If natural groundwater conditions have changed over time, background measurements from many years ago may not reflect current uncontaminated conditions. Similarly, recent background data obtained using improved analytical or field methods may not be comparable to older data and might have to be discarded in favor of more recent measurements in order to construct an appropriate comparison.

Per the USEPA Unified Guidance, a minimum of eight independent background observations will be collected from the monitoring wells before running statistical tests. Although this is still a small sample size by statistical standards, it will allow for minimally acceptable estimates of variability and evaluation of trend and goodness-of-fit.

Due to the need for sufficiently large sample sizes and the complex behavior of groundwater, background will be periodically reviewed and updated per the USEPA Unified Guidance. Because the Landfill will be conducting semi-annual groundwater sampling, and at least four to eight new measurements should be collected to enable such a test, background will be updated every two years. Outlier tests and Wilcoxon rank-sum comparisons will be conducted at each compliance well between existing intrawell background and the potential set of newer background. If a non-significant result is obtained, the newer compliance data will be added to the existing intrawell background sample. However, if a significant result occurs, the compliance measurements will be reviewed to determine whether a gradual trend or other change has occurred.

7.14 Review of Existing Background

It is understood that potential issues may exist with the current background dataset due to historically used sampling procedures and/or the inclusion of trending data and outliers. A background database was provided to Blackstone that included data collected from March 2018 through September 2020 (six total datapoints). Blackstone will evaluate the existing database for outliers, data trends, and consistency once additional datapoints have been collected for comparison. The results of this analysis will be submitted under separate cover.

8.0 LIMITATIONS

This report was prepared in accordance with that level of skill and care ordinarily exercised by other members of Blackstone's profession practicing in the same locality and under similar conditions when the services were provided. No warranties, express or implied, are intended or made.

9.0 REFERENCES

1. USEPA, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance*, March 2009.

2. Day, J., Late Middle and Early Upper Devonian Brachiopod Fauns of Southeastern Iowa and Northwestern Illinois, Illinois State University, 1994.

3. Horick, P., Silurian-Devonian Aquifer of Iowa, Iowa Geological Survey, 1984.

4. Terracon Consultants, Inc., 2020 Annual Water Quality Report, Continental Cement Company Cement Kiln Dust Monofill, Buffalo, Iowa, December 21, 2020.

5. Hickerson W., Anderson R., Paleozoic Stratigraphy of the Quad-Cities Region East-Central Iowa, Northwestern Illinois, Geological Society of Iowa, April 24, 1994.

6. Komex International LTD., Hydrogeological Workplan, Cement Kiln Dust Management Area, LaFarge Davenport Plant, Alberta, Canada, July 2, 1996.

TABLES

CONTINENTAL CEMENT COMPANY

Table 1a
Existing Monitoring Well and Piezometer Network

Continental Cement Landfill
Permit Number 82-SDP-16-97P

Well ID	Location (Easting / Northing)	TOC Elevation	Total Depth	Approximate Groundwater Elevation	Screen Length (ft)	Gradient
Upper GBZ Monitoring Wells						
1B	2408909 / 546267.4	617.759	574.51	594.44	20	Upgradient
2A	2409895 / 545676.1	589.596	524.98	560.98	20	Downgradient
Middle GBZ Monitoring Wells						
1A	2408901 / 546267.5	617.272	474.43	482.73	20	Sidegradient
3	2410005 / 545114	569.372	468.07	501.57	20	Upgradient
4	2408798 / 545106.5	490.901	456.38	484.19	NA	Downgradient
5	2408744 / 545496.4	490.488	463.20	486.37	10	Sidegradient
11	2409216 / 544852	533.597	423.25	472.73	20	Downgradient
12	2408546 / 545902.2	526.758	448.86	474.79	20	Downgradient
13	2409208 / 544442.7	564.989	465.26	505.99	40	Upgradient
14	2408613 / 544786.9	488.497	456.39	473.98	20	Downgradient
15	2407821 / 543883.2	565.03	429.68	497.64	20	Upgradient
16	2408010 / 545084.8	483.558	417.30	471.64	20	Downgradient
18	2408823 / 545092.4	490.733	423.35	481.88	20	Downgradient
Silurian GBZ Monitoring Wells						
3L	2410007 / 545144.4	570.355	417.69	474.18	10	Upgradient
4L	2408806 / 545112.6	490.527	429.23	481.71	10	Downgradient
7	2409278 / 547324.6	598.23	412.83	469.56	13.5	Downgradient
16L	2408015 / 545093.8	483.22	367.39	471.07	20	Downgradient
19	2409193 / 546682.8	615.295	399.55	470.06	20	Downgradient
Stope Monitoring Well						
2CR	2409765 / 545875.7	592.563	486.12			
Sump Monitoring Wells						
Leachate-Sump	2408957 / 545743.8	536.522				
Quarry-Sump	2407834 / 544450.5	485.636	443.42	449.74		
Leachate Monitoring Points						
MW-9	2409452 / 545411.2	596.29	498.49	Dry		
MW-10	2409664 / 545430.8	594.155	495.79	495.79		
UL-1	2409014 / 545798.2	553.785	544.38	Dry		
LL-1	2409020 / 545789.2	553.39	528.79	532.49		
UL-2	2408874 / 545928	542.305	535.15	537.44		
LL-2	2408869 / 545936	540.732	529.83	530.60		
UL-3	2408805 / 546029.2	543.105	535.69	536.69		
LL-3	2408810 / 546021.1	541.198	530.47	Dry		

All TD and groundwater elevation are based off the most recent Jan, 2021 field activites or as-builts
* - Unknown if well is still in place
Blank cells are unknown

Table 1b
Proposed Monitoring Well and Piezometer Network

Continental Cement Landfill
Permit Number 82-SDP-16-97P

Well ID	Location (Easting / Northing)	TOC Elevation	Total Depth	Approximate Groundwater Elevation	Screen Length (ft)	Gradient
Shallow GBZ Monitoring Wells						
1B	2408909 / 546267.4	617.759	43.249	594.44	20	Upgradient
2A	2409895 / 545676.1	589.596	64.616	560.98	20	Downgradient
Deep GBZ Monitoring Wells						
1A	2408901 / 546267.5	617.272	142.842	482.73	20	Downgradient
3	2410005 / 545114	569.372	101.302	501.57	20	Sidegradient
4	2408798 / 545106.5	490.901	34.521	484.19	NA	Downgradient
5	2408744 / 545496.4	490.488	27.29	486.37	10	Downgradient
11	2409216 / 544852	533.597	110.347	472.73	20	Downgradient
12	2408546 / 545902.2	526.758	77.898	474.79	20	Downgradient
13	2409208 / 544442.7	564.989	99.729	505.99	40	Upgradient
14	2408613 / 544786.9	488.497	32.107	473.98	20	Downgradient
15	2407821 / 543883.2	565.03	135.35	497.64	20	Upgradient
16	2408010 / 545084.8	483.558	66.26	471.64	20	Downgradient
18	2408823 / 545092.4	490.733	67.383	481.88	20	Downgradient
3L	2410007 / 545144.4	570.355	152.67	474.18	10	Sidegradient
4L	2408806 / 545112.6	490.527	61.297	481.71	10	Downgradient
7	2409278 / 547324.6	598.23	185.4	469.56	13.5	Upgradient
16L	2408015 / 545093.8	483.22	115.83	471.07	20	Downgradient
19	2409193 / 546682.8	615.295	215.745	470.06	20	Downgradient
Stope Monitoring Well						
2CR	2409765 / 545875.7	592.563	486.12			
Sump Monitoring Wells						
Leachate-Sump	2408957 / 545743.8	536.522				
Quarry-Sump	2407834 / 544450.5	485.636	443.42	449.74		
Leachate Monitoring Points						
MW-9	2409452 / 545411.2	596.29	498.49	Dry		
MW-10	2409664 / 545430.8	594.155	495.79	495.79		
UL-1	2409014 / 545798.2	553.785	544.38	Dry		
LL-1	2409020 / 545789.2	553.39	528.79	532.49		
UL-2	2408874 / 545928	542.305	535.15	537.44		
LL-2	2408869 / 545936	540.732	529.83	530.60		
UL-3	2408805 / 546029.2	543.105	535.69	536.69		
LL-3	2408810 / 546021.1	541.198	530.47	Dry		

All TD and groundwater elevation are based off the most recent Jan, 2021 field activites or as-builts
* - Unknown if well is still in place
Blank cells are unknown

Table 2
Monthly Static Waterlevel Measurements

Continental Cement Landfill
Permit Number 82-SDP-16-97P

Monitoring Point ID	Date											
	1/9/2020	2/11/2020	3/16/2020	4/7/2020	5/12/2020	6/9/2020	7/14/2020	8/11/2020	9/4/2020	10/13/2020	1/28/2021	2/22/2021
MW-1A	483.01	482.77	483.71	483.87	483.07	482.67	482.58	481.32	481.37	480.57	481.81	482.73
MW-3		470.27	473.45	470.95	468.54						495.05	501.57
MW-4	484.37	484.78	485.1	485.6	484.8	485.33	484.6	483.9	483.4	483.8	483.93	484.19
MW-5	486.68	487.05	487.5	486.92	486.49	487.39	487.34	483.32	481.59	485.29	486.71	486.37
MW-11	470.82	471.36	474.01	470.97	468.37	468.21	467.23	465.11	465.56	464.21	465.6	472.73
MW-12	474.98	472.86	476.04	474.86	475.05	475.05	474.43	473.26	471.86	473.31	474.14	474.79
MW-13	508.14		514.79	509.9	507.79	507.79	508.59	505.89	505.99	505.99	NM	NM
MW-14	474	474.15	474.66	474.65	473.54	473.95	473.71	472.2	472.3	472.5	473.11	473.98
MW-15	498.38	498.23	508.98	500.73	498.66	497.82	498.22	495.53	495.48	495.13	496.12	497.64
MW-16	471.2	471.16	471.56	472.11	471.16	471.36	470.72	469.19	468.36	469.16	470.57	471.64
MW-18	480.67	480.57	481.84	481.52	480.28	480.74	479.89	478.93	478.73	478.68	479.95	481.88
MW-3L	469.21	470.05	473.21	470.83	468.45	467.31	467.29	464.46	464.26	463.01	467.66	474.18
MW-4L	480.53	480.68	481.8	481.48	480.25	480.58	479.75	478.74	478.68	478.58	480.28	481.71
MW-7	469.28	468.08	469.71	469.59	466.98	466.98	466.63	463.18	463.58	462.73	466.16	469.56
MW-16L	465.87	466.71	469.37	465.52	461.67	462.82	461.9	458.97	459.09	458.72	462.66	471.07
MW-19	469.13	468.52	470.78	469.65	468.43	466.9	466.79	464.53	465.3	463.1	466.12	470.06
MW-1B	594.27	594.44	594.68	594.76	595.33	594.61	594.17	588.83	588.36	589.16	594.47	594.44
MW-2A	560.86	560.48	561.05	561.43	561.04	561.25	560.36	560.36	560.1	560.6	561.02	560.98
MW-2CR	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Q-Sump	453.74	453.72	455.44	453.75	453.21	453.31	453.64	447.07	447.07	455.08	455.19	449.74
Leachate Monitoring Point												
MW-9	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW-10	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	495.89	495.94
UL-1	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	545.07
LL-1	531.52	530.69	Dry	Dry	531.27	531.77	531.64	531.14	530.89	531.69	532.49	532.91
UL-2	536.34	536.99	537.09	536.08	NM	NM	NM	Dry	Dry	NM	537.44	537.47
LL-2	530.48	530.44	530.45	531.7	NM	NM	NM	530.53	Dry	NM	530.6	530.78
UL-3	Dry	535.85	536.13	535.99	NM	NM	536.34	Dry	Dry	537.81	536.69	536.52
LL-3	Dry	Dry	Dry	531.10	NM	NM	Dry	Dry	Dry	Dry	Dry	Dry

NM - Not Monitored
msl - mean sea level

Table 3

Sample Method, Collection, Preservation, and Holding Time

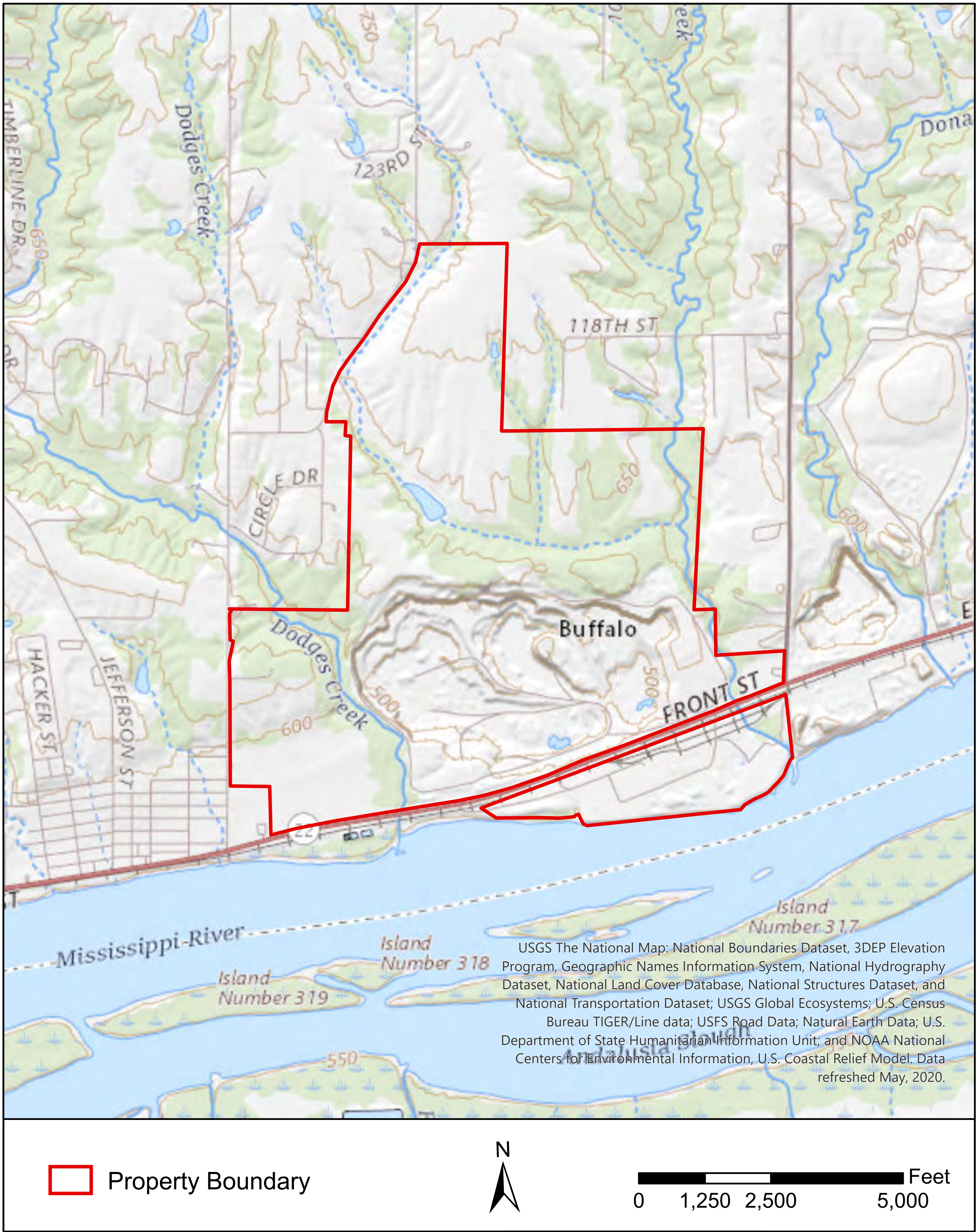
Continental Cement Landfill
Permit Number 82-SDP-16-97P

Analysis	Method	Containers	Preservatives	Holding Times
Total Metals	EPA Method 6010B	500 mL plastic	HNO3 pH<2; Cool 4 degrees Celsius	6 Months
Chloride	SM4500	125 mL plastic	Cool 4 degrees Celsius	28 Days
Total Dissolved Solids	SM 2540	500 mL plastic	Cool 4 degrees Celsius	28 Days
Sulfate	9056	125 mL plastic	Cool 4 degrees Celsius	28 Days
Nitrate/Nitrite	SM 4500	125 mL plastic	Cool 4 degrees Celsius	48 Hours
Phosphorous	EPA 365.1	125 mL plastic	H2SO4 pH<2; Cool 4 degrees Celsius	28 Days

FIGURES

CONTINENTAL CEMENT COMPANY

Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental



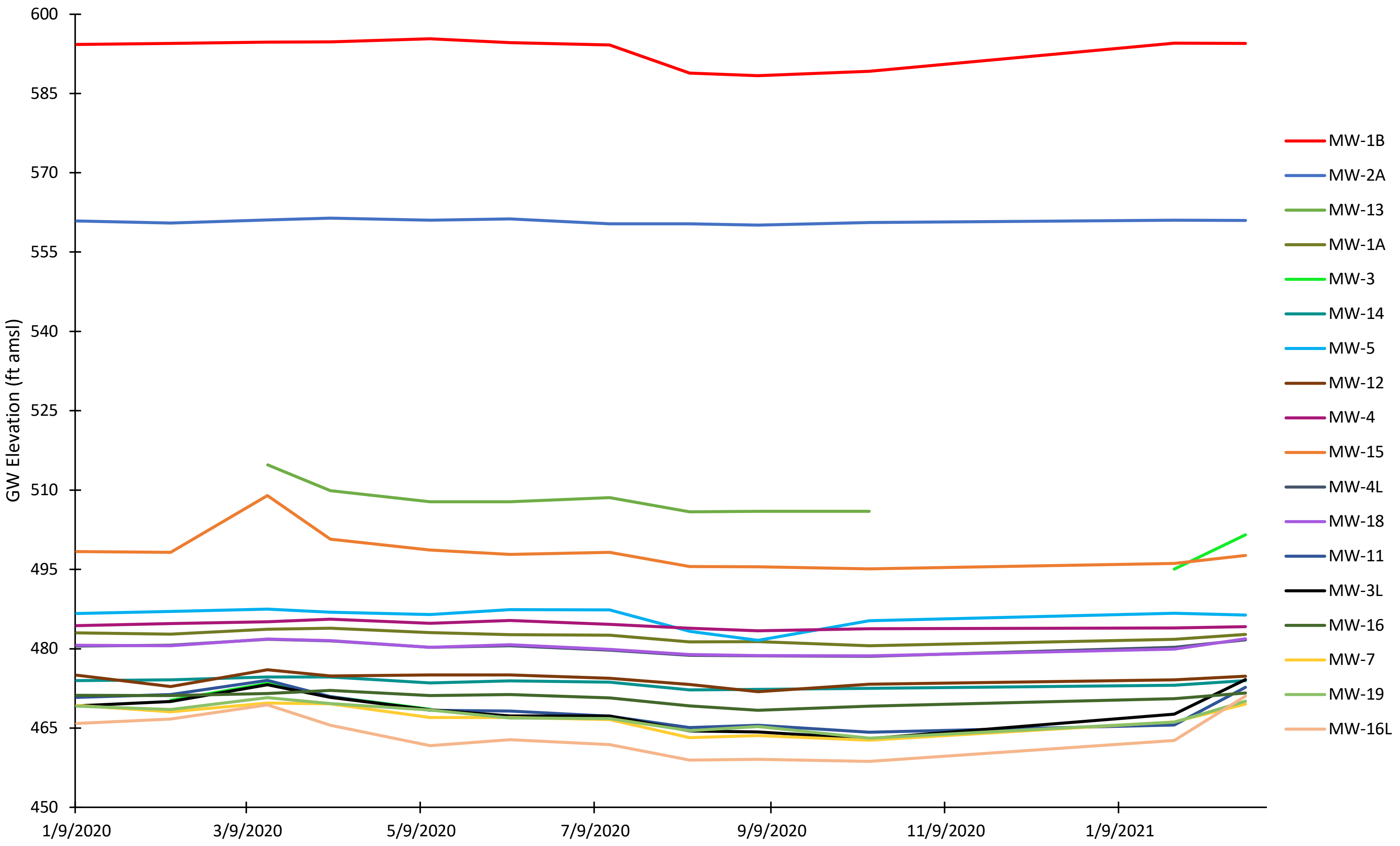
USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed May, 2020.

FIGURE 1	Project Mgr. KB	Date: 02-03-2021	CONTINENTAL CEMENT BUFFALO, IOWA	SHEET NAME Site Topographic Vicinity Map	BLACKSTONE ENVIRONMENTAL
	Designed By: TS	Rev.:		PROJECT NAME Continental Cement Landfill Services	
	Drawn By: TS	Rev.:			
	Checked By: LJ	Rev.:		PROJECT LOCATION 301 East Front Street Buffalo, Iowa	
	Job No.: 3066	Rev.:			

Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental

FIGURE 1B	Project Mgr. KB Designed By: TS Drawn By: TS Checked By: LJ Job No.: 3066	Date: 02-03-2021 Rev.: Rev.: Rev.: Rev.:	CONTINENTAL CEMENT BUFFALO, IOWA	SHEET NAME Site Plan PROJECT NAME Continental Cement Landfill Services PROJECT LOCATION 301 East Front Street Buffalo, Iowa

BLACKSTONE ENVIRONMENTAL



FIGURE

2

Sheet Name:

Hydrograph

Project Mgr.	KB	Job No.:	3066
Drawn By:	TS	Date:	03-03-2021
Checked By:	LJ	Rev:	

Continental Cement
Buffalo, Iowa
301 East Front Street Buffalo, Iowa

BLACKSTONE ENVIRONMENTAL

FIGURE
3

Project Mgr. KB
Designed By: TS
Drawn By: ME
Checked By: LJ
Job No.: 3066

Date: 03-16-2021
Rev.: 03-24-2021
Rev.:
Rev.:
Rev.:

CONTINENTAL CEMENT

BUFFALO, IOWA

SHEET NAME
Upper GBZ Groundwater Contour Map

PROJECT NAME
Continental Cement Landfill Services

PROJECT LOCATION
301 East Front Street Buffalo, Iowa

BLACKSTONE ENVIRONMENTAL

FIGURE 4	Project Mgr. KB	Date: 03-16-2021	CONTINENTAL CEMENT BUFFALO, IOWA
	Designed By: TS	Rev.:	
	Drawn By: TS	Rev.:	
	Checked By: LJ	Rev.:	
	Job No.: 3066	Rev.:	

SHEET NAME
Middle GBZ Groundwater Contour Map

PROJECT NAME
Continental Cement Landfill Services

PROJECT LOCATION
301 East Front Street Buffalo, Iowa

BLACKSTONE ENVIRONMENTAL

Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental

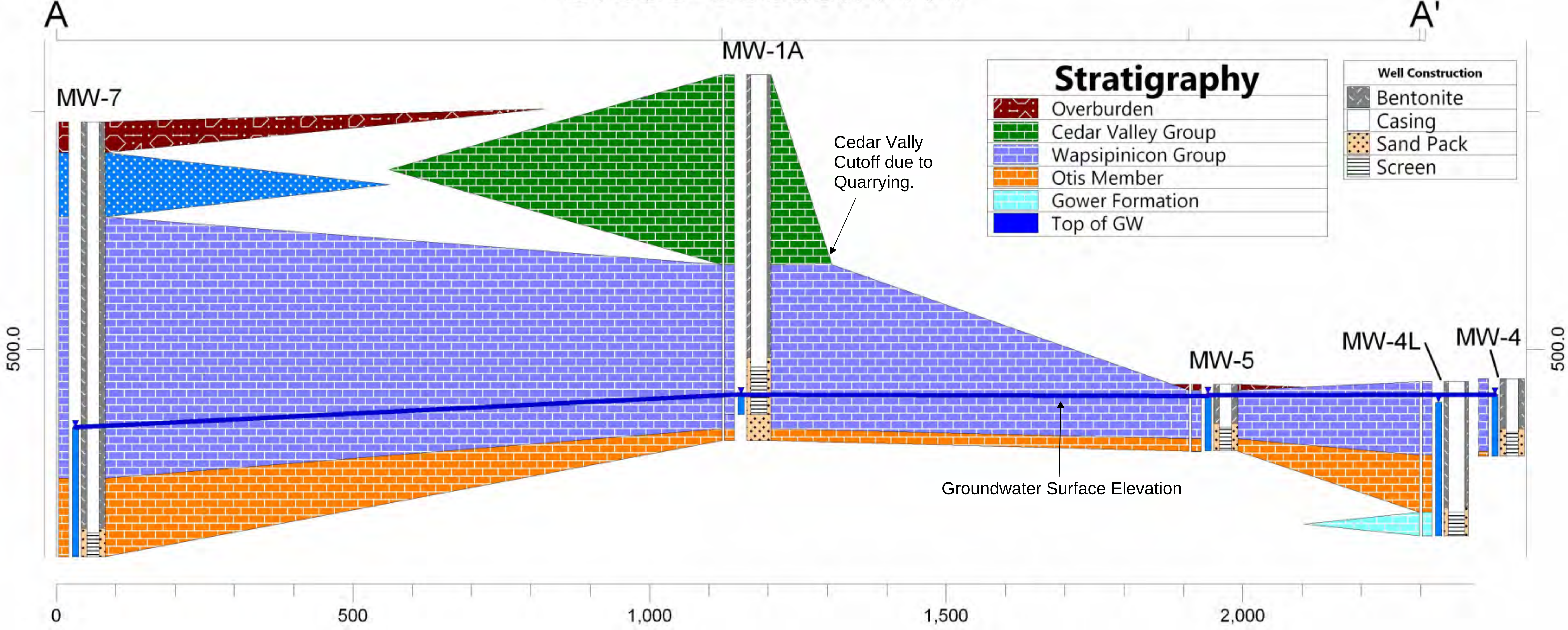
FIGURE 5	Project Mgr. KB	Date: 03-16-2021	CONTINENTAL CEMENT BUFFALO, IOWA	SHEET NAME Lower GBZ Groundwater Contour Map
	Designed By: TS	Rev.: 03-16-2021		PROJECT NAME Continental Cement Landfill Services
	Drawn By: ME	Rev.:		PROJECT LOCATION 301 East Front Street Buffalo, Iowa
	Checked By: LJ	Rev.:		
	Job No.: 3066	Rev.:		

BLACKSTONE ENVIRONMENTAL

Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental

FIGURE 6	Project Mgr. KB	Date: 03-16-2021	CONTINENTAL CEMENT BUFFALO, IOWA	SHEET NAME Combined Lower & Middle Contour Map	BLACKSTONE ENVIRONMENTAL
	Designed By: ME	Rev.: 03-24-2021		PROJECT NAME Continental Cement Landfill Services	
	Drawn By: ME	Rev.:			
	Checked By: LJ	Rev.:		PROJECT LOCATION 301 East Front Street Buffalo, Iowa	
	Job No.: 3066	Rev.:			

Cross-Section A-A'



4x Vertical Exaggeration

BLACKSTONE ENVIRONMENTAL

SHEET NAME
CROSS SECTION A-A'

PROJECT NAME
CONTINENTAL CEMENT LANDFILL SERVICES

PROJECT LOCATION
BUFFALO, IA

CONTINENTAL CEMENT
BUFFALO, IOWA

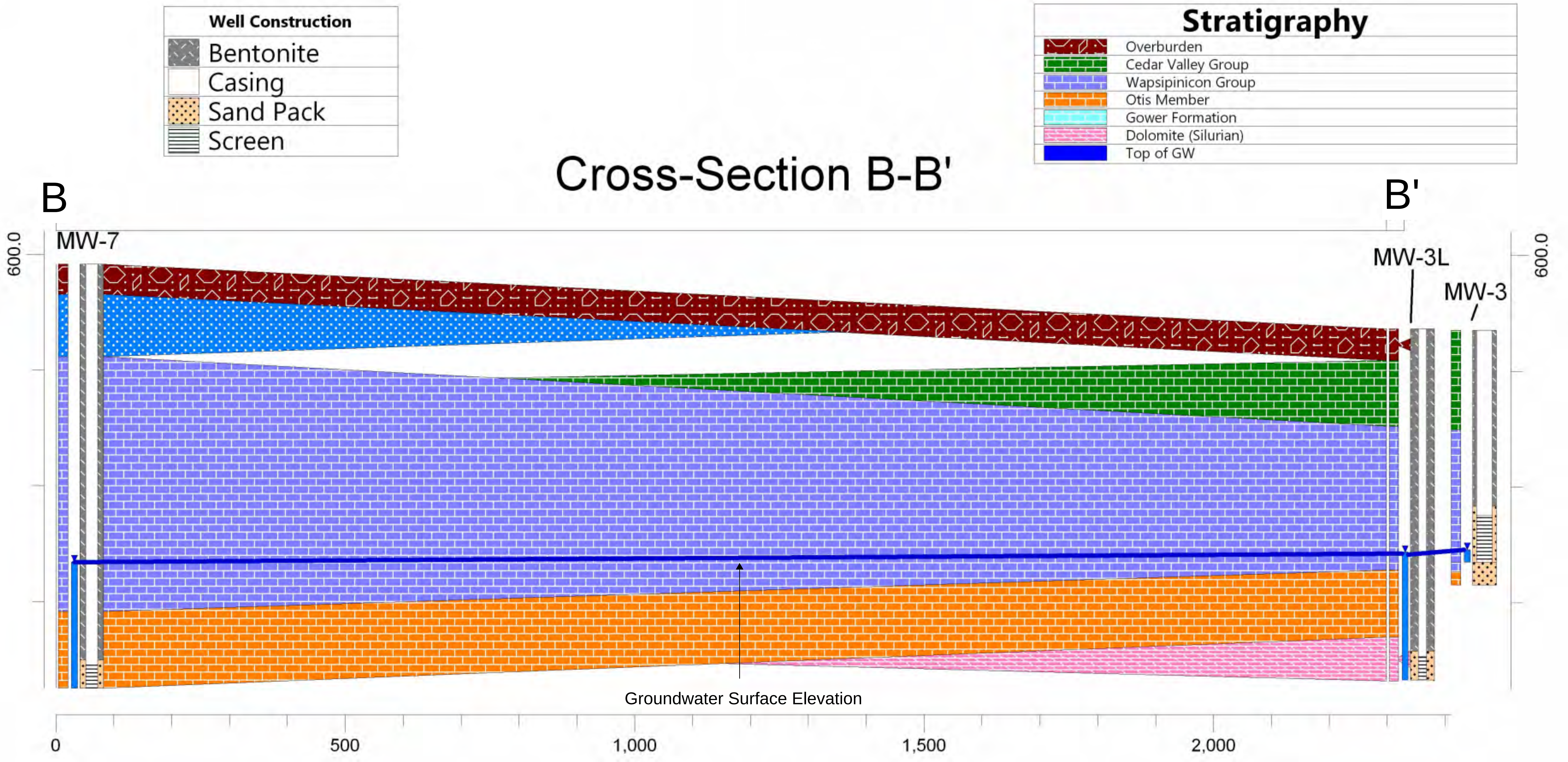
Date: 3-24-2021
Rev.:
Rev.:
Rev.:
Rev.:

Project Mgr: KB
Designed By: ME
Drawn By: ME
Checked By: LJ
Job No.: 3066

FIGURE
7

Path: Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental\Continental.aprx

Cross-Section B-B'



4x Vertical Exaggeration

Path: Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental\Continental.aprx

BLACKSTONE
ENVIRONMENTAL

SHEET NAME
CROSS SECTION B-B'
PROJECT NAME
CONTINENTAL CEMENT LANDFILL SERVICES
PROJECT LOCATION
BUFFALO, IA

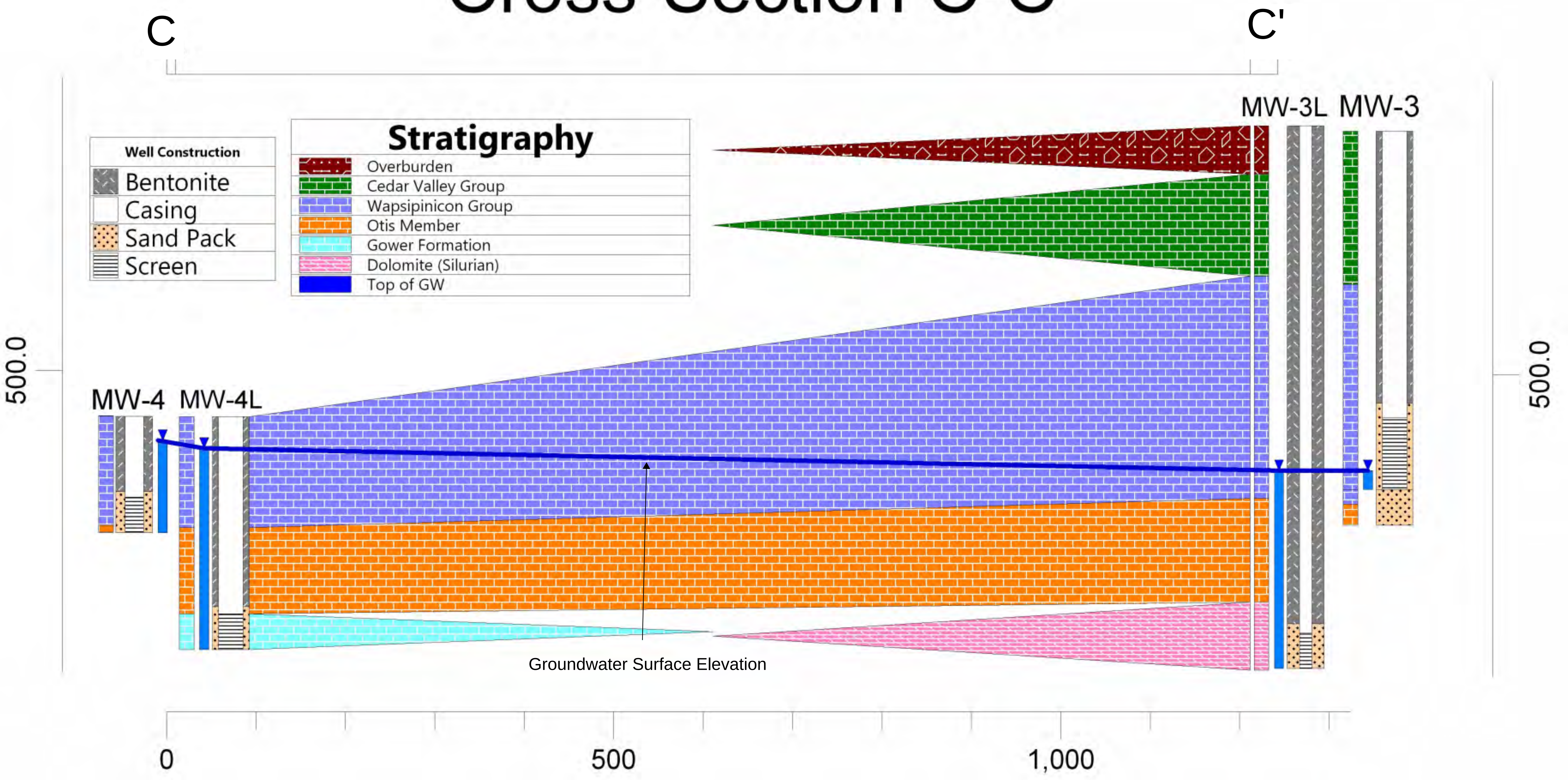
CONTINENTAL CEMENT
BUFFALO, IOWA

Date: 3-24-2021
Rev.:
Rev.:
Rev.:
Rev.:

Project Mgr. KB
Designed By: ME
Drawn By: ME
Checked By: LJ
Job No.: 3066

FIGURE
8

Cross-Section C-C'



4x Vertical Exaggeration

BLACKSTONE
ENVIRONMENTAL

SHEET NAME
CROSS SECTION C-C'
PROJECT NAME
CONTINENTAL CEMENT LANDFILL SERVICES
PROJECT LOCATION
BUFFALO, IA

CONTINENTAL CEMENT
BUFFALO, IOWA

Date: 3-24-2021
Rev.:
Rev.:
Rev.:
Rev.:

Project Mgr: KB
Designed By: ME
Drawn By: ME
Checked By: LJ
Job No.: 3066

FIGURE
9

Path: Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental\Continental.aprx

Path: Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental\Continental.aprx

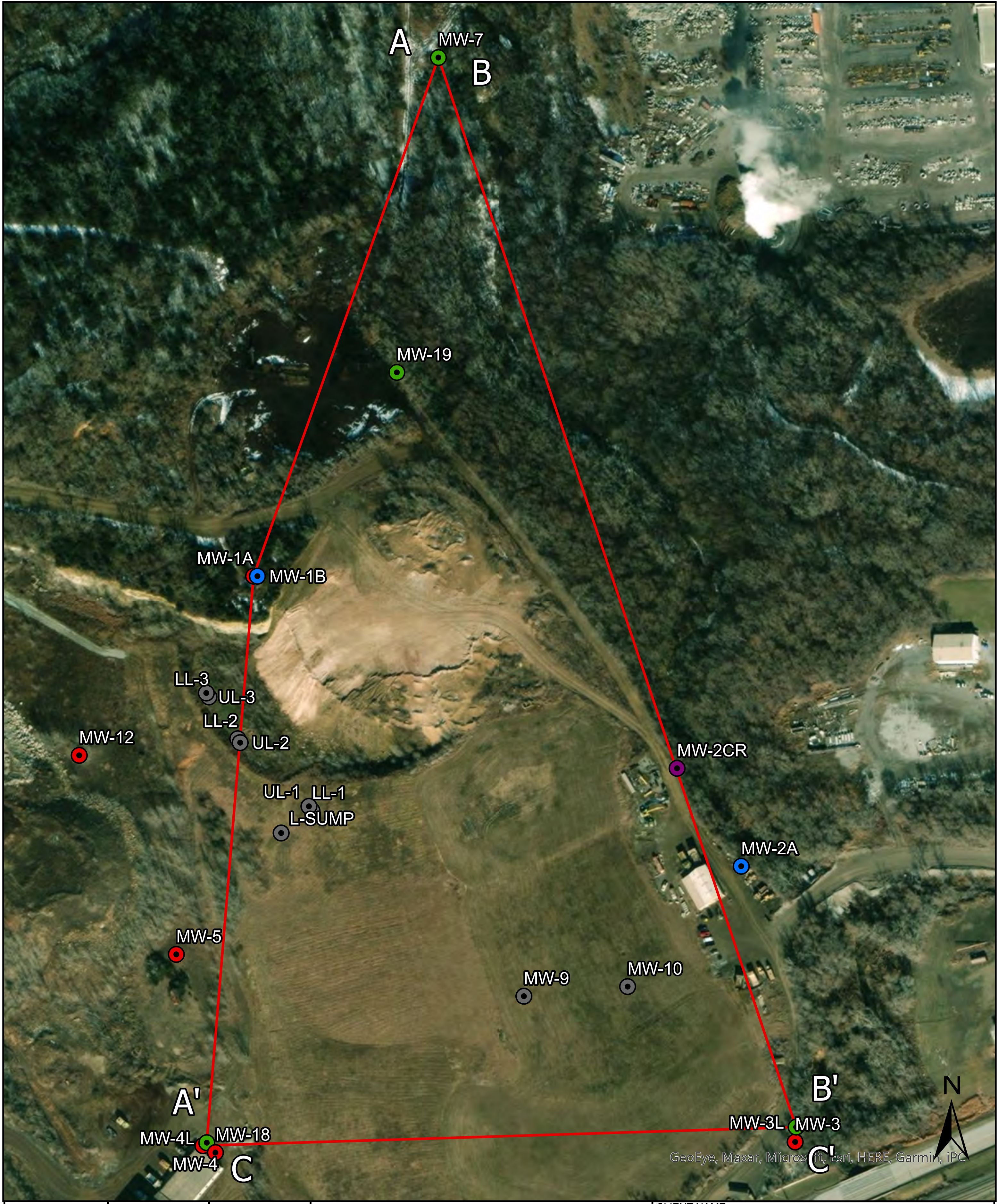
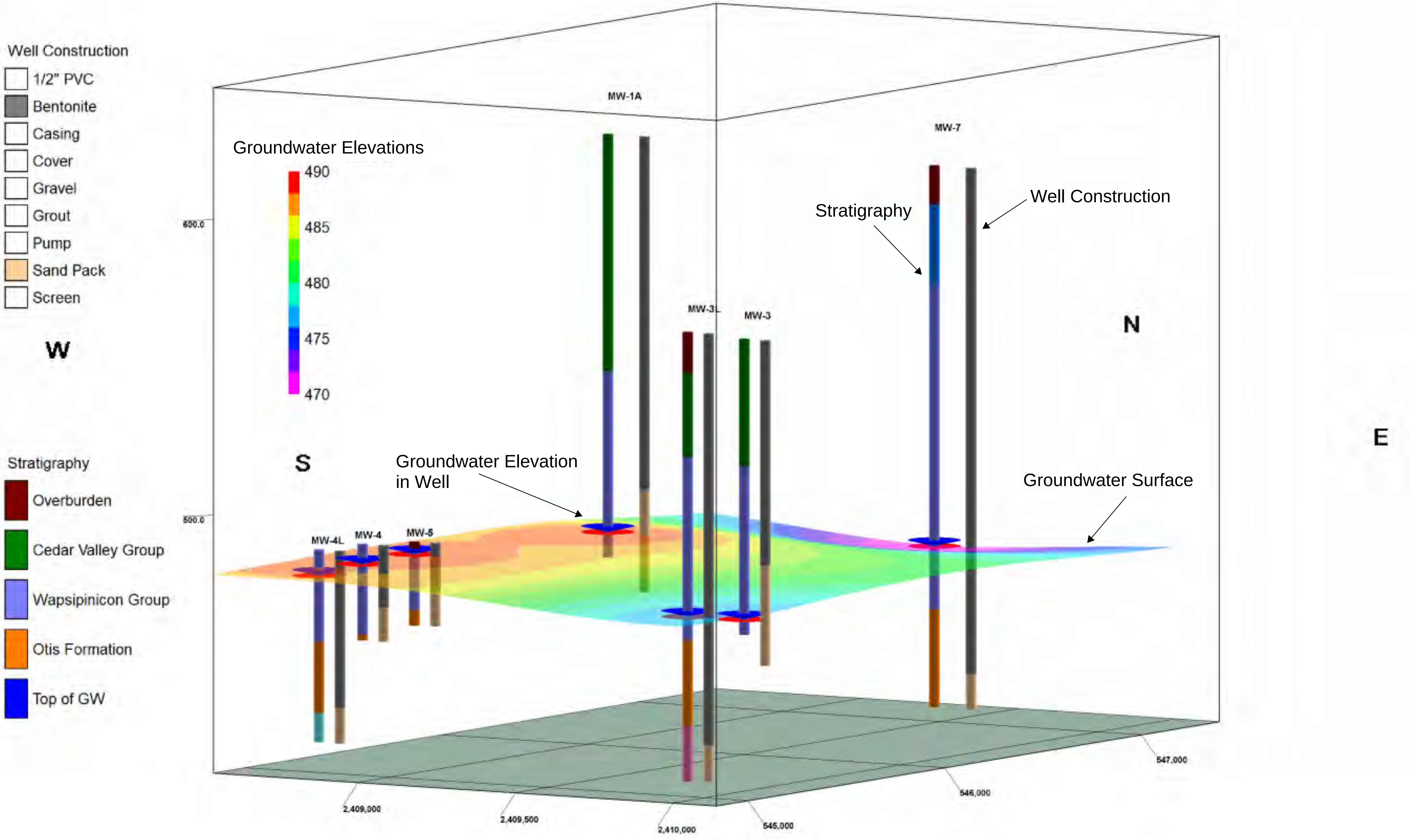


FIGURE 10	Project Mgr. KB	Date: 3-25-2021	BLACKSTONE ENVIRONMENTAL	CLIENT NAME CONTINENTAL CEMENT
	Designed By: ME	Rev.:		SHEET NAME CROSS SECTION PLAN VIEW
	Drawn By: ME	Rev.:		PROJECT NAME AND LOCATION BUFFALO, IA
	Checked by: LJ	Rev.:		
	Job No.: 3066	Rev.:		



8X Vertical Exaggeration

BLACKSTONE ENVIRONMENTAL

SHEET NAME
Groundwater Surface Model - Monofill Area

PROJECT NAME
CONTINENTAL CEMENT LANDFILL SERVICES

PROJECT LOCATION
BUFFALO, IA

CONTINENTAL CEMENT
BUFFALO, IOWA

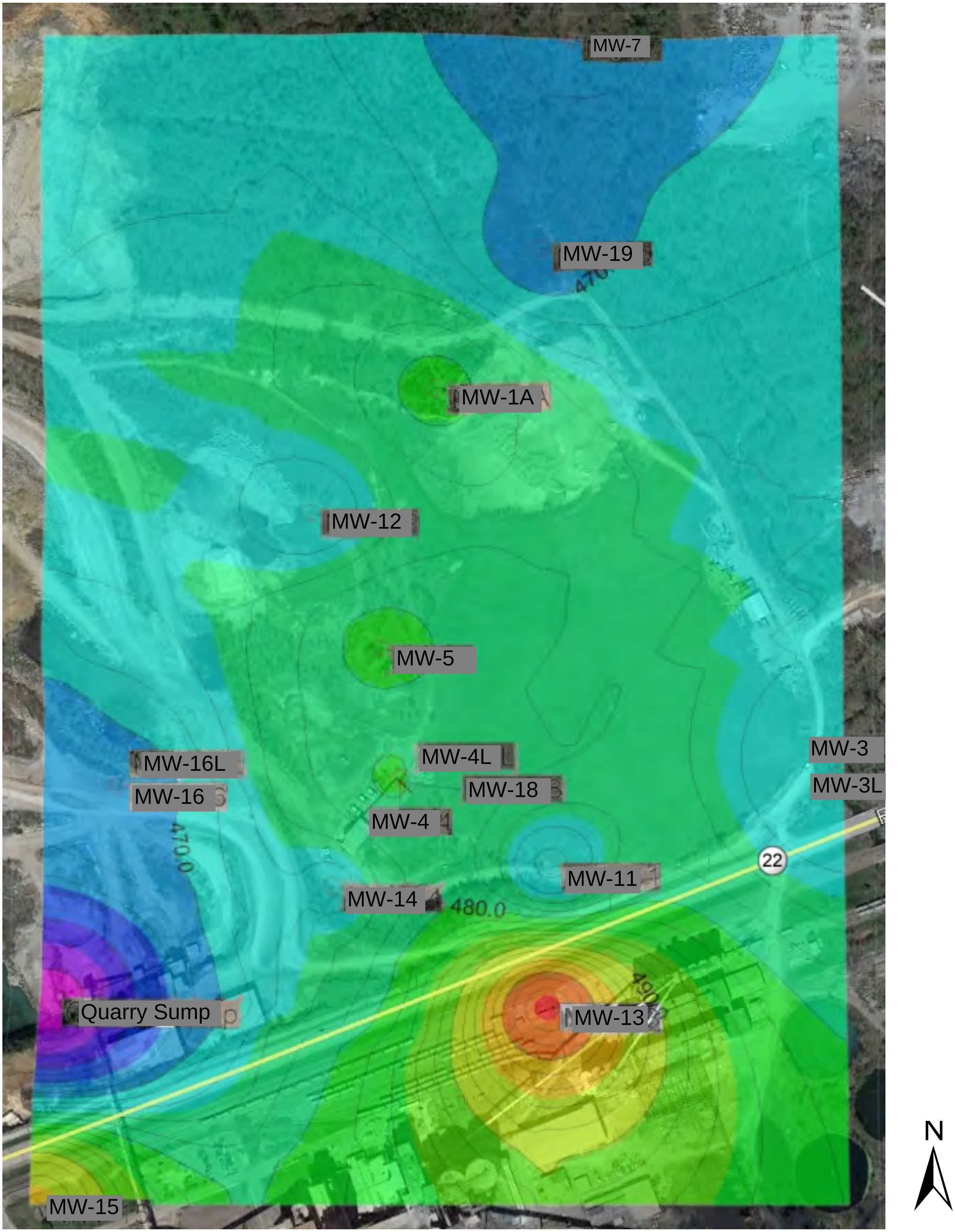
Date: 3-24-2021
Rev.:
Rev.:
Rev.:
Rev.:

Project Mgr. KB
Designed By: ME
Drawn By: ME
Checked By: LJ
Job No.: 3066

FIGURE
11

Path: Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental\Continental.aprx

Path: Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental\Continental.aprx



FIGURE

12

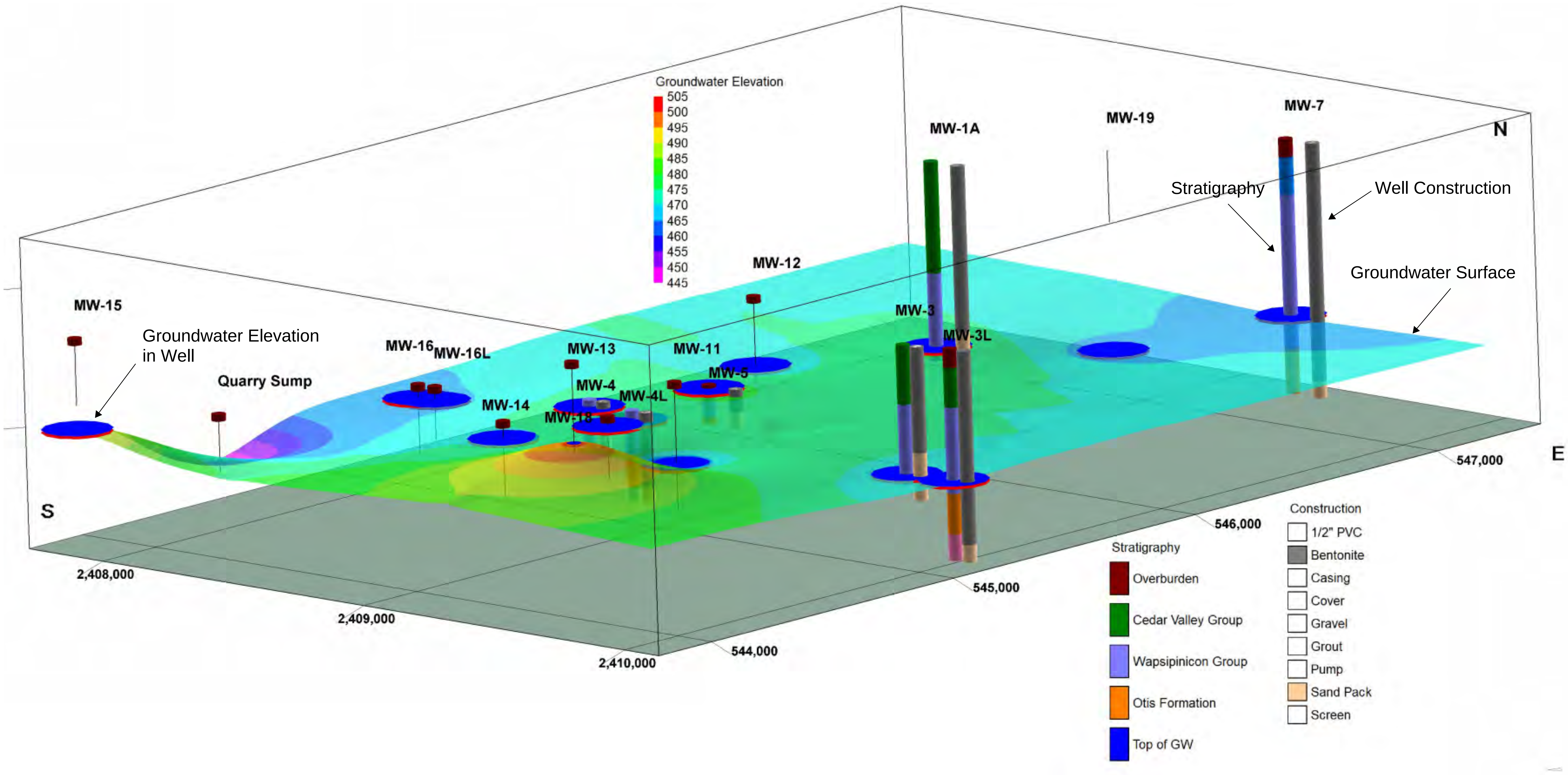
Project Mgr. KB	Date: 3-25-2021
Designed By: ME	Rev.:
Drawn By: ME	Rev.:
Checked by: LJ	Rev.:
Job No.: 3066	Rev.:

BLACKSTONE
ENVIRONMENTAL

CLIENT NAME
CONTINENTAL CEMENT

SHEET NAME
GROUNDWATER SURFACE MODEL CONTOUR MAP

PROJECT NAME AND LOCATION
BUFFALO, IA



Path: Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental\Continental.aprx

BLACKSTONE ENVIRONMENTAL

SHEET NAME
Groundwater Surface Model

PROJECT NAME
CONTINENTAL CEMENT LANDFILL SERVICES

PROJECT LOCATION
BUFFALO, IA

CONTINENTAL CEMENT
BUFFALO, IOWA

Date: 3-24-2021
Rev.:
Rev.:
Rev.:
Rev.:

Project Mgr.: KB
Designed By: ME
Drawn By: ME
Checked By: LJ
Job No.: 3066

FIGURE
12

APPENDIX A

CONTINENTAL CEMENT COMPANY

Boring Logs and Well Construction Diagrams

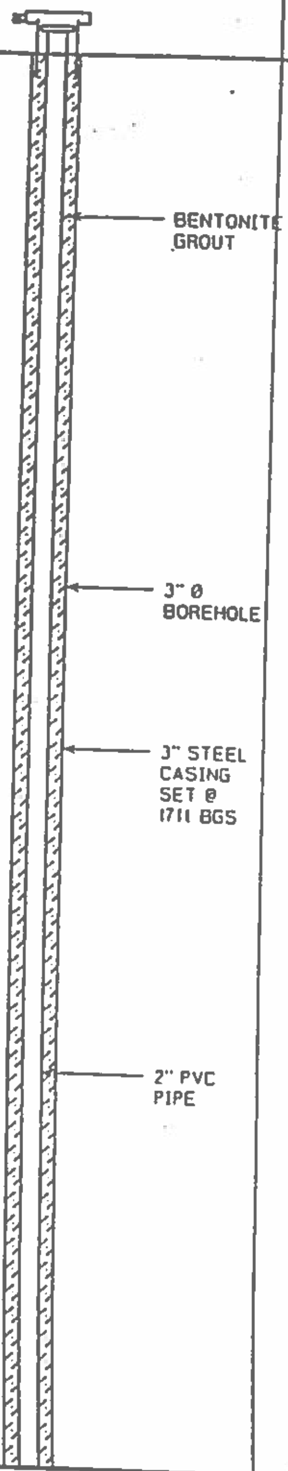
STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-01)
Page 1 of 5

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW1A-95
DATE COMPLETED: FEBRUARY 1, 1995
DRILLING METHOD: WC
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
	GROUND SURFACE REFERENCE POINT (Top of Riser)	615.50 616.95						
	LIMESTONE (CEDAR VALLEY GROUP), dolomitized, sandy, hard, vuggy, fossilized, reddish tan, andelusia member							
-2.5								
-5.0								
-7.5								
-10.0					1	85	5	
2.5								
-15.0								
-17.5	- calcarenite, medium to fine grained, grey to tan, fossiliferous, stratified and interbedded with calcilutite, silty to muddy, cou falls member							
-20.0								
-22.5								
-25.0								
-27.5					2	85	-	
-30.0								
.5								
	- interbedded argillaceous calcites				3	85	17	



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▽ STATIC WATER LEVEL ▼

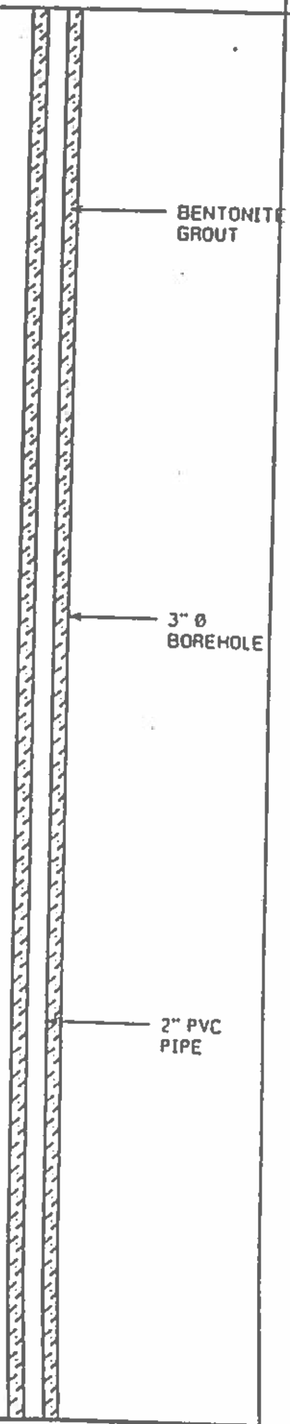
STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-01)
Page 2 of 5

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW1A-95
DATE COMPLETED: FEBRUARY 1, 1895
DRILLING METHOD: WC
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
	distinctly stratified fossiliferous and unfossiliferous beds, vuggy calcite replacements, various hues of gray and tan, rapid member and solon member							
-37.5								
-40.0								
-42.5								
-45.0								
-47.5								
-50.0								
-52.5					3	85	17	
-55.0								
-57.5								
-60.0								
-62.5								
-65.0								
-67.5								



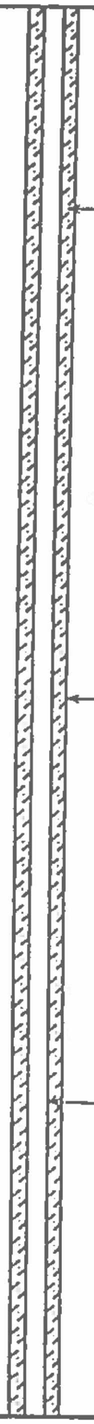
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-01)
Page 3 of 5

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW1A-95
DATE COMPLETED: FEBRUARY 1, 1995
DRILLING METHOD: WC
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
72.5								
75.0			BENTONITE GROUT		3	95	17	
77.5								
80.0	LIMESTONE (WAPSIPINICON GROUP), massive, microspar to intraclastic stratified beds, brecciated and fractured fossiliferous with pyrite and calcite replacements of fossils and infilling of fractures and breccia matrix, hardened beds are stylolitic, gray-tan, davenport member	*535.50*						
82.5								
85.0								
87.5			3" Ø BOREHOLE					
90.0								
92.5					4	95	10	
95.0								
97.5			2" PVC PIPE					
100.0								
102.5								

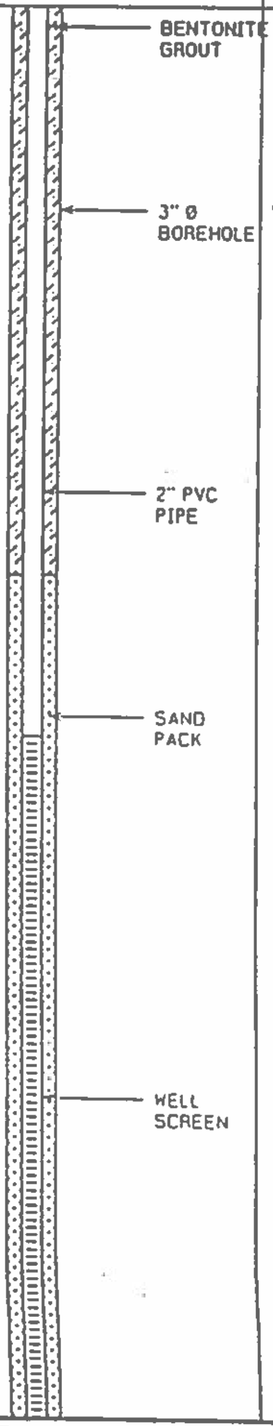
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE: REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊻ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-01)
Page 4 of 5

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW1A-95
DATE COMPLETED: FEBRUARY 1, 1995
DRILLING METHOD: WC
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
-107.5								
-110.0								
-112.5					4	95	10	
-115.0								
-117.5								
-120.0								
-122.5	- highly fractured weathered and flaggy on upper contact stratified interbedded arenitic, petroliferous and prominently stylolitic, some shaley beds white to gray to tan, some beds are more crystaline toward the lower contact, spring grove member							
-125.0								
-127.5								
-130.0					5	95	12	
-132.5								
-135.0								
-137.5								
	- dolomitic, brecciated and fractured bedded, argillaceous to arenitic limestone, some fossils, quartz filling fractures				6	95	64	

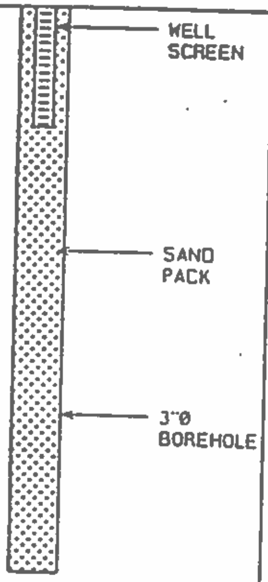
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊻ STATIC WATER LEVEL ⊻

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-01)
Page 5 of 5

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW1A-95
DATE COMPLETED: FEBRUARY 1, 1995
DRILLING METHOD: WC
CRA SUPERVISOR: D. SHEILD



DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
	distictly stratified lower contact with sandy, gray and tan beds, kenwood member							
-142.5								
-145.0					6	95	64	
-147.5								
	LIMESTONE (OTIS FORMATION), finely bedded and argillaceous brecciated, vuggy and fractured with calcite filling vugs and fractured, bluish gray to tan	466.58						
-150.0								
-152.5					7	85	20	
	END OF HOLE @ 153.9ft BGS	461.58						
-155.0			<u>SCREEN DETAILS</u> Screened interval: 123 to 143ft BGS Length: 20ft Diameter: 2" Slot Size: #10 Material: PVC Sand Pack: 119 to 153.9ft BGS Material: #30 Flint					
-157.5								
-160.0								
-162.5								
-165.0								
-167.5								
-170.0								
172.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊻ STATIC WATER LEVEL ⊻

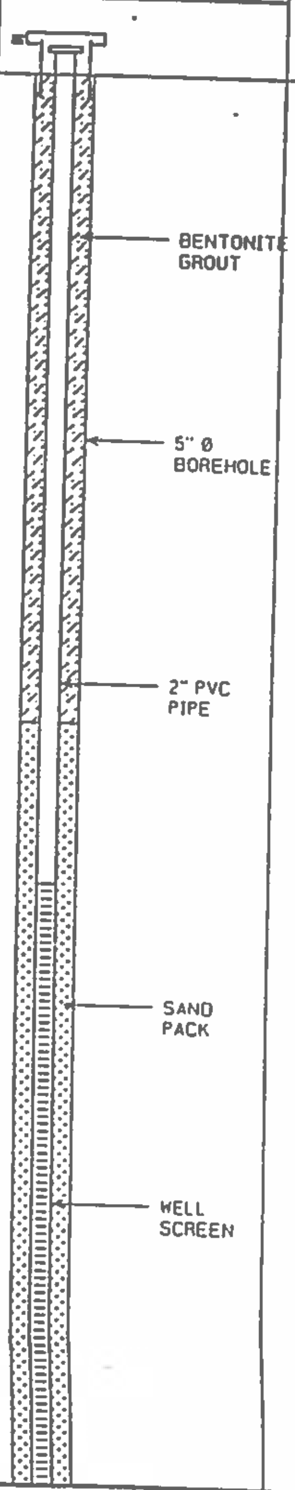
STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-02)
Page 1 of 2

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW18-95
DATE COMPLETED: FEBRUARY 21, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
	GROUND SURFACE REFERENCE POINT (Top of Riser)	*815.40* *818.51*						
	LIMESTONE (CEDAR VALLEY GROUP), dolomitized, sandy, hard, vuggy, fossilized, reddish tan, andelusia member							
-2.5								
-5.0								
-7.5								
-10.0								
-12.5								
-15.0								
-17.5	- interbedded calcilutite and fossiliferous beds, silty to muddy, cou falls member							
-20.0								
-22.5								
-25.0								
-27.5								
-30.0								
2.5								



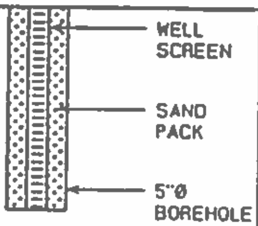
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊻ STATIC WATER LEVEL ⊻

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-02)
Page 2 of 2

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW18-95
DATE COMPLETED: FEBRUARY 21, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
	- interbedded argillaceous calcilutite, fossiliferous, with calcite filled vugs, gray and tan, rapid member		 					
37.5								
40.0	END OF HOLE @ 40.0ft BGS	*575.49*	SCREEN DETAILS Screened interval: 20 to 40ft BGS Length: 20ft Diameter: 2" Slot Size: #10 Material: PVC Sand Pack: 16 to 41ft BGS Material: #30 Flint					
42.5								
45.0								
47.5								
50.0								
52.5								
55.0								
57.5								
60.0								
62.5								
65.0								
67.5								

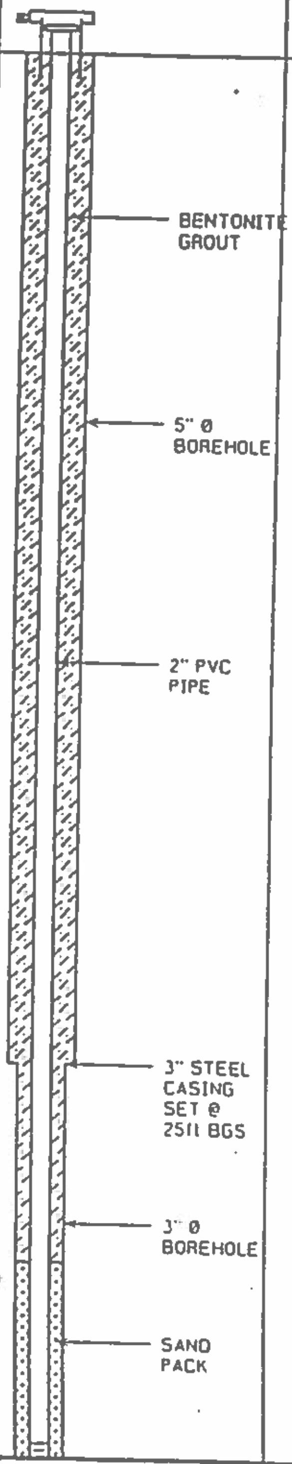
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ∇ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-03)
Page 1 of 4

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW2A-95
DATE COMPLETED: FEBRUARY 1, 1995
DRILLING METHOD: WC
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
	GROUND SURFACE REFERENCE POINT (Top of Riser)	*587.37* *588.22*						
	SM-SAND (FILL), some gravel, little silt, fine to medium grained, brown, moist							
-2.5								
-5.0								
-7.5								
-10.0	SC/SM-SAND (FILL), silty, some clay, trace gravel, fine to medium grained, brown, moist	*577.37*						
-12.5								
-15.0								
-17.5	SM-SAND (FILL), some silt, little gravel, fine to medium grained, brown, moist	*569.87*						
-20.0								
-22.5								
-25.0	LIMESTONE (CEDAR VALLEY GROUP), interbedded calcilutite and arenitic, fossiliferous, very fine to coarse grained, slightly stylolitic and fractured with traces of calcite and pyrite filling fractures, gray and tan, rapid and solon member	*562.37*						
-27.5								
-30.0								
-32.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▽ STATIC WATER LEVEL ▼

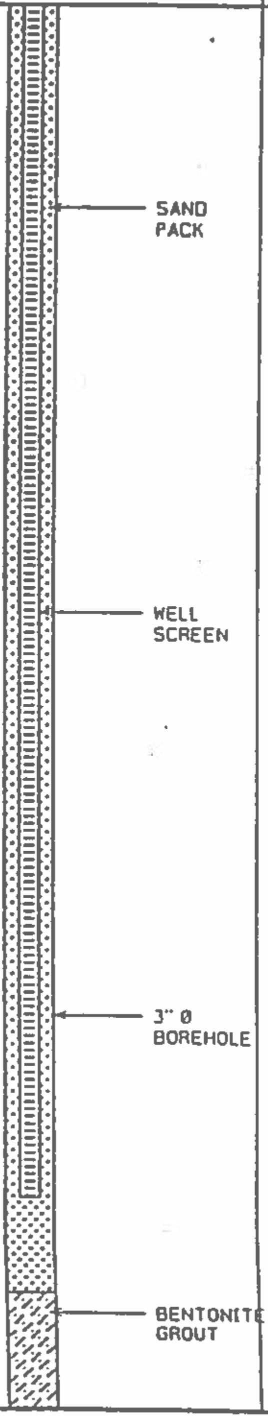
STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-03)
Page 2 of 4

PROJECT NAME: LAFARGE
PROJECT NUMBER: 8031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW2A-95
DATE COMPLETED: FEBRUARY 1, 1995
DRILLING METHOD: WC
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
-37.5								
-40.0								
	LIMESTONE (WAPSIPINICON GROUP), argillaceous to microspar, compact crystaline, interbedded and fossiliferous, abundant stylolites with vugs and abundant fractures, locally brecciated with pyrite and calcite healing fractures and voids, gray to light brown, davenport member	*546.37*						
-42.5								
-45.0								
-47.5								
-50.0								
-52.5								
-55.0								
-57.5								
-60.0								
-62.5								
-65.0								
-67.5								

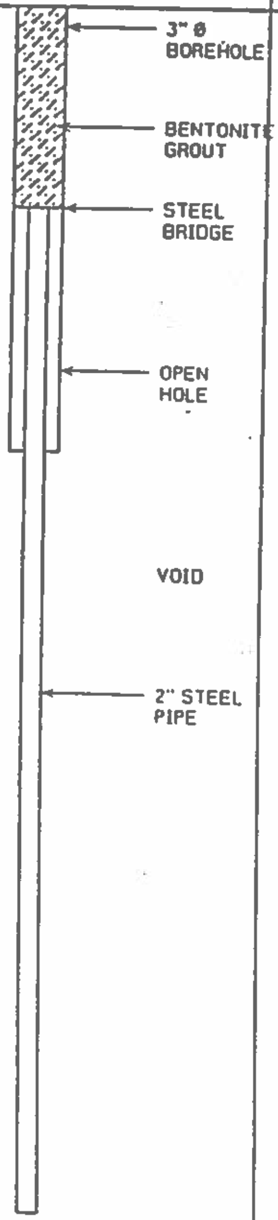


NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊻ STATIC WATER LEVEL ⊻

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW2A-95
DATE COMPLETED: FEBRUARY 1, 1995
DRILLING METHOD: WC
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
72.5								
75.0								
77.5								
80.0	- petroliferous, highly fractured, stylolitic, finely bedded, microcrystalline to arenitic, with calcite and pyrite filling fractures, light brown, spring grove member	506.37						
82.5	- void (81.0 to 100.0ft BGS)							
85.0								
87.5								
90.0								
	- standing water (91 to 100ft BGS)	∇						
92.5								
95.0								
97.5								
100.0	BEDROCK	487.37						
	END OF HOLE @ 100.0ft BGS	487.37						
02.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ∇ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-03)
Page 4 of 4

PROJECT NAME: LAFARGE
ROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW2A-95
DATE COMPLETED: FEBRUARY 1, 1995
DRILLING METHOD: WC
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
			<u>SCREEN DETAILS</u> Screened Interval: 34.6 to 64.6ft BGS Length: 30ft Diameter: 2" Slot Size: #10 Material: PVC Sand Pack: 30 to 67ft BGS Material: #30 Flint					
-107.5								
-110.0								
-112.5								
-115.0								
.5								
-120.0								
-122.5								
-125.0								
-127.5								
-130.0								
-132.5								
-135.0								
.5								

<u>NOTES:</u> MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▽ STATIC WATER LEVEL ▼

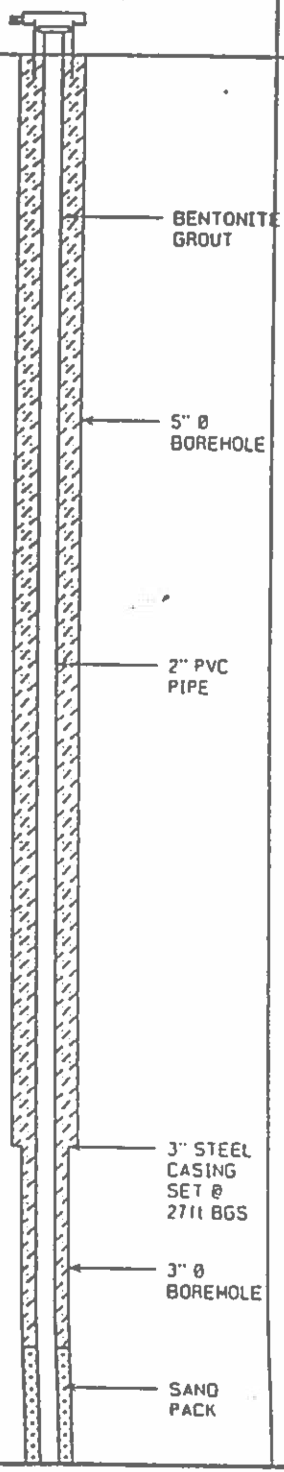
STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-04)
Page 1 of 4

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW2B-95
DATE COMPLETED: FEBRUARY 21, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
	GROUND SURFACE REFERENCE POINT (Top of Riser)	*587.21* *580.61*						
	SM-SAND (FILL), some gravel, fine to medium grained, brown, moist							
-2.5								
-5.0								
-7.5								
-10.0	SC/SM-SAND (FILL), silty, some clay, trace gravel, fine to medium grained, brown, moist	*577.21*						
-12.5								
-15.0								
-17.5	SM-SAND (FILL), some silt, little gravel, fine to medium grained, brown, moist	*569.71*						
-20.0								
-22.5								
-25.0								
-27.5	LIMESTONE (CEDAR VALLEY GROUP), interbedded calcilutite and arenitic, fossiliferous, very fine to coarse grained, slightly stylolitic and fractured with traces of calcite and pyrite filling fractures, gray and tan, rapid and solon member	*560.21*						
-30.0								
-32.5								



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▽ STATIC WATER LEVEL ▼

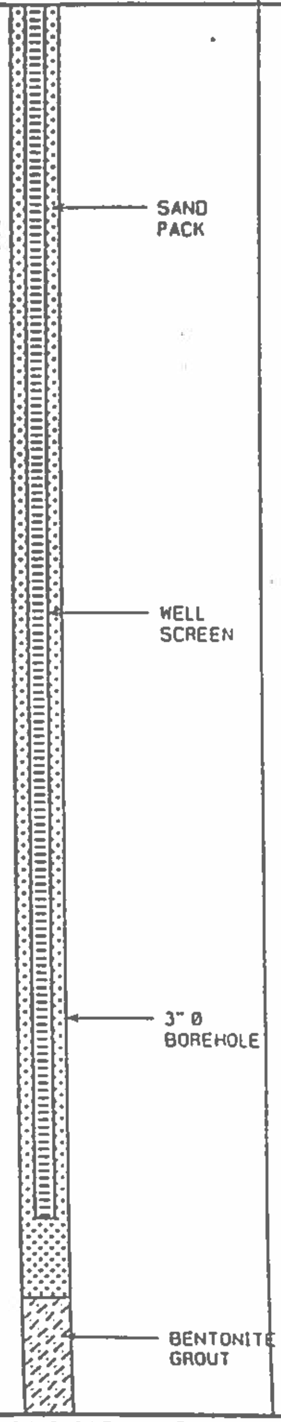
STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-04)
Page 2 of 4

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW2B-95
DATE COMPLETED: FEBRUARY 21, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
-37.5								
-40.0								
	LIMESTONE (WAPSIPINICON GROUP), argillaceous to microspar, compact crystaline, interbedded and fossiliferous, abundant stylolites with vugs and abundant fractures, locally brecciated with pyrite and calcite healing fractures and voids, gray to light brown, davenport member	546.21						
-42.5								
-45.0								
-47.5								
-50.0								
-52.5								
-55.0								
-57.5								
-60.0								
-62.5								
-65.0								
-67.5								



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▽ STATIC WATER LEVEL ▼

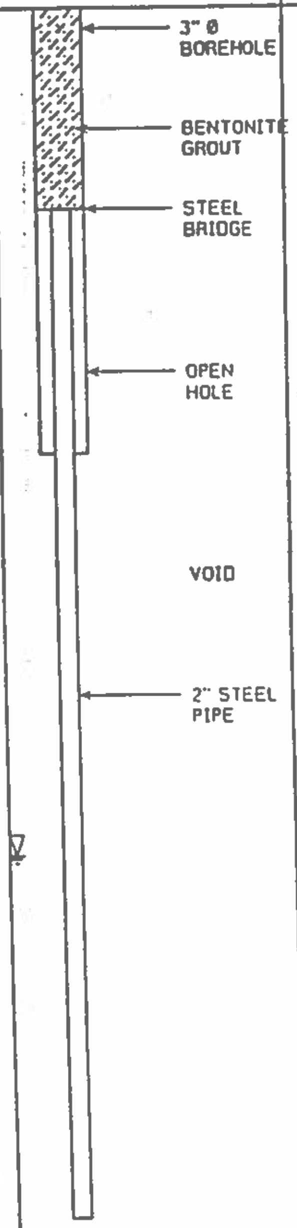
STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-04)
Page 3 of 4

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW2B-95
DATE COMPLETED: FEBRUARY 21, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
72.5								
75.0								
77.5								
80.0	- petroliferrous, highly fractured, stylolitic, finely bedded, microcrystalline to arenitic, with calcite and pyrite filling fractures, light brown, spring grove member	506.21						
82.5	- void (81.0 to 100.0ft BGS)							
85.0								
87.5								
90.0	- standing water							
92.5								
95.0								
97.5								
100.0	BEDROCK END OF HOLE @ 100.0ft BGS	487.21 487.21						
102.5								



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ∇ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-04)
Page 4 of 4

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW2B-95
DATE COMPLETED: FEBRUARY 21, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
			<u>SCREEN DETAILS</u> Screened Interval: 35 to 65ft BGS Length: 30ft Diameter: 2" Slot Size: #10 Material: PVC Sand Pack: 32 to 67ft BGS Material: #30 Flint					
-107.5								
-110.0								
-112.5								
-115.0								
7.5								
-120.0								
-122.5								
-125.0								
-127.5								
-130.0								
-132.5								
-135.0								
.5								

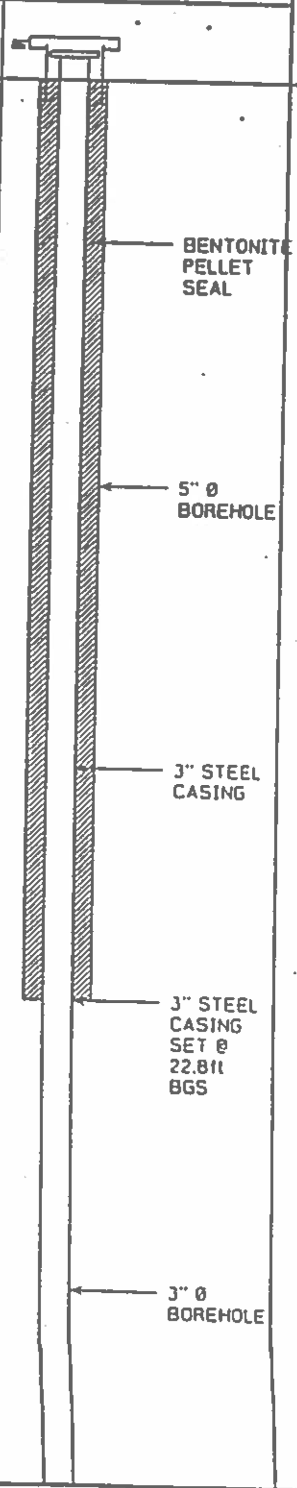
<u>NOTES:</u> MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊻ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW2C-95
DATE COMPLETED: FEBRUARY 23, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
	GROUND SURFACE REFERENCE POINT (Top of Riser)	592.33 589.71						
	SM-SAND (FILL), some silt and gravel, fine to medium grained, brown, moist							
-2.5								
-5.0								
-7.5								
-10.0								
-12.5								
-15.0								
-17.5								
-20.0								
-22.5								
	LIMESTONE (CEDAR VALLEY GROUP), interbedded calcilulite and arenitic, fossiliferous, very fine to coarse grained, slightly stylolitic and fractured with traces of calcite and pyrite filling fractures, gray and tan, rapid and solon member	569.83						
-25.0								
-27.5								
-30.0								
-32.5								



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊻ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(WL-05)
Page 2 of 3

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW2C-95
DATE COMPLETED: FEBRUARY 23, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
-37.5								
-40.0			3" Ø BOREHOLE					
	LIMESTONE (WAPSIPINICON GROUP), argillaceous to microspar, compact crystaline, interbedded and fossiliferous, abundant stylolites with vugs and abundant fractures, locally brecciated with pyrite and calcite healing fractures and voids, gray to light brown, davenport member	551.33						
-42.5								
-45.0								
7.5								
-50.0								
-52.5								
-55.0								
-57.5								
-60.0								
-62.5								
-65.0								
.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊻ STATIC WATER LEVEL ⊻

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-05)
Page 3 of 3

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW2C-95
DATE COMPLETED: FEBRUARY 23, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
-72.5								
-75.0			3" Ø BOREHOLE					
-77.5								
-80.0	- petroliferous, highly fractured, stylolitic, finely bedded, microcrystalline to arenitic, with calcite and pyrite filling fractures, light brown, spring grove member							
-82.5								
	- void (83.0 to 103.0ft BGS)	*509.33*						
-85.0								
-87.5			VOID					
-90.0								
-92.5								
-95.0	- standing water		∇					
-97.5								
-100.0								
-102.5								
	BEDROCK	*488.83*						
	END OF HOLE @ 103.5ft BGS	*488.83*						

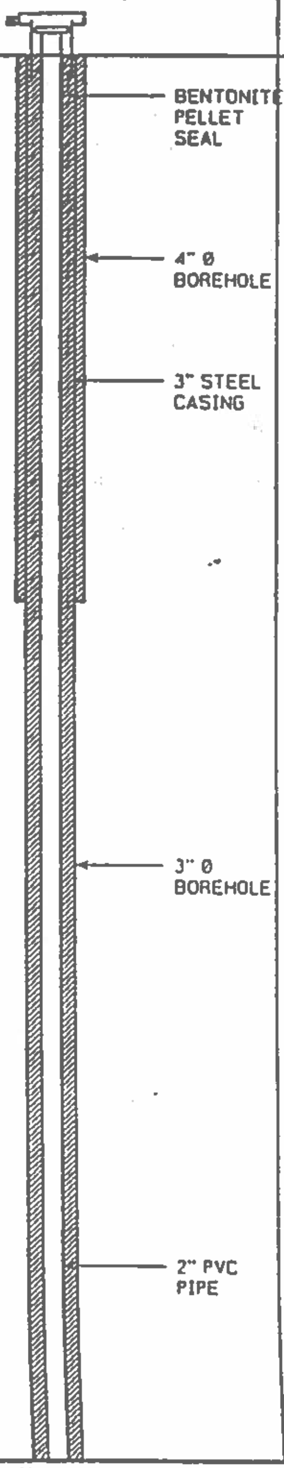
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

WATER FOUND ∇ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW3-95
DATE COMPLETED: FEBRUARY 1, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

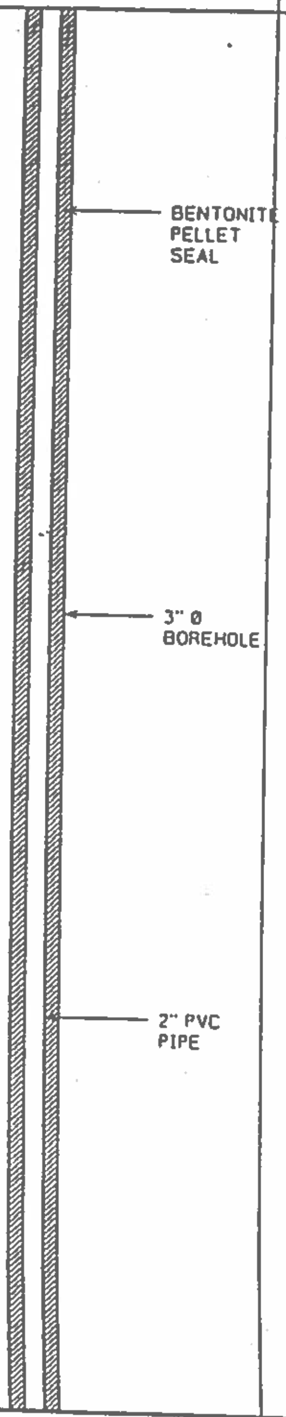
DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
	GROUND SURFACE REFERENCE POINT (Top of Riser)	587.09 589.17						
	LIMESTONE (CEDAR VALLEY GROUP), interbedded calcareous muds, silts and sandstones, very fine to fine grained, abundant fossils, corals, bivalves, some calcite replacement, trace of pyrite along fractures, beds range from 0.04 to 11.8" in thickness, trace of stylolites, some soft sediment brecciation, gray tones, rapid member							
-2.5								
-5.0								
-7.5								
-10.0								
-12.5								
-15.0								
-17.5								
-20.0					1	100	55	
-22.5								
-25.0	- very finely bedded, very fine calculites, from mudstone to wackestone fabric, more massively bedded, slightly fossiliferous, brecciated with pyrite and calcite filling fractures, solon member							
-27.5								
-30.0					2	100	55	
-32.5	- sandy, very fine to coarse grained, calculite, some shaley partings interspersed, trace of fossils, corals, brachiopods, crinoids and trilobites,				3	100	55	

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊻ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW3-95
DATE COMPLETED: FEBRUARY 1, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
-37.5	slightly fractured and brecciated with pyrite and calcite filling fractures and voids, vuggy, pyrite replacement of fossils, undulating bottom, gray and tan, solon member							
-40.0			BENTONITE PELLET SEAL		3	100	55	
-42.5								
-45.0	LIMESTONE (WAPSIPINICON GROUP), interbedded sublithographic to brecciated beds, little fossils, some domal stromatolites in sandy to muddy beds, breccia fragments in upper portion range from 0.04 to 2.0", slightly fractured with prominent stylolites, pyrite and calcite filling fractures, with some disseminated pyrite, colors are highly variable in individual beds of gray and tan to pink, davenport member	*524.26*						
-47.5								
-50.0			3" Ø BOREHOLE					
-52.5								
-55.0								
-57.5					4	100	55	
-60.0			2" PVC PIPE					
-62.5								
-65.0								
-67.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ∇ STATIC WATER LEVEL ▼

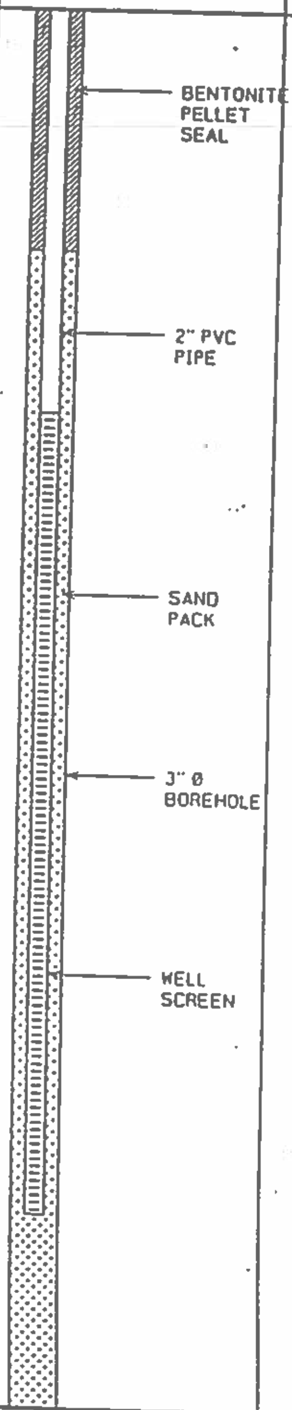
STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-08)
Page 3 of 4

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW3-95
DATE COMPLETED: FEBRUARY 1, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

MONITOR INSTALLATION



DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
72.5							
				4	100	55	
75.0							
77.5	- petroliferous and prominently flaggy or weathered in upper contact, highly stylolitic, finely bedded, with mudstone to very fine sandstone, lower portion is highly brecciated and highly fractured and vuggy with abundant calcite, trace of pyrite, tan to tan gray, spring grove member						
80.0							
2.5							
85.0				5	100	33	
87.5							
90.0							
92.5							
95.0	- dolomitic, highly brecciated and fractured, some fossils, sandy, bedded, vuggy with quartz and a trace of pyrite filling vugs, breccia fragments from 0.04 to 3.2", with rounded to angular fragments, gray to white with brown sandy beds, kenwood member						
97.5							
				6	100	55	
100.0							
2.5							
	LIMESTONE (OTIS FORMATION), finely	462.92		7	100	10	

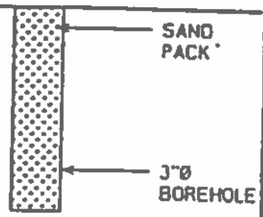
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-08)
Page 4 of 4

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW3-95
DATE COMPLETED: FEBRUARY 1, 1995
DRILLING METHOD: WR
CRA SUPERVISOR: D. SHEILD

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
107.5	bedded, medium to very fine grained, sublithographic, trace of fossils, brachiopods, massively brecciated with prominent stylolites, some shaley beds, vuggy with abundant calcite, light bluish grey to dark grey to pink				7	100	10	
110.0	END OF HOLE @ 110.0ft BGS	457.09	<u>SCREEN DETAILS</u> Screened interval: 80 to 100ft BGS Length: 20ft Diameter: 2" Slot Size: #10 Material: PVC Sand Pack: 76 to 110ft BGS Material: #30 Flint					
112.5								
115.0								
117.5								
120.0								
122.5								
125.0								
127.5								
130.0								
132.5								
135.0								
137.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊻ STATIC WATER LEVEL ⊻

KOMEX INTERNATIONAL LTD.　　OFFICE REPORT ON SITE INVESTIGATION　　SHEET 1 OF 6

CONTRACT NO.: 4283
BORING NO.: MW3L
NORTHING:

COMPILED BY: M. Brewster
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Nov. 20, 1996
CONTRACTOR: Laforge/GSI
ELEVATION: 567.66 ft.a.s.l. (Gr.)

SAMPLE TYPES

A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON

T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION

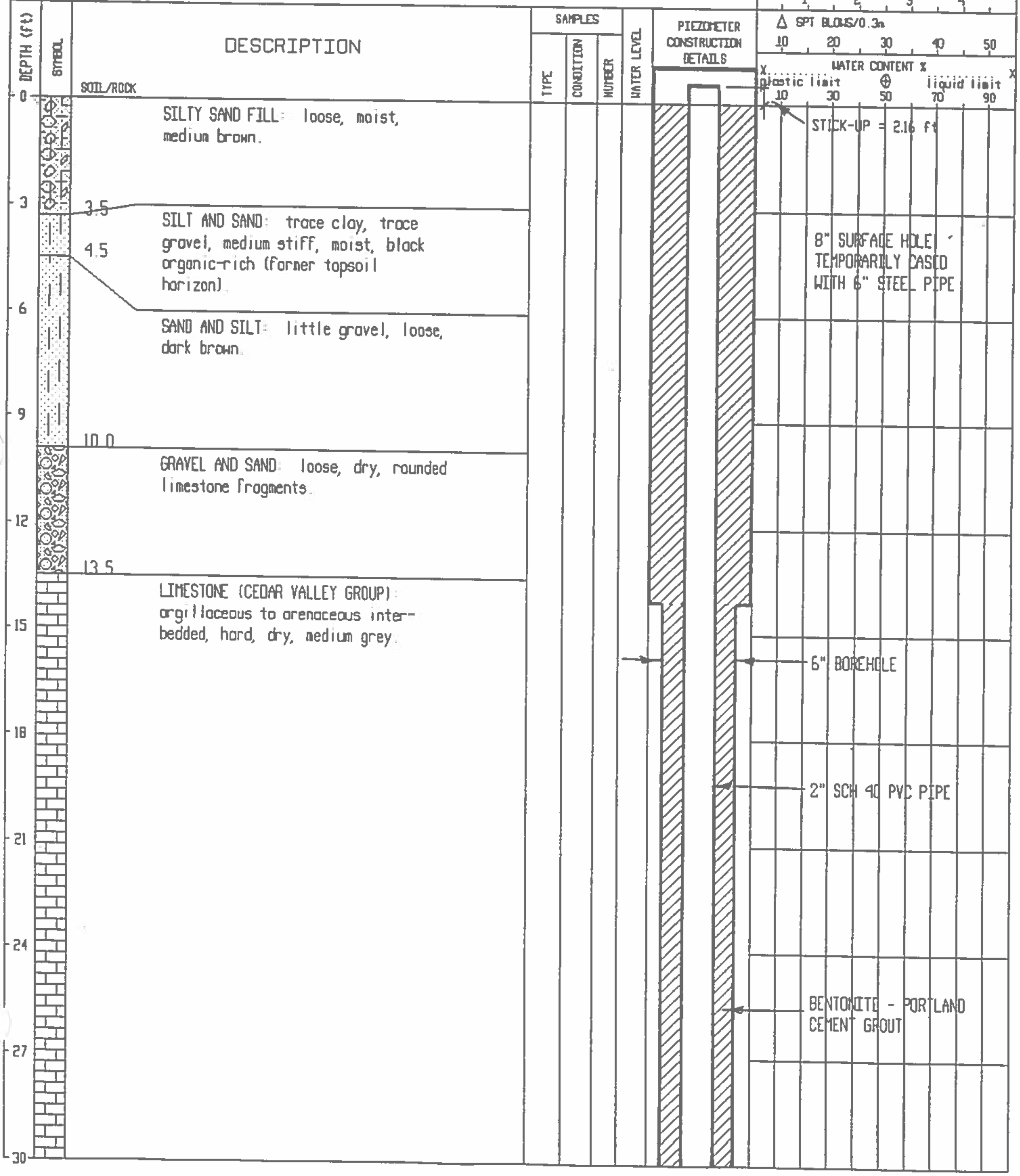
☒ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION

● PENETROMETER kg/cm2

△ SPT BLOWS/0.3m

WATER CONTENT %



SILTY SAND FILL: loose, moist, medium brown.

3.5 SILT AND SAND: trace clay, trace gravel, medium stiff, moist, black organic-rich (former topsoil horizon).

4.5 SAND AND SILT: little gravel, loose, dark brown.

10.0 GRAVEL AND SAND: loose, dry, rounded limestone fragments.

13.5 LIMESTONE (CEDAR VALLEY GROUP): argillaceous to arenaceous interbedded, hard, dry, medium grey.

KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 2 OF 6

CONTRACT NO.: 4283
BORING NO.: MW3L
NORTHING:

COMPILED BY: M. Brewster
LOCATION: Davenport, Iowa
EASTING:

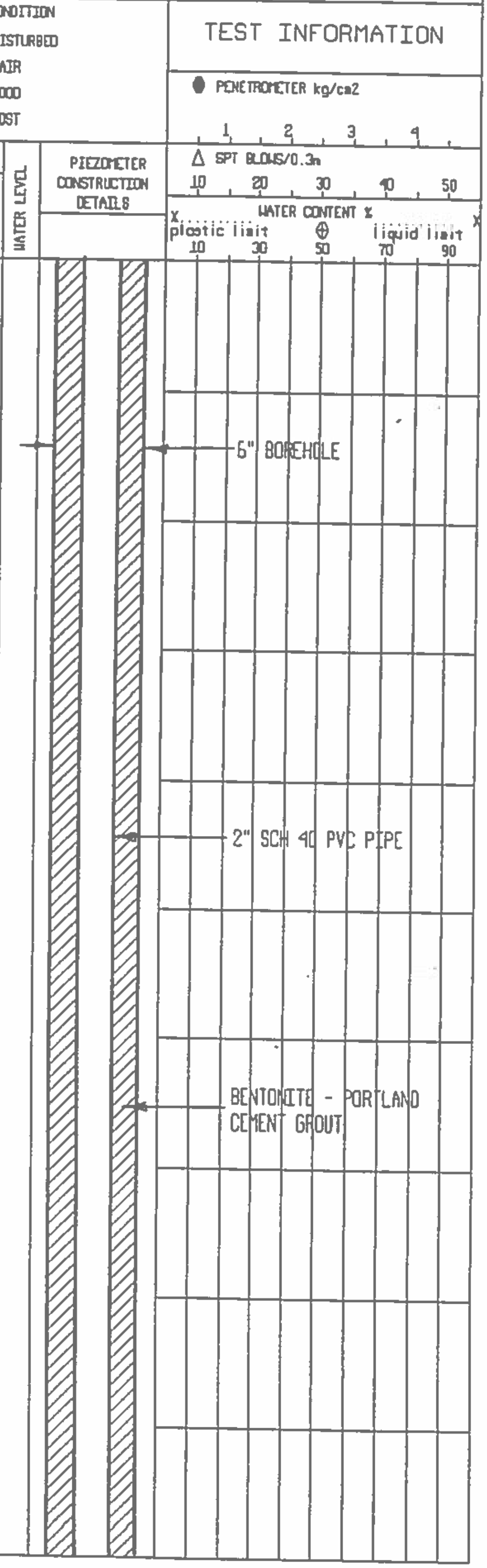
BORING DATE: Nov. 20, 1996
CONTRACTOR: LaFarge/GSI
ELEVATION:

SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON

T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
☒ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

DEPTH	SYMBOL	SOIL/ROCK	DESCRIPTION	TYPE	CONDITION	NUMBER	WATER LEVEL
-30			LIMESTONE (CEDAR VALLEY GROUP): as above, with trace black medium sand sized grains, little fossils (corrals), light grey.				
-42		42.0	LIMESTONE (WAPSIPINICON GROUP): arenaceous, dark grey.				
		50	Limestone, argillaceous, trace fossils, light tan.				
-60							



KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 3 OF 6

CONTRACT NO.: 4283
BORING NO.: MW3L
NORTHING:

COMPILED BY: M. Brewster
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Nov. 20, 1996
CONTRACTOR: Lafarge/GSI
ELEVATION:

SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON
T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

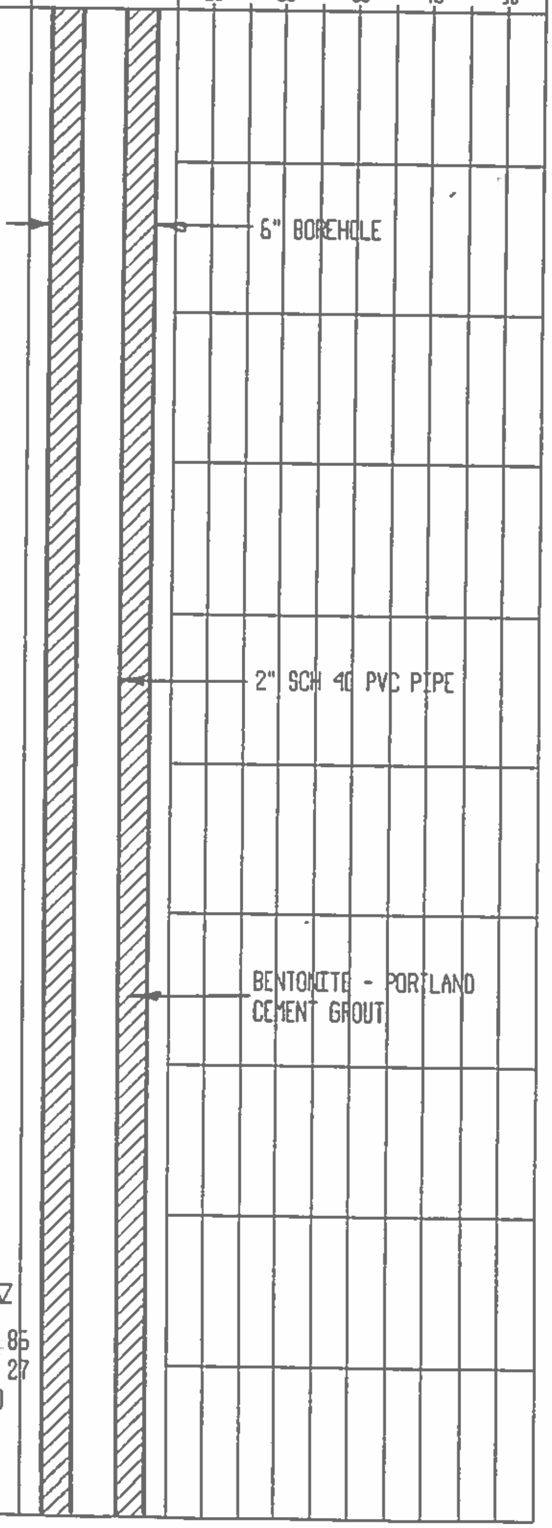
SAMPLE CONDITION
☒ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION
● PENETROMETER kg/cm2 1 2 3 4
△ SPT BLOWS/0.3m 10 20 30 40 50
WATER CONTENT %
x plastic limit ⊕ liquid limit x
10 30 50 70 90

DEPTH | SYMBOL | DESCRIPTION SOIL/ROCK | SAMPLES: TYPE | CONDITION | NUMBER | WATER LEVEL | PIEZOMETER CONSTRUCTION DETAILS

DEPTH	SOIL/ROCK	DESCRIPTION
60		LIMESTONE: as above, trace black sand grains, pyritic, no fissils, buff to medium tan.
63		
66		
69		
	70.0	Limestone, argillaceous to arenaceous, infrequent black shale beds, medium to light brown.
72		
75		
78		
	80.0	Dolomitic (weakly reactive).
81		
84		
87		
90		

▽
85.85
(Nov 27
1996)



KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 4 OF 6

CONTRACT NO.: 4283
BORING NO.: MW3L
NORTHING:

COMPILED BY: M. Brewster
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Nov. 20, 1996
CONTRACTOR: LaFarge/GSI
ELEVATION:

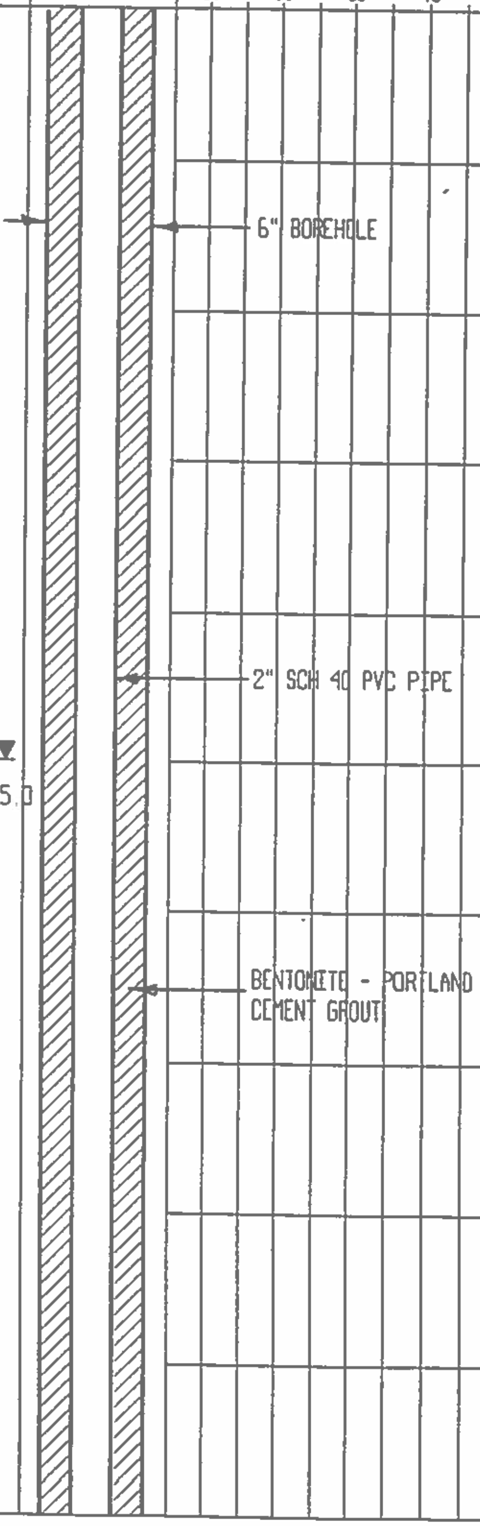
SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON
T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
∇ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
☒ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION
● PENETROMETER kg/cm2 — 1, 2, 3, 4
△ SPT BLOWS/0.3m — 10, 20, 30, 40, 50
WATER CONTENT % — x plastic limit, ⊕, liquid limit x — 10, 30, 50, 70, 90

DEPTH	SOIL/ROCK	DESCRIPTION	SAMPLES TYPE	CONDITION	NUMBER	WATER LEVEL
90		LIMESTONE: as above, light tan to buff, iron oxide (possibly sidersite) coatings.				
93						
	95.0	LIMESTONE (KENWOOD MEMBER): argillaceous to arenaceous, dolomitic, some fossils, light to dark grey.				
96						
99						
102						
	104.0	LIMESTONE (OTIS FORMATION): argillaceous, trace fossils, dark grey. At 105 Ft. groundwater estimated flow 5 to 10 gpm.				▼ 105.0
105						
108						
111						
114						
117						
120						

PIEZOMETER CONSTRUCTION DETAILS



KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 5 OF 6

CONTRACT NO.: 4283
BORING NO.: MW3L
NORTHING:

COMPILED BY: M. Brewster
LOCATION: Davenport, Iowa
EASTING:

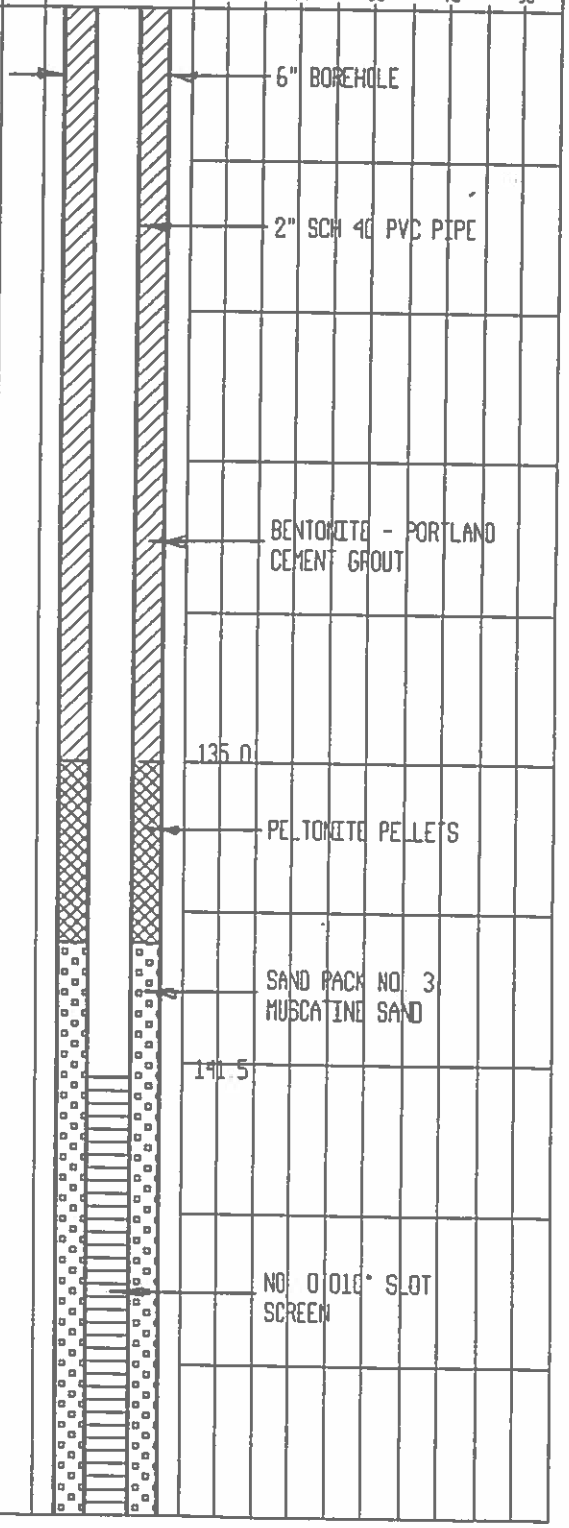
BORING DATE: Nov. 20, 1996
CONTRACTOR: Laforge/GSI
ELEVATION:

SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON
T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
☒ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION
● PENETROMETER kg/cm2 1 2 3 4
△ SPT BLOWS/0.3m 10 20 30 40 50
WATER CONTENT %
X plastic limit ⊕ liquid limit X
10 30 50 70 90

DEPTH	SYMBOL	DESCRIPTION SOIL/ROCK	SAMPLES TYPE	CONDITION	NUMBER	WATER LEVEL	PIEZOMETER CONSTRUCTION DETAILS
-120		LIMESTONE (OTIS FORMATION): as above.					
-123							
-126							
-129							
-132		133.0					
		DOLOMITE (SILURIAN): argillaceous, trace arenaceous, chinoderm and corral fossils, thin black shales, soft, fissile.					
-135							
-138							
-141							
-144							
-147							
-150							



KOMEX INTERNATIONAL LTD.

OFFICE REPORT ON SITE INVESTIGATION

SHEET 6 OF 6

CONTRACT NO.: 4283
BORING NO.: MW3L
NORTHING:

COMPILED BY: M. Brewster
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Nov. 20, 1996
CONTRACTOR: Laforge/GSI
ELEVATION:

SAMPLE TYPES
- A AUGER SAMPLE
- W WASH SAMPLE
- R ROCK CORE
- C CRREL BARREL
- S SPLIT SPOON
- T SHELBY TUBE
- O THIN WALL OPEN
- P THIN WALL PISTON
- ▽ STATIC WATER LEVEL
- ▼ DYNAMIC WATER LEVEL

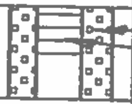
SAMPLE CONDITION
- ⊠ DISTURBED
- ▥ FAIR
- ▨ GOOD
- ■ LOST

TEST INFORMATION

● PENETROMETER kg/cm2: 1 2 3 4

△ SPT BLOWS/0.3m: 10 20 30 40 50

WATER CONTENT %: x plastic limit 10 30 ⊕ 50 liquid limit 70 90 x

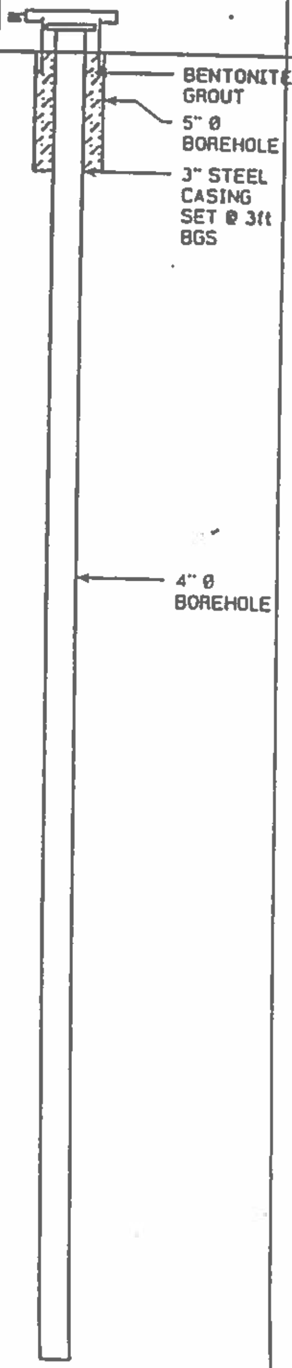
DEPTH	SYMBOL	DESCRIPTION SOIL/ROCK	SAMPLES TYPE	SAMPLES CONDITION	SAMPLES NUMBER	WATER LEVEL	PIEZOMETER CONSTRUCTION DETAILS
150	▨	DOLOMITE (SILURIAN): as above.					
153		TOTAL DEPTH = 152.0 ft.					
156							
159							
162		NOTES: Estimated gw flow @ 2 gpm. Logs based on cuttings from downhole air percussion hammer. Cuttings were predominantly dust with rock chips to 1/4".					
165							
168							
171							
174							
177							
180							

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-07)
Page 1 of 1

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW4-95
DATE COMPLETED: FEBRUARY 25, 1995
DRILLING METHOD: NX CORE
CRA SUPERVISOR: C. AHRENS



DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
	GROUND SURFACE REFERENCE POINT (Top of Riser)	*489.43* *491.83*						
	LIMESTONE (WAPSIPINICON GROUP), extremely fine grained, massive, fractured, light beige, spring grove member							
-2.5								
					1	80	-	
-5.0								
-7.5					2	90	-	
-10.0								
					3	53	-	
-12.5					4	96	-	
	- very fine grained, massive, rare stylolites, light brown to light gray							
-15.0								
	- extremely fine grained, contorted to wavy bedding planes 1" thick, very light brown to light gray							
-17.5								
	- very fine grained, breccia, light gray				5	100	-	
-20.0	- extremely fine to very fine grained beds, 2" thick, very light brown to very light gray							
	- dolomitic, very fine to microfine, wavy to contorted beds 3" thick, argillaceous to slightly argillaceous, occasional bed of green-gray argillite, very light gray to gray, kenwood member							
-22.5								
-25.0								
-27.5					6	98	-	
-30.0	- 3" chert nodule (@ 30.3ft BGS)							
	- dolomitic, extremely fine grained, 0.25 to 0.75" laminations, 0.25" calcite nodules, gray to dark brown, kenwood member	*458.93*						
-32.5	LIMESTONE (OTIS FORMATION), massive, microfine, very light brown	*456.93*						
	END OF HOLE @ 32.5ft BGS							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

WATER FOUND ⊻ STATIC WATER LEVEL ⊻

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

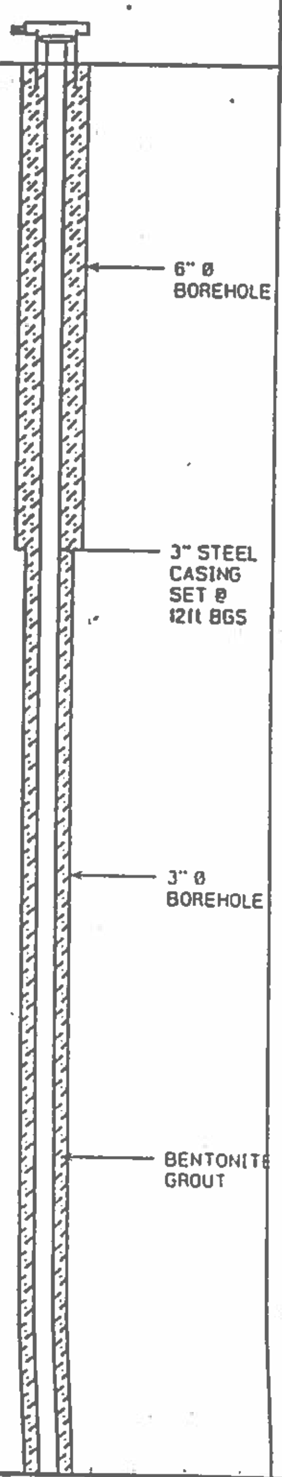
(WL-09)
Page 1 of 3

PROJECT NAME: LAFARGE
PROJECT NUMBER: 8031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW4L-95
DATE COMPLETED: MAY 5, 1995
DRILLING METHOD: 6" AND 3" WET ROTARY
CRA SUPERVISOR: C. AHRENS

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
	GROUND SURFACE REFERENCE POINT (Top of Riser)	*489.46* *491.49*					
	LIMESTONE (WAPSIPINICON GROUP), spring grove member						
-2.5							
-5.0							
-7.5							
-10.0							
-12.5							
-15.0							
-17.5							
-20.0							
	DOLOSTONE (WAPSIPINICON GROUP), kenwood member	*468.46*					
-22.5							
-25.0							
-27.5							
-30.0							
	LIMESTONE (OTIS FORMATION)	*458.46*					
-32.5							

MONITOR INSTALLATION



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▽ STATIC WATER LEVEL ▼

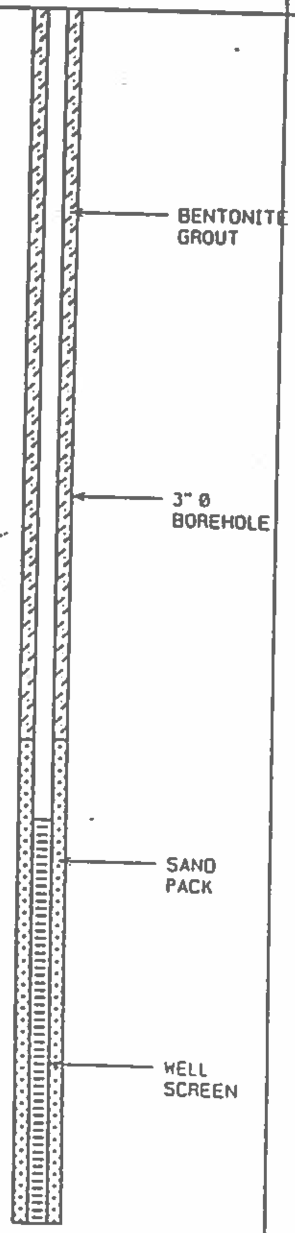
STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-09)
Page 2 of 3

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW4L-95
DATE COMPLETED: MAY 5, 1995
DRILLING METHOD: 6" AND 3" WET ROTARY
CRA SUPERVISOR: C. AHRENS

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
-37.5								
-40.0								
-42.5								
-45.0								
.5								
-50.0								
-52.5								
-55.0	LIMESTONE (BLANDING FORMATION)	*434.46*						
-57.5								
-60.0								
-62.5								
-65.0	END OF HOLE @ 65.0ft BGS	*424.46*						
5								



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊻ STATIC WATER LEVEL ⊻

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-09)
Page 3 of 3

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW4L-95
DATE COMPLETED: MAY 5, 1995
DRILLING METHOD: 6" AND 3" WET ROTARY
CRA SUPERVISOR: C. AHRENS

DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
			<u>SCREEN DETAILS</u> Screened Interval: 55 to 65ft BGS Length: 10ft Diameter: 2" Slot Size: #10 Material: PVC Sand Pack: 53 to 65ft BGS Material: Sand					
-72.5								
-75.0								
-77.5								
-80.0								
-82.5								
-85.0								
-87.5								
-90.0								
-92.5								
-95.0								
-97.5								
-100.0								
-102.5								

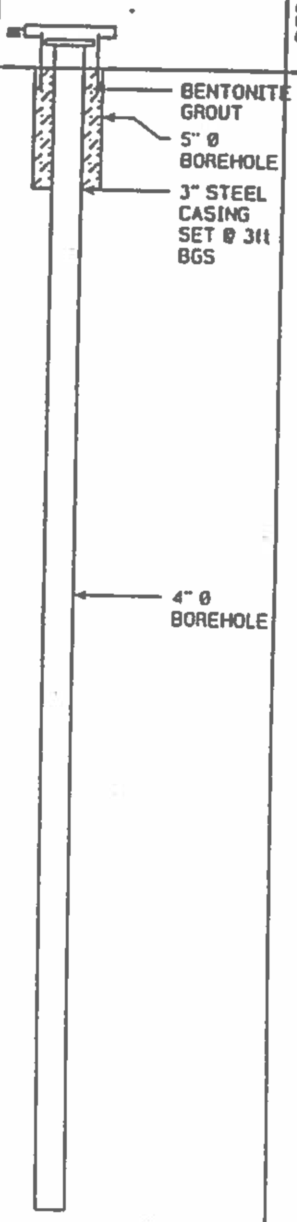
<u>NOTES:</u> MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

(WL-08)
Page 1 of 1

PROJECT NAME: LAFARGE
PROJECT NUMBER: 6031
CLIENT: LAFARGE CORPORATION
LOCATION: DAVENPORT, IOWA

HOLE DESIGNATION: MW5-95
DATE COMPLETED: FEBRUARY 24, 1995
DRILLING METHOD: NX CORE
CRA SUPERVISOR: C. AHRENS



DEPTH ft. BGS	DESCRIPTION OF STRATA	ELEV. ft. AMSL	MONITOR INSTALLATION	BEDROCK INTERVAL	RUN NUMBER	CORE RECOVERY %	RQD %	WATER RETURN %
	GROUND SURFACE REFERENCE POINT (Top of Riser)	*485.28* *488.03*						
-2.5								
	LIMESTONE (WAPSIPINICON GROUP), very fine grained, fractured, abundant stylolites, becoming dolomitized with depth, very light brown, spring grove member	*482.60*						
-5.0								
	- fine grained, massive, minor fractures filled with calcite, very light brown to very light gray				1	100	-	
-7.5								
	- very fine grained, wavy beds up to 0.5" thick							
-10.0	- extremely fine grained, brecciated, part argillite filled, very light brown							
	- dolomitic, microcrystalline to fine grained, wavy to swirled beds 4" thick, light brownish gray, kenwood member							
-12.5					2	100	-	
-15.0	- dolomitic, very fine to microcrystalline, wavy to swirled beds 2" thick, slightly argillaceous to argillaceous, becomes more dolomitic with depth, light gray to brownish gray							
-17.5	- 1" chert nodule (@ 18.33ft BGS)							
-20.0								
-22.5	- 3" chert nodule (@ 22.66ft BGS)				3	100	-	
	LIMESTONE (OTIS FORMATION), massive, microcrystalline, mottled very light brown and light gray	*462.34*						
-25.0					4	100	-	
-27.5								
	END OF HOLE @ 28.3ft BGS	*457.01*						
-30.0								
-32.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ▽ STATIC WATER LEVEL ▼

KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 1 OF 5.

CONTRACT NO : 4161
BORING NO.: MW7
NORTHING:

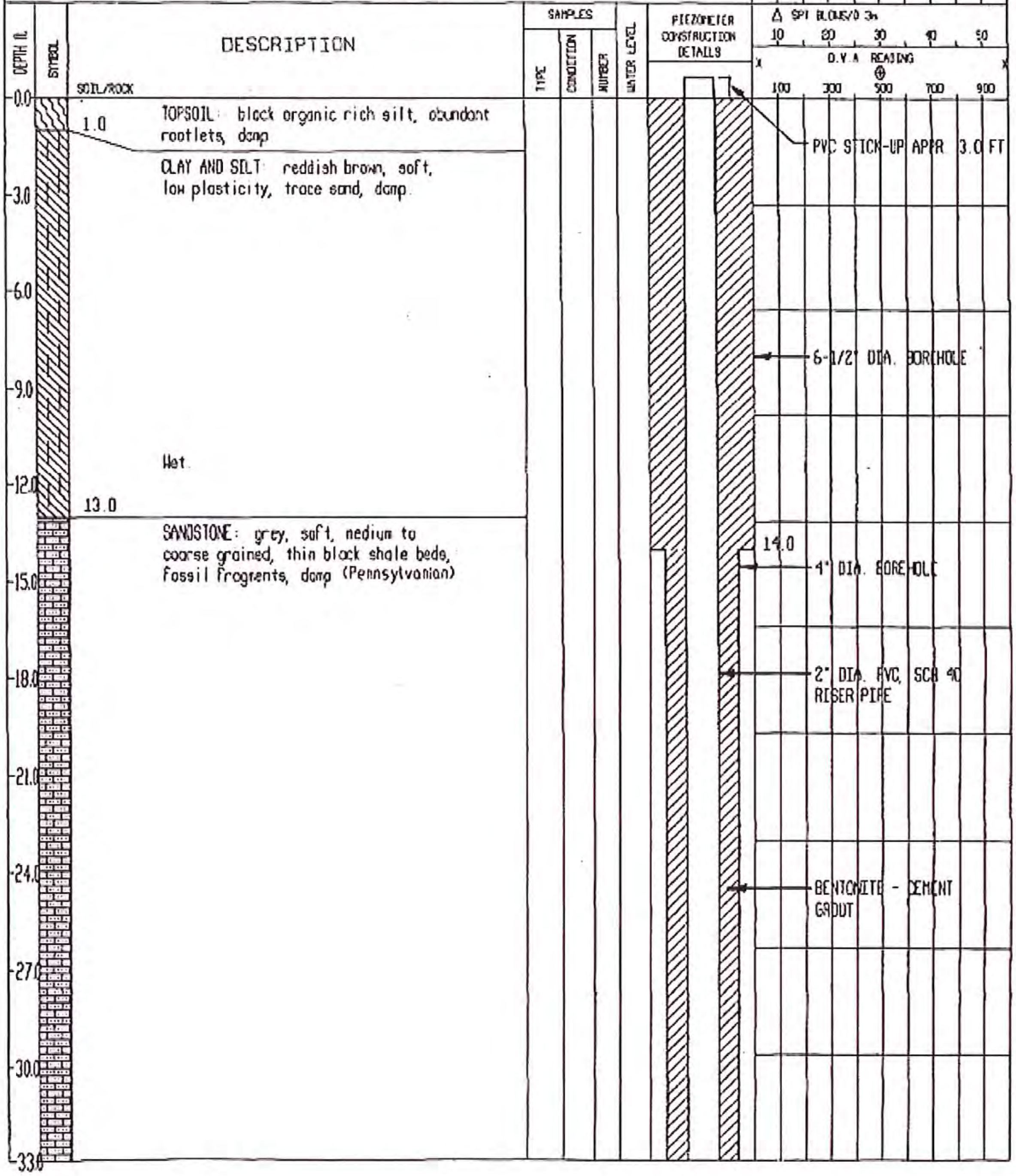
COMPILED BY: S. Ross
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Dec. 14-16, 1995
CONTRACTOR: Geotechnical Services Inc.
ELEVATION: appr. 596.8 ft. asl (grl

SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CAREL BARREL
S SPLIT SPOON
T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
⁘ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION
● PENETROMETER kg/cm2
△ SPT BLOWS/0.3m
⊕ O.V.A. READING



1.0 TOPSOIL: black organic rich silt, abundant rootlets, damp

CLAY AND SILT: reddish brown, soft, low plasticity, trace sand, damp.

Wet.

13.0 SANDSTONE: grey, soft, medium to coarse grained, thin black shale beds, fossil fragments, damp (Pennsylvanian)

KOMEX INTERNATIONAL LTD OFFICE REPORT ON SITE INVESTIGATION SHEET 2 OF 6

CONTRACT NO.: 9161	COMPILED BY: S. Ross	BORING DATE: Dec. 14-16, 1995
BORING NO.: MW7	LOCATION: Davenport, Iowa	CONTRACTOR: Geotechnical Services Inc.
NORTHING:	EASTING:	ELEVATION: appr. 596.8 ft. asl (gr)

SAMPLE TYPES

A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CORE BARREL
S SPLIT SPOON

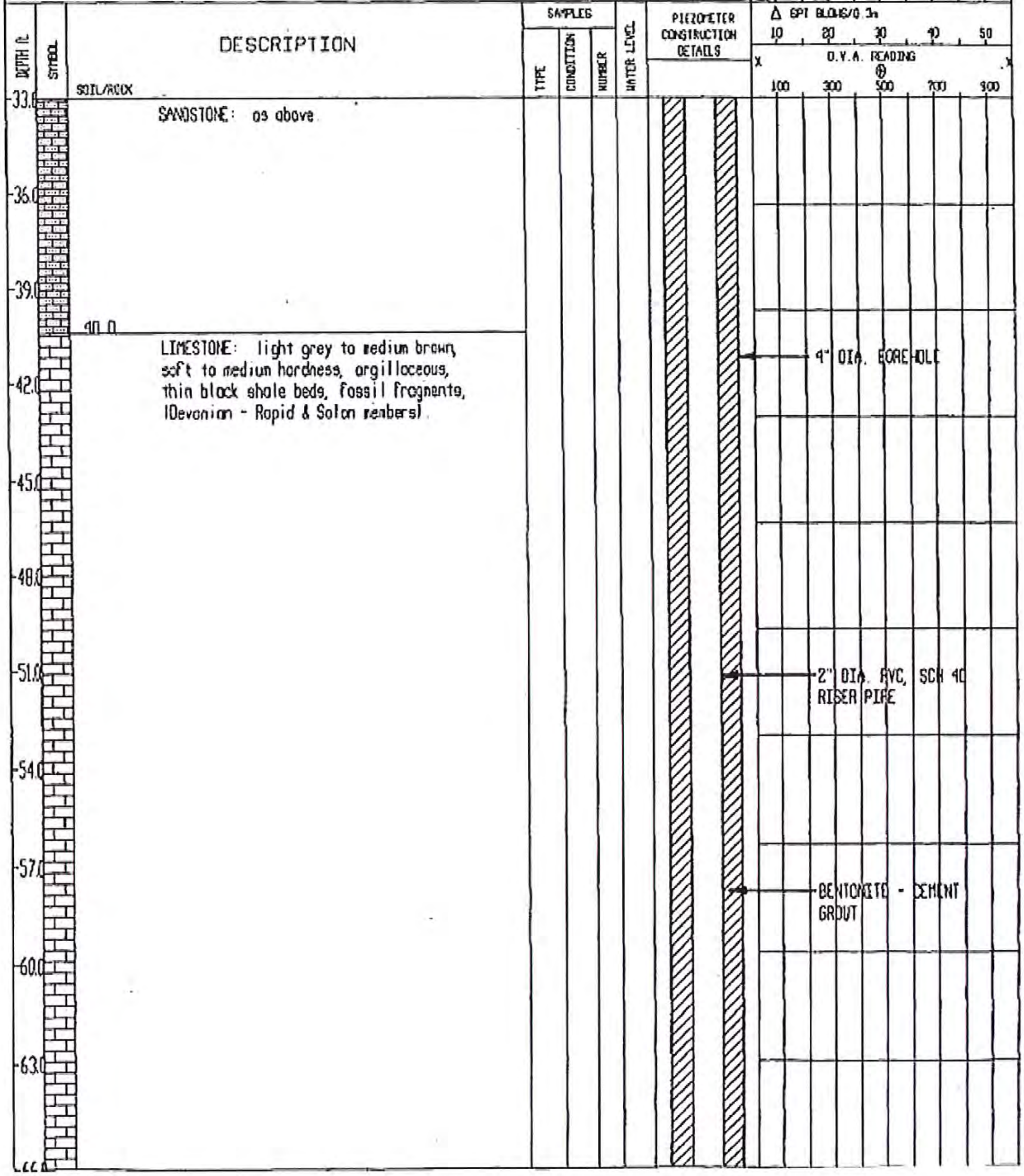
T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION

☒ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION

● PENETROMETER kg/cm2



DESCRIPTION

SANDSTONE: as above.

LIMESTONE: light grey to medium brown, soft to medium hardness, argillaceous, thin black shale beds, fossil fragments, (Devonian - Rapid & Solon members).

KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 3 OF 6

CONTRACT NO.: 4161
BORING NO.: MW7
NORTHING:

COMPILED BY: S. Ross
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Dec. 14-16, 1995
CONTRACTOR: Geotechnical Services Inc.
ELEVATION: appr. 596.8 ft. asl (gr)

SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON
T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
⁙ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION
● PENETROMETER kg/cm2
1 2 3 4
△ SPT BLOWS/0.3m
10 20 30 40 50
X O.V.A. READING ⊕ X
100 300 500 700 900

DEPTH ft.	SYMBOL	DESCRIPTION SOIL/ROCK	SAMPLES TYPE	SAMPLES CONDITION	SAMPLES NUMBER	WATER LEVEL	PIEZOMETER CONSTRUCTION DETAILS
66.0		LIMESTONE: as above.					
69.0							
72.0							
75.0							
78.0							
81.0							
84.0							
87.0							
90.0							
93.0							
96.0							
99.0							

KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 4 OF 6

CONTRACT NO : 4161
BORING NO.: MW7
NORTHING:

COMPILED BY: S. Ross
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Dec. 14-16, 1995
CONTRACTOR: Geotechnical Services Inc.
ELEVATION: appr. 596.8 ft. asl (gr)

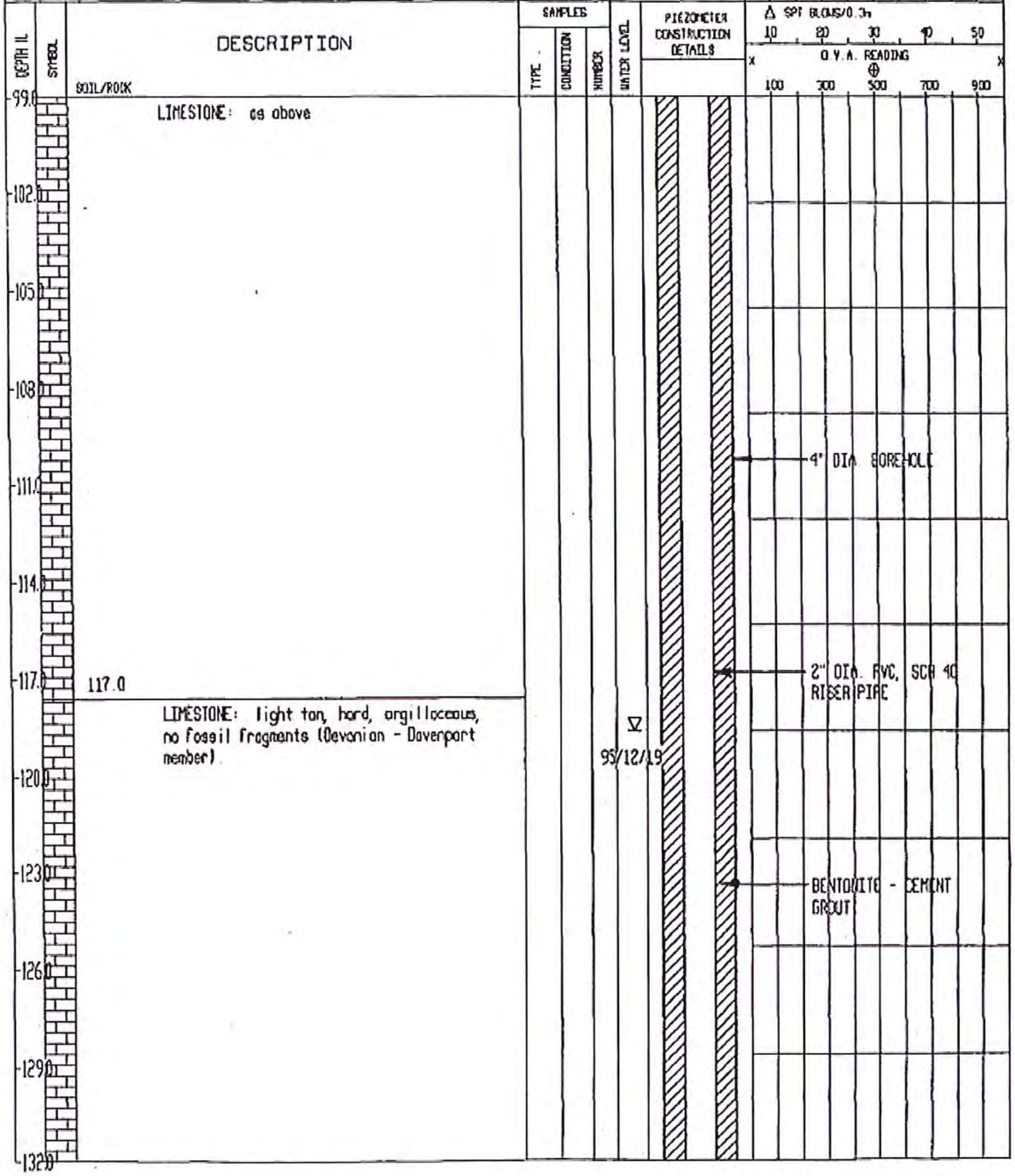
SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON

T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
∇ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
⁙ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION

● PENETROMETER kg/cm2



LIMESTONE: as above

117.0

LIMESTONE: light tan, hard, argillaceous, no fossil fragments (Devonian - Davenport member).

KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 5 OF 6.

CONTRACT NO.: 4161
BORING NO.: MW7
NORTHING:

COMPILED BY: S. Ross
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Dec. 14-16, 1995
CONTRACTOR: Geotechnical Services Inc.
ELEVATION: appr. 596.8 ft. asl (gr)

SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON

T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

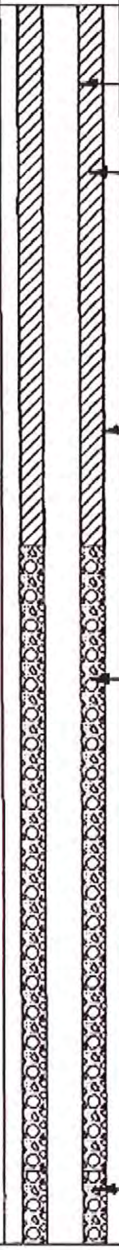
SAMPLE CONDITION
⛝ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION
● PENETROMETER kg/cm2
1 2 3 4
△ SPT BLOWS/0.3m
10 20 30 40 50
X O.V.A. READING X
⊕
100 300 500 700 900

DEPTH ft.	SOIL/ROCK	DESCRIPTION
132.0		LIMESTONE: as above.
135.0		
	137.0	LIMESTONE: grey, very hard, argillaceous, dolomitic, few fossil fragments (Devonian Kenwood member)
138.0		
141.0		
144.0		
147.0		
150.0	150.0	LIMESTONE: light to dark grey, thin beds, very hard, argillaceous, few fossil fragments, producing approx. 0.1 gal/min (Devonian - Otis Formation).
153.0		
156.0		
159.0		
162.0		
165.0		

SAMPLES: TYPE, CONDITION, NUMBER; WATER LEVEL

PIEZOMETER CONSTRUCTION DETAILS



2" DIA PVC, SCH 40 RISER PIPE

BENTONITE-CEMENT GROUT MIXTURE

4" DIA. BOREHOLE

145.0

BENTONITE GROUT (lift *2)

162.0

BENTONITE GROUT (lift *1)

KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 6 OF 6

CONTRACT NO.: 4161
BORING NO.: MW7
NORTHING:

COMPILED BY: S. Ross
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Dec 14-16, 1995
CONTRACTOR: Geotechnical Services Inc.
ELEVATION: appr. 596.8 ft. asl (gr)

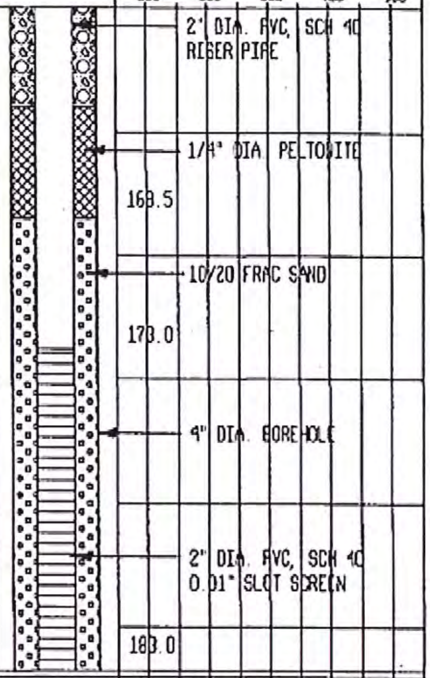
SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CAREL BARREL
S SPLIT SPOON
T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
⁙ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION
● PENETROMETER kg/cm2 1 2 3 4
△ SPT BLOWS/0.3m 10 20 30 40 50
O.V.A. READING ⊕ 100 300 500 700 900

DEPTH ft	SYMBOL	DESCRIPTION SOIL/ROCK	SAMPLES TYPE	SAMPLES CONDITION	SAMPLES NUMBER	WATER LEVEL
165.0		LIMESTONE: grey to light brown, thin beds, very hard, argillaceous, dolomitic, black thin shale layers, no fossil fragments, producing water approx. 5 gal/min (Silurian)				
168.0						
171.0						
174.0						
177.0						
180.0						
183.0		TOTAL DEPTH = 183.0 FT.				
186.0						
189.0						
192.0						
195.0						
198.0						

PIEZOMETER CONSTRUCTION DETAILS



KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 1 OF 2

CONTRACT NO.: 4283
BORING NO.: MW8
NORTHING:

COMPILED BY: M. Brewster
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Nov. 20, 1996
CONTRACTOR: Lafarge/GSI
ELEVATION: 542.20 ft.a.s.l. (Gr.)

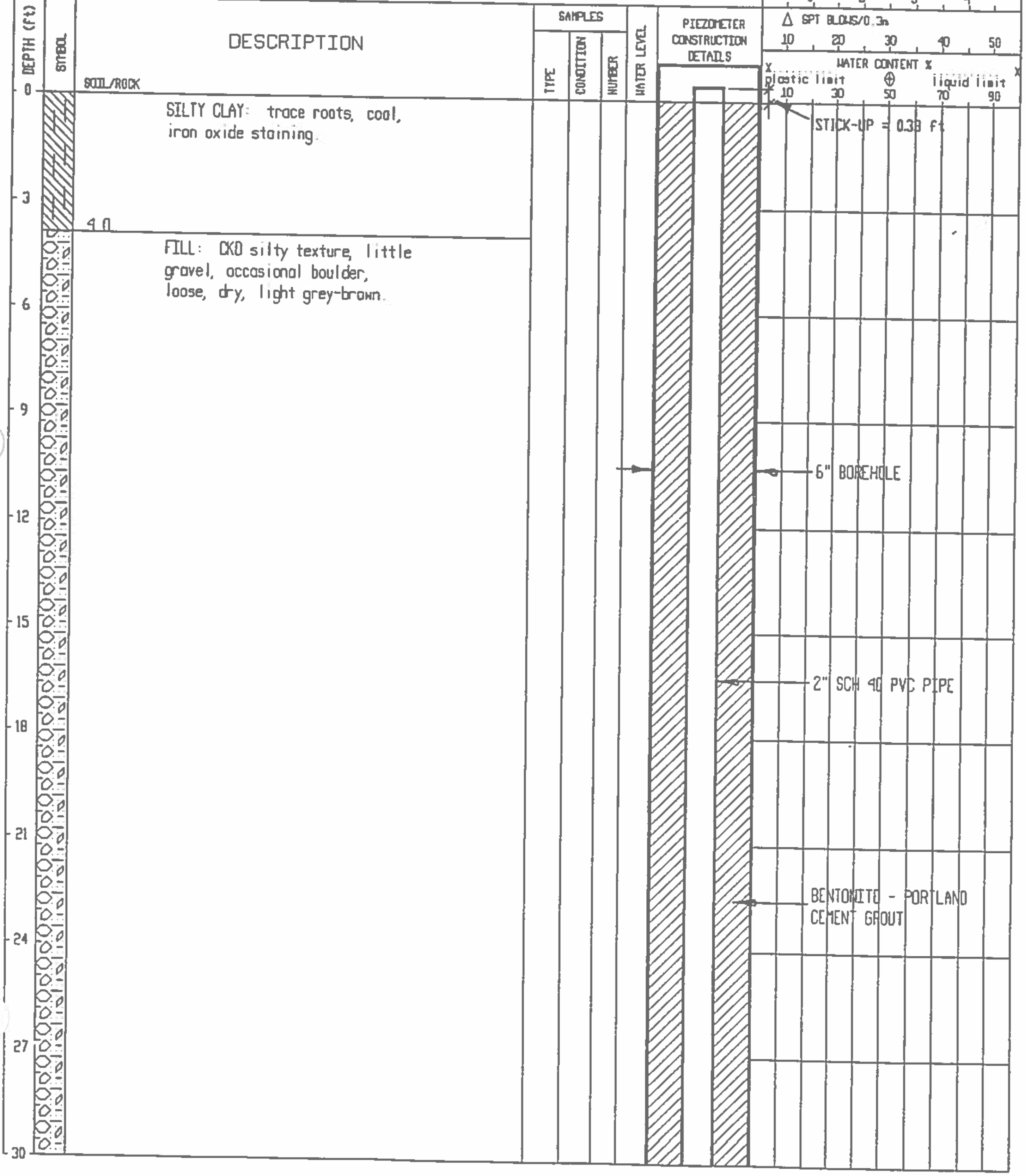
SAMPLE TYPES

A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON
T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
∇ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION

☒	DISTURBED
▥	FAIR
▨	GOOD
■	LOST

TEST INFORMATION



SILTY CLAY: trace roots, coal, iron oxide staining.

FILL: CKD silty texture, little gravel, occasional boulder, loose, dry, light grey-brown.

KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 2 OF 2

CONTRACT NO.: 4283
BORING NO.: MW8
NORTHING:

COMPILED BY: M. Brewster
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Nov. 20, 1996
CONTRACTOR: Laforge/GSI
ELEVATION:

SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON

T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
☒ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

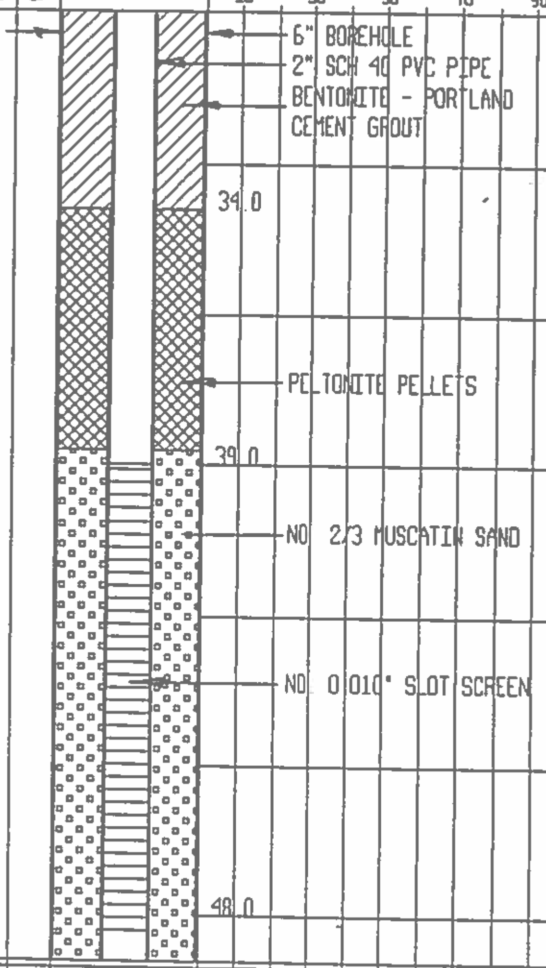
TEST INFORMATION

● PENETROMETER kg/cm2
1 2 3 4

△ SPT BLOWS/0.3m
10 20 30 40 50

x WATER CONTENT % x
plastic limit ⊕ liquid limit
10 30 50 70 90

DEPTH	SYMBOL	DESCRIPTION SOIL/ROCK	SAMPLES TYPE	CONDITION	NUMBER	WATER LEVEL	PIEZOMETER CONSTRUCTION DETAILS
30		FILL: as above.					
33							
36							
39							
42							
45							
48							
51		TOTAL DEPTH = 49.0 ft.					
54							
57							
60							



NOTES:
Very soft drilling, poor cuttings returns with air-rotary hammer (Laforge quarry rig). No groundwater encountered within the depth of investigation. Expected base of CKD pile at approx. 50 ft

KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 1 OF 4

CONTRACT NO.: 4283
BORING NO.: MW9
NORTHING:

COMPILED BY: M. Brewster
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Nov. 20, 1996
CONTRACTOR: Geotechnical Services Inc.
ELEVATION: 593.18 ft.a.s.l. (Gr.)

SAMPLE TYPES

A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON

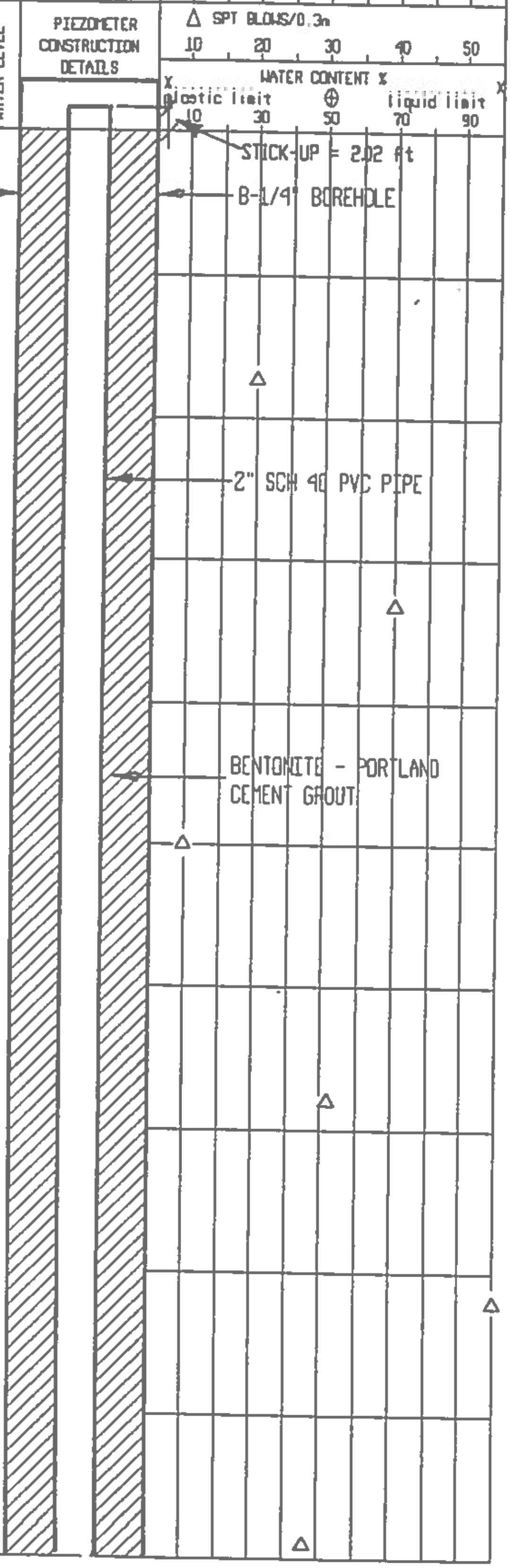
T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION

☒ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION

DEPTH (ft)	SOIL/ROCK	DESCRIPTION	TYPE	CONDITION	NUMBER	WATER LEVEL
0.0		SAND TOPSOIL: trace clay, silt, gravel, slightly moist, roots, orange-brown.				
3	3.0	SILTY CLAY: medium stiff, moist, low plasticity, grey-brown.				
	5.0	SILT: little clay, trace sand, coal, very stiff, dry, medium brown.				
6	6.5	CEMENT KILN DUST (CKD): silty, very stiff, dry, light grey to tan, crumbles easily.				
9						
12	13.0	Some moisture.				
15						
18						
21						
24	25.0	CKD very hard, dry.				
27						
30						



KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 2 OF 4

CONTRACT NO.: 4283	COMPILED BY: M. Brewster	BORING DATE: Nov. 20, 1996
BORING NO.: MW9	LOCATION: Davenport, Iowa	CONTRACTOR: Geotechnical Services Inc.
NORTHING:	EASTING:	ELEVATION:

SAMPLE TYPES

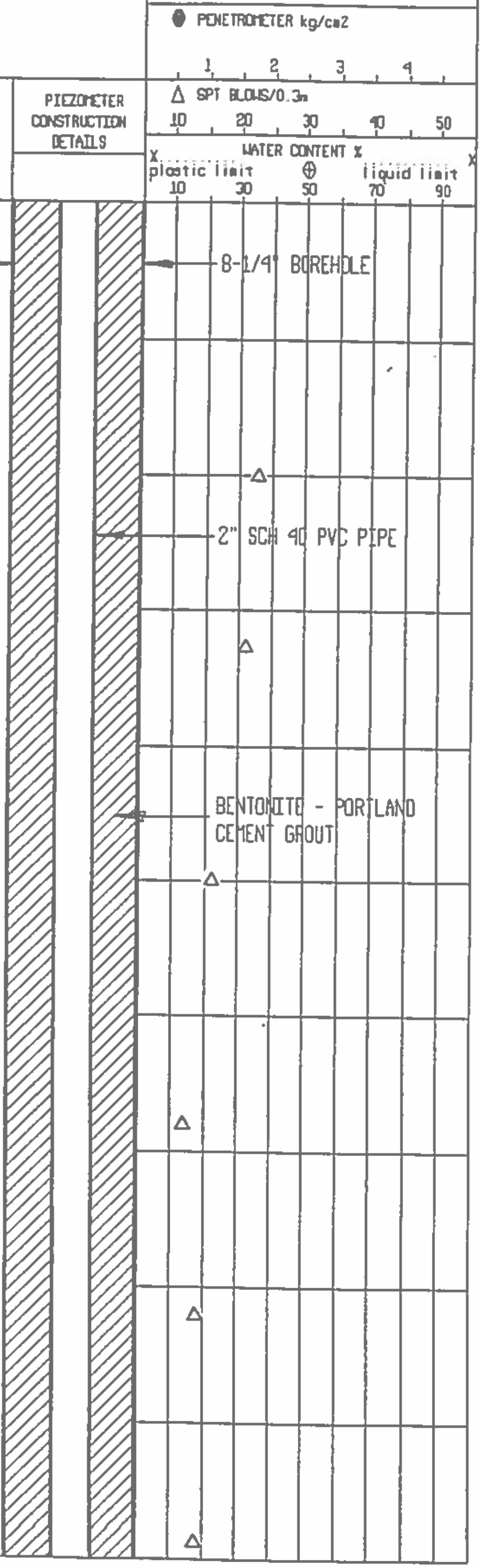
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON
T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION

⊠ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION

DEPTH	SYMBOL	DESCRIPTION SOIL/ROCK		SAMPLES TYPE	CONDITION	NUMBER	WATER LEVEL
30			CEMENT KILN DUST (CKD): silty, very stiff, dry, light grey to tan, crumbles easily.				
33							
36							
39							
42		43.0	Hard, cement-like layer.				
45		45.0	Solid, nodularized CKD, light tan, almost white.				
48							
51							
54							
57							
60							



KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 3 OF 4

CONTRACT NO.: 4283
BORING NO.: MW9
NORTHING:

COMPILED BY: M. Brewster
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Nov. 20, 1996
CONTRACTOR: Geotechnical Services Inc.
ELEVATION:

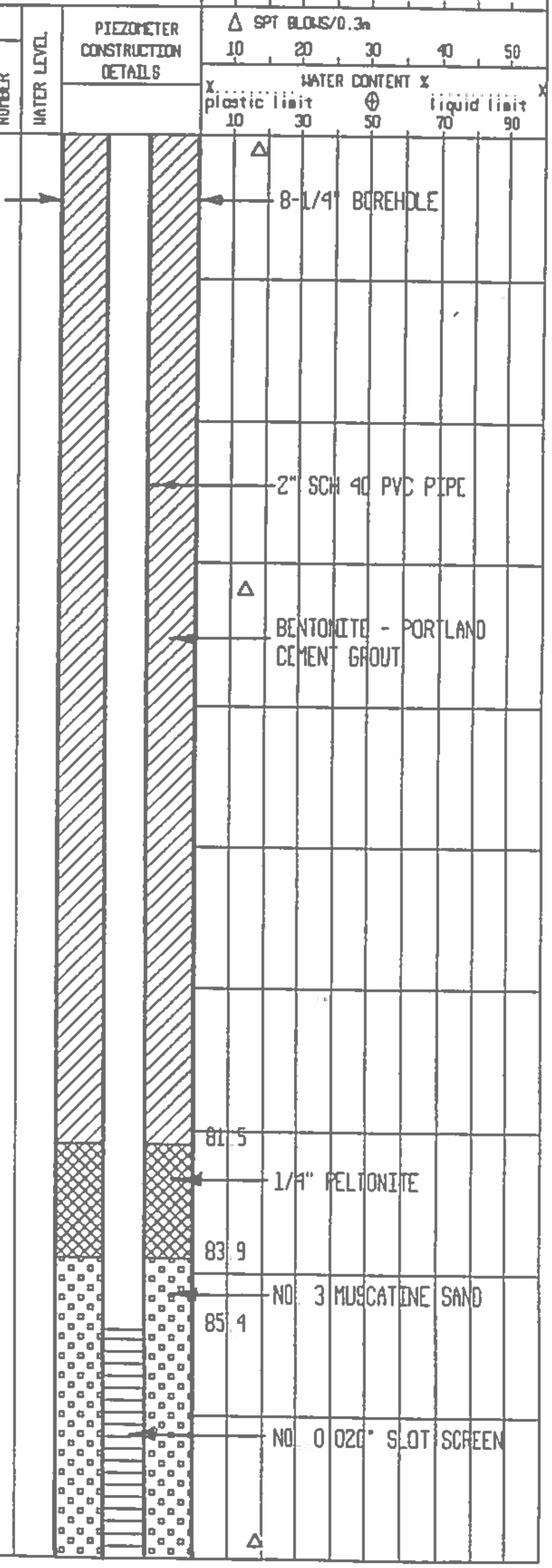
SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON

T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
∇ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
⊠ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION
● PENETROMETER kg/cm2
△ SPT BLOWS/0.3m
WATER CONTENT %

DEPTH	SYMBOL	DESCRIPTION SOIL/ROCK	TYPE	CONDITION	NUMBER	WATER LEVEL
60		CEMENT KILN DUST (CKD): as above.				
63						
66						
69						
		70 As above, CKD varies from tan to near white, loose, dry.				
72						
75						
78						
81						
84						
87						
90						



KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 4 OF 4

CONTRACT NO.: 4283
BORING NO.: MW9
NORTHING:

COMPILED BY: M. Brewster
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Nov. 20, 1996
CONTRACTOR: Geotechnical Services Inc.
ELEVATION:

SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON

T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
∇ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
☒ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

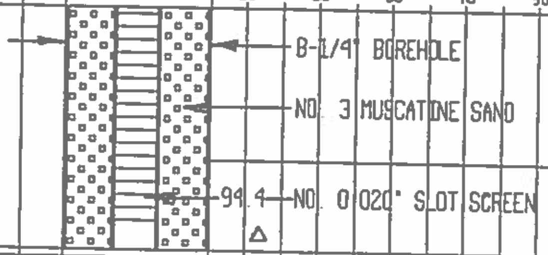
TEST INFORMATION

● PENETROMETER kg/cm2 1 2 3 4
△ SPT BLOWS/0.3m 10 20 30 40 50
WATER CONTENT % plastic limit ⊕ liquid limit 10 30 50 70 90

DEPTH | SYMBOL | DESCRIPTION SOIL/ROCK | SAMPLES TYPE | CONDITION | NUMBER | WATER LEVEL | PIEZOMETER CONSTRUCTION DETAILS

90

CEMENT KILN DUST (CKD): as above.



93

96

TOTAL DEPTH = 95.0 ft.

95.0

99

102

105

NOTES:
Hole drilled to 95 ft. using 8-1/4"
stem auger. No moisture was
encountered within the depth of
exploration. Base of CKD pile
estimated at 100 ft. depth.

108

111

114

117

120

KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 1 OF 4

CONTRACT NO.: 4283
BORING NO.: MW10
NORTHING:

COMPILED BY: G. Kimler
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Dec. 19, 1996
CONTRACTOR: Laforge/GSI
ELEVATION: 590.72 ft.a.s.l. (Gr)

SAMPLE TYPES
- A AUGER SAMPLE
- W WASH SAMPLE
- R ROCK CORE
- C CRREL BARREL
- S SPLIT SPOON
- T SHELBY TUBE
- O THIN WALL OPEN
- P THIN WALL PISTON
- ▽ STATIC WATER LEVEL
- ▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
- ☒ DISTURBED
- ▥ FAIR
- ▨ GOOD
- ■ LOST

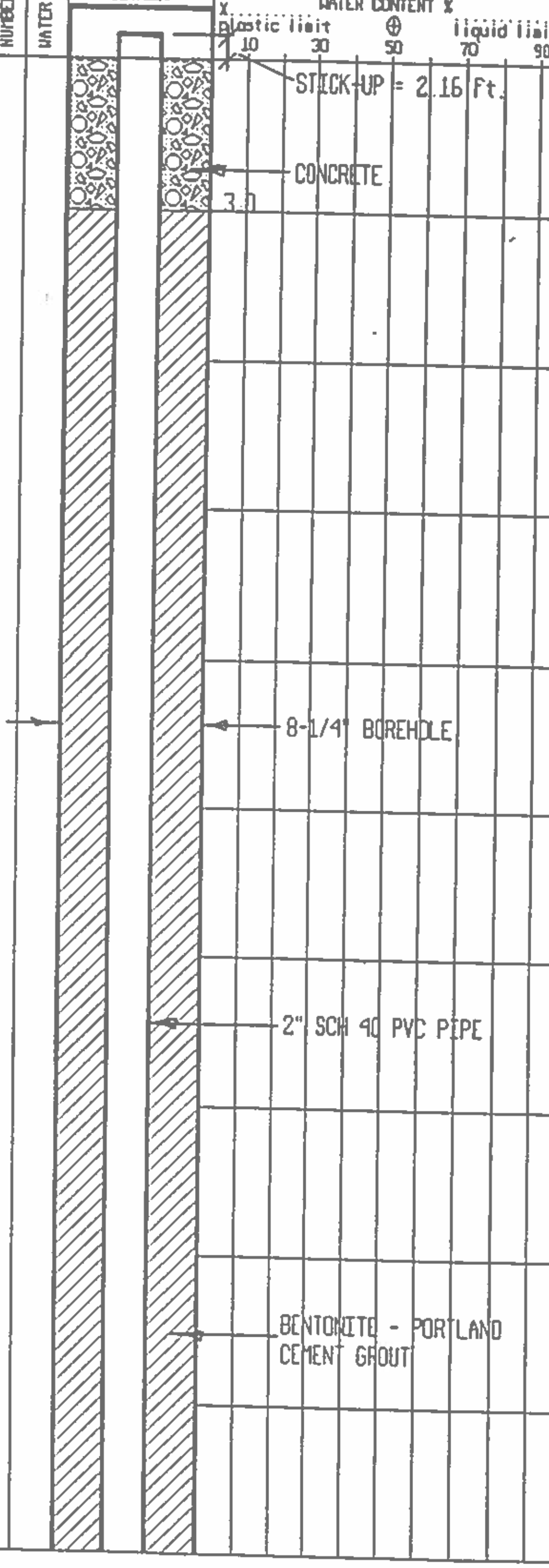
TEST INFORMATION

● PENETROMETER kg/cm2 1 2 3 4

△ SPT BLOWS/0.3m 10 20 30 40 50

WATER CONTENT %: x plastic limit 10 30 ⊕ 50 70 liquid limit 90 x

DEPTH (ft)	SYMBOL	DESCRIPTION SOIL/ROCK	SAMPLES TYPE	SAMPLES CONDITION	SAMPLES NUMBER	WATER LEVEL	PIEZOMETER CONSTRUCTION DETAILS
0		CEMENT KILN DUST:					
3							
6							
9							
12							
15							
18							
21							
24							
27							
30							



KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 2 OF 4

CONTRACT NO.: 4283
BORING NO.: MW10
NORTHING:

COMPILED BY: G. Kimler
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Dec. 19, 1996
CONTRACTOR: Lafarge/GSI
ELEVATION: 590.72 ft.a.s.l. (Gr)

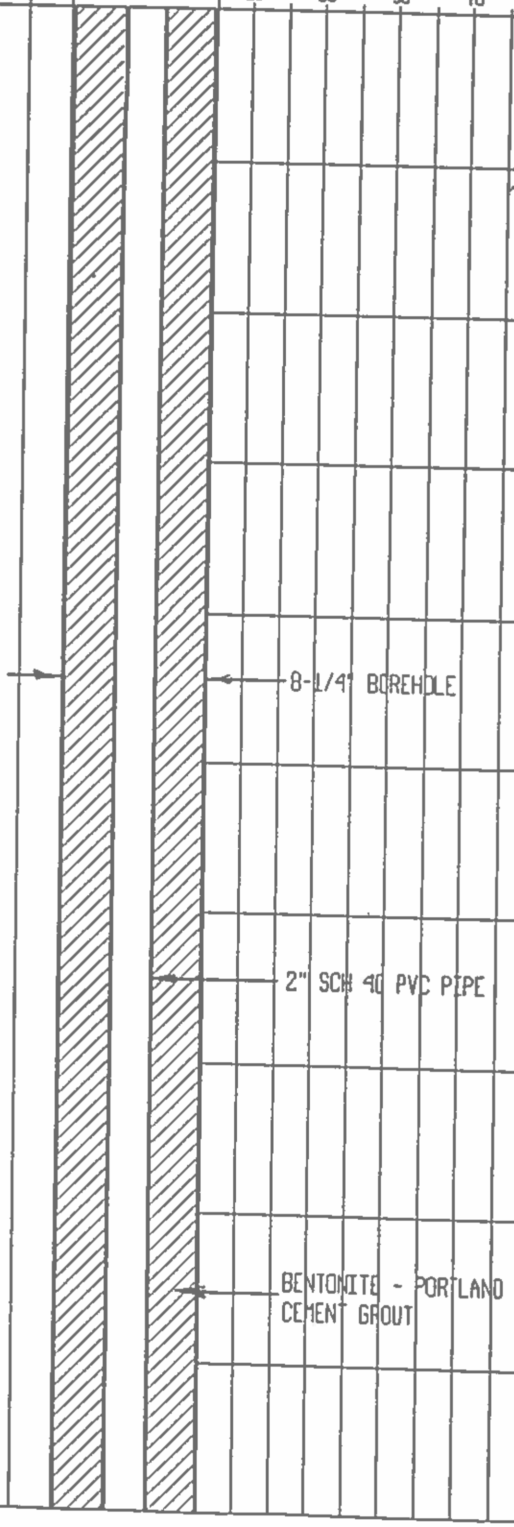
SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON

T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
∇ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
☒ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION
● PENETROMETER kg/cm2 1 2 3 4
△ SPT BLOWS/0.3m 10 20 30 40 50
x WATER CONTENT % x
plastic limit ⊕ liquid limit
10 30 50 70 90

DEPTH	SYMBOL	DESCRIPTION SOIL/ROCK	SAMPLES TYPE	CONDITION	NUMBER	WATER LEVEL	PIEZOMETER CONSTRUCTION DETAILS
30		CEMENT KILN DUST					
33							
36							
39							
42							
45							
48							
51							
54							
57							
60							



KOMEX INTERNATIONAL LTD. OFFICE REPORT ON SITE INVESTIGATION SHEET 3 OF 4

CONTRACT NO.: 4283
BORING NO.: MW10
NORTHING:

COMPILED BY: G. Kimler
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Dec. 19, 1996
CONTRACTOR: Laforge/GSI
ELEVATION: 590.72 ft.a.s.l. (Gr)

SAMPLE TYPES
A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON

T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
▽ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION
☒ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION
● PENETROMETER kg/cm2 — 1 2 3 4
△ SPT BLOWS/0.3m — 10 20 30 40 50
WATER CONTENT % — X plastic limit ⊕ liquid limit X — 10 30 50 70 90

DEPTH | SYMBOL | DESCRIPTION SOIL/ROCK | SAMPLES: TYPE, CONDITION, NUMBER | WATER LEVEL | PIEZOMETER CONSTRUCTION DETAILS

60 — CEMENT KILN DUST:

63

66

69

72

75

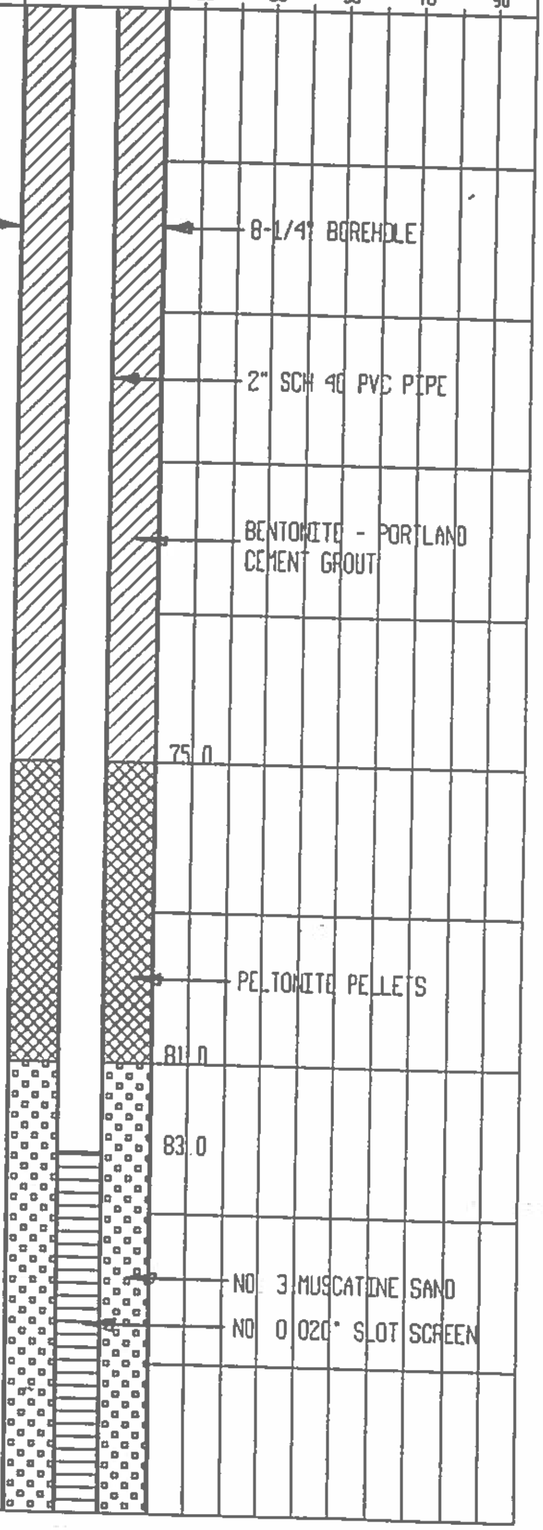
78

81

84

87

90



KOMEX INTERNATIONAL LTD.

OFFICE REPORT ON SITE INVESTIGATION

SHEET 4 OF 4

CONTRACT NO.: 4283
BORING NO.: MW10
NORTHING:

COMPILED BY: G. Kimler
LOCATION: Davenport, Iowa
EASTING:

BORING DATE: Dec. 19, 1996
CONTRACTOR: Lafarge/GSI
ELEVATION: 590.72 ft.a.s.l. (Gr)

SAMPLE TYPES

A AUGER SAMPLE
W WASH SAMPLE
R ROCK CORE
C CRREL BARREL
S SPLIT SPOON

T SHELBY TUBE
O THIN WALL OPEN
P THIN WALL PISTON
∇ STATIC WATER LEVEL
▼ DYNAMIC WATER LEVEL

SAMPLE CONDITION

☒ DISTURBED
▥ FAIR
▨ GOOD
■ LOST

TEST INFORMATION

● PENETROMETER kg/cm2
1 2 3 4

Δ SPT BLOWS/0.3m
10 20 30 40 50

X plastic limit — WATER CONTENT % ⊕ — liquid limit X
10 30 50 70 90

DEPTH	SYMBOL	DESCRIPTION SOIL/ROCK	SAMPLES TYPE	SAMPLES CONDITION	SAMPLES NUMBER	WATER LEVEL	PIEZOMETER CONSTRUCTION DETAILS
90		CEMENT KILN DUST:					
93							
96		TOTAL DEPTH = 93.0 m					
99		NOTES: Hole drilled and logged by GSI personnel.					
102							
105							
108							
111							
114							
117							
120							

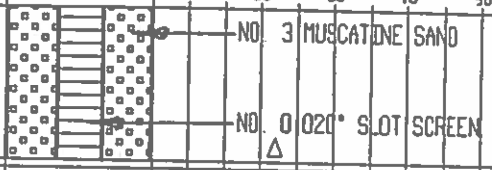


TABLE 1
PIEZOMETER INSTALLATION DETAILS, DATUM / GROUNDWATER SURFACE ELEVATIONS AND HYDRAULIC CONDUCTIVITIES

PIEZOMETER	DATUM ELEVATION (top of PVC) (ft)	STICKUP (PVC) (ft)	TOTAL DEPTH OF PIEZOMETER (ft bgs)	DEPTH INTERVAL OF SAND PACK (ft bgs)	DATE (d-m-y)	DEPTH TO WATER (ft btoc)	GROUNDWATER SURFACE ELEVATION (ft asl)	HYDRAULIC CONDUCTIVITY (ft/s)	LITHOLOGY OF COMPLETION ZONE
MW1A	616.95	1.45	143.0	119.0 - 153.9	2-Mar-95 5-May-95 18-Dec-95 24-Nov-96	129.85 126.09 131.40 130.91	487.10 490.86 485.55 486.04	NT	Limestone (Devonian-Spring/Grove and Kenwood Members, and Otis Formation)
MW1B	618.51	3.02	40.0	16.0 - 41.0	2-Mar-95 5-May-95 18-Dec-95 24-Nov-96	40.70 27.72 30.50 30.28	577.81 590.79 588.01 588.23	NT	Limestone (Devonian - Cou Falls and Rapid members)
MW2A	588.22	0.85	64.0	30.0 - 67.0	5-May-95 18-Dec-95 23-Nov-96	29.33 36.96 35.56	561.07 553.44 552.66	NT	Limestone (Devonian - Rapid, Solon, and Davenport members)
MW2B	589.61	2.40	65.0	32.0 - 67.0	5-May-95 18-Dec-95 23-Nov-96	38.20 40.28 41.20	552.21 550.13 548.41	NT	Limestone (Devonian - Rapid, Solon, and Davenport members)
MW2C	592.33	2.62	100.4*	22.8 - 103.5*	23-Nov-96	100.23	492.10		Limestone (Devonian - Rapid, Solon, Davenport and Spring Grove members)
MW3	569.17	2.08	100.0	76.0 - 110.0	2-Mar-95 5-May-95 19-Dec-95 27-Nov-96	86.91 71.10 86.30 86.45	482.26 498.07 482.87 482.72	1.8×10^{-6}	Limestone (Devonian Spring Grove and Kenwood members, and Otis Formation)
MW3L	570.16	2.50	152.0	138 - 151.7	27-Nov-96	88.36	481.80	$> 3.0 \times 10^{-4}$	Limestone (Silurian - Blanding Formation)
MW4	491.83	2.40	32.5*	3.0 - 32.5*	2-Mar-95 5-May-95 18-Dec-95 24-Nov-96	10.65 10.10 10.73 10.63	481.18 481.73 481.10 481.20	1.3×10^{-4}	Limestone (Devonian Spring Grove and Kenwood members, and Otis Formation)

TABLE 1
PIEZOMETER INSTALLATION DETAILS, DATUM / GROUNDWATER SURFACE ELEVATIONS AND HYDRAULIC CONDUCTIVITIES

PIEZOMETER	DATUM ELEVATION (top of PVC) (ft)	STICKUP (PVC) (ft)	TOTAL DEPTH OF PIEZOMETER (ft bgs)	DEPTH INTERVAL OF SAND PACK (ft bgs)	DATE (d-m-y)	DEPTH TO WATER (ft btoc)	GROUNDWATER SURFACE ELEVATION (ft asl)	HYDRAULIC CONDUCTIVITY (ft/s)	LITHOLOGY OF COMPLETION ZONE
MW4L	491.49	2.03	65.0	53.0 - 65.0	5-May-95 18-Dec-95 24-Nov-96	9.67 10.32 10.08	481.82 481.17 481.41	> 3.0 x 10^{-4}	Limestone (Silurian - Blanding Formation)
MW5	488.03	2.77	28.3	3.0 - 28.3*	2-Mar-95 5-May-95 18-Dec-95 24-Nov-96	2.98 2.58 3.58 3.53	485.05 485.45 484.45 484.50	NT	Limestone (Devonian - Spring Grove, Kenwood members and Otis Formation
MW6	565.27	2.62	148.0	133.0 - 148.0	18-Dec-95 23-Nov-96	75.40 76.49	489.87 488.78	>3 x 10^{-4}	Limestone (Silurian - Blanding Formation)
MW7	598.84	3.14	183.0	169.5 - 183.0	19-Dec-95 23-Nov-96	121.95 120.43	476.89 478.41	>3 x 10^{-4}	Limestone (Silurian - Blanding Formation)
MW8	542.53	0.33	49.0	39.0 - 49.0	23-Nov-96	DRY	-	NT	CKD fill
MW9	595.20	2.02	95.0	83.9 - 95.0	23-Nov-96	DRY	-	NT	CKD fill
MW10	592.88	2.16	93.0	81.0 -93.0	23-Nov-96	DRY	-	NT	CKD fill

Notes:

1. ftbgs- denotes feet below ground surface
2. ftbtoc- denotes feet below top of 2" PVC collar
3. * - denotes open borehole completion
4. NT- denotes not tested

APPENDIX B

CONTINENTAL CEMENT COMPANY

Example Field Forms

CONTINENTAL CEMENT GROUNDWATER SAMPLING LOG

Site Name: Continental Cement CKD Monofil

Date: ______

Weather Conditions: ______

Purging/Sampling Device: Hydrasleeves

Samplers: ______

Analytical Parameters: ______

Sample Location	Sample Time	Water Level (ft btoc)	Total Depth (ft btoc)	Temperature (Degrees C)	pH	Conductivity (uS/cm)	Sample Appearance	Sample Odor	Comments
MW-1B									
MW-2A									
MW-1A									
MW-3									
MW-4									
MW-5									
MW-11									
MW-12									
MW-13									
MW-14									
MW-15									
MW-16									

Field Observations/Comments:

BLACKSTONE
ENVIRONMENTAL

CONTINENTAL CEMENT GROUNDWATER SAMPLING LOG

Site Name: Continental Cement CKD Monofil

Date:

Weather Conditions:

Purging/Sampling Device: Hydrasleeves

Samplers:

Analytical Parameters:

Sample Location	Sample Time	Water Level (ft btoc)	Total Depth (ft btoc)	Temperature (Degrees C)	pH	Conductivity (uS/cm)	Sample Appearance	Sample Odor	Comments
MW-18									
MW-3L									
MW-4L									
MW-7									
MW-16L									
MW-19									
Q-Sump									
MW-2CR									

Field Observations/Comments:

BLACKSTONE ENVIRONMENTAL

CONTINENTAL CEMENT MONITORING POINT SAMPLING LOG

Site Name: Continental Cement CKD Monofil

Date: ______________________________

Weather Conditions: ______________________________

Purging/Sampling Device: ______________________________

Samplers: ______________________________

Analytical Parameters: ______________________________

Sample Location	Sample Time	Water Level (ft btoc)	Total Depth (ft btoc)	Temperature (Degrees C)	pH	Conductivity (uS/cm)	Sample Appearance	Sample Odor	Volume purged & Final Water Level
MW-9									
MW-10									
UL-1									
LL-1									
L-Sump									
UL-2									
LL-2									
UL-3									
LL-3									

Field Observations/Comments:

BLACKSTONE ENVIRONMENTAL

APPENDIX C

CONTINENTAL CEMENT COMPANY

Example Chain of Custody

CHAIN-OF-CUSTODY Analytical Request Document

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevant fields

LAB USE ONLY- Affix Workorder/Login Label Here or List Pace Workorder Number or MTJL Log-in Number Here

ALL BOLD OUTLINED AREAS are for LAB USE ONLY

Company:

Address:

Billing Information:

Report To:

Email To:

Copy To:

Site Collection Info/Address:

Customer Project Name/Number:

State: / County/City:

Time Zone Collected: [ ]PT [ ]MT [ ]CT [ ]ET

Phone:
Email:

Site/Facility ID #:

Compliance Monitoring?
[ ] Yes [ ] No

Collected By (print):

Purchase Order # :
Quote #:

DW PWS ID #:
DW Location Code:

Collected By (signature):

Turnaround Date Required:

Immediately Packed on Ice:
[ ] Yes [ ] No

Sample Disposal:
[ ] Dispose as appropriate
[ ] Return
[ ] Archive: _______________
[ ] Hold: _________________

Rush: (Expedite Charges Apply)
[ ] Same Day [ ] Next Day
[ ] 2 Day [ ] 3 Day
[ ] 4 Day [ ] 5 Day

Field Filtered (if applicable):
[ ] Yes [ ] No

Analysis: ____________________

Container Preservative Type **

Lab Project Manager:

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other _______________

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start)		Composite End		Res Cl	# of Ctns	Container Type: Plastic (P) or Glass (G)	Analyses										Lab Profile/Line:
			Date	Time	Date	Time														Lab Sample Receipt Checklist: Custody Seals Present/Intact Y N NA Custody Signatures Present Y N NA Collector Signature Present Y N NA Bottles Intact Y N NA Correct Bottles Y N NA Sufficient Volume Y N NA Samples Received on Ice Y N NA VOA - Headspace Acceptable Y N NA USDA Regulated Soils Y N NA Samples in Holding Time Y N NA Residual Chlorine Present Y N NA Cl Strips: ___________________ Sample pH Acceptable Y N NA pH Strips: ___________________ Sulfide Present Y N NA Lead Acetate Strips: ___________ LAB USE ONLY: Lab Sample # / Comments:

Customer Remarks / Special Conditions / Possible Hazards:

Type of Ice Used: Wet Blue Dry None

SHORT HOLDS PRESENT (<72 hours) : Y N N/A

Packing Material Used:

Lab Tracking #:

Radchem sample(s) screened (<500 cpm): Y N NA

Samples received via:
FEDEX UPS Client Courier Pace Courier

LAB Sample Temperature Info:
Temp Blank Received: Y N NA
Therm ID#: ________________
Cooler 1 Temp Upon Receipt: __oC
Cooler 1 Therm Corr. Factor:___oC
Cooler 1 Corrected Temp: _____oC
Comments:

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:

MTJL LAB USE ONLY
Table #:
Acctnum:
Template:
Prelogin:
PM:
PB:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

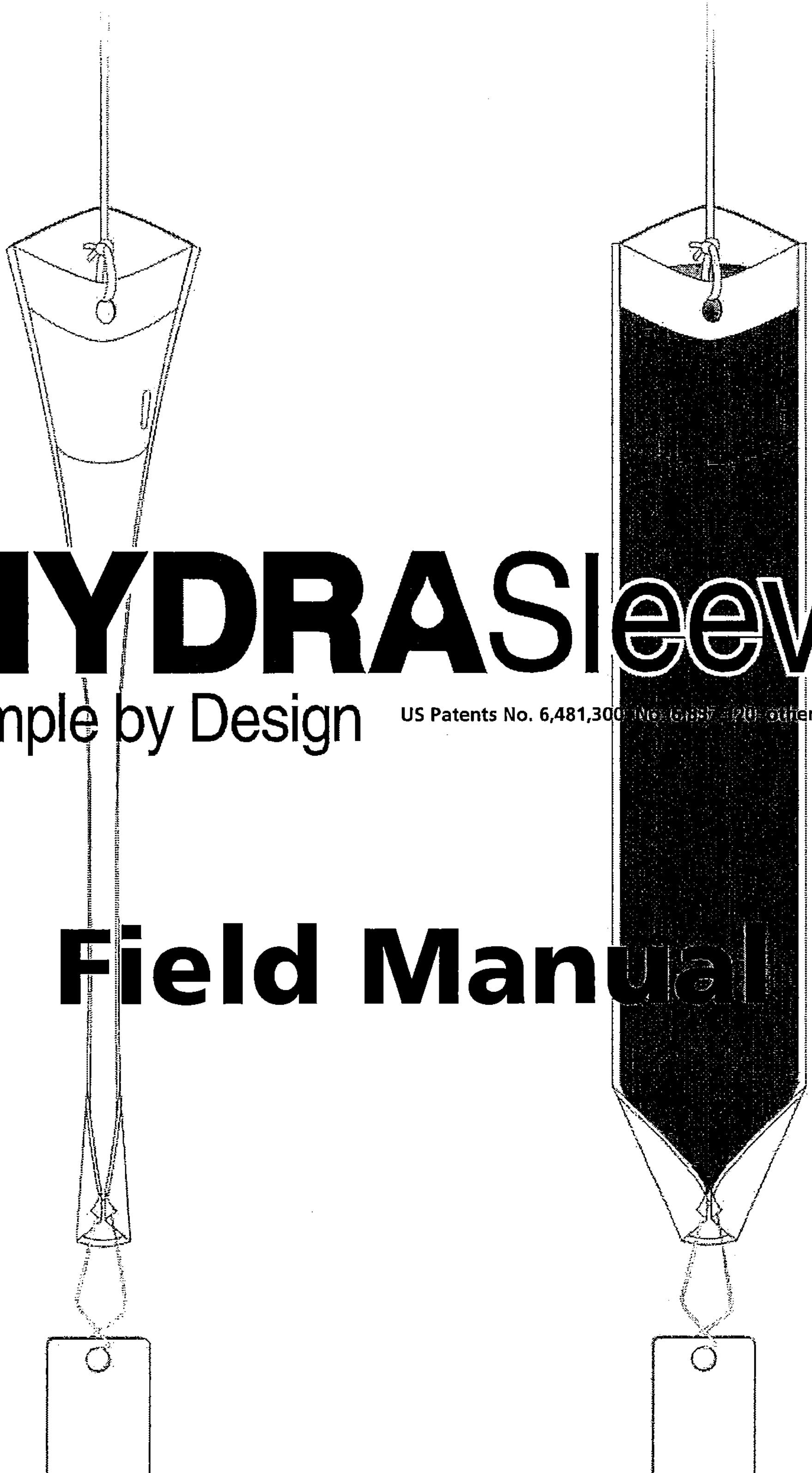
Non Conformance(s):
YES / NO

Page: _____
of: _____

APPENDIX D

CONTINENTAL CEMENT COMPANY

HydraSleeve Field Manual



HYDRASleeve

Simple by Design

US Patents No. 6,481,300; No. 6,837,120; others pending

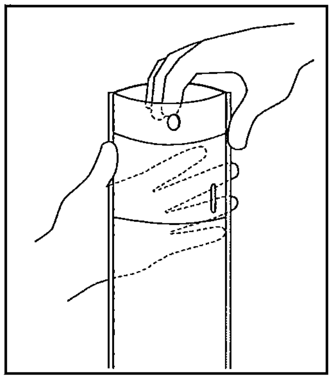
Field Manual

Introduction

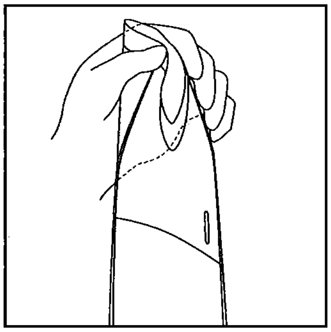
The HydraSleeve groundwater sampler can be used to collect a representative sample for most physical and chemical parameters without purging the well. It collects a whole water sample from a user-defined interval (typically within the well screen), without mixing fluid from other intervals. One or more HydraSleeves are placed within the screened interval of the monitoring well, and a period of time is allocated for the well to re-equilibrate. Hours to months later, the sealed HydraSleeve can be activated for sample collection. When activated, HydraSleeve collects a sample with no drawdown and minimal agitation or displacement of the water column. Once the sampler is full, the one-way reed valve collapses, preventing mixing of extraneous, non-representative fluid during recovery.

Assembly

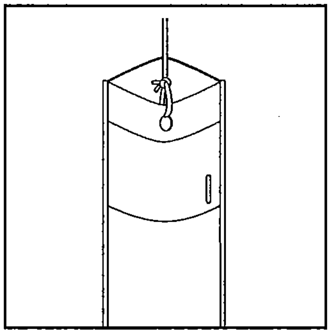
Assembling the HydraSleeve is simple, and can be done by one person in the field, taking only a minute or two.



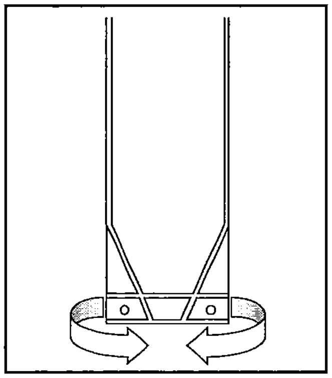
1 Remove HydraSleeve from package and grasp top to "pop" open.



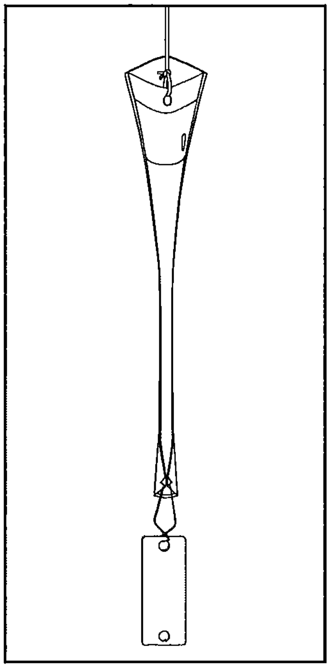
2 Squeeze side fins together at top to bend reinforcing strips outward.



3 Attach line to hole at top of HydraSleeve.



4 Fold the two holes at bottom of HydraSleeve together and attach weight



5 Sampler is ready to insert into the well.

Placing the HydraSleeve(s)

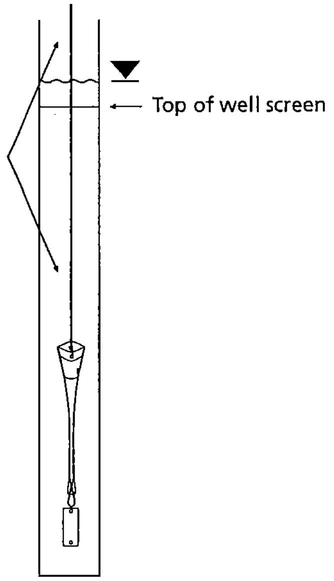
To collect a representative groundwater sample without purging, the well must be allowed time to re-equilibrate after placement of the sampler. When any device is lowered into a well, some mixing of the water column occurs. The diameter of the device and its shape greatly affect the degree of mixing. The flat cross-section of the empty HydraSleeve minimizes the disturbance to the water column as the sampler is lowered into position, reducing the time needed for the well to return to equilibrium.

There are three basic methods for holding a HydraSleeve in position as the well equilibrates.

TOP DOWN DEPLOYMENT (Figure 1)
Measure the correct amount of suspension line needed to "hang" the top of the HydraSleeve(s) at the desired sampling depth (in most cases, this will be at the bottom of the sampling zone). The upper end of the tether can be connected to the well cap to suspend the HydraSleeve at the correct depth until activated for sampling.

Note: For deep settings, it may be difficult to accurately measure long segments of suspension line in the field. Factory prepared, custom suspension line and attachment points can be provided.

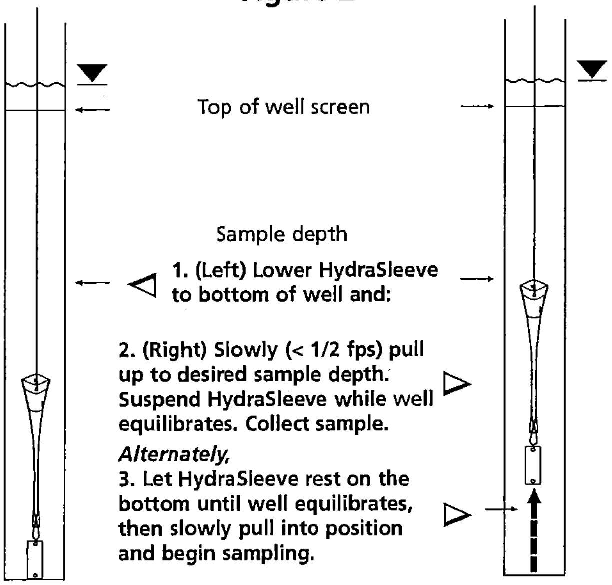
Figure 1



BOTTOM DEPLOYMENT (Figure 2)
Sound the well to determine the exact depth. Lower the weighted HydraSleeve into the well and let it touch the bottom. <u>Very slowly</u> (less than 1/2 foot per second) raise the sampler to the point where the check valve is at the depth the sample is to be collected. Attach the suspension line to the top of the well to suspend it at this depth. (It is often easier to measure a few feet from the bottom of the well up to the sample point, than it is to measure many feet from the top of the well down.)

Alternately, the sampler can be left on the bottom until the well re-equilibrates. For sampling, it can be very slowly pulled (< 1/2 fps) to sampling depth, then activated (see "Sample Collection," p. 6) to collect the sample, and retrieved to the surface.

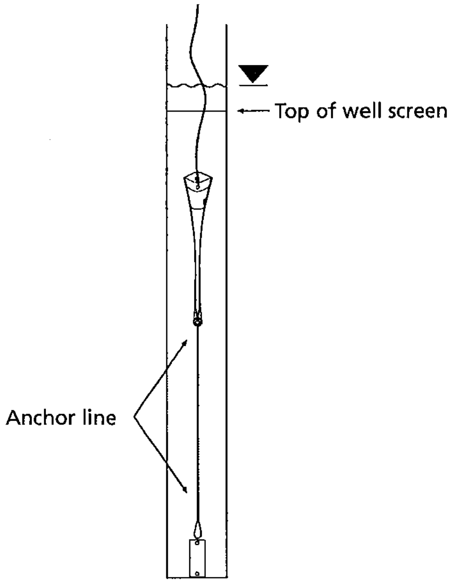
Figure 2



BOTTOM ANCHOR (Figure 3)

Determine the exact depth of the well. Calculate the distance from the bottom of the well to the desired sampling depth. Attach an appropriate length anchor line between the weight and the bottom of the sampler and lower the assembly until the weight rests on the bottom of the well, allowing the top of the sampler to float at the correct sampling depth.

Figure 3



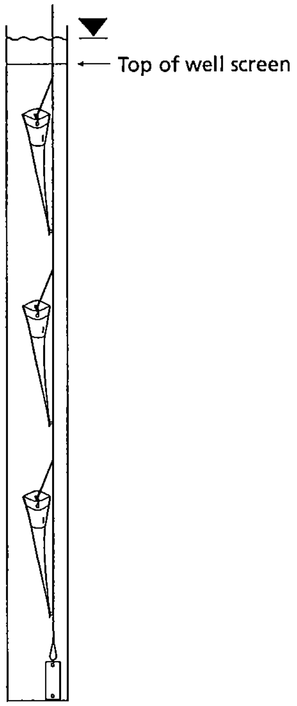
Multiple Interval Deployment

There are two basic methods for placing multiple HydraSleeves in a well to collect samples from different levels simultaneously.

ATTACHED TO A SINGLE TETHER (Figure 4)

To use 3 or more samplers simultaneously, we recommend attaching them all to a tether for support to prevent the sampling string from pulling apart. The weight is attached to a single length of suspension line and allowed to rest on the bottom of the well. The top and bottom of each HydraSleeve are attached to the tether at the desired sample intervals. Cable tie or stainless steel clips (supplied) work well for attaching the HydraSleeves to the line. Simply push one end of the clip between strands of the rope at the desired point before attaching the clip to the HydraSleeve.

Figure 4

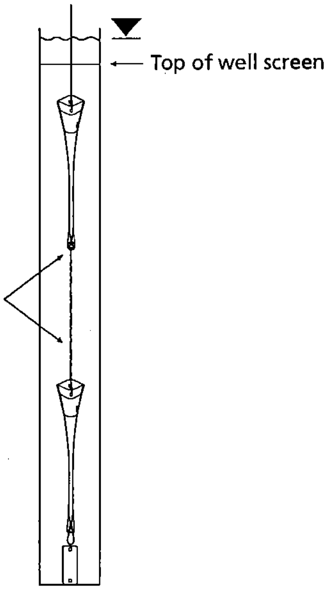


Separate HydraSleeves to the desired spacing by measuring along the tether when attaching samplers.

ATTACHED END TO END (Figure 5)

To place 2 or 3 stacked HydraSleeves for vertical profiling, use one of the methods described above to locate the bottom sampler. Attach the bottom of the top sampler to the top of the following HydraSleeve(s) with a carefully measured length of suspension cable. Connect the weight to the bottom sampler. Note: if many HydraSleeves are attached to a tether, more weight may be required than with a single sampler.

Figure 5



Separate HydraSleeves to the desired spacing by measuring tether between samplers.

Sample Collection

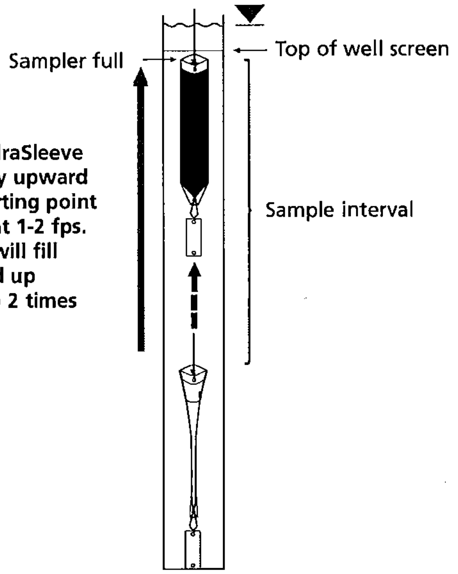
The HydraSleeve must move upward at a rate of one foot per second or faster (about the speed a bailer is usually pulled upward) for water to pass through the check valve into the sample sleeve. The total upward distance the check valve must travel to fill the sample sleeve is about 1 to 2 times the length of the sampler. For example, a 24-inch HydraSleeve needs a total upward movement of 24 to no more than 48 inches to fill. The upward motion can be accomplished using one long continuous pull, several short strokes, or any combination that moves the check valve the required distance in the open position. A special technique is used for sampling low-yield wells.

CONTINUOUS PULL (Figure 6)

Pull the HydraSleeve continuously upward from its starting point at a constant 1 to 2 feet per second until full. This method usually provides the least turbid samples and is analogous to coring the water column from the bottom up.

Note: When using this method, the screen interval should be long enough so the sampler fills before exiting the top of the screen.

Figure 6



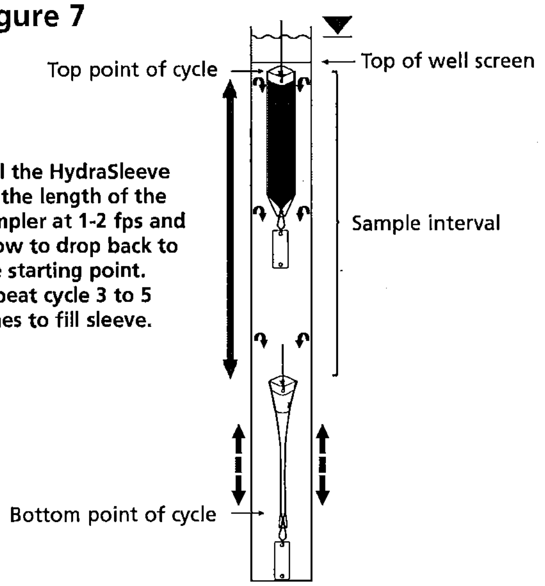
Pull the HydraSleeve continuously upward from its starting point at a constant 1-2 fps. The sleeve will fill when pulled up approx. 1 to 2 times its length.

SHORT STROKES (Figure 7)

Pull the sampler upward at about 1 to 2 feet per second for the length of the sampler and let it drop back to the starting point. Repeat the cycle 3 to 5 times.

This method provides a shorter sampling interval than the continuous pull method (above), and usually reduces the turbidity levels of the sample below that of numerous rapid, short cycles (below). The sample comes from between the top of the cycle and the bottom of the sampler at its lowest point.

Figure 7

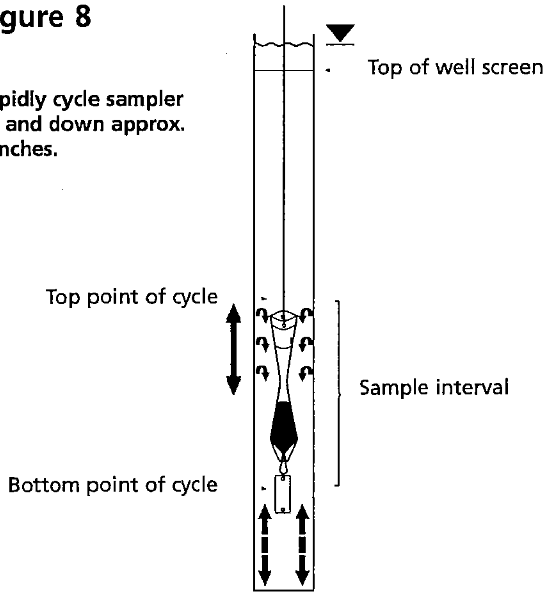


Pull the HydraSleeve up the length of the sampler at 1-2 fps and allow to drop back to the starting point. Repeat cycle 3 to 5 times to fill sleeve.

RAPID, SHORT CYCLES (Figure 8)

Cycle the HydraSleeve up and down using rapid, short strokes (6-inch cycle at a minimum of 1 cycle per second) 5 to 8 times. This method provides the shortest sampling interval. Dye studies have shown that when using this method the sample flows into the check valve from along the length of the sampler and immediately above the check valve. The sample interval is from the bottom the sampler at its lowest point in the cycle to the top of the check valve at the peak of the cycle.

Figure 8

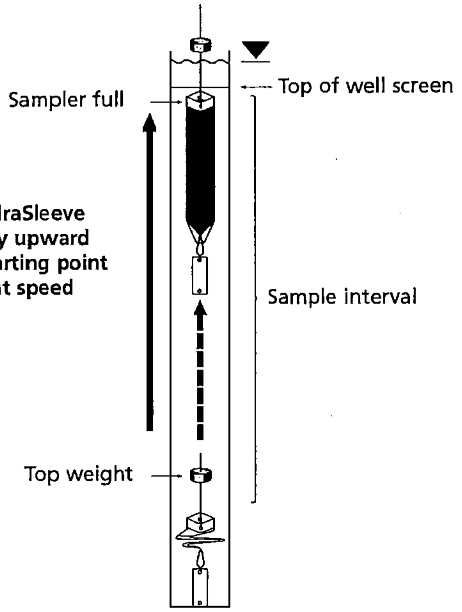


Rapidly cycle sampler up and down approx. 6 inches.

SAMPLING LOW-YIELD WELLS (Figure 9)

HydraSleeve provides the best available technology for sampling low yield wells. When pulled upward after the well re-equilibrates, the HydraSleeve will collect a water core from the top of the sampler to about its own length above that point. The sample is collected with no drawdown in the well and minimal sample agitation. An optional top weight can be attached to compress the sampler in the bottom of the well if needed for an extremely short water column. With a top weight, the check valve is pushed down to within a foot of the bottom of the well.

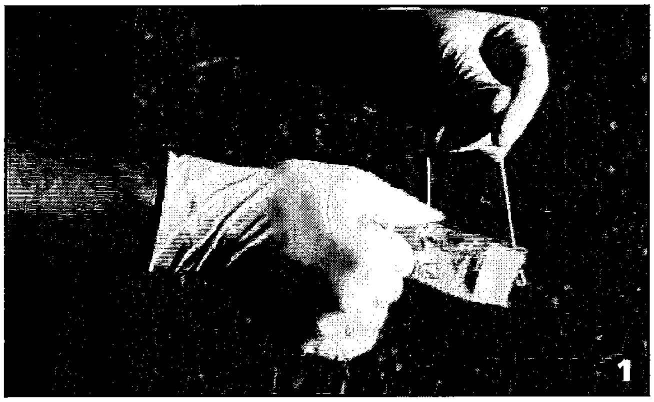
Figure 9



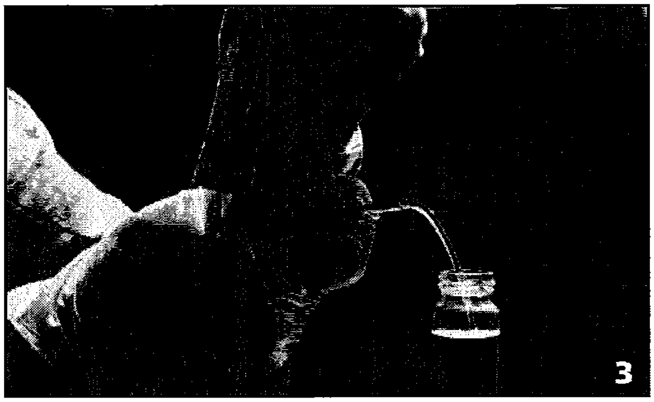
Pull the HydraSleeve continuously upward from the starting point at a constant speed

Sample Discharge

The best way to remove a sample from the HydraSleeve with the least amount of aeration and agitation is with the short plastic discharge tube (included).


1


2


3

First, squeeze the full sampler just below the top to expel water resting above the flexible check valve. (Photo 1, top left)

Then, push the pointed discharge tube through the outer polyethylene sleeve about 3-4 inches below the white reinforcing strips. (Photo 2, middle left)

Discharge the sample into the desired container. (Photo 3, bottom left)

Raising and lowering the bottom of the sampler or pinching the sample sleeve just below the discharge tube will control the flow of the sample. The sample sleeve can also be squeezed, forcing fluid up through the discharge tube, similar to squeezing a tube of toothpaste. With a little practice, and using a flat surface to set the sample containers on, HydraSleeve sampling becomes a one-person operation.

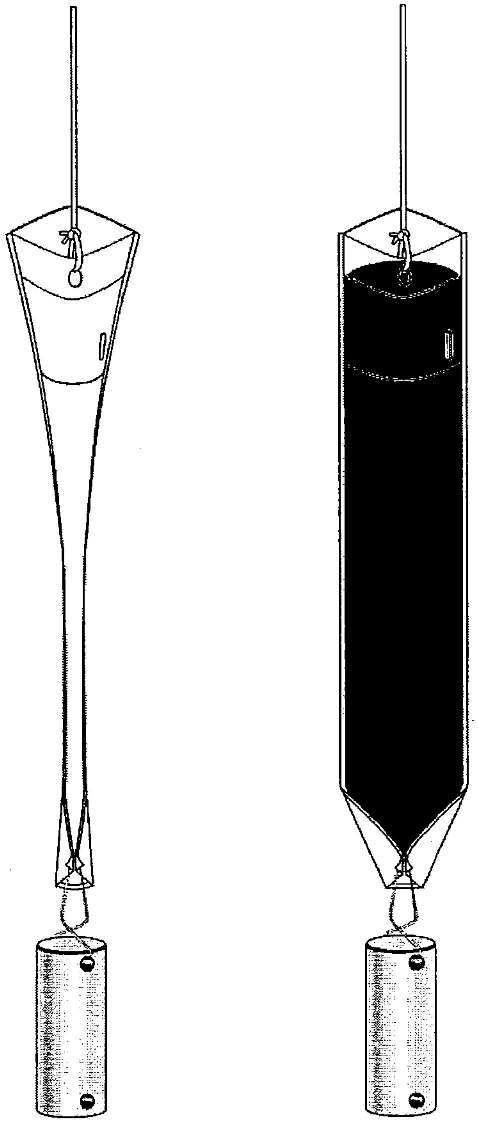
GeoInsight

1680 Hickory Loop, Suite B • Las Cruces, NM 88005
Phone: 1.800.996.2225 • 1.505.523.5799 • Fax: 1.505.523.0789
www.geoinsightonline.com • KentCordry@aol.com

HYDRASleeve™

Simple by Design US Patent No. 6,481,300; No. 6,837,120 others pending

Standard Operating Procedure: Sampling Ground Water with a HydraSleeve



This Guide should be used in addition to field manuals appropriate to sampling device (i.e., HydraSleeve or Super Sleeve).

Find the appropriate field manual on the HydraSleeve website at http://www.hydrasleeve.com.

For more information about the HydraSleeve, or if you have questions, contact:
GeoInsight, 2007 Glass Road, Las Cruces, NM 88005, 1-800-996-2225,
info@hydrasleeve.com.

Table of Contents

Introduction

The HydraSleeve is classified as a no-purge (passive) grab sampling device, meaning that it is used to collect ground-water samples directly from the screened interval of a well without having to purge the well prior to sample collection. When it is used as described in this Standard Operating Procedure (SOP), the HydraSleeve causes no drawdown in the well (until the sample is withdrawn from the water column) and only minimal disturbance of the water column, because it has a very thin cross section and it displaces very little water (<100 ml) during deployment in the well. The HydraSleeve collects a sample from within the screen only, and it excludes water from any other part of the water column in the well through the use of a self-sealing check valve at the top of the sampler. It is a single-use (disposable) sampler that is not intended for reuse, so there are no decontamination requirements for the sampler itself.

The use of no-purge sampling as a means of collecting representative ground-water samples depends on the natural movement of ground water (under ambient hydraulic head) from the formation adjacent to the well screen through the screen. Robin and Gillham (1987) demonstrated the existence of a dynamic equilibrium between the water in a formation and the water in a well screen installed in that formation, which results in formation-quality water being available in the well screen for sampling at all times. No-purge sampling devices like the HydraSleeve collect this formation-quality water as the sample, under undisturbed (non-pumping) natural flow conditions. Samples collected in this manner generally provide more conservative (i.e., higher concentration) values than samples collected using well-volume purging, and values equivalent to samples collected using low-flow purging and sampling (Parsons, 2005).

Applications of the HydraSleeve

The HydraSleeve can be used to collect representative samples of ground water for all analytes (volatile organic compounds [VOCs], semi-volatile organic compounds [SVOCs], common metals, trace metals, major cations and anions, dissolved gases, total dissolved solids, radionuclides, pesticides, PCBs, explosive compounds, and all other analytical parameters). Designs are available to collect samples from wells from 1" inside diameter and larger. The HydraSleeve can collect samples from wells of any yield, but it is especially well-suited to collecting samples from low-yield wells, where other sampling methods can't be used reliably because their use results in dewatering of the well screen and alteration of sample chemistry (McAlary and Barker, 1987).

The HydraSleeve can collect samples from wells of any depth, and it can be used for single-event sampling or long-term ground-water monitoring programs. Because of its thin cross section and flexible construction, it can be used in narrow, constricted or damaged wells where rigid sampling devices may not fit. Using multiple HydraSleeves deployed in series along a single suspension line or tether, it is also possible to conduct in-well vertical profiling in wells in which contaminant concentrations are thought to be stratified.

As with all groundwater sampling devices, HydraSleeves should not be used to collect groundwater samples from wells in which separate (non-aqueous) phase hydrocarbons (i.e., gasoline, diesel fuel or jet fuel) are present because of the possibility of incorporating some of the separate-phase hydrocarbon into the sample.

Description of the HydraSleeve

The HydraSleeve (Figure 1) consists of the following basic components:

- A suspension line or tether (A.), attached to the spring clip or directly to the top of the sleeve to deploy the device into and recover the device from the well. Tethers with depth indicators marked in 1-foot intervals are available from the manufacturer.
- A long, flexible, 4-mil thick lay-flat polyethylene sample sleeve (C.) sealed at the bottom (this is the sample chamber), which comes in different sizes, as discussed below with a self-sealing reed-type flexible polyethylene check valve built into the top of the sleeve (B.) to prevent water from entering or exiting the sampler except during sample acquisition.
- A reusable stainless-steel weight with clip (D.), which is attached to the bottom of the sleeve to carry it down the well to its intended depth in the water column. Bottom weights available from the manufacturer are 0.75" OD and are available in three sizes: 5 oz. (2.5" long); 8 oz. (4" long); and 16 oz. (8" long). In lieu of a bottom weight, an optional top weight may be attached to the top of the HydraSleeve to carry it to depth and to compress it at the bottom of the well (not shown in Figure 1);
- A discharge tube that is used to puncture the HydraSleeve after it is recovered from the well so the sample can be decanted into sample bottles (not shown).
- Just above the self-sealing check valve at the top of the sleeve are two holes which provide attachment points for the spring clip and/or suspension line or tether. At the bottom of the sample sleeve are two holes which provide attachment points for the weight clip and weight.

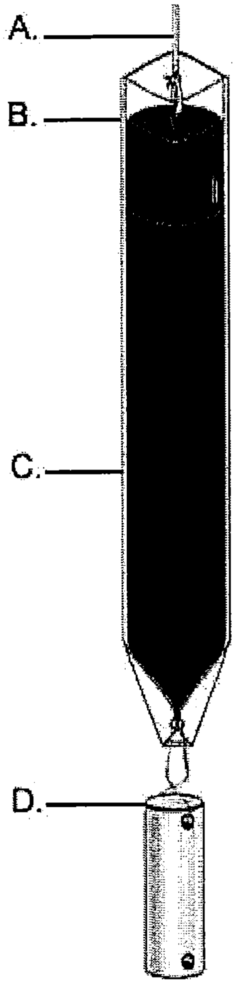


Figure 1. HydraSleeve components.

Note: The sample sleeve and the discharge tube are designed for one-time use and are disposable. The spring clip, weight and weight clip may be reused after thorough cleaning. Suspension cord is generally disposed after one use although, if it is dedicated to the well, it may be reused at the discretion of the sampling personnel.

Selecting the HydraSleeve Size to Meet Site-Specific Sampling Objectives

It is important to understand that each HydraSleeve is able to collect a finite volume of sample because, after the HydraSleeve is deployed, you only get one chance to collect an undisturbed sample. Thus, the volume of sample required to meet your site-specific sampling and analytical requirements will dictate the size of HydraSleeve you need to meet these requirements.

The volume of sample collected by the HydraSleeve varies with the diameter and length of the HydraSleeve. Dimensions and volumes of available HydraSleeve models are detailed in Table 1.

Table 1. Dimensions and volumes of HydraSleeve models.

Diameter	**Volume**	**Length**	**Lay-Flat Width**	**Filled Dia.**
2-Inch HydraSleeves				
Standard 625-ml HydraSleeve	625 ml	< 30”	2.5”	1.4”
Standard 1-Liter HydraSleeve	1 Liter	38”	3”	1.9”
1-Liter HydraSleeve SS	1 Liter	36”	3”	1.9”
2-Liter HydraSleeve SS	2 Liters	60”	3”	1.9”
4-Inch HydraSleeves				
Standard 1.6-Liter HydraSleeve	1.6 Liters	30”	3.8”	2.3”
Custom 2-Liter HydraSleeve	2 Liters	36”	4”	2.7”

HydraSleeves can be custom-fabricated by the manufacturer in varying diameters and lengths to meet specific volume requirements. HydraSleeves can also be deployed in series (i.e., multiple HydraSleeves attached to one tether) to collect additional sample to meet specific volume requirements, as described below.

If you have questions regarding the availability of sufficient volume of sample to satisfy laboratory requirements for analysis, it is recommended that you contact the laboratory to discuss the minimum volumes needed for each suite of analytes. Laboratories often require only 10% to 25% of the volume they specify to complete analysis for specific suites of analytes, so they can often work with much smaller sample volumes that can easily be supplied by a HydraSleeve.

HydraSleeve Deployment

Information Required Before Deploying a HydraSleeve

Before installing a HydraSleeve in any well, you will need to know the following:

- The inside diameter of the well
- The length of the well screen
- The water level in the well
- The position of the well screen in the well
- The total depth of the well

The inside diameter of the well is used to determine the appropriate HydraSleeve diameter for use in the well. The other information is used to determine the proper placement of the HydraSleeve in the well to collect a representative sample from the screen (see HydraSleeve Placement, below), and to determine the appropriate length of tether to attach to the HydraSleeve to deploy it at the appropriate position in the well.

Most of this information (with the exception of the water level) should be available from the well log; if not, it will have to be collected by some other means. The inside diameter of the well can be measured at the top of the well casing, and the total depth of the well can be measured by sounding the bottom of the well with a weighted tape. The position and length of the well screen may have to be determined using a down-hole camera if a well log is not available. The water level in the well can be measured using any commonly available water-level gauge.

HydraSleeve Placement

The HydraSleeve is designed to collect a sample directly from the well screen, and it fills by pulling it up through the screen a distance equivalent to 1 to 1.5 times its length. This upward motion causes the top check valve to open, which allows the device to fill. To optimize sample recovery, it is recommended that the HydraSleeve be placed in the well so that the bottom weight rests on the bottom of the well and the top of the HydraSleeve is as close to the bottom of the well screen as possible. This should allow the sampler to fill before the top of the device reaches the top of the screen as it is pulled up through the water column, and ensure that only water from the screen is collected as the sample. In short-screen wells, or wells with a short water column, it may be necessary to use a top-weight on the HydraSleeve to compress it in the bottom of the well so that, when it is recovered, it has room to fill before it reaches the top of the screen.

Example

2" ID PVC well, 50' total depth, 10' screen at the bottom of the well, with water level above the screen (the entire screen contains water).

Correct Placement (figure 2): Using a standard HydraSleeve for a 2" well (2.6" flat width/1.5" filled OD x 30" long, 650 ml volume), deploy the sampler so the weight (an 8 oz., 4"-long weight with a 2"-long clip) rests at the bottom of the well. The top of the sleeve is thus set at about 36" above the bottom of the well. When the sampler is recovered, it will be pulled upward approximately 30" to 45" before it is filled; therefore, it is full (and the top check valve closes) at approximately 66" (5 ½ feet) to 81" (6 ¾ feet) above the bottom of the well, which is well before the sampler reaches the top of the screen. In this example, only water from the screen is collected as a sample.

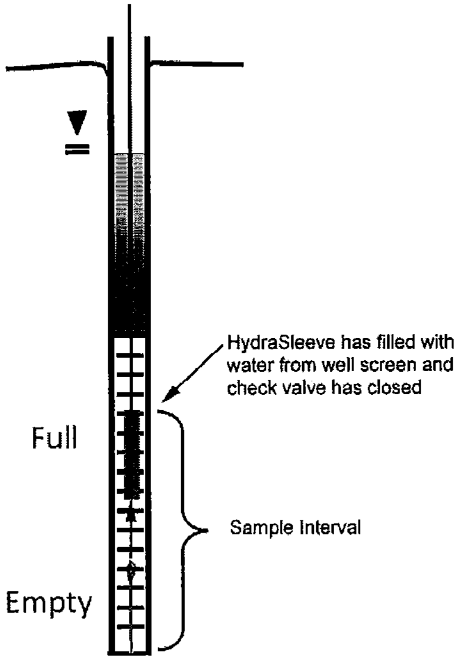


Figure 2. Correct placement of HydraSleeve.

Incorrect Placement (figure 3): If the well screen in this example was only 5' long, and the HydraSleeve was placed as above, it would not fill before the top of the device reached the top of the well screen, so the sample would include water from above the screen, which may not have the same chemistry.

The solution? Deploy the HydraSleeve with a top weight, so that it is collapsed to within 6" to 9" of the bottom of the well. When the HydraSleeve is recovered, it will fill within 39" (3 ¼ feet) to 54" (4 ½ feet) above the bottom of the well, or just before the sampler reaches the top of the screen, so it collects only water from the screen as the sample.

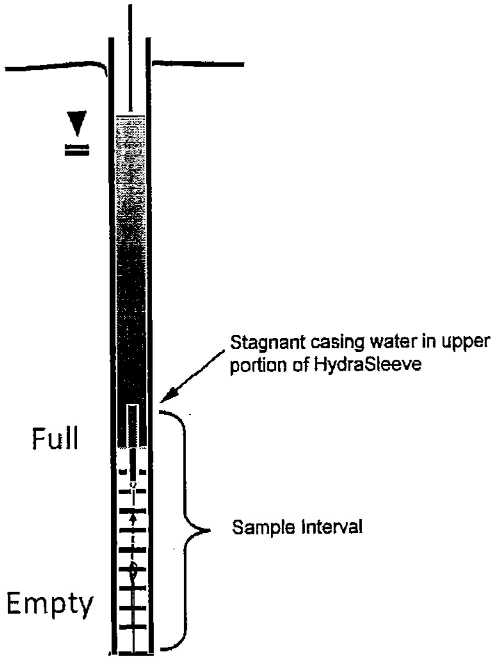


Figure 3. Incorrect placement of HydraSleeve.

This example illustrates one of many types of HydraSleeve placements. More complex placements are discussed in a later section.

Procedures for Sampling with the HydraSleeve

Collecting a ground-water sample with a HydraSleeve is a simple one-person operation.

Note: Before deploying the HydraSleeve in the well, collect the depth-to-water measurement that you will use to determine the preferred position of the HydraSleeve in the well. This measurement may also be used with measurements from other wells to create a ground-water contour map. If necessary, also measure the depth to the bottom of the well to verify actual well depth to confirm your decision on placement of the HydraSleeve in the water column.

Measure the correct amount of tether needed to suspend the HydraSleeve in the well so that the weight will rest on the bottom of the well (or at your preferred position in the well). Make sure to account for the need to leave a few feet of tether at the top of the well to allow recovery of the sleeve

Note: Always wear sterile gloves when handling and discharging the HydraSleeve.

I. Assembling the HydraSleeve

1. Remove the HydraSleeve from its packaging, unfold it, and hold it by its top.
2. Crimp the top of the HydraSleeve by folding the hard polyethylene reinforcing strips at the holes.
3. Attach the spring clip to the holes to ensure that the top will remain open until the sampler is retrieved.
4. Attach the tether to the spring clip by tying a knot in the tether.

Note: Alternatively, attach the tether to one (NOT both) of the holes at the top of the Hydrasleeve by tying a knot in the tether.

5. Fold the flaps with the two holes at the bottom of the HydraSleeve together and slide the weight clip through the holes.
6. Attach a weight to the bottom of the weight clip to ensure that the HydraSleeve will descend to the bottom of the well.

II. Deploying the HydraSleeve

1. Using the tether, carefully lower the HydraSleeve to the bottom of the well, or to your preferred depth in the water column

   During installation, hydrostatic pressure in the water column will keep the self-sealing check valve at the top of the HydraSleeve closed, and ensure that it retains its flat, empty profile for an indefinite period prior to recovery.

Note: Make sure that it is not pulled upward at any time during its descent. If the HydraSleeve is pulled upward at a rate greater than 0.5'/second at any time prior to recovery, the top check valve will open and water will enter the HydraSleeve prematurely.

2. Secure the tether at the top of the well by placing the well cap on the top of the well casing and over the tether.

Note: Alternatively, you can tie the tether to a hook on the bottom of the well cap (you will need to leave a few inches of slack in the line to avoid pulling the sampler up as the cap is removed at the next sampling event).

III. Equilibrating the Well

The equilibration time is the time it takes for conditions in the water column (primarily flow dynamics and contaminant distribution) to restabilize after vertical mixing occurs (caused by installation of a sampling device in the well).

- Situation: The HydraSleeve is deployed for the first time or for only one time in a well

  The HydraSleeve is very thin in cross section and displaces very little water (<100 ml) during deployment so, unlike most other sampling devices, it does not disturb the water column to the point at which long equilibration times are necessary to ensure recovery of a representative sample.

  In most cases, the HydraSleeve can be recovered immediately (with no equilibration time) or within a few hours. In regulatory jurisdictions that impose specific requirements for equilibration times prior to recovery of no-purge sampling devices, these requirements should be followed.

- Situation: The HydraSleeve is being deployed for recovery during a future sampling event

  In periodic (i.e., quarterly or semi-annual) sampling programs, the sampler for the current sampling event can be recovered and a new sampler (for the next sampling event) deployed immediately thereafter, so the new sampler remains in the well until the next sampling event.

Thus, a long equilibration time is ensured and, at the next sampling event, the sampler can be recovered immediately. This means that separate mobilizations, to deploy and then to recover the sampler, are not required. HydraSleeves can be left in a well for an indefinite period of time without concern.

IV. HydraSleeve Recovery and Sample Collection

1. Hold on to the tether while removing the well cap.
2. Secure the tether at the top of the well while maintaining tension on the tether (but without pulling the tether upwards)
3. Measure the water level in the well.
4. In one smooth motion, pull the tether up between 30" to 45" (36" to 54" for the longer HydraSleeve) at a rate of about 1' per second (or faster).

   The motion will open the top check valve and allow the HydraSleeve to fill (it should fill in about 1 to 1.5 times the length of the HydraSleeve). This is analogous to coring the water column in the well from the bottom up.

   When the HydraSleeve is full, the top check valve will close. You should begin to feel the weight of the HydraSleeve on the tether and it will begin to displace water. The closed check valve prevents loss of sample and entry of water from zones above the well screen as the HydraSleeve is recovered.
5. Continue pulling the tether upward until the HydraSleeve is at the top of the well.
6. Decant and discard the small volume of water trapped in the Hydrasleeve above the check valve by turning the sleeve over.

V. Sample Collection

Note: Sample collection should be done immediately after the HydraSleeve has been brought to the surface to preserve sample integrity.

1. Remove the discharge tube from its sleeve.
2. Hold the HydraSleeve at the check valve.
3. Puncture the HydraSleeve just below the check valve with the pointed end of the discharge tube
4. Discharge water from the HydraSleeve into your sample containers.

Control the discharge from the HydraSleeve by either raising the bottom of the sleeve, by squeezing it like a tube of toothpaste, or both.

5. Continue filling sample containers until all are full.

Measurement of Field Indicator Parameters

Field indicator parameter measurement is generally done during well purging and sampling to confirm when parameters are stable and sampling can begin. Because no-purge sampling does not require purging, field indicator parameter measurement is not necessary for the purpose of confirming when purging is complete.

If field indicator parameter measurement is required to meet a specific non-purging regulatory requirement, it can be done by taking measurements from water within a HydraSleeve that is not used for collecting a sample to submit for laboratory analysis (i.e., a second HydraSleeve installed in conjunction with the primary sample collection HydraSleeve [see Multiple Sampler Deployment below]).

Alternate Deployment Strategies

Deployment in Wells with Limited Water Columns

For wells in which only a limited water column exists to be sampled, the HydraSleeve can be deployed with an optional top weight instead of a bottom weight, which collapses the HydraSleeve to a very short (approximately 6" to 9") length, and allows the HydraSleeve to fill in a water column only 36" to 45" in height.

Multiple Sampler Deployment

Multiple sampler deployment in a single well screen can accomplish two purposes:

- It can collect additional sample volume to satisfy site or laboratory-specific sample volume requirements.
- It can accommodate the need for collecting field indicator parameter measurements.
- It can be used to collect samples from multiple intervals in the screen to allow identification of possible contaminant stratification.

It is possible to use up to 3 standard 30" HydraSleeves deployed in series along a single tether to collect samples from a 10' long well screen without collecting water from the interval above the screen.

The samplers must be attached to the tether at both the top and bottom of the sleeve. Attach the tether at the top with a stainless-steel clip (available from the manufacturer). Attach the tether at the bottom using a cable tie. The samplers must be attached as follows (figure 4):

- The first (attached to the tether as described above, with the weight at the bottom) at the bottom of the screen
- The second attached immediately above the first
- The third (attached the same as the second) immediately above the second

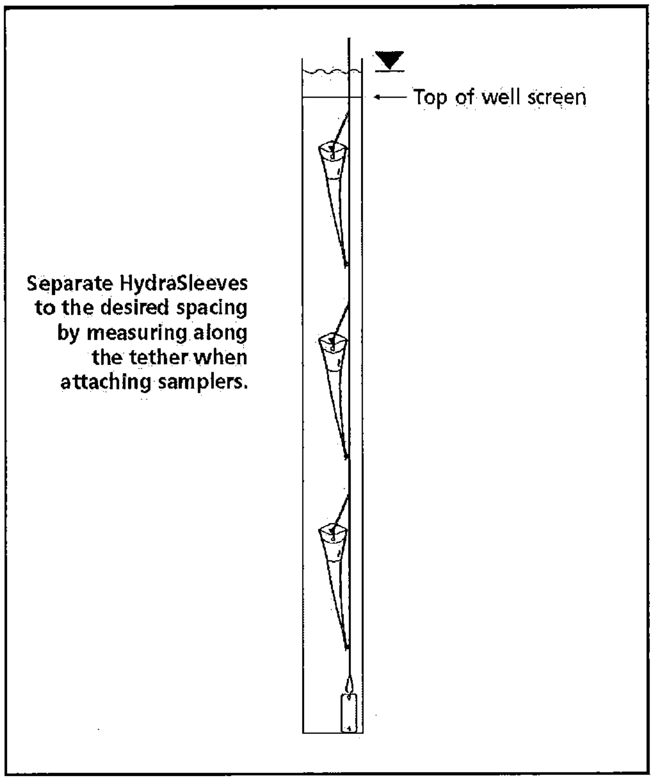
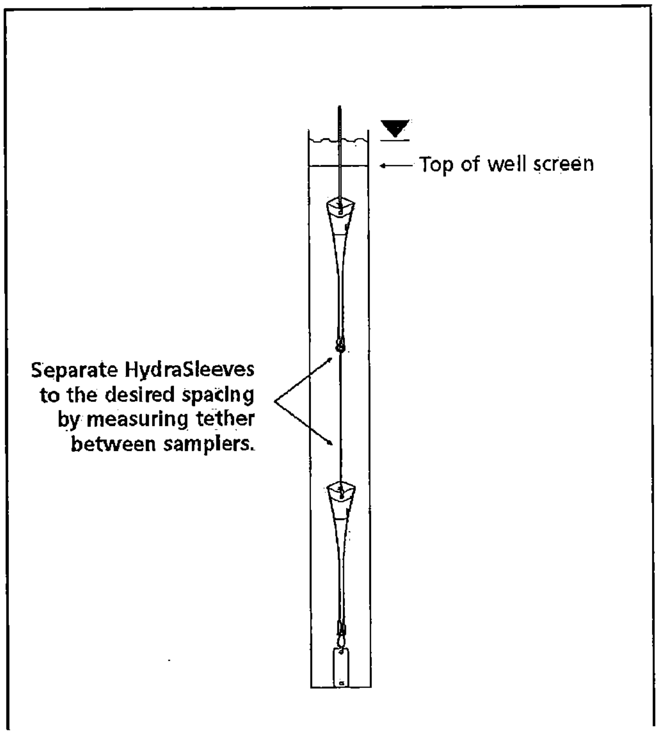


Figure 4. Multiple HydraSleeve deployment.

Alternately, the first sampler can be attached to the tether as described above, a second attached to the bottom of the first using a short length of tether (in place of the weight), and the third attached to the bottom of the second in the same manner, with the weight attached to the bottom of the third sampler (figure 5).



Separate HydraSleeves to the desired spacing by measuring tether between samplers.

Figure 5. Alternative method for deploying multiple HydraSleeves.

In either case, when attaching multiple HydraSleeves in series, more weight may be required to hold the samplers in place in the well than would be required with a single sampler. Recovery of multiple samplers and collection of samples is done in the same manner as for single sampler deployments.

Post-Sampling Activities

The recovered HydraSleeve and the sample discharge tubing should be disposed as per the solid waste management plan for the site. To prepare for the next sampling event, a new HydraSleeve can be deployed in the well (as described previously) and left in the well until the next sampling event, at which time it can be recovered.

The weight and weight clip can be reused on this sampler after they have been thoroughly cleaned as per the site equipment decontamination plan. The tether may be dedicated to the well and reused or discarded at the discretion of sampling personnel.

References

McAlary, T. A. and J. F. Barker, 1987, Volatilization Losses of Organics During Ground-Water Sampling From Low-Permeability Materials, Ground-Water Monitoring Review, Vol. 7, No. 4, pp. 63-68

Parsons, 2005, Results Report for the Demonstration of No-Purge Ground-Water Sampling Devices at Former McClellan Air Force Base, California; Contract F44650-99-D-0005, Delivery Order DKO1, U.S. Army Corps of Engineers (Omaha District), U.S. Air Force Center for Environmental Excellence, and U.S. Air Force Real Property Agency

Robin, M. J. L. and R. W. Gillham, 1987, Field Evaluation of Well Purging Procedures, Ground-Water Monitoring Review, Vol. 7, No. 4, pp. 85-93

EON
PRODUCTS INC.

Instructions for Installing HydraSleeves with Spring Clip and Top Weight

Your HydraSleeve will attach directly to the bottom of the rope, as follows:

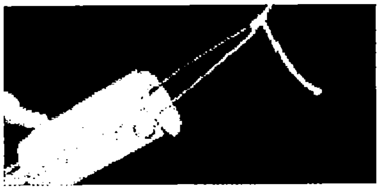
You will not have a weight on the end of your rope. Instead, you will only have a SST ring and black snap connector.

Prepare your HydraSleeve for deployment as pictured to the right. Flex the top of the HydraSleeve then insert it into the hollow top weight, being sure to align the holes of the HydraSleeve with the holes of the top weight.

Next, connect the stainless steel spring clip to the top of the HydraSleeve and the top weight.

Squeeze the clip closed slightly and insert the legs into the top of the HydraSleeve.

Release so the legs spread and extend through the holes in the HydrsSleeve and the weight; locking clip, weight and HydraSleeve together.



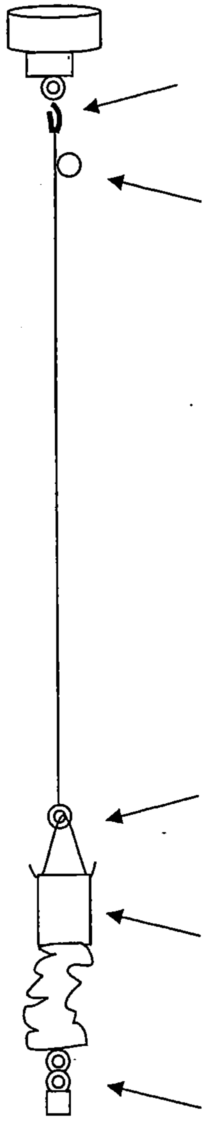
Attach tether to the apex of the clip.

Attach the spring clip to the end of the tether using the black snap connector provided. Finally, attach the solid weight to the bottom of the HydraSleeve using a cable tie.

Please give us a call if you need further assistance. Thank you.

P.O. Box 443, Snellville, Georgia 30078-0443
800-474-2490 770-978-9971 Fax: 770-978-8661
www.eonpro.com

EON
PRODUCTS INC.



Attach Snap Connector on tether to Split Ring on bottom of Well Cap

Aluminum Identification tag

Attach Spring Clip to Split Ring on bottom of tether.

Insert HydraSleeve into Top Weight, aligning holes. Insert Spring Clip into holes, catching both HydraSleeve and Top Weight. When deployed, HydraSleeve will be compressed to sample near bottom of well.

Attach weight to bottom of Hydrasleeve

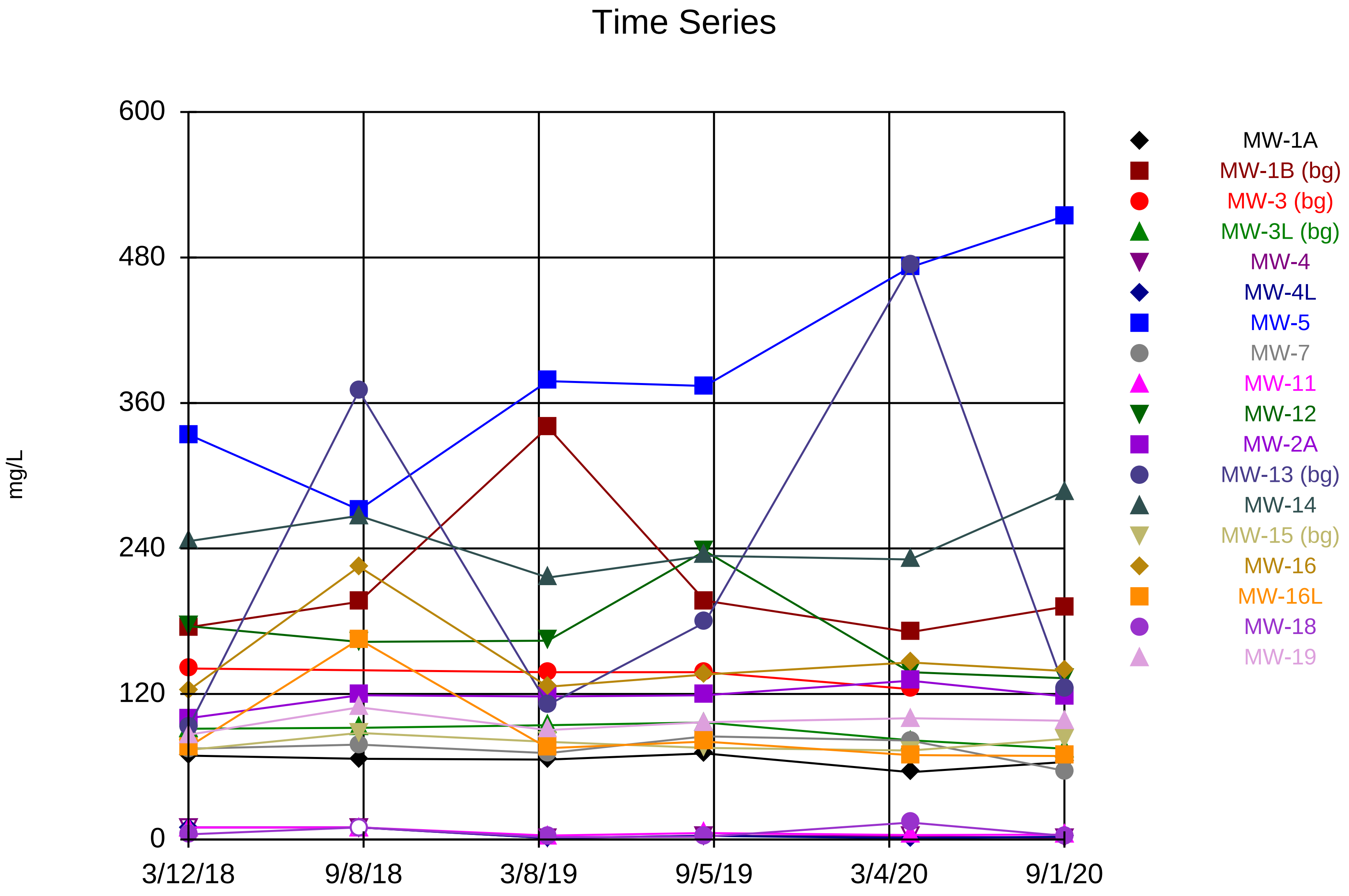
APPENDIX E

CONTINENTAL CEMENT COMPANY

Time Series Plots

Sanitas™ v.9.6.28 Sanitas software licensed to Blackstone Environmental, Inc. UG

Hollow symbols indicate censored values.



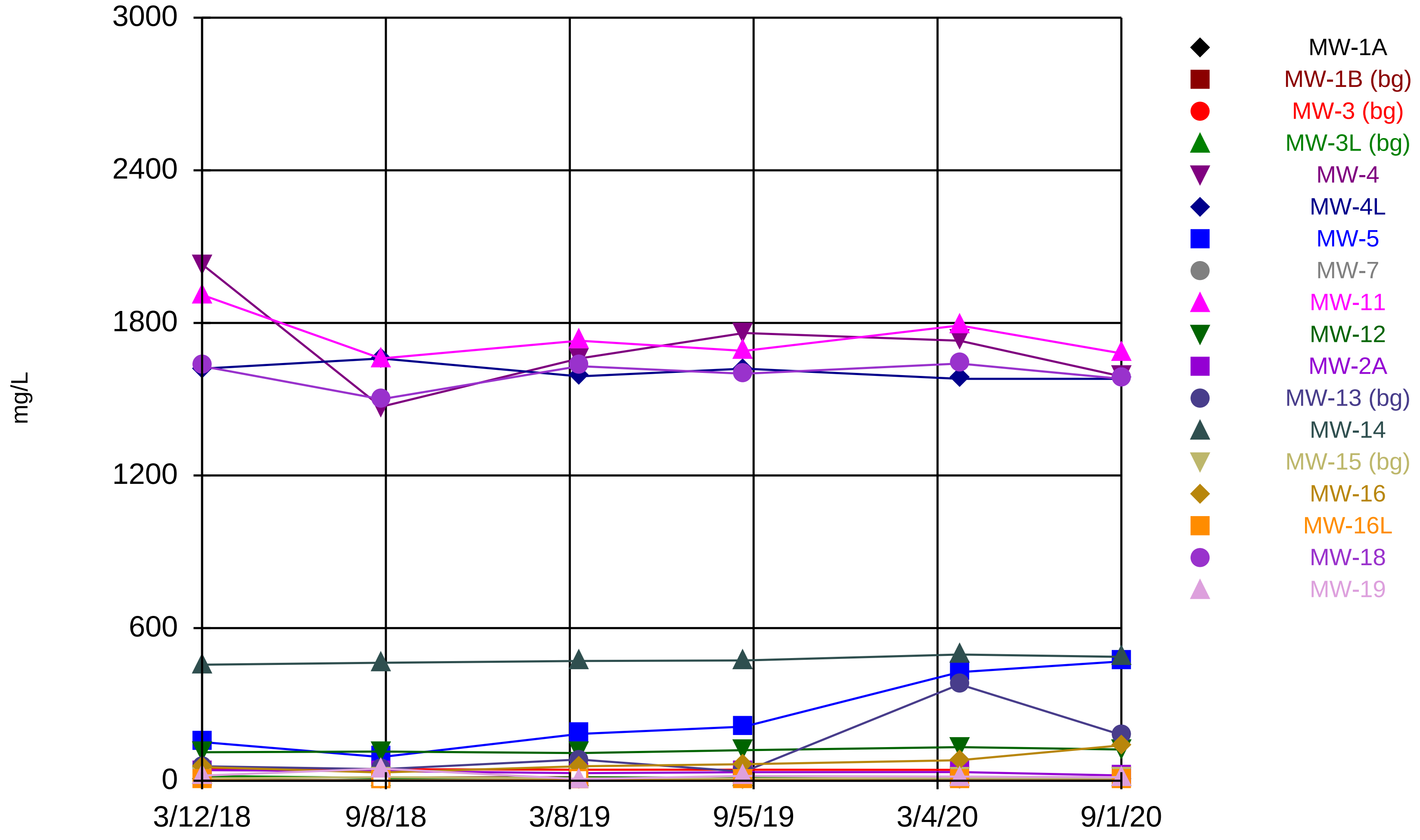
Constituent: Calcium Total Analysis Run 3/17/2021 2:04 PM

Continental Cement Company Client: Blackstone Data: Import 1

Sanitas™ v.9.6.28 Sanitas software licensed to Blackstone Environmental, Inc. UG

Hollow symbols indicate censored values.

Time Series

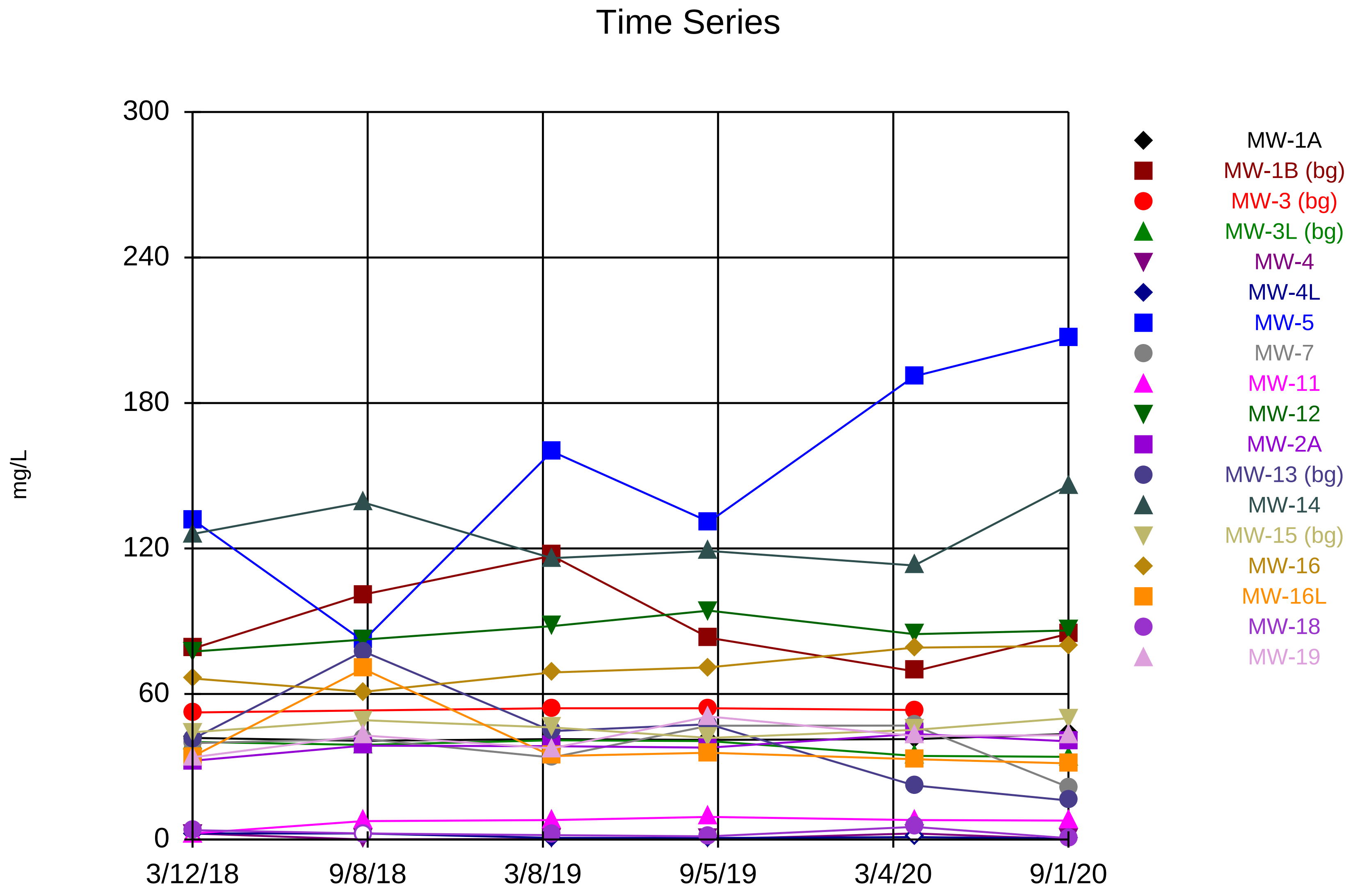


Constituent: Chloride Analysis Run 3/17/2021 1:42 PM

Continental Cement Company Client: Blackstone Data: Import 1

Sanitas™ v.9.6.28 Sanitas software licensed to Blackstone Environmental, Inc. UG

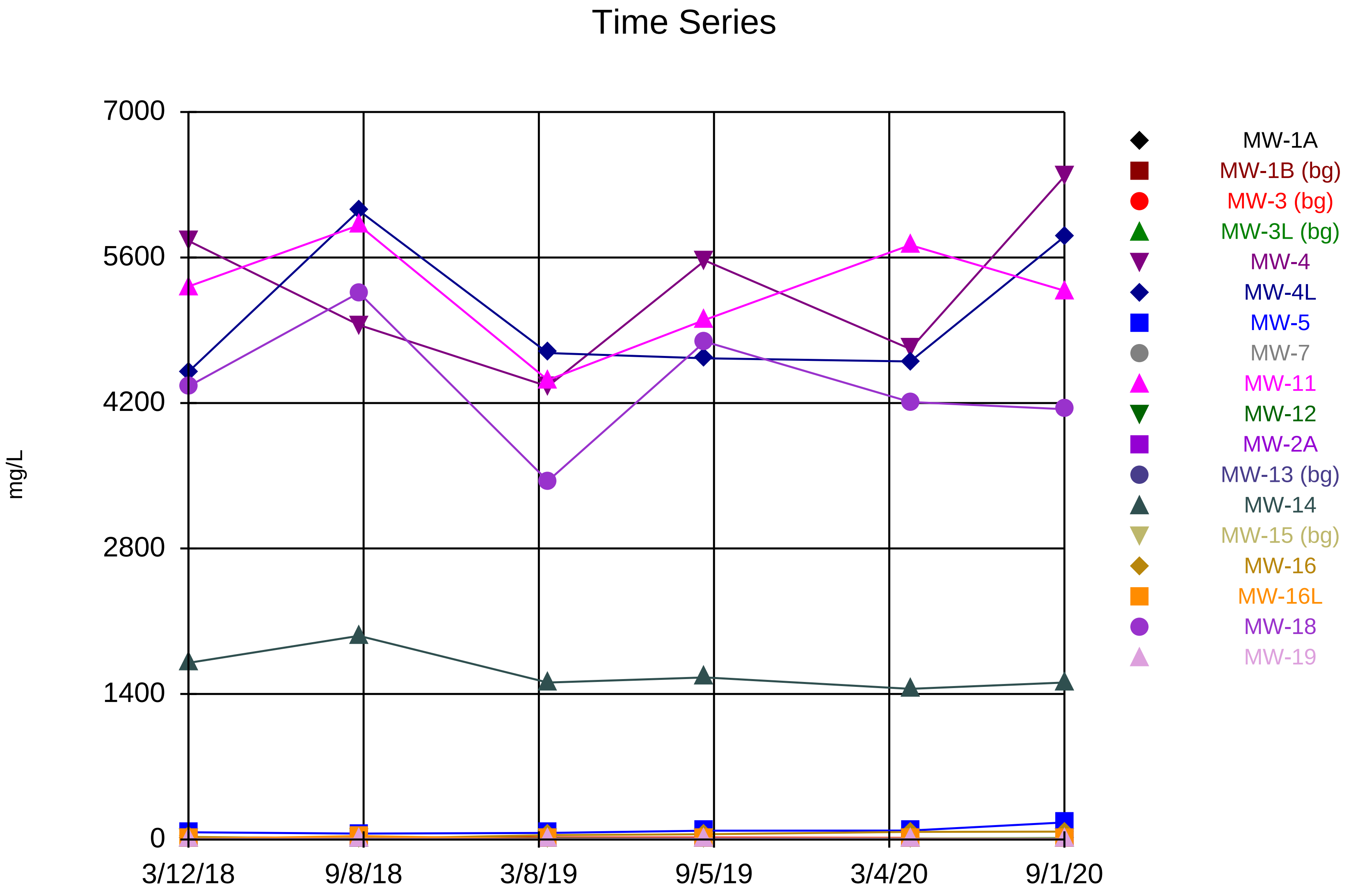
Hollow symbols indicate censored values.



Constituent: Magnesium Total   Analysis Run 3/17/2021 2:02 PM

Continental Cement Company   Client: Blackstone   Data: Import 1

Sanitas™ v.9.6.28 Sanitas software licensed to Blackstone Environmental, Inc. UG

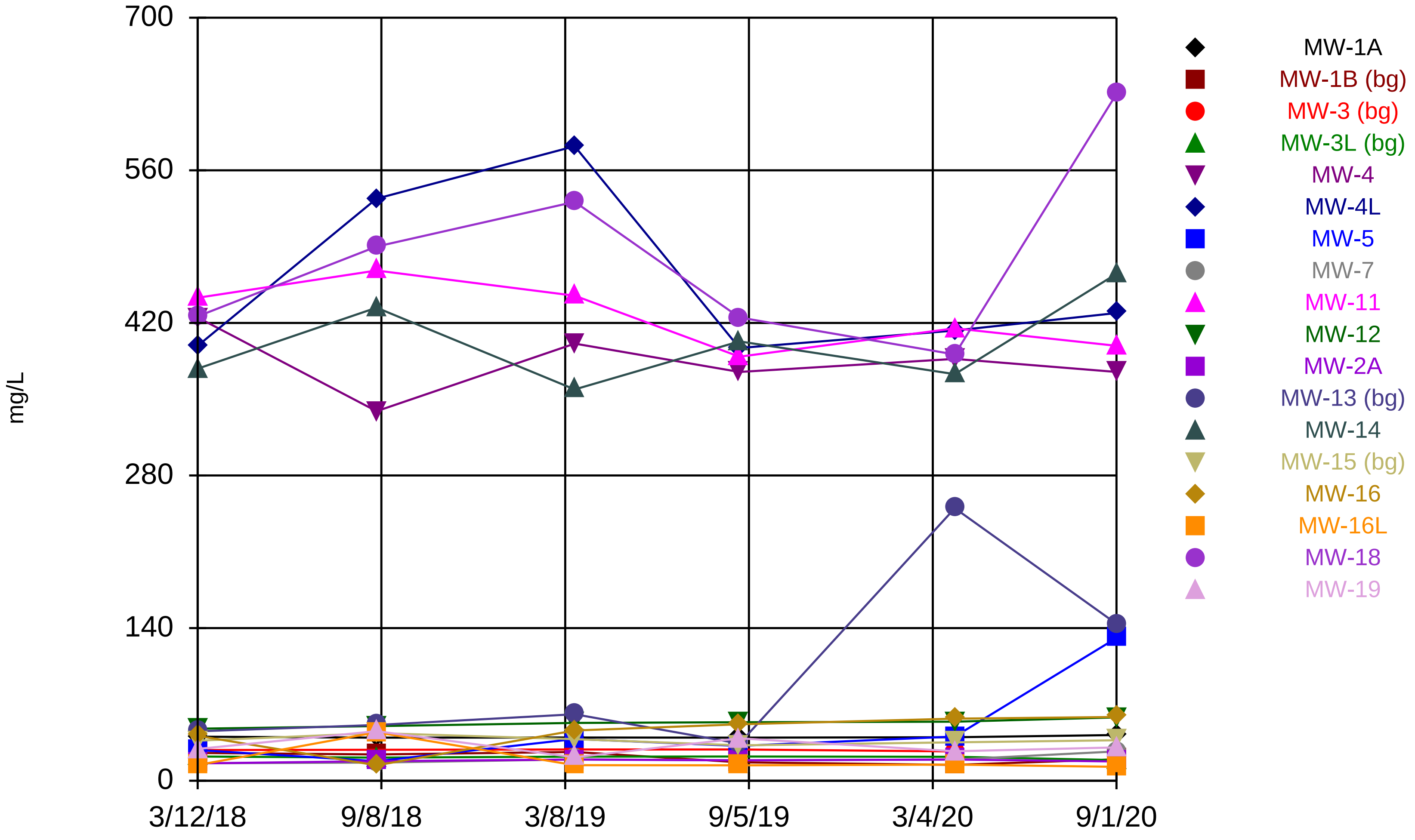


Constituent: Potassium Total Analysis Run 3/17/2021 2:01 PM

Continental Cement Company Client: Blackstone Data: Import 1

Sanitas™ v.9.6.28 Sanitas software licensed to Blackstone Environmental, Inc. UG

Time Series

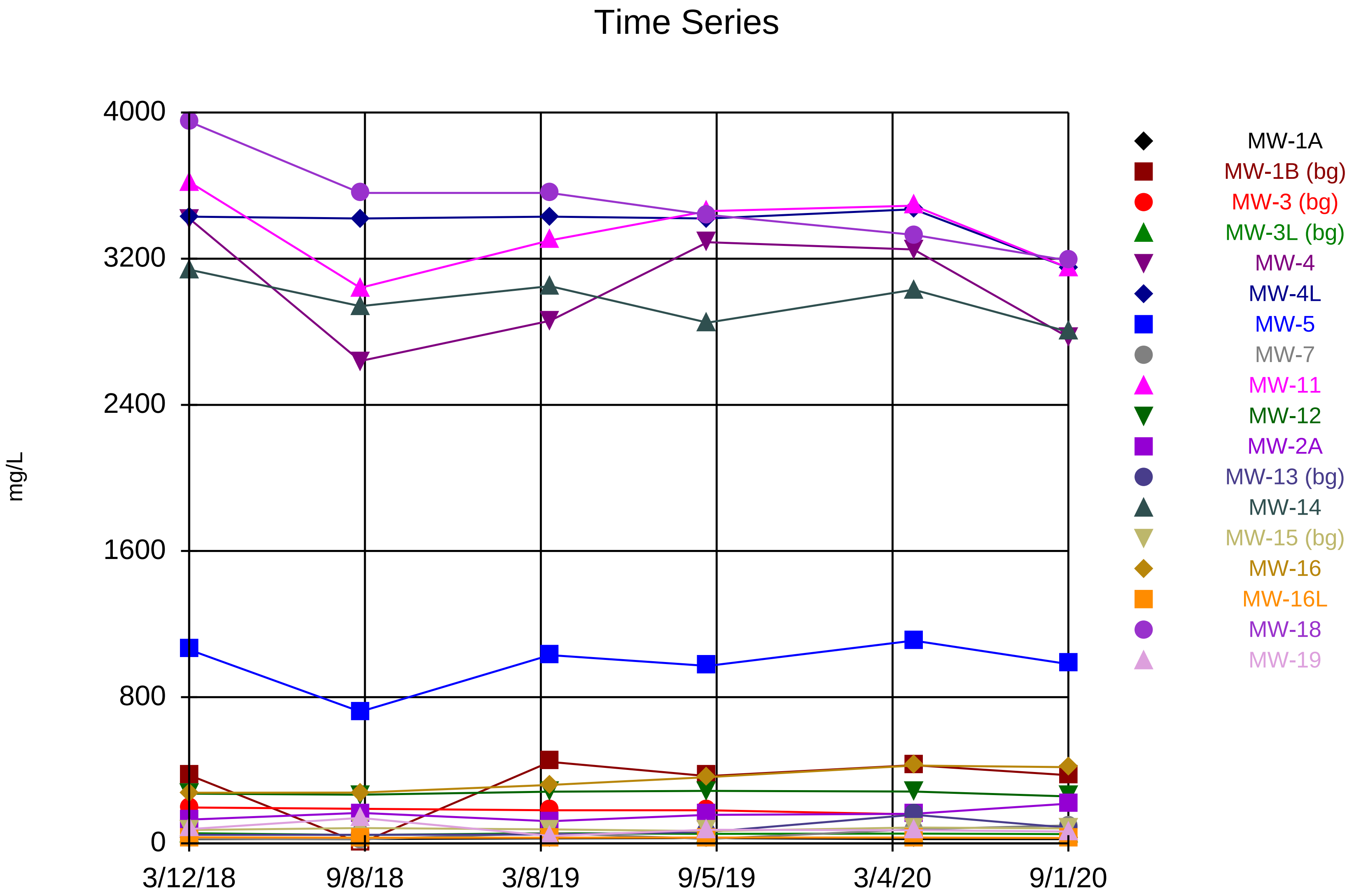


Constituent: Sodium Total Analysis Run 3/17/2021 1:47 PM

Continental Cement Company Client: Blackstone Data: Import 1

Sanitas™ v.9.6.28 Sanitas software licensed to Blackstone Environmental, Inc. UG

Hollow symbols indicate censored values.



Constituent: Sulfate Analysis Run 3/17/2021 1:59 PM

Continental Cement Company Client: Blackstone Data: Import 1

BLACKSTONE
ENVIRONMENTAL

APPENDIX D

Site Operations Plan

REVISED Site Operations Plan

Continental Cement CKD Monofill Landfill
301 East Front Street
Buffalo, Iowa
IDNR Landfill Permit Number 82-SDP-16-97P

Prepared for:
Continental Cement
301 East Front Street
Buffalo, Iowa 52728

Prepared by:
Blackstone Environmental
514 17th Street, #206
Moline, Illinois 61265

BLACKSTONE
ENVIRONMENTAL

November 5, 2021

BLACKSTONE
ENVIRONMENTAL

REVISED SITE OPERATIONS PLAN
CONTINENTAL CEMENT CKD MONOFILL LANDFILL
301 EAST FRONT STREET
BUFFALO, IOWA
IDNR LANDFILL PERMIT NUMBER 82-SDP-16-97P

Prepared for:

Continental Cement
301 East Front Street
Buffalo, Iowa 52728

Prepared by:

Krista A. Brodersen
Senior Project Manager

Reviewed by:

Lindsay E James

Lindsay E. James, R.G
Senior Project Manager

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

This Site Operations Plan (SOP) presents a written plan that details the operations related to the Cement Kiln Dust (CKD) monofill operated by Continental Cement Company, LLC (Continental) at 301 East Front Street in Buffalo, Scott County, Iowa (Site).

Quarrying and manufacturing of Portland cement products have been conducted at the Continental facility since 1924 and other uses are not anticipated in the future. The cement manufacturing process includes the heating of limestone with silica, alumina, and iron minerals to form clinker. The clinker (nodules of sintered material) is mixed with gypsum and other additives and ground into a fine powder to form cement. As part of the manufacturing process, particulate matter is generated as a by-product of maintaining kiln chemistry to control the composition of the cement product. This material is known as CKD. Continental operates an approximately 20-acre monofil for the disposal of CKD. The southern portion of the monofill has been filled to original grade and closed in general accordance with the requirements of the Iowa Department of Natural Resources (IDNR) Permit Number 82-SDP-15-96C. An active monofill disposal cell is operated under IDNR Permit Number 82-SDP-16-97P. Historically, an average of 30 tons of CKD per day has been disposed at the monofill. Current operations and practices have reduced the amount of CKD sent to the monofill on a regular basis, with typical monthly disposal rates of 10 tons.

1.1 Site Information (567 IAC 115.13(1))

Information	Name	Address	Telephone Number
Owner/Applicant	Continental Cement Company, LLC	301 East Front Street Buffalo, Iowa 52728	563-323-2751
Responsible Official	Shawn Mages, Plant Manager	301 East Front Street Buffalo, Iowa 52728	563-328-6236
Licensed Design Engineer	Kyle Kukuk, P.E., Blackstone Environmental, Inc., Iowa License Number: 22790	16200 Foster Overland Park, Kansas 66085	913-495-9990

1.2 Site Legal Description (567 IAC 115.13(2)) and Proof of Ownership (567 IAC 115.13(9))

The Site is shown on Figure 1 and is located approximately four miles west of Davenport, Iowa within Sections 14, 15, 22, and 23 of Township 77 North, - Range 2 East (Buffalo Township), Scott County, Iowa. The development fill area is located between N 1500 to N 2300 and W 300 to E 500. The facility has been in operation, under various ownership, from 1924 for the quarrying of limestone rock and the manufacture of Portland cement. The CKD landfill is located in an inactive portion of the quarry approximately 2,000 feet east of the active quarry area and comprises approximately 20 acres. A copy of the legal description is provided in Appendix A.

1.3 Site Map (567 IAC 115.13(3))

Figure 2 is a map of the Continental facility that includes the zoning and land use, haul routes, homes and buildings within a half-mile, and section lines and legal boundaries. Airports or runways are not located near the Site. Figure 3 is the landfill location.

1.4 Waste Data (567 IAC 115.13(4),(6))

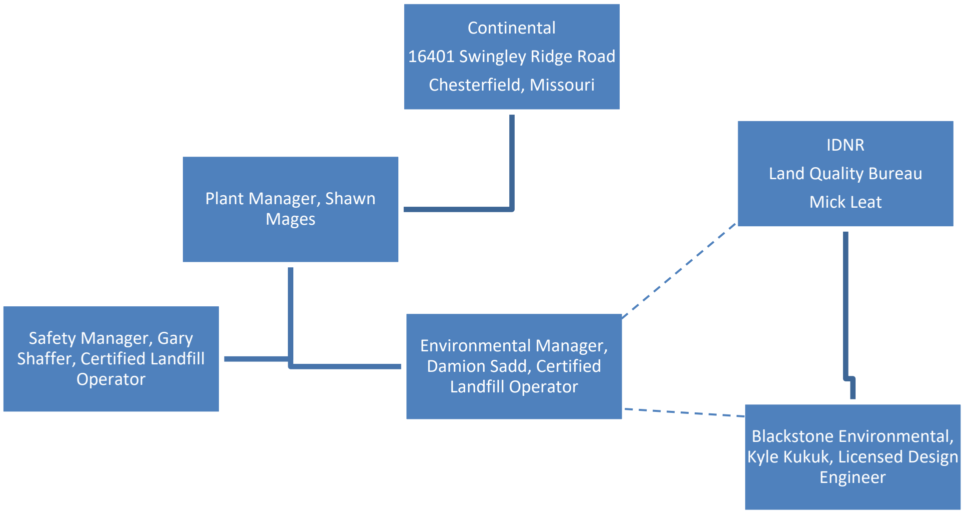
The cement manufacturing process includes the heating of limestone with silica, alumina, and iron minerals to form clinker. The clinker (nodules of sintered material) is mixed with gypsum and other additives and ground into a fine powder to form cement. As part of the manufacturing process, particulate matter, referred to as CKD, is generated as a by-product of maintaining kiln chemistry to control the composition of the cement product. Continental operates an approximately 20-acre monofil for the disposal of CKD. The southern portion of the monofill has been filled to original grade and closed in general accordance with the requirements of the Iowa Department of Natural Resources (IDNR) Permit Number 82-SDP-15-96C. An active monofill disposal cell is operated under IDNR Permit Number 82-SDP-16-97P. An average of 10 tons of CKD per month is disposed at the monofill.

A sample of the CKD material was collected on October 8, 2021 and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals, calcium, aluminum, magnesium, iron, and potassium. These sample results are considered representative of the wastes currently disposed in the landfill. The results are presented in Appendix B. The CKD was also sampled for TCLP metals in 2003, 2010, and 2013. The previous results are also included in Appendix B.

1.5 Organization of Project Management (567 IAC 115.13(5))

The Site is owned and operated by Continental. Mr. Shawn Mages is the Plant Manager and is the landfill operator responsible for the overall operation of Continental. The two certified landfill operators are Mr. Damion Sadd, Continental Environmental Manager, and Mr. Gary Shaffer, Continental Safety Manager. Mr. Sadd and Mr. Shaffer, as well as other personnel, report to Mr. Mages. An organization chart is below.

The Licensed Design Engineer for Continental is:
Kyle Kukuk, P.E., Iowa License Number: 22790
Blackstone Environmental, Inc.
16200 Foster Street
Overland Park, Kansas 66085
913-495-9990



1.6 Disposal Process (567 IAC 115.13(6))

The CKD area operates in a consistent and predictable manner because the source and nature of the CKD are known. Other waste materials are not allowed in the area.

The CKD is captured with air quality control equipment and stored in a silo located south of the landfill. When the silo is filled, the CKD is wetted to control dust and transported by haul truck to the monofill where it is dumped. End loaders and bulldozers level and push the piles as needed. In general, the monofill is raised uniformly over the surface. The CKD is placed by dumping the trucks onto the landfill working face. The placement is determined by the landfill operator on a weekly basis.

The CKD is hauled from the silo on an on-site gravel access road, across East Front Street, and then again on an on-site gravel access road to the landfill. The gravel access roads have speed limits and are wetted as necessary. East Front Street also has a speed limit. Continental personnel are responsible for maintaining the access roads in a suitable condition for traffic by vehicles.

Due to the cementitious nature of the conditioned CKD, the material tends to bind together when placed at the landfill forming a relatively uniform and solid deposit. The material is able to stand at a relatively steep angle of repose with negligible risk of slumping or slope failure. Further, the material is relatively impervious thereby reducing the likelihood of saturation which could reduce the shear strength and lead to slope instability.

Employees with duties associated with the storage, handling, transport, or disposal of CKD are trained to place CKD in a manner which will reduce the likelihood of slope failures, waste shifts, and waste subsidence. Transport vehicle drivers are instructed to place material at a safe distance back from the edge of the active cell to avoid surcharging the edge of the cell. Accumulated material is periodically pushed into the active cell with earthmoving equipment. The landfill is also inspected weekly so that situations which would lead to mass movement of waste are avoided or quickly corrected.

1.7 Equipment Plan

Generally, end loaders and bulldozers are used for placement, compaction, and cover of CKD. Other equipment is available for the operators as needed from the maintenance building located south of the monofill.

1.7.1 Equipment (567 IAC 115.13(7))

The table below details the equipment to be used, capacities, and expected loads.

Equipment	Capacity	Expected Loads
End loader	12 yards	12 yards
Haul trucks	60 tons	60 tons
Bulldozer	none	none
Leachate Pump	20 gallons per minute	20 gallons per minute

1.8 Equipment Contingency Plan (567 IAC 115.13(8))

In the event of equipment breakdown, the equipment is either repaired where it broke down or the CKD is removed from the equipment with an excavator and placed into another operating vehicle for disposal.

During maintenance downtime of equipment, Continental has other equipment stored in the maintenance building that will be used.

In the event of a fire in equipment or vehicles, the fire would be extinguished using fire extinguishers located in each vehicle. If the equipment is drivable and safe to be driven after the fire has been extinguished, the CKD will be disposed at the landfill. If the equipment is not drivable/safe, the CKD will be removed from the equipment with an excavator and placed into another operating vehicle for disposal.

1.9 Additional Information

Additional information required by the IDNR is provided below.

1.9.1 Construction and Operation (567 IAC 115.6)

The landfill has been constructed and operates according to the approved plans and term of IDNR Landfill Permit Number 82-SDP-16-97P.

1.9.2 Inspection Prior to Start-Up (567 IAC 115.12)

The IDNR will be notified when the initial construction of a sanitary disposal project has been completed in order that an inspection may be made to determine that the project is constructed as designed. Solid waste will not be accepted until that project has been inspected and approved by the IDNR.

1.9.3 Facility Development Timetable

The facility has been in operation, under various ownership, since 1924 for the quarrying of limestone rock and the manufacture of Portland cement. The first CKD was placed in the landfill in 1980s. The southern portion of the monofill was filled to original grade and closed in 2005 in general accordance with the requirements of the Iowa Department of Natural Resources (IDNR) Permit Number 82-SDP-15-96C. The northern portion of the monofill is an active cell that was first used in 1998. It is operated under IDNR Permit Number 82-SDP-16-97P. It is expected to provide approximately 11 years of capacity at the current waste generation rates.

2.0 GENERAL OPERATING INFORMATION

The general operating requirements outlined in 567 IAC 115.26 are detailed in the following sections.

2.1 Cover Materials Quantities and Sources (567 IAC 115.26(1)1(1))

The monofill is approximately 20 acres in area. The southern portion of the monofill has been filled to original grade and closed in general accordance with the requirements of IDNR Permit Number 82-SDP-15-96C. Cell 2 is the active cell and is approximately 10 acres in area. It is estimated that it has approximately 11 years before it is at capacity. As the active cell has over a decade before it is closed, the source, volume, and characteristics of cover material to be used is undetermined at this time. It is expected that clay and topsoil overburden from the quarry would be used as cover materials.

2.2 Site Area (567 IAC 115.26(1)1(2))

The Continental CKD monofill is located in an inactive portion of Continental's former rock quarry approximately 2,000 feet east of the active quarry area and comprises approximately 20 acres. The monofill is located approximately 1.3 miles east/northeast of the City of Buffalo in Scott County, Iowa, and approximately 700 feet north of the Mississippi River. Please refer to Figures 1, 2, and 3 for the Site location.

The Continental facility is bound by the Mississippi River to the south, Linwood Mining to the east, farmland to the north, and undeveloped land, farmland, and residences to the west. The CKD monofill is located approximately 200 feet from the Linwood Mining facility to the east, approximately 1,400 feet from the Mississippi River to the south, and over a mile from the northern and western boundaries.

2.3 Solid Waste Unloading (567 IAC 115.26(2)a)

CKD is unloaded at the CKD disposal area only when an operator is on duty at that area. An equipment operator unloads and spreads the waste.

2.4 Facility Access (567 IAC 115.26(2)b

Access to the CKD disposal area is restricted to Continental personnel. The Site is not open to the public and a gate is located at the entrance to the Site.

2.5 Site Records (567 IAC 115.26(2)c)

Copies of permits, engineering plans, and reports are kept at the Continental offices located at 301 East Front Street in Buffalo, Iowa.

2.6 Permanent Sign (567 IAC 115.26(2)d

The Site is not open to the public and has a permanent sign posted at the site entrance specifying:

- Name of operation.
- That the site is not open to the public.
- An emergency telephone number.

2.7 Collection of Leachate (567 IAC 115.26(2)e)

The monofill has an engineered clay liner and leachate collection system to contain and remove leachate from the landfill units. Design plans for the leachate collection system were completed in 1997 and an as-built construction drawing for the system was completed in 2001. The leachate collection system consists of upper and lower drainage layers that include a 4-foot-thick clay layer between the two. The upper drainage layer has two 2-inch diameter slotted polyvinyl chloride (PVC) collection lines installed in a 1-foot-thick sand drainage layer. Three monitoring points (UL-1, UL-2, and UL-3) monitor the leachate thickness in the upper drainage layer. The lower drainage layer is located below the 4-foot-thick clay liner and consists of a 1-foot-thick sand drainage layer. No PVC leachate collection lines were installed in the lower drainage layer. Three monitoring points (LL-1, LL-2, and LL-3) monitor the leachate thickness in the lower drainage layer.

The slotted 2-inch PVC collection lines in the upper drainage layer connect to the 6-inch solid PVC header line which drains into the leachate collection sump. Both leachate collection lines have cleanout points installed at the intersections with the header line on the west side of the monofill. The leachate collection lines are jetted and cleared a minimum of once per year or as needed.

A 10-foot diameter, 12-foot deep, leachate collection sump is located along the southwest portion of the monofill. The 6-inch leachate header drains to the collection sump where it is ultimately pumped out and conveyed back up to the top of the landfill and applied to the waste mass via sprinkler system for dust suppression. Recent updates include installation of solar powered equipment and a supervisory control and data acquisition (SCADA) system to allow for the operators to monitor the leachate sump pump status remotely.

The solar powered leachate pumping system equipment includes solar panels, leachate pump with level-sensing transducer, leachate piping to the active face, leachate sprayer, and mounting equipment. The SCADA system and monitoring station at the leachate sump includes a leachate sump level, high level alarm of leachate sump, and low-level shutoff of leachate sump.

The total volume of leachate collected for each month is recorded as well as the elevation of leachate in the piezometers. If the water column is greater than one foot, these monitoring points are purged until the water column is less than one foot. This information is provided to the IDNR in the Annual Water Quality Control Report.

The combined landfill liner system, drainage, and leachate collection systems are present to prevent contaminants from being released to groundwater.

Leachate recirculation is not an approved activity, nor is it currently conducted at the Site. Leachate is only used to control dusts and prevent erosion as these activities are not expected to exacerbate leachate head issues. Should recirculation be desired in the future, a request for approval will be submitted to IDNR.

2.8 Inclement Weather Operations (567 IAC 115.26(2)f)

An all-weather fill area, which is accessible for disposal during all weather conditions, is present at the Site. The roads at the Continental Site are inspected periodically and are resurfaced as necessary. The CKD is wetted prior to transport and is therefore, not susceptible to high winds. Additionally, leachate is sprayed on the CKD to reduce dust entrainment. A snowplow or bulldozer are used when snow is present to maintain the roadways.

2.9 Cover Material (567 IAC 115.26(2)g)

Daily cover is accomplished through placement of CKD and spraying of leachate. CKD is covered if inactive for 60 days. Clay is used as cover material followed by topsoil for long-term cover material.

2.10 Grading and Drainage Control (567 IAC 115.26(2)h)

Surrounding area runoff is not allowed into the landfill. Area grade diverts any runoff away from or around the landfill area. Rain that falls directly onto the uncapped monofill area is contained within the monofill and percolates into the landfilled waste. Such percolation is collected as leachate.

2.11 Finished Surface Maintenance (567 IAC 115.26(2)i)

The finished surface of the monofill is repaired as required, covered with soil, and seeded with native grasses or other suitable vegetation immediately upon completion or promptly in the spring on areas terminated during winter conditions. As necessary, seeded slopes are covered with straw or similar material to prevent erosion.

2.12 Landfill Inspections (567 IAC 115.26(2) j, k, and l)

The monofill area is staked and inspected semi-annually by a professional engineer registered in the State of Iowa. A Semi-Annual Engineers Report is prepared by the engineer and submitted to the IDNR within 30 days of the inspection. The report includes areas of conformance or nonconformance with the approved plans and specifications.

If any pockets, seams, or layers of sand or other highly permeable material are encountered at the landfill, the permit holder will promptly notify the IDNR and will ensure that a professional engineer registered in the State of Iowa has certified that sands encountered were excavated or sealed off properly or otherwise handled as explicitly provided for in the permit before solid waste is disposed of in that area of the monofill.

The total volume of leachate collected for each month is recorded as well as the elevation of leachate in the piezometers. This information is provided to the IDNR in the Annual Water Quality Control Report.

2.13 Hydrologic Monitoring System (567 IAC 115.26(3)

A Revised Hydraulic Monitoring System Plan dated March 29, 2021 (Revised April 19, 2021) was submitted to the IDNR that presents sampling and analysis procedures for the Continental monofill. The Revised Hydraulic Monitoring System Plan describes the hydrogeologic setting of the facility, the groundwater monitoring network, groundwater bearing zones, background and compliance monitoring parameters and frequencies, sampling procedures, groundwater flow characteristics, and statistical methodology.

3.0 OPERATING REQUIREMENTS FOR ALL SANITARY DISPOSAL PROJECTS (567 IAC 115.27)

Continental's general operating procedures to comply 567 IAC 115.27 (455B) are presented below.

- 115.27(1) Open burning is not conducted at the Site.
- 115.27(2) Litter is not disposed of at the Site. Litter from Site operations is containerized and disposed of at the Scott County Landfill.
- CKD is confined to the CKD disposal area. Due to the nature of CKD, it is not strewn beyond the confines of the operating area.
- 115.27(3) Scavenging is prohibited. As the waste disposed consists of CKD, materials to be scavenged or salvaged are not present.
- 115.27(4) As the landfill only accepts CKD, the waste stream does not support rodents, insects, or other vermin. The landfill does not produce a nuisance odor.
- 115.27(5) Equipment designated in the plans and specifications, or equivalent equipment are used to operate the site. Generally, end loaders and bulldozers are used for placement, compaction, and cover of CKD. Other equipment is available for the operators as needed from the maintenance building located south of the monofill.
- 115.27(6) The major internal roads consist of all-weather construction and are maintained in good condition. Dust is controlled on internal roads.
- 115.27(7) The Site is not open to the public.
- 115.27(8) Free liquids or waste containing free liquids are not disposed at the CKD landfill.

4.0 SPECIFIC REQUIREMENTS FOR A SANITARY LANDFILL PROPOSING TO ACCEPT A SPECIFIC TYPE OF SOLID WASTE

4.1 Plan Requirements (567 IAC 115.28(1))

The cement manufacturing process includes the heating of limestone with silica, alumina, and iron minerals to form clinker. The clinker is mixed with gypsum and other additives and ground into a fine powder to form cement. As part of the manufacturing process, CKD is generated as a by-product of maintaining the composition quality of the cement product. The average chemical composition of CKD reflects the composition of the feed rock and soils and includes the following compounds: $CaCO_3$, CaO, AL_2O_3, $Ca(OH)_2$, $Ca(MgFe)(CO_3)_2$, SiO_2, K_2SO_4, KCl, and $CaMg(CO_3)_2$.

A sample of the CKD material was collected on October 8, 2021 and analyzed for TCLP Metals, calcium, aluminum, magnesium, iron, and potassium. These sample results are considered representative of the wastes currently disposed in the landfill. The results are presented in Appendix B.

The monofill has an engineered clay liner and leachate collection system to contain and remove leachate from the landfill units. Please refer to Section 2.7 for further details. A Revised Hydraulic Monitoring System Plan dated March 29, 2021 (Revised April 19, 2021) is in use at the Site that presents sampling and analysis procedures for the monofill. Please refer to Section 2.13 for further details.

4.2 Specific operating requirements for sanitary landfills proposing to accept a specific type of solid waste (567 IAC 115.28(2))

Continental's monofill is used for the disposal of CKD fill only. Other wastes are not accepted. Continental's specific operating requirements to comply 567 IAC 115.28(2) are presented below.

4.3 Daily, Intermediate, and Final Cover (567 IAC 115.28(2)a)

In general accordance with the permit, the CKD waste is covered and graded with a minimum of 6-inches of compacted soil if inactive for 60 days rather than daily as CKD is the only waste accepted.

Disposal areas in the monofill not used for more than 60 days will be covered with an additional six inches of soil for a total of one foot of cover material. Areas will be seeded as required to prevent erosion.

The final cover will be consistent with the proposed land use and will not be less than two feet. Final cover is described in the Closure and Development Plan dated January 1997 and a Supplemental to Cement Kiln Dust Closure and Development Plan dated June 1997 that has been submitted to the IDNR.

4.4 Number and Duties of Personnel (567 IAC 115.28(2)b)

The CKD monofill is owned, operated, and managed by Continental. The designated person responsible for operations is identified in Section 1.5 above. There are two certified operators and multiple employees that operate landfill equipment and perform filling and cover operations. Key features of the facility will be inspected on an approximately monthly basis in order to supplement the biannual inspections. The form included in Appendix C will be used by the Certified Operators on an approximately monthly basis to inspect the facility.

4.5 Storage and Preliminary Processing of Solid Waste (567 IAC 115.28(2)c)

The CKD area operates in a consistent and predictable manner because the source and nature of the CKD are known. Other waste materials are not allowed in the area. The CKD is wetted and transported by haul truck to the monofill where it is dumped. CKD is wetted prior to transport to control dusts during transport of wastes to the working face for disposal. End loaders and bulldozers level and push the piles as needed. In general, the monofill is raised uniformly over the surface.

4.6 Safety Procedures and Equipment and Operating Equipment (567 IAC 115.28(2)d and e)

Typical equipment used to manage landfill operations includes end loaders and bulldozers. Other equipment is available to the operators if the need arises from the maintenance building located south of the monofill. In the event of an equipment breakdown, equipment is repaired. In the event of fire, landfill equipment is equipped with a fire extinguisher. The Scott County fire department will be called depending on the severity of the condition or in the event of personnel injury. Maintenance downtime is predictably rare and of very short duration.

Equipment designated in the plans and specifications, or equivalent equipment will be used to operate the Site.

4.7 Buildings and Shelter (567 IAC 115.28(2)f)

An approximately 4,200 square foot maintenance building is located south of the monofill. The maintenance building contains an office, breakroom, and maintenance area.

4.8 Mine Monitoring

In a letter dated September 9, 2020, IDNR required the sampling of monitoring well MW-2CR annually to monitor groundwater quality downgradient from the landfill. The monitoring well is located on Continental's property and closely adjacent to the landfill. The well was installed in 2017 by Terracon Consultants. According to Terracon Consultants' Well Record, the well was drilled to a depth of 107 feet where an open mine was encountered. Based on the Well Record, the well casing was grouted to 19 feet below ground surface (bgs) and was not sealed from 19 feet bgs down. The Well Record indicates the bottom of the well is open to a Linwood Mining and Materials (Linwood) mine shaft. Linwood is located adjacent to Continental and has mine shafts that are under the Continental property. The mine shafts beneath the Continental property are no longer mined and are used to exhaust lime kiln dust and gases. Continental has not granted Linwood permission to exhaust beneath their property and there are no agreements between the companies regarding the exhaust.

In the past, MW-2CR was not able to be sampled due to the amount of exhaust released when the well cap was opened. Continental has coordinated with Linwood to sample the well during a temporary shutdown of Linwood kilns and/or during a period when exhausts are treated through other emission control equipment. During 2021, Linwood indicated they were having a temporary shutdown of their kilns on October 8, 2021 and the well was sampled.

In July 2021, groundwater monitoring well MW-21 was installed on the eastern boundary of the Site, adjacent to the Linwood property but not within the mine shaft. This well is now sampled as part of the routine semi-annual monitoring.

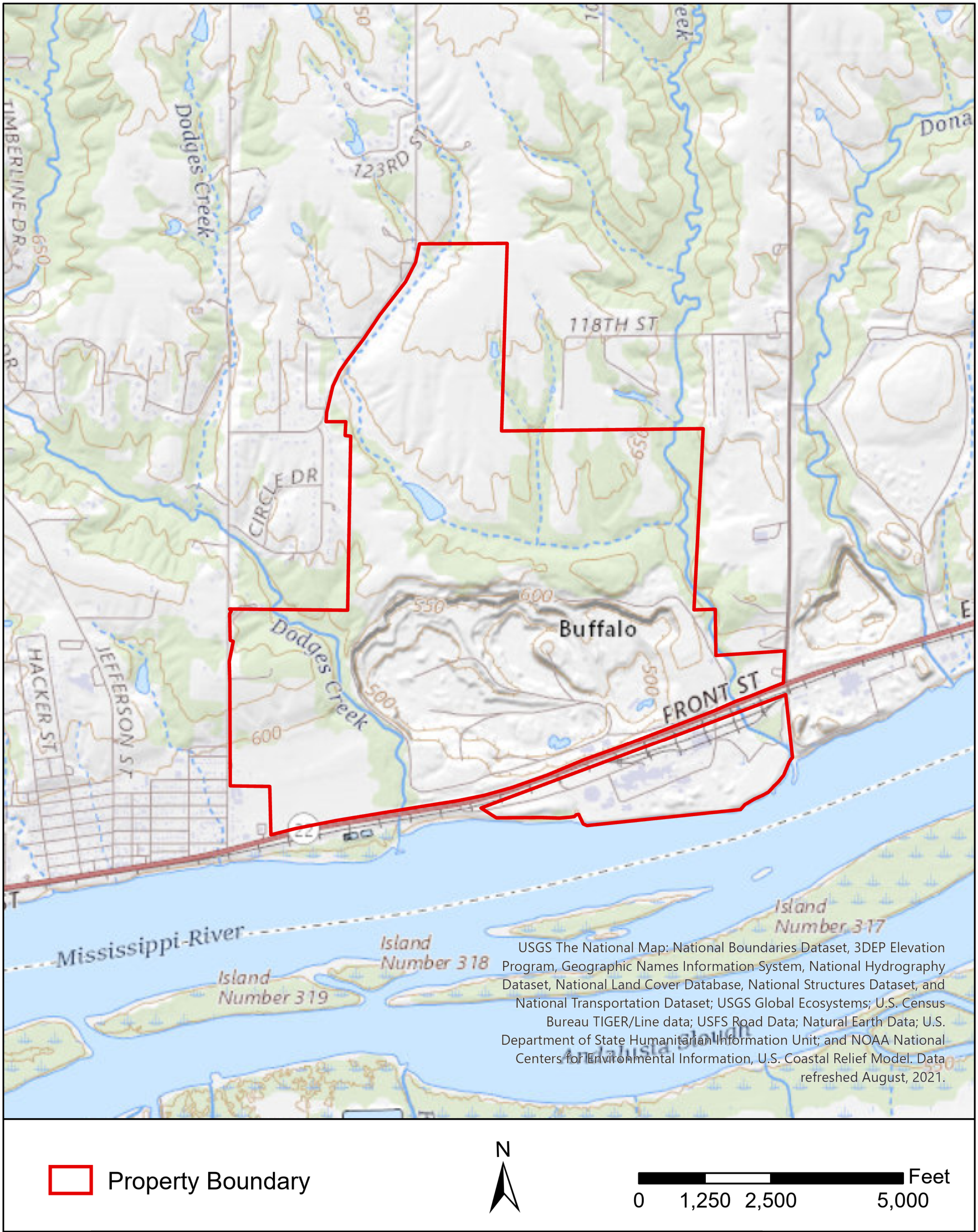
These samples will be used along with the routine groundwater results to monitor and evaluate conditions within the mine as they relate to Continental operations to ensure that the materials present within the mine are not contributing to or exacerbating leachate releases associated with Continental. The results of MW-2CR and MW-21 monitoring will be included as part of a separate report.

5.0 EMERGENCY RESPONSE AND REMEDIAL ACTION PLANS (567 IAC 115.30)

In 2021, Continental updated their Emergency Response and Remedial Action Plan (ERRAP) to comply with 567 IAC 115.30. A copy of the updated plan is included in Appendix D.

FIGURES

Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental



USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed August, 2021.

FIGURE
1

Project Mgr. KB
Designed By: TS
Drawn By: TS
Checked By: LJ
Job No.: 3066

Date: 11-2021
Rev.:
Rev.:
Rev.:
Rev.:

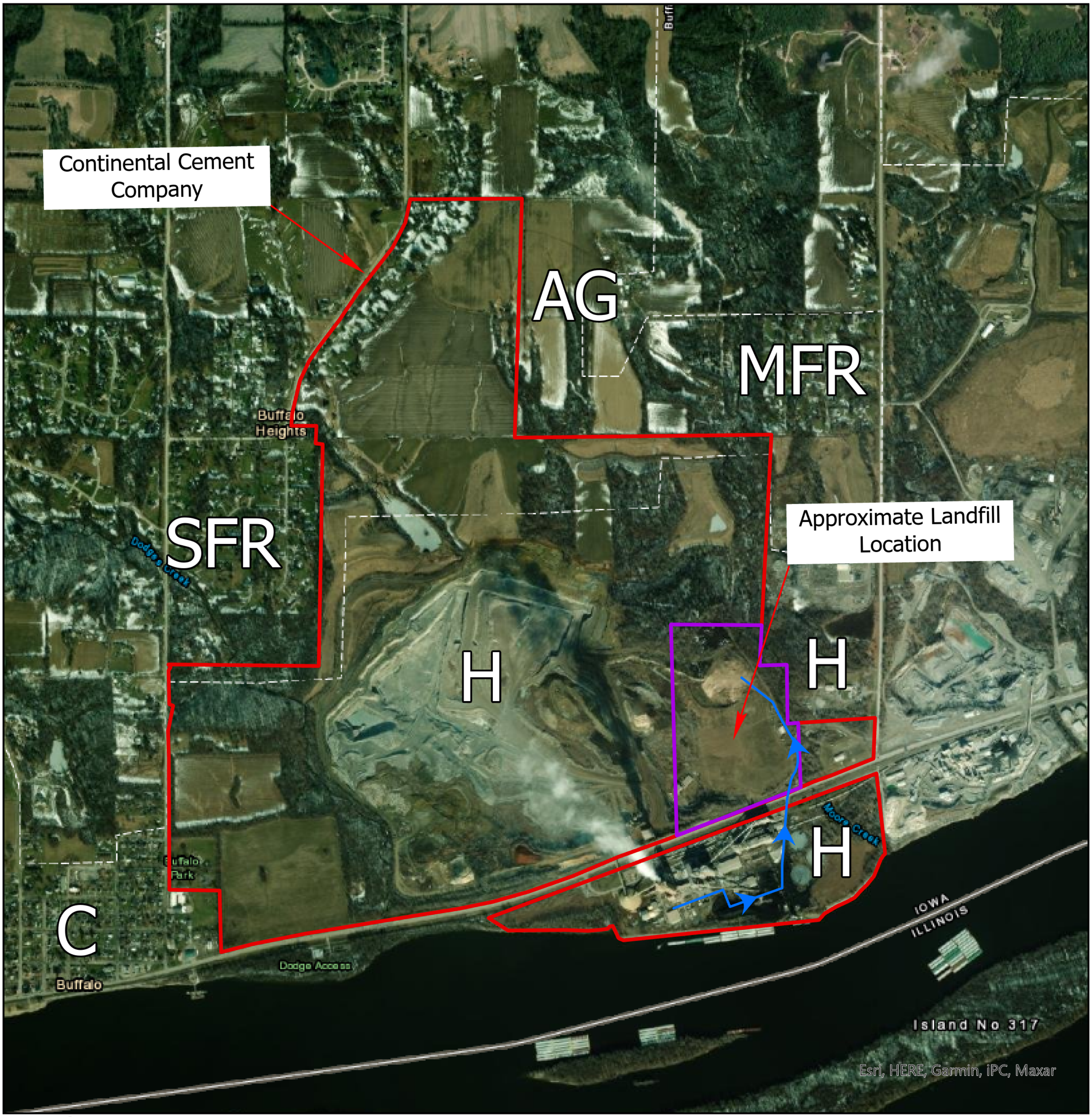
CONTINENTAL CEMENT

BUFFALO, IOWA

SHEET NAME
Site Topographic Vicinity Map
PROJECT NAME
Continental Cement Site Operations Plan
PROJECT LOCATION
301 East Front Street Buffalo, Iowa

BLACKSTONE
ENVIRONMENTAL

Path: Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental\Continental.aprx



LEGEND

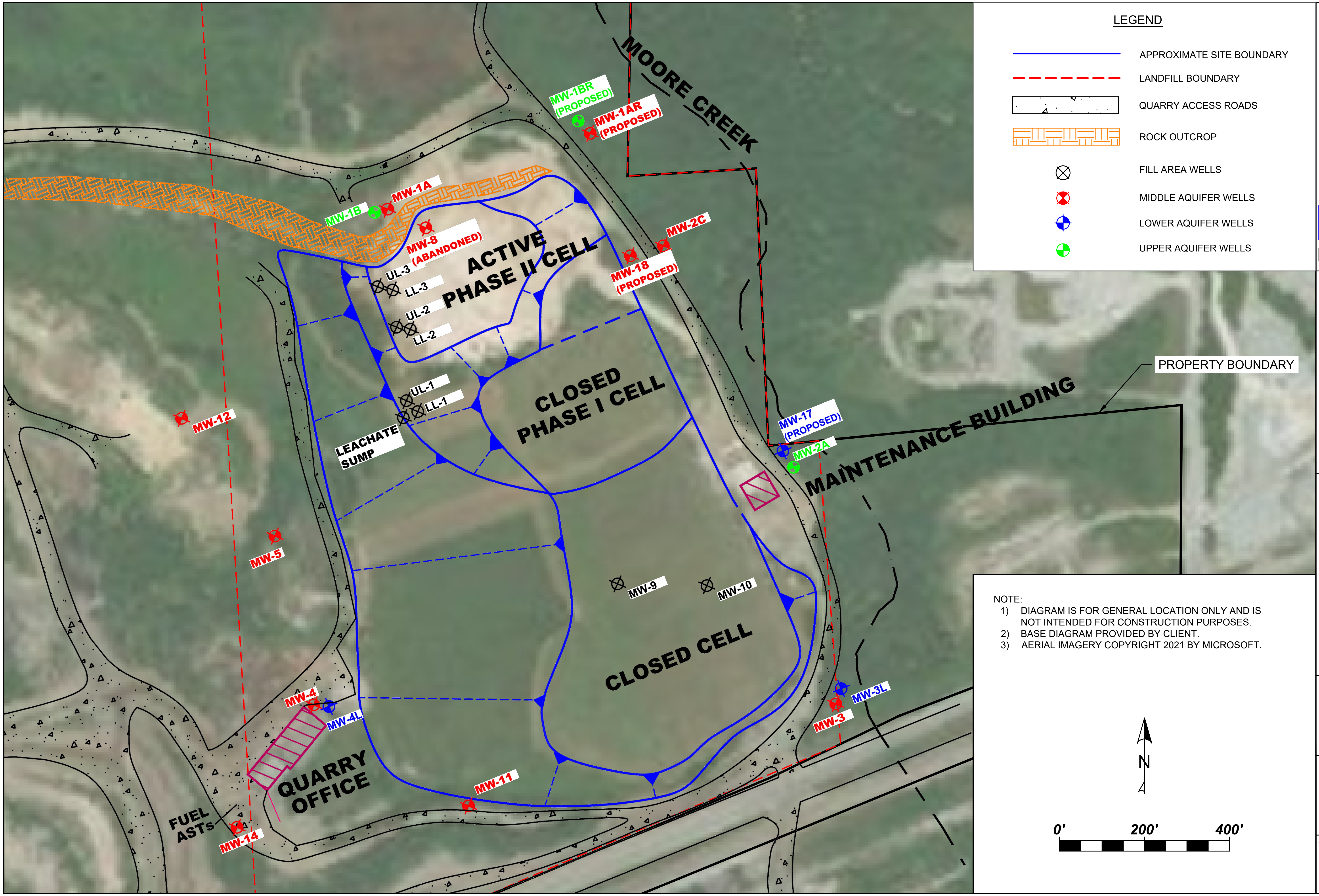
H	- Heavy Industrial	MFR	- Multi-Family Residence
C	- Two Family	SFR	- Single-Family Residence
AG	- Agricultural - General	→	- Haul Route

N

0 1,000 2,000 3,000 4,000 Feet

FIGURE 2	Project Mgr. KB	Date: 11-2021	BLACKSTONE ENVIRONMENTAL	CLIENT NAME Continental Cement
	Designed By: ME	Rev.:		SHEET NAME Site Plan
	Drawn By: ME	Rev.:		PROJECT NAME AND LOCATION Site Operations Plan, Buffalo, IA
	Checked by: KB	Rev.:		
	Job No.: 3066	Rev.:		

File: Z:\Shared\Clients\Continental Cement\PROJECTS\3630 - CKD Landfill Permit Renewal Application\WORKING\Figures\Site Map-Spring 2022 Edited June 2024



LEGEND

━	APPROXIMATE SITE BOUNDARY
╌	LANDFILL BOUNDARY
▭	QUARRY ACCESS ROADS
▨	ROCK OUTCROP
⊗	FILL AREA WELLS
⊗	MIDDLE AQUIFER WELLS
⊕	LOWER AQUIFER WELLS
⊕	UPPER AQUIFER WELLS

NOTE:
1) DIAGRAM IS FOR GENERAL LOCATION ONLY AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES.
2) BASE DIAGRAM PROVIDED BY CLIENT.
3) AERIAL IMAGERY COPYRIGHT 2021 BY MICROSOFT.

BLACKSTONE ENVIRONMENTAL
16200 FOSTER STREET OVERLAND PARK, KS 66085
P: 913-495-9990 F: 913-648-2077

SHEET NAME SITE MAP
PROJECT NAME 2024 LANDFILL PERMIT RENEWAL
PROJECT LOCATION CEMENT KILN DUST LANDFILL

CLIENT
CONTINENTAL CEMENT COMPANY
301 EAST FRONT STREET
BUFFALO, IOWA 52728

Project Mgr: KK
Date 06/26/2024
Designed By: ES
Rev.
Drawn By: EG
Rev.
Checked By: ES
Rev.
Rev.
Rev.

SHEET
1

APPENDIX A

Legal Description

CONTINENTAL CEMENT COMPANY, L.L.C.

ASSISTANT SECRETARY'S CERTIFICATE

May 9, 2018

The undersigned, being the duly appointed and acting Assistant Secretary of Continental Cement Company, L.L.C., a Delaware limited liability company (the "Company"), hereby certifies, as of the date hereof, on behalf of the Company, solely in such person's capacity as Assistant Secretary of the Company and not in such person's individual capacity, as follows:

1. Pursuant to that certain Asset Purchase Agreement, dated as of April 16, 2015, by and among the Company, Lafarge North America, Inc., a Maryland corporation ("Seller") and certain other parties, as guarantors for the Company, the Company purchased from Seller and Seller sold to the Company certain assets of Seller, including, among other assets, (a) a cement plant located in Buffalo, Iowa (the "Cement Plant"), (b) a quarry located in Davenport, Iowa (the "Quarry") and (c) a cement distribution terminal located in West Des Moines, Iowa (the "Terminal"), in each case more particularly described on the attached Exhibit A (collectively, the "Davenport Properties"), each of which are used in the business of (i) mining aggregates at the Quarry and (ii) producing, marketing, distributing and selling portland cement and related products at or from the Cement Plant and the Terminal (the "Transferred Business").

2. The Company owns all right, title and interest in and to the Davenport Properties used in connection with the Transferred Business.

[Signature page follows]

IN WITNESS WHEREOF, the undersigned has hereunto set his hand on behalf of the Company as of the date first written above.

By: ___________________________
Name: Chris Gaskill
Title: Assistant Secretary

EXHIBIT A

Davenport Properties

WEST DES MOINES

THAT PART OF LOT ONE (1) OF THE WEST 854 FEET OF LOT F VALLEY FUNCTION; PART OF LOTS D, E, F AND THE VACATED STREET NORTH OF LOT E IN VALLEY JUNCTION, MORE PARTICULARLY DESCRIBED AS FOLLOWS;

A TRACT OF LAND LYING IN THE NORTHEAST QUARTER OF SECTION 15, TOWNSHIP 78 NORTH, RANGE 25 WEST OF THE FIFTH PRINCIPAL MERIDIAN, MORE PARTICULARLY DESCRIBED AS FOLLOWS. COMMENCING AT THE NORTHWEST CORNER OF LOT F OF THE RECORDED PLAT OF VALLEY JUNCTION, IOWA, WITH SAID NORTHWEST CORNER BEING ON THE LINE BETWEEN THE NORTH QUARTER CORNER AND THE CENTER OF SAID SECTION 15, AND HAVING AN ASSUMED TRUE BEARING SOUTH 0°00' WEST WITH ALL SUBSEQUENT BEARINGS REFERENCED THEREFROM; THENCE SOUTH 87°24' EAST ALONG THE NORTH LINE OF SAID LOT F, A DISTANCE OF 858.3 FEET; THENCE SOUTH 0°00' EAST, A DISTANCE OF 375 FEET; THENCE SOUTH 90°00' EAST, A DISTANCE OF 200 FEET TO THE POINT OF BEGINNING, SAID POINT ALSO BEING THE NORTHEAST CORNER OF PROPERTY DESCRIBED IN DEED DATED AUGUST 31,1953, FROM THE CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD COMPANY TO PENN-DIXIE CEMENT CORPORATION AND AS RECORDED ON PAGE 207, BOOK 2631 IN THE OFFICE OF THE RECORDER OF POLK COUNTY, IOWA; THENCE SOUTH 0°00' EAST A DISTANCE OF 1016.34 FEET; THENCE SOUTH 30°54' WEST, A DISTANCE OF 172.84 FEET TO A POINT OF INTERSECTION WITH A LINE 200 FEET NORTHWESTERLY OF, AS MEASURED AT RIGHT ANGLES TO, AND PARALLEL WITH THE CENTERLINE OF THE MAIN TRACT OF SAID RAILROAD COMPANY; SAID LAST TWO BEARING LINES BEING THE TWO NORTHERLY LINES OF THE EASTERLY BOUNDARIES OF THE PROPERTY DESCRIBED IN SAID DEED DATED AUGUST 31, 1953; THENCE NORTH 47°44' EAST ALONG SAID LINE PARALLEL AND 200 FEET NORTHWESTERLY FROM THE CENTERLINE OF SAID MAIN LINE TRACK, A DISTANCE OF 557.65 FEET TO THE WESTERLY LINE OF ELEVENTH STREET IN THE CITY OF WEST DES MOINES, POLK COUNTY, IOWA; THENCE NORTH 39°46' WEST ALONG THE WESTLINE OF SAID ELEVENTH STREET; A DISTANCE OF 51.7 FEET; THENCE SOUTH 50°14' WEST ALONG SAID WEST LINE OF SAID STREET, A DISTANCE OF 10 FEET; THENCE NORTHERLY ALONG SAID WEST LINE OF SAID STREET, A DISTANCE OF 251.25 FEET ALONG A 316.5 FOOT RADIUS CURVE CONCAVE NORTHEASTERLY AND TANGENT TO THE FOLLOWING COURSE; THENCE NORTH 0°00' EAST ALONG THE SAID WEST LINE OF SAID STREET, A DISTANCE OF 529.87 FEET; THENCE NORTHERLY ALONG SAID WEST LINE OF SAID STREET ON A 256.5 FOOT RADIUS CURVE CONCAVE SOUTHWESTERLY AND

TANGENT TO THE PRECEDING COURSE, A DISTANCE OF 3.2 FEET; THENCE NORTH 90°00' WEST, A DISTANCE OF 197.8 FEET TO THE POINT OF BEGINNING.

AND

COMMENCING AT THE NORTH 1/4 CORNER OF SECTION 15-T78NR25 WEST OF THE 5TH P.M., WEST DES MOINES, POLK COUNTY, IOWA, THENCE S 0°00 E, ALONG THE WEST LINE OF THE N.E. 1/4 OF SAID SECTION 15, 185.15 FEET, TO THE SOUTH RIGHT-OF-WAY LINE OF THE MINNEAPOLIS AND ST. LOUIS RAILROAD, AS II IS PRESENTLY ESTABLISHED, THENCE S 87°26' 1/2" E, ALONG SAID SOUTH RIGHT-OF-WAY LINE, 87.12 FEET. THENCE CONTINUING S 87°26' 1/2" E, ALONG THE SOUTH RIGHT-OF-WAY LINE OF THE MINNEAPOLIS AND ST. LOUIS RAILROAD, AND PARALLEL WITH AND 50.0 FEET NORMALLY DISTANT FROM AND SOUTH OF THE CENTER LINE OF SAID MINNEAPOLIS AND ST. LOUIS RAILROAD, 567.53 FEET, TO THE POINT OF BEGINNING, THENCE CONTINUING S 87°26 1/2' E ALONG SAID SOUTH RIGHT-OF-WAY LINE OF THE MINNEAPOLIS AND ST. LOUIS RAILROAD, 200.2 FEET, THENCE S 0°00' E, PARALLEL TO AND 854.0 FEET EAST OF THE WEST LINE OF THE NE 1/4 OF SAID SECTION 15, 375.0 FEET, THENCE N 90°00 E, 200.0 FEET, THENCE S 0°00' E, PARALLEL WITH AND 1054.0 FEET EAST OF THE WEST LINE OF THE NE 1/4 OF SAID SECTION 15, 1018.8 FEET, THENCE S 30°44' W 173.86 FEET, TO THE NORTHWESTERLY RIGHT-OF-WAY LINE OF THE CHICAGO-ROCK ISLAND AND PACIFIC RAILROAD, AS IT IS PRESENTLY ESTABLISHED, THENCE S 47°42 1/2' W, PARALLEL WITH AND 200.0 FEET NORMALLY DISTANT FROM AND NORTHWESTERLY OF THE CENTER LINE OF THE MAIN LINE TRACK OF THE CHICAGO-ROCK ISLAND PACIFIC RAILROAD, AND ALONG THE NORTHWESTERLY RIGHT-OF-WAY OF SAID CHICAGO-ROCK ISLAND AND PACIFIC RAILROAD 420.63 FEET TO A POINT ON SAID NORTHWESTERLY RIGHT-OF-WAY OF THE CHICAGO-ROCK ISLAND AND PACIFIC RAILROAD,THENCE N 0°00' W, PARALLEL WITH AND 654.0 FEET EAST OF THE WEST LINE OF THE NE 1/4 OF SAID SECTION 15,1834.21 FEET TO THE POINT OF BEGINNING.

ALL BEING AN OFFICIAL PLAT, NOW INCLUDED IN AND FORMING A PART OF THE CITY OF WEST DES MOINES. POLK COUNTY, IOWA (EXCEPT THAT PART PLATTED AS SCHRODER INDUSTRIAL PARK).

DAVENPORT (BUFFALO, IOWA):

CHAIN ONE AND TWO:

PARCEL NO. 1: PART OF THE NORTHEAST QUARTER OF SECTION 23 IN TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M., MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING ON THE NORTH LINE OF SAID QUARTER SECTION AT A POINT 15 CHAINS AND 40 LINKS WEST OF THE NORTHEAST CORNER OF SAID NORTHEAST QUARTER; THENCE RUNNING WEST 24 CHAINS AND 60 LINKS TO THE NORTHWEST CORNER OF SAID QUARTER SECTION; THENCE SOUTH 40 CHAINS

AND 55 LINKS TO THE NORTH BANK OF THE MISSISSIPPI RIVER; THENCE NORTH 66 DEGREES EAST, 1 CHAIN AND 43 LINKS TO A POINT ON SAID RIVER BANK; THENCE NORTH 84 DEGREES EAST, ON AND ALONG SAID RIVER BANK TO A POINT 24 CHAINS AND 1 LINK DISTANT; THENCE NORTH 37 CHAINS AND 47 LINKS TO THE PLACE OF BEGINNING.

EXCEPTING THEREFROM THE RIGHT OF WAY OF THE CHICAGO, ROCK ISLAND AND PACIFIC RAILWAY COMPANY; AND EXCEPTING PUBLIC HIGHWAYS.

PARCEL NO. 2: THE WEST ONE-HALF OF THE SOUTHEAST QUARTER OF SECTION 4, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M., SCOTT COUNTY, IOWA.

PARCEL NO. 3: LOTS 3 AND 4 OF THE SUBDIVISION OF THE ESTATE OF ELIAS MOORE, DECEASED, IN THE NORTHEAST QUARTER OF SECTION 23, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M. MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT A POINT IN THE EAST LINE OF SECTION 23 WHICH IS 8 CHAINS 59 LINKS SOUTH OF THE NORTHEAST CORNER OF SAID SECTION; THENCE RUNNING DUE WEST 15 CHAINS AND 40 LINKS; THENCE RUNNING DUE SOUTH 28 CHAINS AND 88 LINKS TO A STAKE STANDING ON THE BANK OF THE MISSISSIPPI RIVER; THENCE WITH THE MEANDERS OF THE SAID RIVER NORTH 84 DEGREES EAST 12 CHAINS AND 99 LINKS; THENCE WITH THE MEANDERS OF SAID RIVER NORTH 62 DEGREES EAST 2 CHAINS 82 LINKS; MORE OR LESS, TO A EAST LINE OF SAID SECTION; THENCE DUE NORTH ALONG THE EAST LINE OF SAID SECTION 26 CHAINS AND 13 LINKS TO THE PLACE OF BEGINNING, SUBJECT TO RAILROAD RIGHTS-OF WAY AND TO PUBLIC HIGHWAYS.

PARCEL NO. 4: THE EAST HALF OF THE SOUTHWEST QUARTER OF SECTION 14, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M. (DOES NOT INCLUDE PARCEL NO. 5 TRACT.)

PARCEL NO. 6: ALL THAT PART OF THE LAND INCLUDED IN THE PLAT OF THE ESTATE OF LEROY DODGE RECORDED IN PARTITION SUIT NO. 13437 IN THE DISTRICT COURT OF IOWA IN AND FOR SCOTT COUNTY, SAID PLAT INCLUDING LAND SITUATED IN SECTIONS 14, 15, 22 AND 23, TOWNSHIP 77 NORTH, RANGE 2 EAST, DESCRIBED AS FOLLOWS:

ALL OF LOT 1, ACCORDING TO SAID PLAT,

ALL OF LOT 2, ACCORDING TO SAID PLAT,

ALL OF LOT 3, ACCORDING TO SAID PLAT,

ALL OF THAT PART OF THE LOT 7, ACCORDING TO SAID PLAT, WHICH LIES SOUTH OF THE SECTION LINE BETWEEN SAID SECTIONS 15 AND 22,

ALL OF LOT 8, ACCORDING TO SAID PLAT, EXCEPT (A) THAT PART CONVEYED BY FRANK L. DODGE TO DAVENPORT PAVING BRICK & TILE COMPANY BY DEED

RECORDED IN BOOK 57 OF LAND DEEDS, AT PAGE 490, (B) THAT PART CONVEYED BY FRANK L. DODGE TO HORACE H. CASS BY DEED RECORDED IN BOOK 48 OF LAND DEEDS, AT PAGE 283, AND IN BOOK 49 OF LAND DEEDS, AT PAGE 288, (C) THAT PART CONVEYED BY FRANK L. DODGE TO DORMAN & MOOREHEAD BY DEED RECORDED IN BOOK 52 OF LAND DEEDS, AT PAGE 83, (D) THAT PART THERETOFORE CONVEYED BY FRANK L. DODGE TO THE CHICAGO, ROCK ISLAND & PACIFIC RAILWAY COMPANY FOR STATION GROUNDS, (E) THAT PART CONVEYED BY DEWEY PORTLAND CEMENT COMPANY TO BUFFALO, IOWA, INDEPENDENT SCHOOL DISTRICT NO. 1 BY DEED RECORDED IN BOOK 90 OF LAND DEEDS, AT PAGE 45, AND (F) THAT PART CONVEYED BY DEWEY PORTLAND CEMENT COMPANY TO IOWA-ILLINOIS GAS AND ELECTRIC COMPANY BY DEED RECORDED IN BOOK 243 OF DEEDS, AT PAGE 238.

ALL OF LOT 9, ACCORDING TO SAID PLAT.

EXCEPTING THEREFROM THAT PORTION THEREOF CONVEYED TO THE CITY OF BUFFALO, IOWA, BY QUIT CLAIM DEED DATED JULY 22, 1980 AND RECORDED AS DOCUMENT #7502-81 IN THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA.

EXCEPTING THEREFROM THAT PORTION THEREOF CONVEYED TO THE STATE OF IOWA BY DEED DATED AUGUST 3, 1982 AND RECORDED AS DOCUMENT #12944-82 IN THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA.

PARCEL NO. 7: THAT 8 ACRE PORTION OF THE BED OF THE MISSISSIPPI RIVER WHICH LIES ADJACENT TO THE IOWA BANK OF SAID RIVER AND ADJACENT TO THE SOUTHERLY LINE OF GOVERNMENT LOTS TWO (2) AND THREE (3) OF SECTION TWENTY-THREE (23) OF TOWNSHIP SEVENTY-SEVEN (77) NORTH, RANGE TWO (2) EAST OF THE FIFTH PRINCIPAL MERIDIAN, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHEAST CORNER OF SAID SECTION THENCE SOUTH 1740.10 FEET ALONG THE EAST LINE OF SAID SECTION; THENCE SOUTH 32 DEGREES 40 MINUTES WEST 1162.25 FEET TO THE NORTHEAST CORNER OF THE PRESENT SEA-WALL; THENCE ALONG THE FACE OF SAID SEA-WALL AND ALONG THE IOWA BANK OF SAID RIVER, SOUTH 33 DEGREES 48 MINUTES WEST 51.20 FEET; THENCE SOUTH 82 DEGREES 6 MINUTES WEST 455.70 FEET; THENCE SOUTH 81 DEGREES 39 MINUTES WEST 419.70 FEET TO THE WESTERLY END OF SAID SEA-WALL; THENCE SOUTH 85 DEGREES 16 ½ MINUTES WEST 310 FEET TO THE POINT OF BEGINNING; THENCE SOUTH 85 DEGREES 16 ½ MINUTES WEST 1100 FEET TO THE EASTERLY BANK OF A PRESENT CREEK OUTLET AT A POINT APPROXIMATELY 2930 FEET WEST OF AND 3000 FEET SOUTH OF THE NORTHEAST CORNER OF SAID SECTION; THENCE NORTHERLY ALONG SAID CREEK OUTLET BANK TO THE PRESENT IOWA SHORE LINE OF SAID RIVER AT ELEVATION OF 547 FEET ABOVE MEAN SEA-LEVEL; THENCE EASTERLY ALONG SAID SHORE LINE TO A POINT 1860 FEET WEST OF AND 2550 FEET SOUTH OF THE NORTHEAST CORNER OF SAID SECTION; THENCE SOUTHERLY 330 FEET ALONG THE WEST LINE OF THE

PREMISES OWNED BY DEWEY PORTLAND CEMENT COMPANY TO THE POINT OF BEGINNING.

EXCEPTIONS TO ALL THE ABOVE PARCELS

EXCEPT THAT PORTION DEEDED TO THE STATE OF IOWA BY DEED DATED AUGUST 31, 1982 AND RECORDED AS DOCUMENT NO. 12944-82 IN THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA, AND EXCEPTING THOSE LANDS CONDEMNED BY THE UNITED STATES OF AMERICA UNDER ORDER DATED AUGUST 11, 1939 AND RECORDED IN THE OFFICE OF THE SCOTT COUNTY, IOWA RECORDER AT BOOK 82 LAND DEEDS, PAGE 264 AND EXCEPTING THE TRACT CONVEYED TO THE CITY OF BUFFALO, IOWA BY DEED DATED JULY 22, 1980 AND RECORDED IN THE OFFICE OF THE SCOTT COUNTY, IOWA RECORDER AS DOCUMENT NO. 7502-81.

PARCELS NO. 10 AND 11: THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 14, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M. ALSO DESCRIBED AS LOT 4 IN THE PARTITION OF THE ESTATE OF LEROY DODGE.

ALSO PART OF THE SOUTHEAST QUARTER OF SECTION 15, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M., DESCRIBED AS COMMENCING AT THE NORTHEAST CORNER OF THE SOUTHEAST QUARTER OF SAID SECTION 15; THENCE WEST ON THE NORTH LINE OF SAID SOUTHEAST QUARTER OF SECTION 15, 15 CHAINS; THENCE SOUTH ON THE EAST LINE OF LOT 6, 20 CHAINS; THENCE EAST ON THE NORTH LINE OF LOT 1, 15 CHAINS; THENCE NORTH ON THE WEST LINE OF LOT 4, 20 CHAINS TO THE PLACE OF BEGINNING, WHICH REAL ESTATE IS ALSO DESCRIBED AS LOT 5 IN THE PARTITION OF THE ESTATE OF LEROY DODGE, DECEASED.

THE ABOVE DESCRIBED TRACTS OF REAL ESTATE ARE PARTICULARLY DESCRIBED BY SURVEY AS FOLLOWS:

BEGINNING AT THE NORTHEAST CORNER OF THE SOUTHEAST ¼ OF SECTION 15, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH PRINCIPAL MERIDIAN SAID POINT BEING ALSO THE NORTHWEST CORNER OF THE SOUTHWEST ¼ OF SECTION 14, TOWNSHIP AND RANGE AFORESAID, THENCE NORTH 89 DEGREES 52 MINUTES 14 SECONDS EAST ALONG THE NORTH LINE OF THE SAID SOUTHWEST
¼ OF SECTION 14 A DISTANCE OF 1331.0 FEET; THENCE SOUTH 0 DEGREES 42 MINUTES 49 SECONDS WEST 1331.34 FEET; THENCE NORTH 89 DEGREES 52 MINUTES 41 SECONDS WEST 2325.32 FEET TO THE SOUTHEAST CORNER OF LOT 44 DEVIL'S CREEK ESTATES ADDITION; THENCE NORTH 0 DEGREES 37 MINUTES 00 SECONDS EAST ALONG THE EAST LINE OF SAID DEVIL'S CREEK ESTATES ADDITION A DISTANCE OF 1325.43 FEET; THENCE SOUTH 89 DEGREES 52 MINUTES 53 SECONDS EAST 996.64 FEET TO THE PLACE OF BEGINNING. SITUATED IN BUFFALO TOWNSHIP, SCOTT COUNTY, IOWA.

CHAIN THREE:

PARCEL 12

THE NORTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 14; THE NORTH 16 ACRES OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 14; THE EAST 20 ACRES OF THE NORTHEAST QUARTER OF THE NORTHEAST QUARTER OF SECTION 15; EXCEPT THOSE PORTIONS THERE CONVEYED BY DOCUMENT NUMBERS 13993-82 AND 18202 83, RECORDS OF THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA.

ALSO, THE NORTH HALF OF THE SOUTHEAST QUARTER OF THE NORTHEAST QUARTER OF SECTION 15 EXCEPT THAT PART DESCRIBED AS COMMENCING AT A POINT ON SECTION LINE BETWEEN SECTIONS 14 AND 15; THENCE NORTH 20 FEET FROM CENTER LINE OF SOUTHEAST QUARTER OF THE NORTHEAST QUARTER OF SECTION 15; THENCE WEST 73 RODS, THENCE SOUTH 20 FEET; THENCE EAST 73 RODS TO THE PLACE OF BEGINNING, AND ALSO EXCEPTING THEREFROM THAT PORTION SOLD ON CONTRACT RECORDED AS DOCUMENT NUMBER 9033 75, RECORDS OF THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA, ALL IN TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH PRINCIPAL MERIDIAN.

CHAIN FOUR:

PARCEL 13

THE SOUTH 16 ACRES OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 14, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M. THE NORTH 8 ACRES OF THE SOUTH 24 ACRES, BEING LOT THREE OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 14, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M.

THE SOUTH 20 ACRES OF THE SOUTHEAST QUARTER OF THE NORTHEAST QUARTER OF SECTION 15, TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH P.M., EXCEPTING THEREFROM THE LAND INCLUDED IN LOTS 15 AND 16 IN BUFFALO HEIGHTS, AS APPEARS FROM THE PLAT OF SAID SUBDIVISION RECORDED IN BOOK 63 OF MISCELLANEOUS RECORDS, ON PAGE 291, IN THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA.

ALSO, A STRIP OF LAND COMMENCING AT THE NORTHWEST CORNER OF LAST TRACT ABOVE, THENCE WEST 73 RODS, NORTH 20 FEET, EAST 73 RODS, AND SOUTH 20 FEET TO THE PLACE OF BEGINNING.

EXCEPT THAT PORTION OF THE ABOVE DESCRIBED REAL ESTATE THAT WAS CONVEYED TO ALBERT VINER AND WINONA B. VINER BY THE QUIT CLAIM DEED DATED JANUARY 18, 1973, AND RECORDED AS DOC. #963-73 IN THE OFFICE OF THE RECORDER OF SCOTT COUNTY, IOWA.

CHAIN 5:

PARCEL 14

ALL THAT PORTION OF THE LAND INCLUDED IN THE PLAT OF THE ESTATE OF LEROY DODGE, RECORDED IN PARTITION SUIT NO 13437 IN THE DISTRICT COURT OF IOWA, AND SCOTT COUNTY, SAID PLAT INCLUDING LAND SITUATED IN SECTIONS 14, 15, 22 & 23 OF TOWNSHIP 77 NORTH, RANGE 2 EAST OF THE 5TH PRINCIPAL MERIDIAN SCOTT COUNTY, IOWA, LYING SOUTH OF THE SOUTHERLY RIGHT-OF-WAY LINE OF IOWA STATE HIGHWAY 22 AND NORTH OF THE ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AS A POINT OF REFERENCE AT THE NORTHEAST CORNER OF SECTION 23, TOWNSHIP 77 NORTH, RANGE 2 EAST;

THENCE SOUTH 00°1'51" WEST 1139.58 FEET ALONG THE EAST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 23 TO A POINT ON THE SOUTHERLY RIGHT-OF-WAY LINE OF THE CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD SAID RIGHT-OF-WAY LINE BEING 50 FEET IN PERPENDICULAR DISTANCE SOUTHEASTERLY FROM THE CENTERLINE OF THE WEST-BOUND MAIN LINE (NORTHERLY OF TWO) TRACK (FOR PURPOSES OF THIS DESCRIPTION, THE SAID EAST LINE OF THE NORTHEAST QUARTER OF SECTION 23 IS ASSUMED TO BEAR SOUTH 00°1'51" WEST);

THENCE SOUTH 68° 24''17" WEST 3916.36 FEET ALONG THE SAID SOUTHERLY RIGHT-OF-WAY LINE OF THE CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD PARALLEL TO THE CENTERLINE OF THE SAID WEST-BOUND MAIN LINE TRACK, TO A POINT OF TANGENCY OF THE SAID RAILROAD RIGHT-OF-WAY LINE;

THENCE SOUTHWESTERLY 799.65 FEET ALONG THE SAID SOUTHERLY RIGHT-OF- WAY LINE OF THE CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD ALONG A
5799.58 FEET RADIUS CURVE, CONCAVE NORTHWESTERLY, PARALLEL TO THE CENTERLINE OF THE SAID WEST-BOUND MAIN LINE TRACK TO THE POINT OF BEGINNING (THE CHORD OF SAID CURVE BEARS SOUTH 77° 22' 03" WEST 79.03 FEET);

THENCE SOUTH 61° 13'53" EAST 307.06 FEET TO A POINT AT THE ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER;

THENCE ALONG THE FOLLOWING DESCRIBED MEANDER OF THE ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER;

NORTH 87° 50'58" WEST 418.37 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 80° 10" 32" WEST 325.68 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 76° 47' 55" WEST 293.01 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 6° 40' 17" WEST 351.51 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 4° 36'47" WEST 74.21 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 36° 24'29" WEST 191.26 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 6° 56'22" WEST 250.63 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE SOUTH 6° 24' 17" WEST 245.81 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE NORTH 88° 05'04" WEST 276.83 FEET ALONG THE SAID ORDINARY HIGH WATER LINE OF THE MISSISSIPPI RIVER TO A POINT;

THENCE NORTH 88° 51' 27" WEST 254.28 FEET ALONG THE SAID ORDINARY HIGH WATER POINT OF THE MISSISSIPPI RIVER TO A POINT;

THENCE NORTH 88° 06' 32" WEST 422.12 FEET ALONG THE SAID ORDINARY HIGH WATER POINT OF THE MISSISSIPPI RIVER TO A POINT.

Ember
Stanley [illegible]

8161-83
83 MAY 24 P3:35
$43.00 [illegible]
FILED
SCOTT COUNTY, IOWA
Recording fee $ 15.00
[illegible] $ 25.00

SPECIAL WARRANTY DEED

KNOW ALL MEN BY THESE PRESENTS:

That MARTIN MARIETTA CORPORATION, a corporation organized and existing under the laws of the State of Maryland, in consideration of the sum of one dollar and other valuable consideration in hand paid does hereby CONVEY unto
Davenport Cement Company, an Iowa general partnership

The following described real estate situated in Scott County, Iowa:

Parcel No. 1: Part of the Northeast Quarter of Section 23 in Township 77 North, Range 2 East of the 5th P.M., more particularly described as follows:

Commencing on the North line of said quarter section at a point 15 chains and 40 links West of the Northeast corner of said Northeast Quarter; thence running West 24 chains and 60 links to the Northwest corner of said quarter section; thence South 40 chains and 55 links to the North bank of the Mississippi River; thence North 66 degrees East, 1 chain and 43 links to a point on said river bank; thence North 84 degrees East, on and along said river bank to a point 24 chains and 1 link distant; thence North 37 chains and 47 links to the place of beginning.

Excepting therefrom the right of way of The Chicago, Rock Island and Pacific Railway Company; and excepting public highways.

Parcel No. 2: The West one-half of the Southeast Quarter of Section 14, Township 77 North, Range 2 East of the 5th P.M., Scott County, Iowa.

Parcel No. 3: Lots 3 and 4 of the subdivision of the Estate of Elias Moore, deceased, in the Northeast Quarter of Section 23, Township 77 North, Range 2 East of the 5th P.M., more particularly described as follows:

Commencing at a point in the East line of Section 23 which is 8 chains 59 links South of the Northeast corner of said section; thence running due West 15 chains and 40 links; thence running due South 28 chains and 88 links to a stake standing on the bank of the Mississippi River; thence with the meanders of the said river North 84 degrees East 12 chains and 99 links; thence with the meanders of said river North 62 degrees East 2 chains 82 links, more or less, to the East line of said section; thence due North along the East line of said Section 26 chains and 13 links to the place of beginning, subject to railroad rights-of-way and to public highways.

chains and 13 links to the place of beginning, subject to railroad rights-of-way and to public highways.

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

CANCELLED
$938.51

CANCELLED
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED
25 MAY 83
$938.51

ESTATE
SFER TAX
CANCELLED

12,200.65

Parcel No. 4. The East Half of the Southwest Quarter of Section 14, Township 77 North, Range 2 East of the 5th P.M.

(This Deed does not contain a Parcel 5 tract.)

Parcel No. 6. All that part of the land included in the plat of the Estate of LeRoy Dodge recorded in partition suit No. 13437 in the District Court of Iowa in and for Scott County, said plat including land situated in Sections 14, 15, 22 and 23, Township 77 North, Range 2 East, described as follows:

All of Lot 1, according to said plat,

All of Lot 2, according to said plat,

All of Lot 3, according to said plat,

All that part of the Lot 7, according to said Plat, which lies south of the section line between said Sections 15 and 22,

All of Lot 8, according to said plat, EXCEPT (a) that part conveyed by Frank L. Dodge to Davenport Paving Brick & Tile Company by deed recorded in Book 57 of Land Deeds, at page 490, (b) that part conveyed by Frank L. Dodge to Horace H. Cass by deed recorded in Book 48 of Land Deeds, at page 283, and in Book 49 of Land Deeds, at page 288, (c) that part conveyed by Frank L. Dodge to Dorman & Moorehead by deed recorded in Book 52 of Land Deeds, at page 83, (d) that part heretofore conveyed by Frank L. Dodge to The Chicago, Rock Island & Pacific Railway Company for station grounds, (e) that part conveyed by Dewey Portland Cement Company to Buffalo, Iowa, Independent School District No. 1 by deed recorded in Book 90 of Land Deeds, at page 45, and (f) that part conveyed by Dewey Portland Cement Company to Iowa-Illinois Gas and Electric Company by deed recorded in Book 243 of Deeds, at page 238.

All of Lot 9, according to said plat.

Excepting therefrom that portion thereof conveyed to the City of Buffalo, Iowa, by Quit Claim Deed dated July 22, 1980 and recorded as Document #7502-81 in the office of the Recorder of Scott County, Iowa.

Excepting therefrom that portion thereof conveyed to the State of Iowa by Deed dated August 3, 1982 and recorded as Document #12944-82 in the office of the Recorder of Scott County, Iowa.

Parcel No. 7. That 8 acre portion of the bed of the Mississippi River which lies adjacent to the Iowa Bank of said river and adjacent to the Southerly line of Government Lots Two (2) and Three (3) of Section Twenty-Three (23) of Township Seventy-seven (77) North, Range Two (2) East of the Fifth Principal Meridian, more particularly described as follows:

Commencing at the Northeast corner of said Section; thence south 1740.10 feet along the East line of said section; thence south 32 degrees 40 minutes west 1162.25 feet to the northeast corner of the present sea-wall; thence along the face of said sea-wall and along the Iowa bank of said river, South 33 degrees 48 minutes West 51.20 feet; thence South 82 degrees 6 minutes West 455.70 feet; thence South 81 degrees 39 minutes West 419.70 feet to the Westerly end of said sea-wall; thence South 85 degrees 16 1/2 minutes West 310 feet to the point of beginning; thence South 85 degrees 16 1/2 minutes West 1100 feet to the Easterly bank of a present creek outlet at a point approximately 2930 feet West of and 3000 feet South of the Northeast corner of said section; thence Northerly along said creek outlet bank to the present Iowa shore line of said river at elevation of 547 feet above mean sea-level; thence Easterly along said shore line to a point 1860 feet West of and 2550 feet South of the Northeast corner of said section; thence Southerly 330 feet along the West line of the premises owned by Dewey Portland Cement Company to the point of beginning.

EXCEPTIONS TO ALL OF THE ABOVE PARCELS

Except that portion deeded to the State of Iowa by Deed dated August 31, 1982 and recorded as Document No. 12944-82 in the office of the Recorder of Scott County, Iowa, and excepting those lands condemned by the United States of America under order dated August 11, 1939 and recorded in the office of the Scott County, Iowa, Recorder at Book 82 Land Deeds, Page 264 and excepting the tract conveyed to the City of Buffalo, Iowa by deed dated July 22, 1980 and recorded in the office of the Scott County, Iowa Recorder as Document No. 7502-81.

ALL OF THE FOREGOING PARTICULARLY DESCRIBED PARCELS OF REAL ESTATE ARE CONVEYED SUBJECT TO THE FOLLOWING:

Subject to a certain Grant of Easement to the Town of Buffalo, Iowa, dated December 1, 1972 and filed for record in the Office of the Recorder of Scott County, Iowa, as Document Number 1100-73 on January 24, 1973 and a certain Lease Agreement between the Town of Buffalo, Iowa, as lessor, and Marietta Facilities, Inc., a Delaware Corporation as lessee dated December 1, 1972 and recorded in the Office of the Recorder of Scott County, Iowa, as Document No. 1101-73 on January 24, 1973 and a certain Indenture of Trust dated December 1, 1972 between the Town of Buffalo, Iowa, and Davenport Bank and Trust Company of Davenport, Iowa, as Trustee which Indenture of Trust is dated December 1, 1972 and is recorded in the Office of the Scott County, Iowa Recorder as Document No. 1102-73 on January 24, 1973; and

Further subject to the terms, provisions, covenants, conditions and restrictions contained in and rights and obligations created by a Lease Agreement dated May 21, 1971 and filed for record February 8, 1978 in the Office of the Scott County, Iowa Recorder as Document Number 2311-78 by and between Martin Marietta Corporation, Linwood Stone Products Company, an Iowa Corporation and Schwerman Trucking Company a Wisconsin corporation; and

Further subject to all other existing leases and rights of tenants in possession, existing railroad rights of way and depot grounds, easements, restrictions, reservations, or agreements of record, the rights of the public and the State of Iowa in roads and highways through the same, taxes and assessments, general and special, not now due and payable, and a certain boundary Adjustment Agreement between Grantor and the State of Iowa recorded on October 4, 1982 in the office of the Recorder of Scott County, Iowa as Document No. 12945-82, and TOGETHER WITH any easements appurtenant or of record for the benefit of the real estate herein conveyed; and

Further subject to any rights or claims of the United States of America in and to the subject premises acquired pursuant to a certain order vesting title entered in the United States District Court for the Southern District of Iowa, Davenport Division, dated August 11, 1939 and filed in the office of the Recorder of Scott County, Iowa on August 18, 1939 at Book 82 Land Deeds 264; and

Further subject to the rights of the United States of America, the State of Iowa, the City of Buffalo, Iowa, and the Public in and to that part of the subject premises falling in the bed of the Mississippi River; also rights of property owners in and to the free and unobstructed flow of the waters of said river.

THE GRANTOR HEREIN ALSO CONVEYS TO THE GRANTEE HEREIN THE FOLLOWING ADDITIONAL PARCELS OF REAL ESTATE SITUATED IN SCOTT COUNTY, IOWA:

Parcel No. 8: That part of the Southwest Quarter of the Southeast Quarter of Section 17, Township 77 North, Range 2 East of the 5th P.M., which lies West of the highway running through said quarter section as the same was located and established by Easement dated November 3, 1926 and recorded in Book 77 of Land Deeds at Page 235, records of the office of the Recorder of Scott County, Iowa.

Except that portion thereof included in the tract conveyed by Jacob Fridley and wife to Christ Kautz by Deeds dated June 14, 1862 and November 22, 1864 and recorded in Book 32 of Land Deeds, Page 150 and 159, respectively; and excepting the piece one rod in width conveyed by Jacob Fridley and wife to Conrad Appel by Deed dated March 12, 1872 and recorded in Book 43 of Land Deeds at Page 13, records of the office of the Recorder of Scott County, Iowa.

Also excepting that portion thereof conveyed to Scott County, Iowa by Quit Claim Deed dated April 29, 1964 and recorded in Book 278 of Deeds on Page 571 in the office of the Recorder of Scott County, Iowa.

Parcel No. 9: All of the Southeast Quarter of the Southwest Quarter in Section 17, Township 77 North, Range 2 East of the 5th P.M., excepting 3 acres, more or less, lying and being situated Northeast of the Blue Grass Road, which was conveyed to Stephen A. Collins by deeds recorded in Book 53 of Land Deeds, Page 626, and in Book 66 of Land Deeds, Page 601 in the office of the Recorder of Scott County, Iowa; and also excepting 3 acres, more or less, which was conveyed to Jack O. Phillips, et al, by deed recorded in Book 87 of Land Deeds, Page 352 in the office of the Recorder of Scott County, Iowa.

Except that portion thereof conveyed to Scott County, Iowa, by Quit Claim Deed dated April 29, 1964 and recorded in Book 278 of Deeds on Page 571 in the office of the Recorder of Scott County, Iowa.

Parcels No. 10 and 11: The Northwest Quarter of the Southwest Quarter of Section 14, Township 77 North, Range 2 East of the 5th P.M. Also described as Lot 4 in the partition of the Estate of LeRoy Dodge.

Also part of the Southeast Quarter of Section 15, Township 77 North, Range 2 East of the 5th P.M., described as commencing at the Northeast corner of the Southeast Quarter of said Section 15; thence West on the North line of said Southeast Quarter of Section 15, 15 chains; thence South on the East line of Lot 6, 20 chains; thence East on the North line of Lot 1, 15 chains; thence North on the West line of Lot 4, 20 chains to the place of beginning, which real estate is also described as Lot 5 in the partition of the Estate of LeRoy Dodge, deceased.

The above described tracts of real estate are particularly described by survey as follows:

Beginning at the Northeast corner of the Southeast 1/4 of Section 15, Township 77 North, Range 2 East of the 5th Principal Meridian said point being also the Northwest corner of the Southwest 1/4 of Section 14, Township and Range aforesaid, thence North 89 degrees 52 minutes 14 seconds East along the North line of the said Southwest 1/4 of Section 14 a distance of 1331.0 feet; thence South 0 degrees 42 minutes 49 seconds West 1331.34 feet; thence North 89 degrees 52 minutes 41 seconds West 2325.32 feet to the Southeast Corner of Lot 44 Devil's Creek Estates Addition; thence North 0 degrees 37 minutes 00 seconds East along the East line of said Devil's Creek Estates Addition a distance of 1325.43 feet; thence South 89 degrees 52 minutes 53 seconds East 996.64 feet to the place of beginning. Situated in Buffalo Township, Scott County, Iowa.

ALL OF THE FOREGOING PARTICULARLY DESCRIBED PARCELS OF REAL ESTATE ARE CONVEYED SUBJECT TO THE FOLLOWING:

Subject to existing leases and rights of tenants in possession, easements, restrictions, reservations, or agreements of record, the rights of the public and the State of Iowa in roads and highways through the same, taxes and assessments, general and special, not now due and payable, and TOGETHER WITH any easements appurtenant or of record for the benefit of the real estate herein conveyed.

Martin Marietta Corporation hereby convenants with said grantee, and successors in interest, to Warrant and Defend the said premises against the lawful claims of all persons claiming by, through or under it, except as may be above stated.

IN WITNESS WHEREOF said corporation has caused this instrument to be duly executed this 23rd day of May, 1983.

MARTIN MARIETTA CORPORATION

By
P.H. Serdel Its Vice President

By
James A. Kelly Its Assistant Secretary

STATE OF New York , New York COUNTY, ss.

On this 23rd day of May , A.D. 1983, before me, the undersigned, a Notary Public in and for said State, personally appeared Philip H Seidel a/k/a P.H. Seidel and Jane A. Kelly to me personally known, who being by me duly sworn, did say that they are the Vice President and Assistant Secretary, respectively, of said corporation; that the seal affixed thereto is the seal of said corporation; that said instrument was signed and sealed on behalf of said corporation by authority of its Board of Directors; and that the said Philip H Seidel and Jane A. Kelly as such officers, acknowledged the execution of said instrument to be the voluntary act and deed of said corporation, by it and by them voluntarily executed.

Edward S. Rosenthal

Edward S. Rosenthal
Notary Public in and for
said State

EDWARD S. ROSENTHAL
Notary Public, State of New York
No. 31-4761304
Qualified in New York County
Commission Expires March 30, 1983

APPENDIX B

CKD Analytical Results

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

November 02, 2021

Lindsay E. James
Blackstone Environmental, Inc.
16200 Foster Street
Overland Park, KS 66085

RE: Project: Cont. 3185
Pace Project No.: 60384336

Dear Lindsay James:

Enclosed are the analytical results for sample(s) received by the laboratory on October 09, 2021. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Kansas City

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Hank Kapka
hank.kapka@pacelabs.com
(913)599-5665
PM Lab Management

Enclosures

CERTIFICATIONS

Project:	Cont. 3185
Pace Project No.:	60384336

Pace Analytical Services Kansas

9608 Loiret Boulevard, Lenexa, KS 66219
Missouri Inorganic Drinking Water Certification #: 10090
Arkansas Drinking Water
Arkansas Certification #: 20-020-0
Arkansas Drinking Water
Illinois Certification #: 2000302021-3
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212020-2
Oklahoma Certification #: 9205/9935
Florida: Cert E871149 SEKS WET
Texas Certification #: T104704407-19-12
Utah Certification #: KS000212019-9
Illinois Certification #: 004592
Kansas Field Laboratory Accreditation: # E-92587
Missouri SEKS Micro Certification: 10070

SAMPLE SUMMARY

Project: Cont. 3185
Pace Project No.: 60384336

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60382604002	**CKD 1**	Water	10/08/21 11:53	10/09/21 08:45

SAMPLE ANALYTE COUNT

Project: Cont. 3185
Pace Project No.: 60384336

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60382604002	**CKD 1**	EPA 6010	JLH	12	PASI-K
		EPA 7470	VRB	1	PASI-K

PASI-K = Pace Analytical Services - Kansas City

ANALYTICAL RESULTS

Project:	Cont. 3185
Pace Project No.:	60384336

Sample: CKD 1 **Lab ID: 60382604002** Collected: 10/08/21 11:53 Received: 10/09/21 08:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP, TCLP	Analytical Method: EPA 6010 Preparation Method: EPA 3010 Leachate Method/Date: EPA 1311; 10/21/21 18:21 Initial pH: 11.43; Final pH: 11.67 Pace Analytical Services - Kansas City							
Aluminum	**2710**	ug/L	2000	1	10/22/21 12:07	10/25/21 11:03	7429-90-5	
Arsenic	ND	mg/L	0.50	1	10/22/21 12:07	10/25/21 11:03	7440-38-2	
Barium	ND	mg/L	2.5	1	10/22/21 12:07	10/25/21 11:03	7440-39-3	
Cadmium	ND	mg/L	0.050	1	10/22/21 12:07	10/25/21 11:03	7440-43-9	
Calcium	**830000**	ug/L	50000	1	10/22/21 12:07	10/25/21 11:03	7440-70-2	
Chromium	ND	mg/L	0.10	1	10/22/21 12:07	10/25/21 11:03	7440-47-3	
Iron	ND	ug/L	1000	1	10/22/21 12:07	10/25/21 11:03	7439-89-6	
Lead	ND	mg/L	0.50	1	10/22/21 12:07	10/25/21 11:03	7439-92-1	
Magnesium	ND	ug/L	50000	1	10/22/21 12:07	10/25/21 11:03	7439-95-4	
Potassium	**68000**	ug/L	50000	1	10/22/21 12:07	10/25/21 11:03	7440-09-7	
Selenium	ND	mg/L	0.50	1	10/22/21 12:07	10/25/21 11:03	7782-49-2	
Silver	ND	mg/L	0.10	1	10/22/21 12:07	10/25/21 11:03	7440-22-4	
7470 Mercury, TCLP	Analytical Method: EPA 7470 Preparation Method: EPA 7470 Leachate Method/Date: EPA 1311; 10/21/21 18:21 Initial pH: 11.43; Final pH: 11.67 Pace Analytical Services - Kansas City							
Mercury	ND	mg/L	0.0020	1	10/23/21 15:17	10/25/21 09:38	7439-97-6	

QUALITY CONTROL DATA

Project: Cont. 3185
Pace Project No.: 60384336

QC Batch: 751580
QC Batch Method: EPA 7470
Analysis Method: EPA 7470
Analysis Description: 7470 Mercury TCLP
Laboratory: Pace Analytical Services - Kansas City
Associated Lab Samples: 60382604002

METHOD BLANK: 3007464 Matrix: Water
Associated Lab Samples: 60382604002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	mg/L	ND	0.0020	10/25/21 09:34	

LABORATORY CONTROL SAMPLE: 3009446

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	mg/L	0.015	0.015	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 3009447 3009448

Parameter	Units	60383151001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	mg/L	ND	0.015	0.015	0.014	0.015	95	100	75-125	4	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALITY CONTROL DATA

Project: Cont. 3185
Pace Project No.: 60384336

QC Batch: 751373
QC Batch Method: EPA 3010
Analysis Method: EPA 6010
Analysis Description: 6010 MET TCLP
Laboratory: Pace Analytical Services - Kansas City
Associated Lab Samples: 60382604002

METHOD BLANK: 3007464
Matrix: Water
Associated Lab Samples: 60382604002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Arsenic	mg/L	ND	0.50	10/25/21 10:58	
Barium	mg/L	ND	2.5	10/25/21 10:58	
Cadmium	mg/L	ND	0.050	10/25/21 10:58	
Chromium	mg/L	ND	0.10	10/25/21 10:58	
Lead	mg/L	ND	0.50	10/25/21 10:58	
Selenium	mg/L	ND	0.50	10/25/21 10:58	
Silver	mg/L	ND	0.10	10/25/21 10:58	

LABORATORY CONTROL SAMPLE: 3008359

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Arsenic	mg/L	10	10.1	101	80-120	
Barium	mg/L	10	10.0	100	80-120	
Cadmium	mg/L	10	10.2	102	80-120	
Chromium	mg/L	10	10.3	103	80-120	
Lead	mg/L	10	10.0	100	80-120	
Selenium	mg/L	10	10.4	104	80-120	
Silver	mg/L	5	5.0	101	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 3008360 3008361

Parameter	Units	60383151001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Arsenic	mg/L	ND	10	10	9.8	10.1	98	101	75-125	3	20	
Barium	mg/L	ND	10	10	9.7	10.1	97	100	75-125	3	20	
Cadmium	mg/L	ND	10	10	10.0	10.2	100	102	75-125	2	20	
Chromium	mg/L	ND	10	10	9.9	10.4	99	104	75-125	4	20	
Lead	mg/L	ND	10	10	9.9	10.1	99	100	75-125	2	20	
Selenium	mg/L	ND	10	10	10.1	10.4	100	103	75-125	3	20	
Silver	mg/L	ND	5	5	4.9	5.1	98	101	75-125	3	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALIFIERS

Project:	Cont. 3185
Pace Project No.:	60384336

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Reported results are not rounded until the final step prior to reporting. Therefore, calculated parameters that are typically reported as "Total" may vary slightly from the sum of the reported component parameters.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project:	Cont. 3185
Pace Project No.:	60384336

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60382604002	**CKD 1**	EPA 3010	751373	EPA 6010	751511
60382604002	**CKD 1**	EPA 7470	751580	EPA 7470	751583

Pace Analytical® www.pacelabs.com

Sample Condition Upon Receipt

WO# : 60382604

60382604

Client Name: Blackstone Env. Services

Courier: FedEx ☒ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☐ Client ☐ Other ☐

Tracking #: 284685271414 Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present: Yes ☐ No ☒ Seals intact: Yes ☐ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☒ Foam ☐ None ☐ Other ☒ ZPLC

Thermometer Used: T296 **Type of Ice:** [✓ Wet] Blue None

Cooler Temperature (°C): **As-read** 2.3 **Corr. Factor** -0.3 **Corrected** 2.0

Date and initials of person examining contents: 100921MLK

Temperature should be above freezing to 6°C

Chain of Custody present:	☒Yes ☐No ☐N/A	
Chain of Custody relinquished:	☐Yes ☒No ☐N/A	
Samples arrived within holding time:	☒Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☒Yes ☐No ☐N/A	NOx
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	
Sufficient volume:	☒Yes ☒No ☐N/A	Total metals not requested
Correct containers used:	☒Yes ☐No ☐N/A	but rcvd a BP3N.
Pace containers used:	☒Yes ☐No ☐N/A	
Containers intact:	☒Yes ☐No ☐N/A	Bromate requested but did
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☒N/A	not receive volume for it.
Filtered volume received for dissolved tests?	☐Yes ☒No ~~☒N/A~~ 100921 MLK	
Sample labels match COC: Date / time / ID / analyses	☒Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☒No ☐N/A	
Containers requiring pH preservation in compliance? (HNO$_3$, H$_2$SO$_4$, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO) LOT#	☒Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added. Initial pH ~3.0. Added
Cyanide water sample checks: Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	☐Yes ☐No ☐Yes ☐No	1 mL HNO3 (Lot #47265) on 10/9/21 @ 0958. Final
Trip Blank present:	☐Yes ☐No ☒N/A	pH ~1.0
Headspace in VOA vials (>6mm):	☐Yes ☐No ☒N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☒N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☒N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: ______ Date/Time: ______

Comments/ Resolution: ______

Project Manager Review: ______ Date: ______

Pace Analytical®
WWW.PACELABS.COM

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at https://info.pacelabs.com/hubfs/pas-standard-terms.pdf.

Page : 1 Of 1

Section A
Required Client Information:
Company: Blackstone Environmental Overland Park, KS
Address: 9153 West 133rd Street
Overland Park, KS 66213
Email: ljames@blackstone-env.com
Phone: 319-541-3697 Fax:
Requested Due Date:

Section B
Required Project Information:
Report To: Lindsay James
Copy To:
Purchase Order #:
Project Name: Continental
Project #: 3185

Section C
Invoice Information:
Attention:
Company Name:
Address:
Pace Quote:
Pace Project Manager: hank.kapka@pacelabs.com;
Pace Profile #: x

Regulatory Agency

State / Location
IA

6038 2604

MATRIX	CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Other	OT
Tissue	TS

ITEM #	SAMPLE ID One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	~~TDS by 2540C~~ lab	~~TSS + pH, Alk, Anions~~	6010 Metals	Bromate	TDS by 2540C	Alk, bicarb+carb	Sttc, Kg	F, Cl, SO4	NO3 NO2	ph	TCLP metals	Dissolved metals	Residual Chlorine (Y/N)	
1	MW-2CR	WT	G	10-8-21	11:35				4	X		X										X	X	X	X	X	X	X		X		Sample NOT field filtered.
2	CKD1	SL	G	10-8-21	11:53				1	X																			X			
3																																
4																																
5																																
6																																
7																																
8																																
9																																
10																																
11																																
12																																

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
				EBrockett / Pace	10-9-21	0845	2.0	Y	Y	Y

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Krista Brodersen
SIGNATURE of SAMPLER:
DATE Signed: 10-8-2021

COC PAGE ____ of ____

SBS ____
DI ____
MeOH (only) ____
BK ____
Kit

Client: Blackstone Env.

Site: ____

Sample Container Count

Profile # ____

Notes ____

COC Line Item	Matrix	R	VG9H	DG9H	DG9Q	VG9U	DG9U	BG1U	AG1H	AG1U	AG2U	AG3S	AG4U	AG5U	BP1U	BP2U	BP3U	BP1N	BP3N	BP3F	BP3S	BP3C	BP3Z	JGFU	WGKU	ZPLC	DG9M	DG9B				
1															2	1			1													
2																									1							
3																																
4																																
5																																
6																																
7																																
8																																
9																																
10																																
11																																
12																																

Container Codes

Glass			
DG9B	40mL bisulfate clear vial	WGKU	8oz clear soil jar
DG9H	40mL HCl amber voa vial	WGFU	4oz clear soil jar
DG9M	40mL MeOH clear vial	WG2U	2oz clear soil jar
DG9Q	40mL TSP amber vial	JGFU	4oz unpreserved amber wide
DG9S	40mL H2SO4 amber vial	AG0U	100mL unores amber glass
DG9T	40mL Na Thio amber vial	AG1H	1L HCl amber glass
DG9U	40mL amber unpreserved	AG1S	1L H2SO4 amber glass
VG9H	40mL HCl clear vial	AG1T	1L Na Thiosulfate clear/amber glass
VG9T	40mL Na Thio. clear vial	AG1U	1liter unpres amber glass
VG9U	40mL unpreserved clear vial	AG2N	500mL HNO3 amber glass
BG1S	1liter H2SO4 clear glass	AG2S	500mL H2SO4 amber glass
BG1U	1liter unpres glass	AG3S	250mL H2SO4 amber glass
BG3H	250mL HCL Clear glass	AG2U	500mL unpres amber glass
BG3U	250mL Unpres Clear glass	AG3U	250mL unpres amber glass
		AG4U	125mL unpres amber glass
		AG5U	100mL unpres amber glass

Plastic	
BP1C	1L NAOH plastic
BP1N	1L HNO3 plastic
BP1S	1L H2SO4 plastic
BP1U	1L unpreserved plastic
BP1Z	1L NaOH, Zn Acetate
BP2C	500mL NAOH plastic
BP2N	500mL HNO3 plastic
BP2S	500mL H2SO4 plastic
BP2U	500mL unpreserved plastic
BP2Z	500mL NaOH, Zn Acetate
BP3C	250mL NaOH plastic
BP3F	250mL HNO3 plastic - field filtered
BP3N	250mL HNO3 plastic
BP3U	250mL unpreserved plastic
BP3S	250mL H2SO4 plastic
BP3Z	250mL NaOH, Zn Acetate
BP4U	125mL unpreserved plastic
BP4N	125mL HNO3 plastic
BP4S	125mL H2SO4 plastic

Misc.	
I	Wipe/Swab
SP5T	120mL Coliform Na Thiosulfate
ZPLC	Ziploc Bag
AF	Air Filter
C	Air Cassettes
R	Terracore Kit
U	Summa Can

Matrix	
WT	Water
SL	Solid
NAL	Non-aqueous Liquid
OL	OIL
WP	Wipe
DW	Drinking Water

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

704 Enterprise Drive Cedar Falls, IA 50613 * 800-750-2401 * Fax 319-277-2425

February 11, 2010

Client:
TERRACON - BETTENDORF
870 40th Avenue
Bettendorf, IA 52722

Work Order: CTA0801
Project Name: Lafarge CKD Sample - Buffalo, IA
Project Number: 07107001

Attn: John Brimeyer

Date Received: 01/21/10

The Chain(s) of Custody, 2 pages, are included and are an integral part of this report.

If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 1-(800)750-2401

SAMPLE IDENTIFICATION	**LAB NUMBER**	**COLLECTION DATE AND TIME**
CKD	CTA0801-01	01/21/10 11:30

Case Narrative: The TCLP extraction temperature range for this sample is 18.3 degrees C to 21.6 degrees C. The SPLP extraction temperature range for this sample is 18.4 degrees C to 24.1 degrees C.

Samples were received into laboratory at a temperature of 0.10 °C.

NELAC states that samples which require thermal preservation shall be considered acceptable if the arrival temperature is within 2 degrees C of the required temperature or the method specified range. For samples with a temperature requirement of 4 degrees C, an arrival temperature from 0 degrees C to 6 degrees C meets specifications. Samples that are delivered to the laboratory on the same day that they are collected may not meet these criteria. In these cases, the samples are considered acceptable if there is evidence that the chilling process has begun, such as arrival on ice.

Please refer to the Temperature and Sample Receipt form that is included with this report for additional information regarding the condition of samples at the time of receipt by the laboratory.

The reported results were obtained in compliance with the 2003 NELAC standards unless otherwise noted.
Iowa Certification Number: 007

Reproduction of this analytical report is permitted only in its entirety. This report shall not be reproduced except in full without the written approval of the laboratory.

TestAmerica Laboratories, Inc. certifies that the analytical results contained herein apply only to the specific sample analyzed.

Approved By:

Stefanie Nester

TestAmerica Cedar Falls
Stefanie Nester
Project Coordinator

TERRACON - BETTENDORF
870 40th Avenue
Bettendorf, IA 52722
John Brimeyer

Work Order: CTA0801
Project: Lafarge CKD Sample - Buffalo, IA
Project Number: 07107001

Received: 01/21/10
Reported: 02/11/10 15:51

ANALYTICAL REPORT

Analyte	Sample Result	Data Qualifiers	Units	Quan. Limit	Dilution Factor	Date Analyzed	Analyst	Seq/ Batch	Method
Sample ID: CTA0801-01 (CKD - Soil)					**Sampled: 01/21/10 11:30**		**Recvd: 01/21/10 16:00**		
General Chemistry Parameters									
% Solids	**100**		%	0.100	1	01/22/10 15:54	sas	10A0701	SM 2540 G
Total Metals by SW 846 Series Methods									
Antimony	<50.0	IE	mg/kg dry	50.0	9.65	01/28/10 06:33	cjt	10A0720	SW 6010B
Arsenic	**4.90**		mg/kg dry	1.00	0.979	01/26/10 12:52	cjt	10A0680	SW 7060A
Barium	**68.6**		mg/kg dry	5.00	9.65	01/28/10 06:33	cjt	10A0720	SW 6010B
Beryllium	**0.974**		mg/kg dry	0.250	0.979	02/04/10 13:54	cjt	10A0680	SW 7091
Boron	**55.8**		mg/kg dry	50.0	9.65	01/28/10 06:33	cjt	10A0720	SW 6010B
Cadmium	<10.0	IE	mg/kg dry	10.0	9.65	01/28/10 06:33	cjt	10A0720	SW 6010B
Chromium	**22.6**		mg/kg dry	10.0	9.65	01/28/10 06:33	cjt	10A0720	SW 6010B
Lead	**113**		mg/kg dry	50.0	9.65	01/28/10 06:33	cjt	10A0720	SW 6010B
Manganese	**2700**		mg/kg dry	5.00	9.65	01/28/10 06:32	cjt	10A0720	SW 6010B
Mercury	<0.0200		mg/kg dry	0.0200	0.983	02/01/10 16:42	lbb	10B0047	SW 7471A
Molybdenum	<25.0	IE	mg/kg dry	25.0	9.65	01/28/10 06:33	cjt	10A0720	SW 6010B
Nickel	**25.7**		mg/kg dry	25.0	9.65	01/28/10 06:33	cjt	10A0720	SW 6010B
Selenium	<75.0	IE	mg/kg dry	75.0	9.65	01/28/10 06:33	cjt	10A0720	SW 6010B
Silver	<10.0	IE	mg/kg dry	10.0	9.65	01/28/10 06:33	cjt	10A0720	SW 6010B
Thallium	**45.0**		mg/kg dry	4.00	3.92	01/28/10 12:45	cjt	10A0680	SW 7841
Vanadium	**29.8**		mg/kg dry	25.0	9.65	01/28/10 06:33	cjt	10A0720	SW 6010B
Zinc	**262**		mg/kg dry	10.0	9.65	01/28/10 06:33	cjt	10A0720	SW 6010B
TCLP Metals									
Arsenic	<1.50	IE, T6	mg/L	1.50	5	01/29/10 00:54	cjt	10A0762	SW 6010B
Barium	**0.552**	T6	mg/L	0.500	5	01/29/10 00:54	cjt	10A0762	SW 6010B
Cadmium	<0.100	IE, T6	mg/L	0.100	5	01/29/10 00:54	cjt	10A0762	SW 6010B
Chromium	<0.100	IE, T6	mg/L	0.100	5	01/29/10 00:54	cjt	10A0762	SW 6010B
Lead	<0.500	IE, T6	mg/L	0.500	5	01/29/10 00:54	cjt	10A0762	SW 6010B
Mercury	<0.00200	T6	mg/L	0.00200	1	01/29/10 12:42	bjb	10A0821	SW 7470A
Selenium	<0.750	IE, T6	mg/L	0.750	5	01/29/10 00:54	cjt	10A0762	SW 6010B
Silver	<0.100	IE, T6	mg/L	0.100	5	01/29/10 00:54	cjt	10A0762	SW 6010B
SPLP Metals									
Antimony	<0.0300	M1, RL1,T6	mg/L	0.0300	5	02/10/10 09:20	lbb	10B0017	SW 7041
Arsenic	<0.0250	T6	mg/L	0.0250	5	02/04/10 15:55	cjt	10B0017	SW 7060A
Barium	<0.500	IE, M1,T6	mg/L	0.500	5	02/02/10 15:52	cjt	10B0013	SW 6010B
Beryllium	<0.0500	IE,T6	mg/L	0.0500	5	02/02/10 15:52	cjt	10B0013	SW 6010B
Cadmium	<0.100	IE,T6	mg/L	0.100	5	02/02/10 15:52	cjt	10B0013	SW 6010B
Chromium	<0.100	IE,T6	mg/L	0.100	5	02/02/10 15:52	cjt	10B0013	SW 6010B
Copper	<0.500	IE,T6	mg/L	0.500	5	02/02/10 15:52	cjt	10B0013	SW 6010B
Lead	<0.500	IE,T6	mg/L	0.500	5	02/02/10 15:52	cjt	10B0013	SW 6010B
Mercury	<0.00200	T6	mg/L	0.00200	1	02/03/10 13:53	bjb	10B0132	SW 7470A
Selenium	<0.750	IE,T6	mg/L	0.750	5	02/02/10 15:52	cjt	10B0013	SW 6010B
Thallium	**0.645**	M1,T6	mg/L	0.0400	20	02/11/10 09:33	cjt	10B0017	SW 7841

TERRACON - BETTENDORF
870 40th Avenue
Bettendorf, IA 52722
John Brimeyer

Work Order: CTA0801
Project: Lafarge CKD Sample - Buffalo, IA
Project Number: 07107001

Received: 01/21/10
Reported: 02/11/10 15:51

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
SPLP Metals							
SW 6010B	10B0013	CTA0801-01	50.00	50.00	02/01/10 08:57	KMD	SW 3010A - SPLP
SW 7041	10B0017	CTA0801-01	50.00	50.00	02/01/10 09:10	KMD	SW 3020A - SPLP
SW 7060A	10B0017	CTA0801-01	50.00	50.00	02/01/10 09:10	KMD	SW 3020A - SPLP
SW 7470A	10B0132	CTA0801-01	3.00	30.00	02/03/10 11:40	BJB	EPA 245.5/SW 7471
SW 7841	10B0017	CTA0801-01	50.00	50.00	02/01/10 09:10	KMD	SW 3020A - SPLP
TCLP Metals							
SW 6010B	10A0762	CTA0801-01	50.00	50.00	01/27/10 11:05	BJB	SW 3010A - TCLP
SW 7470A	10A0821	CTA0801-01	3.00	30.00	01/28/10 12:54	BJB	EPA 245.2/SW 7470
Total Metals by SW 846 Series Methods							
SW 6010B	10A0720	CTA0801-01	1.04	50.00	01/26/10 09:25	KMD	SW 3050B
SW 7060A	10A0680	CTA0801-01	1.02	50.00	01/25/10 11:05	KMD	SW 3050B GFAA
SW 7091	10A0680	CTA0801-01	1.02	50.00	01/25/10 11:05	KMD	SW 3050B GFAA
SW 7471A	10B0047	CTA0801-01	0.61	30.00	02/01/10 14:15	BJB	EPA 245.5/SW 7471
SW 7841	10A0680	CTA0801-01	1.02	50.00	01/25/10 11:05	KMD	SW 3050B GFAA

LABORATORY BLANK QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Total Metals by SW 846 Series Methods														
Arsenic	10A0680			mg/kg wet	N/A	1.00	<1.00							
Beryllium	10A0680			mg/kg wet	N/A	0.250	<0.250							
Thallium	10A0680			mg/kg wet	N/A	1.00	<1.00							
Antimony	10A0720			mg/kg wet	N/A	5.00	<5.00							
Barium	10A0720			mg/kg wet	N/A	0.500	<0.500							
Boron	10A0720			mg/kg wet	N/A	5.00	<5.00							
Cadmium	10A0720			mg/kg wet	N/A	1.00	<1.00							
Chromium	10A0720			mg/kg wet	N/A	1.00	<1.00							
Lead	10A0720			mg/kg wet	N/A	5.00	<5.00							
Manganese	10A0720			mg/kg wet	N/A	0.500	<0.500							
Molybdenum	10A0720			mg/kg wet	N/A	2.50	<2.50							
Nickel	10A0720			mg/kg wet	N/A	2.50	<2.50							
Selenium	10A0720			mg/kg wet	N/A	7.50	<7.50							
Silver	10A0720			mg/kg wet	N/A	1.00	<1.00							
Vanadium	10A0720			mg/kg wet	N/A	2.50	<2.50							
Zinc	10A0720			mg/kg wet	N/A	1.00	<1.00							
Mercury	10B0047			mg/kg wet	N/A	0.0200	<0.0200							
TCLP Metals														
Arsenic	10A0762			mg/L	N/A	0.300	<0.300							
Barium	10A0762			mg/L	N/A	0.100	<0.100							
Cadmium	10A0762			mg/L	N/A	0.0200	<0.0200							
Chromium	10A0762			mg/L	N/A	0.0200	<0.0200							
Lead	10A0762			mg/L	N/A	0.100	<0.100							
Selenium	10A0762			mg/L	N/A	0.150	<0.150							
Silver	10A0762			mg/L	N/A	0.0200	<0.0200							
Mercury	10A0821			mg/L	N/A	0.00200	<0.00200							
SPLP Metals														
Barium	10B0013			mg/L	N/A	0.100	<0.100							
Beryllium	10B0013			mg/L	N/A	0.0100	<0.0100							
Cadmium	10B0013			mg/L	N/A	0.0200	<0.0200							
Chromium	10B0013			mg/L	N/A	0.0200	<0.0200							
Copper	10B0013			mg/L	N/A	0.100	<0.100							
Lead	10B0013			mg/L	N/A	0.100	<0.100							
Selenium	10B0013			mg/L	N/A	0.150	<0.150							
Antimony	10B0017			mg/L	N/A	0.00600	<0.00600							
Arsenic	10B0017			mg/L	N/A	0.00500	<0.00500							
Thallium	10B0017			mg/L	N/A	0.00200	<0.00200							
Mercury	10B0132			mg/L	N/A	0.00200	<0.00200							

LABORATORY DUPLICATE QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Total Metals by SW 846 Series Methods													
QC Source Sample: CTA0773-11													
Arsenic	10A0680	9.18		mg/kg dry	N/A	1.32	8.74				5	20	
Beryllium	10A0680	1.08		mg/kg dry	N/A	0.329	1.05				3	20	
Thallium	10A0680	<1.32		mg/kg dry	N/A	1.32	<1.32					20	
QC Source Sample: CTA0773-10													
Antimony	10A0720	<6.48		mg/kg dry	N/A	6.48	<6.48					20	
Barium	10A0720	245		mg/kg dry	N/A	0.648	217				12	20	
Boron	10A0720	18.4		mg/kg dry	N/A	6.48	16.8				9	20	
Cadmium	10A0720	<1.30		mg/kg dry	N/A	1.30	<1.30					20	
Chromium	10A0720	27.6		mg/kg dry	N/A	1.30	25.9				6	20	
Lead	10A0720	15.2		mg/kg dry	N/A	6.48	15.4				2	20	
Manganese	10A0720	885		mg/kg dry	N/A	0.648	1010				13	20	
Molybdenum	10A0720	<3.24		mg/kg dry	N/A	3.24	<3.24					20	
Nickel	10A0720	26.8		mg/kg dry	N/A	3.24	29.5				10	20	
Selenium	10A0720	<9.72		mg/kg dry	N/A	9.72	<9.72					20	
Silver	10A0720	<1.30		mg/kg dry	N/A	1.30	<1.30					20	
Vanadium	10A0720	55.8		mg/kg dry	N/A	3.24	52.9				5	20	
Zinc	10A0720	69.9		mg/kg dry	N/A	1.30	74.6				7	20	
TCLP Metals													
QC Source Sample: CTA0831-01													
Arsenic	10A0762	<0.900		mg/L	N/A	0.900	<0.900					20	
Barium	10A0762	<0.300		mg/L	N/A	0.300	<0.300					20	
Cadmium	10A0762	<0.0600		mg/L	N/A	0.0600	<0.0600					20	
Chromium	10A0762	<0.0600		mg/L	N/A	0.0600	<0.0600					20	
Lead	10A0762	<0.300		mg/L	N/A	0.300	<0.300					20	
Selenium	10A0762	<0.450		mg/L	N/A	0.450	<0.450					20	
Silver	10A0762	<0.0600		mg/L	N/A	0.0600	<0.0600					20	
SPLP Metals													
QC Source Sample: CTA0801-01													
Barium	10B0013	<0.500		mg/L	N/A	0.500	0.584					20	
Beryllium	10B0013	<0.0500		mg/L	N/A	0.0500	<0.0500					20	
Cadmium	10B0013	<0.100		mg/L	N/A	0.100	<0.100					20	
Chromium	10B0013	0.0512		mg/L	N/A	0.100	<0.100					20	
Copper	10B0013	<0.500		mg/L	N/A	0.500	<0.500					20	
Lead	10B0013	<0.500		mg/L	N/A	0.500	<0.500					20	
Selenium	10B0013	<0.750		mg/L	N/A	0.750	<0.750					20	
QC Source Sample: CTA0801-01													
Antimony	10B0017	<0.0300		mg/L	N/A	0.0300	<0.0300					20	
Arsenic	10B0017	<0.0250		mg/L	N/A	0.0250	<0.0250					20	
Thallium	10B0017	0.645		mg/L	N/A	0.0100	<0.0100					20	
QC Source Sample: CTA0801-01													
Mercury	10B0132	<0.00200		mg/L	N/A	0.00200	<0.00200					20	

LCS/LCS DUPLICATE QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Total Metals by SW 846 Series Methods														
Arsenic	10A0680		1.89	mg/kg wet	N/A	1.00	1.91		101		80-120			
Beryllium	10A0680		0.947	mg/kg wet	N/A	3.75	0.890		94		80-120			
Thallium	10A0680		1.89	mg/kg wet	N/A	2.00	1.77		93		80-120			
Antimony	10A0720		92.0	mg/kg wet	N/A	5.00	79.0		86		85-110			
Barium	10A0720		46.0	mg/kg wet	N/A	0.500	42.2		92		80-115			
Boron	10A0720		92.0	mg/kg wet	N/A	5.00	85.4		93		85-120			
Cadmium	10A0720		46.0	mg/kg wet	N/A	1.00	41.9		91		80-120			
Chromium	10A0720		46.0	mg/kg wet	N/A	1.00	42.6		93		90-115			
Lead	10A0720		92.0	mg/kg wet	N/A	5.00	94.1		102		80-120			
Manganese	10A0720		46.0	mg/kg wet	N/A	0.500	42.9		93		85-115			
Molybdenum	10A0720		92.0	mg/kg wet	N/A	2.50	87.9		95		90-110			
Nickel	10A0720		92.0	mg/kg wet	N/A	2.50	84.9		92		90-110			
Selenium	10A0720		184	mg/kg wet	N/A	7.50	172		93		85-115			
Silver	10A0720		46.0	mg/kg wet	N/A	1.00	43.1		94		80-110			
Vanadium	10A0720		46.0	mg/kg wet	N/A	2.50	43.5		95		85-115			
Zinc	10A0720		46.0	mg/kg wet	N/A	1.00	46.7		101		80-115			
Mercury	10B0047		0.161	mg/kg wet	N/A	0.0200	0.168		104		80-120			
TCLP Metals														
Arsenic	10A0762		2.00	mg/L	N/A	0.300	1.96		98		85-120			
Barium	10A0762		1.00	mg/L	N/A	0.100	0.928		93		80-115			
Cadmium	10A0762		1.00	mg/L	N/A	0.0200	0.912		91		85-120			
Chromium	10A0762		1.00	mg/L	N/A	0.0200	0.927		93		85-115			
Lead	10A0762		2.00	mg/L	N/A	0.100	1.85		93		80-120			
Selenium	10A0762		4.00	mg/L	N/A	0.150	4.26		107		85-120			
Silver	10A0762		1.00	mg/L	N/A	0.0200	0.864		86		80-110			
Mercury	10A0821		0.0167	mg/L	N/A	0.00200	0.0174		104		80-120			
SPLP Metals														
Barium	10B0013		1.00	mg/L	N/A	0.100	0.947		95		80-110			
Beryllium	10B0013		1.00	mg/L	N/A	0.0100	0.965		96		80-120			
Cadmium	10B0013		1.00	mg/L	N/A	0.0200	0.949		95		80-115			
Chromium	10B0013		1.00	mg/L	N/A	0.0200	0.935		94		80-110			
Copper	10B0013		2.00	mg/L	N/A	0.100	2.11		105		90-110			
Lead	10B0013		2.00	mg/L	N/A	0.100	1.92		96		80-115			
Selenium	10B0013		4.00	mg/L	N/A	0.150	4.57		114		90-120			
Antimony	10B0017		0.0400	mg/L	N/A	0.00600	0.0373		93		80-120			
Arsenic	10B0017		0.0400	mg/L	N/A	0.00500	0.0388		97		80-120			
Thallium	10B0017		0.0400	mg/L	N/A	0.00400	0.0372		93		80-120			
Mercury	10B0132		0.0167	mg/L	N/A	0.00200	0.0167		100		80-120			

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
Total Metals by SW 846 Series Methods														
QC Source Sample: CTA0773-01														
Arsenic	10A0680	2.19	4.09	mg/kg dry	N/A	1.07	6.58	6.39	107	99	75-125	3	20	
Beryllium	10A0680	0.100	2.05	mg/kg dry	N/A	8.03	3.00	3.18	142	145	75-125	6	20	M1
Thallium	10A0680	<1.07	4.09	mg/kg dry	N/A	1.07	3.72	3.95	91	93	75-125	6	20	
QC Source Sample: CTA0773-10														
Arsenic	10A0680	12.2	5.11	mg/kg dry	N/A	2.59	18.6		125		75-125			
Beryllium	10A0680	0.223	2.56	mg/kg dry	N/A	19.4	3.67		135		75-125			M1
Thallium	10A0680	<1.30	5.11	mg/kg dry	N/A	1.30	4.76		93		75-125			
QC Source Sample: CTA0773-02														
Antimony	10A0720	<6.50	254	mg/kg dry	N/A	6.50	119	104	47	43	75-115	13	20	M1
Barium	10A0720	186	127	mg/kg dry	N/A	0.650	330	368	113	151	75-125	11	20	MHA
Boron	10A0720	19.8	254	mg/kg dry	N/A	6.50	215	212	77	80	75-125	2	15	
Cadmium	10A0720	<1.30	127	mg/kg dry	N/A	1.30	105	98.7	82	82	75-115	6	15	
Chromium	10A0720	31.0	127	mg/kg dry	N/A	1.30	134	135	81	86	75-125	1	10	
Lead	10A0720	12.1	254	mg/kg dry	N/A	6.50	246	232	92	92	75-125	6	20	
Manganese	10A0720	461	127	mg/kg dry	N/A	0.650	1430	617	763	130	75-125	79	20	MHA,R
Molybdenum	10A0720	<3.25	254	mg/kg dry	N/A	3.25	189	179	74	75	75-110	5	10	M1
Nickel	10A0720	27.1	254	mg/kg dry	N/A	3.25	242	228	84	84	80-110	6	10	
Selenium	10A0720	<9.75	508	mg/kg dry	N/A	9.75	441	423	87	88	85-115	4	10	
Silver	10A0720	<1.30	127	mg/kg dry	N/A	1.30	107	77.7	84	65	75-110	32	10	M1,R
Vanadium	10A0720	62.4	127	mg/kg dry	N/A	3.25	170	173	84	92	80-115	2	20	
Zinc	10A0720	69.5	127	mg/kg dry	N/A	1.30	179	174	86	87	75-125	3	20	
QC Source Sample: CTA0773-09														
Antimony	10A0720	<17.9	219	mg/kg dry	N/A	17.9	84.4		39		75-115			M1
Barium	10A0720	235	109	mg/kg dry	N/A	1.79	249		12		75-125			MHA
Boron	10A0720	36.2	219	mg/kg dry	N/A	17.9	214		81		75-125			
Cadmium	10A0720	<3.58	109	mg/kg dry	N/A	3.58	46.1		42		75-115			M1
Chromium	10A0720	27.3	109	mg/kg dry	N/A	3.58	69.1		38		75-125			MHA
Lead	10A0720	32.2	219	mg/kg dry	N/A	17.9	127		43		75-125			M1
Manganese	10A0720	915	109	mg/kg dry	N/A	1.79	937		21		75-125			MHA
Molybdenum	10A0720	<8.95	219	mg/kg dry	N/A	8.95	75.3		34		75-110			M1
Nickel	10A0720	25.6	219	mg/kg dry	N/A	8.95	118		42		80-110			M1
Selenium	10A0720	<26.8	437	mg/kg dry	N/A	26.8	205		47		85-115			M1
Silver	10A0720	<3.58	109	mg/kg dry	N/A	3.58	47.9		44		75-110			M1
Vanadium	10A0720	44.8	109	mg/kg dry	N/A	8.95	89.5		41		80-115			MHA
Zinc	10A0720	345	109	mg/kg dry	N/A	3.58	555		191		75-125			MHA
QC Source Sample: CTA0773-01														
Mercury	10B0047	0.00686	0.172	mg/kg dry	N/A	0.0214	0.187	0.176	105	104	80-120	6	20	
TCLP Metals														
QC Source Sample: CTA0801-01														
Arsenic	10A0762	<1.50	2.00	mg/L	N/A	1.50	1.89		95		75-125			
Barium	10A0762	0.552	1.00	mg/L	N/A	0.500	1.44		89		75-125			
Cadmium	10A0762	<0.100	1.00	mg/L	N/A	0.100	0.857		86		75-120			
Chromium	10A0762	<0.100	1.00	mg/L	N/A	0.100	0.951		95		80-115			
Lead	10A0762	<0.500	2.00	mg/L	N/A	0.500	1.87		93		75-125			
Selenium	10A0762	<0.750	4.00	mg/L	N/A	0.750	4.33		108		75-125			
Silver	10A0762	<0.100	1.00	mg/L	N/A	0.100	0.848		85		75-125			
QC Source Sample: CTA0801-01														
Mercury	10A0821	<0.00200	0.0167	mg/L	N/A	0.00200	0.0171		102		75-125			

TERRACON - BETTENDORF
870 40th Avenue
Bettendorf, IA 52722
John Brimeyer

Work Order: CTA0801
Project: Lafarge CKD Sample - Buffalo, IA
Project Number: 07107001

Received: 01/21/10
Reported: 02/11/10 15:51

MATRIX SPIKE/MATRIX SPIKE DUPLICATE QC DATA

Analyte	Seq/ Batch	Source Result	Spike Level	Units	MDL	MRL	Result	Dup Result	% REC	Dup %REC	% REC Limits	RPD	RPD Limit	Q
SPLP Metals														
QC Source Sample: CTA0801-01														
Barium	10B0013	<0.500	1.00	mg/L	N/A	0.500	1.37		137		75-125			M1
Beryllium	10B0013	<0.0500	1.00	mg/L	N/A	0.0500	0.918		92		75-125			
Cadmium	10B0013	<0.100	1.00	mg/L	N/A	0.100	0.890		89		75-125			
Chromium	10B0013	0.0512	1.00	mg/L	N/A	0.100	0.954		90		75-125			
Copper	10B0013	<0.500	2.00	mg/L	N/A	0.500	2.01		100		75-125			
Lead	10B0013	<0.500	2.00	mg/L	N/A	0.500	1.90		95		75-125			
Selenium	10B0013	<0.750	4.00	mg/L	N/A	0.750	3.96		99		75-125			
QC Source Sample: CTA0801-01														
Antimony	10B0017	<0.0300	0.0400	mg/L	N/A	0.0300	<0.0300				75-125			M1
Arsenic	10B0017	<0.0250	0.0400	mg/L	N/A	0.0250	0.0353		88		75-125			
Thallium	10B0017	0.645	0.0400	mg/L	N/A	0.100	0.984		847		75-125			M1
QC Source Sample: CTA0801-01														
Mercury	10B0132	<0.00200	0.0167	mg/L	N/A	0.00200	0.0160		96		75-125			

CERTIFICATION SUMMARY

TestAmerica Cedar Falls

Method	Matrix	Nelac	Iowa
SM 2540 G	Solid/Soil		X
SW 1311	Solid/Soil	X	X
SW 1312	Solid/Soil	X	X
SW 6010B	Solid/Soil	X	X
SW 7041	Solid/Soil	X	X
SW 7060A	Solid/Soil	X	X
SW 7091	Solid/Soil	X	X
SW 7470A	Solid/Soil	X	X
SW 7471A	Solid/Soil	X	X
SW 7841	Solid/Soil	X	X

Any abnormalities or departures from sample acceptance policy shall be documented on the 'Sample Receipt and Termperature Log Form' and 'Sample Non-conformance Form' (if applicable) included with this report.

For information concerning certifications of this facility or another TestAmerica facility, please visit our website at www.TestAmericaInc.com

Samples collected by TestAmerica Field Services personnel are noted on the Chain of Custody (COC) and are sampled in accordance with TA-CF SOP CF-FSS-01.

.

DATA QUALIFIERS AND DEFINITIONS

IE	Elevated reporting limit due to interelement interference.
M1	The MS and/or MSD were outside control limits.
MHA	Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information.
R	Sample duplicate RPD exceeded the laboratory control limit.
RL1	Reporting limit raised due to sample matrix effects.
T6	The temperature during the 18 hour TCLP/SPLP extraction exceeded the 21-25 degrees C range stated in SW 1311/SW1312.

ADDITIONAL COMMENTS

Results are reported on a wet weight basis unless otherwise noted.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Cedar Falls Division
704 Enterprise Drive
Cedar Falls, IA 50613

Phone 319-277-2401 or 800-750-2401
Fax 319-277-2425

To assist us in using the proper analytical methods,
is this work being conducted for regulatory purposes?
Compliance Monitoring ______

Client Name: Terracon
Client #: ______
Address: 370 40th Avenue
City/State/Zip Code: Bettendorf IA 52722
Project Manager: John Brimeyer
Email Address: jfbrimeyer@terracon.com
Telephone Number: 563-355-9561
Fax: 563-355-4789
Sampler Name: (Print Name) Jay Fegley
Sampler Signature: Jay Fegley

Project Name: Lafarge CKD Sample
Project #: 07107001
Site/Location ID: Buffalo
State: IA
Report To: John Brimeyer
Invoice To: John Brimeyer
Quote #: ______
PO#: ______

TAT
___ Standard
___ Rush (surcharges may apply)

Date Needed: ______

Fax Results: Y N

Email Results: Y N

QC Deliverables
___ None
___ Level 2 *(Batch QC)*
___ Level 3
___ Level 4
Other: ______

SAMPLE ID	Date Sampled	Time Sampled	G = Grab, C = Composite	Field Filtered	Matrix: SL - Sludge DW - Drinking Water GW - Groundwater S - Soil/Solid WW - Wastewater Specify, Other	Preservation & # of Containers: HNO_3	HCl	NaOH	H_2SO_4	Methanol	None	Other (Specify)	Analyze For: SPLP Metals per list	TCLP RCRA metals	Total Metals per list								**REMARKS**
CKD	1/21	11:30	C		S						4+		X	X	X								

Special Instructions:
List of metals for SPLP & Total analysis provided to Sean Hayes

LABORATORY COMMENTS:

Relinquished By: Jay Fegley Date: 1-21-09 Time: PM Received By: Date: 1/21/09 Time: 11:55
Relinquished By: Date: 1/21/10 Time: 2:30pm Received By: Date: 1/21/10 Time: 1600
Relinquished By: Date: Time: Received By: Date: Time:

TAL-0033 (0708)

Page ______ of ______

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

704 ENTERPRISE DRIVE • CEDAR FALLS, IA 50613
800-750-2401 • 319-277-2425 FAX

Sample Receipt and Temperature Log Form

Client: Terracon

Project: Lafarge

City:

Date: 1-21-10

Receiver's Initials: CH

Time (Delivered): 16:00

Temperature Record:

Cooler ID# (If Applicable) Q4

0.1 °C / [✓ On Ice]

☑ Temp Blank

☐ Temperature out of compliance

Thermometer:

☐ IR - 61997671 'B'
☑ IR - 90876942 'C'
☐ IR - 61854108
☐ 22126775

Courier:

☐ UPS
☐ FedEx
☐ FedEx Ground
☐ US Postal Service
☐ Spee-Dee
☑ TA Courier
☐ TA Field Services
☐ Client
☐ Other

Custody seals present?
☐ Yes

Custody seals intact?
☐ Yes ☐ No

☐ Non-Conformance report started

Exceptions Noted

☐ Sample(s) not received in a cooler.

☐ Samples(s) received same day of sampling.

☐ Evidence of a chilling process

☐ Temperature not taken:

***Refer to SOP CF-SS-01 for Temperature Criteria**

H:\QA Folder\QA Forms & Log Book pgs\Cooler Receipt rev15.doc

QUAD CITY WATER TREATMENT CO.

1798 Iowa Drive • P.O. Box 745 • LeClaire, Iowa 52753-0745
Ph. (563) 289-3373 • Fax (563) 289-5526

LABORATORY REPORT

Scott Nielson
Environmental Manager
LaFarge of North America
P.O. Box 690
Buffalo IA 52728-0690

Report Date	11/23/04
Samples Rec	11/21/03
Samples Date	9/5/03
Sample ID	CDK soil sample
Lab No	031121-33

Parameters	TCLP Results mg/l	RCRA Max Allowable mg/l	Methods	Completed By
Arsenic	<0.05	5	1311-7061	12-4-03rb
Barium	<5	100	1311-7080	12-4-03rb
Cadmium	<0.05	1	1311-7130	12-5-03ej
Total Chromium	0.18	5	1311-7190	12-5-03ej
Lead	2.02	5	1311-7420	12-5-03ej
Mercury	<0.05	0.2	1311-7470	12-4-03rb
Silver	0.39	5	1311-7760	12-5-03ej
Selenium	<0.05	1	1311-7741	12-4-03rb

ANALYSIS CERTIFIED BY:
ROBERT B. BLACK
ENVIRONMENTAL CHEMIST

QUAD CITY WATER TREATMENT CO.

1798 Iowa Drive • P.O. Box 745 • LeClaire, Iowa 52753-0745
Ph. (563) 289-3373 • Fax (563) 289-5526

LABORATORY REPORT

Scott Nielson
Environmental Manager
LaFarge of North America
P.O. Box 690
Buffalo IA 52728-0690

Report Date	11/23/04
Samples Rec	11/21/03
Samples Date	6/2/03
Sample ID	CDK soil sample
Lab No	031121-32

Parameters	TCLP Results mg/l	RCRA Max Allowable mg/l	Methods	Completed By
Arsenic	<0.05	5	1311-7061	12-4-03rb
Barium	<5	100	1311-7080	12-4-03rb
Cadmium	<0.05	1	1311-7130	12-5-03ej
Total Chromium	<0.05	5	1311-7190	12-5-03ej
Lead	1.52	5	1311-7420	12-5-03ej
Mercury	<0.05	0.2	1311-7470	12-4-03rb
Silver	<0.05	5	1311-7760	12-4-03ej
Selenium	<0.05	1	1311-7741	12-4-03rb

ANALYSIS CERTIFIED BY:
ROBERT B. BLACK
ENVIRONMENTAL CHEMIST

QUAD CITY WATER TREATMENT CO.
1798 Iowa Drive • P.O. Box 745 • LeClaire, Iowa 52753-0745
Ph. (563) 289-3373 • Fax (563) 289-5526

LABORATORY REPORT

Scott Nielson
Environmental Manager
LaFarge of North America
P.O. Box 690
Buffalo IA 52728-0690

Report Date	11/23/04
Samples Rec	11/8/04
Samples Date	1st quarter 204
Sample ID	CDK soil sample
Lab No	041108-27

Parameters	TCLP Results mg/l	RCRA Max Allowable mg/l	Methods	Completed By
Arsenic	0.08	5	1311-7061	11-15-04rb
Barium	<5	100	1311-7080	11-15-04rb
Cadmium	<0.05	1	1311-7130	11-10-04ej
Total Chromium	0.036	5	1311-7190	11-10-04ej
Lead	7.44	5	1311-7420	11-10-04ej
Mercury	<0.05	0.2	1311-7470	11-15-04rb
Silver	<0.05	5	1311-7760	11-10-04ej
Selenium	0.24	1	1311-7741	11-15-04rb

ANALYSIS CERTIFIED BY:
ROBERT B. BLACK
ENVIRONMENTAL CHEMIST

QUAD CITY WATER TREATMENT CO.

1798 Iowa Drive • P.O. Box 745 • LeClaire, Iowa 52753-0745
Ph. (563) 289-3373 • Fax (563) 289-5526

LABORATORY REPORT

Scott Nielson
Environmental Manager
LaFarge of North America
P.O. Box 690
Buffalo IA 52728-0690

Report Date 11/23/04
Samples Rec 11/8/04
Samples Date 1st quarter 2004
Sample ID CDK soil sample
Lab No 041108-28

Parameters	TCLP Results mg/l	RCRA Max Allowable mg/l	Methods	Completed By
Arsenic	<0.05	5	1311-7061	11-15-04rb
Barium	<5	100	1311-7080	11-15-04rb
Cadmium	<0.05	1	1311-7130	11-10-04ej
Total Chromium	0.033	5	1311-7190	11-10-04ej
Lead	1.93	5	1311-7420	11-10-04ej
Mercury	<0.05	0.2	1311-7470	11-15-04rb
Silver	<0.05	5	1311-7760	11-10-04ej
Selenium	<0.05	1	1311-7741	11-15-04rb

ANALYSIS CERTIFIED BY:
ROBERT B. BLACK
ENVIRONMENTAL CHEMIST

SUMMIT
ENVIRONMENTAL TECHNOLOGIES, INC.
Analytical Laboratories

COPY
3.1.4

LABORATORY REPORT

Client
Lafarge North America
PO Box 690
Buffalo, IA 52728

Order Number
030592

Project Number
CKD

Issued
Monday, February 10, 2003

Total Number of Pages
6

Approved By :
Bassam Youssef
Laboratory Manager

NELAC Accreditation #E87688

2LA ISO/IEC 17025 Accreditation #0724.01

Sample Summary

Client: Lafarge North America
Order Number: 030592

Laboratory ID	Client ID	Matrix	Sampling Date
030592-01	Cement Kiln Dust	Solid	1/31/03

Report Narrative

Client: Lafarge North America
Order Number: 030592

No problems were encountered during analysis of this order number, except as noted.

The information contained in this analytical report is the sole property of Summit Environmental Technologies, Inc. and that of the client. It cannot be reproduced in any form without the consent of Summit Environmental Technologies, Inc. or the client for which this report was issued. The results contained in this report are only representative of the samples received. Conditions can vary at different times and at different sampling conditions. Summit Environmental Technologies, Inc. is not responsible for use or interpretation of the data included herein.

February 10, 2003

Client:	Lafarge North America
Address:	PO Box 690 Buffalo, IA 52728

Date Collected:	1/31/03
Date Received:	2/5/03
Project #:	CKD
Client ID #:	Cement Kiln Dust
Laboratory ID #:	030592-01
Matrix:	Solid
Extraction Method:	1311
Date of Analysis:	2/6/03

TCLP Metals

Parameter	**Detection Limit (mg/l)**	**Results (mg/l)**	**Regulatory Level (mg/l)**
Arsenic	0.50	<0.5	5.0
Barium	2.0	<2.0	100.0
Cadmium	0.10	<0.1	1.0
Chromium	0.20	<0.2	5.0
Lead	0.50	<0.5	5.0
Mercury	0.0020	<0.002	0.20
Selenium	0.50	<0.5	1.0
Silver	0.50	<0.5	5.0

SUMMIT
ENVIRONMENTAL TECHNOLOGIES, INC.
Analytical Laboratories

February 10, 2003

Client: Lafarge North America
Address: PO Box 690
Buffalo, IA 52728

Date Collected: 1/31/03
Date Received: 2/5/03
Project #: CKD
Client ID #: Cement Kiln Dust
Laboratory ID #: 030592-01
Matrix: Solid
Extraction Method: 1311
Date of Analysis: 2/7/03

TCLP Volatiles

Parameter	**Detection Limit (mg/L)**	**Results (mg/L)**	**Regulatory Level (mg/L)**
1,1-Dichloroethene	0.10	<0.1	0.70
1,2-Dichloroethane	0.10	<0.1	0.50
2-Butanone (MEK)	2.0	<2.0	200.0
Benzene	0.10	<0.1	0.50
Carbon tetrachloride	0.10	<0.1	0.50
Chlorobenzene	0.10	<0.1	100.0
Chloroform	0.10	<0.1	6.0
Tetrachloroethene	0.10	<0.1	0.70
Trichloroethene	0.10	<0.1	0.50
Vinyl Chloride	0.20	<0.2	0.20

SUMMIT
ENVIRONMENTAL TECHNOLOGIES, INC.
Analytical Laboratories

February 10, 2003

Client: Lafarge North America
Address: PO Box 690
Buffalo, IA 52728

Date Collected: 1/31/03
Date Received: 2/5/03
Project #: CKD
Client ID #: Cement Kiln Dust
Laboratory ID #: 030592-01
Matrix: Solid
Extraction Method: 1311
Date of Analysis: 2/6/03

TCLP BNA

Parameter	**Detection Limit (mg/l)**	**Results (mg/l)**	**Regulatory Level (mg/l)**
1,4-Dichlorobenzene	0.10	<0.1	7.5
2,4,5-Trichlorophenol	0.25	<0.25	400.0
2,4,6--Trichlorophenol	0.25	<0.25	2.0
2,4-Dinitrotoluene	0.10	<0.1	0.13
Cresols	0.10	<0.1	200.0
Hexachloro-1,3-butadiene	0.10	<0.1	0.50
Hexachlorobenzene	0.10	<0.1	0.13
Hexachloroethane	0.10	<0.1	3.0
Nitrobenzene	0.10	<0.1	2.0
Pentachlorophenol	0.25	<0.25	100.0
Pyridine	0.25	<0.25	5.0

Summit Environmental Technologies, Inc.

Cooler receipt form

Customer: LaFarge

Order Number: 030592

Date Received: 2/5/03

Time Received: 10:00 A

Number of Coolers/Boxes: 1

N/A

Shipper: FED EX [✓ UPS] Airborne US Cargo US Postal Walk-in Pickup Other: ____________

Packaging: Peanuts Bubble wrap [✓ Paper] [✓ Foam] None

Tape on cooler/box [✓ Y] N N/A

Custody Seals intact Y N [✓ N/A]

C.O.C. in plastic Y [✓ N] N/A

Ice___/Blue Ice___ [✓ present] Y N N/A

Temperature: 8.5 °C N/A

C.O.C. filled out properly Y [✓ N] N/A

Samples in separate bags Y N [✓ N/A]

Sample containers intact* [✓ Y] N N/A

Label(s) complete (ID, date, time, etc) Y [✓ N] N/A

Label(s) agree with C.O.C. Y N N/A

Correct containers used [✓ Y] N N/A

Preserved properly Y N [✓ N/A]

Sufficient Sample [✓ Y] N N/A

Bubbles absent from 40ml Y N N/A

Sample ID	pH	Sample ID	pH

*If no which ones broken: ____________

Was client called about broken samples Y N

Will client send new sample(s) Y N

Talked to ____________

Date/Time ____________

Logged in by: ____________

Comments: ~~pest~~ no Full TCLP No pest or herbs
& Date Collected is 1/31/03
we rec. blank C.O.C

BN 2/5/03

Rev. 4

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

SUMMIT ENVIRONMENTAL TECHNOLOGIES, INC.

Akron, OH

for technical competence in the field of

Environmental Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC Guide 25-1990 "General Requirements for the Competence of Calibration and Testing Laboratories" (equivalent to relevant requirements of the ISO 9000 series of standards) and any additional program requirements in the identified field of testing.

Presented this 3rd day of April, 2000.

President
For the Accreditation Council
Certificate Number 724.01
Valid to: January 31, 2002

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation

Summit Environmental Technologies, Inc.
595 East Tallmadge Avenue
Akron, Ohio 44310 Tel: 330.253.8211 Fax: 330.253.4489

Analysis Request/Chain of Custody

For Summit Environmental Technologies, Inc. use only
Page ____ of ____.
SET No.

Client Name: Lafarge North America

Client Address: PO Box 690
Buffalo, IA 52728

Client Phone No. 563-328-6206

Client Fax No. 563-323-7001

Please Fax Results ✓ ☐

Contact Person: Scott Nielson

Sampled by: Rick Vinger

Project Name: CKD

Project Address: Same

Report to: Scott Nielson

PO #

Quote No.

Check if Ohio VAP samples ✓ ☐

Analytical Parameters and Methods

#	Sample Identification	Date Collected	Time Collected	Grab	Composite	Matrix: S=Solid, L=Liquid, O=Oil SL=Sludge, A=Air	Preservative	Number of Containers	TCLP							
1	Cement Kiln Dust	12-15 → 1-22			X				X							

Relinquished by	Date	Time	Received by	Date	Time	Notes/Comments
Received in Lab by	Date	Time	Rush Requested: ____ Days Must be approved by lab manager			

[illegible]

Summit Environmental Technologies, Inc.
595 East Tallmadge Avenue
Akron, Ohio 44310 Tel: 330.253.8211 Fax: 330.253.4489

Analysis Request/Chain of Custody

For Summit Environmental Technologies, Inc. use only
Page ____ of ____
SET No.

030592-01

Client Name: Lafarge North America
Client Address: PO Box 690
Buffalo, IA 52728
Client Phone No. 563-328-6206
Client Fax No. 563-323-7001
Please Fax Results ✓ ☐
Contact Person: Scott Nielson
Sampled by: Rick Vinger

Project Name: CKD
Project Address: Same
Report to: Scott Nielson
PO #
Quote No.
Check if Ohio VAP samples ✓ ☐

	Sample Identification	Date Collected	Time Collected	Grab	Composite	Matrix: S=Solid, L=Liquid, O=Oil, SL=Sludge, A=Air	Preservative	Number of Containers	Analytical Parameters and Methods: TCLP
1	Cement Kiln Dust	12-15 → 1-22			X				X

Relinquished by: SAH

Notes/Comments

Received by:
2/5/03 1000

APPENDIX C

Monthly Certified Operators Inspection Form

CERTIFIED OPERATOR MONTHLY INSPECTION FORM

Site:	Cement Kiln Dust (CKD) Landfill
Operator:	Continental Cement Company
Permit Number:	82-SDP-16-97P (Active) 82-SDP-16-97P (Closed)
Project Location:	301 East Front Street Buffalo, Iowa 52728
Certified Operator:	
Inspection Date:	
Daily Waste Volume:	
CLOSED PHASE I CELL	
Access Roads	
Drainage Structures	
Vegetation	
Monitoring Wells	
Liner Integrity	
Additional Comments	
ACTIVE PHASE II CELL	
Access Roads	
Ditches/Swales/Culverts	
Vegetation	
Monitoring Wells	
Exposed Sand	
Additional Comments	
LEACHATE CONTROL SYSTEM	
Access Roads	
Sump working	
Visible piping	
Pump	
Leachate Structures	
Solar System Performance	
Sprinkler System Performance	
Additional Comments	
COVER INTEGRITY	
Soil Cover Condition	
Stormwater Drainage	
Vegetation	
Monitoring Wells	
Additional Comments	

ADDITIONAL COMMENTS

APPENDIX D

Emergency Response and Remedial Action Plan

Emergency Response and Remedial Action Plan (ERRAP)

Continental Cement Davenport Plant CKD Landfill
301 East Front Street
Buffalo, Iowa
IDNR Landfill Permit Number 82-SDP-16-97P

Prepared for:
Continental Cement
301 East Front Street
Buffalo, Iowa 52728

Prepared by:
Blackstone Environmental, Inc.
16200 Foster Street
Overland Park, Kansas 66085

August 30, 2024

BLACKSTONE
ENVIRONMENTAL

EMERGENCY RESPONSE AND REMDIAL ACTION PLAN
CONTINENTAL CEMENT DAVENPORT PLANT CKD LANDFILL

301 EAST FRONT STREET
BUFFALO, IOWA
IDNR LANDFILL PERMIT NUMBER 82-SDP-16-97P

Prepared for:

Continental Cement
301 East Front Street
Buffalo, Iowa 52728

Prepared by:

Maren Williams

Maren Williams
Project Engineer

Reviewed by:

Kyle Kukuk, P.E.
Senior Project Manager

Blackstone Project Number: 3630

August 30, 2024

TABLE OF CONTENTS

Section **Page**

APPENDICES

1.0 FACILITY INFORMATION

Continental Cement Company, LLC (Continental) is located at 301 Front Street in Buffalo, Scott County, Iowa (Site). Quarrying and manufacturing of Portland cement products have been conducted at the Continental facility since 1924 and other uses are not anticipated in the future. The cement manufacturing process includes the heating of limestone with silica, alumina, and iron minerals to form clinker. The clinker (nodules of sintered material) is ground into a fine powder and mixed with gypsum to form cement. As part of the manufacturing process, removal of particulate is required to control the composition of the cement product. This material is known as cement kiln dust (CKD). Continental Cement Company operates an approximately 20-acre monofil for the disposal of CKD. The southern portion of the monofill has been filled to original grade and closed in general accordance with the requirements of the Iowa Department of Natural Resources (IDNR) Permit Number 82-SDP-15-96C. An active monofill disposal cell (Phase II) is operated under IDNR Permit Number 82-SDP-16-97P. The amount of CKD per day disposed at the monofill varies by day. Continental continues to operate with the overall goal of minimizing landfilled CKD and beneficially reusing material when able.

The Continental facility is located approximately four miles west of Davenport, Iowa within Sections 14,15,22, and 23, of Township 77 North, - Range 2 East (Buffalo Township), Scott County as shown on the attached Figure 1, Appendix A. The facility has been in operation, under various ownership, from 1924 for the quarrying of limestone rock and the manufacture of Portland cement. The CKD landfill is located in an inactive portion of the quarry approximately 2000 feet east of the active quarry area and comprises approximately 20 acres. A site diagram of the landfill is attached as Figure 2, Appendix A.

The Certified Operator responsible for the operation of the project is as follows:

Damion Sadd, Environmental Manager
301 East Front Street
P.O. Box 690
Buffalo, IA 52728
(563)328-6204

2.0 REGULATORY REQUIREMENTS

In accordance with Iowa Code section 455B.306(6)(d) an Emergency Response and Remedial Action Plan (ERRAP) was submitted as part of the December 27, 2021, permit renewal application. Condition X.2.h of the new permit issued by IDNR on January 6, 2022, required submission of a revised ERRAP for subsequent permit renewal applications.

3.0 EMERGENY RESPONSE AND REMEDIAL ACTION PLAN

3.1 Failure of Utilities

The landfill is utilized for the disposal of CKD, which is a byproduct manufactured at the same site. Since no utilities are located within the landfill, operations at the plant will also be affected if a failure of utilities occurs. Due to this fact, it is possible to cease operations at the landfill, if necessary, without adversely affecting CKD storage and disposal for short-term and long-term events.

3.2 Weather Related Events

Disposal operations of CKD are primarily performed during winter when tornadoes, windstorms, intense rainstorms and erosion, lightning strikes, and flooding are historically not factors. Because the landfill is utilized for the disposal of CKD, which is manufactured the same site, if weather related events occur, operations at the plant will also be affected. Due to this fact, it is possible to cease operations at the landfill, if necessary, without adversely affecting CKD storage and disposal.

3.3 Fires and Explosions

The CKD landfill is a monofil constructed and operated to dispose of CKD, a material generated through the manufacture of Portland cement. This material is created in a pyro processing system at temperatures in excess of 2600ºF. Once the material leaves the pyro processing system, it has been thoroughly fired, therefore, CKD as a landfilled material being stored, transported, unloaded, or placed cannot: Be altered by fire, support a flame, be susceptible to creating an explosion, or assist in a runaway reaction needed to generate an explosion.

There are no buildings, equipment, utilities, stored fuels, facilities, or working areas located within the landfill that can catch on fire. CKD does not break down to form methane gas, so methane gas does not accumulate in the landfill and lead to explosive atmospheres.

3.4 Regulated Waste Spills and Releases

Continental's current operation procedures were created to minimize the release of CKD to the ambient air during storage, transport, unloading, and placement of the material. These procedures include:

- After processing, CKD is stored within an enclosed structure (e.g., silo).
- During the process of loading for transport to the landfill, CKD is conditioned with water to minimize dusting during transport and placement.

- Conditioned CKD tends to agglomerate in the truck which makes it less vulnerable to spillage during transport.
- Employees operating landfill transport trucks are trained in the correct operating procedures, which include instruction regarding the amount of material suitable for one truckload. Employees are encouraged not to overfill trucks to ensure that material does not leave the truck during transport prior to unloading at the landfill.
- The time between transport and placement in the landfill is minimized to reduce drying time which could lead to wind erosion during placement.
- Employees operating landfill placement equipment are trained in the correct operating procedures, which include instruction regarding proper placement of material in the landfill. Employees are aware that CKD is not to be pushed into the bermed sides of the landfill, ensuring that all placed material is well contained withing the landfill bed.
- The landfill is inspected weekly to ensure that CKD is not being released to the surface water including the quarry sump and that the CKD is well within the bermed area so that releases do not occur during storm events.
- A four-foot clay liner compacted to 1x10-7 cm/sec is in place underlying the CKD material to prevent releases to the groundwater.
- Monthly water level monitoring and semi-annual sampling is conducted to monitor for CKD release to the groundwater utilizing wells located both inside and outside of the landfill.

3.5 Hazardous Material Spills and Releases

The CKD landfill is a monofil constructed and operated to dispose of CKD, a material generated through the manufacturing of Portland cement. This material is created in a pyro processing system at temperatures in excess of 2600ºF. Once the material leaves the pyro processing system, it has been thoroughly fired. Only CKD, a non-hazardous solid waste, is disposed of at the facility. Except for small quantities of fuels, oils, and other materials contained in transport vehicles and earth moving equipment, hazardous materials are not stored, used, or disposed of at the landfill site.

3.6 Mass Movement of Land and Waste

Due to the cementitious nature of the conditioned CKD, the material tends to bind together when placed at the landfill forming a relatively uniform and solid deposit. The material is able to stand at a relatively steep angle of repose with negligible risk of slumping or slope failure. Further, the material is relatively impervious thereby reducing the likelihood of saturation which could reduce the shear strength and lead to slope instability.

Employees with duties associated with the storage, handling, transport, or disposal of CKD are trained to place CKD in a manner which will reduce the likelihood of slope failures, waste shifts, and waste subsidence. Transport vehicle drivers are instructed to place material at a safe distance back from the edge of the active cell to avoid surcharging the edge of the cell. Accumulated material is periodically pushed into the active cell with earthmoving equipment. The landfill is also inspected weekly so that situations which would lead to mass movement of waste are avoided or quickly corrected.

3.7 Emergency and Release Notifications and Reporting

CKD, a non-hazardous material generated through the manufacturing of Portland cement, is not subject to release notification and reporting requirements. If releases of fuel, oils, or other materials occur from the transport vehicle or excavating equipment, Continental will provide proper notification to the IDNR and/or the United States Environmental Protection Agency in accordance with applicable requirements.

Due to the cementitious nature of the CKD material, windblown emissions from the face of the landfill or CKD piles are negligible. Further, the runoff from the exposed material is directed into the lined portion of the active cell allowing suspended sediment to settle out on site. The small quantities of fuel, oils, and other materials contained in transport vehicles or excavating equipment, if released, would likely be absorbed by surficial materials at the site. The likelihood of a release of materials affecting off-site properties is negligible. As such, notification to the city and county agencies, news media, or special populations will not be required.

3.8 Emergency Waste Management Procedures

Since the landfill is utilized for the disposal of CKD, which is manufactured at the same site, operations at the plant will also be affected. Due to this fact, it is possible to cease operations at the landfill, if necessary, without adversely affecting CKD storage and disposal for long-term emergency events. In case of a short-term emergency, CKD is stored in a silo at the plant site. Hauling of CKD can be temporarily discontinued until the emergency is resolved.

3.9 Primary Emergency Equipment Inventory

The landfill is staffed only during CKD unloading activities or while shaping and/or capping placed CKD material. The actual time on-site is less than 25 hours per month. Further, combustible materials are not stored, used, or disposed of at the site. As such, emergency equipment is not maintained at the site and water sources/hydrants are not located at the site. In the event of an emergency, equipment resources would be provided by the City of Buffalo, Iowa and/or Scott County.

3.10 Emergency Aid

In the event of an emergency requiring aid, local authorities will be contacted.

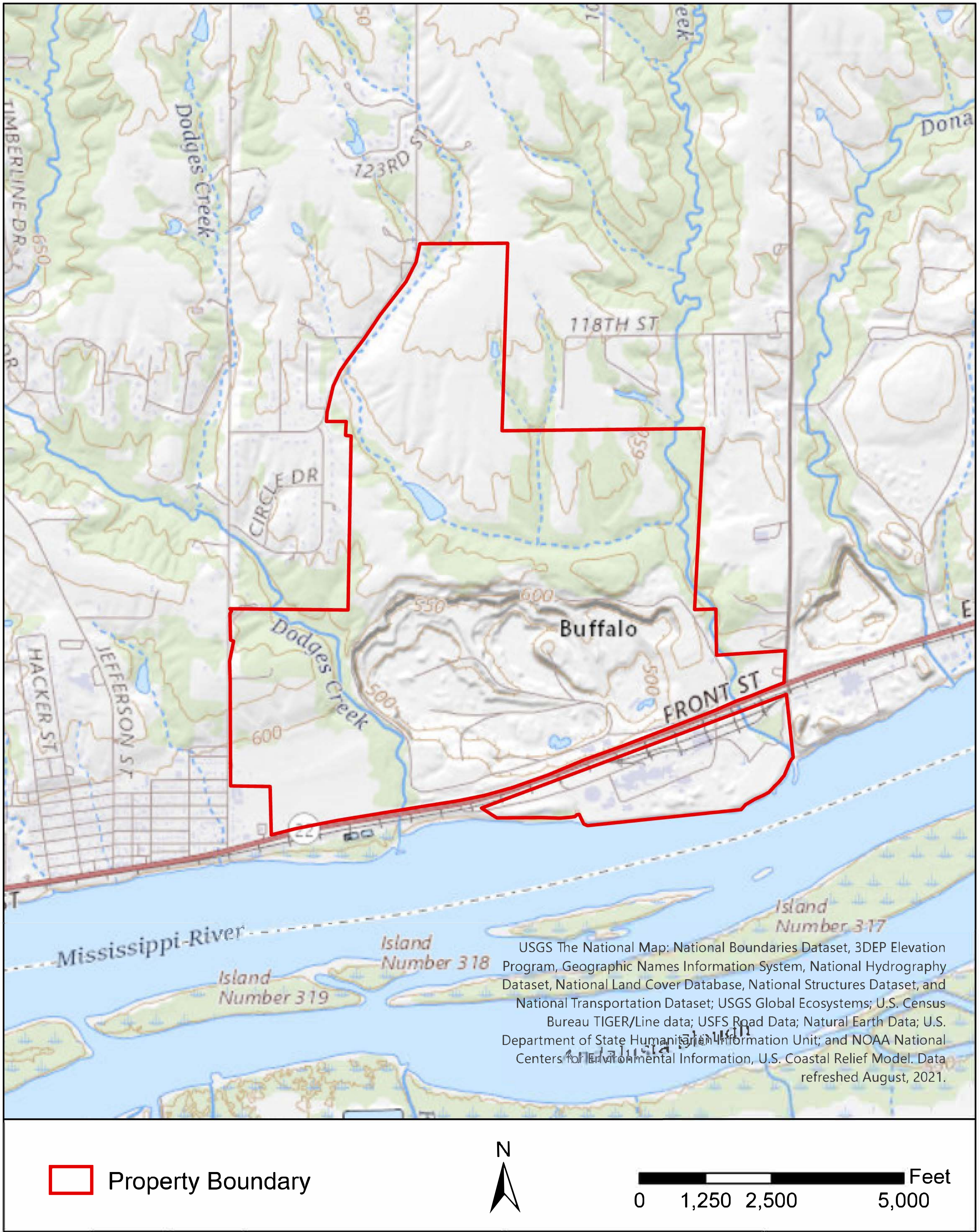
3.11 Training

Employees operating landfill transport trucks and/or landfill placement equipment will be trained on the provisions of the ERRAP along with correct operating procedures. Training will be provided by the Environmental Manager or their designee. Training will be conducted for employee's first-time assignment to duties associated with the storage, handling, transport, or disposal of CKD and periodically thereafter in conjunction with modifications to the ERRAP or issuance of an updated landfill operating permit. Training will be documented in accordance with Continental procedures.

APPENDIX A

Figures

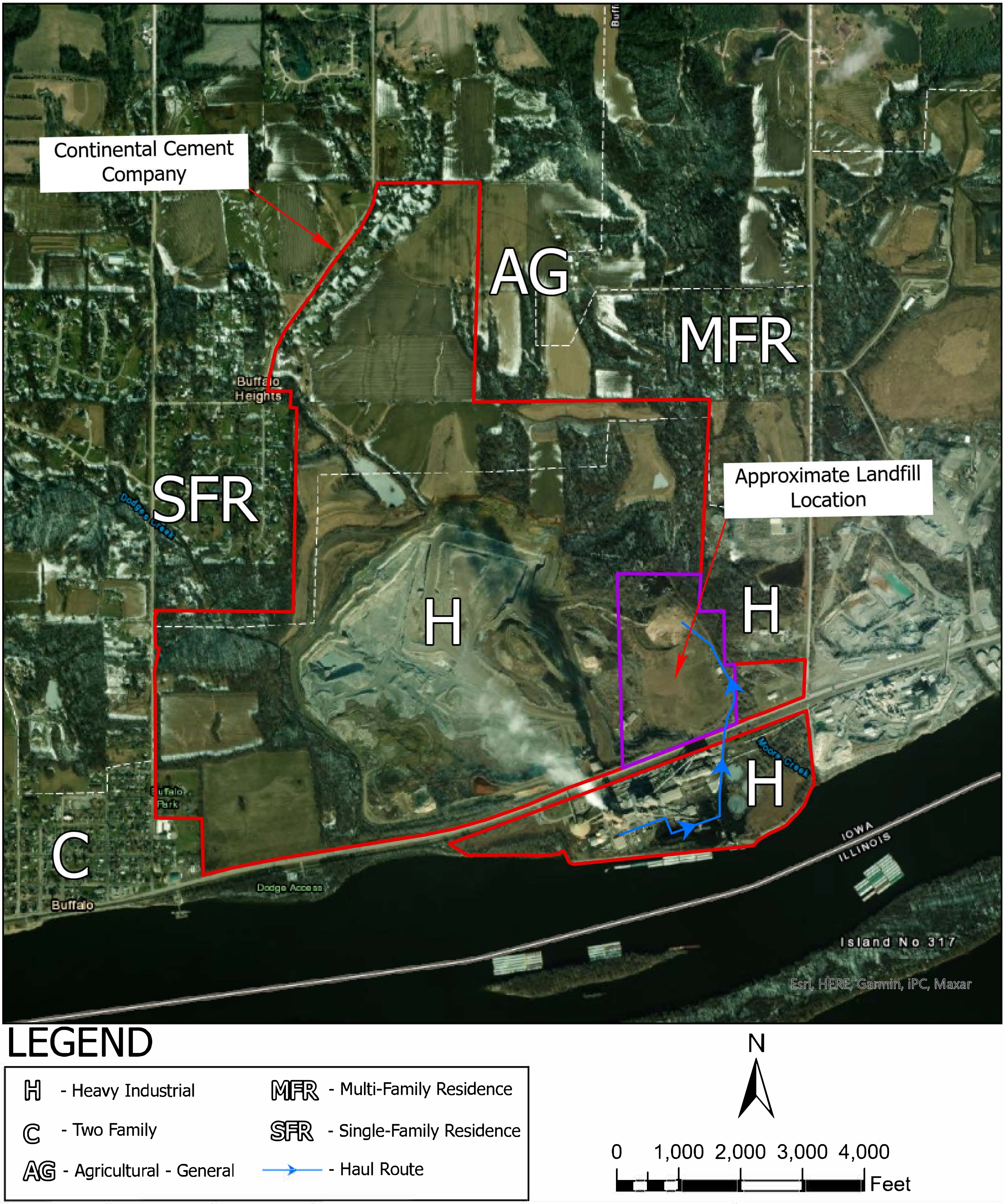
Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental



USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed August, 2021.

FIGURE 1	Project Mgr. KK	Date: June 2024	CONTINENTAL CEMENT BUFFALO, IOWA	SHEET NAME Site Topographic Vicinity Map	BLACKSTONE ENVIRONMENTAL
	Designed By: TS	Rev.:		PROJECT NAME Continental Cement Permit Renewal	
	Drawn By: TS	Rev.:		PROJECT LOCATION 301 East Front Street Buffalo, Iowa	
	Checked By: LJ	Rev.:			
	Job No.: 3630	Rev.:			

Path: Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental\Continental.aprx



FIGURE

2

Project Mgr. KK

Designed By: ME

Drawn By: ME

Checked by: KB

Job No.: 3630

Date: June 2024

Rev.:

Rev.:

Rev.:

Rev.:

BLACKSTONE ENVIRONMENTAL

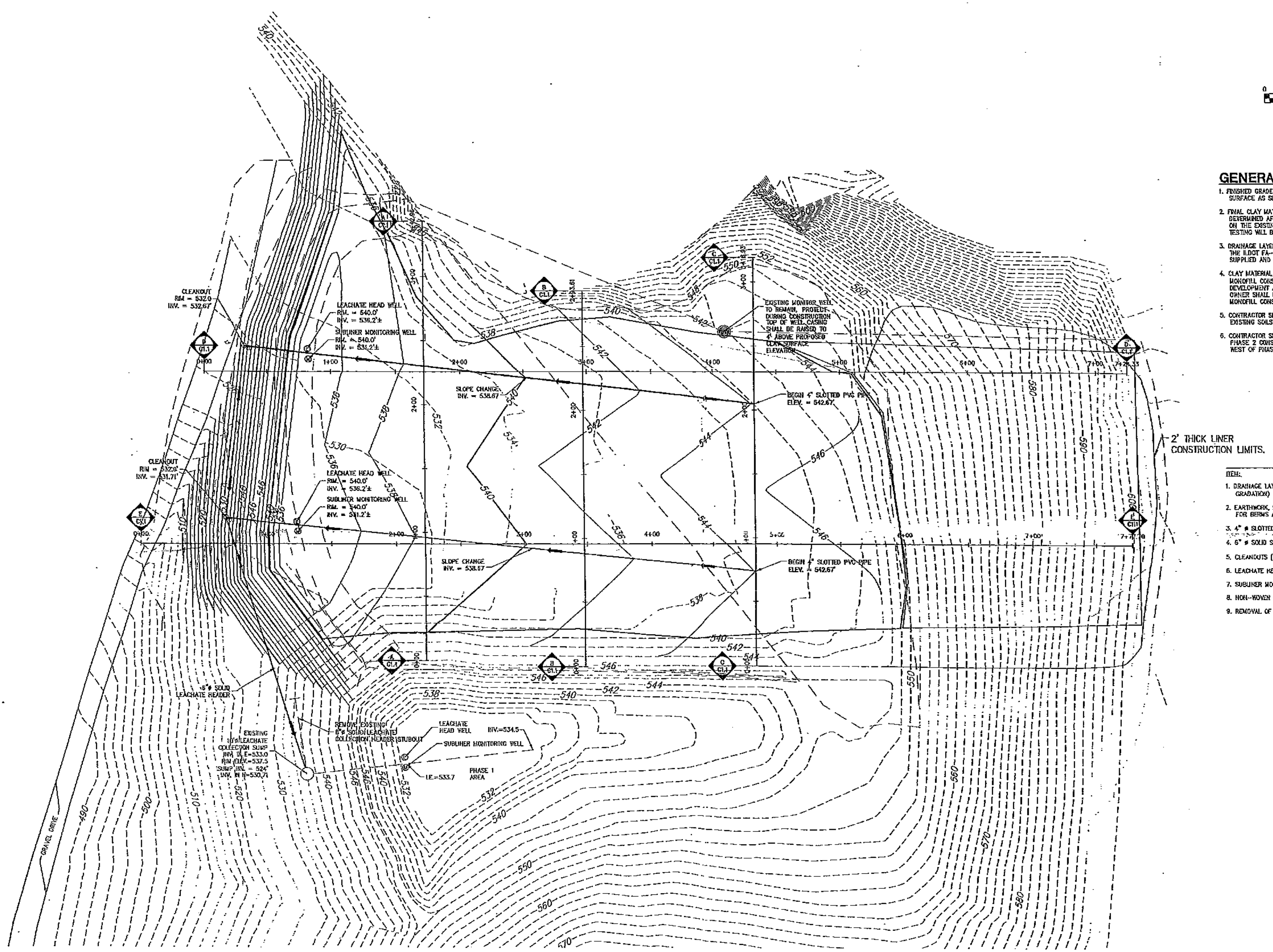
CLIENT NAME
Continental Cement

SHEET NAME
Permit Renewal

PROJECT NAME AND LOCATION
Site Operations Plan, Buffalo, IA

APPENDIX E

Facility Development Drawings



0 20 40 80
SCALE IN FEET

GENERAL NOTES:

1. FINISHED GRADE CONTOURS ARE TO TOP OF CLAY LAYER SURFACE AS SHOWN ON SHEET C5.1.
2. FINAL CLAY MATERIAL COMPACTING REQUIREMENTS WILL BE DETERMINED AFTER PERMEABILITY TESTS HAVE BEEN COMPLETED ON THE EXISTING CLAY MATERIAL. PERMEABILITY AND COMPACTION TESTING WILL BE PROVIDED BY THE OWNER.
3. DRAINAGE LAYERS SHALL BE CONSTRUCTED OUT OF MATERIAL MEETING THE ILDOT FA-1 GRADATION. DRAINAGE LAYER MATERIAL SHALL BE SUPPLIED AND PLACED BY THE CONTRACTOR.
4. CLAY MATERIAL WILL BE PROVIDED BY THE OWNER. MATERIAL USED FOR MONOFILL CONSTRUCTION IS LOCATED LESS THAN 2000' AWAY FROM THE DEVELOPMENT AREA. CONTRACTOR SHALL EXCAVATE AND TRANSPORT MATERIAL. OWNER SHALL DIRECT CONTRACTOR REGARDING MATERIAL TO BE USED FOR MONOFILL CONSTRUCTION.
5. CONTRACTOR SHALL STRIP VEGETATION AND SCARIFY AND COMPACT EXISTING SOILS PRIOR TO ANY EARTHWORK.
6. CONTRACTOR SHALL REMOVE MONOFILL ACCESS ROAD AS REQUIRED FOR PHASE 2 CONSTRUCTION. PLACE ROCK MATERIAL IN STOCKPILE AREA DIRECTLY WEST OF PHASE 2 DEVELOPMENT AREA.

QUANTITIES:

ITEM:	UNITS	QUANTITY:
1. DRAINAGE LAYERS (ILDOT FA-1 GRADATION)	TONS	13,300
2. EARTHWORK, INCLUDES ALL CLAY FOR BERMS AND LINERS	C.Y.	32,500
3. 4" ø SLOTTED SCHEDULE 80 PVC PIPE	L.F.	808
4. 6" ø SOLID SCHEDULE 80 PVC PIPE	L.F.	340
5. CLEANOUTS (SCHEDULE 80 PVC)	EA	2
6. LEACHATE HEAD WELL	EA	2
7. SUBLINER MONITORING WELL	EA	2
8. NON-WOVEN GEOTEXTILE	S.Y.	720
9. REMOVAL OF EXISTING ACCESS ROAD	LS	1

SDP AMENDMENT # 1
Date: July 1, 2003

PLANS AND SPECIFICATIONS
APPURTENANT TO
PERMIT FOR SANITARY DISPOSAL PROJECT
NO. 82-SDP-16-97P
DATED August 27, 2001
IOWA DEPARTMENT OF
NATURAL RESOURCES
ENVIRONMENTAL SERVICES DIVISION
By Nina M. Koger

LICENSED PROFESSIONAL ENGINEER
MYRON K.
SCHEIBE
8807
IOWA

ONLY THESE COPIES OF THIS DOCUMENT SIGNED IN CONTRASTING INK COLOR ARE TO BE CONSIDERED CERTIFIED OFFICIAL COPIES PER IOWA ADMINISTRATION CODE 193C-1.5D

I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT DESCRIBED BELOW 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 IOWA.

SIGNATURE: My Scheibe
NAME: MYRON K. SCHEIBE
DATE: 10-9-02
MY LICENSE RENEWAL DATE IS: DECEMBER 31, 2003
PAGES, SHEETS OR DIVISIONS COVERED BY THIS SEAL: C1.1
C5.1, C7.1

SHIVE-HATTERY
Cedar Rapids, IA · Iowa City, IA · Des Moines, IA
Moline, IL · Bloomington, IL · Chicago, IL
SHIVE-HATTERY, INC. 1830 SIXTH AVENUE MOLINE, ILLINOIS 61265
PHONE (309) 764-7650 FAX (309) 764-8616

CKD MONOFILL PHASE 2 CONSTRUCTION

LAFARGE
BUFFALO, IA

REVISIONS
REV. NO.
APPROVED DATE
REV. NO.
APPROVED DATE
REV. NO.
APPROVED DATE

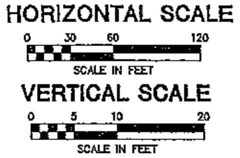
DRAWN CPT / BKR
APPROVED
ISSUED FOR BIDDING
DATE 5-2-01
FIELD BOOK 355

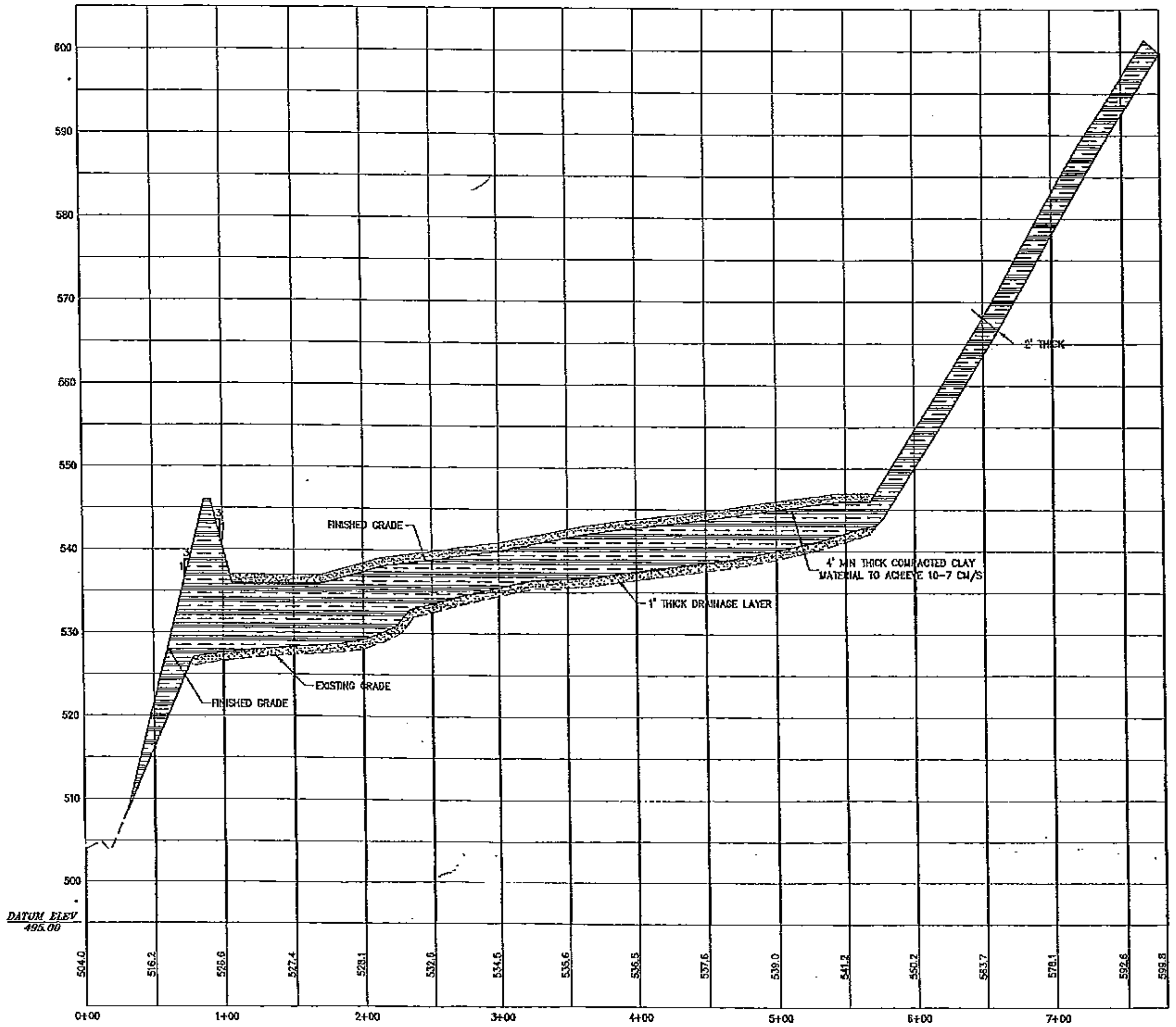
SHEET NAME
SITE PLAN AND GRADING PLAN

PROJECT NO. 398318-3

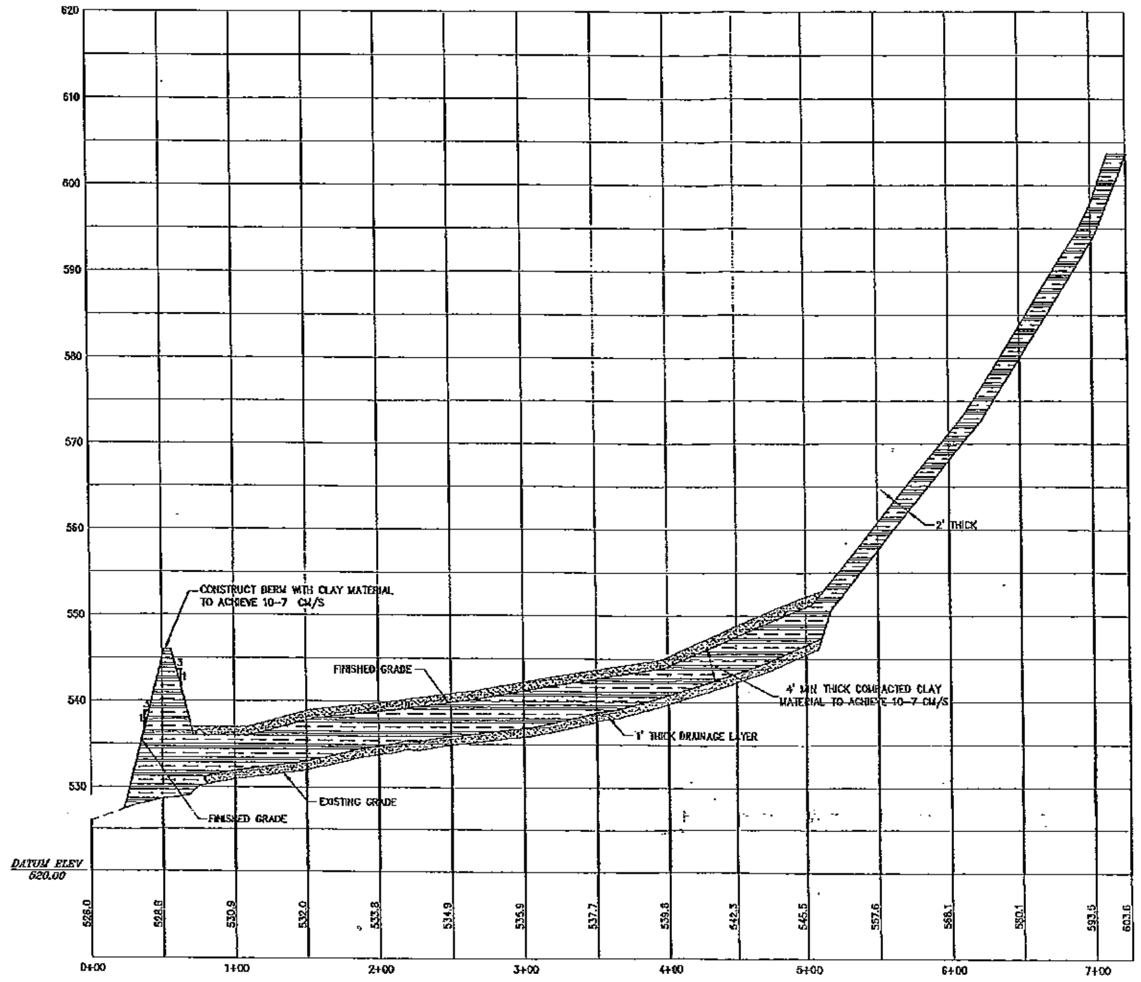
SHEET NO.
C1.1

Andreo | P:\PROJECTS\398318-3\DWG\XR-MP-01A.DWG | DATE: 05/21/2001 | Time: 14:17 |

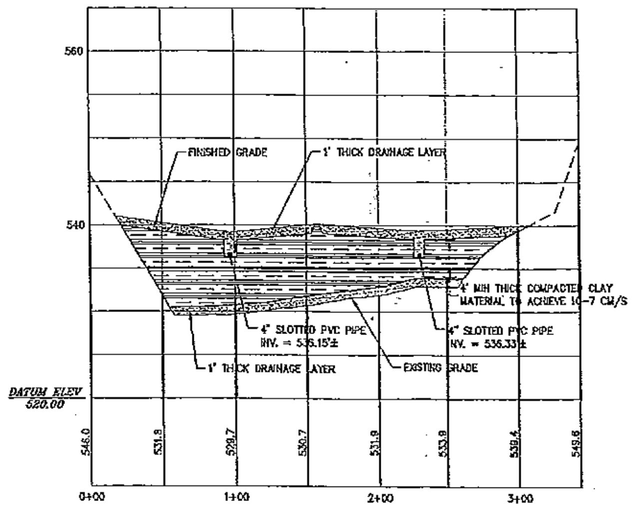




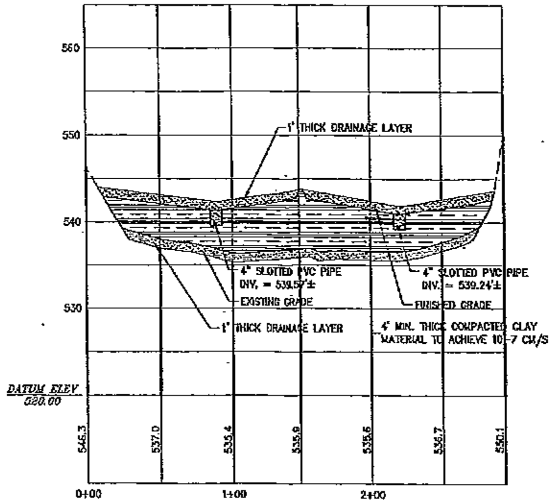
SECTION E-E



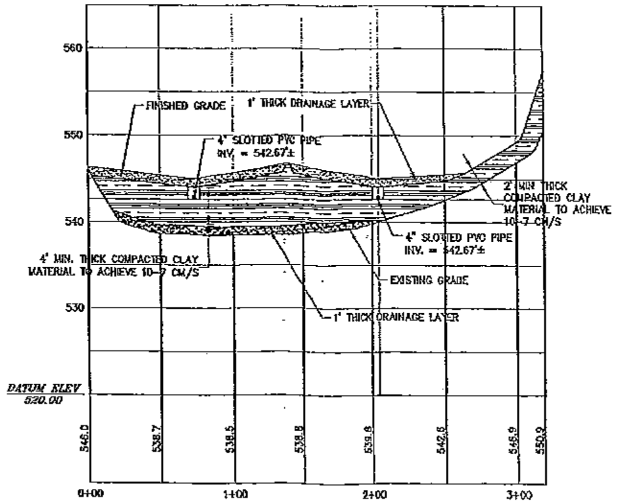
SECTION D-D



SECTION A-A



SECTION B-B



SECTION C-C

SHIVE HATTERY
Cedar Rapids, IA · Iowa City, IA · Des Moines, IA
Moline, IL · Bloomington, IL · Chicago, IL
SHIVE-HATTERY, INC. 1830 SIXTH AVENUE MOLINE, ILLINOIS 61265
PHONE (309) 764-7650 FAX (309) 764-8516

CKD MONOFILL PHASE 2
CONSTRUCTION

LAFARGE
BUFFALO, IA

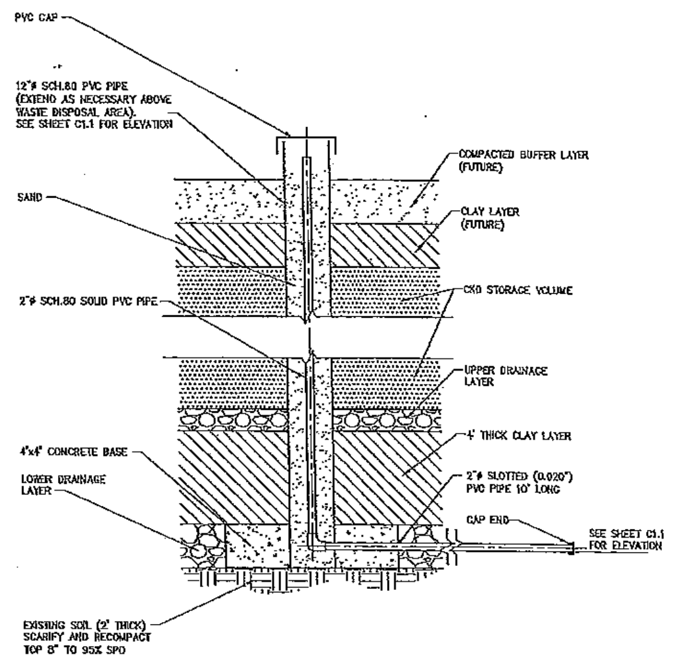
REVISIONS
REV. NO.
APPROVED DATE
REV. NO.
APPROVED DATE
REV. NO.
APPROVED DATE

DRAWN CPT
APPROVED
ISSUED FOR BIDDING
DATE 5-2-01
FIELD BOOK 355

SHEET NAME
CROSS SECTIONS

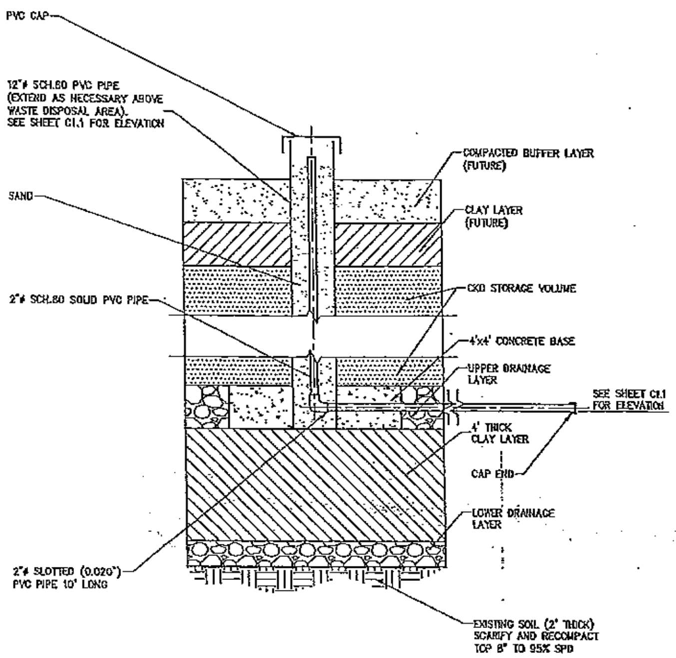
PROJECT NO. 398318-3
SHEET NO.
C5.1

| JMEDN | P:\Projects\398318-3\dwg\XR-MP-BID.DWG | DATE: 09/11/2002 | Time: 10:41 |



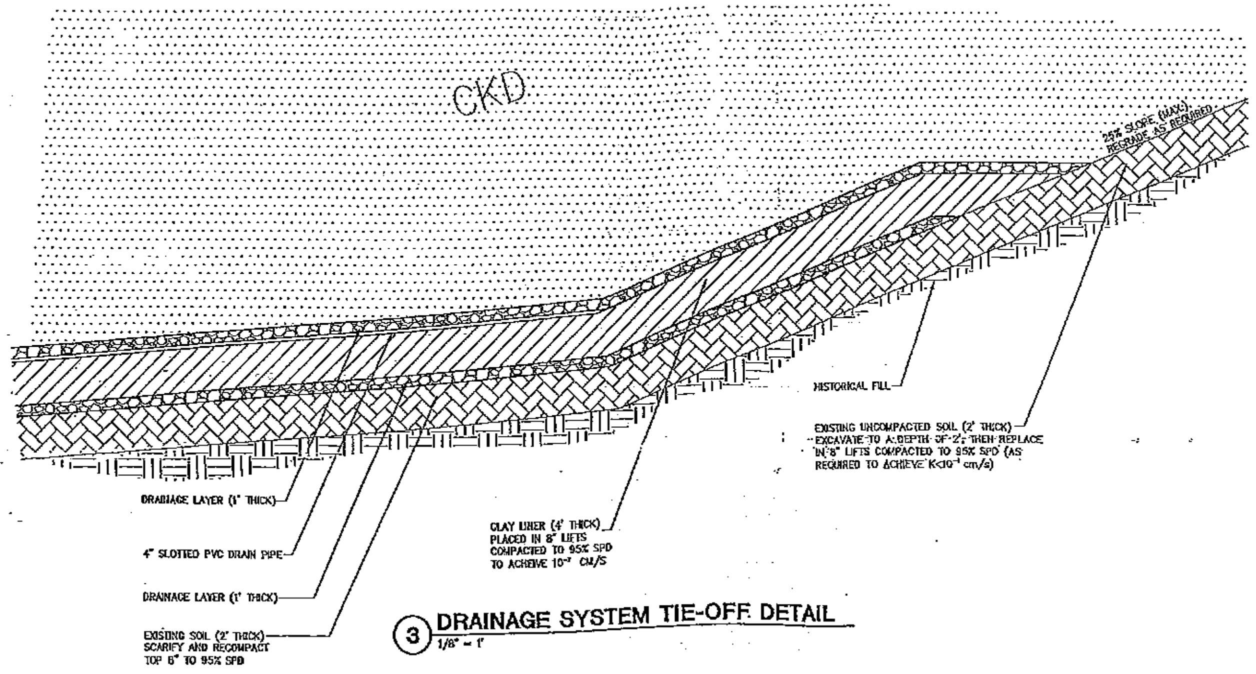
① SUBLINER MONITORING WELL DETAIL

1/2" = 1'



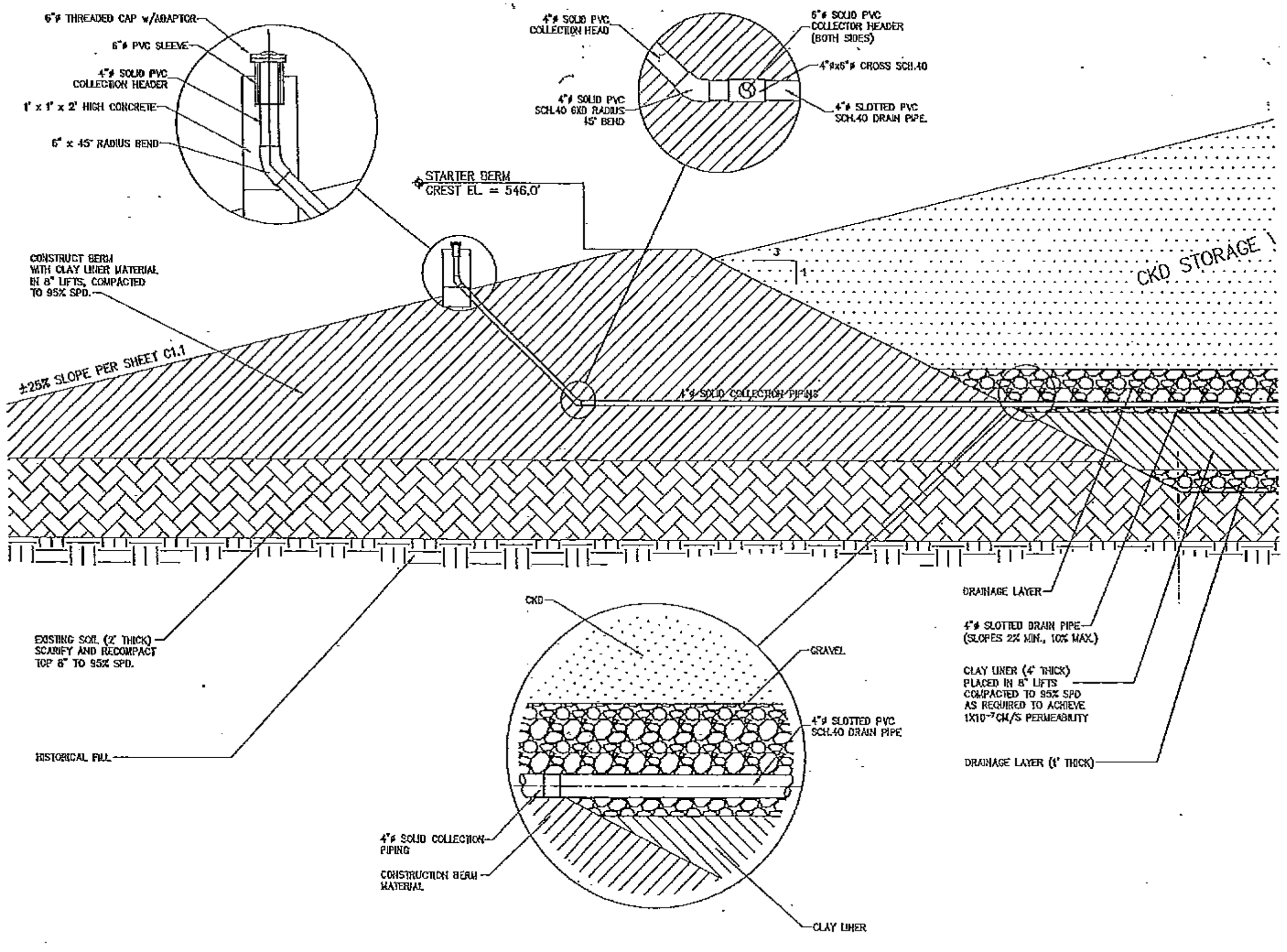
② LEACHATE HEAD WELL DETAIL

1/2" = 1'



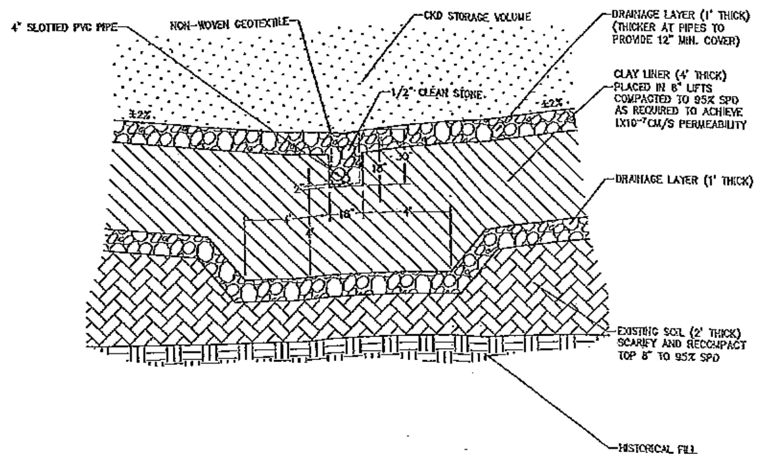
③ DRAINAGE SYSTEM TIE-OFF DETAIL

1/8" = 1'



④ CLEANOUT DETAIL & COLLECTION TRENCH PROFILE

NOT TO SCALE



⑤ TYPICAL COLLECTION TRENCH SECTION

1/4" = 1'

XReference Files: | bionro | P:\PROJECTS\398318-3\DWG\CD-C7016.DWG | DATE: 04/16/2001 | Time: 10:17 |

SHIVE HATTERY
Cedar Rapids, IA · Iowa City, IA · Des Moines, IA
Moline, IL · Bloomington, IL · Chicago, IL
SHIVE-HATTERY, INC. 1830 SIXTH AVENUE MOLINE, ILLINOIS 61265
PHONE (309) 764-7650 FAX (309) 764-8815

CKD MONOFILL PHASE 2 CONSTRUCTION

LAFARGE
BUFFALO, IA

REVISIONS
REV. NO.
APPROVED DATE
REV. NO.
APPROVED DATE
REV. NO.
APPROVED DATE

DRAWN CPT / BKR
APPROVED
ISSUED FOR BIDDING
DATE 5-2-01
FIELD BOOK 360

SHEET NAME
DETAILS

PROJECT NO. 398318-3
SHEET NO.
C7.1

File: D:\CC Closing Drawings

DRAWING INDEX

DRAWING NO.	TITLE
0	COVER SHEET
1	EXISTING CONDITIONS
2	FINAL COVER PLAN
3	CROSS-SECTIONS
4	DETAILS

CLOSURE DRAWINGS

CONTINENTAL CEMENT CKD MONOFILL
SCOTT COUNTY, IOWA
IOWA LANDFILL PERMIT NO. 82-SDP-16-97P
MAY 2022

PREPARED FOR:

CONTINENTAL CEMENT

CONTINENTAL CEMENT
301 EAST FRONT STREET
BUFFALO, IA 52728

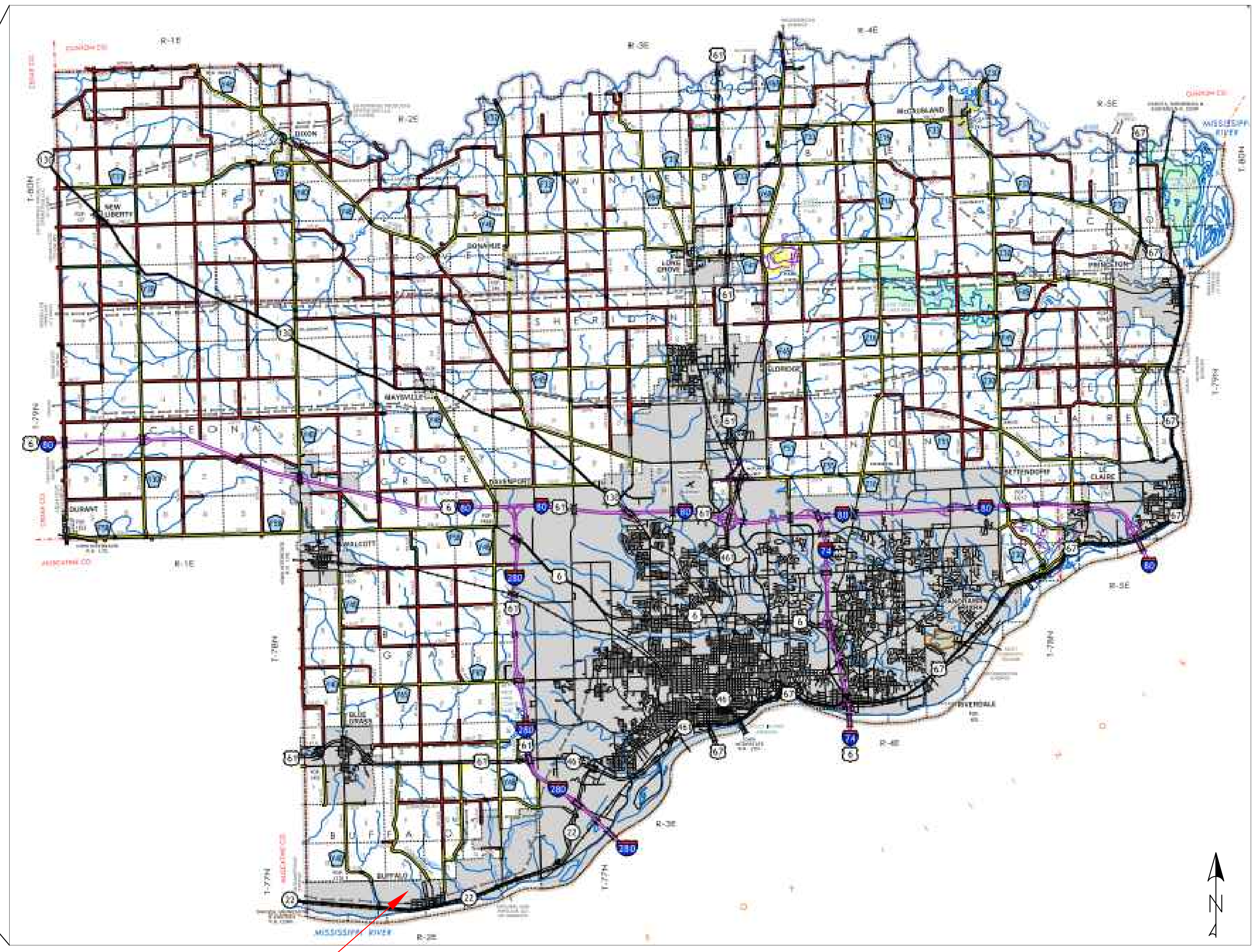
PREPARED BY:

BLACKSTONE ENVIRONMENTAL

1465 41ST STREET, SUITE 13
MOLINE, ILLINOIS 61265

PROJECT NO. 3251
MAY 2022

IOWA



VICINITY MAP

CONTINENTAL CEMENT
MONOFILL

ERIC SONSTHAGEN
P24844

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 IOWA.

Eric Sonsthagen May 31, 2022

SIGNATURE DATE

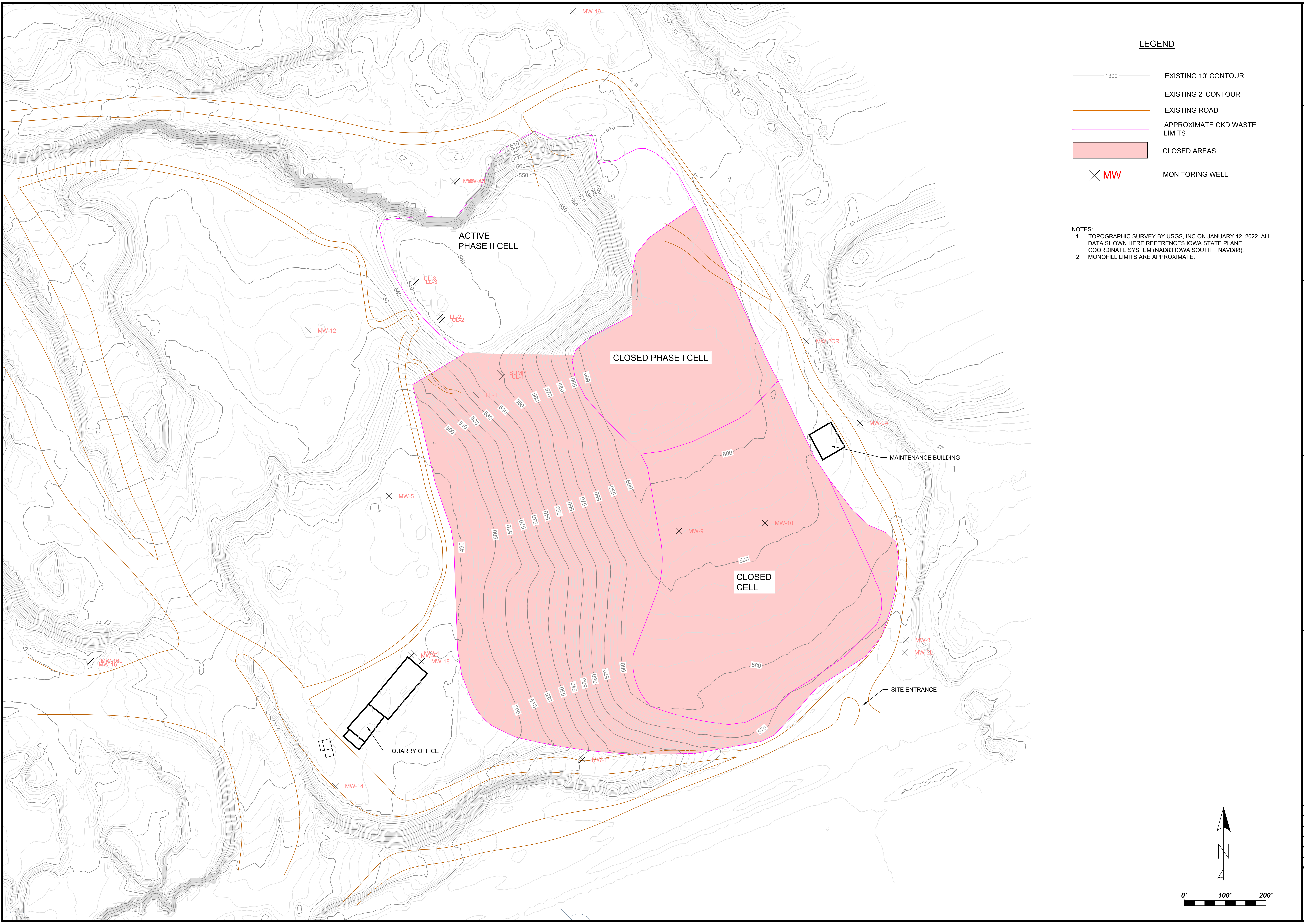
ERIC SONSTHAGEN
LICENSE NUMBER: P24844
MY LICENSE RENEWAL DATE IS
DECEMBER 31, 2023

PAGES OR SHEETS COVERED BY THIS SEAL:

SHEETS 0-4

PLAN DRAWINGS - NOT FOR CONSTRUCTION

File: D:\CC Closing Drawings



LEGEND

——— 1300 ———	EXISTING 10' CONTOUR
———	EXISTING 2' CONTOUR
———	EXISTING ROAD
———	APPROXIMATE CKD WASTE LIMITS
🟥	CLOSED AREAS
✕ MW	MONITORING WELL

NOTES:
1. TOPOGRAPHIC SURVEY BY USGS, INC ON JANUARY 12, 2022. ALL DATA SHOWN HERE REFERENCES IOWA STATE PLANE COORDINATE SYSTEM (NAD83 IOWA SOUTH + NAVD88).
2. MONOFILL LIMITS ARE APPROXIMATE.

BY	DESCRIPTION	DATE

SHEET NAME
EXISTING CONDITIONS

PROJECT NAME
CLOSURE DRAWINGS

PROJECT LOCATION
CONTINETAL CEMENT

CLIENT
CONTINENTAL CEMENT

BLACKSTONE ENVIRONMENTAL

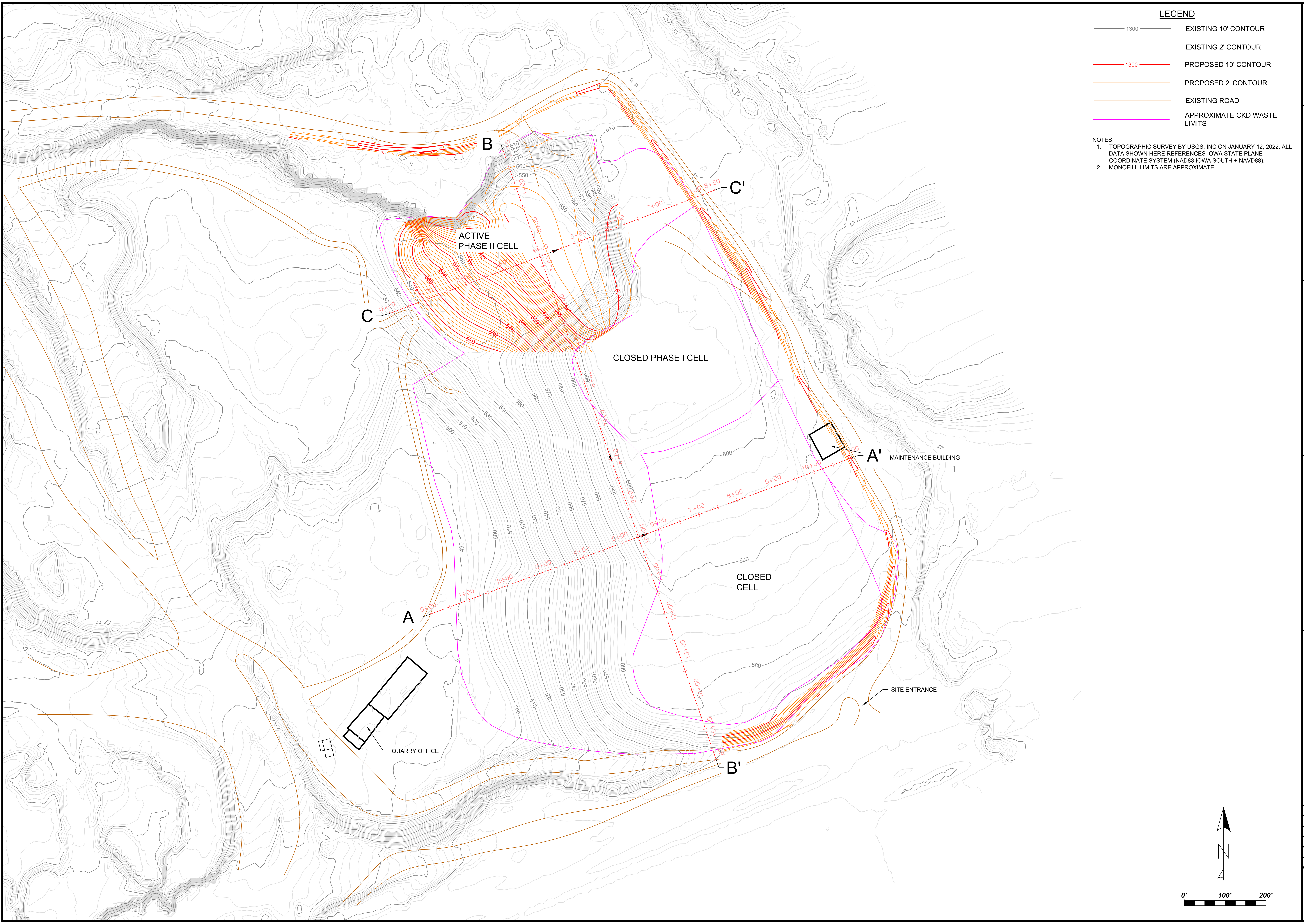
BLACKSTONE ENVIRONMENTAL, INC.
1465 41ST STREET, SUITE 13
MOLINE, IL 61265
P: 913-495-9990 F: 913-648-2077

PROJ. MGR: EMS
DESIGNED BY: DN
DRAWN BY: DN
CHECKED BY: EMS
JOB NO.: 3251
DATE: 5.26.2022

SHEET
1

PLAN DRAWINGS - NOT FOR CONSTRUCTION

File: D:\CC Closing Drawings



LEGEND

—— 1300 ——	EXISTING 10' CONTOUR
————	EXISTING 2' CONTOUR
—— 1300 ——	PROPOSED 10' CONTOUR
————	PROPOSED 2' CONTOUR
————	EXISTING ROAD
————	APPROXIMATE CKD WASTE LIMITS

NOTES:

1. TOPOGRAPHIC SURVEY BY USGS, INC ON JANUARY 12, 2022. ALL DATA SHOWN HERE REFERENCES IOWA STATE PLANE COORDINATE SYSTEM (NAD83 IOWA SOUTH + NAVD88).
2. MONOFILL LIMITS ARE APPROXIMATE.

DATE	DESCRIPTION	BY

SHEET NAME
FINAL COVER PLAN

PROJECT NAME
CLOSURE DRAWINGS

PROJECT LOCATION
CONTINETAL CEMENT

CLIENT
CONTINENTAL CEMENT

BLACKSTONE ENVIRONMENTAL

BLACKSTONE ENVIRONMENTAL, INC.
1465 41ST STREET, SUITE 13
MOLINE, IL 61265
P: 913-495-9990 F: 913-648-2077

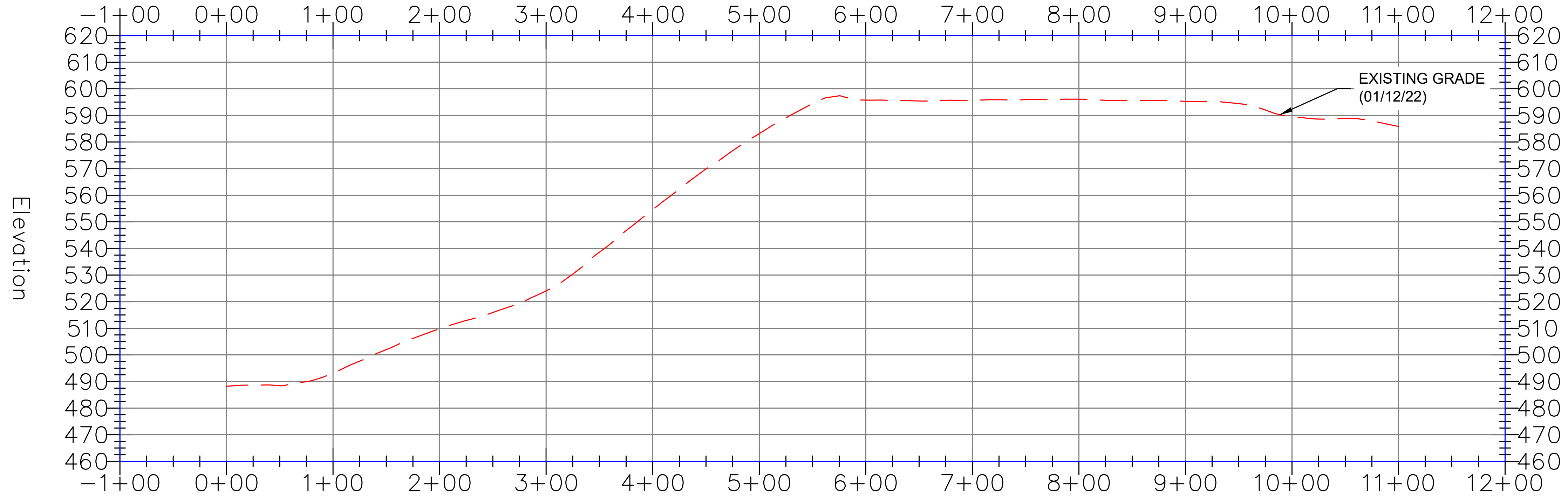
PROJ. MGR: EMS
DESIGNED BY: DN
DRAWN BY: DN
CHECKED BY: EMS
JOB NO.: 3251
DATE: 5.26.2022

SHEET
2

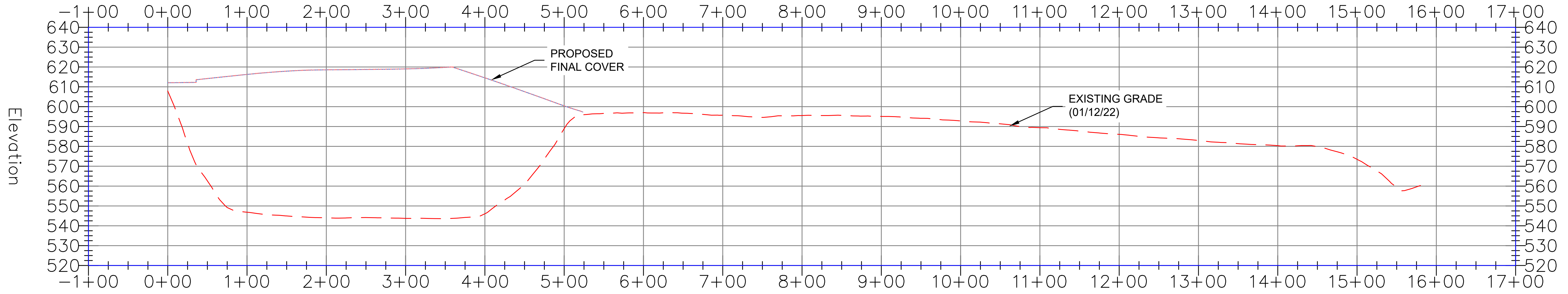
PLAN DRAWINGS - NOT FOR CONSTRUCTION

File: D:\CC Closing Drawings

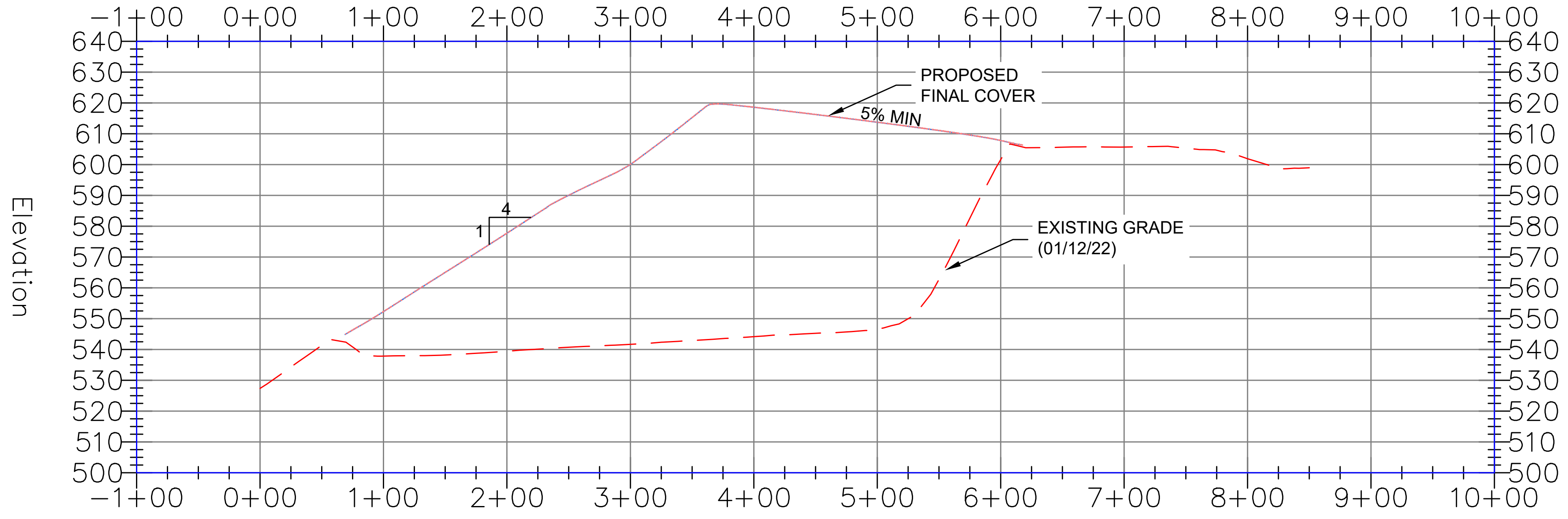
A–A' PROFILE

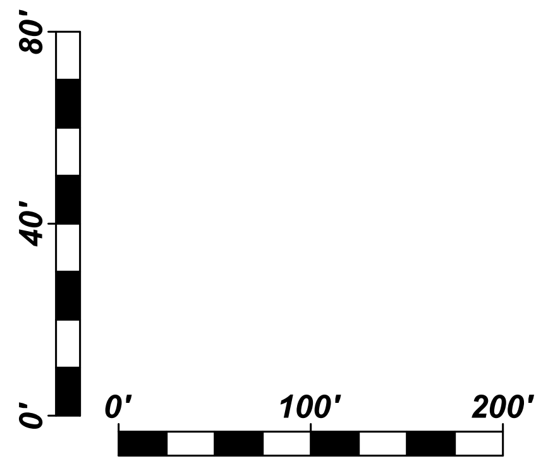


B–B' PROFILE



C–C' PROFILE





DATE	DESCRIPTION	BY

SHEET NAME
CROSS-SECTIONS

PROJECT NAME
CLOSURE DRAWINGS

PROJECT LOCATION
CONTINETAL CEMENT

CLIENT
CONTINENTAL CEMENT

BLACKSTONE ENVIRONMENTAL

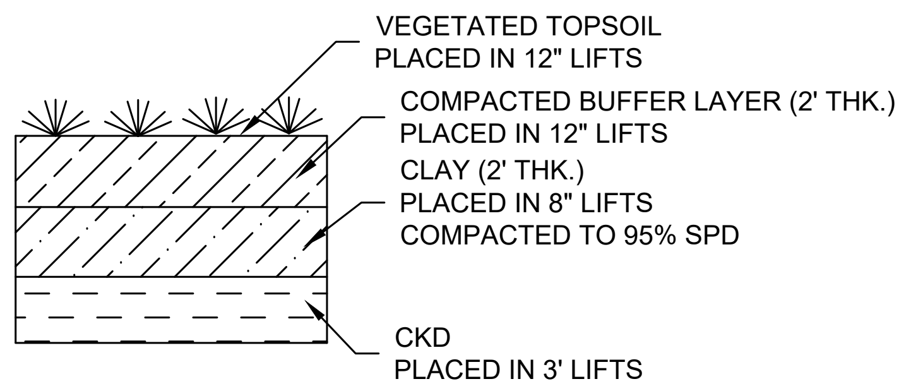
BLACKSTONE ENVIRONMENTAL, INC.
1465 41ST STREET, SUITE 13
MOLINE, IL 61265
P: 913-495-9990 F: 913-648-2077

PROJ. MGR: EMS
DESIGNED BY: DN
DRAWN BY: DN
CHECKED BY: EMS
JOB NO.: 3251
DATE: 5.26.2022

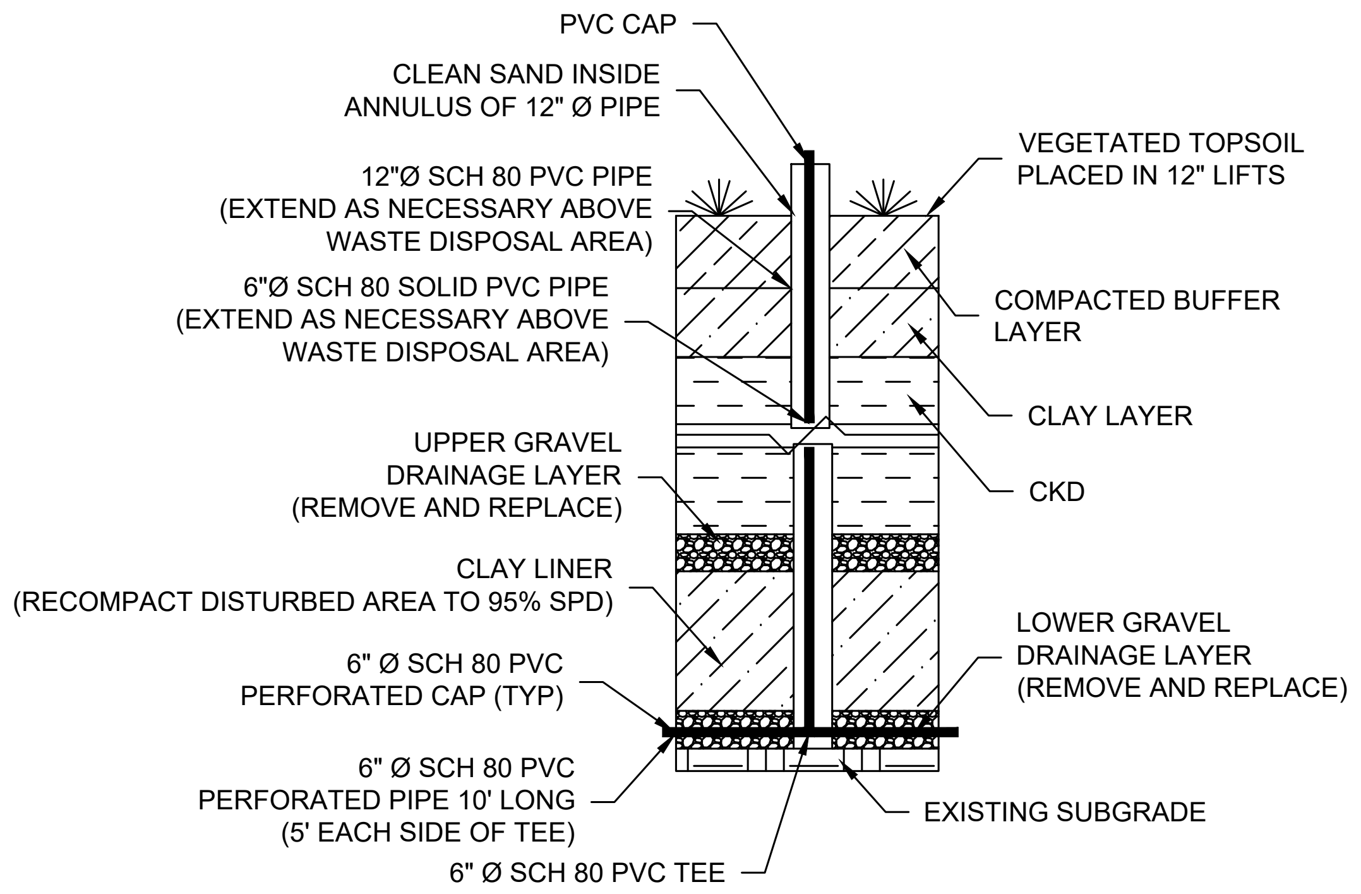
SHEET
3

PLAN DRAWINGS - NOT FOR CONSTRUCTION

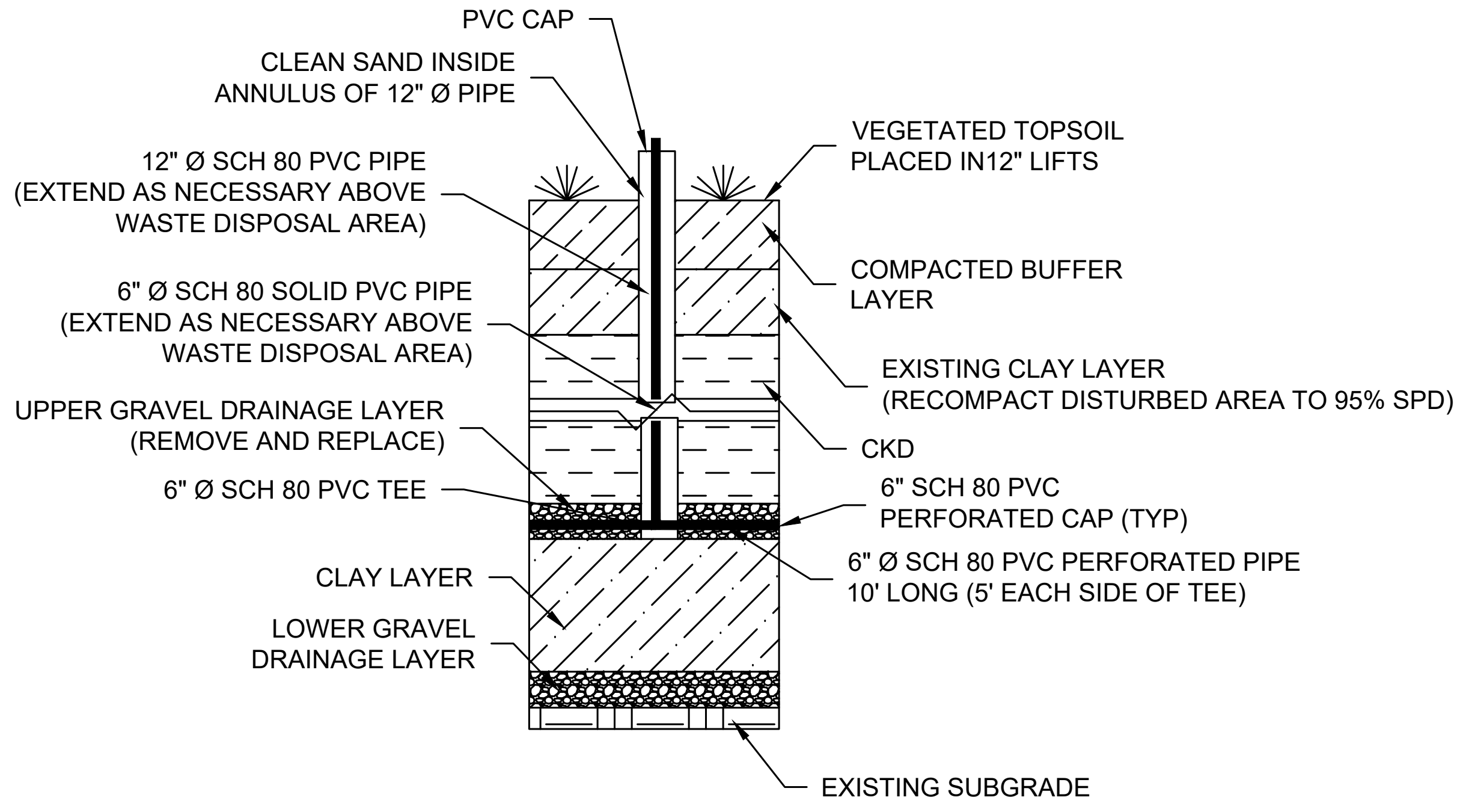
File: D:\CC Closing Drawings



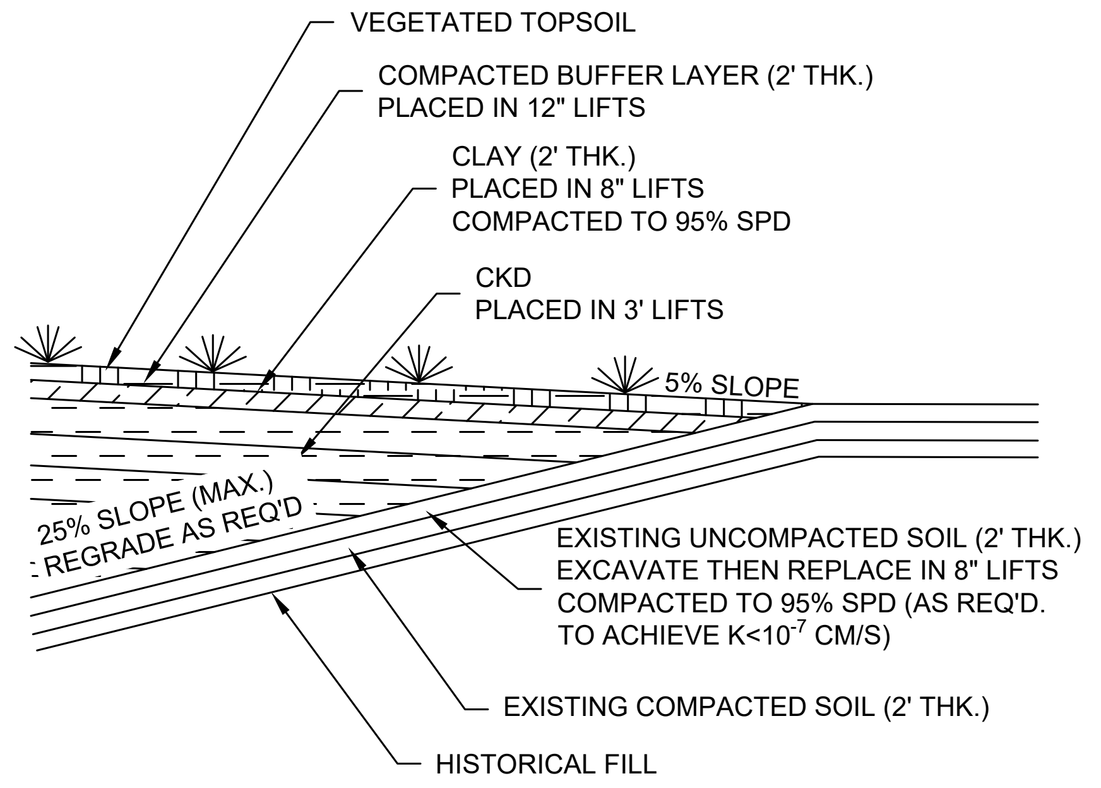
1/4 FINAL COVER DETAIL
NOT TO SCALE



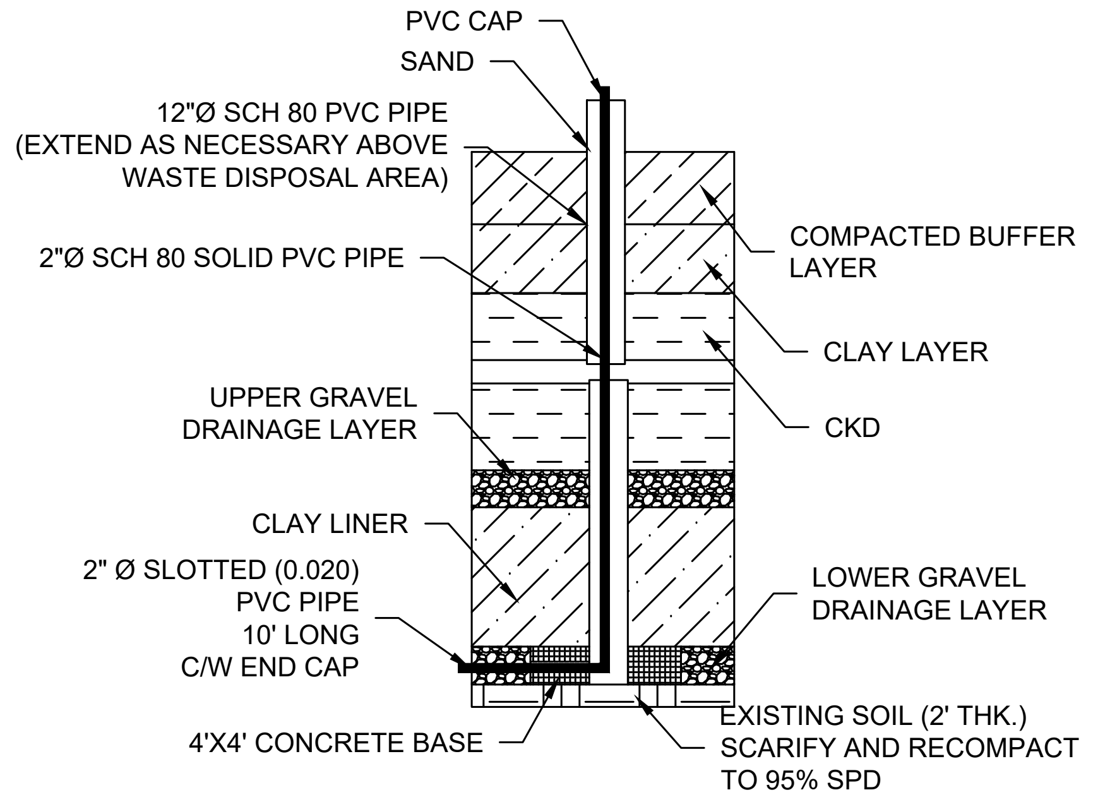
2/4 REPLACEMENT SUBLINER MONITORING WELL
NOT TO SCALE



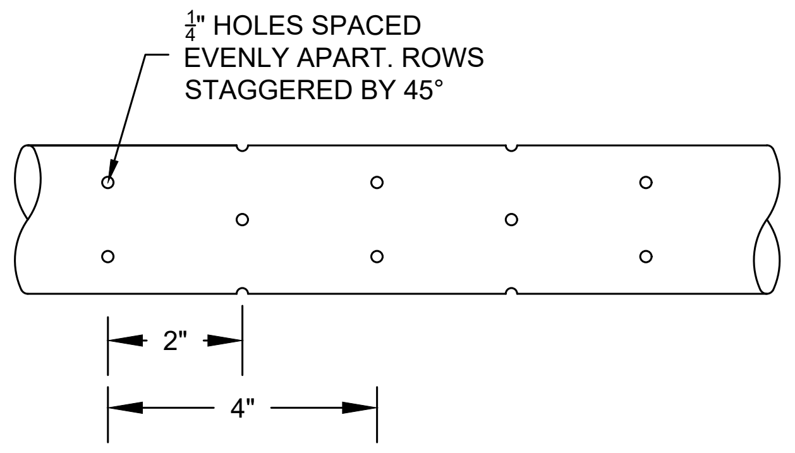
3/4 REPLACEMENT LEACHATE HEAD WELL DETAIL
NOT TO SCALE



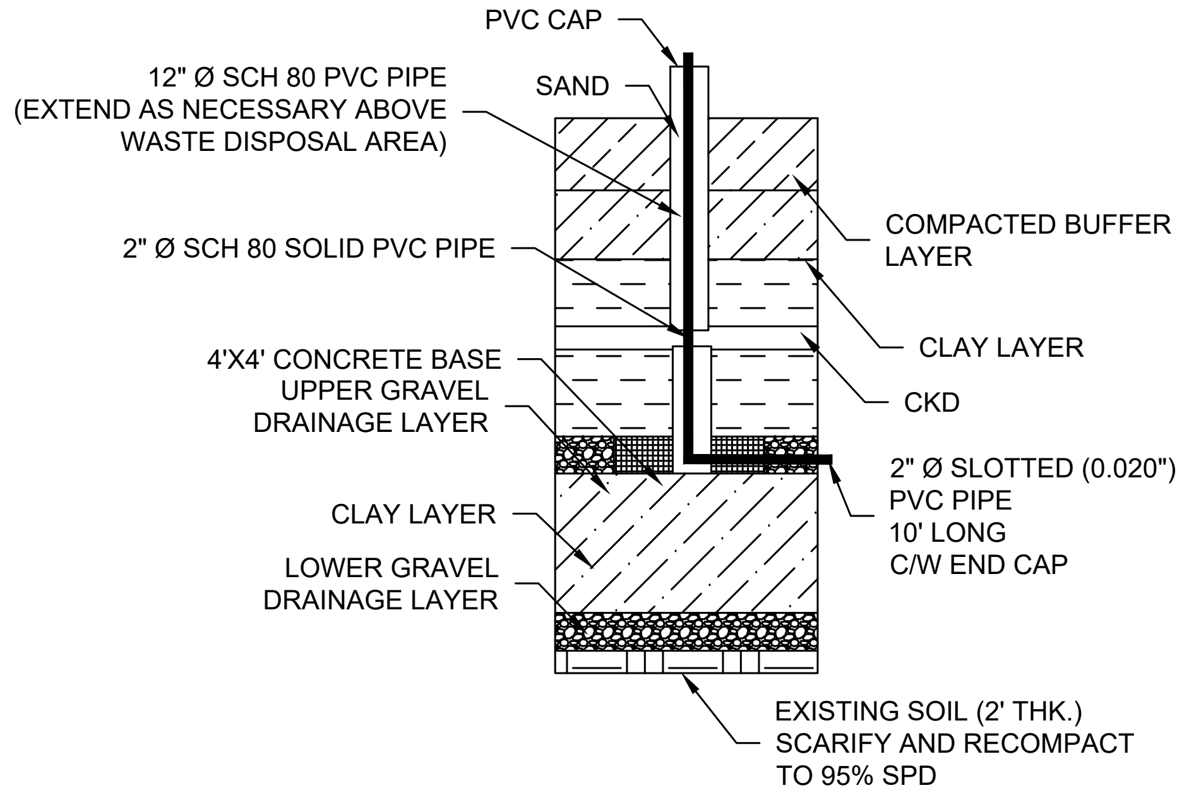
4/4 CAP TIE-OFF DETAIL
NOT TO SCALE



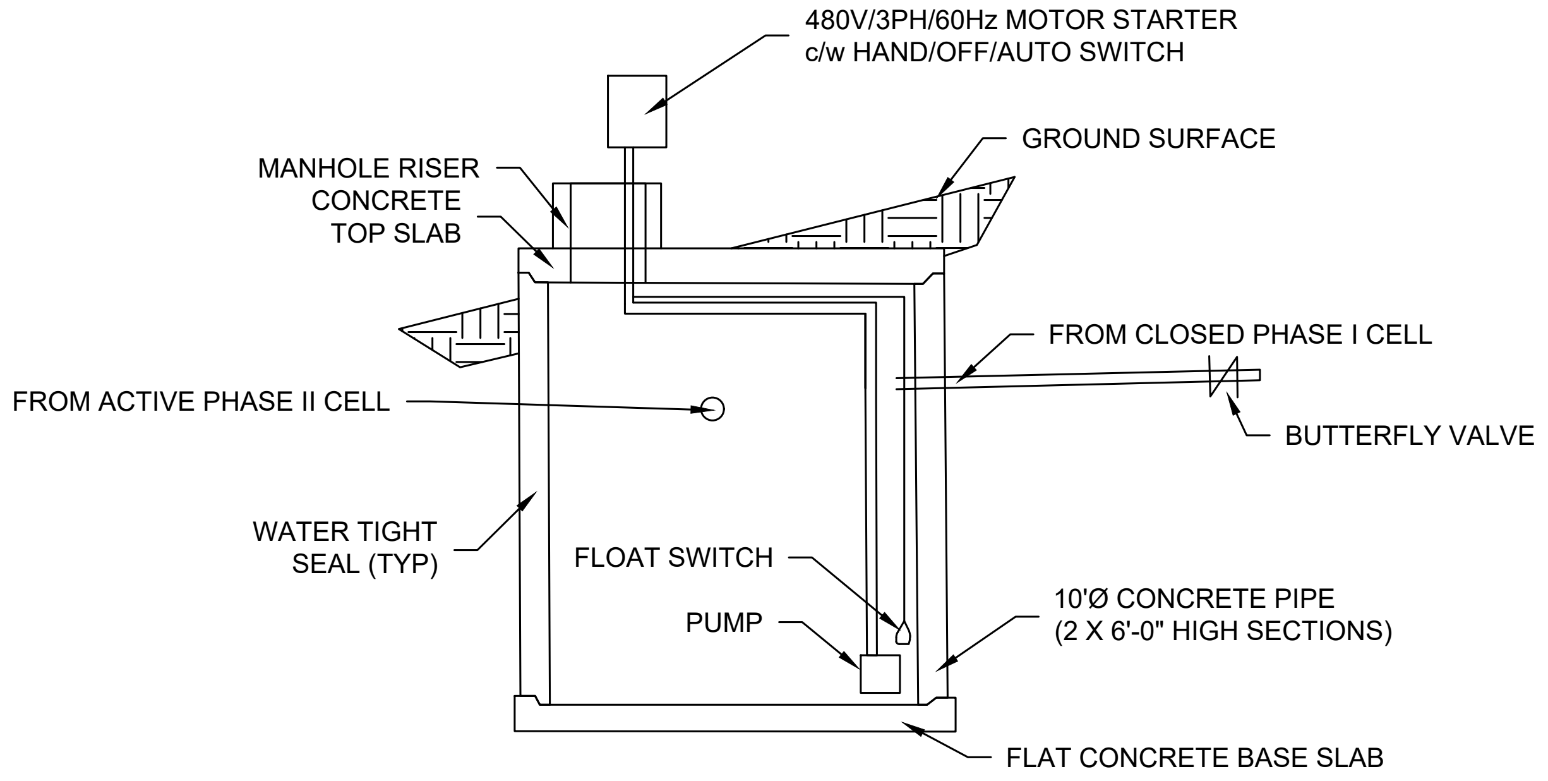
5/4 SUBLINER MONITORING WELL
NOT TO SCALE



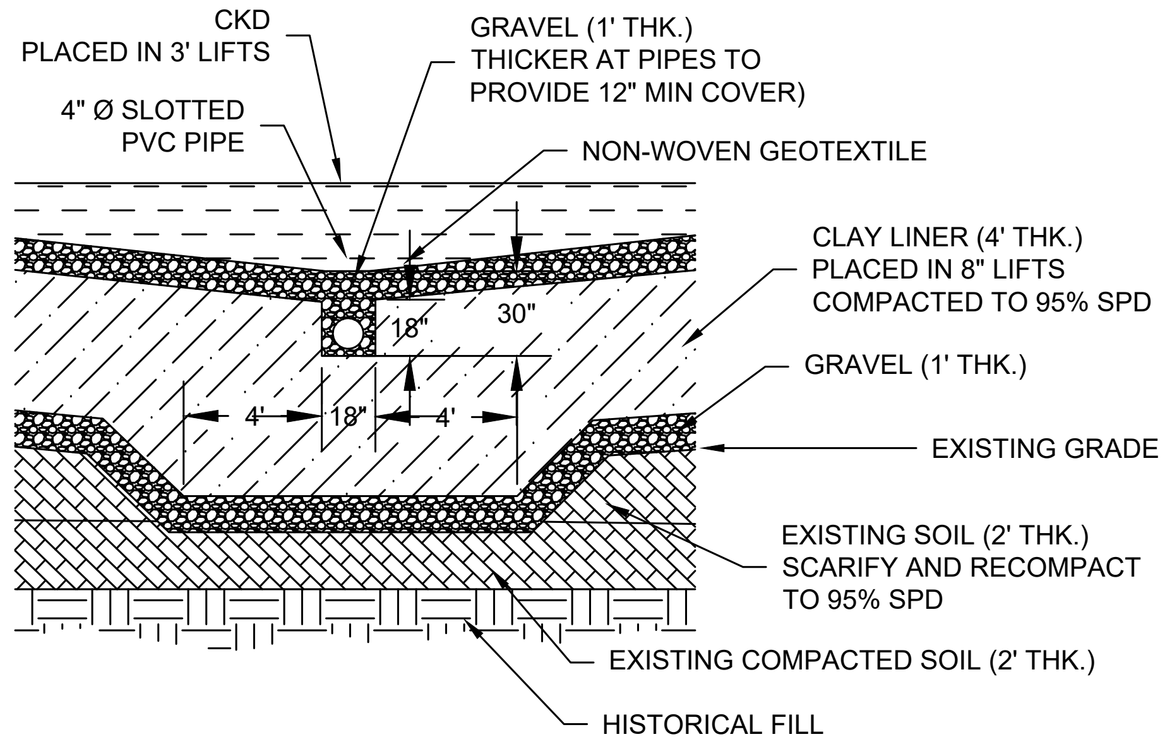
6/4 REPLACEMENT WELL PIPE PERFORATION PATTERN DETAIL
NOT TO SCALE



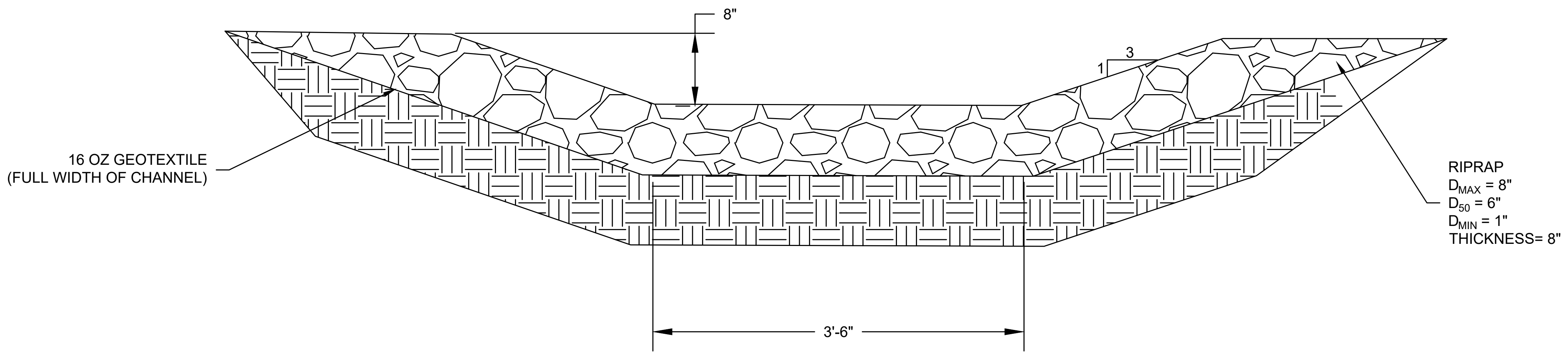
7/4 LEACHATE HEAD WELL DETAIL
NOT TO SCALE



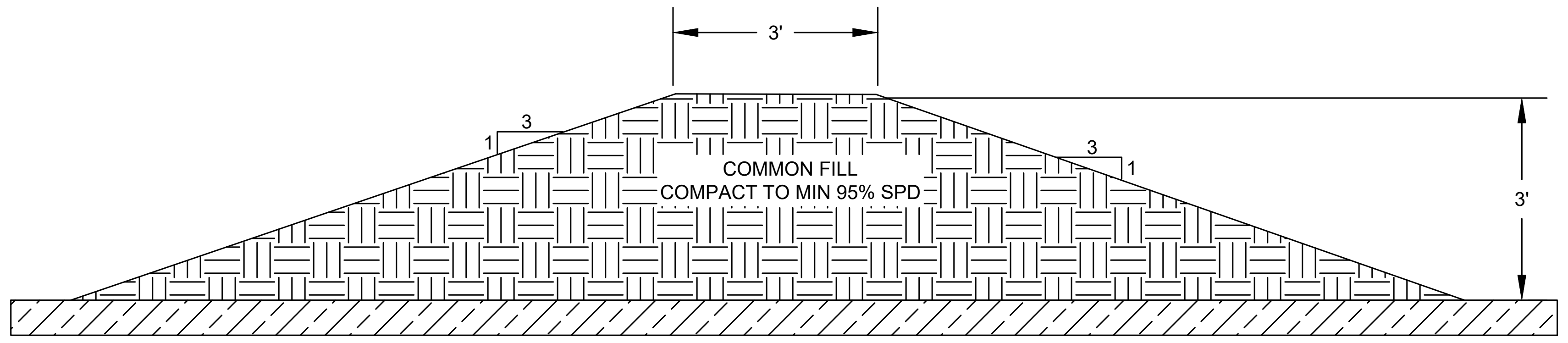
8/4 LEACHATE SUMP DETAIL
NOT TO SCALE



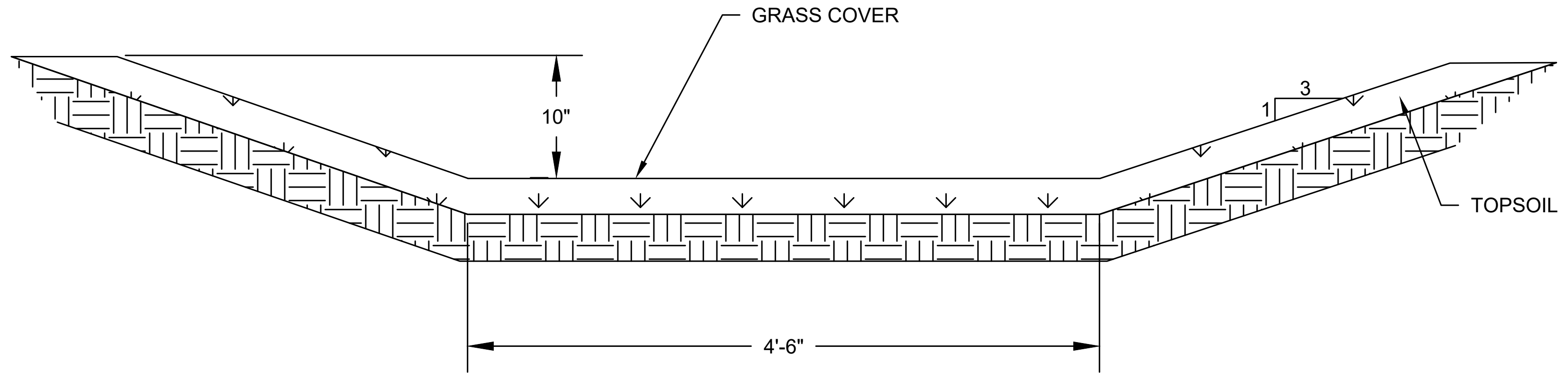
9/4 TYPICAL COLLECTION TRENCH SECTION
NOT TO SCALE



10/4 DITCH DESIGN DETAIL (>5%)
NOT TO SCALE



11/4 TYPICAL RETENTION BERM DETAIL
NOT TO SCALE



12/4 DITCH DESIGN DETAIL (<5%)
NOT TO SCALE

DATE | DESCRIPTION | BY

SHEET NAME
DETAILS

PROJECT NAME
CLOSURE DRAWINGS

PROJECT LOCATION
CONTINETAL CEMENT

CLIENT
CONTINENTAL CEMENT

BLACKSTONE ENVIRONMENTAL

BLACKSTONE ENVIRONMENTAL, INC.
1465 41ST STREET, SUITE 13
MOLINE, IL 61265
P: 913-495-9990 F: 913-648-2077

PROJ. MGR: EMS
DESIGNED BY: DN
DRAWN BY: DN
CHECKED BY: EMS
JOB NO.: 3251
DATE: 5.26.2022

SHEET
4

PLAN DRAWINGS - NOT FOR CONSTRUCTION

APPENDIX F

Closure/Post Closure Plan

CLOSURE, POST-CLOSURE PLAN

Continental Cement
Cement Kiln Dust Landfill
Buffalo, Iowa
IDNR Landfill Permit Number 82-SDP-16-97P

Prepared for:
Continental Cement
301 East Front Street
Buffalo, Iowa 52728

Prepared by:
Blackstone Environmental
1465 41st Street, Suite 13
Moline, Illinois 61265

May 31, 2022

Closure, Post-Closure Plan
Continental Cement
Cement Kiln Dust Landfill
301 East Front Street
Buffalo, Iowa
IDNR Landfill Permit Number 82-SDP-16-97P

Prepared for:
Continental Cement Company, LLC
301 East Front Street
Buffalo, Iowa

Prepared by:

Eric Sonsthagen

Eric Sonsthagen, P.E.
Senior Project Engineer

Reviewed by:

Edward A. Shepard, Jr., P.E.
Senior Project Manager

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

1.0 INTRODUCTION

The following section provides information regarding the background and purpose of this Closure, Post-Closure Plan (Plan).

1.1 Background

The Cement Kiln Dust (CKD) Landfill is located within a portion of Continental Cement Company's (Continental's) former rock quarry at the Continental facility located in the Southeast Quarter of Section 23, Township 77 North, Range 02 East, in Scott County, Iowa. The Landfill is located approximately 1.3 miles east/northeast of the City of Buffalo in Scott County, Iowa, and approximately 700 feet north of the Mississippi River. Figure 1 provides a topographic map of the property.

The facility has been used for quarrying and manufacturing cement products dating back to the 1920's. The facility is bordered by the Mississippi River to the south, by Linwood Mining and Minerals Corporation (Linwood) to the east, by the City of Buffalo to the west, and by residential and agricultural land to the north.

The original plant was operated from the 1920s until the late 1970s when a new facility was constructed. The current facility manufactures Portland cement and related products. A byproduct of the process is CKD. The CKD material has historically been landfilled within the east end of the quarry as shown on Figure 2. The facility currently generates approximately 2,500 tons of CKD per year.

The CKD landfill area comprises of approximately 29 acres consisting of three sections; the southern Closed Cell and the Closed Phase I Cell have been filled to original grade, and the-northern Active Phase II Cell has been partially filled. The landfill location is provided on Figure 3. CKD will continue to be landfilled in the Active Phase II cell until it reaches final grades when it will then be closed with a cover system.

This Plan includes the methods and schedule anticipated to properly close the landfill. Following closure of the landfill, the 30-year post-closure maintenance period will be initiated.

1.2 Facility Planning

Continental's long-term goal is to reduce the amount of CKD that is landfilled. Efforts to achieve that goal have been implemented that include using the CKD in the cement manufacturing process that has greatly reduced the amount of CKD that has been landfilled in the last several years. New technologies are being explored and trials are being conducted that may allow the CKD to be reclaimed from the landfill and processed into a beneficial product. Over the last six to nine months, the efforts Continental has made include:

- Meeting with multiple potential equipment suppliers to gain understanding on potential CKD reuse options.

- Provide initial material samples for a preliminary feasibility evaluation.
- Provide additional material samples for a refined feasibility evaluation.

The preliminary feasibility evaluation had promising results. Continental is currently awaiting the analytical results of the refined feasibility evaluation for one potential supplier. Likely next steps include a feasibility study and conceptual site-specific design.

Updates on the efforts to reduce the landfilling of CKD and possibly reclaiming the CKD from the landfill will be provided to the IDNR in the Semi-Annual Engineering Inspection Reports.

1.3 Purpose

This Plan was developed to comply with the Iowa Department of Natural Resources (IDNR) requirements promulgated under Iowa Administrative Code (IAC) 567 Chapter 115 Sanitary Landfills: Industrial Monofills. The Plan describes how and when the facility will be closed in accordance with applicable requirements and is protective of human health and the environment. It describes the proposed groundwater monitoring plan, leachate control system, and necessary site inspection and maintenance activities; and includes the name, address and telephone number of the person or office to serve as a contact with regard to the facility during the post-closure period.

2.0 CLOSURE PLAN

The following section provides information regarding the closure plan sequencing, closure activities, final use, and record survey plat. The closure plan has been developed in a manner that minimized the potential for post-closure release of pollutants to the air, groundwater, and surface waters.

2.1 General Closure Requirements

In accordance with IAC 567.115.27(9) the IDNR will be notified in writing at least 180 days prior to the date the owner/operator expects to being closure of the facility or suspension of operations. Since this facility is not open to the public and only accepts material generated by the owner/operator, a notice of closure date will not be posted at the facility prior to closure. Additionally, a notice will not be published in a newspaper of local circulation prior to closure.

The owner/operator will make provisions to begin final closure within 90 days after the date on which the phase or permitted area receives the final volume of waste. The owner and an engineer registered in the State of Iowa will certify that this Plan has been implemented in compliance with the rules, this Plan, and the permit. Upon completion of closure activities, as-built plans showing changes from the original design plans; test results indicating compliance with final cover requirements, waste removal, equipment decontamination; a copy of the notation field with the county recorder; and other forms of documentation will be submitted to the IDNR as required.

2.2 Closure Activities

The site will begin closure of the landfill within 90 days after receipt of the final volume of waste. The entire active Phase II Cell is anticipated to be closed in a single phase. The closure activities will consist of construction of the final cover, and construction of the final stormwater control structures. These closure activities will be completed in accordance with the approved permit documents in place at the time of closure, including the design drawings, technical specifications, and construction quality assurance plan.

Closure of the active Phase II Cell is designed to meet the following elements:

- Promote stormwater drainage and minimize erosion.
- Minimize infiltration of stormwater by construction of a low permeability cover system.
- Protect the cover system from temperature and moisture by constructing a buffer layer.
- Minimize erosion and sedimentation by constructing a vegetative soil layer and establishing vegetation.
- Provide a technical basis for closure of the existing CKD landfill for approval by the State of Iowa.

A plan view of the existing CKD landfill area is shown on Drawing 1 of Appendix A. Technical details pertaining to closure are presented on Drawing 4. Drawing 2 presents a plan view of the Closure and Drawing 3 presents three cross-sections through the CKD landfill.

Upon completion of each phase of closure activities, a Professional Engineer registered in the State of Iowa, will certify that the facility was properly closed in accordance with the approved plans. The certification documentation will be submitted to the IDNR and include construction quality assurance documentation on the various closure system components including evidence that the barrier soil layer was constructed to meet the 1 x 10^{-7} centimeters per second (cm/sec) permeability standard, as built drawings of the landfill, verification of depths of the final cover components, and types of soil cover on 100-foot centers, and evidence of establishment of vegetation.

2.2.1 Final Cover

The final cover system will consist of the following components from the top layer to the bottom:

- 24-inch soil layer capable of sustaining vegetative growth.
- 24-inch layer of soil compacted to achieve a permeability of less than or equal to 1 x 10^{-7} cm/sec.

A minimum of two permanent surveying monuments will be installed by a land surveyor registered in the State of Iowa from which the location and elevation of wastes, containment structures, and monitoring facilities can be determined throughout the post-closure period.

The final cover system will be built in accordance with the approved permit documents in place at the time of closure, including the design drawings, technical specifications, and construction quality assurance plan. The final cover system will have side slopes no greater than 4H:1V with a crown that is sloped at 5 percent.

The cover system will be constructed using soils excavated as part of the quarry expansion activities or other materials capable of achieving the specified hydraulic conductivity. Soils deemed acceptable for use in the cover system will contain a minimum of 10 percent clay by dry weight. Materials will be spread in lifts no greater than 8 inches thick and will be compacted to a minimum 95 percent standard Proctor density to achieve minimum permeability. Laboratory testing has been completed to verify that the proposed final cover materials compacted in this manner possess a hydraulic conductivity no greater than 1 x 10^{-7} cm/sec, as determined using the falling head permeability test. This cap design complies with the Iowa Code which specifies a hydraulic conductivity no greater than 1 x 10^{-7} cm/sec (IAC 567-115.26(13)(b)).

A minimum of one field density test will be performed per lift per acre to verify that the density determined by the laboratory analysis as correlated to permeability has been achieved. Results of field density tests will be submitted to IDNR within the certification documentation. The cover system compacted soil layer will be keyed into the bottom liner at the boundary of the waste cell. If initiation of the application of the final cover has not begun within 60 days of completing the final waste lift, an intermediate cover of 1-foot of soil will be applied in the interim.

A 2-foot vegetative soil layer will be placed and graded as soon as reasonably possible after the placement of final cover. The vegetative layer will be fertilized, mulched, and seeded to achieve a healthy stand of vegetation. The vegetative soil layer will have sufficient nutrients required for establishing and sustaining vegetation. Topsoil removed at part of the site operations will be stockpiled and used as the vegetative soil layer during installation of the final cover.

After installation the vegetative soil layer will be seeded with native grasses that will provide vegetative cover that is resistant to erosion. The seed mixture will comprise Merion Blue Grass, Kentucky Blue Grass, Creeping Red Fescue, and Perennial Rye Grass, or other appropriate grasses in proportions optimized to account for the site conditions. Organic matter and fertilizers will be added to the topsoil layer to enhance initial growth. Erosion during the germination stage will be minimized by adding mulch or straw to the seed application.

Orice initial growth is established, erosional features or areas of sparse growth will be refilled with topsoil and reseeded. This process will be repeated until a consistent cover layer of vegetation is established. Slopes will be regularly monitored to ensure that the vegetative cover is performing in accordance with its intended design. The closed areas will be cut at least once per year to prevent development of deep-rooted vegetation, such as trees, that could compromise the integrity of the cover system.

2.2.2 Landfill Gas (LFG) Control and Monitoring System

A landfill gas (LFG) control or monitoring system is not necessary to control and/or recover LFG from the waste mass or to prevent off-site migration as the CKD material does not decompose and generate landfill gas. As such, no LFG system control or monitoring will be installed during closure activities.

2.2.3 Stormwater Control System

Stormwater run-off from the top of the Closed Cell and Closed Phase I Cell landfill will be directed south and east to a collection ditch that runs parallel to a quarry access road. This ditch drains into the quarry and will convey runoff from the 25-year, 24-hour storm event. It will be lined with erosion resistant vegetation over segments where the gradient of the ditch is less than 5 percent. The ditch will be lined with fiber cloth and riprap or will be founded on bedrock over segments where the gradient exceeds 5 percent.

Stormwater run-off from the top of the Phase II Cell will be directed to the east and to the west. Stormwater directed to the east will connect to the existing stormwater ditch adjacent to the quarry access road. Stormwater from directed to the west will drain to the southwest to the quarry.

Stormwater run-off from the CKD landfill will ultimately flow into the quarry where it will flow to the quarry dewatering sump. Stormwater from the quarry dewatering sump is discharged to the Mississippi River through Outfall 001, which is monitored as part of the facilities National Pollution Discharge Elimination System (NPDES) permit.

2.3 Soil Balance

The soil required for the landfill closure was calculated to provide an overall site soil balance. It is anticipated that final cover system described above (2-foot compacted layer and 2-foot vegetative layer) will require approximately 21,250 cubic yards of clayey soils and approximately 21,250 cubic yards of vegetative soils over the approximately 6-acre Active Phase II Cell. The total soil required for final cover (compacted and vegetative cover soils) is estimated at 42,500 cubic yards. Existing stockpiles of soil within the quarry and soils generated from future excavations are anticipated to exceed the quantity necessary for landfill closure. Existing stockpiled soils were previously tested and deemed suitable for use as final cover.

2.4 Final Use

After the site has undergone final closure, the final design grades and cover system of the proposed landfill will allow for the land to be used for open green space. Uses that do not conflict with long-term post-closure care plans for the area may be considered in the future. At this time, significant structures are not planned for development on the completed landfill final cover.

2.5 Survey Plat

Upon completion of final closure of the landfill, the owner/operator will have a licensed surveyor registered in the State of Iowa prepare a survey plat of the site. The survey plat will show, at a minimum, the name of the property owner as it appears on the deed; a survey and detailed legal description of the waste limits, the permitted area, and the property boundary; the general types and locations of solid wastes; the depths of fill; the locations of leachate control and groundwater monitoring systems that must be maintained after closure including the length of time that these systems must be maintained; and the location of boundary markers and benchmarks located at the site.

Prior to filing the survey plat with the County Recorder of Deeds, the owner/operator will obtain approval of the survey plat from the IDNR. After receiving approval from the IDNR and before filing with the County Recorder of Deeds, the survey plat will be notarized by a lawful notary public. Filing of the notarized survey plat will take place within 30 days of receipt of IDNR approval. Two copies of the notarized and properly recorded survey plat showing the County Recorder of Deed's seal or stamp, the book and page numbers, and the date of filing will be submitted to the IDNR within 30 days of the date of filing.

3.0 POST-CLOSURE PLAN

The following section describes the Post-Closure Plan for the CKD Landfill and consists of general information; cap maintenance; leachate system operation and maintenance; groundwater and leachate monitoring; miscellaneous site maintenance; recordkeeping; and remedial action.

3.1 General

This Post-Closure Plan includes the maintenance and monitoring activities to be performed at the CKD Landfill for the 30-year post-closure period after IDNR has approved final site closure. The post-closure activities will include maintenance of cover integrity; operation and maintenance of the leachate collection system and groundwater collection system; maintenance, sampling, and testing of groundwater monitoring wells, leachate collection system, and lysimeters; and miscellaneous site maintenance.

Access to the site is limited to the quarry entrance through the use of perimeter fencing. The site entrance is controlled by a lockable gate. Emergency contacts and procedures will be posted at the landfill/site entrance. In the event of an emergency, dial 911 in order to direct the appropriate assistance to the site. Fire, police, and ambulance assistance is available to the site by dialing 911.

3.2 Cover System Maintenance

After the site is closed, the final cover will be inspected on a semi-annual basis for stressed vegetation, poor vegetative coverage, and erosion of the final cover. Final cover system maintenance will consist of filling areas of excessive differential settlement, regrading to control erosion, replacement of eroded cover soils, perimeter drainage channel maintenance, revegetation, weed control, and mowing. Typically, final cover system repairs will be conducted in the spring and fall such that seeding may be effective and not cause further damage to the cover system. Mowing of the facility will be conducted at least annually.

Since the final use for the site is green space, no provisions are needed for additional depth of cover material to allow cultivation and to support vegetation in addition to that required for the final cover.

3.3 Leachate System Operation and Maintenance

Leachate will continue to be collected by the leachate piping within the landfill and transferred to the leachate sump. Leachate will be pumped from the sump and stored in temporary holding tanks located near the quarry office where the leachate will be transferred to haul trucks that will haul the leachate off-site for treatment routed to a leachate pond for storage and evaporation during the post-closure period. The leachate collection system will be operated and maintained during the post-closure care period. Maintenance of the leachate collection system will include pump replacements or repairs and leachate conveyance pipe repairs, as necessary. The anticipated leachate generation for the closed facility is expected to decline significantly overtime upon installation of the final cover system as the CKD material does not retain moisture.

Leachate collection system monitoring and maintenance will include the following:

- Inspecting the system for proper operation
- Cleaning the leachate collection pipes
- Maintaining the leachate pumping system
- Managing leachate disposal

3.4 Groundwater and Leachate Monitoring

Groundwater and leachate will be monitored throughout the 30-year post-closure care period. Sampling and monitoring locations will be inspected during each sampling event. Repairs to the sampling locations will be made, as necessary to maintain a functioning monitoring system.

3.4.1 Groundwater Monitoring

Groundwater monitoring wells will continue to be sampled during the 30-year post-closure care period in accordance with the Hydrologic Monitoring System Plan in place at the time of monitoring and the terms and conditions of the IDNR permit. Semi-annual sampling, analysis, and reporting will be conducted in accordance with the Hydrologic Monitoring System Plan in place at the time of monitoring. The groundwater monitoring system in place at the time of this Plan development consists of 20 groundwater monitoring wells and a single stope well as depicted in Table 1.

Table 1 – Groundwater Monitoring Network

Groundwater Well ID	Groundwater Well ID
MW-1A	MW-1B
MW-2A	MW-3
MW-3L	MW-4
MW-4L	MW-5
MW-7	MW-11
MW-12	MW-13
MW-14	MW-15
MW-16	MW-16L
MW-18	MW-19
MW-20	MW-21
MW-2CR (stope well)	

Groundwater monitoring and reporting will be conducted in accordance with the general requirements contained within IAC 567-115.26 and the most recent Hydrologic Monitoring System Plan. Groundwater monitoring results will be submitted annual to the IDNR in accordance with IAC 567-115.26(8).

3.4.2 *Leachate Monitoring*

Leachate will continue to be monitored during the 30-year post-closure care period. Leachate samples will be collected in accordance the Hydrologic Monitoring System Plan in place at the time of monitoring and the terms and conditions of the IDNR permit. Semi-annual sampling, analysis, and reporting will be conducted in accordance with the Hydrologic Monitoring System Plan in place at the time of monitoring. The leachate monitoring system in place at the time of this Plan development consists of six monitoring locations as depicted in Table 2.

Table 2 – Leachate Monitoring Locations

Monitoring Location ID	Monitoring Location ID
MW-9	MW-10
UL-1	UL-2
UL-3	L-Sump

Leachate monitoring and reporting will be conducted in accordance with the general requirements contained within IAC 567-115.26 and the most recent Hydrologic Monitoring System Plan. Leachate monitoring results will be submitted annual to the IDNR in accordance with IAC 567-115.26(8).

3.4.3 *Lower Lysimeter Monitoring*

The lower lysimeters will continue to be monitored during the 30-year post-closure care period. Lower lysimeter samples will be collected in accordance the Hydrologic Monitoring System Plan in place at the time of monitoring and the terms and conditions of the IDNR permit. Semi-annual sampling, analysis, and reporting will be conducted in accordance with the Hydrologic Monitoring System Plan in place at the time of monitoring. The lower lysimeters in place at the time of this Plan development consists of three monitoring locations as depicted in Table 3.

Table 3 – Lower Lysimeter Monitoring Locations

Lower Lysimeter ID
LL-1
LL-2
LL-3

Leachate monitoring and reporting will be conducted in accordance with the general requirements contained within IAC 567-115.26 and the most recent Hydrologic Monitoring System Plan. Leachate monitoring results will be submitted annual to the IDNR in accordance with IAC 567-115.26(8).

3.5 Miscellaneous Site Maintenance

Miscellaneous site maintenance activities will include perimeter fence and gate maintenance, quarry dewatering sump maintenance or replacement, and drainage channel maintenance. The perimeter fences and gates will be maintained and repaired to restrict unauthorized site access. The permanent surveying monuments will be maintained and repaired or replaced, as necessary. The quarry dewatering sump will be maintained, repaired, or replaced, as necessary. The perimeter drainage channels will be maintained and repaired, as necessary. The site roads will be maintained and repaired as necessary to maintain access to features such as the leachate collection systems as well as the environmental monitoring locations.

3.6 Recordkeeping

During the post-closure care period, semi-annual reports will be submitted to IDNR. The reports will contain information concerning the general conditions at the site, groundwater monitoring results, quantity of leachate collected and treated, and other information as required by the closure permit. The locations and elevations of permanent monuments required by IAC 567.115.26(13) will be determined at least once every three years, or more frequently in the event of obvious disturbance of the monument. The semi-annual reports will be provided to the IDNR by April 30 and October 31 each year and cover the preceding 6-month period.

The post-closure care contact for the CKD Landfill will be:

Continental Cement Company
Mr. Damion Sadd/Environmental & Public Affairs Manager
301 East Front Street
Buffalo, Iowa 52728
Telephone: (563) 328-6204

The Environmental and Public Affairs Manager should be contacted regarding questions or issues with the landfill or access to the landfill. During this period, landfill records will be maintained by Continental. The records will be made available to the IDNR representatives upon request for review.

3.7 Remedial Action

If Continental is required to develop a corrective action or remediation action plan for the CKD Landfill during the life of the landfill or during the post-closure care period, then cost estimates will be prepared and additional financial assurance will be secured as appropriate. At this time, there are no remedial action requirements.

4.0 FINANCIAL ASSURANCE

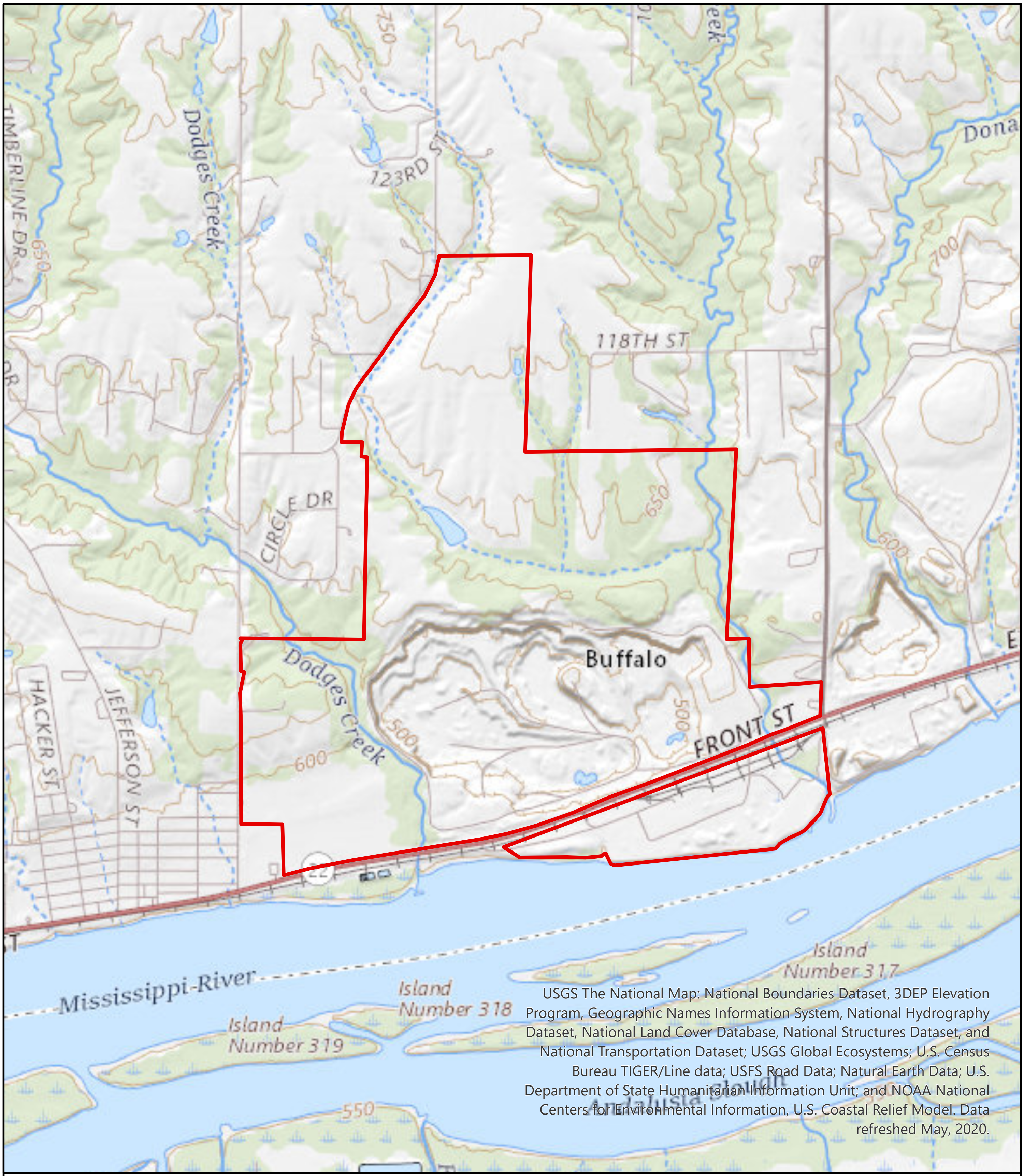
The most recent closure and post-closure cost estimate and associated financial assurance for the CKD Landfill are contained in Appendix B. The financial assurance instrument for the site has been updated annually in accordance with IAC 567-115.31 requirements. New cost estimates will be submitted for approval and the amount of financial assurance adjusted appropriately as changes in site conditions that impact closure and or post-closure care costs are implemented. If no site conditions impacting costs are completed during a given year, then the most recent closure and post-closure cost estimate will be adjusted annual for inflation.

5.0 LIMITATIONS

This report was prepared in accordance with that level of skill and care ordinarily exercised by other members of Blackstone's profession practicing in the same locality and under similar conditions when the services were provided. No warranties, express or implied, are intended or made.

FIGURES

Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental



USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed May, 2020.

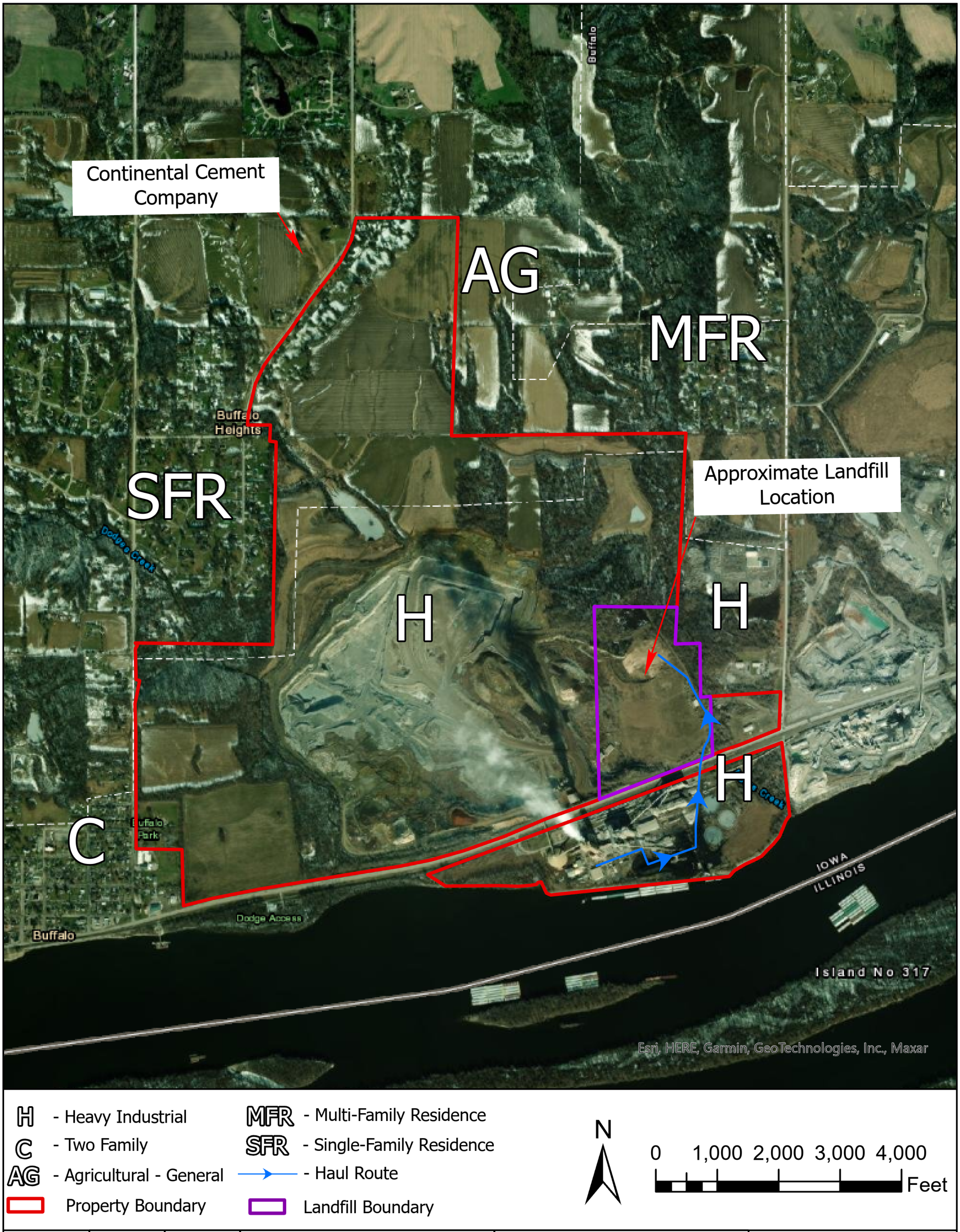
🟥 Property Boundary

N

0 1,250 2,500 5,000 Feet

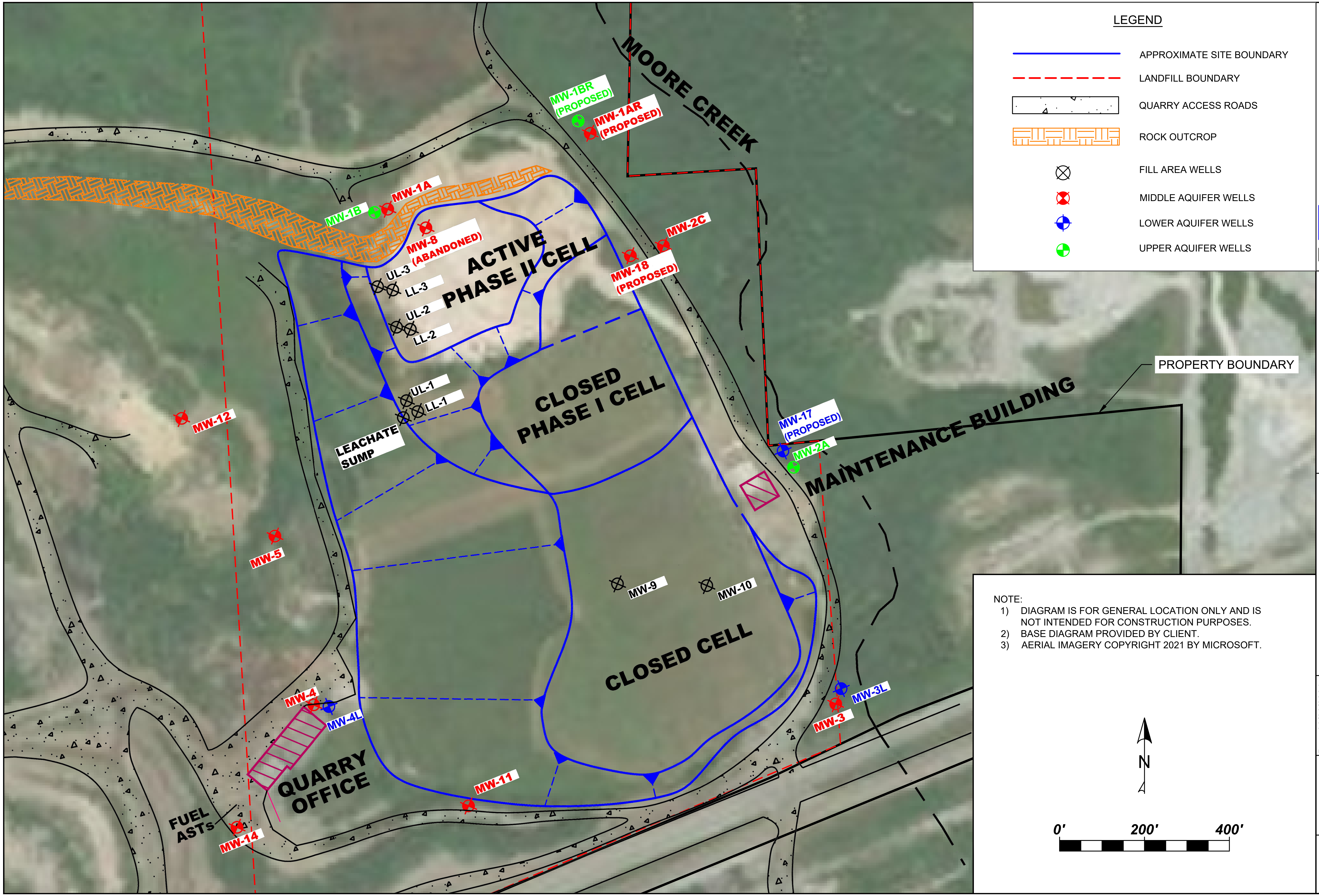
FIGURE 1	Project Mgr. KB	Date: May 2022	CONTINENTAL CEMENT BUFFALO, IOWA	SHEET NAME Site Topographic Vicinity Map	BLACKSTONE ENVIRONMENTAL
	Designed By: TS	Rev.:		PROJECT NAME Closure, Post-Closure Plan	
	Drawn By: TS	Rev.:			
	Checked By: LJ	Rev.:		PROJECT LOCATION 301 East Front Street Buffalo, Iowa	
	Job No.: 3251	Rev.:			

Path: Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental\Continental.aprx



Esri, HERE, Garmin, GeoTechnologies, Inc., Maxar

FIGURE 2	Project Mgr. KB	Date: May 2022	CONTINENTAL CEMENT BUFFALO, IOWA	SHEET NAME Site Plan	BLACKSTONE ENVIRONMENTAL
	Designed By: ME	Rev.:		PROJECT NAME Closure, Post-Closure Plan	
	Drawn By: ME	Rev.:		PROJECT LOCATION 301 East Front Street Buffalo, Iowa	
	Checked By: LJ	Rev.:			
	Job No.: 3251	Rev.:			



LEGEND

―	APPROXIMATE SITE BOUNDARY
– – –	LANDFILL BOUNDARY
▭	QUARRY ACCESS ROADS
▨	ROCK OUTCROP
⊗	FILL AREA WELLS
⊗	MIDDLE AQUIFER WELLS
⊕	LOWER AQUIFER WELLS
⊕	UPPER AQUIFER WELLS

NOTE:
1) DIAGRAM IS FOR GENERAL LOCATION ONLY AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES.
2) BASE DIAGRAM PROVIDED BY CLIENT.
3) AERIAL IMAGERY COPYRIGHT 2021 BY MICROSOFT.

BLACKSTONE ENVIRONMENTAL
16200 FOSTER STREET OVERLAND PARK, KS 66085
P: 913-495-9990 F: 913-648-2077

SHEET NAME	SITE MAP
PROJECT NAME	2024 LANDFILL PERMIT RENEWAL
PROJECT LOCATION	CEMENT KILN DUST LANDFILL

CLIENT
CONTINENTAL CEMENT COMPANY
301 EAST FRONT STREET
BUFFALO, IOWA 52728

Project Mgr: KK	Date 06/26/2024
Designed By: ES	Rev.
Drawn By: EG	Rev.
Checked By: ES	Rev.
	Rev.

SHEET
3

File: Z:\Shared\Clients\Continental Cement\PROJECTS\3630 - CKD Landfill Permit Renewal Application\WORKING\Figures\Site Map-Spring 2022 Edited June 2024

APPENDIX A

Closure Drawings

File: D:\CC Closing Drawings

DRAWING INDEX

DRAWING NO.	**TITLE**
0	COVER SHEET
1	EXISTING CONDITIONS
2	FINAL COVER PLAN
3	CROSS-SECTIONS
4	DETAILS

CLOSURE DRAWINGS

CONTINENTAL CEMENT CKD MONOFILL
SCOTT COUNTY, IOWA
IOWA LANDFILL PERMIT NO. 82-SDP-16-97P
MAY 2022

PREPARED FOR:

CONTINENTAL CEMENT

CONTINENTAL CEMENT
301 EAST FRONT STREET
BUFFALO, IA 52728

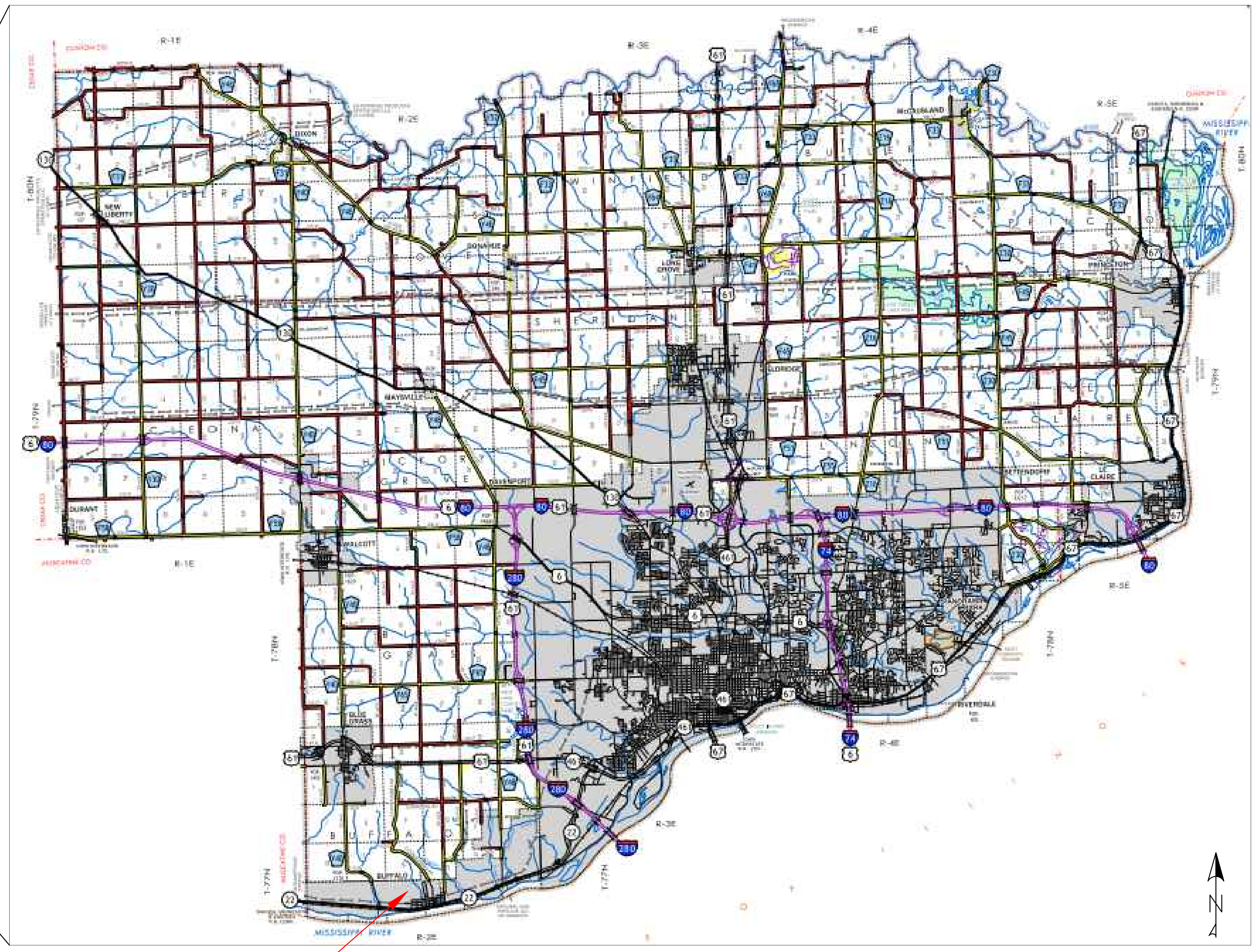
PREPARED BY:

BLACKSTONE ENVIRONMENTAL

1465 41ST STREET, SUITE 13
MOLINE, ILLINOIS 61265

PROJECT NO. 3251
MAY 2022

IOWA



VICINITY MAP

CONTINENTAL CEMENT
MONOFILL

ERIC SONSTHAGEN P24844

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 IOWA.

Eric Sonsthagen May 31, 2022

SIGNATURE DATE

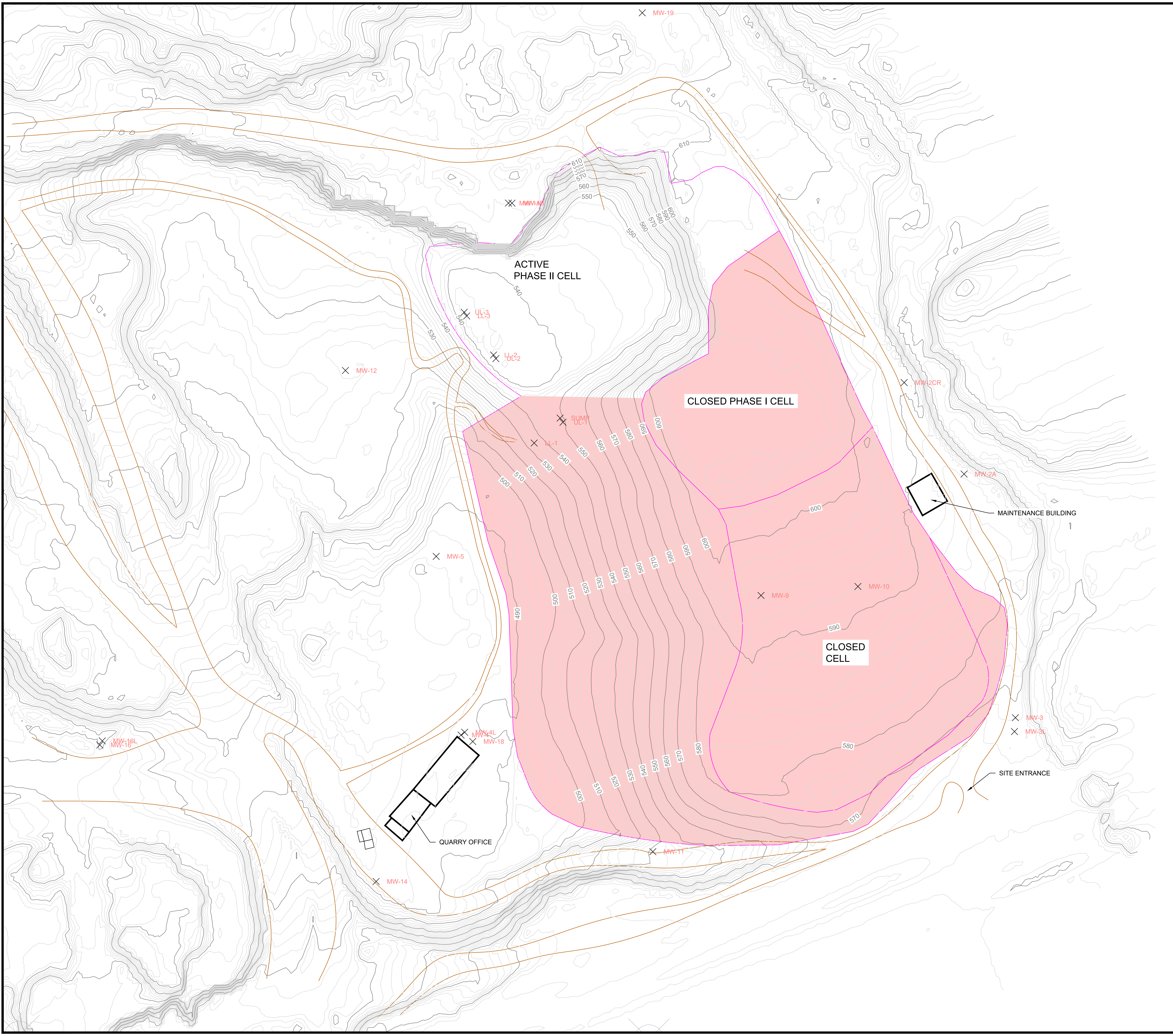
ERIC SONSTHAGEN
LICENSE NUMBER: P24844
MY LICENSE RENEWAL DATE IS
DECEMBER 31, 2023

PAGES OR SHEETS COVERED BY THIS SEAL:

SHEETS 0-4

PLAN DRAWINGS - NOT FOR CONSTRUCTION

File: D:\CC Closing Drawings



LEGEND

—— 1300 ——	EXISTING 10' CONTOUR
————	EXISTING 2' CONTOUR
————	EXISTING ROAD
————	APPROXIMATE CKD WASTE LIMITS
▨	CLOSED AREAS
× MW	MONITORING WELL

NOTES:

1. TOPOGRAPHIC SURVEY BY USGS, INC ON JANUARY 12, 2022. ALL DATA SHOWN HERE REFERENCES IOWA STATE PLANE COORDINATE SYSTEM (NAD83 IOWA SOUTH + NAVD88).
2. MONOFILL LIMITS ARE APPROXIMATE.

N

0' 100' 200'

DATE	DESCRIPTION	BY

SHEET NAME
EXISTING CONDITIONS

PROJECT NAME
CLOSURE DRAWINGS

PROJECT LOCATION
CONTINETAL CEMENT

CLIENT
CONTINENTAL CEMENT

BLACKSTONE ENVIRONMENTAL

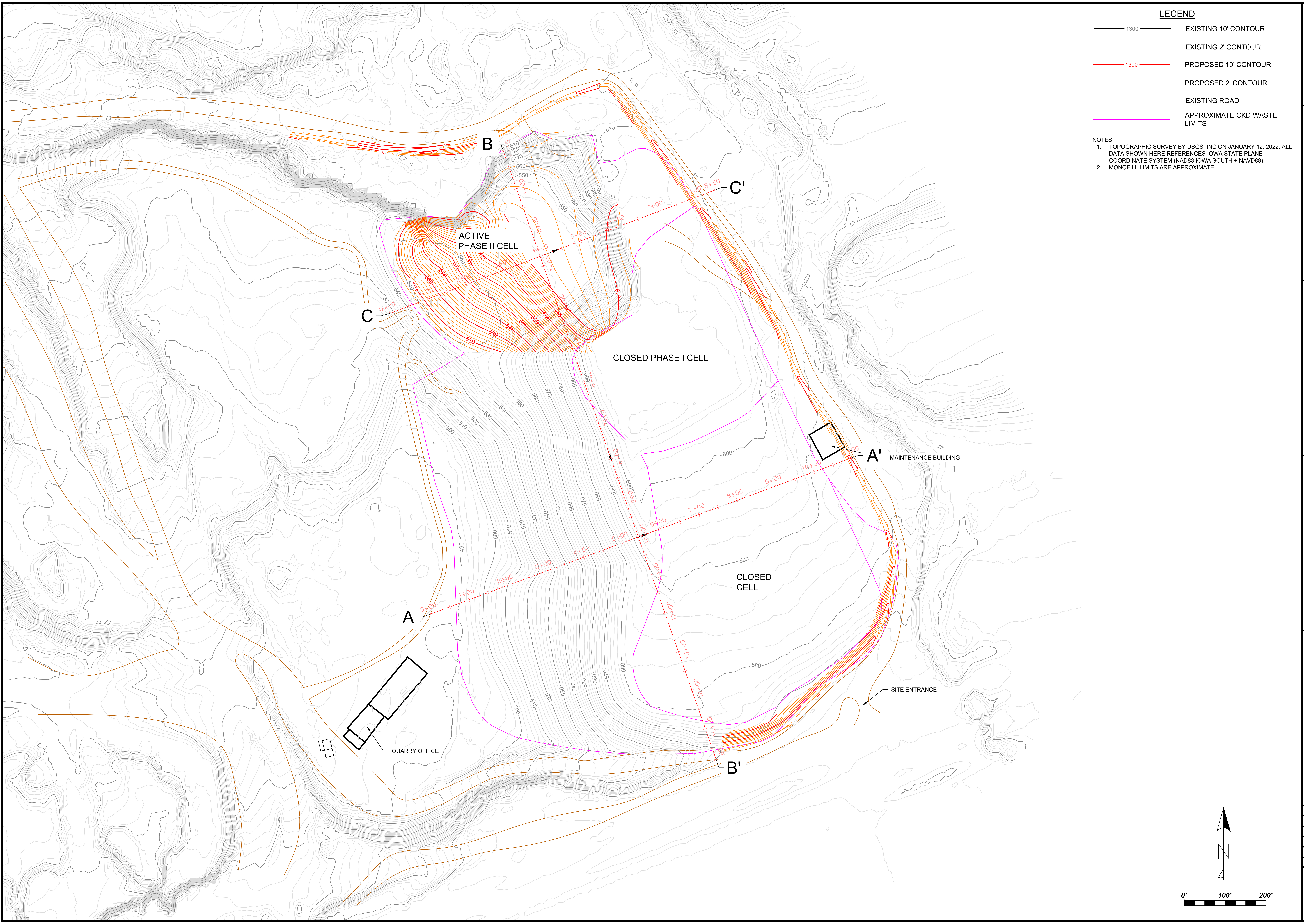
BLACKSTONE ENVIRONMENTAL, INC.
1465 41ST STREET, SUITE 13
MOLINE, IL 61265
P: 913-495-9990 F: 913-648-2077

PROJ. MGR: EMS
DESIGNED BY: DN
DRAWN BY: DN
CHECKED BY: EMS
JOB NO.: 3251
DATE: 5.26.2022

SHEET
1

PLAN DRAWINGS - NOT FOR CONSTRUCTION

File: D:\CC Closing Drawings



LEGEND

1300	EXISTING 10' CONTOUR
	EXISTING 2' CONTOUR
1300	PROPOSED 10' CONTOUR
	PROPOSED 2' CONTOUR
	EXISTING ROAD
	APPROXIMATE CKD WASTE LIMITS

NOTES:
1. TOPOGRAPHIC SURVEY BY USGS, INC ON JANUARY 12, 2022. ALL DATA SHOWN HERE REFERENCES IOWA STATE PLANE COORDINATE SYSTEM (NAD83 IOWA SOUTH + NAVD88).
2. MONOFILL LIMITS ARE APPROXIMATE.

DATE	DESCRIPTION	BY

SHEET NAME
FINAL COVER PLAN

PROJECT NAME
CLOSURE DRAWINGS

PROJECT LOCATION
CONTINETAL CEMENT

CONTINENTAL CEMENT

CLIENT

BLACKSTONE ENVIRONMENTAL

BLACKSTONE ENVIRONMENTAL, INC.
1465 41ST STREET, SUITE 13
MOLINE, IL 61265
P: 913-495-9990 F: 913-648-2077

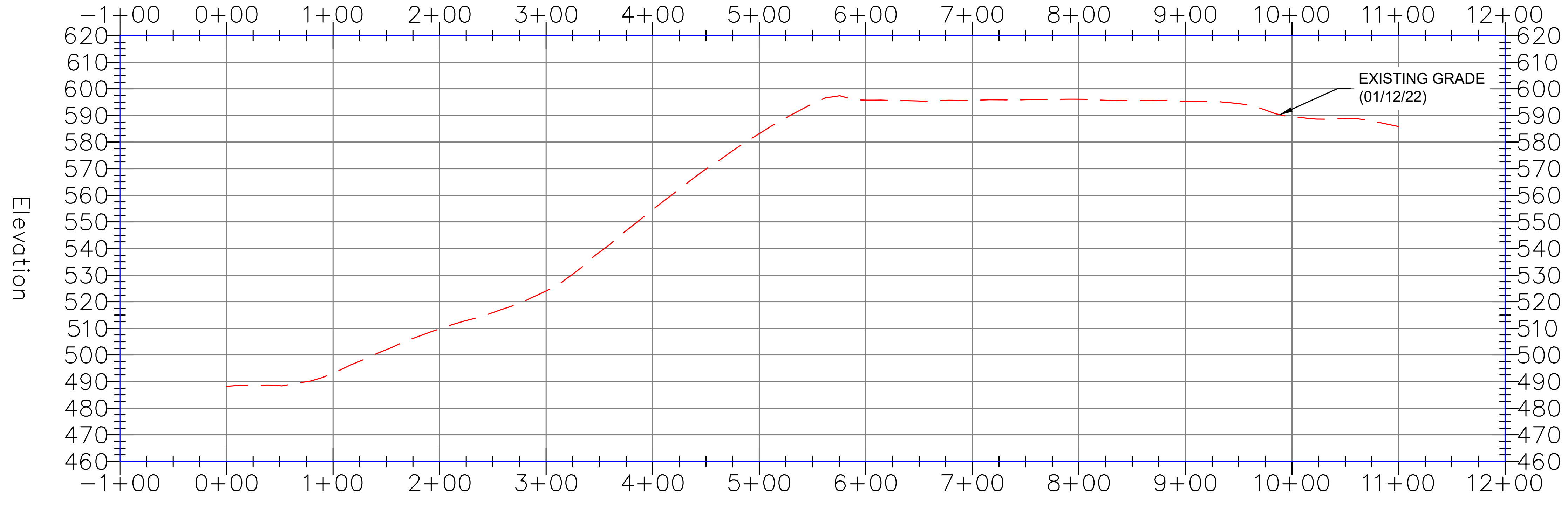
PROJ. MGR: EMS
DESIGNED BY: DN
DRAWN BY: DN
CHECKED BY: EMS
JOB NO.: 3251
DATE: 5.26.2022

SHEET
2

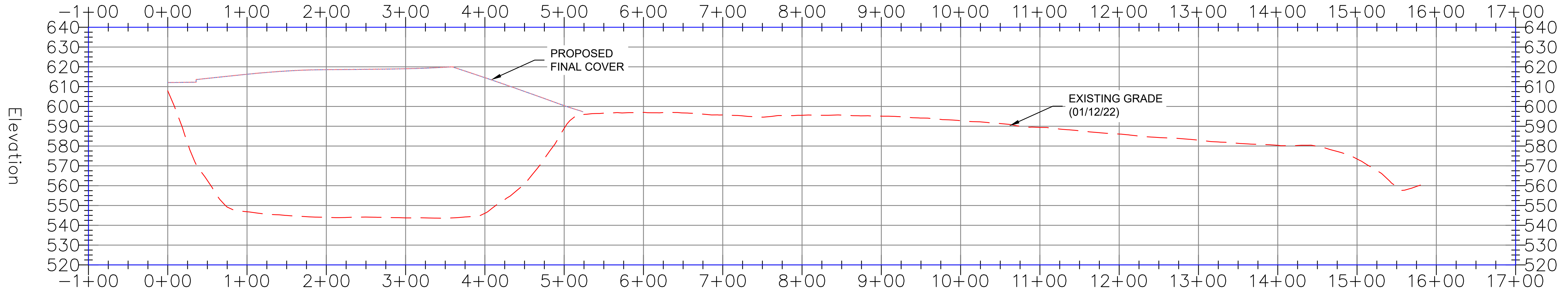
PLAN DRAWINGS - NOT FOR CONSTRUCTION

File: D:\CC Closing Drawings

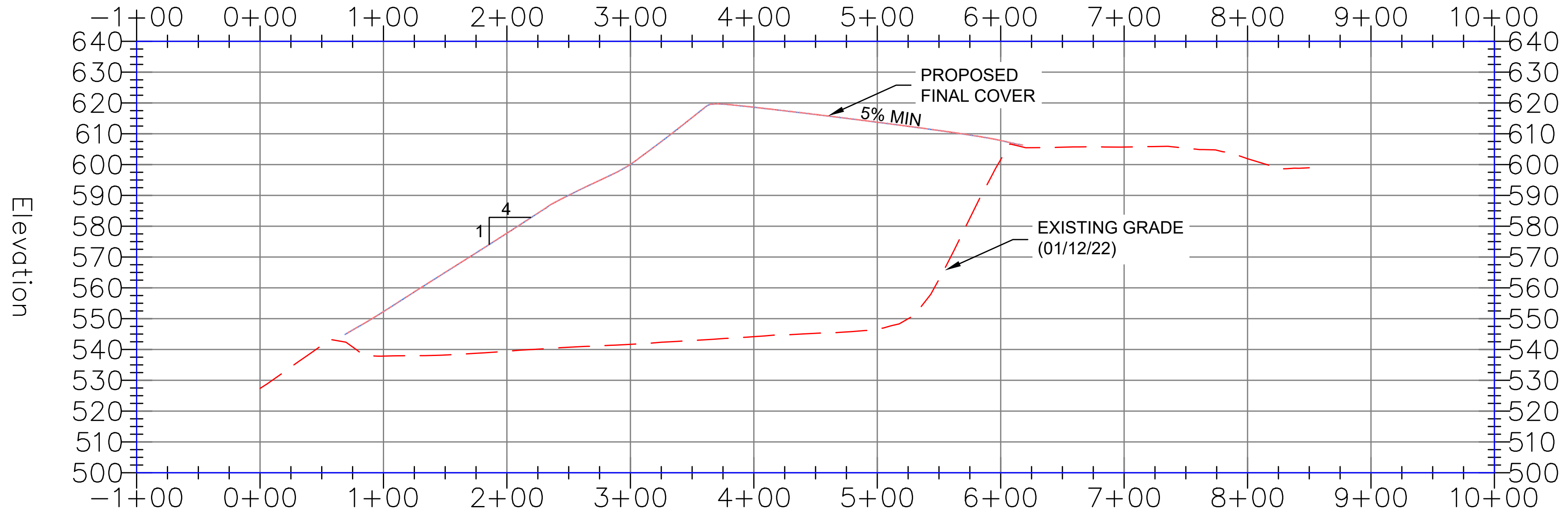
A–A' PROFILE

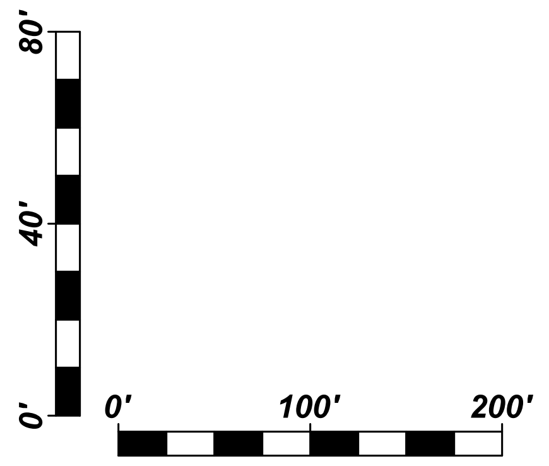


B–B' PROFILE



C–C' PROFILE





DATE	DESCRIPTION	BY

SHEET NAME
CROSS-SECTIONS

PROJECT NAME
CLOSURE DRAWINGS

PROJECT LOCATION
CONTINETAL CEMENT

CLIENT
CONTINENTAL CEMENT

BLACKSTONE ENVIRONMENTAL

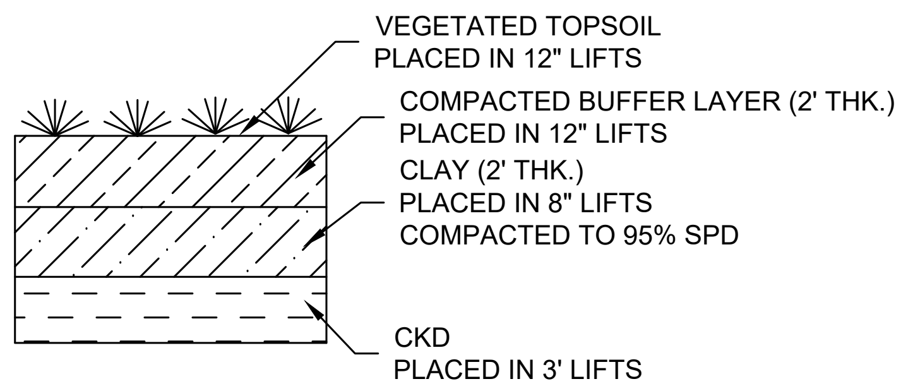
BLACKSTONE ENVIRONMENTAL, INC.
1465 41ST STREET, SUITE 13
MOLINE, IL 61265
P: 913-495-9990 F: 913-648-2077

PROJ. MGR: EMS
DESIGNED BY: DN
DRAWN BY: DN
CHECKED BY: EMS
JOB NO.: 3251
DATE: 5.26.2022

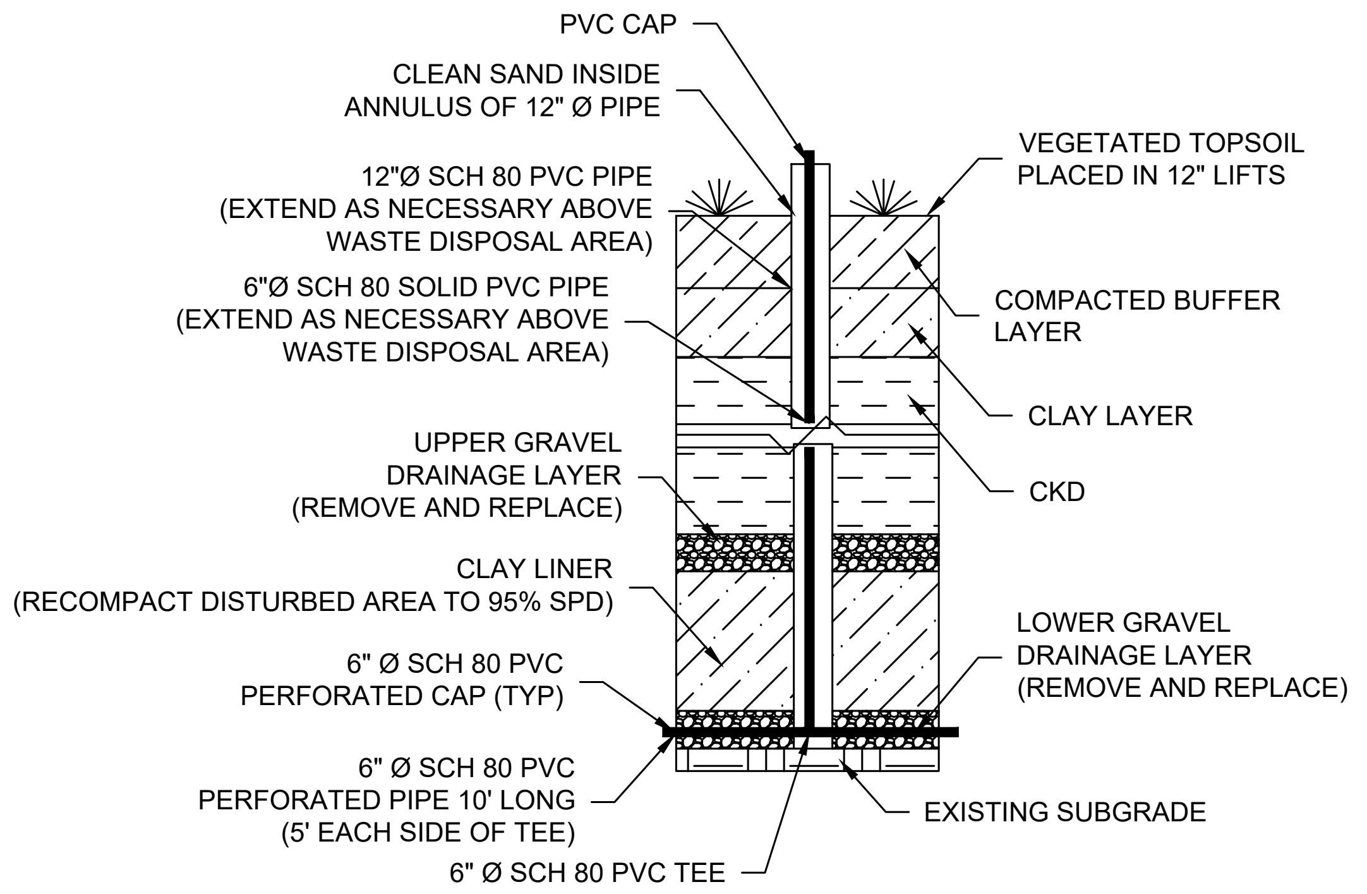
SHEET
3

PLAN DRAWINGS - NOT FOR CONSTRUCTION

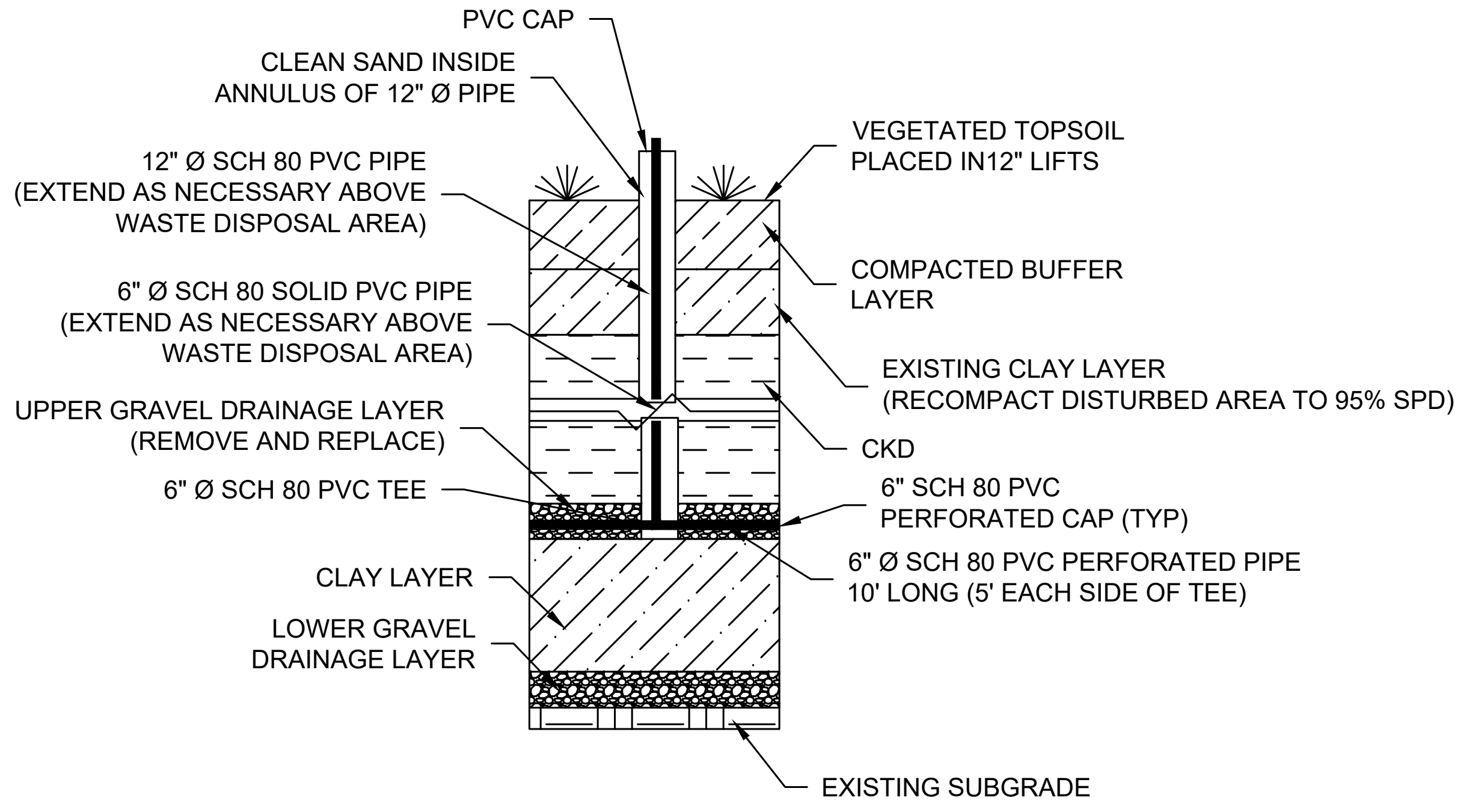
File: D:\CC Closing Drawings



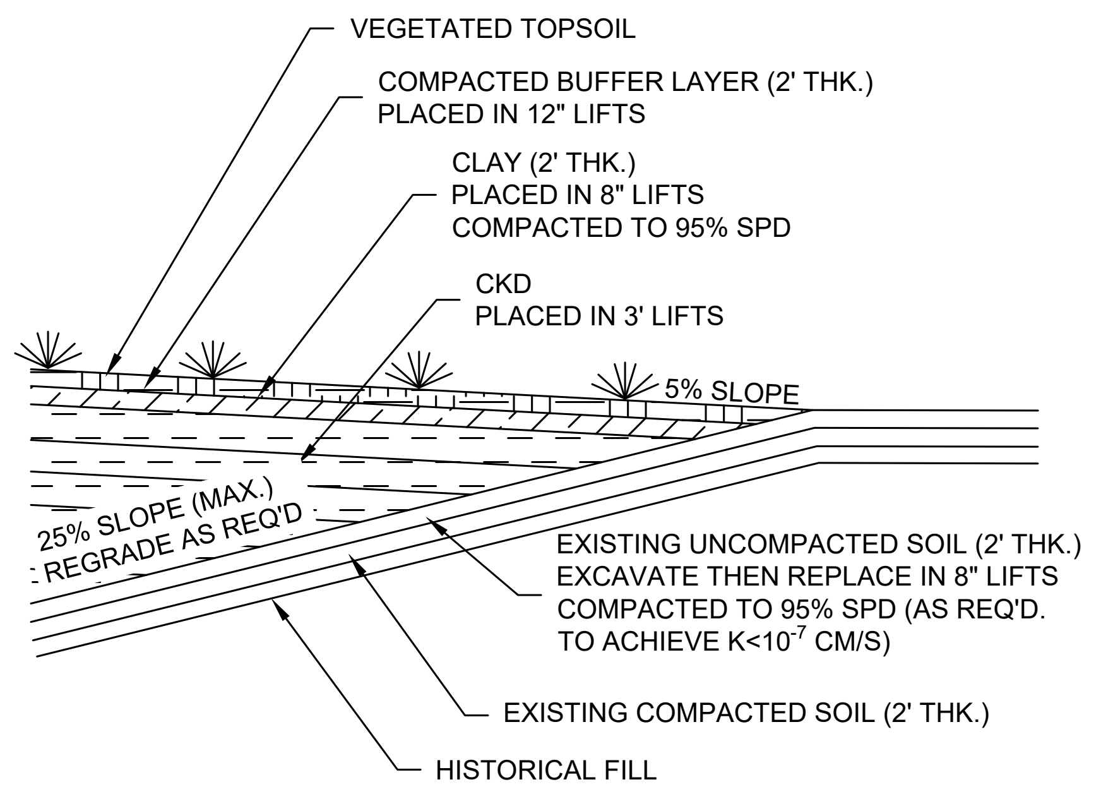
1 FINAL COVER DETAIL
4 NOT TO SCALE



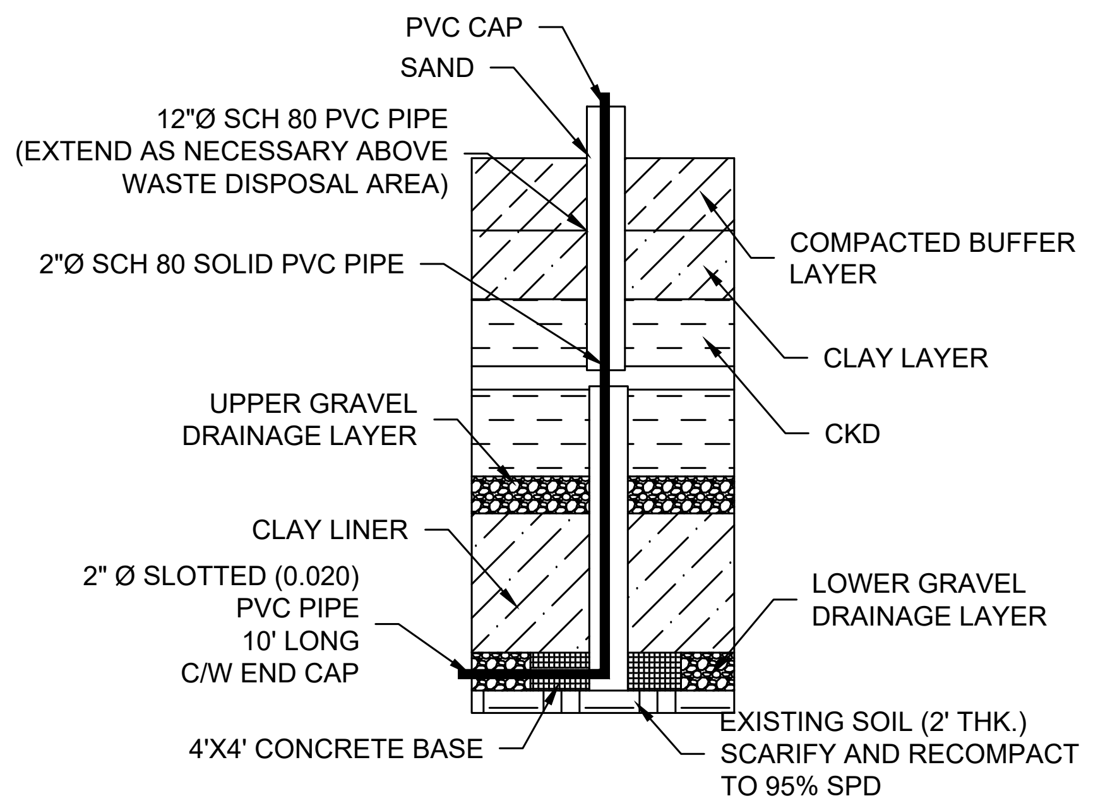
2 REPLACEMENT SUBLINER MONITORING WELL
4 NOT TO SCALE



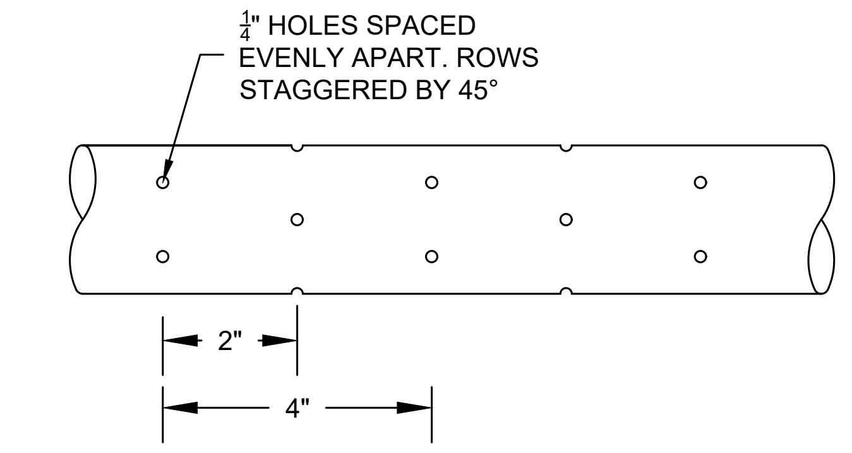
3 REPLACEMENT LEACHATE HEAD WELL DETAIL
4 NOT TO SCALE



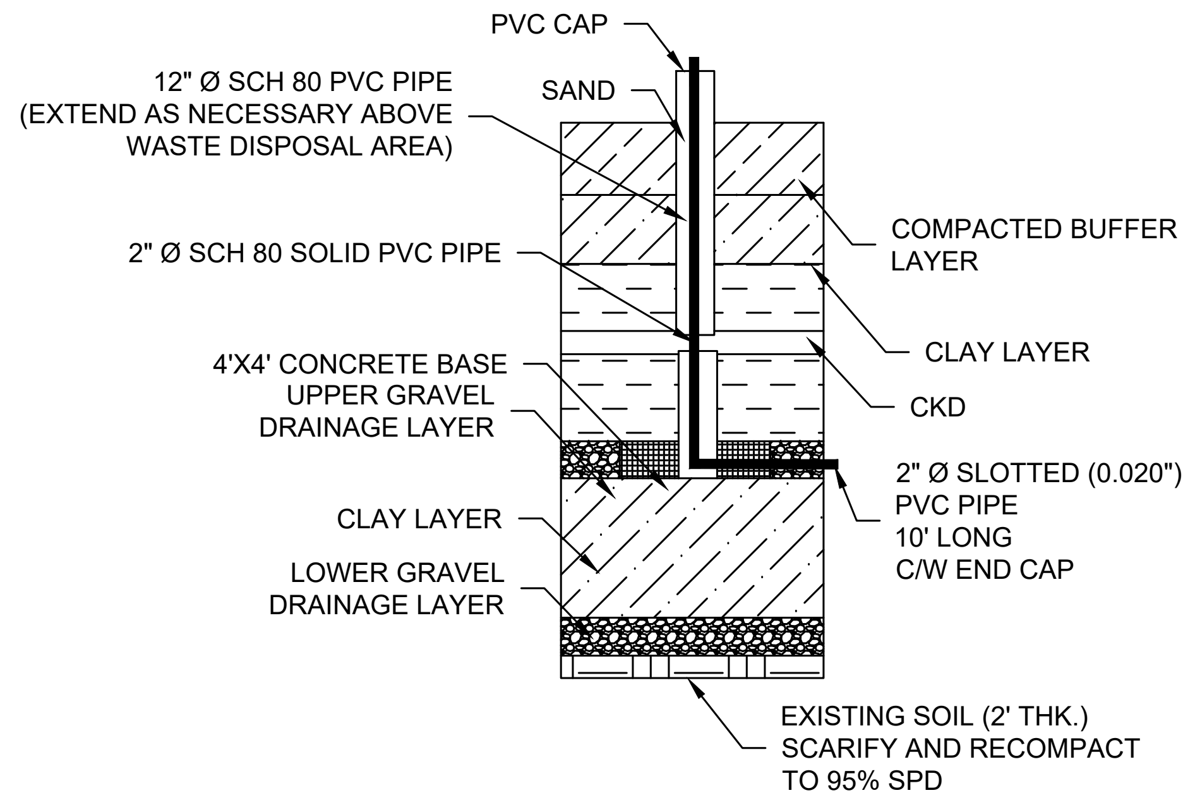
4 CAP TIE-OFF DETAIL
4 NOT TO SCALE



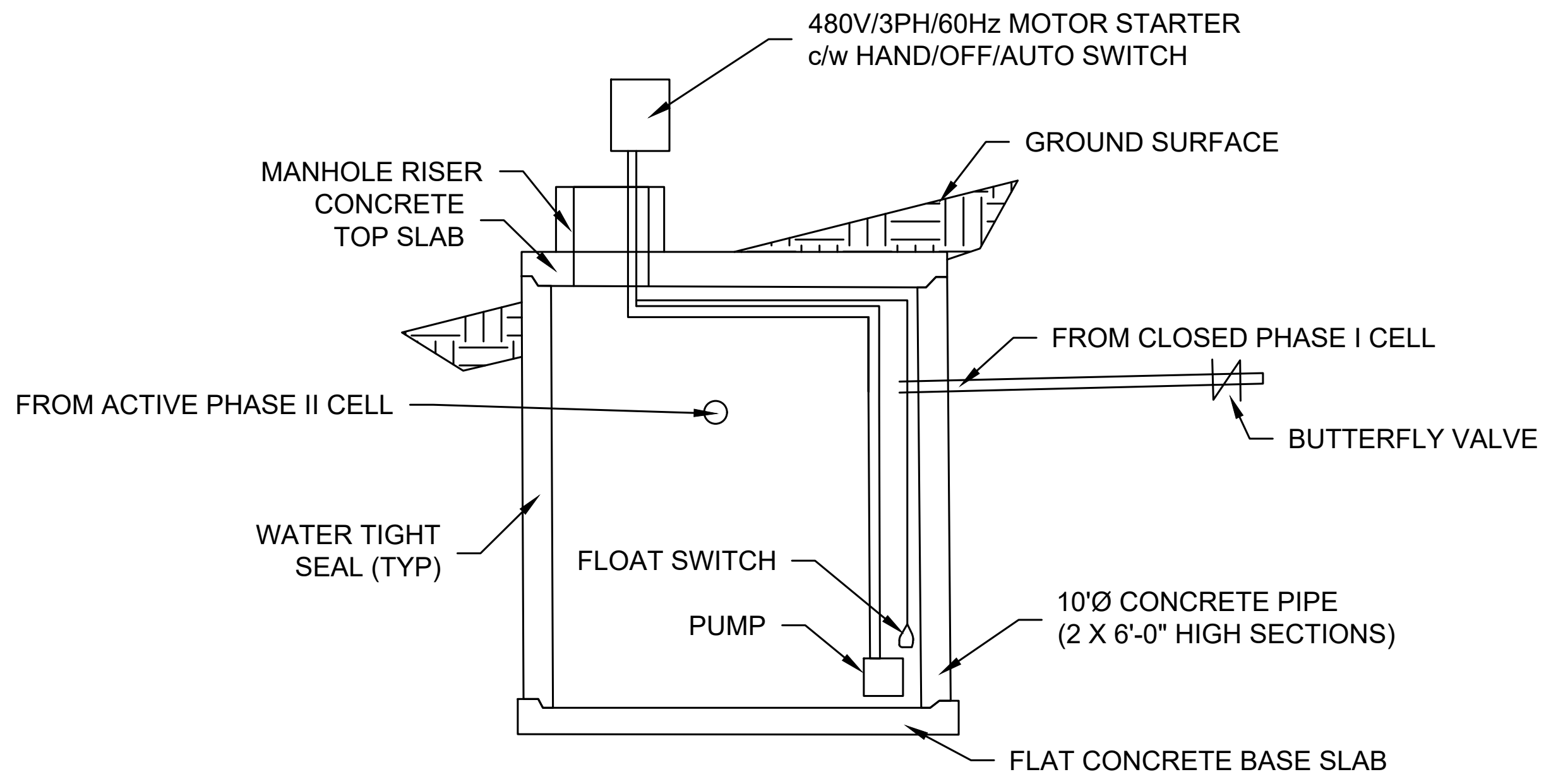
5 SUBLINER MONITORING WELL
4 NOT TO SCALE



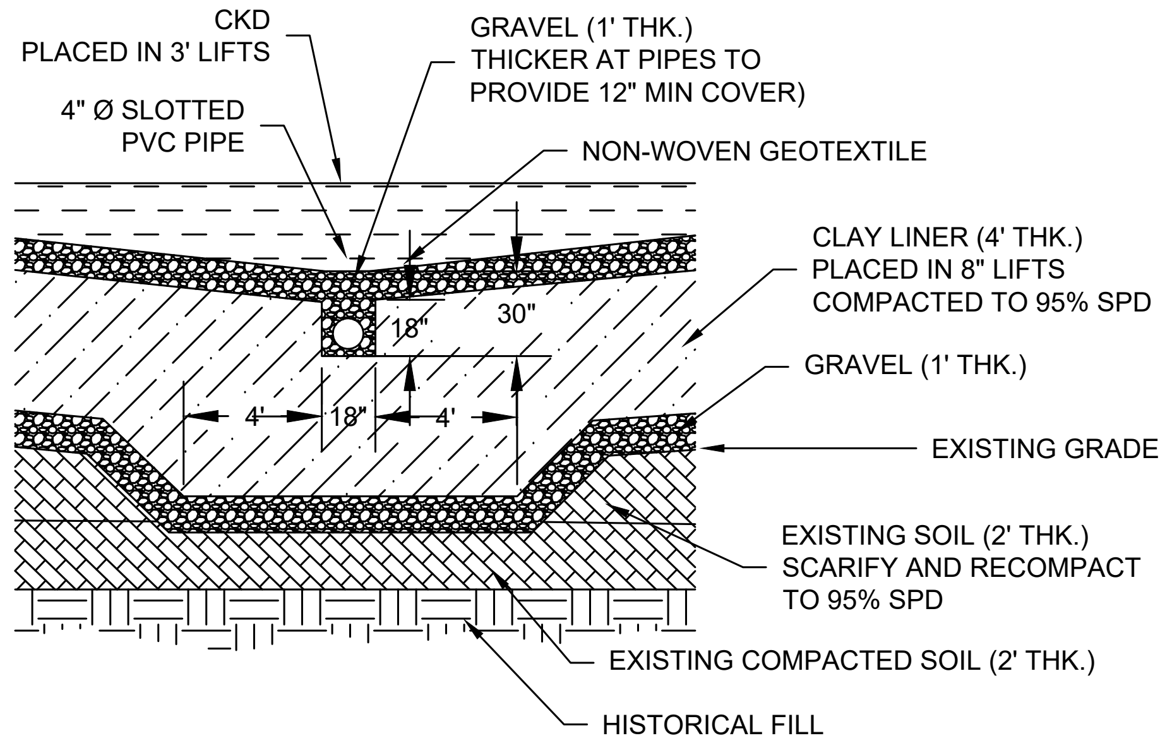
6 REPLACEMENT WELL PIPE PERFORATION PATTERN DETAIL
4 NOT TO SCALE



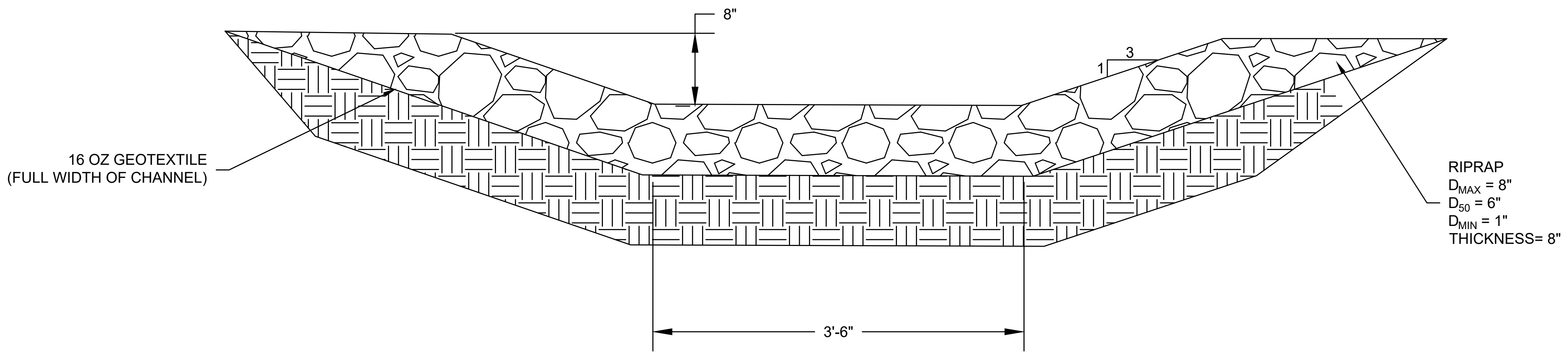
7 LEACHATE HEAD WELL DETAIL
4 NOT TO SCALE



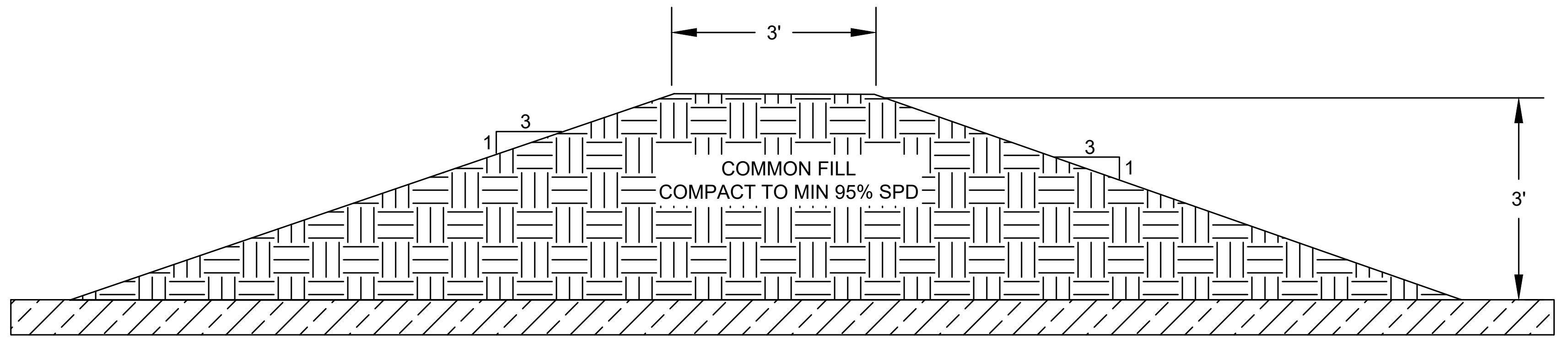
8 LEACHATE SUMP DETAIL
4 NOT TO SCALE



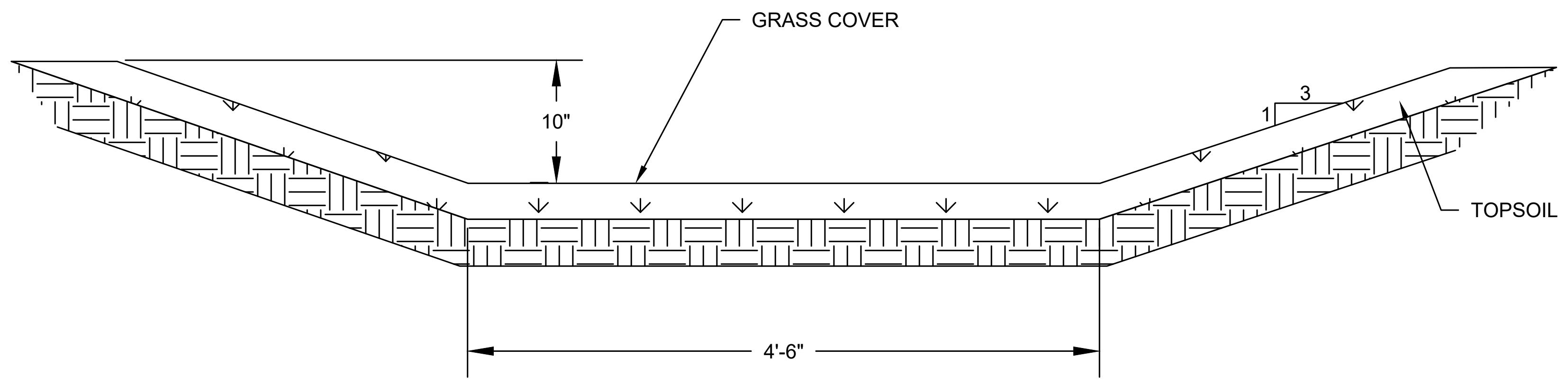
9 TYPICAL COLLECTION TRENCH SECTION
4 NOT TO SCALE



10 DITCH DESIGN DETAIL (>5%)
4 NOT TO SCALE



11 TYPICAL RETENTION BERM DETAIL
4 NOT TO SCALE



12 DITCH DESIGN DETAIL (<5%)
4 NOT TO SCALE

DATE | DESCRIPTION | BY

SHEET NAME
DETAILS

PROJECT NAME
CLOSURE DRAWINGS

PROJECT LOCATION
CONTINETAL CEMENT

CLIENT
CONTINENTAL CEMENT

BLACKSTONE ENVIRONMENTAL

BLACKSTONE ENVIRONMENTAL, INC.
1465 41ST STREET, SUITE 13
MOLINE, IL 61265
P: 913-495-9990 F: 913-648-2077

PROJ. MGR: EMS
DESIGNED BY: DN
DRAWN BY: DN
CHECKED BY: EMS
JOB NO.: 3251
DATE: 5.26.2022

SHEET
4

PLAN DRAWINGS - NOT FOR CONSTRUCTION

APPENDIX B

Closure and Post-Closure Cost Estimate

BLACKSTONE
ENVIRONMENTAL

March 28, 2022

Iowa Department of Natural Resources
Solid Waste Section
Wallace State Office Building
901 East Grand Avenue
Des Moines, Iowa 50319-0034

RE: Closure/Post-Closure Cost Estimate
Continental Cement Company – Davenport Plant CKD Landfill
Buffalo, Scott County, Iowa
IDNR Permit No. 82-SDP-15-96C and 82-SDP-16-97P

Dear Sir/Madam:

Blackstone Environmental, Inc. (Blackstone) is pleased to submit the closure/post-closure (CPC) cost estimates for the Continental Cement Company Davenport Plant Cement Kiln Dust (CKD) Landfill. This CPC cost estimate has been prepared in general accordance with the requirements of Title 567 Iowa Administrative Code Chapter 115.31 (567 IAC 115.31).

Continental operates a CKD landfill located in Buffalo, Iowa. A portion of the landfill is closed under Iowa Department of Natural Resources (IDNR) Permit No. 82-SDP-15-96C. The rest of the site is operated as a monofill for disposal of CKD under IDNR Permit No. 82-SDP-16-97P.

A summary of the closure and post-closure cost estimates are provided below. Detailed cost estimate tables are provided on the follow pages.

Table 1 – Closure and Post-Closure Cost Estimate Summary

Total Closure Costs	**$484,956.09**
Total Post-Closure Costs	**$1,051,768.06**
Total CPC Costs	**$1,536,724.15**

This cost estimate was prepared in accordance with applicable requirements and generally accepted environmental engineering practices.

If you have any questions, please contact Eric Sonsthagen with Blackstone at 402-208-2014 or Damion Sadd with Continental Cement at Damion.Sadd@continentalcement.com or 563-328-6204.

Respectfully,
BLACKSTONE ENVIRONMENTAL, INC.

Eric Sonsthagen

Eric Sonsthagen, P.E.
Senior Project Engineer

Krista A. Brodersen
Senior Project Manager

CERTIFICATION

I hereby certifies the portion of this engineering document described below was prepared by me and that I am a licensed Professional Engineer under the laws of the State of Iowa.

ERIC M.
SONSTHAGEN
P24844

Eric Sonsthagen

March 28, 2022

Eric Sonsthagen, P.E. License No. P24844

Pages covered by this seal: All

License Renewal Date: 12/31/2023

Closure Cost Estimate - Continental Cement Company

FACILITY OWNER: Continental Cement Company
FACILITY NAME: Davenport Plant CKD Landfill
DATE: 3/10/2022
PERMIT NUMBER: 82-SDP-16-97P
ESTIMATOR: Eric Sonsthagen, P.E.

Permit No.: 82-SDP-16-97P

ITEM	QUANTITY	UNITS	UNIT COST	COST
INITIAL CLOSURE PREPARATION				
CPC Plan Document Revisions	1	Each	$7,037.24	$7,037.24
FINAL COVER				
Site preparation earthwork and grading for final cover	5	Days	$2,463.02	$12,315.12
Final cover construction	18,000	CY	$12.67	$228,064.41
VEGETATIVE LAYER				
Final cover vegetation soil	14,000	CY	$11.25	$157,525.97
Seeding, mulching, and fertilizing	4.1	ACRE	$1,407.45	$5,770.52
EROSION CONTROL				
Erosion Control structures, ponds, terraces	5	Days	$2,463.02	$12,315.12
GROUNDWATER MONITORING SYSTEM				
Upgrade or repair existing wells	1	EACH	$1,407.45	$1,407.45
Well abandonment	0	EACH	$0.00	$0.00
LEACHATE COLLECTION SYSTEM				`
Leachate system modifications	1	EACH	$4,222.27	$4,222.27
FACILITY OPERATIONS				
Facility modifications	1	EACH	$14,074.49	$14,074.49
PROFESSIONAL SERVICES				
Engineering Services	1	EACH	$21,111.77	$21,111.77
ADMINISTRATION AND CONTINGENCY				
Legal, Financial, and Administration Services	1	EACH	$14,074.49	$14,074.49
Closure Compliance Documentation	1	EACH	$7,037.23	$7,037.23
			Total Closure Costs	**$ 484,956.09**

Post-Closure Cost Estimate - Continental Cement Company

FACILITY OWNER: Continental Cement Company
FACILITY NAME: Davenport Plant CKD Landfill
DATE: 3/10/2022
PERMIT NUMBER: 82-SDP-16-97P
ESTIMATOR: Eric Sonsthagen, P.E.

Permit No.: 82-SDP-16-97P

ITEM	QUANTITY	UNITS	UNIT COST	COST
MAINTENANCE ITEMS				
General Maintenance	30	Years	$1,548.19	$46,445.82
Cap and Vegetation Maintenance	30	Years	$3,096.38	$92,891.31
Drainage and Erosion Control Maintenance	30	Years	$0.00	$0.00
Waste Systems Maintenance	30	Years	$0.00	$0.00
Gas Control Maintenance	30	Years	$0.00	$0.00
Leachate Control Maintenance	30	Years	$2,500.00	$75,000.00
Groundwater Monitoring System Maintenance	30	Years	$1,407.45	$42,223.35
LEACHATE SYSTEM				
Leachate Management and Disposal	30	Years	$0.00	$0.00
Leachate Control Performance Evaluations	30	Years	$0.00	$0.00
GROUNDWATER MONITORING SYSTEM				
Groundwater Monitoring Performance Evaluations	30	Years	$2,814.87	$84,446.07
Groundwater Monitoring and Reporting	30	Years	$18,296.86	$548,905.82
INSPECTIONS				`
Facility Inspections	30	Years	$2,814.87	$84,446.07
ADMINISTRATION AND ENGINEERING				
Legal, Financial, and Administration Services	1	EACH	$14,074.49	$14,074.49
Engineering Services	1	EACH	$21,111.77	$21,111.77
Financial Assurance Accounting	30	Years	$1,407.45	$42,223.35
			Total Post-Closure Costs	**$ 1,051,768.06**

Industrial Monofill
Financial Assurance Report Form

Section 1: FACILITY INFORMATION *(please print or type)*

Information Requested	
Facility Name	Davenport Plant CKD Landfill
Permitted Agency/Entity	Continental Cement Company
Permit Number	82-SDP-16-97P

Section 2: CLOSURE/POSTCLOSURE OR CORRECTIVE ACTION COST ESTIMATES

Information Requested	Cost Estimate	Date of Cost Estimate
Updated Closure Cost Estimate	$ 484,956.09	3/10/22
Updated Postclosure Cost Estimate	$ 1,051,768.06	3/10/22
Initial or Updated Corrective Action Cost Estimate	$	

*Attach closure/postclosure cost estimate(s) signed and certified by an Iowa-licensed professional engineer. Cost estimates shall include, at a minimum, each of the cost line items defined in 115.31(3)"c" for closure and 115.31(4)"c" for postclosure. Please provide closure and/or postclosure site area acreage information with the estimates.

Provide a cost estimate for corrective action only if corrective action is required and a corrective action plan has been approved by the Department. Attach the corrective action cost estimate signed and certified by an Iowa-licensed professional engineer. The cost estimate shall account for total costs of the activities described in the approved corrective action plan for the corrective action period.

Section 3: FACILITY WASTE TONNAGE INFORMATION

Information Requested	Tons
Remaining permitted capacity as of the beginning of permit holder's current fiscal year	747,088
Amount of waste disposed of at the facility during the prior year	2,531

Section 4: PROOF OF COMPLIANCE

Publicly Owned Industrial Monofills *(ATTACH AUDIT REPORT)*

Owner's Most Recent Annual Audit Report

Prepared by: ____________________

For fiscal year ending: ____________

Privately Owned Industrial Monofills *(ATTACH AFFIDAVIT)*

Attach owner/operator's affidavit indicating that an annual review has been performed by a certified public accountant to determine whether the privately owned monofill is in compliance with IAC 567 Chapter 115. The affidavit shall state the name of the certified public accountant, the dates and conclusions of the review, and the steps taken to rectify any deficiencies identified by the accountant.

Section 5: FINANCIAL ASSURANCE INSTRUMENT

Type and Value of Financial Assurance Instrument(s)	*(ATTACH INSTRUMENT(S)*		
Assurance Instrument	**Establishment Date**	**Mechanism Covers**	**Instrument Value**
Trust Fund **567 IAC 115.31(6)"a"**		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Surety Bond **567 IAC 115.31(6)"b"**	March 1, 2016	Closure ☒ Postclosure ☒ Corrective Action ☐	$ 1,536,724.15
Letter of Credit **567 IAC 115.31(6)"c"**		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Insurance **567 IAC 115.31(6)"d"**		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Corporate Financial Test **567 IAC 115.31(6)"e"**		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Local Gov't. Financial Test **567 IAC 115.31(6)"f"**		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Corporate Guarantee **567 IAC 115.31(6)"g"**		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Local Gov't Guarantee **567 IAC 115.31(6)"h"**		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Local Gov't. Dedicated Fund **567 IAC 115.31(6)"i"**		Closure ☐ Postclosure ☐ Corrective Action ☐	$

Section 7: FUND PAYMENTS *(only if using dedicated or trust fund)*

Completion of the following fund information complies with the annual financial statement requirements of IAC 567 115.31(3)"a" and 115.31(4)"a" by indicating the current balance(s) of the dedicated/trust fund and the projected amount(s) to be deposited in the fund(s).

Under "Beginning Balance", please state the fund balance 30 days after the start of the previous fiscal year, for "Ending Balance", indicate the fund balance 30 days after the close of the previous fiscal year, and for "Projected Deposit", indicate the amount to be deposited within 30 days of the close of the permit holder's fiscal year.

Information Requested	Beginning Balance	Ending Balance	Projected Deposit
Dedicated Fund Balance *(see formula below)*	$	$	$
Trust Fund Balance *(see formula below)*	$	$	$

Formula for Projected Deposits

Dedicated/Trust Fund

$$\frac{CE - CB}{Y}$$

Where "CE" is the closure or postclosure cost estimate, "CB" is the balance 30 days after close of the previous fiscal year, and "Y" is number of years remaining in the pay-in period.

If needed, the space below can be used to show calculations for projected deposit(s)

Section 8: PERMIT HOLDER ENDORSEMENT

SUBMITTAL OF THIS COMPLETED AND ENDORSED FORM ALONG WITH ALL REQUIRED DOCUMENTATION ESTABLISHES NOTIFICATION AND PROOF OF PERMIT HOLDER COMPLIANCE WITH IAC 567 CHAPTER 115.

Damion Sadd	Environmental and Public Affairs Manager	
Name of Official	**Title**	
Continental Cement Company		
Agency/Entity		
301 E. Front Street		
Address		
Buffalo	IA	52728
City	**State**	**Zip**
563-328-6204		
Telephone	**Fax**	
Damion.Sadd@continentalcement.com		
Email Address		

Signature of Official	**Title**	**Date**

Questions? Contact Bill Blum at (515) 725-8376 or Bill.Blum@dnr.iowa.gov

SURETY RIDER

To be attached to and form a part of

Bond No. 019052863

dated effective March 1, 2016
(MONTH-DAY-YEAR)

executed by Continental Cement Co., LLC, as Principal,
(PRINCIPAL)

and by Liberty Mutual Insurance Company, as Surety,

in favor of Iowa Department of Natural Resources
(OBLIGEE)

in consideration of the mutual agreements herein contained the Principal and the Surety hereby consent to changing

The Bond Amount from:

Six Hundred Thirty-nine Thousand Six Hundred Fifty-two & 95/100 Dollars ($639,652.95)

To:

One Million Five Hundred Thirty-six Thousand Seven Hundred Twenty-four & 15/100 Dollars ($1,536,724.15)

Nothing herein contained shall vary, alter or extend any provision or condition of this bond except as herein expressly stated.

This rider is effective March 16, 2022
(MONTH-DAY-YEAR)

Signed and Sealed March 16, 2022
(MONTH-DAY-YEAR)

Continental Cement Co., LLC
(PRINCIPAL)

By:
(PRINCIPAL) DAVID LOOMES: PRESIDENT

Liberty Mutual Insurance Company
(SURETY)

By:
Linda Lee Nipper, Attorney-in-Fact

S-0443/GEEF 10/99

Liberty Mutual.
SURETY

This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated.

Liberty Mutual Insurance Company
The Ohio Casualty Insurance Company
West American Insurance Company

Certificate No: 8204866

POWER OF ATTORNEY

KNOWN ALL PERSONS BY THESE PRESENTS: That The Ohio Casualty Insurance Company is a corporation duly organized under the laws of the State of New Hampshire, that Liberty Mutual Insurance Company is a corporation duly organized under the laws of the State of Massachusetts, and West American Insurance Company is a corporation duly organized under the laws of the State of Indiana (herein collectively called the "Companies"), pursuant to and by authority herein set forth, does hereby name, constitute and appoint, Linda Lee Nipper all of the city of Salt Lake City, state of Utah each individually if there be more than one named, its true and lawful attorney-in-fact to make, execute, seal, acknowledge and deliver, for and on its behalf as surety and as its act and deed, any and all undertakings, bonds, recognizances and other surety obligations, in pursuance of these presents and shall be as binding upon the Companies as if they have been duly signed by the president and attested by the secretary of the Companies in their own proper persons.

IN WITNESS WHEREOF, this Power of Attorney has been subscribed by an authorized officer or official of the Companies and the corporate seals of the Companies have been affixed thereto this 15th day of February, 2021.

Liberty Mutual Insurance Company
The Ohio Casualty Insurance Company
West American Insurance Company

1912 1919 1991

By: David M. Carey
David M. Carey, Assistant Secretary

Not valid for mortgage, note, loan, letter of credit, currency rate, interest rate or residual value guarantees.

For bond and/or Power of Attorney (POA) verification inquiries, please call 610-832-8240 or email HOSUR@libertymutual.com.

STATE OF PENNSYLVANIA ss
COUNTY OF MONTGOMERY

On this 15th day of February, 2021, before me personally appeared David M. Carey, who acknowledged himself to be the Assistant Secretary of Liberty Mutual Insurance Company, The Ohio Casualty Company, and West American Insurance Company, and that he, as such, being authorized so to do, execute the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed my notarial seal at King of Prussia, Pennsylvania, on the day and year first above written.

Teresa Pastella

Commonwealth of Pennsylvania - Notary Seal
Teresa Pastella, Notary Public
Montgomery County
My commission expires March 28, 2025
Commission number 1126044
Member, Pennsylvania Association of Notaries

By: Teresa Pastella
Teresa Pastella, Notary Public

This Power of Attorney is made and executed pursuant to and by authority of the following By-laws and Authorizations of The Ohio Casualty Insurance Company, Liberty Mutual Insurance Company, and West American Insurance Company which resolutions are now in full force and effect reading as follows:

ARTICLE IV – OFFICERS: Section 12. Power of Attorney.
Any officer or other official of the Corporation authorized for that purpose in writing by the Chairman or the President, and subject to such limitation as the Chairman or the President may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Corporation to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact, subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Corporation by their signature and execution of any such instruments and to attach thereto the seal of the Corporation. When so executed, such instruments shall be as binding as if signed by the President and attested to by the Secretary. Any power or authority granted to any representative or attorney-in-fact under the provisions of this article may be revoked at any time by the Board, the Chairman, the President or by the officer or officers granting such power or authority.

ARTICLE XIII - Execution of Contracts: Section 5. Surety Bonds and Undertakings.
Any officer of the Company authorized for that purpose in writing by the chairman or the president, and subject to such limitations as the chairman or the president may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact, subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Company by their signature and execution of any such instruments and to attach thereto the seal of the Company. When so executed such instruments shall be as binding as if signed by the president and attested by the secretary.

Certificate of Designation – The President of the Company, acting pursuant to the Bylaws of the Company, authorizes David M. Carey, Assistant Secretary to appoint such attorneys-infact as may be necessary to act on behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations.

Authorization – By unanimous consent of the Company's Board of Directors, the Company consents that facsimile or mechanically reproduced signature of any assistant secretary of the Company, wherever appearing upon a certified copy of any power of attorney issued by the Company in connection with surety bonds, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

I, Renee C. Llewellyn, the undersigned, Assistant Secretary, of Liberty Mutual Insurance Company, The Ohio Casualty Insurance Company, and West American Insurance Company do hereby certify that this power of attorney executed by said Companies is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this 16th day of March 2022.

1912 1919 1991

By:
Renee C. Llewellyn, Assistant Secretary

Marsh MSurety POA LMIC OCIC WAIC Multi Co_022021

BLACKSTONE
ENVIRONMENTAL

APPENDIX G

Emergency Response and Remedial Action Plan

Emergency Response and Remedial Action Plan (ERRAP)

Continental Cement Davenport Plant CKD Landfill
301 East Front Street
Buffalo, Iowa
IDNR Landfill Permit Number 82-SDP-16-97P

Prepared for:
Continental Cement
301 East Front Street
Buffalo, Iowa 52728

Prepared by:
Blackstone Environmental, Inc.
16200 Foster Street
Overland Park, Kansas 66085

August 30, 2024

BLACKSTONE
ENVIRONMENTAL

EMERGENCY RESPONSE AND REMDIAL ACTION PLAN
CONTINENTAL CEMENT DAVENPORT PLANT CKD LANDFILL
301 EAST FRONT STREET
BUFFALO, IOWA
IDNR LANDFILL PERMIT NUMBER 82-SDP-16-97P

Prepared for:

Continental Cement
301 East Front Street
Buffalo, Iowa 52728

Prepared by:

Maren Williams

Maren Williams
Project Engineer

Reviewed by:

Kyle Kukuk, P.E.
Senior Project Manager

Blackstone Project Number: 3630

August 30, 2024

TABLE OF CONTENTS

1.0 FACILITY INFORMATION

Continental Cement Company, LLC (Continental) is located at 301 Front Street in Buffalo, Scott County, Iowa (Site). Quarrying and manufacturing of Portland cement products have been conducted at the Continental facility since 1924 and other uses are not anticipated in the future. The cement manufacturing process includes the heating of limestone with silica, alumina, and iron minerals to form clinker. The clinker (nodules of sintered material) is ground into a fine powder and mixed with gypsum to form cement. As part of the manufacturing process, removal of particulate is required to control the composition of the cement product. This material is known as cement kiln dust (CKD). Continental Cement Company operates an approximately 20-acre monofil for the disposal of CKD. The southern portion of the monofill has been filled to original grade and closed in general accordance with the requirements of the Iowa Department of Natural Resources (IDNR) Permit Number 82-SDP-15-96C. An active monofill disposal cell (Phase II) is operated under IDNR Permit Number 82-SDP-16-97P. The amount of CKD per day disposed at the monofill varies by day. Continental continues to operate with the overall goal of minimizing landfilled CKD and beneficially reusing material when able.

The Continental facility is located approximately four miles west of Davenport, Iowa within Sections 14,15,22, and 23, of Township 77 North, - Range 2 East (Buffalo Township), Scott County as shown on the attached Figure 1, Appendix A. The facility has been in operation, under various ownership, from 1924 for the quarrying of limestone rock and the manufacture of Portland cement. The CKD landfill is located in an inactive portion of the quarry approximately 2000 feet east of the active quarry area and comprises approximately 20 acres. A site diagram of the landfill is attached as Figure 2, Appendix A.

The Certified Operator responsible for the operation of the project is as follows:

Damion Sadd, Environmental Manager
301 East Front Street
P.O. Box 690
Buffalo, IA 52728
(563)328-6204

2.0 REGULATORY REQUIREMENTS

In accordance with Iowa Code section 455B.306(6)(d) an Emergency Response and Remedial Action Plan (ERRAP) was submitted as part of the December 27, 2021, permit renewal application. Condition X.2.h of the new permit issued by IDNR on January 6, 2022, required submission of a revised ERRAP for subsequent permit renewal applications.

3.0 EMERGENY RESPONSE AND REMEDIAL ACTION PLAN

3.1 Failure of Utilities

The landfill is utilized for the disposal of CKD, which is a byproduct manufactured at the same site. Since no utilities are located within the landfill, operations at the plant will also be affected if a failure of utilities occurs. Due to this fact, it is possible to cease operations at the landfill, if necessary, without adversely affecting CKD storage and disposal for short-term and long-term events.

3.2 Weather Related Events

Disposal operations of CKD are primarily performed during winter when tornadoes, windstorms, intense rainstorms and erosion, lightning strikes, and flooding are historically not factors. Because the landfill is utilized for the disposal of CKD, which is manufactured the same site, if weather related events occur, operations at the plant will also be affected. Due to this fact, it is possible to cease operations at the landfill, if necessary, without adversely affecting CKD storage and disposal.

3.3 Fires and Explosions

The CKD landfill is a monofil constructed and operated to dispose of CKD, a material generated through the manufacture of Portland cement. This material is created in a pyro processing system at temperatures in excess of 2600ºF. Once the material leaves the pyro processing system, it has been thoroughly fired, therefore, CKD as a landfilled material being stored, transported, unloaded, or placed cannot: Be altered by fire, support a flame, be susceptible to creating an explosion, or assist in a runaway reaction needed to generate an explosion.

There are no buildings, equipment, utilities, stored fuels, facilities, or working areas located within the landfill that can catch on fire. CKD does not break down to form methane gas, so methane gas does not accumulate in the landfill and lead to explosive atmospheres.

3.4 Regulated Waste Spills and Releases

Continental's current operation procedures were created to minimize the release of CKD to the ambient air during storage, transport, unloading, and placement of the material. These procedures include:

- After processing, CKD is stored within an enclosed structure (e.g., silo).
- During the process of loading for transport to the landfill, CKD is conditioned with water to minimize dusting during transport and placement.

- Conditioned CKD tends to agglomerate in the truck which makes it less vulnerable to spillage during transport.
- Employees operating landfill transport trucks are trained in the correct operating procedures, which include instruction regarding the amount of material suitable for one truckload. Employees are encouraged not to overfill trucks to ensure that material does not leave the truck during transport prior to unloading at the landfill.
- The time between transport and placement in the landfill is minimized to reduce drying time which could lead to wind erosion during placement.
- Employees operating landfill placement equipment are trained in the correct operating procedures, which include instruction regarding proper placement of material in the landfill. Employees are aware that CKD is not to be pushed into the bermed sides of the landfill, ensuring that all placed material is well contained withing the landfill bed.
- The landfill is inspected weekly to ensure that CKD is not being released to the surface water including the quarry sump and that the CKD is well within the bermed area so that releases do not occur during storm events.
- A four-foot clay liner compacted to 1x10-7 cm/sec is in place underlying the CKD material to prevent releases to the groundwater.
- Monthly water level monitoring and semi-annual sampling is conducted to monitor for CKD release to the groundwater utilizing wells located both inside and outside of the landfill.

3.5 Hazardous Material Spills and Releases

The CKD landfill is a monofil constructed and operated to dispose of CKD, a material generated through the manufacturing of Portland cement. This material is created in a pyro processing system at temperatures in excess of 2600ºF. Once the material leaves the pyro processing system, it has been thoroughly fired. Only CKD, a non-hazardous solid waste, is disposed of at the facility. Except for small quantities of fuels, oils, and other materials contained in transport vehicles and earth moving equipment, hazardous materials are not stored, used, or disposed of at the landfill site.

3.6 Mass Movement of Land and Waste

Due to the cementitious nature of the conditioned CKD, the material tends to bind together when placed at the landfill forming a relatively uniform and solid deposit. The material is able to stand at a relatively steep angle of repose with negligible risk of slumping or slope failure. Further, the material is relatively impervious thereby reducing the likelihood of saturation which could reduce the shear strength and lead to slope instability.

Employees with duties associated with the storage, handling, transport, or disposal of CKD are trained to place CKD in a manner which will reduce the likelihood of slope failures, waste shifts, and waste subsidence. Transport vehicle drivers are instructed to place material at a safe distance back from the edge of the active cell to avoid surcharging the edge of the cell. Accumulated material is periodically pushed into the active cell with earthmoving equipment. The landfill is also inspected weekly so that situations which would lead to mass movement of waste are avoided or quickly corrected.

3.7 Emergency and Release Notifications and Reporting

CKD, a non-hazardous material generated through the manufacturing of Portland cement, is not subject to release notification and reporting requirements. If releases of fuel, oils, or other materials occur from the transport vehicle or excavating equipment, Continental will provide proper notification to the IDNR and/or the United States Environmental Protection Agency in accordance with applicable requirements.

Due to the cementitious nature of the CKD material, windblown emissions from the face of the landfill or CKD piles are negligible. Further, the runoff from the exposed material is directed into the lined portion of the active cell allowing suspended sediment to settle out on site. The small quantities of fuel, oils, and other materials contained in transport vehicles or excavating equipment, if released, would likely be absorbed by surficial materials at the site. The likelihood of a release of materials affecting off-site properties is negligible. As such, notification to the city and county agencies, news media, or special populations will not be required.

3.8 Emergency Waste Management Procedures

Since the landfill is utilized for the disposal of CKD, which is manufactured at the same site, operations at the plant will also be affected. Due to this fact, it is possible to cease operations at the landfill, if necessary, without adversely affecting CKD storage and disposal for long-term emergency events. In case of a short-term emergency, CKD is stored in a silo at the plant site. Hauling of CKD can be temporarily discontinued until the emergency is resolved.

3.9 Primary Emergency Equipment Inventory

The landfill is staffed only during CKD unloading activities or while shaping and/or capping placed CKD material. The actual time on-site is less than 25 hours per month. Further, combustible materials are not stored, used, or disposed of at the site. As such, emergency equipment is not maintained at the site and water sources/hydrants are not located at the site. In the event of an emergency, equipment resources would be provided by the City of Buffalo, Iowa and/or Scott County.

3.10 Emergency Aid

In the event of an emergency requiring aid, local authorities will be contacted.

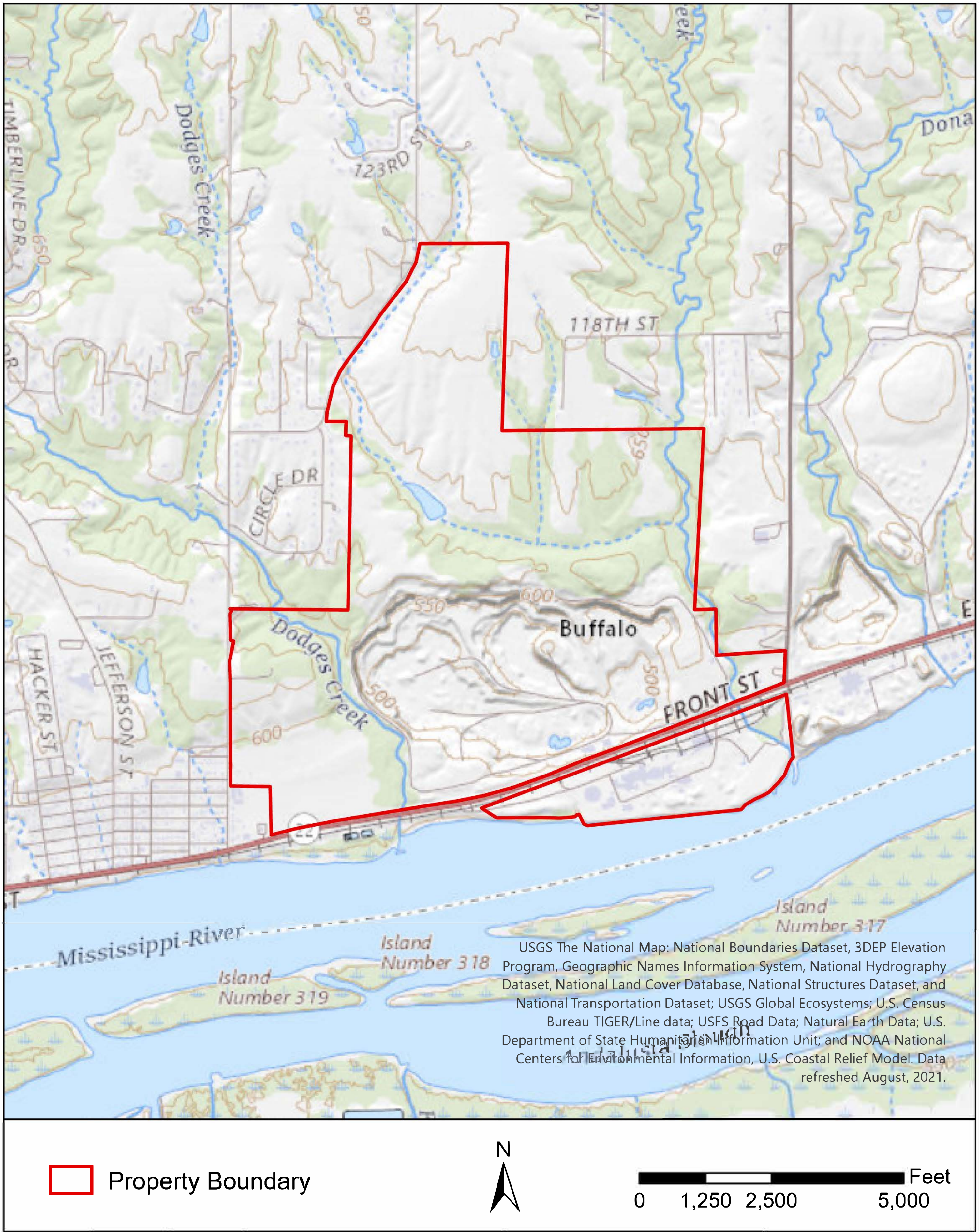
3.11 Training

Employees operating landfill transport trucks and/or landfill placement equipment will be trained on the provisions of the ERRAP along with correct operating procedures. Training will be provided by the Environmental Manager or their designee. Training will be conducted for employee's first-time assignment to duties associated with the storage, handling, transport, or disposal of CKD and periodically thereafter in conjunction with modifications to the ERRAP or issuance of an updated landfill operating permit. Training will be documented in accordance with Continental procedures.

APPENDIX A

Figures

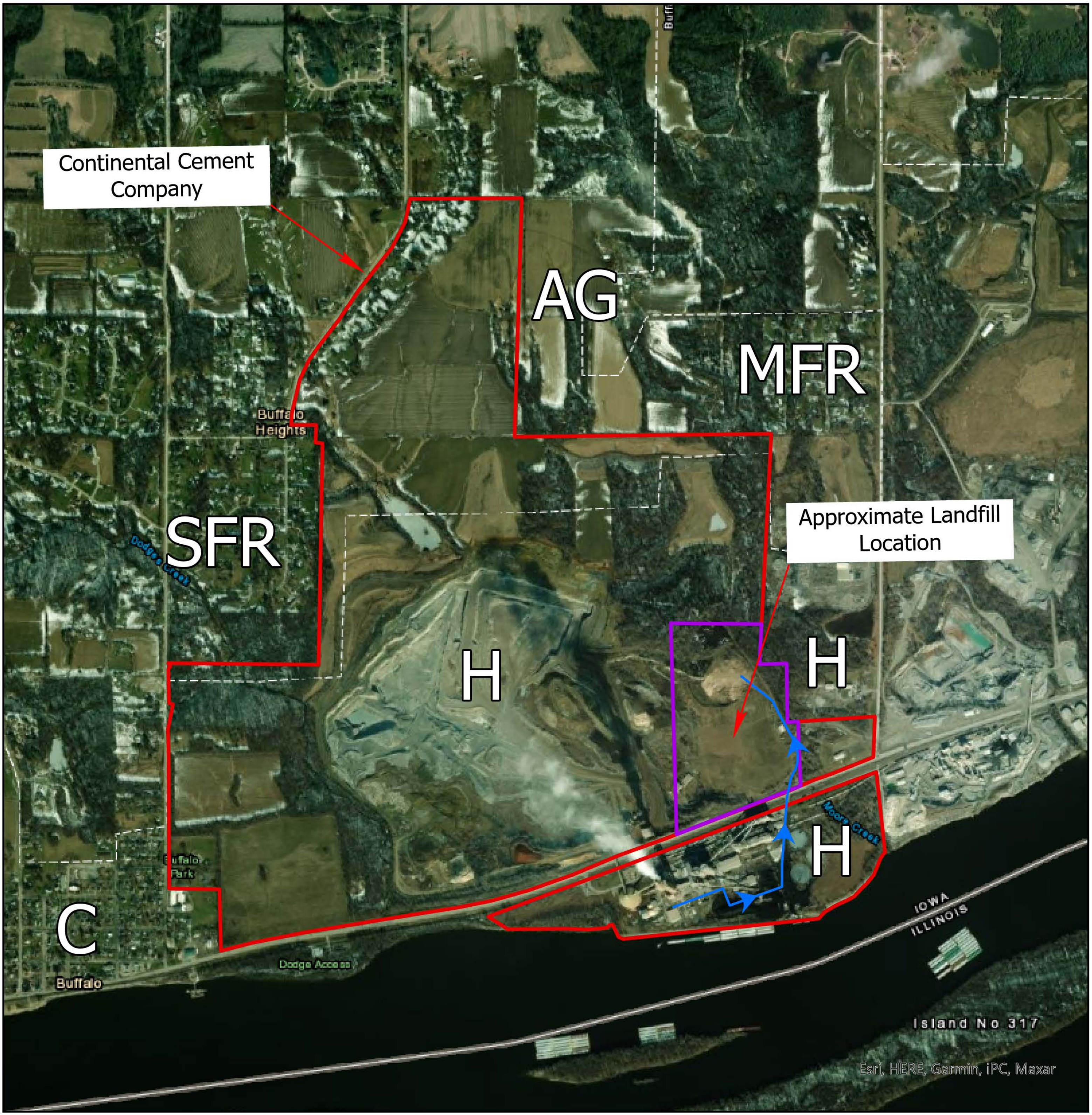
Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental



USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed August, 2021.

FIGURE 1	Project Mgr. KK	Date: June 2024	CONTINENTAL CEMENT BUFFALO, IOWA	SHEET NAME Site Topographic Vicinity Map	BLACKSTONE ENVIRONMENTAL
	Designed By: TS	Rev.:		PROJECT NAME Continental Cement Permit Renewal	
	Drawn By: TS	Rev.:			
	Checked By: LJ	Rev.:		PROJECT LOCATION 301 East Front Street Buffalo, Iowa	
	Job No.: 3630	Rev.:			

Path: Z:\Shared\Clients\Continental Cement\PROJECTS\3066 Landfill Services\WORKING\GIS\Continental\Continental.aprx



LEGEND

H	- Heavy Industrial	MFR	- Multi-Family Residence
C	- Two Family	SFR	- Single-Family Residence
AG	- Agricultural - General	→	- Haul Route

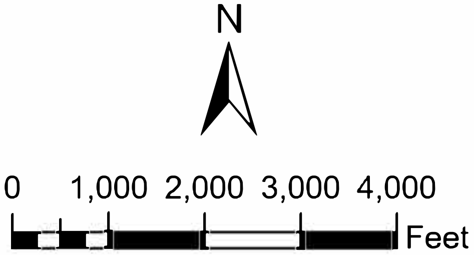


FIGURE 2	Project Mgr. KK	Date: June 2024	BLACKSTONE ENVIRONMENTAL	CLIENT NAME Continental Cement
	Designed By: ME	Rev.:		SHEET NAME Permit Renewal
	Drawn By: ME	Rev.:		
	Checked by: KB	Rev.:		PROJECT NAME AND LOCATION Site Operations Plan, Buffalo, IA
	Job No.: 3630	Rev.:		

APPENDIX H

Comprehensive Waste Plan

RECORD COPY

82-SDP-15-96

PdS

copy in active

Suite 100, 4500 - 16th Avenue N.W.
Calgary, Alberta, Canada T3B 0M6
Telephone: (403) 247-0200
Fax: (403) 247-4811 or 247-0779
e-mail: komex@komex.com
web: www.komex.com

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

CANADA'S 50 BEST MANAGED PRIVATE COMPANIES

June 30, 1997

OUR FILE: KI96-4161

Con 12-1-1
Doc # 44825

Waste Management Assistance Division
Department of Natural Resources
Wallace State Office Building
Des Moines, Iowa, 50319-0034

Attention: Garth Frable

Dear Sir:

Re: ***Comprehensive Plan - Lafarge Davenport Cement Plant***
Cement Kiln Dust Closure and Development Permit
DNR File No. 82-SDP-15-96

Accompanying this letter, please find 3 copies of the Comprehensive Plan for Lafarge's Cement Kiln Dust (CKD) management activities at the above-noted site. The Plan focusses on issues relevant to CKD, a mineral by-product of the cement manufacturing process. Issues related to management of municipal waste are not included, as the CKD management area is strictly a CKD monofill utilized only for the Davenport Cement Plant.

We understand that approval of the Comprehensive Plan is required to obtain a permit for CKD landfilling activities. Hence, we would appreciate your timely review. Please do not hesitate to contact the undersigned or Brian Gasiorowski of Lafarge at (248) 354 9050 if you have any questions. We trust that the Plan satisfies the relevant components of the Iowa statutes.

Respectfully,

KOMEX INTERNATIONAL LTD.

Gordon J. Johnson, M.S., P.Eng.

cc. Cyrus Rustin, IDNR
Brian Gasiorowski, Heinz Knopfel, Lafarge

J:\4161\CORR\FRJN30GJ.DOC

CALGARY, EDMONTON, VANCOUVER, LOS ANGELES, BRISTOL, QUITO, NICOSIA, SANA'A

1997 JUL -1 A 11: 21

DEPT. OF
NATURAL RESOURCES

DATE STAMP

Suite 100, 4500 - 16th Avenue N.W.
Calgary, Alberta, Canada T3B 0M6
Telephone: (403) 247-0200
Fax: (403) 247-4811 or 247-0779
e-mail: komex@komex.com
web: www.komex.com

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

CANADA'S 50 BEST MANAGED PRIVATE COMPANIES

COMPREHENSIVE WASTE MANAGEMENT PLAN - LAFARGE DAVENPORT CEMENT KILN DUST MANAGEMENT AREA

PREPARED FOR:

LAFARGE CORPORATION

KI97-4161

JUNE, 1997

CALGARY, EDMONTON, VANCOUVER, LOS ANGELES, BRISTOL, QUITO, NICOSIA, SANA'A

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

1.1 BACKGROUND

Lafarge Corporation operates a cement manufacturing facility that is located at 301 East Front Street, Buffalo, Iowa (Figure 1). The plant generates Cement Kiln Dust (CKD) as part of the cement manufacturing process and currently places this material in the quarry (Figure 2). Accordingly, Lafarge has recently applied for a permit for this activity in accordance with the Iowa Administrative Code (IAC Chapters 100 to 101). The State has requested that Lafarge submit a Comprehensive Plan for management and minimization of the landfilled materials in accordance with IAC Subrule 101.5 (IDNR, 1997). This report provides Lafarge's Comprehensive Plan (Plan) and addresses the relevant portions of Guidelines for Solid Waste Comprehensive Plans Part I: Solid Waste Mangement Alternatives (Guidelines) (IDNR, 1990).

1.2 GENERAL

Review of the Guidelines indicates that the primary purpose of a Comprehensive Plan is to reduce the volume of municipal solid waste that requires landfilling and to allow for beneficial reuse wherever practical. The Guidelines generally focus on issues related to the public and to management of municipal solid waste. Hence, a considerable portion of the Guidelines is not relevant to CKD, which is a non-organic mineral material, or to Lafarge's landfill, which is a monofill comprising materials generated from a single source (Lafarge's cement manufacturing process). For these reasons, this Plan focuses on the following issues included in the Guidelines that are relevant to CKD management at Davenport:

- purpose and scope;
- description of the CKD;
- planning;
- previous waste reduction initiatives;
- analysis of alternatives;
- meeting the State's volume reduction and recycling goals;
- implementation schedule; and,
- checklist.

1.3 PURPOSE AND SCOPE

The Plan is a document that will help Lafarge implement programs to reduce the volume of CKD being landfilled at the Davenport Plant. Alternatives to landfills reduce the potential for groundwater contamination, preserve valuable natural resources, and enhance energy and economic savings. It will be submitted to the Waste Management Authority Division (WMAD) of the Iowa Department of Natural Resources (IDNR).

The Plan is a part of a legislated, comprehensive approach to solid waste management that complies with statewide solid waste management policy included as part of the Groundwater Protection Act. The Act identifies a hierarchy of preferred management options: The Waste Management Hierarchy. These options are prioritized according to their potential groundwater impacts, their overall environmental impacts, and their ability to conserve resources. The incorporation of these policies will ensure the protection of groundwater, the minimization of impacts on other environmental media and the wise use of natural resources. The potentially relevant Iowa laws state the following:

The Groundwater Protection Act

Pursuant to the Iowa Code, section 455B.306, a private agency operating or planning to operate a solid waste management project is required to prepare a Comprehensive Solid Waste Management Plan and to file it with the Department of Natural Resources.

According to 455B.306 of the Iowa Code, as Solid Waste Comprehensive Plan shall:

> "...incorporate and reflect the waste management hierarchy of the state solid waste management policy and shall at a minimum address the following general topics to the extent appropriate to the technology employed by the applicant at the sanitary disposal project:
>
> 1. The extent to which the solid waste is or can be recycled.
> 2. The economic and technical feasibility of using other existing sanitary disposal project facilities in lieu of initiating or continuing the sanitary disposal project for which the permit is being sought.
> 3. The expected environmental impact of alternative solid waste disposal methods, including the use of sanitary landfills.
> 4. A specific plan and schedule for implementing technically and economically feasible solid waste disposal methods that will result in minimal environmental impact."

Iowa Code section 455B.301A (1987 Code Supplement) contains the state solid waste management policy as follows:

> "The protection of the health, safety, and welfare of Iowans and the protection of the environment require the safe and sanitary disposal of solid wastes. An effective and efficient solid waste disposal program protects the environment and the public, and provides the most practical and beneficial use of the material and energy values of the solid waste. While recognizing the continued necessity for the existence of landfills,

alternative methods of managing solid waste and reduction in the reliance upon land disposal for solid waste are encouraged. In the promotion of these goals, the following waste management hierarchy in descending order of preference, is established as the waste management policy of the state:

1. Volume reduction at the source.
2. Recycling and reuse.
3. Combustion with energy recovery and refuse-derived fuel.
4. Combustion for volume reduction.
5. Disposal in landfill."

The Waste Reduction - Recycling Act

In 1989, the Waste Reduction - Recycling Act (Iowa Code, Chapter 455D) placed additional requirements on the Comprehensive Plan. The law sets a statewide waste volume reduction goal of 25 % by 1994 and 50 % by 2000 through the use of waste reduction at the source and recycling. July 1, 1988 is the baseline year. Comprehensive Plans, Part I, shall provide details of a methodology for meeting the state volume reduction goal.

This Plan includes examination and development of alternative solid waste management systems that incorporate all of the relevant elements contained in these regulatory requirements and Guidelines. As such, the Plan develops technically and economically feasible alternatives to landfilling the CKD at the Davenport Plant. The Plan is a working document that Lafarge will use to develop, implement, and assess programs that will not only extend the life of their landfill area, but will produce a number of other benefits.

1.4 SITE DESCRIPTION

General

This section provides a description of the site in accordance with requirements of the Guidelines. The description refers to Lafarge's property, only and does not include description of the surrounding lands, populations, or transprotation corridors because these issues are not relevant to Lafarge's CKD management program.

The CKD management area is located at the east end of the quarry, approximately 2,000 feet from the active area of mining, and comprises approximately 20 acres (see Figure 2). Quarrying and cement manufacturing operations on the Site are approved through Lafarge's operating permits and licenses. The Site has been used and will continue to be used for the manufacture of Portland cement and related products. No other use is anticipated in the foreseeable future.

The quarry is approximately 90 feet deep in the vicinity of the CKD management area and has been filled to original grade over the eastern and southern portion of the management area. The northern portion of the area has been filled to an elevation of approximately 540 ft AMSL. In the past, the CKD has been placed directly in the quarry, essentially as a monofill.

The management area has historically been used for quarrying and then placement of CKD and off-specification cement materials similar in nature to CKD. On occasion, the area has been used for overburden and waste rock excavated as part of quarry development. Minor amounts of plant trash may have also been deposited in the area, although this volume is expected to be small. The CKD management area comprises only a small proportion of the current quarry.

Siting Criteria

The following characteristics and conditions have been established for the CKD management area:

Property Boundaries:	The management area is located more than 20 feet from an adjacent property line. The eastern property boundary of the Site is generally located 100 feet to the east of the management area. East Front Street (Highway 22) is located approximately 100 feet to the south of the area. No other property boundaries are located within 500 feet of the CKD management area.
Floodplain:	The management area is located outside of the 1 in 100 years floodplain of the Mississippi River. East Front Street separates the management area from the Mississippi River. The base of the quarry is located below the elevation of the river and is maintained dry by a central sump and pumping system which discharges water into the Mississippi River through NPDES 001 (Figure 2).
Nearby Residences:	The area is located more than 500 feet from any existing habitable residence. The nearest residence is located approximately 2,000 feet to the north.
Site Stability:	The Site has been used for more than 70 years for the manufacture of Portland cement and related products. During this time there has been no record of seismic events, active faulting or instability of the quarry walls. This area of Iowa has been established as one of low seismic activity. Hence, the Site is considered geologically stable.

Airports:	The Site is located more than 10,000 feet from any airport, airfield, or runway. CKD dust does not attract birds or pests and hence the management area does not pose a risk to airplane traffic.
Soil Conservation:	The management area is located in a limestone quarry that has been developed to provide raw materials for cement manufacturing. There is no soil in the quarried area. Soil excavated in support of quarry expansion will be reused in the CKD area. The final grade is designed to conform to the surrounding pre-quarry landscape.
Plants and Animals:	Because the management area has and continues to be utilized for quarrying there are no plants that inhabit the management area and few animals. Hence, the CKD management activities will not impact potentially threatened species.
Archeology:	Similarly, due to past quarrying activities, the property is not of archeological or historical significance.
Potential Human Impacts:	The management area is well isolated from adjacent residences and farming areas. Hence, potential for impacts to human health are limited and do not include direct exposure. Potential environmental impacts are related to fugitive dust, which is controlled by conditioning and compacting the CKD, as well as groundwater quality, which is monitored in accordance with the Code.

2. CEMENT KILN DUST

2.1 CEMENT KILN DUST ORIGIN

The cement manufacturing process involves heating carbonate rock (limestone) with minor amounts of silica, alumina and iron minerals to form clinker. The clinker is ground into a fine powder and is mixed with gypsum to form cement. The heating process occurs in the cement kiln. Large quantities of air are used in the cement kiln to support combustion. The air and combustion products entrain particles of clinker, raw materials, and partially calcined materials. These particles are removed from the exhaust gases as an air pollution prevention measure and are recycled into the cement manufacturing process as kiln feed. Some removal of particulate from the clinker manufacturing process is required to control the composition of the final product. This material is known in the industry as cement kiln dust (CKD).

2.2 COMPOSITION

The average chemical composition of CKD reflects the composition of the feed rock and soils and includes the following compounds:

Table 1: Cement Kiln Dust Composition

$CaCO_3$	SiO_2
CaO	K_2SO_4
Al_2O_3	KCl
$Ca(OH)_2$	$CaMg(CO_3)_2$
$Ca(MgFe)(CO_3)_2$	

Metal oxides are present in trace amounts because these compounds condense in the kiln, on the particulates as the gases move counter-current to the material flow. CKD composition is primarily a function of the layout and operation of the kiln. Hence, the composition is stable over time.

CKD consists of relatively uniform silt size particles, in the range of 5 to 20 microns mean particle size diameter, and has a high affinity for water. The addition of water initiates a hydration process that causes kiln dust to set in a manner similar to cement. Because of its fine particle size distribution, the CKD can retain a high proportion of water before reaching saturation. This water is held to the particles by surface tension, resulting in relatively low hydraulic conductivity, on the order of 10^{-6} cm/sec if the CKD is in a compact state (> 90% Standard Protor Density).

In its dry state, the CKD exhibits an angle of internal friction of approximately 34°. Once the hydration process is complete, the material can develop unconfined compressive strengths well in excess of 100 psi, depending on its initial composition.

2.3 REGULATORY REQUIREMENTS

CKD is a non-hazardous solid mineral that is excluded from the Resource Conservation and Recovery Act (RCRA) Subtitle C through the Bevill Amendment. Lafarge has completed discussions with the State of Iowa regarding the regulation of CKD management activities at the Site. It was concluded that the CKD would be regulated as a non-hazardous solid waste, in accordance with Iowa Code Section 567, Chapters 100 to 111 (IDNR, 1996).

3. PLANNING

3.1 RESPONSIBILITIES

The first step in the planning process is to identify key individuals that will be responsible for developing and implementing the Plan. In this case, the generation and management of CKD are controlled entirely by the Lafarge Davenport cement plant and corporate support groups. Hence, the individuals responsible for implementation of the Plan are Lafarge employees and subcontractors. The positions, individuals currently holding the position, and the present area of responsibilities are listed below.

Table 2: Roles and Responsibilities

Job Function	Present Individual	Responsibilities
Plant Environmental Manager	Heinz Knopfel	• CKD management • regulatory issues • funding • program implementation
Regional Environmental Mgr.	Brian Gasiorowski	• implementation of env. programs • regulatory representation • quality assurance
Director of Geology & Raw Materials	Jean-Guy Levaque	• quarry planning • assessment of raw materials • CKD management
Alternate Raw Materials	Greg Daderko	• beneficial reuse of CKD • scheduling alternate raw materials
Consultant	Gordon Johnson	• landfill design • hydrogeological monitoring

3.2 SCHEDULING

Lafarge implemented a CKD task force in 1992 to address the following:

- controlling cement manufacturing raw materials to minimize generation;
- potential beneficial reuse;
- potential process modifications to reduce generation; and,
- management of placement operations.

Each Lafarge facility, including the Davenport Plant was addressed by the program. Measures were taken to minimize the rate of CKD generation by the plant and to investigate potential beneficial reuses of CKD. Initiation of the program has essentially been completed. Measures adopted for the Davenport Plant continue to be revisited on a regular basis with the goal to continuous improvement.

3.3 FUNDS

Funds for implementation of the Plan are made available through the Plant's annual operating budget, which include allowances for CKD management and related issues. Plant operations result in the sale of approximately 1 million tons of cement annually. Income from these operations provide Lafarge with the financial resources necessary to effectively manage its CKD and to effectively address related issues such as the implementation of this Plan.

4. WASTE REDUCTION

4.1 PREVOUS WASTE REDUCTION INITIATIVES

Lafarge Corporation is an active member of the Portland Cement Association (PCA), an organization of cement manufacturers dedicated to improving and extending the uses of portland cement and concrete through market development, engineering, research, education and public awareness. In 1995, the PCA commissioned a study of the Alternate Uses of Cement Kiln Dust (Bhatty, 1995) which is provided as Appendix I. This study addresses all currently known alternative uses of CKD.

As previously stated, Lafarge implemented a CKD task force in 1992 to more effectively manage the dust generated by its cement manufacturing facilities. A major focus of the task force was to investigate means of reducing the CKD generated by active cement plants. To this end, Lafarge implemented a program that embraced all of the alternate uses of CKD as summarized in Appendix I. For the Davenport cement plant, the following landfill reduction initiatives were implemented:

- recycling of all spilled cement materials, kiln brick and like debris into the cement manufacturing process;
- regular geological assessments and quarry mining plans with the goals of coordinating raw materials management to minimize the rate that CKD is generated by the plant;
- utilization of alternate raw materials;
- recirculating dust in the cement manufacturing systems;
- supervising and controlling the CKD management area so that only CKD is placed in this area; and,
- investigating beneficial uses for CKD in the Davenport area.

Recycling

Since the early 1990's, all used kiln brick, off-specification clinker, spilled cement materials and the like are recycled in the cement manufacturing process. Up to this time, these materials were placed in the CKD management area. Although accurate records of the volumes placed in 1988 are not available, an average of approximately 30 tons per day have been recycled.

Raw Materials Control

Geological assessments of the quarry are completed on a regular basis. Mine plans are developed by Lafarge Corporate Technical Services approximately once every 5 years. The purpose of the plans is to control raw feed to maximize the efficiency of the cement manufacturing operations, which in turn minimizes the rate that CKD is generated. Efforts to date include controlling raw materials to limit the concentrations of alkali metals in the raw feed which ultimately reduces the proportion of dust that is removed from the process. These efforts have resulted in reduced rates of CKD generated, although it is not possible to quantify percent reduction because the cement product has changed since 1988, necessitating a change in the manufacturing process.

Substitute Raw Materials

The plant has initiated a program to utilize substitute raw materials in the cement manufacturing process. These materials are low-alkali in nature and result in reduced CKD production. They are also byproducts from other industrial operations that would otherwise be disposed in a commercial landfill. The plant currently utilizes approximately 50,000 tons of alternate raw materials each year.

Recirculation

Over 90 percent of the dust collected in the cement manufacturing process is recirculated into that process. The remaining dust is removed from the process to control the composition of the cement product (Section 2). Lafarge maximizes the percentage of dust recycled in the process to maximize cement productivity. These recirculation measures were in place in 1988.

Control of CKD Management Area

Placement of materials into the CKD management area has been controlled since the early 1990's so that the area is essentially a CKD monofill. It is estimated that approximately 10% of the materials entering into the area in 1988 would have been non-cementititous in nature. These materials are now either recycled or legally disposed off-site.

Beneficial Use

The Davenport plant has trialed beneficial use of CKD generated by the plant on two separate occasions, as follows:

- as an agricultural amendment to increase soil pH; and
- as an admixture to improve the characteristics of animal sewage.

While these trial programs confirmed the potential beneficial uses of CKD they have not yet been implemented on a predictable and consistent scale. At its peak, the beneficial reuse program accounted for up to 50% of the CKD generated by the plant.

4.2 ANALYSIS OF ALTERNATIVES

Lafarge continues to investigate alternative measures that will reduce the volume of CKD requiring landfill at the Davenport Plant. In general, the alternative uses of CKD described in Appendix I have, and continue to be investigated by Lafarge. In accordance with state goals specified in the Guidelines, the following measures will be taken.

Waste Reduction

Future quarrying plans will be designed to reduce alkali content of the raw feed which will in turn reduce CKD production. A 10% reduction is targeted by controlling kiln feed.

Recycling

The recycling of dust in the cement manufacturing process will be continued and will account for over 90% of the dust collected in the manufacturing process.

Lafarge will continue to optimize the use of substitute raw materials to improve the quality of the kiln feed and to reuse materials that would otherwise be disposed in a commercial landfill. A volume of 50,000 tons per year is budgeted for the foreseeable future.

Alternate uses for CKD will continue to be investigated by Lafarge. At this point, no alternate uses have been established on a consistent and reliable basis. Reuse of CKD for soil stabilization or waste amendment appears to be the most likely option at this time.

Incineration

CKD is a non-combustible, non-organic material and thus incineration options are not applicable.

Landfilling

This is the base option that addresses the CKD generated by the facility that remains following implementation of the aforementioned reduction measures. At the present time, on-site management of CKD is required in order to produce low-alkali cement. An estimated 100 tons/day of CKD will be generated by the facility on an ongoing basis, although the rate of generation is a function of the volume of cement produced which in turn is a function of market conditions. CKD is managed in accordance with the Closure and Development Plan for management of CKD which has been submitted to the IDNR for approval. The management plan ensures suitable environmental protection by implementing recognized, effective solid waste management techniques.

The Plan includes conditioning and compaction of the CKD which will reduce the placed volume by up to 20%.

4.3 MEETING THE STATE VOLUME REDUCTION AND RECYCLING GOALS

The underlying table provides a summary of the solid waste reduction and recycling efforts implemented at Lafarge's Davenport cement plant. Generation rates are provided for 1988 (base data), 1997 (current rates) and 2000 (predicted) in accordance with the Waste Recycling and Reduction Act. Current rates are essentially representative of the conditions in place in 1994. A review of this table indicates that Lafarge's Davenport operations currently meets the legislated goal of 50% reduction by 2000.

Lafarge will continue to investigate and implement volume reduction alternatives with the goal of eliminating the need for CKD landfilling at the Davenport plant. However, until a beneficial use for CKD can be established with confidence, there will continue to be a need to manage CKD at the Davenport Plant.

Table 3: Volume Reduction Summary

Current Initiatives

Item	Initiative	Base Case 1988	Existing Initiative 1997	
			Volume Reduced	%
CKD	Control Raw Materials	46,000 tons/yr	10,000 tons/yr	22%
Clinker/Bricks	Recycle	10,000 tons/yr	10,000 tons/yr	100%
Substitute Raw Materials	Recycle	50,000 tons/yr	50,000 tons/yr	100%
*CKD	Beneficial Use	46,000 tons/yr	up to 23,000 tons/yr	up to 50%
Total	**Various**	**106,000 tons/yr**	**70,000 tons/yr**	**66%**

Planned Initiatives

Item	Initiative	Base Case 1997	Future Initiative 2000	
			Estimated Volume Reduced	%
CKD	Control Raw Material	36,000 tons/yr	4,000 tons/yr	10%
CKD	Compaction	40,000 yd^3/yr	8,000 yd^3/y	20%
*CKD	Beneficial Reuse	36,000 tons/yr	up to 36,000 +/y	up to 100%
Total	**Various**	**40,000 yd^3/yr**	**12,000 yd^3/yr**	**30%**

* not included in total (not continuous).

5. IMPLEMENTATION SCHEDULE

The schedule for implementation of the waste reduction initiatives described in this plan is presented below. Although key dates are prescribed, Lafarge deals with the issue of plant operations in general, and CKD generation in particular, on a regular basis with the goal of achieving continuous improvement. Alternate uses for CKD will be addressed by Lafarge both within the corporation and as part of the Portland Cement Association. These programs will continue to ensure that the legislative goals of the State of Iowa continue to be met or exceeded at the Davenport Cement Plant.

Table 4: Implementation Schedule

Initiative	Implementation Date	Review Schedules
Comprehensive Plan	July, 1997	Every 3 years
Substitute Raw Materials	early 1990's	Ongoing
Clinker / Brick Recycling	early 1990's	Ongoing
Quarry Planning	1997	every 5 years
Beneficial Use	early 1990's	Ongoing
CKD Compaction	1997	Ongoing
Assess Generation Rates	1997	Annually

Appendix II provides a completed checklist for issues related to this Comprehensive Plan.

Reported By:

KOMEX INTERNATIONAL LTD.

Gordon J. Johnson, M.S., P.Eng.

J:\4161\reports\JN97.DOC

6. REFERENCES

Bhatty, J. I., 1995. Alternative Uses of Cement Kiln Dust. Report commissioned by the Portland Cement Association, PCA R&D Serial Number 1995.

Komex International Ltd., 1997. Cement Kiln Dust Closure and Development Plan. Revision 1. Report submitted to Iowa Department of Natural Resources for landfill closure and development permits.

State of Iowa, 1997. Iowa Administrative Code, Title VIII, Solid Waste Management and Disposal. Chapters 100 to 113. Revised March, 1997.

State of Iowa, 1990. Guidelines for Solid Waste Comprehensive Plans, Part 1: Solid Waste Management Activities. Iowa Department of Natural Resources. September, 1990.

7. DISCLAIMER

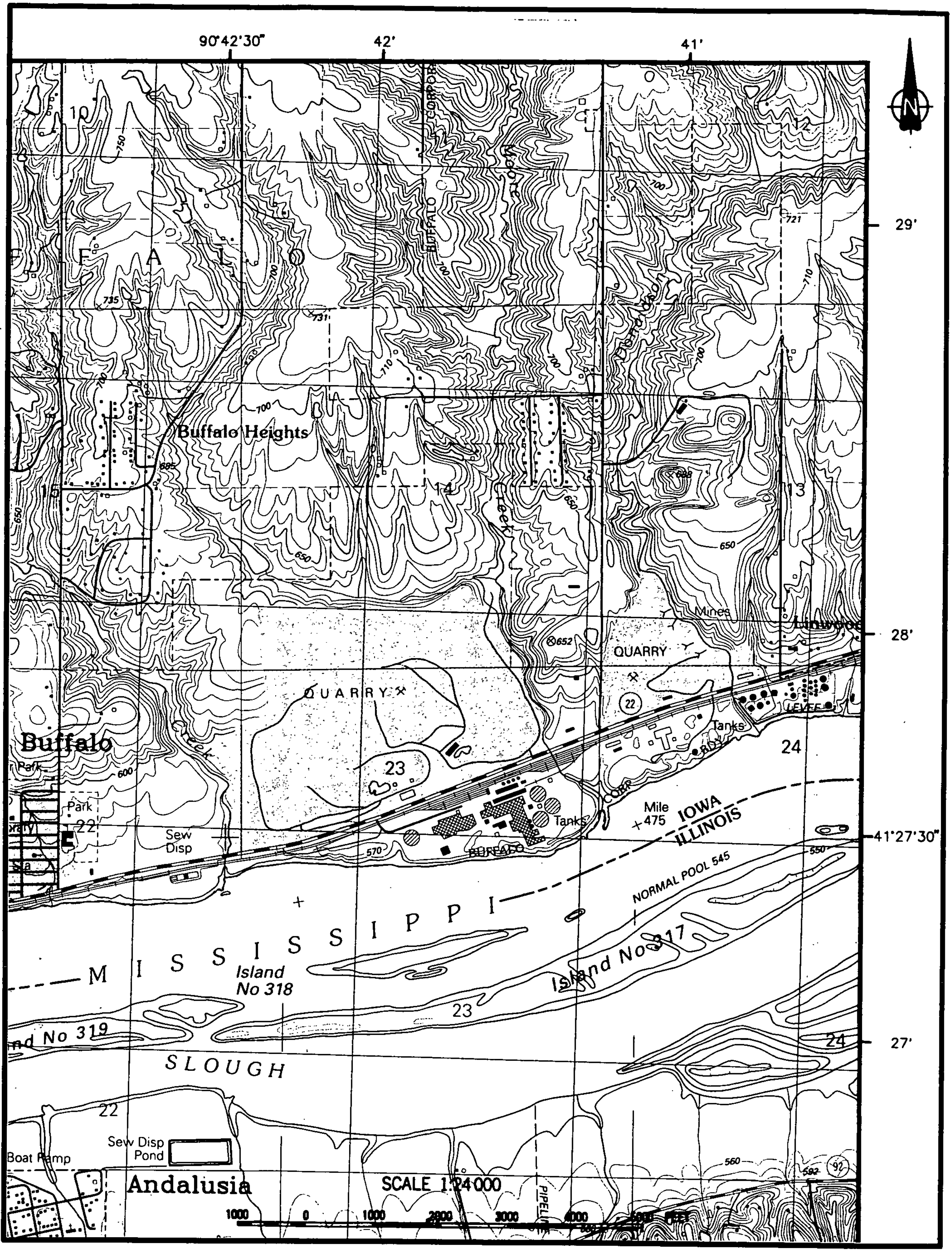
The information presented in this document was compiled and interpreted exclusively for the purposes stated in Section 1 of the document. KOMEX International Ltd. provided this report for Lafarge Corporation solely for the purpose noted above. KOMEX does not accept any responsibility for the use of this report for any purpose other than intended or to any third party for the whole or part of the contents and we exercise no duty of care in relation to this report to any third party.

Any alternative use, including that by a third party, or any reliance on, or decisions made based on this document, are the responsibility of the alternative user or third party.

KOMEX has exercised reasonable skill, care and diligence to assess the information acquired during the preparation of this report, but makes no guarantees or warranties as to the accuracy or completeness of this information. This report is based upon and limited by circumstances and conditions acknowledged herein, and upon information available at the time of the site investigation.

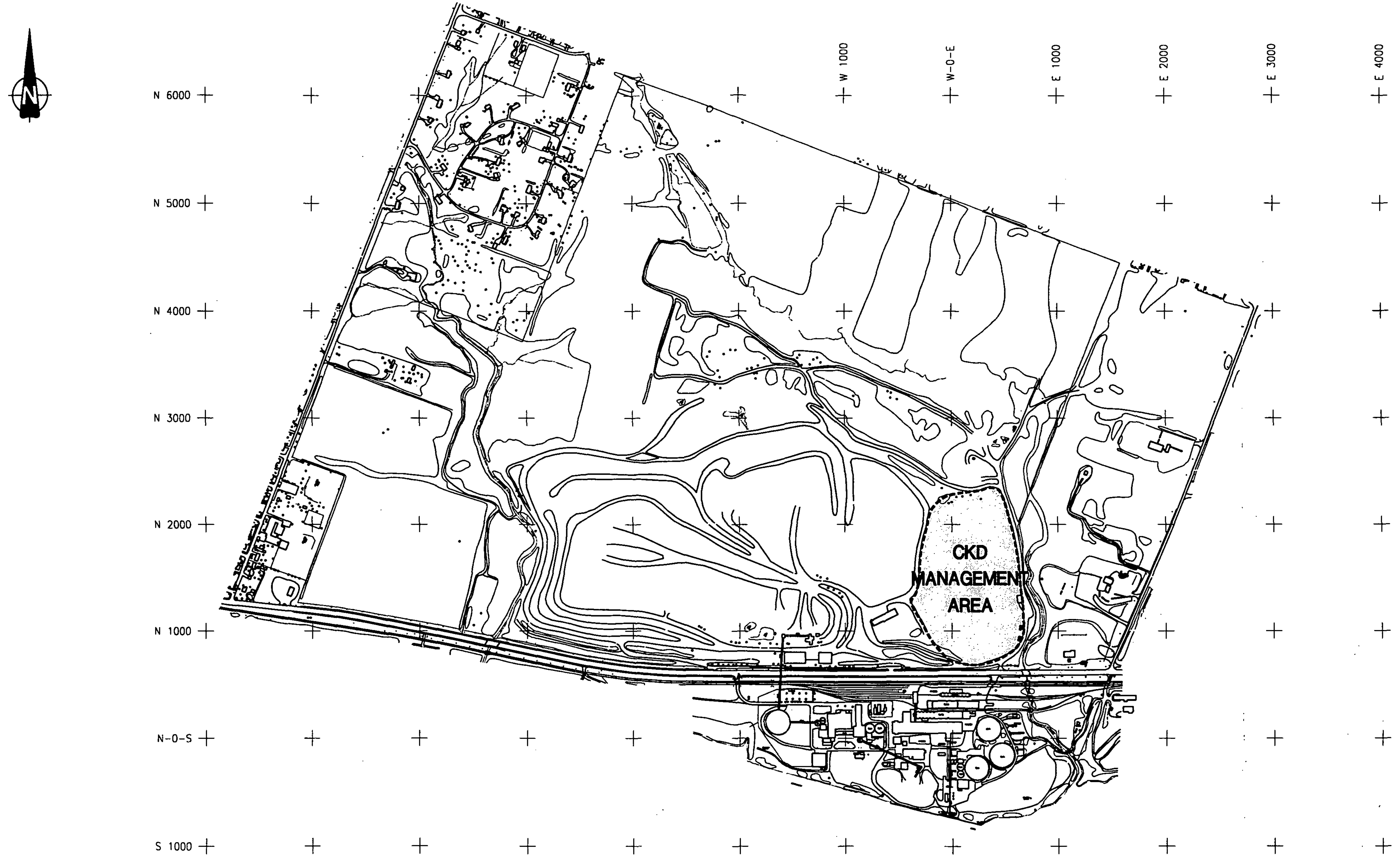
The pertinent information reviewed by Komex has been included in this report. The information provided by others is believed to be accurate but cannot be guaranteed. Any questions concerning the information or its interpretation should be directed to Gordon Johnson of KOMEX.

JOB NO. 4161



LOCATION MAP
DAVENPORT CEMENT PLANT

Figure 1



0 500 1000 1500 2000 2500 3000ft.
SCALE 1" = 1000'

CKD CLOSURE AND DEVELOPMENT PLAN
DAVENPORT, IOWA

LAFARGE CORPORATION

DRAWN BY:	EDITED BY:	DATE:
M.Z.	M.Z.	JAN.25/96

CKD MANAGEMENT AREA

APPROVED:

FIGURE: 2

PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH LAFARGE CORPORATION HAS NOT ENTERED INTO A CONTRACT.

FILE: J:\4161\LAF-ALL.dwg

APPENDIX I

ALTERNATIVE USES OF CEMENT KILN DUST

Portland Cement Association

Alternative Uses of Cement Kiln Dust

by Javed I. Bhatty

RP327

ABSTRACT

This report contains up-to-date information on the utilization of cement kiln dust. The bulk of the cement kiln dust (CKD) generated is recycled as a raw feed substitute in cement manufacturing and a portion of it is used as a secondary material for selected commercial applications. The remaining CKD is often landfilled. Such applications are dependent upon the chemical and physical characteristics of CKD. The major parameters that determine the CKD characteristics are the initial raw material, type of kiln operation, dust collection systems, and fuel type. Since each plant has its own geological and operational position, the CKD use is generally considered on a plant-to-plant basis.

A brief description of the physical and chemical composition of typical CKDs is given in the beginning of the report, followed by their applications that have been reported in the literature thus far. These include recycling of CKD back into cement manufacturing because of similarities to the raw feed, and a variety of other applications that rely upon its fineness and high lime contents. The use of CKD in blended cements, subbase and soil stabilization, waste treatments, and in scrubbing acidic emissions is getting increasing attention. Application of CKD as fertilizers and in chemical processing to recover alkali salts is based on its high potassium contents. Miscellaneous applications include mine backfilling, glass making, coagulant in waste-water treatments, and absorptive agent for oil spillages. Direct landfilling of CKD after appropriate moisture adjustment and compaction has also been reported.

Thus, as can be seen, CKD has extensive application potential. The proper use of CKD, however, will depend upon its composition and availability in order to help consume the large quantity generated without any environmental and management problems.

KEYWORDS

blended cements, cement kiln dust, fertilizer, portland cement manufacturing, recycling, soil stabilization, subbase, waste management, waste treatment

PCA R&D Serial No. 1995

Alternative Uses of Cement Kiln Dust

by Javed I. Bhatty*

INTRODUCTION

Millions of tons of cement kiln dust are generated annually from cement plants operating in North America. The bulk of the dust is recycled into clinker manufacturing as kiln raw feed. About 3.35 million metric tons of this dust, mostly with high alkali contents, is landfilled while about 0.75 million metric tons enters commerce as by-products (Abeln et. al., 1993).** The generation of waste kiln dust—that which cannot be reused in cement manufacturing—is responsible for a significant financial loss to the cement industry in terms of the value of raw materials, processing (quarrying, grinding, storage), energy usage during pyroprocessing, dust collection, and disposal. In terms of quarrying, crushing, grinding, etc., dust represents a significant investment that can be directly translated into an additional requirement for raw materials and loss of potential clinker production. This net loss can exceed 15% in some plants (Klemm, 1980).

Cement kiln dust consists mainly of partially calcined kiln feed and, as such, is generally suitable for recycling back to the kiln. The principal obstacle to such a preferred use has been the requirement of many states for a low alkali cement because of concerns for potential alkali-silica reaction (ASR) with reactive aggregates in concrete. The reduction of the alkali content of many plant clinkers to less than 0.6% equivalent of Na_2O results in a significant increase in CKD production especially in alkali bypass dust from plants so equipped. A further reduction of alkalies in cement to below 0.4% equivalent Na_2O, as done in certain states, would further exacerbate the excess CKD generation problem.

Thus, it is clear that any steps that can be taken by the cement industry to either reduce CKD generation, permit more recycling in the pyroprocessing stage to increase clinker production, or to develop additional uses for CKD as value-added product, would be of great importance. Disposal or landfilling of dust may be necessary, but this constitutes an undesirable alternative and expense.

OBJECTIVE

The objective of this report is to provide a general overview of the existing and proposed methods of reducing waste by utilizing CKD in other industrial applications. The resources of the Portland Cement Association (PCA) Library, the services of several other computerized databases, and relevant reports and files of the CTL staff were used in this study.

DUST GENERATION

Although it is difficult to quantify a direct correlation between dust generation and plant operation, the production of CKD strongly depends upon the type of process and the design of gas velocities in the kiln. Other factors such as kiln performance and dust collection systems also play vital roles. CKD, a fine particulate material, is readily entrained in the gases moving through the kiln. Since each kiln system markedly differs in the amount of dust contact and gas velocities, the quantity of CKD generated varies accordingly.

According to Steuch (1992), the largest amount of dust is generated from long dry kilns in which the dust is stirred up by chains and the gas velocities are high. In contrast, in preheater kilns, feed loading is high and the resulting dust contact with kiln gases is short. Thus, the CKD generation is fairly low. Some of the wet kilns produce the lowest amounts of dust, mainly because these kilns contain pebble-size dust agglomerates that are difficult to sweep away by the moving kiln gases. Yet, the range of dust generated from these kilns does vary. Figure 1 shows the range of kiln dusts generated by each operation type.

These results contrast with those of Müller (1977), which indicated that the amount of dust produced from wet kilns exceeded those from dry and semi-dry/semi-wet kilns, as shown in Table 1. Müller's data is cumulative of both the returned dusts (that recycled to the raw mix for clinker making) and the discarded dusts originated from the then commonly used manufacturing processes. Those processes included long-dry kilns, long-dry kilns fed by nodules, Lepol-kilns (semi-dry kilns) fed by meal nodules, Lepol-kilns fed by filtration nodules, dry kilns with suspension preheaters, long-wet kilns, and short-wet kilns with drum preheaters. The CKD information for these kilns is collectively grouped as "wet", "semi," and "dry" kilns as presented in Table 1.

---

* Senior Scientist, Construction Technology Laboratories, Inc., 5420 Old Orchard Road, Skokie, Illinois 60077-1030

** See Bibliography for references in parentheses

CEMENT KILN DUST CHARACTERISTICS

Chemical Composition

The composition of CKD does not vary significantly from the original raw feed. CKD is a particulate mixture of partially calcined and unreacted raw feed, clinker dust, and ash, enriched with alkali sulfates, halides, and other volatiles. The Bureau of Mines (Haynes and Kramer, 1982) reported a typical dust composition, as given in Table 2.

In practical terms, however, there is no typical or average CKD, as the dust from each plant varies markedly in chemical, mineralogical, and physical composition, depending upon the raw material, type of operation, dust collection facility, and type of fuel used at that plant (Klemm, 1993). CKD from three different types of operations: long-wet, long-dry, and alkali by-pass with precalciner were characterized for chemical and physical make up by Todres et. al. (1992). CKD generated from long-wet and long-dry kilns is composed of partially calcined kiln feed fines enriched with alkali sulfates and chlorides. The dust collected from the alkali bypass of precalciner kilns tend to be coarser, more calcined, and also concentrated with alkali volatiles. Sample compositions of these CKDs are shown in Table 3.

The dusts collected from gas- or oil-fired kilns contain higher proportions of soluble K_2O compared to coal-fired kilns. This is probably due to a more favorable $K_2O:SO_3$ molar ratio in the latter as compared to the former (Klemm, 1980).

Mineralogical Composition

Based on the investigations of nearly 100 European CKDs (Müller, 1977), dusts are particulate mixtures of four major components: (1) unreacted raw feed, (2) partially calcined feed and clinker dust, (3) free lime, and (4) enriched salts of alkali sulfates, halides, and other volatile compounds. The mineralogical compositions of these groups are shown in Table 4.

Particle Size Distribution

The particle size of the CKD is dependent upon the type of kiln operation. Müller (1977) showed that the dusts collected from dry kilns were finer than those from wet and semi-wet/semi-dry kilns as shown in Table 5. This was true for both the returned dust and the discarded dusts. Studies conducted at Construction Technology Laboratories, Inc. (CTL) (Todres et. al., 1992) show that for modern cement plants equipped with alkali bypass, the dust is relatively coarse compared to the CKD from both the wet and dry kilns (see Table 6). The dusts collected from the alkali bypass of precalciner kilns are predominantly calcined feed, rich in alkali sulfates and other volatiles.

Although the chemical composition of CKD is assumed to be uniform over its entire size distribution, one recent study (Klemm, 1993) showed that of the total amounts present in the unseparated dust, the finer fraction collected from an alkali bypass (where 38% of mass was less than 32µm in diameter) contained 47% of the Ka_2O, 49% of the NaO_2, 49% of the SO_3, and 50% of the Cl present in the dust.

CONSIDERATIONS FOR CEMENT KILN DUST USE

Because CKD varies in physico-chemical compositions between plants, and each plant is unique with respect to its geographical condition, the managing of dust is a plant-by-plant situation. However, other factors, such as existing plant equipment and the requirements of the marketplace, must be considered in dealing with dust utilization on a long term basis.

Since the dust has a significant monetary value as a raw material plus additional costs for material processing (Klemm, 1980), and has a chemical composition close to that of the original raw feed, a majority of plants tend to recycle their CKD in the raw kiln feed whenever possible. If they are too high in alkali, they may either be sold for other purposes or be landfilled. One must note, however, that continuous recycling of CKD soon reaches an equilibrium with respect to alkali levels in the kiln feed and the internal cycle of volatilization and condensation within the kiln, resulting in high alkali clinkers. This is not good for plants intending to make low alkali cements. Two states in the United States now require cement to have an alkali content at or below 0.4% of Na_2O equivalent, rather than the usual 0.6% Na_2O equivalent specified in ASTM C150 (ASTM, 1994).

CKD contains insignificant amounts of trace elements and, therefore, minor elements are usually not a concern for most applications. A recent comprehensive study reviews trace metals for 79 plants in the United States and 10 in Canada using both conventional and waste-derived fuels (PCA, 1992). In this study, each CKD was tested for the eight RCRA metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver, and four additional BIF metals: antimony, beryllium, nickel, and thallium. The average levels of trace metals found in the dusts from the study are given in Table 7 and were significantly below the regulatory limits.

UTILIZATION OF CEMENT KILN DUST

In view of the diverse physico-chemical characteristics of CKD and the associated economical and environmental priorities, the use of CKD is best considered on a plant-by-plant basis.

A number of possible options to manage the dust have been considered. As a first choice, attempts have been made to recycle CKD in-process in cement manufacturing directly as kiln feed, or to remove alkali sulfates and chlorides and use the remainder as kiln feed; to treat or modify the CKD for use as a clinker additive, or to blend it in the finished portland cement. Alternatively, the dust has been recycled out-of-process as a by-product or a secondary raw feed for a variety of allied industries. A summary of the major CKD utilization and disposal practices adopted by the cement and allied industries is reported below.

Recycling of CKD in Cement Manufacturing

Directly in Raw Feed. Ideally, the CKD should be used as a partial raw feed in cement manufacturing. A large portion of the CKD recovered in cyclones, baghouses, or precipitators, is already being used as kiln raw feed. The CKD must be low in alkalies for such use, or the manufacturer should be willing to produce high-alkali cements acceptable in the market. The maximum Na_2O equivalent required for Types I and II low-alkali cements is 0.6%, while two states in the United States now require low-alkali cements having no more than 0.4% Na_2O equivalent. Excessive alkalies contribute to alkali-silica reaction (ASR) with reactive aggregates, which is harmful to the long-term performance of concrete.

In cement operations using the dry process, CKD has been blended directly into the raw feed, or pelletized before introduction to reduce dusting. In the wet process, blending CKD with kiln feed is more difficult because semi-calcined dusts harden when exposed to moisture and may affect the slurry viscosity and flowability. The CKD is added to the kiln feed slurry in appropriate proportions just before entering the kiln. The addition of CKD may have a thickening effect on slurry that is normally overcome by using a variety of slurry thinners such as polyphosphates and lignosulfonates.

On the other hand, for CKDs rich in alkalies, a common approach has been to remove alkalies by aqueous leaching and return the "washed" CKD to the kiln. McCord (1977), Klemm (1980), and Fraiman et. al. (1991) have reported this approach and used the "washed" CKD as kiln raw feed. A recently developed scrubber technology (Young and Morrison, 1991), recovers CKD by reducing its alkali and sulfur contents through hot aqueous scrubbing. This process permits CKD to be reused as kiln feed, while also producing saleable by-products such as potassium sulfate for fertilizers. Another recovery system (Fuller, 1992) employs fluidized bed reactor technology and converts up to 90% of the pelletized kiln dust to a clinkered product that can be interground with conventional clinker to produce cement. The volatilized alkalies are recovered separately.

In an older process (EIMCO), the CKD undergoes aqueous leaching in a contactor and later passes through a concentrator to form a 50%-60% solid feed material for the kiln. The resulting clinker is claimed to be low in alkalies. The process is applicable to both the dry and wet processes. The leachate overflow, which is rich in alkalies, could be discharged into receiving basins. It is unlikely that the U. S. Environmental Protection Agency would permit such a process under present regulations.

Insufflation/Mid-Kiln Introduction. Other methods of introducing dust back into the kiln have been either by insufflation into the burning zone or by dust scoops in the mid-section of the kiln from a collar around the kiln. The latter practice has now practically disappeared. Two disadvantages are also cited with insufflation. First, the dust tends to remain airborne for a long time because of its fineness, thus wasting energy for collection and reheating. Second, the dust clouds the area around the burner making it difficult to measure the flame temperature optically— this generally limits the use of dust return to 15% on a kiln feed basis (Steuch, 1992). Additionally, insufflation may encourage the questionable practice of controlling the burning zone temperature by the rate of dust addition. Again, care must be taken that the dust used is low in alkali chlorides and sulfates.

CKD has also been introduced through the primary air burner pipe in coal-fired kilns, as reported by Siegert (1974). A Japanese company (Air Products and Chemicals, Inc., 1991) developed a method for recycling dust in rotary kilns, where oxygen is added to the burning zone to 21% concentration level to enhance combustion.

Blending/Intergrinding with Clinker. A somewhat different approach of intergrinding or blending alkali-free CKD with clinker to produce finished cement of acceptable performance has been employed by a number of firms. One dust recovery system (Fuller, 1992), mentioned earlier, introduced fluid bed technology whereby high alkalies in CKD are volatilized and the low-alkali clinkered residue is interground with plant clinker to produce low-alkali cement of acceptable performance.

In one case, alkalies (mainly K_2O) had been removed from the CKD by volatilization after calcium fluoride was added, and the residues subsequently interground with cement clinker (Huber and Reath, 1917). Klemm (1980) also reported the possibility of adding calcium chloride to the dust to help volatilize K_2O salts and using the calcined solid for cement manu-facturing.

Applications in Construction Industry

Subbase Consolidation for Highway Construction. Because of the generally high free lime content (which sometimes can vary drastically between 3%-23% by weight) and subsequent ability to harden upon exposure to moisture, CKD has been used as binder in soil stabilization suitable for a subbase in streets and highway construction. The University of Toledo and Nicholson (1977) developed a product from CKD, waste glass cullet, fly ash, and wastewater sludge as a subbase material for highways.

Nicholson (1978,1982) patented a road-paving mass from CKD and fly ash at nearly a 1:7 mass ratio with the addition of cement or other admixtures if necessary. In another development, Nicholson (1983) has referred to the use of CKD and fly ash compositions not only for road-base systems but also for sludge stabilization. The marketability of recycled CKD as pozzolanic pavement material as well as an acid neutralization aid has also been suggested.

In a recent work, Sayah (1993), and Zaman et. al. (1992) have demonstrated the effectiveness of CKD in stabilizing highly expansive clay soils. Their data showed similarities to those of portland cement, fly ash, and lime for stabilizing expansive soils. Miller et. al. (1980) used CKD and fly ash in stabilized base courses in road construction in the form of a pozzolanic non-cement concrete with limestone as an aggregate. Such concrete mixes were also found to have autogenous healing characteristics. McCoy and Kriner (1971) reported a wide range of tests conducted on kiln dust compositions for soil consolidation.

Another possible use of CKD is in injection grouts for stabilizing concrete slabs, slabjacking, and voidfilling. The required compressive strength is about 4 MPa (600 psi) at seven days and can be achieved by using CKD without portland cement or with only a small amount of cement.

Blended Cements and Masonry Products. A great deal of work has also been done on the use of CKD in blended cements. Bhatty (1983-1986) has published of series of reports on the addition of CKD to portland cement along with fly ash and blast furnace slag, with variable results. Cements containing CKD alone reportedly had reduced strength, setting time, and workability. The strength loss was attributed to the presence of high alkalies in the dust. The addition of fly ash with CKD lowered the alkali contents and resulted in improved strength. Additions of slag generally reduced workability but increased the strengths because of activation from the high lime content of the CKD.

Bhatty's results also demonstrated that particular ratios of alkali, chlorides, and sulfates are important for better performance of cement blends. A high sulfate blend, for instance, gave the highest strength. However, the high alkali contents could result in susceptibility to alkali-aggregate reaction (ASR), which may be blocked by the slag or fly ash constituents. Based on similar data, Sanduo (1986), suggested that the use of finely ground limestone and cement kiln dust should be allowed in standard ASTM specifications for portland cements.

Daugherty and Funnell (1983) have also evaluated the use of CKD by intergrinding in blended cements. There appeared to be no evidence of adverse effects with up to 10% dust addition, on the setting time, soundness, or shrinkage. The strength results varied, however, probably because of the changing dust composition. Klemm (1980) pointed out that blended cements containing CKD can work satisfactorily only if the total alkali content is not excessive, otherwise fly ash or blast furnace slag should be added to reduce potential ASR problems.

ASTM subcommittee D 34.15 (1993) is currently preparing a specification that would permit the use of a uniform blend of Class F fly ash with CKD. This pozzolanic blended material for construction applications is tentatively designated as Type FCKD.

CKD has also been used successfully in masonry and concrete blocks without the addition of pozzolans. A study by Ravindrarajah (1982) showed that up to 15% of portland cement could be replaced with kiln dust in mixes without loss of strength and workability. However, higher proportions of CKD retarded setting, increased water demand, and reduced workability. Luther (1993) has also reported using up to 10% CKD in granulated blast-furnace slag cement to produce concrete with satisfactory performance.

Wills (1983) substituted up to 60% CKD for portland cement in producing concrete blocks of adequate physical strength after partial curing in CO_2-laden environments at 60°C (140°F). Chen and Lu (1989) produced cementitious blocks from CKD and fly ash components by steam curing treatments. They also reported using small additions of silica fume to suppress the harmful effects of excessive K_2O in the CKD on compressive strength.

von Seebach and Tompkins (1992) patented a hydraulic binder from CKD by preliminary hydration of the partially calcined limestone in the dust. The product is used as a constituent in masonry mortar or plaster for construction purposes. The dust is drawn from the riser duct of the by-pass, and its calcined limestone fraction is hydrated to calcium hydroxide to form the principal binder component. Klemm (1980) reported the use of CKD as an accelerator for gypsum hydration to produce gypsum building materials.

Hydrated CKD has also been successfully evaluated as an anti-stripping agent in hot-mix asphaltic concrete (Klemm, 1993). Preliminary tests on replacing up to 3% hydrated lime by the hydrated CKD have shown favorable results. CKD has been used as an inorganic filler in bituminous paving and asphaltic roofing. Kiln dust has also been used as a filler for asphaltic insulating board sound-deadening materials (Davis and Hooks, 1975).

Chemical Processing of CKD as an Alkali Source

Enriched levels of soluble alkalies (i.e., K_2SO_4) in CKD make it a promising raw material for the extraction of K_2O or its soluble salts. A number of patents have been issued on the subject, most of which require aqueous dissolution of soluble potassium salts that are later removed as a saleable commodity and the water recovered for reuse. The potassium-free dust is usually recycled as kiln feed. Studies pertinent to this approach have been reported by Dean (1972), Singleton and Bruce (1975), McCord (1977), Klemm (1980), Fernandez Lozano and Silva (1985), and Wolfe (1992) with modifications of their own.

Dean (1972) recovered a substantial amount of alkali salts from CKD by mixing it with H_2O in successive stages at temperatures between 21 to 99°C (70 to 210°F). The supersaturated solution thus produced was cooled and alkali salts crystallized and separated. Singleton and Bruce (1975) treated the dust with fresh water at elevated temperatures to essentially dissolve alkali chlorides and sulfates and subsequently remove them by crystallization. The remaining solution is carbonated to form calcium carbonates for recycling.

McCord (1977) recovered the alkalies by leaching the kiln dust at higher temperatures with an aqueous solution of KCl. The extract is cooled for crystallization of KCl and removed. The washed CKD is reclaimed for use as kiln feed. Klemm (1980) proposed the separation of alkalies as K_2SO_4 from the high-alkali dust (~13% K_2O) for agricultural purposes. The K_2SO_4 was extracted by mixing CKD with hot water followed by filtering, cooling the aqueous brine, and K_2SO_4 crystallization. The remaining material can then be reused as raw feed substitute. A yield of more than 86% was reported by lowering the pH with carbon dioxide, thus preventing the formation of the double salt of K and Ca sulfates known as syngenite. Fernandez Lozano and Silva (1985) removed potassium and K_2SO_4 from the CKD with water in a batch leaching tank by vigorous stirring and reported a 92% K_2O separation.

Wolfe (1992) reported the usefulness of leaching to remove alkali from CKD to facilitate recycling both fresh CKD and CKD stockpiled over the years. Tests on the stockpiled CKD showed that more than 80% alkali (K_2O) was removable by using ordinary tap water with or without additives at ambient temperature. Almost 100% more alkali was removed from stockpiled CKD than from the fresh CKD. A preferred process flowsheet (Figure 2) was proposed to remove alkalies from both the stockpiled and fresh CKD and reuse the residue as kiln feed. The process incorporated water leaching, pressure filtration, and evaporation as unit operations.

Another approach, proposed by Wilson and Anable (1986), is the removal of alkalies by pyrotreatment of pelletized dust. Here, the K_2O is volatilized in the presence of SO_3 by heating the dust above 1300°C (2372°F) in a reducing atmosphere generated by coal addition. Figure 3 shows the removal of potassium under reducing conditions. In order to enhance volatilization, $CaCl_2$ or CaF_2 was sometimes added. The resulting low-alkali residues were used in producing cement of adequate engineering characteristics.

Earlier, Klemm (1980) reported that high-alkali kiln dusts could be fused to separate K_2SO_4 as liquid. Several operational difficulties were cited, however. First, although K_2SO_4 in the dust has a melting point of 920°C (1688°F), the dust itself had to be melted beyond 1400°C (2552°F) to volatilize K_2SO_4 and needed to be separated from the fused dust. Second, the K_2SO_4 is reactive and fuses with ceramics, and third, the K_2SO_4 fumes tend to react with the furnace heating elements and eventually inhibit their proper functioning.

Applications as a Fertilizer

Because of the high lime (for acid neutralizing capacity) and potassium concentrations, CKD has already found use as a fertilizer in many parts of the world. This use of CKD is only recently being realized in the United States. If properly developed, however, the market for agricultural lime and potash fertilizer could become large enough to consume the bulk of the CKD that is currently being discarded.

Risser et. al. (1981) produced a lime-potash soil additive composed of 35% CaO, 6% MgO, 5% K_2O, and 4% SO_3 from CKD having a controlled composition. The high pH of CKD provides neutral soils a greater efficiency of herbicides; whereas the potassium satisfies the plant withdrawal requirements. Fraiman et. al. (1991) recommended the use of bypass dust containing high levels of K_2O, SO_3 and Cl, in fertilizer applications. Since potassium is the most valuable fertilizer element contained in the dust and the least desirable element for recycling, CKD with high potassium contents could be adequately utilized as fertilizers.

Taylor (1987) also reported the usefulness of CKD as a substitute for lime and fertilizer elements, which covers a large reserve for nutrients. Since the quality of CKD varies with each cement plant, however, the nutrient value may also change. Baker et. al. (1975) developed nonputrescible soil-like products for general agricultural applications by combining CKD with sewage sludge before vacuum filtering.

One of the concerns with using CKD as a fertilizer substitute is the level of heavy metals it may contain, especially if the CKD is produced from coal-fired kilns. Their effect on the food chain through possible extraction by soil and subsequent movement into vegetation should be determined before such applications are to be considered. However, in a specific study on the use of CKD as a fertilizer in Iowa, Preston (1993) demonstrated that heavy metals in CKD are well below the permissible levels for land application. Furthermore, the overall heavy metal content in the CKD also appears to be within the range found naturally in soils across North America (Dragun, 1991).

In addition to establishing the biological safety, other agricultural factors such as crop yield, variation of soil quality with lime, liming efficiency of CKD (when used either as powder or pellets), and dusting problems (during storing or handling) must also be considered. Nutrients such as nitrogen and phosphorus are still required from other sources.

Other related applications for CKD are its use as cattle and dairy feed additives (Ward et. al., 1979; Wheeler et. al., 1977, 1979). The alkali-buffering nature of CKD appears to have a positive effect on ruminant nutrition for cattle. Steers fed with a diet containing CKD showed improved average daily gain compared to the control group. Again, the level of trace metals should be carefully determined before CKD is used as an animal food supplement (Bush and Nicholson, 1985).

Applications in Waste Treatment

CKD has been used as a substitute for lime in stabilizing waste-water streams. This is possible primarily because of the high neutralizing potential of the CKD (high $CaCO_3$ and CaO) and fine particle size distribution, having Blaine finenesses often greater than 800 m^2/kg. Up to a 35% addition of CKD has satisfactorily met the specified pathogen control level in sewage sludge. High pH, an exothermic reaction, and the resulting accelerated drying when CKD was added were the factors mainly responsible for the pasteurizing effects on municipal waste-water sludge (Nicholson, 1988; Burnham, 1987; Nicholson and Burnham, 1988).

Burnham and Bennett (no date) produced an easy-to-handle granular soil-like material by mixing CKD with the sludge cake in a pugmill. This material, termed an advanced, stabilized, dewatered sludge, was subjected to secondary thermal treatment from the exothermic heat generated by further CKD addition, and by maintaining pH 12 and a temperature between 50-60°C (120-140°F) for 12 hours. The resulting material was a stabilized, environmentally compatible, saleable commodity.

Anglebeck (1987) applied CKD for alkali control in sewage sludge where it could respond to the stabilizing needs should the character of the sludge change. Due to its high pH and liming potential, CKD also absorbed residual odor from the sludges. In some cases where unbalanced sewage treatments result in an acidic and highly odorous sludge that may be simply trucked to landfills, the CKD could aid in neutralizing the sludge for proper handling and stabilization.

As mentioned earlier, Baker et. al. (1975) used CKD as an aid for vacuum filter processing of sewage sludge on site. The report showed that CKD was at least equal to hydrated lime for sewage processing and could be superior if used at a rate one- to three-times greater than that normally used for lime. Potassium and magnesium in the CKD will add further benefits if the resulting sludge-cake were to be used as a nutrient for crop production. The economic benefits and energy savings from using CKD instead of hydrated lime are obvious.

CKD has also been used to purify waste water contaminated with 500-1000 ppm of zinc, manganese, copper, and cobalt (Salem, 1990). The treatment required 2%-30% of CKD per liter of waste water, and involved absorption and purification of metal hydroxides and carbonates. CKD has also been partially or totally substituted for lime in preparing the alum floc as a coagulant for removing turbidity from water (Farnham, 1960). The dust not only neutralized the water but also improved the flocculation by providing abundant nucleation sites for alum flocs.

CKD use has also been reported in a number of solidification/stabilization projects, primarily in remedial actions, and central hazardous waste management facilities. The dust functions primarily as an absorbent or bulking agent (Conner, 1990). A recent paper by MacKay and Emery (1992) describes the stabilization of contaminated soils and sludges in which CKD is used in conjunction with other cementitious products such as slag cement, lime kiln dust, flyash, hydrated lime, and portland cement. The CKD-fly ash process developed by Nicholson (1978, reissue 1982), is applicable to sewage sludge solidification, but appears to be equally appropriate for other wastes.

Another possible application of CKD is in wet scrubber slurry used for adsorbing SO_2 from stack gases, where hydrated lime or limestone slurries are currently being used. Studies have indicated that the kiln dust functioned better than the limestone and almost as good as lime (Gorman, 1972). Furthermore, the scaling problems with scrubbers using kiln dust were less severe than those using a lime slurry. Murdock (1993) has reported the use of a bypass dust as a suitable sorbent in capturing SO_2 in wet scrubbers. Owing to the finer particle distribution, a reactive CaO phase, and the presence of Mg and Na as promoters, the bypass dust exceeded the capture efficiency of standard limestone sorbents. Desulfogypsum scrubber sludge resulting from the stack gas scrubbing was suggested as a viable sulfate source for use in portland cements to control early hydration reactions.

As mentioned earlier, in a similar process by Young and Morrison (1991), an aqueous slurry of fresh CKD is used for scrubbing SO_2 from the kiln exit gases. This also results in the carbonation of lime in the slurry; the alkali and sulfur compounds are subsequently crystallized from cooling the hot brine. The leached CKD is safely recycled as kiln feed. Potassium sulfate is the principal product that is continuously removed from the system and may be sold as an industrial or agricultural chemical. In a recent report Young (1993) has also indicated the capture of HCl and CO_2 from the flue gases using CKD scrubbing. The subsequent products are a fertilizer for land application and a residue for reuse as kiln feed.

Applications in Mining and Metallurgical Industry

U.S. Bureau of Mines studies (Haynes and Kramer, 1982) have documented the use of CKD as a partial hydraulic filler for backfilling coal mine shafts and tunnels. Such an application alone can potentially utilize large volumes of CKD. Because of its fine particle size and high alkali contents, CKD is also being premixed to neutralize acidic media and effluent from mining and mineral processing industries. For instance, Sodyes (Klemm, 1980) used CKD to neutralize a chemical pond containing acidic sulfates. The attempts were only partially successful because the particular CKD used was very coarse. The dust also has the potential to replace fly ash for controlling the spread of fires in coal mines.

CKD has also been used as a binder in pelletizing iron ore fines for recycling in steel making. It has also found applications as coagulant for dewatering of waste sludge from tin rolling mills (Klemm, 1980).

Miscellaneous Applications

Cement kiln dust has also been used as a partial replacement for soda in the production of glass where color and high chemical stability are not essential considerations. High alkalies in CKD increase the rate of sulfate decomposition that is the main cause of foaming in glass baths (Emer, 1969). A soda-kiln-dust glass has many similarities to the conventional soda-lime glass. Fraiman et. al. (1991) have also recommended the use of bypass dust in glass making.

In some Eastern European countries, kiln dust has been successfully incorporated into cementing compositions for gas and oil wells. The kiln dust appears to improve slurry pumpability and also functions as a fluid-loss additive. CKD also sufficiently retarded oil well cement slurries for use at temperatures up to 100°C (212°F), without additional retarders.

Other uses for CKD are based on its fine particle size and high absorptive capacity. It has been used as a decolorizing agent in the clarification and purification of sugar solutions. No information is available, however, on the level of impurities the dust might have contributed to the solution it was clarifying (Klemm, 1980). The U. S. Environmental Protection Agency has studied the use of quicklime or CKD in stabilizing soils contaminated with polychlorinated biphenyls (PCBs). It appears, however, that PCB's apparent loss was the result of evaporation and steam stripping at elevated temperatures (Einhaus et. al., 1991) rather than decomposition.

Kiln dusts containing small amounts of NaCl can be added to oily waste water to absorb oil, forming a sludge that can be easily removed. This technique also appears to be applicable for removing oil contamination from inland rivers or even oil slicks and spills at sea. McCants (1952) patented a process for converting CKD into an absorbent for cleaning up spills in garages and on roads. The product was claimed to be useful as a filter medium for oil clarification and also as a decontaminating agent for areas where poisonous liquids and chemicals have been sprayed or spilled.

Kiln dust may have applications as an absorbent for the removal of SO_x emissions from industrial stack gases. For such uses, the dust is prepared in a porous but granulated or pelletized form to avoid contributing to particulate emissions.

Land Disposal of CKD

A series of investigations were conducted by CTL for land disposal applications of CKD (Todres et. al., 1992; and Todres, 1992). The report showed that, depending upon their physical and chemical composition, and after appropriate moisture adjustments, the dusts were conveniently compacted under medium compaction, to dense and extremely low permeability masses matching those of silt and fine sandstone. Heavy compaction produced an almost impervious mass comparable to clay. To verify the laboratory data under field conditions, follow-up compaction studies were conducted using a double drum vibratory roller. The objective was the eventual disposal of CKD as compact landfill, pavement, or subbase material. Based on the measured permeabilities of Shelby tube samples, an estimated density of 105% of the standard Proctor maximum was obtainable. This corresponds to a permeability coefficient of $2.3x10^{-6}$ cm/s.

Studies have also been carried out to use CKD as a water-tight barrier (liner) for sanitary landfill sites (Ballivy and Breton, 1992). The dust could be consolidated and stabilized when used in conjunction with varying amounts of fly ash (Class C) and silica fume. The mixes had a water to dry-solid ratio of 0.4 and were cured at 100% relative humidity for 10 days after demolding. After consolidation the mixes showed permeability lower than the standard 10^{-7} cm/sec. When tested as liners, these mixes exhibited a good capacity for absorbing heavy metals.

CONCLUSIONS

Most of the CKD removed from kiln exhaust gases by dust collectors is recycled as kiln feed whenever possible. However, the bulk of the waste CKD—that which is not recycled as kiln raw feed—is landfilled, and the rest is consumed in other industries as a raw material or a by-product based on its specific physical and chemical characteristics.

The physical and chemical make up of CKD depends upon the raw kiln feed and the type of cement operation. Generally, the dusts are particulate materials composed of partially calcined feed enriched with alkalies and other volatiles. Because of the diversity of their composition and the associated economical and environmental priorities, the use of CKD can best be considered on a plant-to-plant basis.

The predominant factor preventing the recycling of CKD in cement manufacturing is the high alkali content that may produce clinkers exceeding the required Na_2O equivalent limit. Preferential leaching has been employed to remove alkalies and reuse "washed" residue as kiln feed. Several techniques for removing alkalies and recycling the residue, most of which are still at pilot scale, have also been described in the literature.

When CKD cannot be recycled in cement manufacturing, the second best solution is its industrial use, based on a specific physical and chemical nature. The relevant properties of CKD are particle size, chemical reactivity (because of the partially calcined limestone and free lime contents), and alkali content. Quantitatively, these characteristics depend largely on the specifics of the production process.

Since finely divided calcium carbonate is its principal component, CKD can be used as a minor ingredient in blended cements and non-standard cementitious compositions. In certain cases, the addition of fly ash or blast furnace slag might be required to offset the elevated alkali levels. Although the results vary with the composition, the general outcome appears promising. For that reason, CKD has, for example, been used in making masonry blocks.

The chemical reactivity of CKD and its fineness can also be used in a number of applications for solidification/stabilization systems and neutralization of industrial wastes such as sewage sludges, acid waste streams, and stack gases. CKD is also a useful binder in stabilizing subbases for pavement. In such applications, fly ash is sometimes also needed.

The relatively high potassium content of some dusts makes them usable as low-grade fertilizers and additives for acidic soil conditioning. The market for agricultural lime and potash fertilizers appears promising and could consume a large quantity of CKD. A somewhat related application of CKD is also reported as a food supplement for dairy animals. A common concern is the presence of trace quantities of heavy metals, which must not enter the food chain at higher than permissible levels.

Aqueous extraction or other chemical processing of CKD can yield saleable products such as potassium sulfate salts. The treated CKD may be subsequently recycled as kiln feed. A number of processes are available for such extractions. CKD slurries are also being used in SO_x scrubbing from cement kiln stack gases that subsequently lead to crystallization of K_2SO_4 as a marketable product.

Miscellaneous applications of CKD also include: glass making, mine-backfilling, and oil and acid spillage control.

Depending upon their physical and chemical compositions, CKDs can also be compacted in landfills after appropriate moisture adjustment. This can result in dense beds with low permeabilities matching those of clay, and thereby reducing the potential pollution caused by rainfall or run-off water.

ACKNOWLEDGEMENTS

This study (PCA R&D Serial No. 1995) was conducted at Construction Technology Laboratories, Inc., with the sponsorship of the Portland Cement Association (PCA Project Index No. 92-01a). The contents of this paper reflect the views of the author, who is responsible for the facts and accuracy of the data presented. The contents do not necessarily reflect the views of the Portland Cement Association.

BIBLIOGRAPHY

Abeln, D.L., Hastings, R.J., Schreiber, R.J., and Yonley, C., *Detailed Illustration of Contingent Management Practices for Cement Kiln Dust, SP115T*, Portland Cement Association, Skokie, Illinois, U.S.A., 1993.

Air Products and Chemicals, Inc., *Method and Apparatus For Recycling Dust in Rotary Kilns*, Japan Patent #03,177,785, August 01, 1991, (Chemical Abstract: 115:285999k, 1991).

An Analysis of Selected Trace Metals in Cement and Kiln Dust, SP109T, Portland Cement Association, Skokie, Illinois, U.S.A, 56 pages, 1992.

Anglebeck, D., "Alkaline Stabilization: An Economical and Effective Sludge Stabilization Process Alternative," *A National Conference on Alkaline Treatment and Utilization of Municipal Wastewater Sludges*, organized by National Kiln Management Association, Toledo, Ohio, U.S.A., Section II, August 26-27, 1987.

ASTM C 150-94, *Standard Specification for Portland Cement*, American Society for Testing and Materials, Philadelphia, Pennsylvania, U.S.A., 1994.

ASTM D 5050-90, *Standard Guide for Commercial use of lime Kiln Dust and Portland Cement Kiln Dusts*, American Society for Testing and Materials, Philadelphia, Pennsylvania, U.S.A., 1990.

ASTM Subcommittee D 34.15, *Draft of Standard Specification for Pozzolanic Blended Material in Construction Applications*, American Society for Testing and Materials, Philadelphia, Pennsylvania, U.S.A., August 1993.

Baker, D.E., Welch, S., Stout, W., and Doty, W., "Kiln Dust from Cement Factories for Vacuum Filter Processing of Sewage Sludge," *Compost Science*, Emmaus, Pennsylvania, U.S.A., Vol. 16, No. 4, pp. 28-30, July-August, 1975.

Ballivy, G., Rouis, J., and Breton, D., "Use of Cement Residual Kiln Dust as Landfill Liner," *Cement Industry Solution to Waste Management*, PCA Pub. No. LT168, Ist. International Symposium, Canadian Portland Cement Association, Calgary, Alberta, Canada, pp. 99-118, October 7-9, 1992.

Bhatty, M.S.Y., *Use of Kiln Dust in Blended Cements*, PCA R&D Serial No. 1717, Portland Cement Association, Skokie, Illinois, U.S.A., March, 1983.

Bhatty, M.S.Y., "Use of Cement-Kiln Dust in Blended Cements," *World Cement Technology*, London, U.K., Vol. 15, No. 4, pp. 126-134, May, 1984.

Bhatty, M.S.Y., "Kiln Dust Cement Blends, Evaluated," *Rock Products*, Chicago, Illinois, U.S.A., Vol. 88, No. 10, pp. 47-65, October, 1984.

Bhatty, M.S.Y., "Use of Cement-Kiln Dust in Blended Cements: Alkali-Aggregate Reaction Expansion," *World Cement Technology*, London, U.K., Vol. 16, No. 10, pp. 386-392, December, 1984.

Bhatty, M.S.Y., "Properties of Blended Cements Made with Portland Cement, Cement Kiln Dust, Fly Ash, and Slag," *8th. International Congress on Chemistry of Cement*, Rio de Janeiro, Brazil, Theme 3, Vol. IV, No. 4, pp. 118-127, September 22-27, 1986.

Burnham, J.C., and Bennet, G.F., *Use of CKD for Biological and Metal Stabilization in Municipal Sludge*, Internal Report, Medical College of Ohio, Toledo, and Chemical Engineering Department, University of Toledo, Ohio, Toledo, Ohio, U.S.A., (no date).

Burnham, J.C., "Progress Report on the Pasteurization of Municipal Sludges Utilizing Cement Kiln Dust," A *National Conference on Alkaline Treatment and Utilization of Municipal Wastewater Sludges*, organized by National Kiln Management Association, Toledo, Ohio, U.S.A., Section II, pp. II.2-II.12, August 26-27, 1987.

Bush, R.S., and Nicholson, J.W.G., "The Effect of Cement Kiln Dust on Tissue Accumulation of Trace Minerals in Steers," *Canadian Journal of Animal Science*, Ottawa, Canada, Vol. 65 (2), pp. 429-436, 1985.

Chen, Wei, and Lu, Chunxuan, "Effect of Alkali in the Cement Kiln Dust on the Properties of Steam Cured Products, *Journal of Chinese Ceramic Society*, Beijing, China, Vol. 17, No. 2, pp. 181-188, 1989.

Conner, J.R., *Chemical Fixation and Solidification of Hazardous Wastes*, Van Nostrand Reinhold, New York, U.S.A., 1990.

Daugherty, E.D., and Funnell, J.E., "The Incorporation of Low Levels of By-Products in Portland Cement and the Effects on Cement Quality," *Cement, Concrete, and Aggregates*, American Society for Testing and Materials, Philadelphia, Pennsylvania, U.S.A., Vol. 5, No. 1, pp. 14-20, Summer, 1983.

Davis, T.A., and Hooks, D.B., *Disposal and Utilization of Waste Kiln Dust From Cement Industry*, Report #EPA-670/2-75-043, National Environmental Research Center, U.S. Enviromental Protection Agency (EPA), Cincinnati, Ohio, U.S.A., May, 1975.

Dean, T.C., *Recovering Alkali Metal Salts From Cement Kiln Gases by the Steps of Condensing Leaching and Crystallizing*, U.S. Patent #3,647,395, March, 7, 1972.

Dragun, J., and Chiasson, A., *Elements in North American Soils,* Hazardous Materials Control Resources Institute, Greenbelt, Maryland, U.S.A., 1991.

EIMCO Process Equipment Co., *The EIMCO Cement Dust Leaching System,* Salt Lake City, Utah, U.S.A., (no date).

Einhaus, R.L., Honarkhah, I., and Erickson, P., *Fate of Polychlorinated Biphenyls (PCBs) in Soil Following Stabilization with Quicklime,* Technology Applications, Inc., Cincinnati, Ohio, EPA/600/2-91052, Sponsored by EPA Risk Reduction Engineering Laboratories, 1991.

Emer, P., "Formation of Foam on the Surface of Molten Glass Bath," *Glastechnische Berichte,* Frankfurt, Germany, 42:30, June 1969.

Farnham, W., *Process of Clarifying Turbid Water Using Cottrell Flour and Acidifying Coagulant,* U.S. Patent #2,964,466, December 13, 1960.

Fernandez Lozano, J.A., and Silva, U.H., "Potassium Sulfate Production from Cement Plant Furnace Dust," *Ingenieria Quimica,* Madrid, Spain, Vol. 17(191), pp. 63-68, 1985.

Fraiman, L.S., Ioganson, A.K., and Solovushkov, N.E., "Study of Properties of Bypass Dust," *Tsement,* Leningrad, U.S.S.R., Vol. 9-10, pp. 27-29, 1991.

Fuller Company, *Fuller Kiln Dust Recover System,* Bethlehem, Pennsylvania, U.S.A., 1992.

Gorman, P.G., *Cement Dust as an Absorbant for SO_2 Removal from Stack Gases,* M.Sc. Thesis, University of Missouri, Missouri, U.S.A., 1972.

Haynes, W.B., and Kramer, G.W., *Characterization of U.S. Cement Kiln Dust,* Information Circular #8885, U.S. Bureau of Mines, U.S. Department of Interior, Washington, D.C., 1982.

Huber, F.W., and Reath, F.R., *Processings of Producing Cement and Recovering Potassium Compounds,* U.S. Patent #1,219,315, March 13, 1917.

Klemm, W.A., Cement Kiln Dust: A Look at its Uses and Characteristics, *Proceedings of the 29th. International Cement Seminar,* Rock Products, San Francisco, California, U.S.A., 1993.

Klemm, W.A., *Kiln Dust Utilization,* Martin Marietta Laboratories Report MML TR 80-12, Baltimore, Maryland, U.S.A., March, 1980.

Luther, M.D., Koch Minerals Company, Weirton, West Virginia, Seminar at Construction Technology Laboratories, Inc., Skokie, Illinois, U.S.A., December 2, 1993.

Mackay, M., and Emery, J., "Stabilization/Solidification of Contaminated Soils and Sludges Using Cementitious Systems," *Cement Industry Solution to Waste Management,* Ist. International Symposium, Canadian Portland Cement Association, Calgary, Alberta, Canada, pp. 135-151, October 7-9, 1992.

McCants, H.C., *Method for Conversion of Portland Cement Dust to an Adsorbent Material and Adsorbent Material Made Thereby,* U.S. Patent #2,605,236, July 29, 1952.

McCord A.T., *Process for Reclaiming Cement Kiln Dust and Recovering Chemical Values Therefrom,* U.S. Patent #4,031,184, 1977.

McCoy, W.J., and Kriner, R.W., "Use of Waste Kiln Dust for Soil Consolidation," *Mill Session Papers,* Portland Cement Association, Skokie, Illinois, U.S.A., June 21, 1971.

Miller, C.T., Bensch, D.G., and Colony, D.C., "Use of Cement-Kiln Dust and Fly Ash in Pozzolanic Concrete Base Courses," *Emulsion Mix Design, Stabilization, and Compaction,* Transportation Research Record 754, TRB, Washington D.C., U.S.A., pp. 36-41, 1980.

Müller, H.-P., *What is Dust?: Characterization and Classification of Kiln Dust,* 24th. Technical Meeting, Report No. MA 77/2505/E, "Holderbank" Management and Consulting Ltd., Technical Center, Material Division, Aargau, Switzerland, 1977.

Murdock, K.J., "The Utilization of Bypass Dust in the Capture of SO_2 and the Manufacture of Portland Cement," *Emerging Technologies Symposium on Cement and Concrete in the Global Environment, SP114T,* Portland Cement Association, Skokie, Illinois, U.S.A., March 1993.

Nicholson, J.P., "Cement Kiln Dust: Where is it Going?," *Pit & Quarry,* Cleveland, Ohio, U.S.A., Vol. 76, No.1, pp.98-104, July 1983.

Nicholson, J.P., *Stabilized Mixture,* U.S. Patent #4,101,332, July 18, 1978, Reissue #30,943, May 25, 1982.

Nicholson, J.P., and Burnham J.C., *Treating Wastewater Sludge with Alkaline Materials for Decontamination and Conversion into Fertilizer,* European Patent Application #EP Z83153, September 1988.

Nicholson, J.P., "What are We Doing With Sludge?," *Pollution Engineering,* Northbrook, Illinois, U.S.A., p. 14, March 1988.

Preston, M.L., "Use of Cement Kiln Dust as an Agricultural Lime and Fertilizer," *Emerging Technologies Symposium on Cement and Concrete in the Global Environment*, SP114T, Portland Cement Association, Skokie, Illinois, U.S.A., March 1993.

Ravindrarajah, R.Sri, "Usage of Cement Kiln Dust in Concrete," *International Journal of Cement Composites and Lightweight Concrete*, Harlow, U.K., Vol. 4 (2), pp. 95-102, May 1982.

Risser, J.A., Doty, W.T., and Baker, D.E., "Cement Kiln Dust Useful as Lime-Potash Fertilizer," *Science in Agriculture*, The Pennsylvania State University, College of Agriculture, Agricultural Experiment Station, University Park, Pennsylvania, U.S.A., Vol. 28, No. 2, pp. 6-7, Winter 1981.

Salem N., "Purification of Highly Contaminated Water by Using Cement Dust: A Possible Approach," *Agrochimica*, Pisa, Italy, Vol. 34(4), pp. 352-362, 1990.

Sanduo, T., "Some Views on Cement Specifications," *8th. International Congress on Chemistry of Cement*, Rio de Janeiro, Brazil, Vol. VI, pp. 296-299, 1986.

Sayah, A.I., Stabilization of a Highly Expansive Clay Using Cement Kiln Dust, M.Sc. Thesis, University of Oklahoma, Graduate College, Norman, Oklahoma, U.S.A., 1993.

Siegert, L.D., "Kilns Reuse Dust the Insufflation Way," *Rock Products*, Chicago, Illinois, U.S.A., Vol. 77, No. 2, p. 52, February, 1974.

Singleton, F.H., and Bruce, J.W., *Treatment of Cement Kiln Flue Dust*, U.S. Patent #3,925,534, December, 1975.

Steuch, H.E., "Review of Dust Return System," *Emerging Technologies for Kiln Dust Management, SP113*, Portland Cement Association, Skokie, Illinois, U.S.A., March 1992.

Taylor, O., "Flue Dust: A Concrete Idea?," *Soybean Digest*, St. Louis, Missouri, U.S.A., pp. 48d-48e, May, 1987.

Todres, H.A., *Cement Kiln Dust: Field Compaction and Resulting Permeability*, Research and Development Bulletin RD106T, Portland Cement Association, Skokie, Illinois, U.S.A., 1992.

Todres, H.A., Mishulovich, A., and Ahmad, J., *Cement Kiln Management: Permeability*, Research and Development Bulletin RD103T, Portland Cement Association, Skokie, Illinois, U.S.A., 1992.

University of Toledo, and Nicholson Concrete & Supply Co, "Uses for Cement Kiln Dust- Purpose of Toledo Conference," *The Blade*, Toledo, Ohio, Thursday, July 21, 1977.

von Seebach, M., and Tompkins, J.B., *Method for Producing Hydraulic Binder*, U.S.Patent #5,122,190, June 16, 1992.

Ward, G.M., et. al., "Cement Kiln Dust in Finishing Lamb Diets," *Journal of Animal Science*, Champaign, Illinois, U.S.A., Vol. 49, No. 3, pp. 637-640, 1979.

Wheeler, W.E., and Oltjen, R.R., *Cement Kiln Dust in Diets for Finishing Steers*, United States Department of Agriculture, Agricultural Research Servise Report ARS-NE-88, Washington, D.C., U.S.A., December 1977.

Wheeler, W.E., and Oltjen, R.R., "Cement Kiln Dust in Complete Diets for Finishing Steers and Growing Lambs," *Journal Animal Science*, Champaign, Illinois, U.S.A., Vol. 48, No. 3, pp. 658-665, 1979.

Wills, Jr., M.H., *Concrete Masonry Units Incorporating Cement Kiln Dust*, U.S. Patent #4,407,677, October 4, 1983.

Wilson, R.D., and Anable, W.E., *Removal of Alkalis From Portland Cement Kiln Dust*, RI #9032, Bureau of Mines, U.S. Department of Interior, Washington, D.C., 1986.

Wolfe, J.R., "CKD Impurity Removal Investigations," *Emerging Technologies for Kiln Dust Management, SP113*, Portland Cement Association, Skokie, Illinois, U.S.A., 1992.

Young, G.L., "Use of Cement Kiln Dust (and Other Alkaline Wastes) for the Capture of SO2, HCl, and CO_2 from Flue Gas and Subsequent Production of Fertilizer and Kiln Feed," *Emerging Technologies Symposium on Cement and Concrete in the Global Environment, SP114T*, Portland Cement Association, Skokie, Illinois, U.S.A., 1993.

Young, G.L., and Morrison, G.L., "Passamaquoddy Technology Recovery Scrubber at the Dragon Products Company, Inc. Cement Plant," Rock *Products, 27th. International Cement Seminar*, Atlanta, Georgia, U.S.A., December 3, 1991.

Zaman, M., Laguros, J.G., and Sayah, A.I., "Soil Stabilization Using Cement Kiln Dust," *7th. International Conference on Expansive Soils*, Dallas, Texas, U.S.A., pp. 1-5, August, 1992.

Table 1. Production of Cement Kiln Dusts from Different Operation Types (Müller, 1977)

Kiln operation type	Range of dust production (% of clinker produced)
Wet	10-25
Semi-dry/semi-wet	0-3
Dry	7-15

Table 2. Typical Composition of Cement Kiln Dust (Haynes and Kramer, 1982)

Constituent	% by weight	Constituent	% by weight
$CaCO_3$	55.5	Fe_2O_3	2.1
SiO_2	13.6	KCl	1.4
CaO	8.1	MgO	1.3
K_2SO_4	5.9	Na_2SO_4	1.3
$CaSO_4$	5.2	KF	0.4
Al_2O_3	4.5	Others	0.7

Table 3. Composition of CKDs from Different Operation Types (Todres et. al., 1992)

Constituent	Dust G (wt. %) long-wet kiln	Dust H (wt. %) long-dry kiln	Dust S (wt. %) alkali bypass
SiO_2	15.02	9.64	15.23
Al_2O_3	3.85	3.39	3.07
Fe_2O_3	1.88	1.10	2.00
CaO	41.01	44.91	61.28
MgO	1.47	1.29	2.13
SO_3	6.27	6.74	8.67
Na_2O	0.74	0.27	0.34
K_2O	2.57	2.40	2.51
LOI	25.78	30.24	4.48
Free CaO	0.85	0.52	27.18

Table 4. Typical Mineralogical Compositions of Selected CKDs (Müller, 1977)

CKD component	Mineralogical compositions
Unreacted raw feed	Carbonates Quartz Others (clay minerals, Fe/Al oxides)
Partially calcined feed and clinker dust	Decomposed raw feed Clinker minerals Intermediate phases
Free lime	CaO, Ca(OH)2
Alkali salts and other volatile compounds	KCl, 2NaCl, (K/Na)2SO4, CaSO4

Table 5. Mean Particle Size of the Returned and Discarded CKDs (Müller, 1977)

Kiln operation type	Returned CKD Mean particle size (μm)	Discarded CKD Mean particle size (μm)
Wet process	15	12
Semi-dry/semi-wet process	31	34
Dry process	3	11

Table 6. Size Distribution and Mean Particle Size of the CKDs (Todres et. al., 1992)

Type of kiln operation	>100 (μm)	<45 (μm)	<30 (μm)	<7 (μm)	<0.6 (μm)	Mean (μm)
Long-wet process	5.0	85.0	77.3	43.0	7.5	9.3
Long-dry process	0.0	99.2	98.8	87.2	5.6	3.0
Bypass operation	2.0	84.5	66.0	14.0	2.0	22.2

Table 7. Levels of Trace Metals in CKDs (PCA, 1992)

RCRA and BIF metals	Average TCLP (mg/kg)	RCRA limits (mg/kg)
Antimony	0.012	1.0
Arsenic	0.066	5.0
Barium	1.04	100.0
Beryllium	0.004	0.007
Cadmium	0.0288	1.0
Chromium	0.10	5.0
Lead	0.349	5.0
Mercury	0.0018	0.2
Nickel	0.13	70.0
Selenium	0.152	1.0
Silver	0.07	5.0
Thallium	0.38	7.0

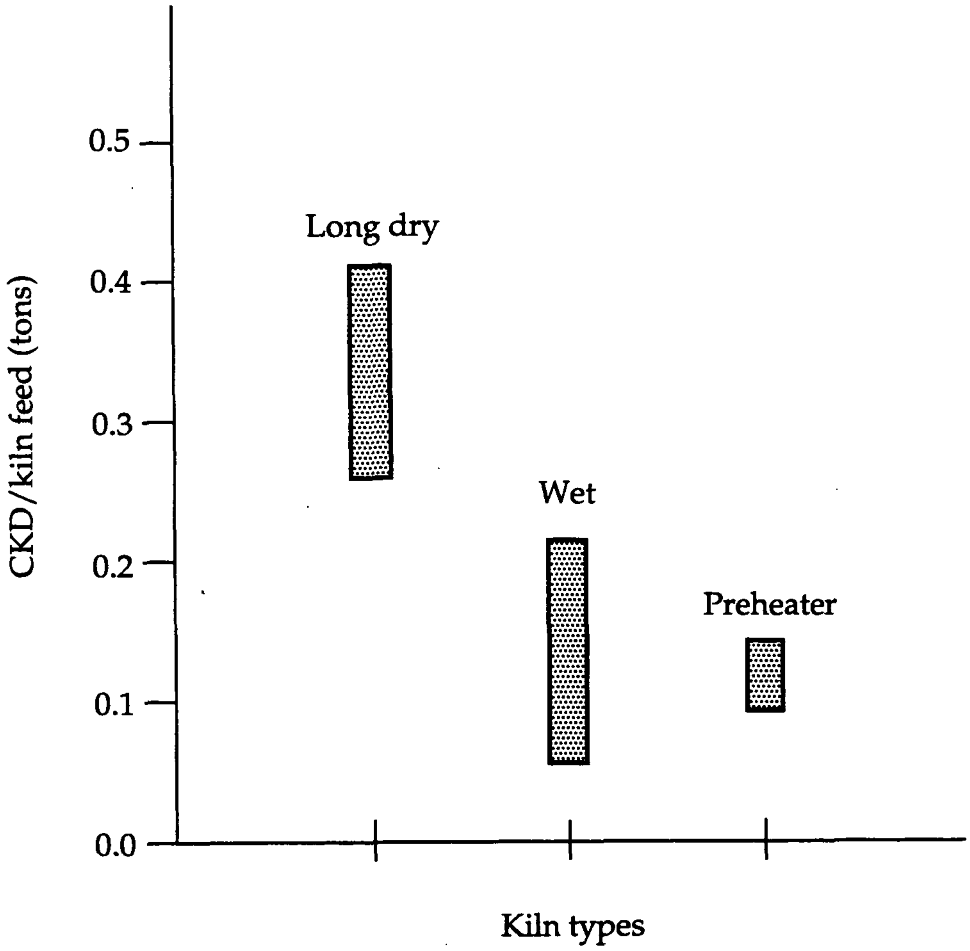


Figure 1. CKD generation as a function of kiln type (Steuch, 1992).

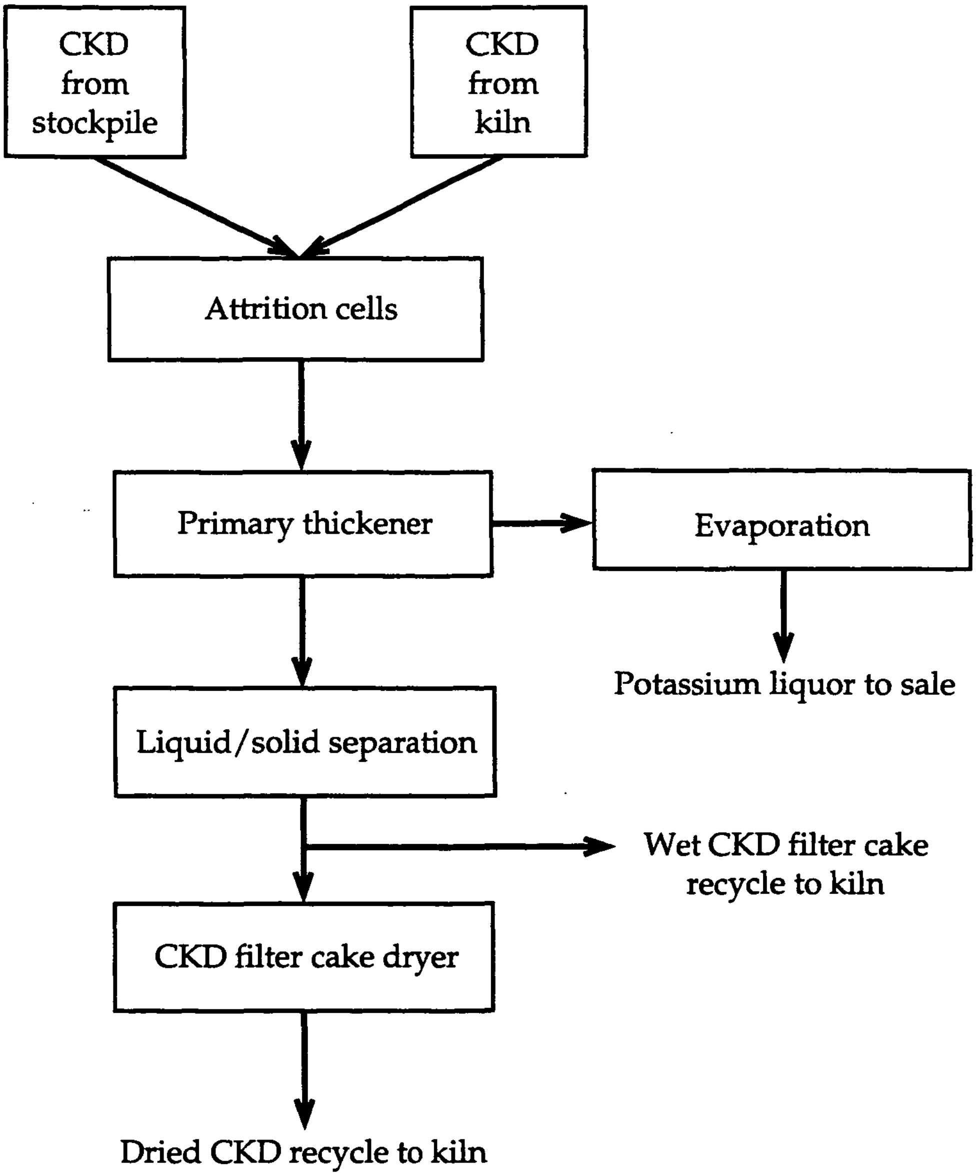


Figure 2. Flowsheet of the preferred process for alkali removal from CKD and recycling as kiln feed (Wolfe, 1992).

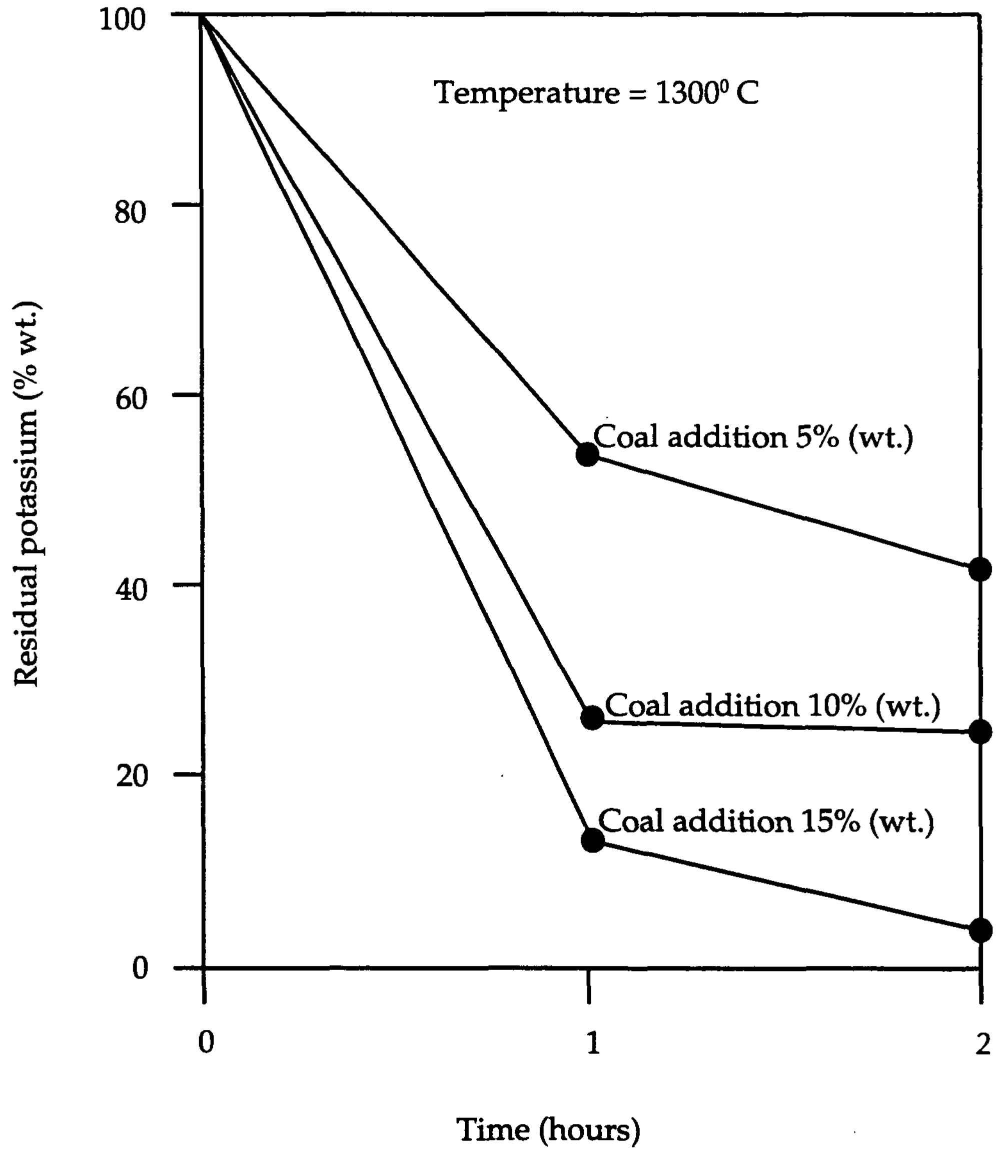


Figure 3. **Removal of potassium from CKD by volatilization under reducing conditions (Wilson and Anable, 1986).**

Metric conversion table

Following are metric conversions of the measurements used in this text. They are based in most cases on the International System of Units (SI).

1 in = 25.40 mm
1 sq in = 645.16 mm2
1 ft = 0.3048 m
1 sq ft = 0.0929 m2
1 sq ft per gallon = 0.0245 m2/L
1 gal = 3.785 L
1 kip = 1000 lbf = 4.448 kN
1 lb = 0.4536 kg
1 lb per cubic yard = 0.5933 kg/m3
1 psf = 4.882 kg/m2
1 psi = 0.006895 MPa
No. 4 sieve = 4.75 mm
No. 200 sieve = 75 mm
1 bag of cement (U.S.) = 94 lb = 42.6 kg
1 bag of cement (Canadian) = 88 lb = 40 kg
1 bag per cubic yard (U.S.) = 55.8 kg/m3
deg. C = (deg. F - 32)/1.8

Portland Cement Association *5420 Old Orchard Road, Skokie, Illinois 60077-1083 (847) 966-6200, FAX (847) 966-9781*

An organization of cement manufacturers to improve and extend the uses of portland cement and concrete through market development, engineering, research, education, and public affairs work.

Printed in U.S.A.

Printed on recycled paper

RP327.01T

APPENDIX II

COMPREHENSIVE SOLID WASTE MANAGEMENT PLAN REVIEW CHECKLIST

APPENDIX A

COMPREHENSIVE SOLID WASTE MANAGEMENT PLAN, PART I
Review Checklist

PLAN CONTENTS	YES	NO	INCOMPLETE	
Identification of Responsible Agencies	✓			
Advisory Committee				
Identification of members	✓			
Description of role, activities	✓			
Documents reviewed	✓			
Meeting dates, locations	✓			
Public Hearings or Meetings				
Date, location of hearing/mtg. #1				N/A
Date, location of hearing/mtg. #2				N/A
Evidence of Cooperation				
Letters from all local governments				N/A
Description of Planning Area				
Locations of existing facilities	✓			
Population centers				N/A
Transportation routes				N/A
Climate	✓			
Natural, historic, archeological features	✓			
Agency jurisdictions	✓			
Description of Previous Planning Activities	✓			
State Volume Reduction Goals				
Report of waste stream, 7/1/88	✓			
Changes in pop., employment, industry production since 7/1/88				N/A
Waste Generation, Composition Analysis				
List of all industries in area				N/A
Analysis of waste generation, comp.	✓			

For each option:	YES	NO	INCOMPLETE	
Materials	✓			
Public education				N/A
Est. % of waste stream diverted	✓			
Present activities	✓			
Environmental impacts				N/A
Costs/revenues				N/A
Recommendations	✓			
5. Sanitary Landfills				
Description of options				N/A
For each option:				
Siting, locations				N/A
Transportation routes, costs				
Capital costs				↓
Present available space				
Groundwater monitoring costs				
Financial assurances				
Environmental impacts				
For new landfills or expansions:				
Plant and animal analyses	✓			
Archeological, historical, architectural analyses	✓			
Proposed Integrated Mgnt. System	✓			
Comparative Cost Analyses				N/A
Implementation Plan and Schedule				
Proposed activities, strategies for each applicable alternative	✓			
For each alternative:				
Reason for decision	✓			
Methods to be used	✓			
Timelines w/ yearly milestones	✓			
Proposed locations of activities	✓			
Estimated costs				N/A
Organizations proposed to implement activities	✓			
Public education strategies, methods				N/A
Financial commitment				N/A

N/A - NOT APPLICABLE

APPENDIX B: INTEGRATED MANAGEMENT SYSTEM COST ANALYSIS
FIRST YEAR COST BREAKDOWN

For each of the management methods analyzed, a clear list of the costs associated with that method should be made. Reference to the section of the plan that analyzes the particular option (both method and specific costs) should be made. The assumptions that apply to the cost analysis should be clearly stated and attached to the list.

The following is an example of the information that should be included in the individual management method cost analysis. Subtotals of the various costs and/or revenues will be entered in the comparative cost analysis.

MANAGEMENT METHOD: NOT APPLICABLE (text reference)

Capital Costs:

1) Building and Construction ____________
2) Equipment ____________
3) Land ____________

Subtotal ____________
Annual Cost (include interest)* ____________

Operation Costs:

1) Salaries ____________
2) Utilities ____________
3) Maintenance ____________
4) Other ____________

Subtotal ____________

Transportation Costs:

1) Collection ____________
2) Haul ____________

Subtotal ____________

Revenues: ____________

Total Method Cost: ____________

List of Assumptions associated with this analysis:

* Annual cost for capital expenditures must include principal, annual percentage rate, and the number of years required to repay the loan.