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PERMIT RENEWAL DOCUMENTS
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

APRIL 17, 2026

CITY OF SPENCER

Prepared By:

Kruse, Cate & Nelson, PC
2303 West 18th Street
Spencer, Iowa
712-262-3468

I. PERMIT RENEWAL EXECUTIVE SUMMARY

OVERVIEW

This document serves as an executive summary of the Development and Operations (DOPs), plans, specifications and supporting documents as required to renew the Solid Waste Landfill Permit # 74-SDP-02-76P for the Northern Plains Regional Landfill located in Palo Alto County Iowa. The facility is owned and operated by the City of Spencer, Iowa.

This document was prepared by: James E Thiesse, PE, LS and
Ross McWhirter, PE
KRUSE, CATE & NELSON, P.C.
Dated: January 15, 2026

II. DEVELOPMENT AND OPERATIONAL PLAN MODIFICATIONS

The original Development and Operations Plan (DOP) for the Northern Plains Regional Landfill is dated December 15, 2004 (IDNR Doc.28914) and consists of 18 Appendixes. We are continuing to use this format for this renewal cycle.

In the 2020 permit renewal Appendixes 3, 4 and 8 were replaced, Appendixes 1, 2, 5, 6, 9, 12, 13 & 14 were updated and no changes were made to 7, 10, 15-18 (Docs. #98741 & 99568)

Appendixes to be modified in this 2026 permit renewal and DOPS 2026 Update include:

Appendix 1:	Primary Plan Requirements	Replace Document
Appendix 2:	Development Drawings and Site Plans	Replace Documents
Appendix 3:	Hydrogeological Investigation and Report	Resubmit Document
Appendix 4:	Hydrological Monitoring Systems Plan	Resubmit Document
Appendix 5:	Leachate Control Plan	Replace Document
Appendix 6:	Emergency Response and Remedial Action Plan	Replace Document
Appendix 7:	Goundwater Quality Assessment Monitoring Plan	Resubmit Document
Appendix 8:	Explosive Gas Control Plan	Resubmit Document
Appendix 9:	Closure/Post Closure Plan	Replace Document
Appendix 10:	Financial Assurance Requirements	Replace Document
Appendix 11:	Comprehensive Plan Requirements	Round 9 (5-1-2027)
Appendix 12:	Scale Certification	Updated
Appendix 13:	Operator's Certifications	Updated
Appendix 14:	Household Hazardous Material Certificate	Updated
Appendix 15:	Legal Description and Proof of Ownership	Updated
Appendix 16:	Ecological Clearance	No changes
Appendix 17:	State Historical Preservation Office Clearance	Add Document
Appendix 18:	NRCS Clearance	No Changes

Appendix 1: Operations Plan. Replacement Document

Because the original document has been updated multiple times, a new document was created to serve as the facility "Appendix 1: Operations Plan of the Development and Operational Plan for Northern Plains Regional Landfill, Palo Alto County, SDP Permit No. 74-SDP-02-76-P" and replaces the "Development and Operational Plan", originally dated December 15, 2004 (#28914) and all updates approved in permit renewal cycles in 2010, 2015 and 2020 (#98741 and 99586).

Appendix 2: Development Drawings and Site Plans. Replacement Documents.

Because the original document has been updated multiple times, a new document was created serve as the facility "Appendix 2: Development Drawings and Site Maps for Northern Plains Regional Landfill (NPRL), Palo Alto County, SDP Permit No. 74-SDP-02-76-P" and is a part of the Development and Operational Plan for the facility. This document replaces the previous "Development Drawings & Site Maps for Northern Plains Regional Landfill (NPRL), Palo Alto County, SDP Permit No. 74-SDP-02-76-P", dated December 6, 2004 previously submitted (#28913 thru 28922) and updated in 2020 (#98741 and 99586).

The current facility construction specifications and Quality Control and Assurance Plan are included in Appendix 5.

Appendix 3: Hydrogeological Investigation and Report. Resubmit Document.

The HIR prepared by HLW Engineering Group, dated September 2020 was submitted for review with the 2020 permit renewal documents (INDR # 98741 starting on page 44). This document remains the current HIR for the landfill and for clarity is being resubmitted herewith.

Appendix 4: Hydrological Monitoring Systems Plan. Resubmit Document with Updates.

The HMSP prepared by HLW Engineering Group, dated September 2020 was submitted for review with the 2020 permit renewal documents (INDR # 98741 starting on page 44). This document remains the current HMSP for the landfill, with the following modifications, and for clarity the original document is being resubmitted herewith.

Update Up Gradient Monitoring Well list in HMSP, dated September 2020 as follows:

a. Add background monitoring wells MW-13, MW18 and MW-20 to list on page 1.
b. Replace Figure 15 showing MW-13, MW18 and MW-20.

Appendix 5: Leachate Control Plan. Replace entire document.

Because the original document has been updated multiple times, a new document was created serve as the facility "Appendix 5: Leachate Control Plan for Northern Plains Regional Landfill (NPRL), Palo Alto County, SDP Permit No. 74-SDP-02-76-P" and is a part of the Development and Operational Plan for the facility. This document replaces the previous "Appendix 5: Leachate Control Plan", dated December 6, 2004 previously submitted (#28913 thru 28922) and updated in 2020 (#98741 and 99586).

Appendix 6: Emergency Response and Remedial Action Plan. **Replacement Document:**

The landfill is required to submit a new "Emergency Response and Remedial Action Plan" pursuant to Iowa Administrative Code (IAC) 567—Chapter 113.8(5) with SDP permit renewal applications. The new document includes references to the Landfill Fire Risk Management Plan Dated March of 2025.

Appendix 7: Groundwater Quality Assessment Plan

This document replaces the original plan requirement document (28914, page 279). Should implementation of the HMSP result in the facility being ordered to enter a Groundwater Quality Assessment Plan, such a plan will be generated by the landfill's environmental consultant: HLW Engineering Group.

Appendix 8: Explosive Gas Control Plan.

The Gas Monitoring system Plan (GMSP) prepared by HLW Engineering Group, dated September 2020 was submitted for review with the 2020 permit renewal documents (INDR # 98741 starting on page 66). This document remains the current GMSP for the landfill and for clarity is being resubmitted herewith.

Appendix 9: Closure/Post Closure Plan.

A new document was created serve as the facility, "Closure and Post Closure Plan, Appendix 9: Development and Operational Plan for Northern Plains Regional Landfill, Palo Alto County, SDP Permit No. 74-SDP-02-76-P". This document replaces the Closure Post Closure Plan originally dated December 15, 2004 (28914) and all updates approved in permit renewal cycles in 2010, 2015 and 2020 (#98741 and 99586).

Appendix 10: Financial Assurance Plan.

A new document was created to describe the procedures required to assure compliance with Iowa Code sections 455B.304(8) and 455B.306(9) by establishing financial assurance for closure, postclosure care and corrective action at the "Northern Plains Regional Landfill, Palo Alto County, SDP Permit No. 74-SDP-02-76-P". Appendix 10 includes the latest Form 542-8090 submittal.

Appendix 11: Comprehensive Plan Requirements.

The NPRL Planning Area has withdrawn as an Environmental Management System (EMS) Participant. The 9th round next Comprehensive Plan update is due May 1, 2027.

Appendix 12-14: Updated Certifications provided.

Appendix 16: No Changes.

Appendix 15: Legal Description and Proof of Ownership.

The title opinion for the original active landfill site is found on page 327 of INDR Docs. #28914 and remains valid.

Since the last permit renewal in 2020, the city has purchased two acreages adjacent to the landfill, removed the buildings and the existing well on the acreage southeast of the landfill. An updated property parcel map surrounding the active landfill site is attached showing the property currently Owned by the City of Spencer. Also included are the deeds to the parcels.

Appendix 17: State Historical Preservation Office Clearance:

Prior to the construction of expansion Cell E1 a "PHASE I CULTURAL RESOURCES INVESTIGATION FOR A PROPOSED LANDFILL EXPANSION PROJECT IN WALNUT TOWNSHIP, PALO ALTO COUNTY, IOWA" prepared by Bear Creek Archeology, Inc., dated July 2023 was completed. This document was submitted to the IDNR and SHPO on July 10, 2023 and the associated construction permit was issued on July 13, 2023 (107203). We could not find the report in the IDNR record so a copy is included for addition to Appendix 17.

Appendix 18: No Changes.

III. SUMMARY OF PERMIT SPECIAL PROVISIONS

The current permit dated March 4, 2021 through March 4, 2026 contains 13 special provisions. This section addresses each special provision in numerical order.

1. The NPRL Planning Area has withdrawn as an Environmental Management System (EMS) Participant. The next Comprehensive Plan (9th round) update is due May 1, 2027.
2. Change reference to reflect permit amendments and proposed changes to the Development and Operations Plan (Appendixes 1-18) since 2020 renewal. Some changes are minor such as changes to names and addresses. More significant, is the addition of cell E (constructed in phases as E1 and E2) to the list of approved cells. The most significant change is the addition of a 22 acre horizontal expansion to the west of Cells A-E. The cells in the expansion area are lettered F-J. Closure of Cells A-J is projected to occur around the year 2050. Most of the 18 Appendixes of the DOP are being replaced or updated. Changes to each Appendix are addressed in order after this summary.
3. Active cells are shown on the updated drawings. It may not be necessary to include historical references to past certifications for active cells in the 2026 permit renewal.
4. Add updated background monitoring well list (MW-13, MW18 and MW-20) to HMSP included in this application.
5. Add reference to the replacement Leachate Control Plan information included in this application.
6. No changes.
7. Consolidate ASR/WSR requirements contained in Special Provisions 7, 8, 9, 11 & 12 and Permit Amendments 1 through 4.
8. See Comment 7.
9. See Comment 7.
10. No comment.
11. Consider deleting this provision as it has been superseded by provision 12.
12. See comment 7.
13. Add reference to updated information provided in DOPS Appendix 9 update.

IV. SUMMARY OF PERMIT AMENDMENTS

The current permit dated March 4, 2021 has been amended 9 times. It is anticipated that the new permit to be issued will be updated to reflect the provisions of the Operations Plan and it will not be necessary to include the specific items listed as amendments. This section addresses each amendment in numerical order.

1. ASR Intermediate Cover variance. See Special Provision Comment 12.
2. Date changes to Special Provision 12. See Special Provisions Comment 12.
3. Corrective Measures Approval. These measures have been completed as shown on As-built drawings approved in amendment 6, dated 4/09/2024.
4. Amendments 4 – 9 all pertain to expansion cell E, constructed in phases E1 and E2. The new cells should be incorporated in the list in the Special Provisions.

There are no additional requests for new permit amendments in addition to those listed above pending at this time.

There are no equivalency reviews being requested at this time.

There are no additional variances from Iowa Administrative Code requirements being requested at this time.

V. SUPPORTING DOCUMENTS REQUIRED BY FORM 50

ORGANIZATIONAL CHART

An updated organizational Chart in section 2.1 of the "Development and Operations Plan" is included in this application.

SITE EXPLORATION AND CHARACTERIZATION REPORT

A new Hydrologic Investigative Report (HIR) dated September 2020 was completed by HLW Engineering Group to include the proposed horizontal expansion area and replaces the previous document, see Appendix 3 for details.

The new HIR includes information from the previous "Site Exploration and Characterization Report", dated November 29, 2004 that was prepared by Team Services of Des Moines, Iowa; and the Hydrologic Investigative Reports (HIR) dated April 7, 1995 and January 1999 and the associated drawings 1-9, completed by Jacobson-Westergard & Associates, Inc.

DESIGN PLANS AND SPECIFICATIONS, INCLUDING QC & A PLAN

Design Plans for the expansion cells are included in the 2026 DOP update. See Appendix 2 for updated drawings (dated 1-15-2026) for design details, base elevations, and leachate collection systems in the expansion area. Construction plans and specifications for individual cells will be submitted to the Department for approval prior to taking bids for construction. The current facility construction specifications and Quality Control and Assurance Plan are included in Appendix 2.

Appendix 2 also includes site verification information for the facility.

DEVELOPMENT AND OPERATIONS PLAN (DOP), EMERGENCY RESPONSE AND REMEDIAL ACTION PLAN (ERRAP) AND PROOF OF MSWLF OPERATIOR CERTIFICATION

The addition of the 22-acre horizontal expansion to the west of Cells A-E is included in this application. The cells in the expansion area are lettered F-J. Closure of Cells A-J is projected to occur around the year 2050. Numerous revisions and additions to the 18 Appendixes of the DOP are required to include references to the proposed expansion and are included in this application. Revised documents are dated 1-15-2026.

In addition, contact information for officials and vendors contained in the DOP was updated.

The basic procedures described in the *updated* "Development and Operations Plan" (DOP) dated 1-15-2026 elsewhere in this application are the basis for the planned expansion.
The Emergency Response and Remedial Action Plan contained in Appendix 6 has been revised to reflect changes in contact information, to add references to the proposed expansion and adds reference to "LANDFILL FIRE MANAGEMENT PLAN" dated March 2025, prepared by Barker-Lemar Engineering Consultants for the NPRL.

The operator's certifications are current and are included in Appendixes 12, 13 and 14.

ENVIRONMENTAL MONITORING PLAN

The Hydrological Monitoring Systems Plan (HMSP) and Explosive Gas Monitoring Systems Plan (GSMP) was submitted for review with the 2020 permit renewal documents (INDR # 98741 starting on page 44). This document is resubmitted as Appendixes 4 and 8 and are considered the current HMSP and GMSP for the landfill.

PROJECT GOALS PER 113.4(10)

Nothing to add or update.

PROOF OF FINANCIAL ASSURANCE

The most current Financial Assurance report was submitted April 16, 2026 and is included in Appendix 10.

CLOSURE POST CLOSURE PLAN

A new document was created serve as the facility, "Closure and Post Closure Plan, Appendix 9: Development and Operational Plan for Northern Plains Regional Landfill, Palo Alto County, SDP Permit No. 74-SDP-02-76-P". This document replaces the Closure Post Closure Plan originally dated December 15, 2004 (28914) and all updates approved in permit renewal cycles in 2010, 2015 and 2020 (#98741 and 99586).

The plan has updated current closure conditions, proposed closure schedule and revised cover design and details, including the horizontal expansion.

COMPREHENSIVE PLAN

The NPRL Planning Area was an Environmental Management System Participant starting in September 2011 but withdrew from the program in November 2022. The service area of the landfill has changed slightly as described on Form 50. The last Comp Plan update was dated March 11, 2011. The 2017 and 2022 Comprehensive Plan updates were waived due to EMS status. The next update is the 9th round due on May 1, 2027.

HOUSEHOLD HAZARDOUS MATERIALS (HHM) COLLECTION CERTIFICATION

The NPRL operates a permitted HHM Regional Collection Center and Storage facility that is in Spencer at the transfer station and operated under the transfer station permit 21-SDP-01-76. The attached License (21-RCC-2011) which expires November 1, 2028, authorizes the operation of this facility. Operators' Certificates for the facility are included in Appendix 14.

END OF EXECUTIVE SUMMARY

APPENDIX 1:

OPERATIONS PLAN
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

January 15, 2026

CITY OF SPENCER
#1717

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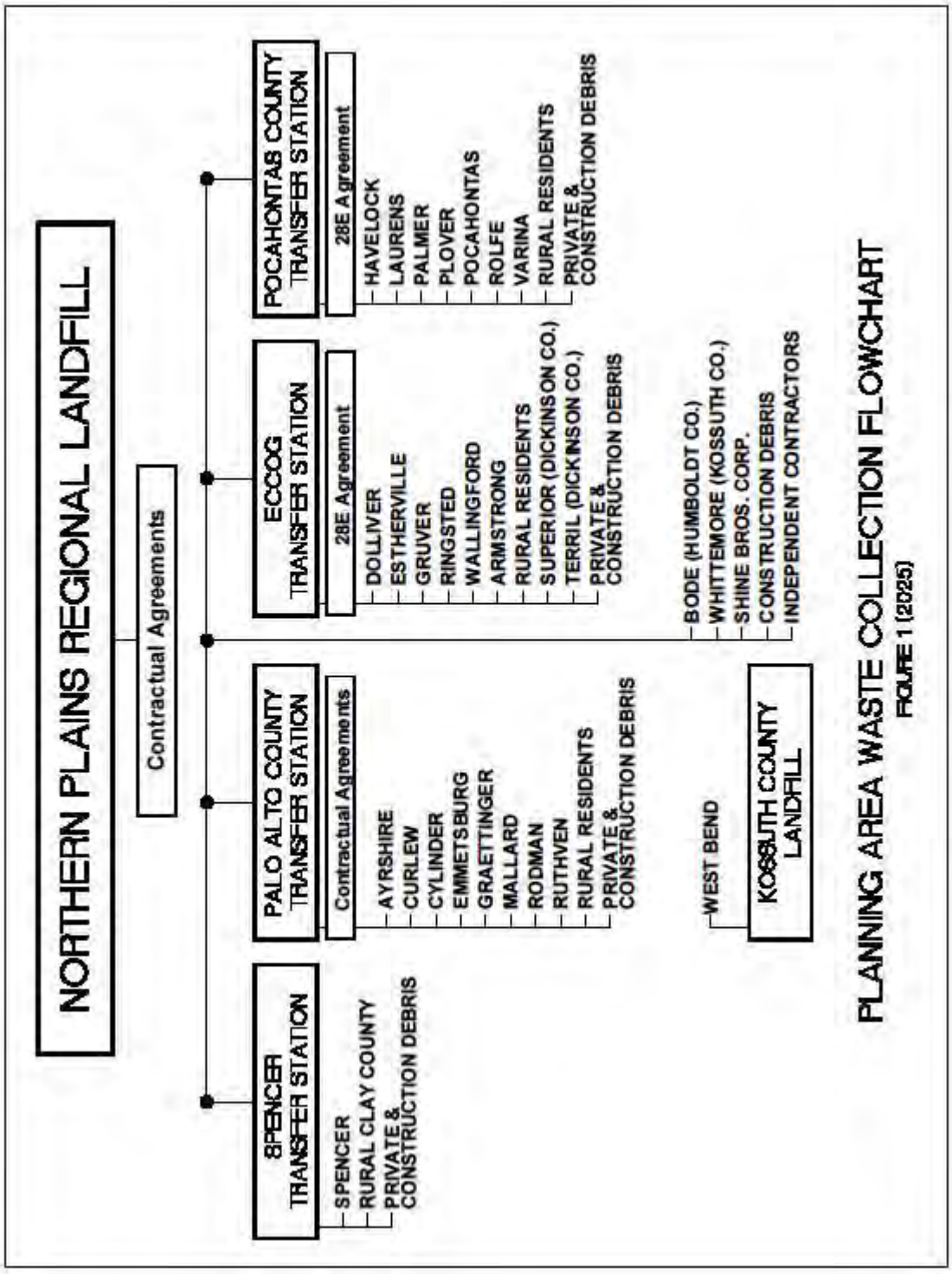
OPERATIONS PLAN


NORTHERN PLAINS REGIONAL LANDFILL
Contractual Agreements
SPENCER TRANSFER STATION
SPENCER
RURAL CLAY COUNTY
PRIVATE & CONSTRUCTION DEBRIS
PALO ALTO COUNTY TRANSFER STATION
Contractual Agreements
AYRSHIRE
CURLEW
CYLINDER
EMMETSBURG
GRAETTINGER
MALLARD
RODMAN
RUTHVEN
RURAL RESIDENTS
PRIVATE & CONSTRUCTION DEBRIS
WEST BEND
KOSSUTH COUNTY LANDFILL
ECCOG TRANSFER STATION
28E Agreement
DOLLIVER
ESTHERVILLE
GRUVER
RINGSTED
WALLINGFORD
ARMSTRONG
RURAL RESIDENTS
SUPERIOR (DICKINSON CO.)
TERRIL (DICKINSON CO.)
PRIVATE & CONSTRUCTION DEBRIS
BODE (HUMBOLDT CO.)
WHITTEMORE (KOSSUTH CO.)
SHINE BROS. CORP.
CONSTRUCTION DEBRIS
INDEPENDENT CONTRACTORS
POCAHONTAS COUNTY TRANSFER STATION
28E Agreement
HAVELOCK
LAURENS
PALMER
PLOVER
POCAHONTAS
ROLFE
VARINA
RURAL RESIDENTS
PRIVATE & CONSTRUCTION DEBRIS
PLANNING AREA WASTE COLLECTION FLOWCHART
FIGURE 1 (2025)

1.0 INTRODUCTION

Because the original document has been updated multiple times, this new document shall serve as the facility: "Appendix 1: Operations Plan of the Development and Operational Plan for Northern Plains Regional Landfill, Palo Alto County, SDP Permit No. 74-SDP-02-76-P" and replaces the "Development and Operational Plan", originally dated December 15, 2004 (#28913) and all updates approved in permit renewal cycles in 2010, 2015 and 2020 (#98741).

This document shall serve as the facility Development and Operational Plan (DOP) going forward pursuant to the requirements of the Iowa Administrative Code 567 – Chapter 113 (IAC 2/5/25) for the "Northern Plains Regional Landfill going forward. Any updates or future revisions to this document shall be submitted with any future SDP permit renewal applications.

This Municipal Solid Waste Landfill (MSWLF) was established and operated as the Flannegan Landfill from 1976 until it was purchased by the City of Spencer in January of 2002. The horizontal expansion plans included in "Appendix 2: Development Drawings and Plan" are the basis for continued operation and expansion of this facility.

This MSWLF consists of a multi-cell Sanitary Solid Waste Landfill with composite clay/flexible membrane liner (FML), leachate collection systems and synthetic lined leachate storage basin. The facility also includes an above ground scale, a combination office/maintenance building and gravel surfaced roads as well as ground-water and methane gas monitoring systems.

The landfill is currently accepting waste from the Spencer Transfer Station, Emmet County Council of Governments (ECCOG) transfer station located near Estherville, Iowa; the Pocahontas County Transfer Station, located near Pocahontas, Iowa; the Palo Alto County Transfer Station, located near Emmetsburg, Iowa; the city of Whittemore, Iowa in Kossuth County and Bode, Iowa in Humboldt County.

2.0 PRIMARY PLAN REQUIREMENTS

2.1 Organizational Chart

The City of Spencer is a municipal corporation governed by an elected Mayor/City Council. Daily operations are managed by a City Manager. Landfill operations are administered by:

SPENCER CITY COUNCIL:	Donavon Wunschel , Mayor
CITY MANAGER:	Kevin Robinson
PUBLIC WORKS DIRECTOR:	Mark White
CERTIFIED LANDFILL OPERATORS:	Dan Chism, Nate Lawson, Linda Schaller

2.2. Names and Addresses of Officials:

a. Landfill Owner:
CITY OF SPENCER, IOWA
101 West 5th Street
Spencer, Iowa 51301

b. Permit Applicant:
CITY OF SPENCER, IOWA
101 West 5th Street
Spencer, Iowa 51301

c. Responsible Official:
ASSISTANT PUBLIC WORKS DIRECTOR
Mark White
City of Spencer, Iowa
712-580-7200

d. Facility Engineer:
KRUSE, CATE & NELSON, P.C.
Ross D McWhirter, PE
2303 West 18th Street
Spencer, Iowa 51301
712-262-3468

e. Agencies Served:
Emmet County Council of Governments (ECCOG)
Pocahontas County Solid Waste Commission
Palo Alto County Solid Waste Commission
City of Spencer, Iowa
Rural Clay County
City of Bode, Iowa
City of Whittemore, Iowa

f. Responsible Officials:

ECCOG	Penny Clayton	712-362-7771
Pocahontas Co. SWC	Larry Northway	712-841-2449
Palo Alto Co. SWC	Althea King	712-298-0684
City of Spencer, Iowa	Mark Krieg	712-580-7200
City of Bode, Iowa	Becky Struthers	515-379-1486
City of Whittemore, Iowa	Linda Farrell	515-884-2265

g. Emergency Contact:

Spencer Public Works	Mark White	712-580-5800
After hours (Spencer Police)		712-262-2151

2.3 Equipment List

The following listed equipment is stationed at the landfill and housed in a building:

- 2024 Rice Lake 70' by 11, Pitless Scale, 200,000 lbs capacity
- 2023-2011 Al-Jon Model 525 self propelled compactor, 525 Horsepower, 110,000 pounds, S/N 14952, Remanufactured in 2023 S/N:1903942022
- 2022 MAC LTT 8000 tank trailer S/N: 558MRA433NK006336
- 2020 John Deere 850L Dozer S/N: 1T0850LXCLF367934
- 2019 Caterpillar 963K Track Loader, 160 Horsepower, 43,000 pounds, 2 Cubic Yard Bucket, S/N: LBL00860
- 2019 International Semi Tractor LT625 VIN: 3HCDZAPR3KL268440
- 2019 Ram 2500 VIN: 3C6MR5AJXKG672567
- 2018 John Deere 250G Excavator S/N: 1FF250GXPJF610908
- 2014 Chevrolet w/snowplow VIN: 1GC1KVCG3EF143517
- 2008 Ford F-150 4x4 VIN: 1FTRF14W48KD70393
- 2000 Chevrolet Tahoe VIN: 1GNEK13R5YR136168
- 2000 IH single axle Dump Truck, 4900, VIN 1HT5DAAR61H347774
- 1999 IH single axle Dump Truck, 4900, VIN 1HT5DAARYH238353
- 1993 Cat D6H XL Dozer, S/N 09KJ00384
- 1990 644E John Deere Wheel Loader, S/N DW644EB525991
- 1986 VIM 7,500 gallon aluminum tank trailer (leachate transport).
- 1985 Bros Sheepfoot 546, 6351A
- 1984 1845 Case Skid loader, S/N 9851758
- Caterpillar Self-Elevating Scrapper S/N: 9XG789
- Case/IH Model X 120 farm tractor S/N JJA0101552
- 1976 Cat 140 G motor Grader, S/N 072V1685

2.4 Equipment Contingency Plan

The following equipment is available at the City of Spencer Street Department, located in Spencer should a piece of the equipment at the landfill fail.

Front-end loaders:	2024 John Deere 644-P wheel loader, 3.5 CY Bucket
Semi Tractor:	2001 Sterling semi tractor
Tractor Backhoe:	2003 John Deere 310SG tractor with backhoe and front end loader
Motor Graders:	2011 John Deere 770G motor grader
	1989 Caterpillar 140G motor grader
Vacuum Truck:	2018 IH/Vactor Sewer cleaning jet and vacuum truck

Leachate is transported in the 2022 MAC LTT 8000 tanker pulled by the 2019 International LT 625 tandem axel semi tractor and the 1986 VIM 7,500 gallon pulled by the 2001 Sterling semi tractor (shared with Spencer sanitation).

Maintenance of the equipment stationed at the landfill is scheduled such that operations are not impacted. Delays in operations that would necessitate shutting down the facility for an extended time are not anticipated due to the availability of back-up equipment and man power. If solid waste can not be properly placed in the active cell during an emergency, solid waste is to be stockpiled as near to the working face as possible in a location that would drain into a lined area and in a manner that would minimize the creation of litter. Should events occur at the landfill that prevent the facility from operating for several days, the garbage haulers, transfer stations, etc. should be immediately notified that the landfill is closed until further notice and solid waste is to be diverted to other nearby landfills (Refer to Appendix 6:ERRAP).

2.5 Hours of Operation

The hours of operation, when the facility is open to contributors, are Monday through Friday from 8:30 am to 3:00 pm. The operators are working at the facility from 7:00 am to 4:00 pm. The NPRL is not open to the General Public.

2.6 Legal Description

The Northwest Quarter of Section 21, Township 97 North, Range 33 West of the 5th Principal Meridian, Palo, Alto County, Iowa.

Located approximately 2 miles south of Graettinger, Iowa on IA Highway 4.

Address: 3032 420th Avenue
Graettinger, IA, 51342

2.7 Proof of Ownership

The City of Spencer is the Owner of the property by warranty deeds, recorded in the Palo Alto County Recorder's Office located in Emmetsburg, Iowa in Book 99, Page 268 and Book 2022, Page 3. See Appendix 15 for a copy of the deeds and Attorney's Title Opinion.

2.8 Survey Monuments

The current coordinate system being used by the City of Spencer is based on assumed coordinates for the northwest corner of the property. Said corner also being the Northwest Corner of Section 21, Township 97 North, Range 33 West, Palo Alto County, Iowa. This permanent land-surveying monument is a government corner and as such is to be maintained and perpetuated by the Palo Alto County Engineer's Office. The second monument is a property corner located on the north line of Section 21, between the Northwest corner and the North ¼ corner of Section 21. Coordinates for these point are shown on the drawings and are as follows:

Reference Point	Description	Northing	Easting
No. 1	NW Corner Section 21-97-33	7583.26	6168.98
No. 2	Rebar on North Line Section 21-97-33	7583.25	8361.61
No. 3	Top SW Bolt Radio Tower Base	5647.23	7087.10
Benchmark	Top SW Bolt Radio Tower Base	Elev. = 1275.22	

Vertical control at the landfill was established by others using permanent benchmarks of known elevation based on USGS datum.

There are numerous other temporary reference points and temporary benchmarks established as working points throughout the facility that are tied into the permanent reference system. The field location of expansion cells is to determined at the time of construction by survey using the coordinate system and permanent monuments.

In addition, all monitoring wells, piezometers and current soils borings have been assigned coordinates based on the coordinates listed.

The original landfill development plan coordinate system has been tied to the property survey of the parcel and the new coordinate system is tied to the permanent property corners providing continuity between both systems.

The permanent survey monuments shall be maintained throughout the life of the facility until the end of the post closure period (not less than 30 years).

2.9 Site Maps

Drawing 1717-X1 (dated 1-15-26) shows the landfill boundary, North arrow, Zoning within ½ mile, section lines and existing houses & buildings. There are no runways within 5 miles of the site.

All property within ½ mile is in the Agricultural-Conservation district and is used for agricultural purposes.

Haul routes to the site are via Iowa Highway 4. There are no load restrictions on Highway 4.

There are no wells with 1,000' of the operations area or proposed expansion area.

See Appendix 2: Development Drawings and Site Maps for more information including the 2025 Expansion Area.

2.10 Anticipated Waste Characteristics

The landfill is expected to receive approximately 25,000 tons of municipal solid waste each year from the agencies listed above. In addition, the landfill is expected to receive approximately 6,000 tons of wire insulation recycling waste (fluff) and 42,000 tons of car recycling auto shredder waste from Shine Bros., Inc. in Spencer. This facility also receives approximately 11,000 tons of miscellaneous waste consisting of construction & demolition waste, special waste and unclassified waste.

Toxic or hazardous waste is to be prohibited from this landfill.

3.0 PROHIBITED OPERATIONS AND ACTIVITIES

To assure compliance with IAC 567 Chapter 113.8(1) "Prohibited operations and activities", the operator shall conduct random waste screening for prohibited materials. The purpose of the screenings is to prevent prohibited materials such as regulated hazardous wastes, polychlorinated biphenyls (PCB) wastes and other prohibited wastes listed in paragraph 113.8(1)"b.", from being disposed of at the landfill.

3.1 Random Load Inspections

Operators at the NPRL will perform random inspections of incoming loads to ensure that incoming loads do not contain prohibited wastes listed in the Appendix.

These random inspections shall be performed on a representative sampling of all loads except wire shredder residue (WSR) and auto shredder residue (ASR) loads which are sampled under a separate protocol. The landfill typically receives 370 loads per month excluding WSR and ASR loads. One Inspection will be performed every two weeks resulting in an average of one inspection per 170 loads received. Note that approximately 30% of the loads, by count, originate at permitted facilities such as a transfer stations and those facilities are also responsible for inspecting loads to prevent prohibited materials from entering their facilities.

3.2 Random Load Selection Procedure

1. A calendar is divided into 2 week intervals (26 per year) Starting on Sunday, day 0.
2. At the beginning of each 2 week interval the operator rolls a pair of dice to generate a random number between 1 and 10. (Rolls of 11 or 12 are not used).
3. The operator counts off the number, rolled on the dice, in days on the calendar from day 0 (Sunday) and this is the date of the next inspection.
4. On the day of the inspection, the operator again rolls dice to determine the load number selected for inspection that day.
5. Note that the calendar used for inspection load selection is available only to the operators.

3.3 Random Load Inspection Procedure

1. The selected load is identified and dumped and spread out near the working face, but isolated from the active area.
2. The operator shall visually inspect the load while wearing the necessary protective gear. Facility operating personnel performing inspections shall be trained to recognize regulated hazardous wastes, PCB wastes and other prohibited wastes listed in paragraph 113.8(1)"b".
3. The hauler of the load is to be present during the inspection.
4. Any prohibited materials found during the inspection shall be loaded back into the hauler's truck for removal from the site.
5. The hauler shall sign the inspection form agreeing to properly dispose of the prohibited material.

6. If regulated hazardous waste or PCB waste is discovered during the inspection, the operator shall notify the EPA Regional Administrator, EPA Region 7 Office: 1-800-223-0425 or 913-281-0991 (24 hr Spill Notification hotline).

3.4 Random Load Inspection Record Keeping

1. The operator shall maintain a copy of the Random Load Selection Calendar for the past three years.
2. The operator shall maintain copies of the "Random Load Inspection Form" for not less than three years.
3. The operator shall attach any additional documentation resulting from the inspection (such as EPA correspondence or telephone conversation log) to the Inspection Form.
4. Records of personnel training completed within the past three years shall also be kept.

3.5 Additional Operational Restrictions and Requirements.

This section of the plan details how the landfill will comply with the requirements of subrule 113.8(1).

1. No open burning of any type is permitted. The fueling of vehicles and equipment, and any other activity that may produce sparks or flame, shall be conducted at least 50 feet away from the working face.
2. Scavenging or salvaging is prohibited, except salvaging by MSWLF operators.
3. Animal feeding and grazing. Feeding animals MSW shall not be allowed. The grazing of domestic animals on fully vegetated areas of the facility not used for disposal, including closed MSWLF units, may be allowed by the department so long as the animals do not cause damage or interfere with operations, inspections, environmental monitoring and other required activities. Large, hoofed animals (including but not limited to buffalo, cattle, llamas, pigs, and horses) shall not be allowed on closed MSWLF units.
4. Litter is to be confined to the landfill property. Any litter beyond the confines of the property or working area is to be collected and stored until it can be incorporated with other solid waste being deposited and covered on the working face. Movable and semi-permanent litter fences are to be constructed along the ridges to contain windborne litter.
5. Flies, insects, rodents, vermin and other vectors are to be controlled by maintaining daily cover of waste.
6. The major interior roads at the landfill are of all weather rock and gravel construction and are maintained in good condition. Water is used for dust control as needed. The city owns several motor graders that can be used as needed to grade the gravel roads and shape the dumping pad.
7. Employees at the working face shall be trained to visually recognize universal symbols, markings and indications of prohibited wastes pursuant to paragraph 113.8(1)"b."
8. The Site is not open to the public.

4.0 DISPOSAL OPERATIONS AND ACTIVITIES

The section of plan details how the landfill will comply with the requirements of subrule 113.8(2) *Disposal operations and activities*:

4.1 Disposal Process Description

The landfill utilizes the place, compact and cover method of solid waste disposal in an excavated area. The solid waste at the landfill is entombed in cells consisting of a composite-lined envelope constructed of low permeability clay soil and a flexible membrane liner. The process provides no treatment of the waste and could be considered long-term storage. Future expansion cell D will require excavation to reach the proposed base elevation for liner construction and to provide cover soil for the future closure of cells.

4.2 Survey Controls and Monuments

Survey controls and monuments will be maintained as follows:

1. The property boundary, the permitted boundary and the boundaries of all MSWLF units shall be surveyed and marked by a professional land surveyor at least once prior to closure.
2. Prior to waste placement, all new MSWLF unit boundaries shall be surveyed and marked by a professional engineer.
3. Survey monuments shall be established to check vertical elevations and the progression of fill sequencing. The survey monuments shall be established and maintained by a professional land surveyor.
4. All survey stakes and monuments shall be clearly marked.
5. A professional engineer shall biennially inspect all survey monuments and replace missing or damaged survey monuments.

4.3 Typical Cell Construction

Cells shall be constructed in accordance with IDNR requirements. All active cells must have a composite liner approved by the IDNR consisting of compacted clay with a thickness of not less than 24" and permeability equal to or less than 1 X 10^{-7} cm/sec, completely covered with a 60 mil thick high-density polyethylene (HDPE) flexible membrane liner (FML). A general outline of cell construction procedure follows:

1. The subgrade for a new MSWLF unit shall be constructed as follows:
   a. All trees, stumps, roots, boulders, debris, and other material capable of deteriorating the in situ material strength or of creating a preferential pathway for contaminants shall be completely removed or sealed off prior to construction.

   b. The material beneath the MSWLF unit shall have sufficient strength to support the weight of the unit during all phases of construction and operation. The loads and loading rate shall not cause or contribute to failure of the liner and leachate collection system.

2. Cell subgrade shall be over-excavated two (2) feet to the grade staked by the engineer.
3. No cell construction shall commence on or with frozen soil.
4. The completed subgrade shall be sloped between 2% and 33%.
5. The clay material to be used for liner construction shall have a standard proctor density test and falling head permeability tests performed to determine the proper moisture/density/permeability relationship. Permeability rate < 1 X 10^{-7} cm/sec.
6. Two (2) feet of clay material shall be placed and compacted in 8" lifts.
7. At least 5 (five) field density tests per 8" lift shall be performed to that the proper moisture/density/permeability relationship is obtained.
8. A synthetic HDPE liner shall be installed in accordance with the manufacturer's installation instructions to create an impermeable seal. The liner shall be in direct contact with the clay liner.
9. The HDPE liner materials and installation shall conform to the Geosynthetic Research Institute (GRI) specification GM13: "Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes."
10. shall meet the requirements of the Geosynthetic Research Institute specification GRI Test Method GM13 (current revision) and the installation tested in accordance with
11. Install the leachate collection system piping in the cell and connect it to the main collection pipe or directly to the lift station.
12. Install the drainage layer consisting of 12" of pea gravel (passing the 3/8" sieve) with a permeability of at least 1 X 10^{-2} cm/sec of a geonet tested for design transmissivity usung ASTM D4716 methods.
13. Project Engineer to submit Engineer's Report in accordance with paragraph 113.7(6)"d" to certify cell construction and submit lab results to both the IDNR Solid Waste Section and the local Field Office No. 3.
14. Obtain approval from IDNR Field Office No. 3

4.4 Typical Cell Construction Quality Control and Assurance (QC&A) Program

Cells shall be constructed under the supervision of a strict quality control and assurance (QC&A) program to ensure that the cells are constructed in accordance with the requirements of rule 113.7(455B) and the approved plans and specifications.

4.4.1 The owner will designate a quality control and assurance (QC&A) officer. The QC&A officer shall be a professional engineer (P.E.) registered in Iowa. The owner or operator will notify the department of the designated QC&A officer and provide the department with that person's contact information. The QC&A officer may delegate another person or persons who are not employees of the facility to supervise or implement an aspect of the QC&A program.

4.4.2 The QC&A officer will document compliance with rule 113.7(455B), and the approved plans and specifications, for the following aspects of construction:

1. The MSWLF unit's subgrade.
2. The liner system, as applicable.
3. The leachate collection, conveyance and storage systems.
4. Any other aspect of construction as required by the department.

4.4.3 A sampling and testing program will be implemented by the QC&A officer as part of the QC&A program. The sampling and testing program shall:

1. Verify full compliance with the requirements of rule 113.7(455B), and the approved plans and specifications.
2. Be approved by the department prior to construction of the MSWLF unit.
3. Detail how each stage of construction will be verified for full compliance with the requirements of rule 113.7(455B), and the approved plans and specifications.
4. Be based on statistically significant sampling techniques and establish criteria for the acceptance or rejection of materials and constructed components of the MSWLF unit.
5. Detail what actions will take place to remedy and verify any material or constructed component that is not in compliance with the requirements of rule 113.7(455B), and the approved plans and specifications.

4.4.4 The QC&A officer shall document the QC&A program. Upon completion of the MSWLF unit construction, the QC&A officer shall submit a final report to the department that verifies compliance with the requirements of rule 113.7(455B), and the approved plans and specifications. A copy of the final report shall also be maintained by the facility in the operating record. At a minimum, the final report shall include the following.

1. A title page and index.
2. The name and permit number of the facility.
3. Contact information for the QC&A officer and persons delegated by the QC&A officer to supervise or implement an aspect of the QC&A program.
4. Contact information for all construction contractors.
5. Copies of daily reports containing the following information:
   a. The date.
   b. Summary of weather conditions.
   c. Summary of locations on the facility where construction was occurring.
   d. Summary of equipment, materials and personnel utilized in construction.
   e. Summary of meetings held regarding the construction of the MSWLF unit.
   f. Summary of construction progress.
   g. Photographs of the construction progress, with descriptions of the time, subject matter and location of each photograph.
   h. Details of sampling and testing program for that day. At a minimum, this report shall include details of where sampling and testing occurred, the methods utilized, personnel involved and test results.
   i. Details of how any material or constructed component that was found not to be in compliance via the sampling and testing program was remedied.

6. A copy of detailed as-built drawings with supporting documentation and photographic evidence. This copy shall also include a narrative explanation of changes from the original department approved plans and specifications.

7. A signed and sealed statement by the QC&A officer that the MSWLF unit was constructed in accordance with the requirements of rule 113.7(455B), and the approved plans and specifications.

4.5 Filling Approved Cell

Once the cell has been certified as acceptable by the IDNR to receive waste, the filling of the cell can begin. The general filling of the cell with waste progresses as follows:

4.5.1 Initial Fill

Filling begins with a four (4) foot initial layer of solid waste to cover the entire drainage layer. The first lift and initial placement of MSW over a new MSWLF unit liner and leachate collection system shall comply with the following requirements:

1. Waste shall not be placed in the cell until the Engineer's Report has been approved by the IDNR.
2. Construction and earth-moving equipment shall not operate directly on the liner and leachate management system. Waste disposal operations shall begin at the edge of the new MSWLF unit by pushing MSW out over the liner and leachate collection system. Compactors and other similarly heavy equipment shall not operate directly on the leachate collection system until a minimum of 4 feet of waste has been mounded over the top of the leachate collection system.
3. Construction and demolition debris and materials clearly capable of spearing through the leachate collection system and liner shall not be placed in the first 4 feet of waste over the top of the leachate collection system. The first 4 feet of waste shall consist of select waste that is unlikely to damage the liner and performance of the leachate collection system.

4.5.2 Typical Fill Sequencing

1. The rate and phasing of disposal operations shall be planned and conducted in a manner and at a rate that do not cause slope failure, lead to extreme differential settlement, or damage the liner and leachate collection system in addition the fill sequencing shall be planned and conducted in a manner compliant with the run-on and runoff requirements of subrule 113.7(8) and surface water requirements of rule 113.10(455B).
2. The operator begins filling a cell by placing solid waste in a corner end of larger cell to establishing a working face or mini-cell. The working face should be keep as compact as possible and should be sloped to provide drainage when covered. (See Drawing 1717-X4). The working face shall be constructed at a slope within the safety and capability limits of the compaction equipment being used. The mini-cell should be approximate a slanted cube at the end of the day.
3. The Solid waste is deposited on the working face, spread in lifts not exceeding 2 feet in depth and compacted. Compact with the Al-Jon compactor making 3-5 passes depending on waste composition until the software registers adequate compaction.. Pushing waste up a working face should produce a more compact lift.
4. Movable and semi-permanent litter fences should be used to contain windborne litter.
5. At the end of each day, (or more often if necessary) the lifts of compacted solid waste forming the mini-cell are covered with 6" of alternative cover material as allowed per 567-Chapter 108. Alternative cover material consists of wire shredder residue (WSR) and/or auto shredder residue (ASR) from Shine Bros., Inc. *No soil blending is required per Special Provision 9.a.* The operator should avoid constructing large thin working faces that result in a low waste to cover ratio. It is considerably better to place 6" of cover over an 8 foot lift (1/16) than over a 4 foot lift (1/8).
6. When precipitation is forecast, the operator should use well-compacted soil cover to reduce rainwater infiltration and subsequent leachate generation.
7. If soil is needed for daily cover, the soil can be taken from stockpiles or excavated from the expansion area, thereby creating the airspace for the next cell. During winter months, cover soil should be obtained from the stockpiles to avoid excavation during frost conditions. The next day's waste is placed adjacent to the working face slope and again 6" of cover will be placed over the waste.
8. Continue placement in this manner until the waste reaches the opposite end of the cell and then construct another row of mini-cells adjacent to the completed row until the base of the larger cell is covered. Then start another lift of mini-cells in a corner of the cell and proceed as described above.
9. Scarification of cover. To help prevent leachate seeps by aiding the downward flow of leachate, cover material or alternative cover material, which prevents the downward flow of leachate and is at least 5 feet from the outer edge of the MSWLF unit, shall be scarified prior to use of that area as a working face. Cover material or alternative cover material that does not impede the downward flow of leachate, as approved by the department, does not require scarification. Scarification may be as simple as the spearing or breaking up of a small area of the cover. Areas of intermediate cover may require removal of some of the cover material or alternative cover material to aid the downward flow of leachate.

4.5.3 Intermediate and Final cover

1. If operating conditions dictate that an area is not going to be used for further disposal for more than 30 days, the operator shall cover the area with not less than 12" of compacted cover soil or approved alternate cover. The material used shall be impervious, compacted until no further evidence of consolidation, and graded to drain without eroding.
2. If operating conditions dictate that an area is not going to be used for further disposal for more than 180 days, the operator shall cover the area with not less than 24" of compacted cover soil. The material used shall be impervious, compacted until no further evidence of consolidation, and graded to drain without eroding. Such active portions shall be seeded if they will not receive waste for a full growing season. *Special Provision 12.a allows the use of ASR for intermediate cover if it is covered with 12" of soil.*
3. Final cover. Final permanent cover shall be in accordance with the closure/postclosure plan but in no case shall be less than 24" deep. See Appendix 9 Closure and Post Closure Plan for final cover details.
4. Existing numbered cells 1A-4A, cells 1-12 and Cells 5A-21A (except the northernmost edge of Cells 15A and 16A if measured vertically) are permanently closed. The western and uppermost portions of Cells A-D will not be completely filled until the Cell E is filled and the final phase to cap the entire footprint is filled to capacity (see drawings 2103-X3 and X4). The Closure Cap over all remaining open Cells A-H, will utilize a synthetic cover and compacted soil in accordance with the closure plan.

4.6 Other Requirements

1. **Leachate seeps**. Leachate seeps shall be contained and plugged upon being identified. Leachate seeps shall not be allowed to reach waters of the state. Soils outside of the MSWLF unit that are contaminated by a leachate seep shall be excavated and then disposed of within the MSWLF unit. Such soils may be used for daily cover material. Notify the Public Works Director of any seeps that are identified.
2. **Leachate recirculation**. The department must approve an MSWLF unit for leachate recirculation. Leachate recirculation shall be limited to cells constructed with a composite liner after Cell A. *See Special Provision 5 for additional requirements and limitations.*
3 **Differential settlement**. Areas of differential settlement sufficient to interfere with runoff and run-on shall be brought back up to the contours of the surrounding active portion. Differential settlement shall not be allowed to cause ponding of water.

4.7 Additional Facility Operations and Activities

1. Waste is unloaded in the operating area only when an operator is on duty in that area.

2. Access is restricted to the site by a gate at the entrance to the site. This gate is locked when the operator is not on duty.

3. A copy of the permit, engineering plans and reports are kept at the site office or at the administrator's office (Spencer City Hall). All waste deposited in the landfill is classified, weighed on site and the weights recorded.

4. This site is not open to the public. There is a sign at the entrance listing the facility name, owner and emergency contact number.

5. Solid waste is not deposited in such a manner that material or leaching can cause pollution of ground or surface water. Solid waste must be deposited in active cell operating area.

6. Waste can be deposited in all types of weather by using the access road on site. The road is to be maintained in a condition suitable for use under all weather conditions precluding the need for a separate all-weather fill area. The first 300 feet of the entrance driveway is paved to reduce tracking offsite.

7. Cover dirt is available for use in winter and wet weather conditions by maintaining a stockpile of material

8. The landfill site is to be graded to minimize flow of surface water onto or into the portion of the site being filled and to prevent soil erosion and ponding of water. Diversion berms are planned surrounding active cells to manage a 25-year, 24hour rainfall event. Temporary settling basins are to be constructed as needed at the base of the landfill to intercept runoff from areas without vegetative cover. These basins are to be 1' to 2' deeper than the outlet pipe to slow the velocity of the runoff and allow sediment to settle out prior to exiting the basin through the outlet pipe. Note that a 25 year, 24 hour rainfall event produces approximately 5.5 inches of precipitation.

9. The finished surface of the site will be graded, covered and seeded according to the Closure/Post Closure Plan (Appendix 9).

10. The site will be staked as needed and inspected at least on a semiannual basis to insure compliance with the approved plans and specifications.

11. Unstable material in or below the subgrade shall be removed and replaced.

12. No sludge disposal is planned at this site.

END OF OPERATIONS PLAN

APPENDIX 2:

DEVELOPMENT DRAWINGS AND SITE PLANS
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

January 15, 2026

CITY OF SPENCER
#1717

1.0 INTRODUCTION

Because the original document has been updated multiple times, this new document shall serve as the facility: "Appendix 2: Development Drawings and Site Maps for Northern Plains Regional Landfill (NPRL), Palo Alto County, SDP Permit No. 74-SDP-02-76-P" and is a part of the Development and Operational Plan for the facility. This document replaces the previous "Development Drawings & Site Maps for Northern Plains Regional Landfill (NPRL), Palo Alto County, SDP Permit No. 74-SDP-02-76-P", dated December 6, 2004 previously submitted (#28913 thru 28922) and updated in 2020 (#98741). This document is required by Iowa Administrative Code 567 - Chapters 113.6. Any updates or revisions to this document shall be submitted with any future SDP permit renewal applications.

This report describes the maps and site plans and siting verification criteria for the landfill.

2.0 PLANS AND MAPS

There are a large number of maps and drawings that have been produced over the years that depict the facility and the improvements at the facility. The maps and drawings presented in this report are the result of an effort to consolidate the information obtained from existing drawings, field notes, field surveys, aerial photos and interviews with people involved with the landfill, both past and present. Aerial photos are dated 2024 and were obtained from Google Earth.

Information regarding the landfill prior to the purchase by the City of Spencer in 2002 was taken from drawings prepared by the consulting engineering firm of Jacobson-Westergard & Associates, Inc. (JWA). The information utilized for the base map was taken directly from digital drawings furnished by JWA. Additional drawings are included in the Apendix 3: HIR Update and Appendix 4: HMSP Update under separate cover by HLW.

The following is a summary of updated drawings dated 1-15-2026 included in the 2026 Development and operational Plan Update.

Drawing Number	Title	Features Shown
1717-X1 1-15-2026	2026 Development Area Plan	Site plan superimposed over aerial photo site boundary, cell boundaries, proposed expansion area, land use, buildings, roads serving the landfill. Als Vicinity Map.
1717-X2 1-15-2026	Surrounding Topography and Drainage	Site plan superimposed over USGS Quad map (1"=1,000'), existing drainage paths, buildings within ½ mile.
1717-X3	Existing Features	On-site topography, cell boundaries, existing

1-15-2026		features, buildings, leachate control system, soil boring and monitoring well locations and expansion area.

Drawing Number	**Title**	**Features Shown**
1717-X4 1-15-2026	Typical Cell Development Scheme	Updated to show expansion cells E-J, future cross section, typical fill sequence.
1717-X6 1-15-2026	Typical Cell Explosive Gas Monitoring	Updated to show expansion cells E-J.
1717CPC-X1 1-15-2026	Closure/Post Closure	Developed Contours, typical cross section, features at closure, potential gas vents, drainage paths.

2026 Expansion Plan Index (All Dated 1-15-2026)

2026-X1	2026 Expansion Plan	Expansion Area Site Plan & Legend
2026-X2	Cell Grading & Piping 1	Cells F2, G2 & North ½ of H Layout
2026-X3	Cell Grading & Piping 2	Cells F1, G1 & South ½ of H Layout
2026-X4	Cell Grading & Piping 3	Cells I & J Layout
2026-X5	Cross Section @ 13+50	Existing & Expansion Cells Cross Section Showing Solid Waste Limits at 13+50
2026-X6	Cross Section @ 9+50	Existing & Expansion Cells Cross Section Showing Solid Waste Limits at 9+50
2026-X7	Cross Section @ -5+00	Expansion Cells Cross Section Showing Cell layouts and solid waste limits at -5+00
2026-X8	Typical Cross Section 1	Example of Typical Cross Section for new Cell construction.
2026-X9	Typical Longitudinal Cross Section (Cells F-H)	Example of Typical longitudinal section for new cell F-H construction.
2026-X10	Standard Drawings 1	Standard Drawings used for Construction.
2026-X11	Standard Drawings 2	Standard Drawings used for Construction.
2026-X12	Standard Drawings 3	Standard Drawings used for Construction.

3.0 SITING VERIFICATION INFORMATION

This section provides verification that the proposed landfill expansion meets the site requirements of 567 IAC-113.6.

3.1 Distance Form Airport Runways. There are no runways within 5 miles of the site.

3.2 Outside Flood Plain and shoreland. The site is outside of any established flood plain or shoreland area.

3.3 Wetlands. The site is outside of any established wetland area. There are presumed wetlands adjacent to and south and east of the older existing cells that were closed in 2008 and 2011. The future expansion of the landfill will be to the north and west, away from the lowland areas. The facility is not anticipated to cause or contribute to the significant degradation of wetlands or endangered species.

3.4 Fault Area Documentation. There is no identified fault that has experienced displacement in Holocene time on or adjacent to the site.

3.5 Seismic Impact Zone Documentation. There is no known seismic impact zone on or adjacent to the site. The site is located in a Universal Building Code Zone 0 Seismic Zone, indicating the lowest potential for seismic activity.

3.6 Unstable Area Documentation. The site has been subject to several extensive soils investigations and no unstable areas have been identified. No known local unusual conditions exist on the site that would affect the integrity of the structural components constructed at the landfill.

3.7 Threatened or Endangered Flora or Fauna. The proposed expansion area has been used for agricultural row crop production and consists of disturbed bare black soil. A December 16, 2004 search by the IDNR Conservation and Recreation Division found no site-specific records of rare species of significant natural communities that would be impacted by the facility.

3.8 Cultural Resources. In 2004, **t**he State Historical Society of Iowa inquiry did not identify and known cultural resource properties on the site. A Phase I Cultural Resources Investigation, IDNR Document #107204, was completed in July of 2023 for the expansion area (Cells E-J). No cultural resources were found on the expansion site.

3.9 Separation for Groundwater. As shown on the cross sections and the HIR reports, the base of the landfill cells are above the water table or the lowered water table as modified by the proposed ground water diversion system. The upper groundwater table in the expansion area resides in a variable thickness water-bearing strata with levels that fluctuate with precipitation. The upper portions of the granular strata will be removed during expansion cell construction. The groundwater in remaining granular strata surrounding the proposed cells will be drained by a system of perforated tile in rock filled trench groundwater diversion system. Ground water depth under the cell will be measured in the perimeter tile system (see drawing 2026-X6).

3.10 Situated Away from Human and Livestock Wells. There were no active wells less than 1,000 feet from the landfill expansion cells listed in the IGS Well search (Refer to the HMSP). The HMSP is designed to detect leachate migration that may impact wells in the area.

3.11 Situated Away from Community Water Systems. The neatest community water system (deep wells) is the City of Graettinger located 1.5 miles north of the site (upgradient). The expansion area is approximately 1,500 feet from the small creek located east of the site that flows into the West Branch of the Des Moines River located less than ½ mile from the site.

3.12 Property Line Setback. The existing cells and proposed expansion area is more than 50 feet from the property line as shown on drawing 1717-X3. Cell boundaries are to be established by field survey.

3.13 Distance from Habitable Residence is Beyond 500 feet. All houses are more than 500 feet from the landfill expansion cells per drawing 1717-X1.

3.14 Situated to Obviate Lateral Movement of Leachate. The site is situated in an area of low permeability clay that will hinder any foreseeable lateral movement of significant quantities of leachate from the landfill. The existing clay soils provide a barrier between the landfill and the underlying shallow aquifer. Refer to the HIR section of the DOPS.

4.0 PERTINENT INFORMATION

All property within ½ mile is in the Agricultural-Conservation district and is used for agricultural purposes.

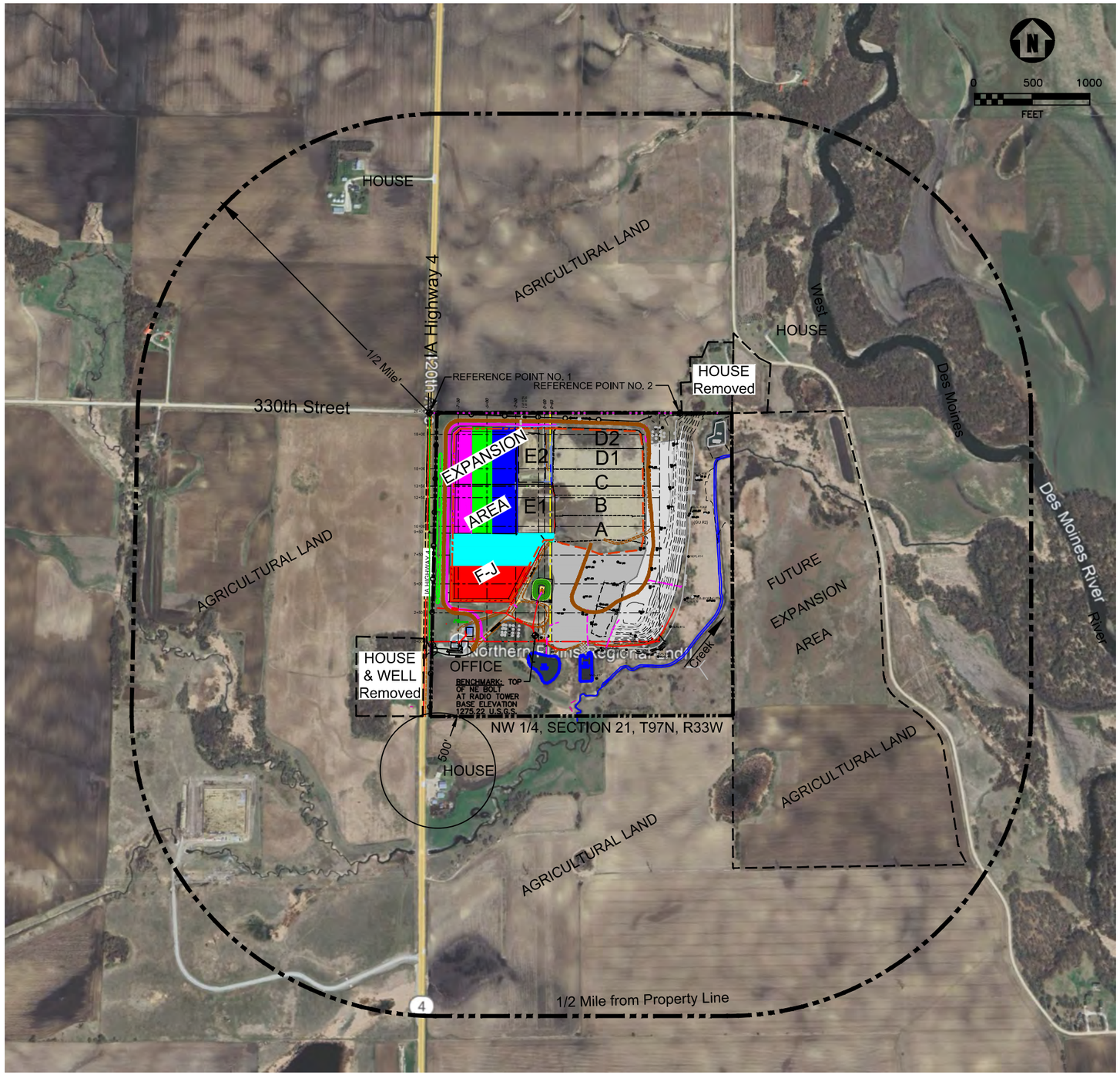
Haul routes to the site are via Iowa Highway 4. There are no load restrictions on Highway 4.

There have been numerous site drawings and plans submitted to the IDNR over the years for improvements constructed under the Flannegan Landfill name.

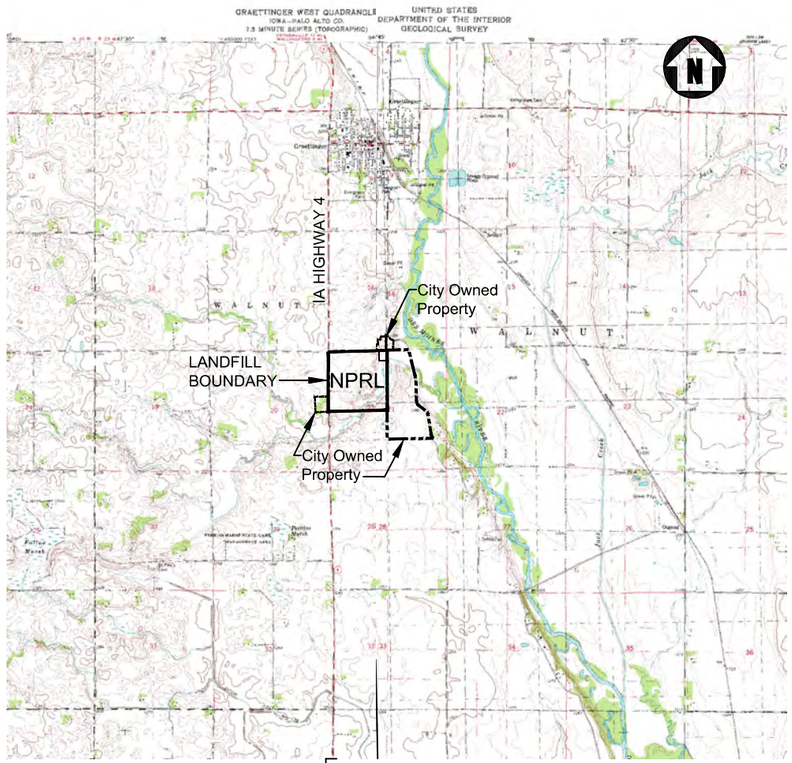
Several of the older cells (5A-17A) were constructed using an alternative liner system consisting of 4 feet of compacted clay. Some of these cells were developed before November 13, 1996 when new liner rules went into effect.

The area of the future cells has very limited potential for lateral movement of significant quantities of leachate from the site. The underlying soils are generally classified as low permeability clay soils.

END OF DRAWING SECTION



AREA MAP
SCALE 1" = 1,000'



2.25 Miles to US 18

VICINITY MAP
SCALE 1" = 3,300'

LEGEND

- Solid Waste Limits Current & Proposed Cells
- Current Open & Proposed Cell Limits
- A-J Current Open & Proposed Cell Identifier
- NPRL Property Boundary
- City Owned Property Boundary

See Exhibit "A" of the HMSP for Well Locations within 3 miles of the site.

REFERENCE POINT	DESCRIPTION	NORTHING	EASTING
NO. 1	NW CORNER SECTION 21-97-33	7583.26	6168.98
NO. 2	REBAR ON NORTH LINE SECTION 21-97-3	7583.25	8361.61
NO. 3	BENCHMARK TOP OF SW BOLT TOWER BASE ELEV= 1275.22		

LICENSED PROFESSIONAL ENGINEER
ROSS D. McWHIRTER
20513
IOWA

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.

January 15, 2026
Ross D. McWhirter

My license renewal date is December 31, 2026.

Pages or sheets covered by this seal: 1717-X1 to 1717-X4

Date of Issuance: January 15, 2026

SPENCER, IOWA
NORTHERN PLAINS REGIONAL LANDFILL
2026 DEVELOPMENT AND OPERATIONS PLAN
2024 Google Earth Aerial Photo

REVISIONS		
DATE	ITEM	APP.

KRUSE, CATE & NELSON, P.C.
ENGINEERING AND LAND SURVEYING SERVICE
SPENCER, IOWA

APP.	JET	SCALE	AS SHOWN	DRWG NO.
DRWN.	JET	DATE	JAN. 15, 2026	1717-X1

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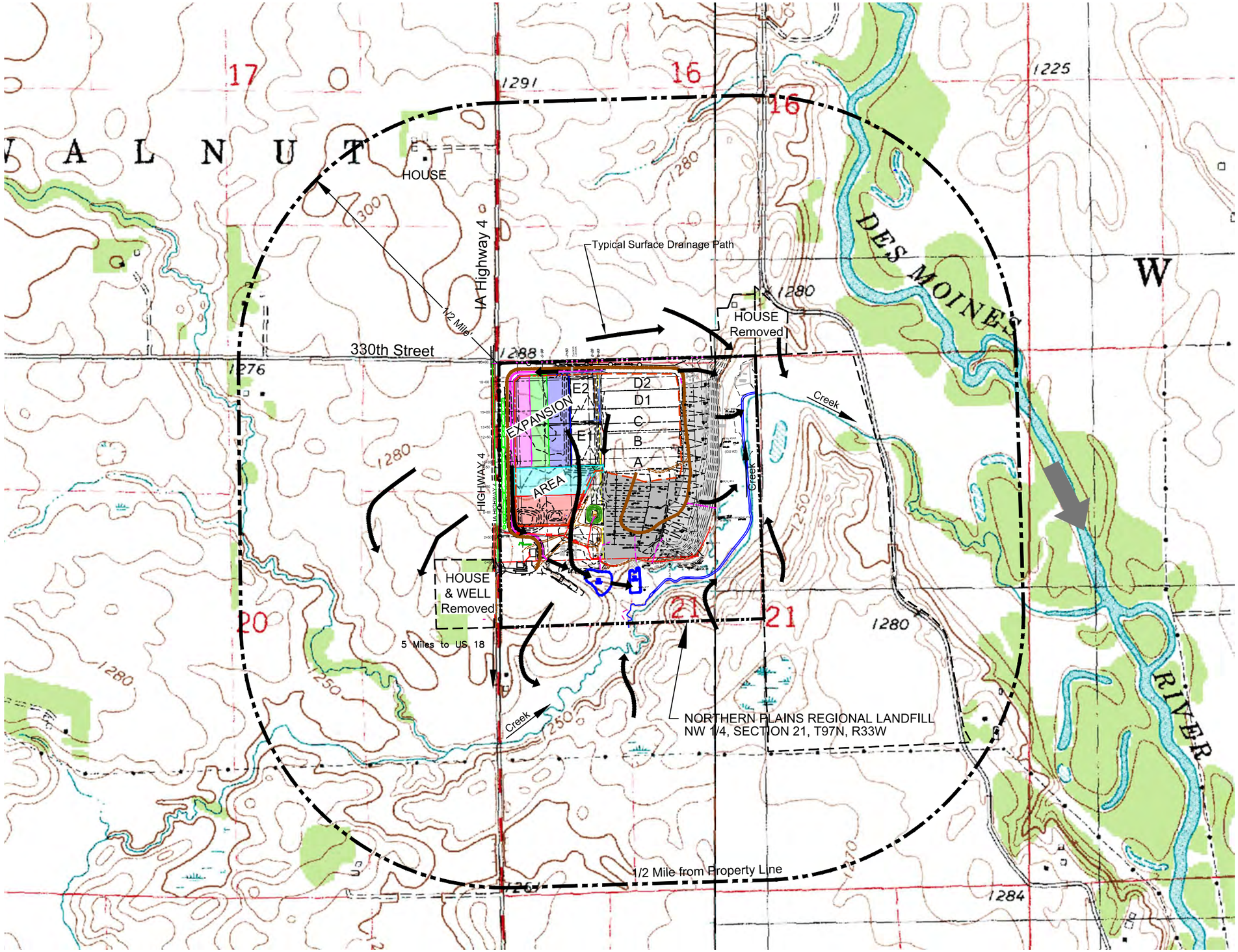

LEGEND

- Piezometer
- Monitoring Well
- Surface Water Monitoring Point
- Existing 5' contour
- Existing 10' contour
- Existing Cell Boundary (1999 Drawings)
- Occupied Structure
- Unoccupied Structure
- Surface Drainage Path

SeeHMSP for Well Locations within 3 mile of the site.

REFERENCE POINT	DESCRIPTION	NORTHING	EASTING
NO. 1	NW CORNER SECTION 21-97-33	7583.26	6168.98
NO. 2	REBAR ON NORTH LINE SECTION 21-97-3	7583.25	8361.61
NO. 3	BENCHMARK TOP OF SW BOLT TOWER BASE ELEV= 1275.22		

DRAINAGE MAP

SPENCER, IOWA

NORTHERN PLAINS REGIONAL LANDFILL
2026 DEVELOPMENT PLAN
SURROUNDING TOPOGRAPHY AND DRAINAGE

REVISIONS		
DATE	ITEM	APP.

KRUSE, CATE & NELSON, P.C.
ENGINEERING AND LAND SURVEYING SERVICE
SPENCER, IOWA

APP.	JET	SCALE AS SHOWN	DRWG NO.
DRWN.	JET	DATE JAN. 15, 2026	1717-X2

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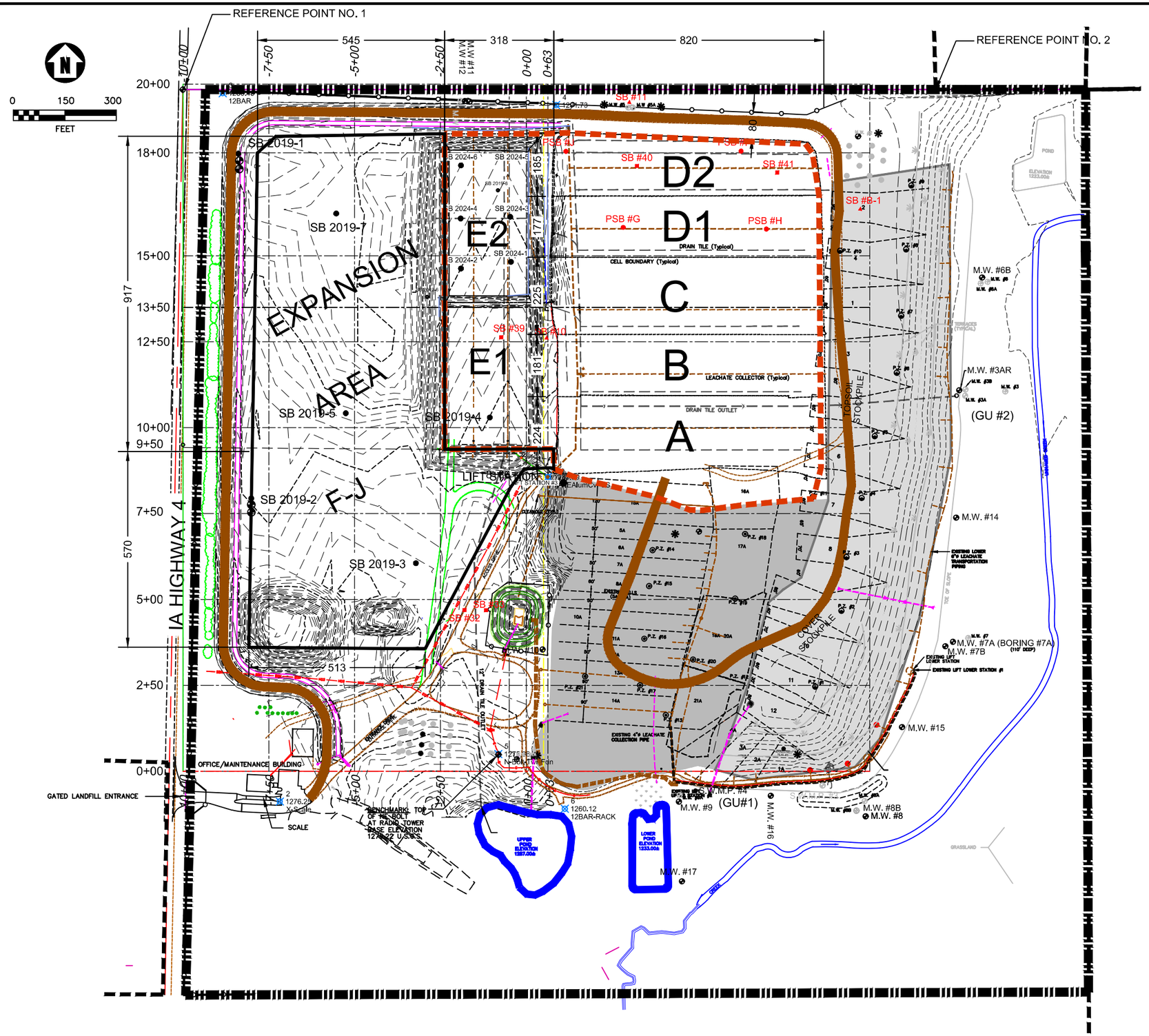

LEGEND

- SURFACE DRAINAGE PATH
- M.W. = MONITORING WELL
- P.Z. = PIEZOMETER
- P.Z. = PROPOSED PIEZOMETER
- S.W.M.P. = SURFACE WATER MONITORING POINT
- M.W. = MONITORING WELL (NOT BEING TESTED)
- NOT INCLUDED IN FUTURE HMSP
- APPROVED SOIL BORING
- UNAPPROVED SOIL BORING
- APPROVED 2019 SOIL BORING
- TREES
- GRASS COVER
- EXISTING COVERED OR DEVELOPING CELLS
- PROPOSED CELLS (Color shaded)
- COVER SOIL STOCKPILES
- GRAVEL ACESS DRIVEWAYS
- EXISTING SOLID WASTE LIMITS
- EXISTING LEACHATE CONTROL SYSTEMS
- EXISTING 5' CONTOUR LINE
- PROPOSED UPPER SW LIMIT 5' CONTOUR LINE
- PROPERTY BOUNDARY (BY LEGAL DESCRIPTION)
- EXISTING FENCE LINE (NORTH SETBACK BOUNDARY)
- CELLS 1-12 AND 1A-4A ARE CLOSED and COVERED (2008)
- CELLS 1-12 AND 1A-4A ARE CLOSED and COVERED (2010)

See HMSP for OFF-SITE Well Locations with 3 mile of the site.
There are o wells within 1,000' of Proposed Solid Waste Footprint.

See HMSP for ON-SITE Well Locations and Descriptions.

CELLS A-E2 are existing open cells.

2025 OPEN CELL SOLID WASTE LIMITS

CELLS F-J are the proposed 2026 permit expansion cells

FUTURE SOLID WASTE EXPANSION CELLS

REFERENCE POINT	DESCRIPTION	NORTHING	EASTING
NO. 1	NW CORNER SECTION 21-97-33	7583.26	6168.98
NO. 2	REBAR ON NORTH LINE SECTION 21-97-3	7583.25	8361.61
NO. 3	BENCHMARK TOP OF SW BOLT TOWER BASE ELEV= 1275.22		

SPENCER, IOWA

NORTHERN PLAINS REGIONAL LANDFILL
2026 DEVELOPMENT PLAN
EXISTING FEATURES (2025)

REVISIONS		
DATE	ITEM	APP.

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APP.	JET	SCALE	AS SHOWN	DRWG NO.
DRWN.	JET	DATE	JAN. 15, 2026	1717-X3

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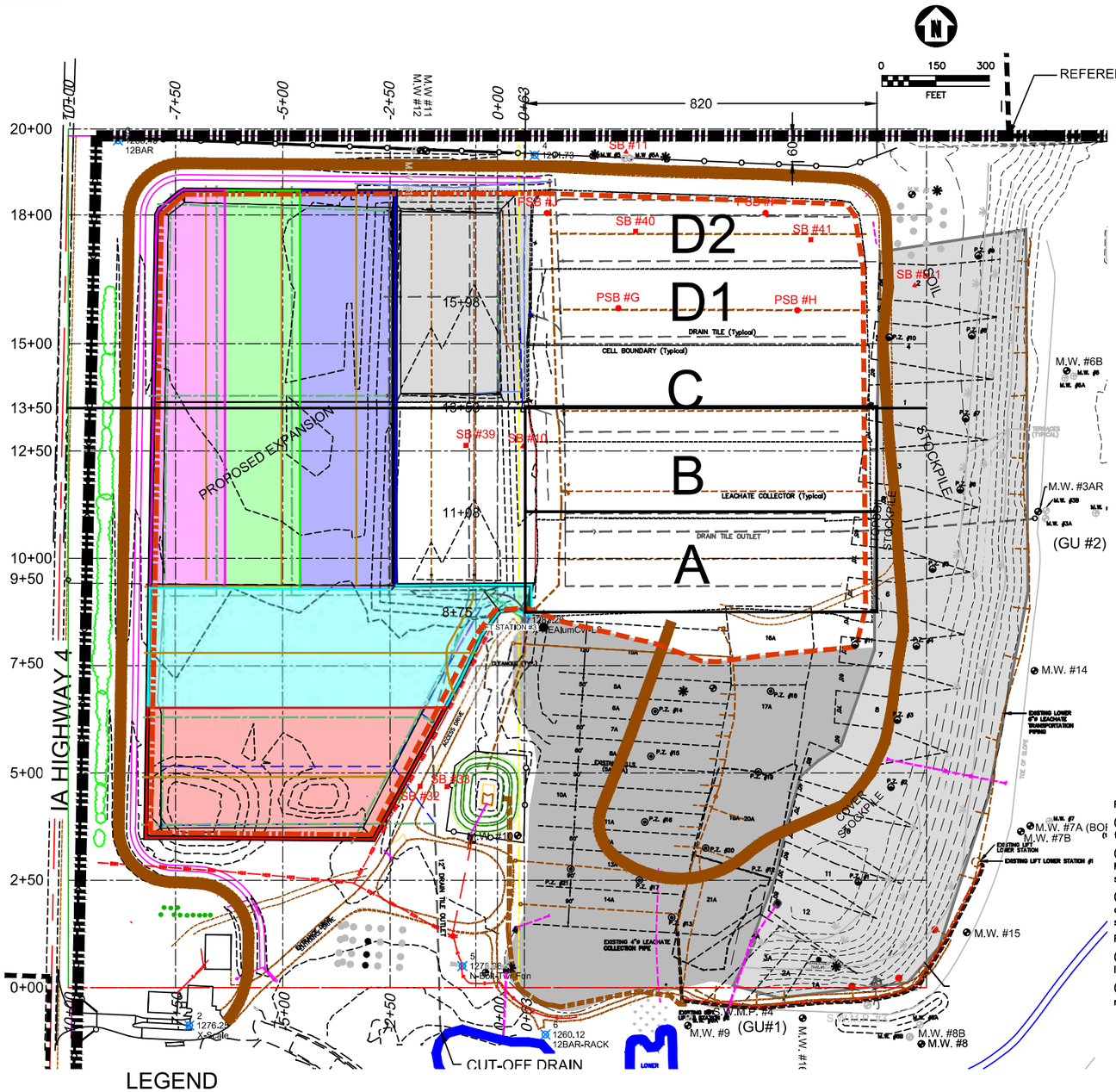


LEGEND

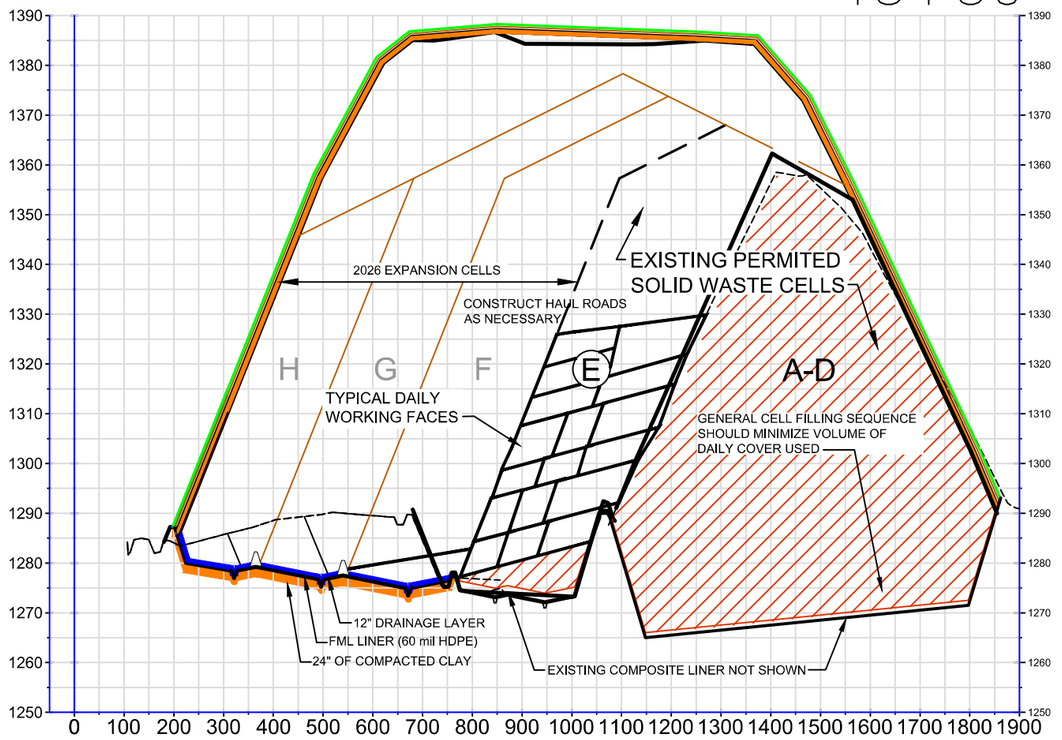
- M.W. = MONITORING WELL
- P.Z. = PIEZOMETER
- P.Z. = PROPOSED PIEZOMETER
- S.W.M.P. = SURFACE WATER MONITORING POINT
- M.W. = MONITORING WELL (NOT BEING TESTED)
- Existing 5' contour
- Finish 1' contour
- Existing Cell Boundry (1999 Drawings)

See Drawing 1717-X3 for Legend

See Exhibit "A' of the HMSP for OFF-SITE Well Locations with 3 mile of the site.

See Drawing 1717HMSP-X2 of the HMSP for ON-SITE Well Locations and Descriptions.

NOTE:
No cells constructed after Cell A are in contact with non-subtitle D lined cells. No future cells are to be in contact with non-subtitle D lined cells.



TYPICAL FILL SEQUENCE

SCALE: Vert. 1" = 15' Horz. 1"=150'

First lift. The first lift and initial placement of MSW over a new MSWLF unit liner and leachate collection system shall comply with the following requirements:

(1) Waste shall not be placed in the new MSWLF unit until the QC&A officer has submitted a signed and sealed final report to the department pursuant to paragraph 113.7(6)"d" and that report has been approved by the department.

(2) Construction and earth–moving equipment shall not operate directly on the liner and leachate management system. Waste disposal operations shall begin at the edge of the new MSWLF unit by pushing MSW out over the liner and leachate collection system. Compactors and other similarly heavy equipment shall not operate directly on the leachate collection system until a minimum of 4 feet of waste has been mounded over the top of the leachate collection system.

(3) Construction and demolition debris and materials clearly capable of spearing through the leachate collection system and liner shall not be placed in the first 4 feet of waste over the top of the leachate collection system. The first 4 feet of waste shall consist of select waste that is unlikely to damage the liner and performance of the leachate collection system.

Fill sequencing. The rate and phasing of disposal operations shall comply with the following requirements:

(1) The fill sequencing shall be planned and conducted in a manner and at a rate that do not cause a slope failure, lead to extreme differential settlement, or damage the liner and leachate collection system.

(2) The working face shall be planned and the fill sequencing conducted in a manner compliant with the run–on and runoff requirements of subrule 113.7(8) and surface water requirements of rule 567––113.10(455B).

a. Incoming waste shall be weighed, recorded, and inspected to ensure it meets landfill acceptance criteria (no hazardous or prohibited materials).

b. Waste shall be spread in thin, uniform layers (usually 1–2 feet thick) over a defined working area. The day's working area should be laid out to minimize the amount of daily cover required.

c. Solid Waste shall be compacted with Al–Jon compactor as it is deposited in the cell. Make multiple passes until software indicates optimum compaction. Place subsequent lifts and compact in the same manner.

Working face. The working face shall comply with the following requirements:

(1) The working face shall be no larger than necessary to accommodate the rate of disposal in a safe and efficient manner.

(2) The working face shall not be so steep as to cause heavy equipment and solid waste collection vehicles to roll over or otherwise lose control.

(3) Litter control devices of sufficient size to help prevent blowing litter shall be utilized at the working face. The operation of the working face shall attempt to minimize blowing litter.

(4) The operation of the working face shall prevent the harborage of vectors and attempt to minimize the attraction of vectors.

(5) Employees at the working face shall be trained to visually recognize universal symbols, markings and indications of prohibited wastes pursuant to paragraph 113.8(1)"b."

See Section 4.4 Filling Approved Cell

SPENCER, IOWA
NORTHERN PLAINS REGIONAL LANDFILL
2026 DEVELOPMENT PLAN
TYPICAL CELL DEVELOPMENT SCHEME

REVISIONS		
DATE	ITEM	APP.

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ENGINEERING AND LAND SURVEYING SERVICE
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APP.	JET	SCALE	AS SHOWN	DRWG NO.
DRWN.	JET	DATE	JAN. 15, 2026	1717-X4

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REFERENCE POINT NO. 1
NW CORNER OF SECTION 21, T97N, R33W PALO ALTO COUNTY

SECTION B-B

REFERENCE POINT NO. 2

15" LETDOWN PIPE See Exhibit "E"

CELL D2

CELL D1

CELL C

CELL B

CELL A

CELL H

CELL G

CELL F

CELL E

PHASE III CLOSURE CAP PROJECTED: 2050

PHASE I CLOSURE CAP CLOSED: 2008

PHASE II CLOSURE CAP CLOSED: 2011

DRAIN TILE (Typical)

CELL BOUNDARY (Typical)

LEACHATE COLLECTOR (Typical)

DRAIN TILE OUTLET

LIFT STATION

STATION #3

ACCESS DRIVE

ENTRANCE DRIVE

12" DRAIN TILE

EXISTING 4"ø LEACHATE COLLECTION PIPE

EXISTING LOWER 6"ø LEACHATE TRANSPORTATION PIPING

EXISTING LIFT LOWER STATION

EXISTING LIFT LOWER STATION #1

M.W. #6B

M.W. #3AR

(GU #2)

M.W. #14

M.W. #7A (BORING #7A)
(110' DEEP)

M.W. #7B

M.W. #15

M.W. #8

M.W. #9 (GU#1)

M.W. #10

M.W. #17

S.W.M.P. #4

REFERENCE POINT NO. 3 BENCHMARK

CUT-OFF DRAIN TILE OUTLET

Typical Surface Drainage Path

LOWER POND ELEVATION 1223.00± TOP OF SLOPE

POND ELEVATION 1223.00±

TERRACES (TYPICAL)

IA HIGHWAY 4

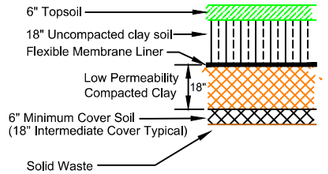
Creek

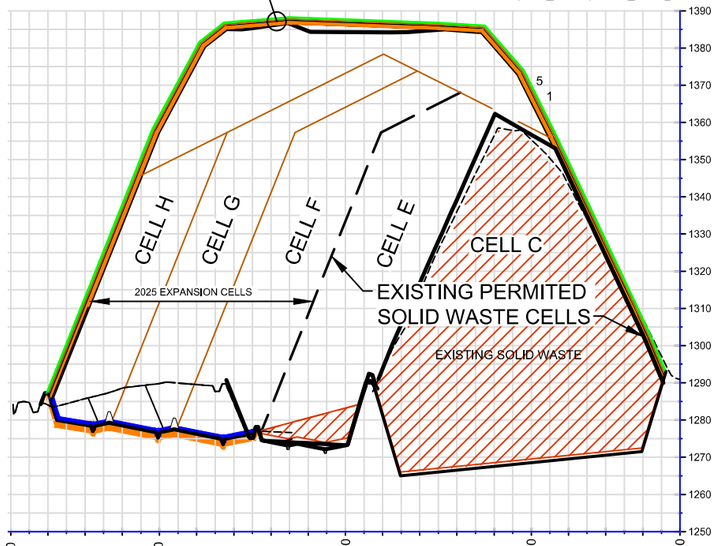
0 120 240

CLOSURE SUMMARY

Phase I	15 Ac.	2008
Phase II	12 Ac.	2010
Phase III	47 Ac.	2050±

CLOSURE CAP DETAIL





SECTION B-B

LEGEND

- SURFACE DRAINAGE PATH
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- P.Z. = PROPOSED PIEZOMETER
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- M.W. = MONITORING WELL (NOT BEING TESTED)
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- UNAPPROVED SOIL BORING
- APPROVED 2019 SOIL BORING
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- EXISTING COVERED OR DEVELOPING CELLS
- PROPOSED CELLS (Color shaded)
- COVER SOIL STOCKPILES
- GRAVEL ACESS DRIVEWAYS
- EXISTING SOLID WASTE LIMITS
- EXISTING LEACHATE CONTROL SYSTEMS
- EXISTING 5' CONTOUR LINE
- PROPOSED UPPER SW LIMIT 5' CONTOUR LINE
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See HMSP for ON-SITE Well Locations and Descriptions.

CELLS A-E2 are existing open cells.

CELLS F-J are the proposed 2026 permit expansion cells

- PHASE III CLOSURE CAP (FUTURE)

SITE PLAN

M.W. #17 Finish 5' contour

LICENSED PROFESSIONAL ENGINEER
ROSS D. McWHIRTER
20513
IOWA

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.

Ross D. McWhirter

January 15, 2026

Ross D. McWhirter

My license renewal date is December 31, 2026.

Pages or sheets covered by this seal: 1717CPC-X1

Date of Issuance: JAN. 15, 2026

SPENCER, IOWA

NORTHERN PLAINS REGIONAL LANDFILL
CLOSURE / POST CLOSURE PLAN
2026 EXPANSION PLAN

REVISIONS		
DATE	ITEM	APP.

KRUSE, CATE & NELSON, P.C.
ENGINEERING AND LAND SURVEYING SERVICE
SPENCER, IOWA

APP.	JET	SCALE	AS SHOWN	DRWG NO.
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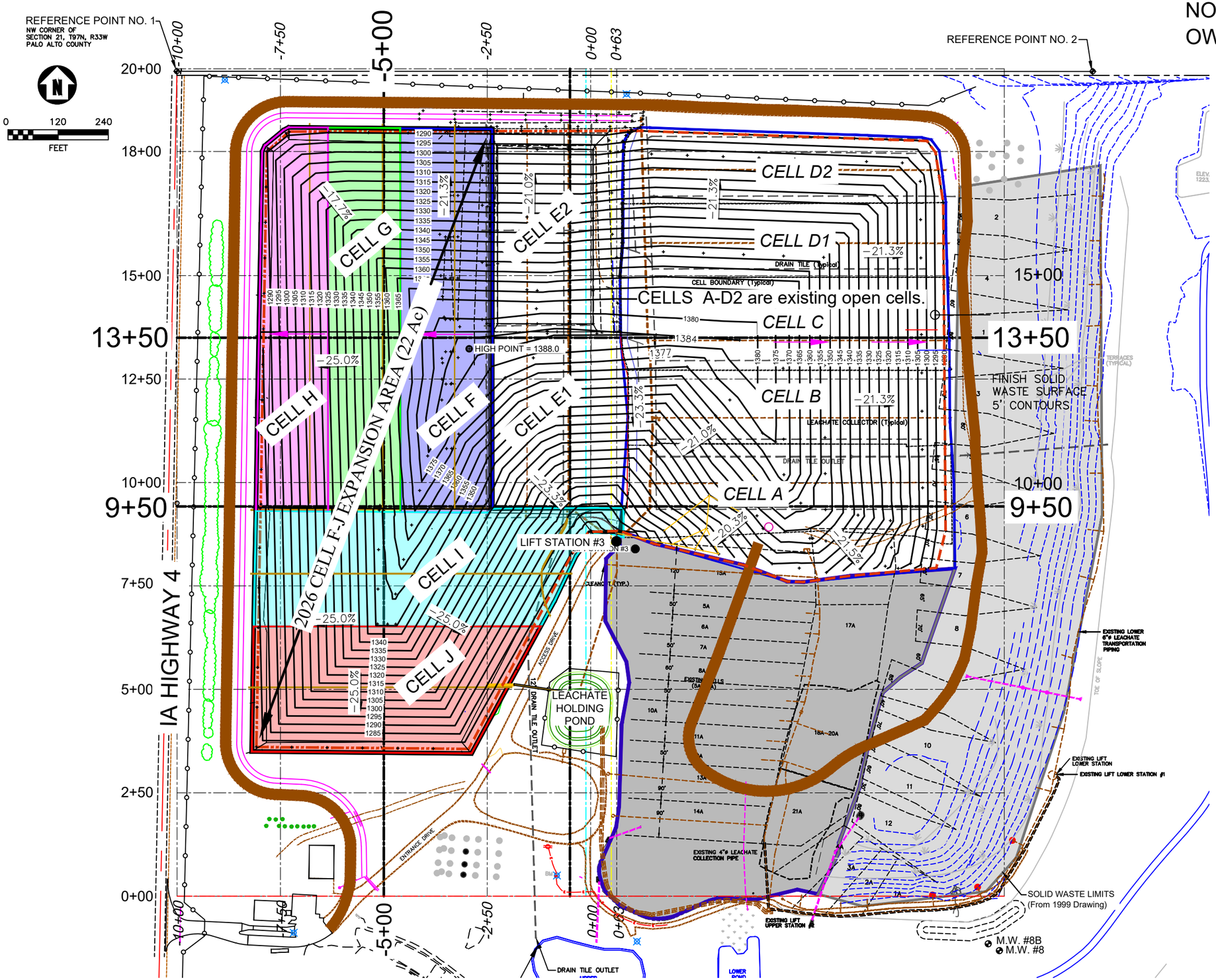
2026 EXPANSION PLAN

NORTHERN PLAINS REGIONAL LANDFILL

OWNER: CITY OF SPENCER, IA



LEGEND

- SURFACE DRAINAGE PATH
- M.W. = MONITORING WELL
- P.Z. = PIEZOMETER
- P.Z. = PROPOSED PIEZOMETER
- S.W.M.P. = SURFACE WATER MONITORING POINT
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- TREES
- GRASS COVER
- EXISTING COVERED OR DEVELOPING CELLS
- PROPOSED CELLS (Color shaded)
- COVER SOIL STOCKPILES
- GRAVEL ACESS DRIVEWAYS
- EXISTING SOLID WASTE LIMITS
- EXISTING LEACHATE CONTROL SYSTEMS
- EXISTING 5' CONTOUR LINE
- PROPOSED UPPER SW LIMIT 5' CONTOUR LINE
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- CELLS 1-12 AND 1A-4A ARE CLOSED and COVERED (2010)

See HMSP for OFF-SITE Well Locations with 3 mile of the site.
There are o wells within 1,000' of Proposed Solid Waste Footprint.

See HMSP for ON-SITE Well Locations and Descriptions.

CELLS A-E2 are existing open cells.

CELLS F-J are the proposed 2026 permit expansion cells

- EXPANSION CELL F
- EXPANSION CELL G
- EXPANSION CELL H
- EXPANSION CELL I
- EXPANSION CELL J

LICENSED PROFESSIONAL ENGINEER
ROSS D. McWHIRTER
20513
IOWA

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.

Ross D. McWhirter — January 15, 2026

Ross D. McWhirter

My license renewal date is December 31, 2026.

Pages or sheets covered by this seal: 2026-X1 to 2026-X12

Date of Issuance: January 15, 2026

SPENCER, IOWA

NORTHERN PLAINS REGIONAL LANDFILL

2026 EXPANSION PLAN

SITE PLAN

REVISIONS		
DATE	ITEM	APP.
4/20/26	Final Slopes	JET

KRUSE, CATE & NELSON, P.C.
ENGINEERING AND LAND SURVEYING SERVICE
SPENCER, IOWA

APP. JET	SCALE AS SHOWN	DRWG NO.
DRWN. JET	DATE JAN. 15, 2026	2026-X1

N

0 30 60
FEET

NORTH ACCESS ROAD

WEST ACCESS ROAD

DRAINAGE SWALE

Typical Leachate Clean-Out (CO) — B / X9

Clean-Out & GW Monitoring — A / X9

DRAINAGE SWALE — B / X11

CO CO/WM

CO/WM

CO

CO/WM

CO/WM

1290.0

Proposed 6" Cut-off Drainage Tile

Proposed Top of FML 1' Contour

-2.0%

-2.2%

-2.2%

-2.2%

-2.2%

-2.2%

-2.2%

1290.0

1290.0

161

175

222

315

234

135

175

214

494

-1.0%

-1.0%

-1.0%

-1.7%

-2.0%

-2.0%

-2.0%

-2.0%

-2.0%

490

F / X11

CELL H

CELL G2

CELL F2

CELL E2

1280

1275

B / X11

94

176

175

175

99

Proposed Top of FML 1' Contour

Proposed 6" Leachate Collection Pipe

1288.0

1288.0

-2.0%

-2.2%

-2.2%

-2.2%

-2.2%

-2.2%

-2.2%

CO/WM

1287.0

1287.0

Proposed 6" Cut-off Drainage Tile

LEGEND

See Drawing 2026-X3

B / X10 Separation Berm if Constructed in Phases

Existing Separation Berm

SPENCER, IOWA
NORTHERN PLAINS REGIONAL LANDFILL
2026 EXPANSION PLAN
CELL GRADING AND PIPING LAYOUT PLAN 1

REVISIONS		
DATE	ITEM	APP.

KRUSE, CATE & NELSON, P.C.
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DRWN.	JET	DATE	JAN. 15, 2026

DRWG NO. 2026-X2

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CO/WM

CELL H

CELL G1

CELL F1

CELL E1

WEST ACCESS ROAD

DRAINAGE SWALE

B
X11

F
X11

B
X10

Separation Berm

CO

CO/WM

1287.0

1285.0

1280.0

169

175

222

325

234

142

214

434

437

100

176

99

44

132

131

83

-2.0%

-2.2%

-2.1%

-1.7%

-1.0%

1275

1270

1271

1272

-5.5%

LEGEND

- Existing Storm Sewer
- CO/WM — Proposed 6" Tile Clean-Out/Ground Water Monitoring Location (A/X9)
- Proposed 6" Cut-off Drainage Tile
- CO — Proposed 6" Leachate Pipe Clean-Out (B/X9)
- Proposed 6" Leachate Collection Pipe
- Proposed Expansion Area Boundary
- 1277.0 — Proposed Top of FML 1' Contour
- 1275.0 — Proposed Top of FML 5' Contour

N

0 30 60

FEET

SPENCER, IOWA

NORTHERN PLAINS REGIONAL LANDFILL
2026 PERMIT EXPANSION PLAN
CELL GRADING AND PIPING LAYOUT PLAN 2

REVISIONS		
DATE	ITEM	APP.

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SPENCER, IOWA

APP.	JET	SCALE AS SHOWN	DRWG NO. 2026-X3
DRWN.	JET	DATE JAN. 15, 2026	

CELL I

CELL J

LIFT STATION #3

Proposed 6" Leachate Collection Pipe

Proposed 6" Cut-off Drainage Tile

Proposed Top of FML 1' Contour

Proposed Top of FML 5' Contour

6" Cut-off Drainage Tile

Separation Berm if Constructed in Phases

Leachate Collection Sump

Sideslope Pump Riser

Typical Leachate Clean-Out (CO)

Connect Cut-off Tile to Existing Precast Manhole. Isolate manhole from solid waste cell with FML.

2" Leachate Forcemain to Holding Pond

CLEANOUT (TYP.)

LEACHATE HOLDING POND

12" DRAIN TILE OUTLET

WEST ACCESS ROAD

DRAINAGE SWALE

889 694 531

408 284 247

148 110 133

277 259 305 265 132

32

-0.5%

-2.0%

-2.1%

-5.5%

-17.9%

1277.0 1275.0 1278.0 1279.0 1282.0

SPENCER, IOWA
NORTHERN PLAINS REGIONAL LANDFILL
2026 EXPANSION PLAN
CELL GRADING AND PIPING LAYOUT PLAN 3

REVISIONS		
DATE	ITEM	APP.

KRUSE, CATE & NELSON, P.C.
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SPENCER, IOWA

APP. JET DRWN. JET SCALE AS SHOWN DATE JAN. 15, 2026 DRWG NO. 2026-X4

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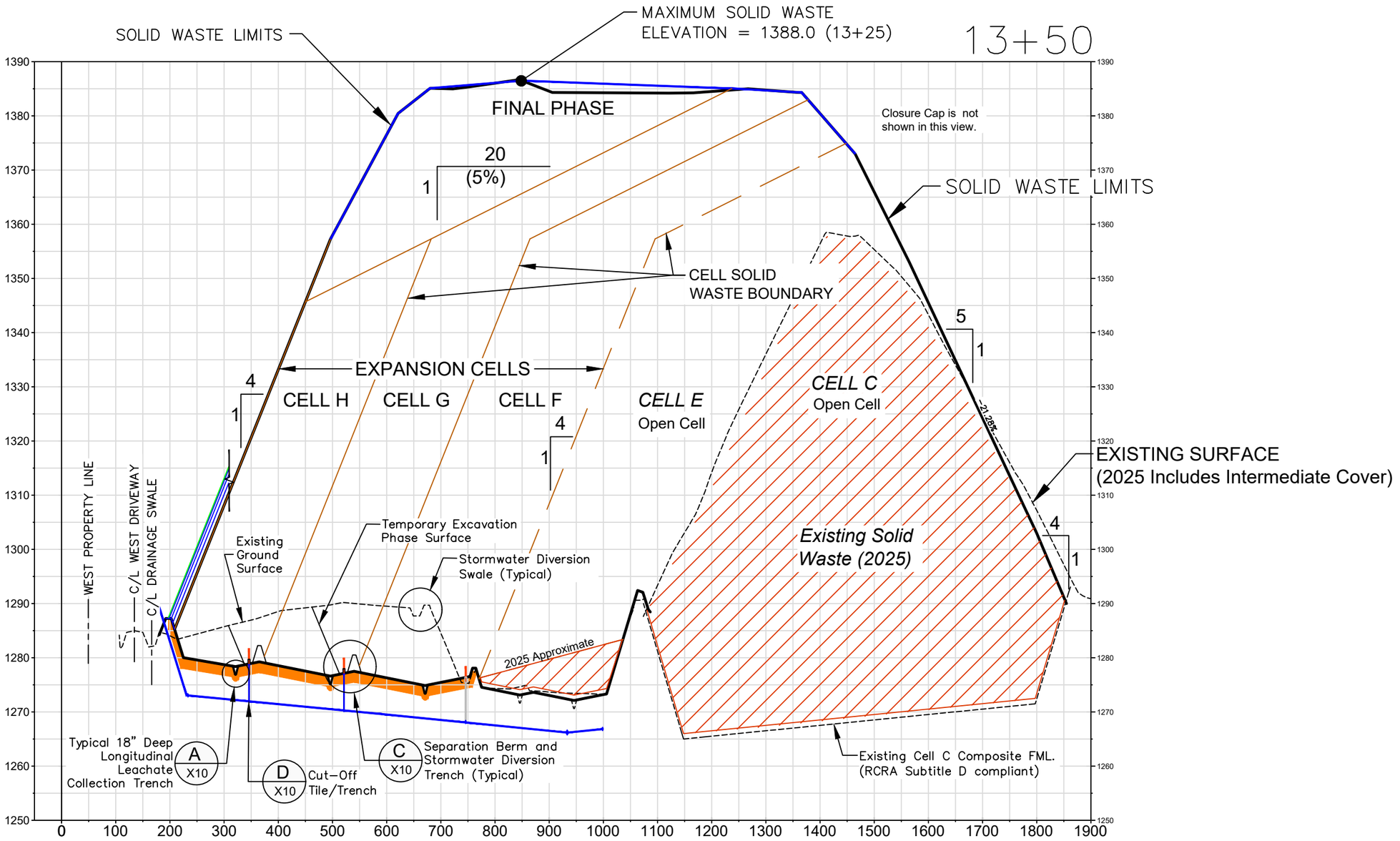

SECTION 13+50 - Looking North

SCALE: H 1" = 200', V 1" = 20'

SPENCER, IOWA

NORTHERN PLAINS REGIONAL LANDFILL
2026 EXPANSION PLAN
CROSS SECTION 13+50

REVISIONS		
DATE	ITEM	APP.

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SPENCER, IOWA

APP. JET
DRWN. JET
SCALE AS SHOWN
DATE JAN. 15, 2026
DRWG NO. 2026-X5

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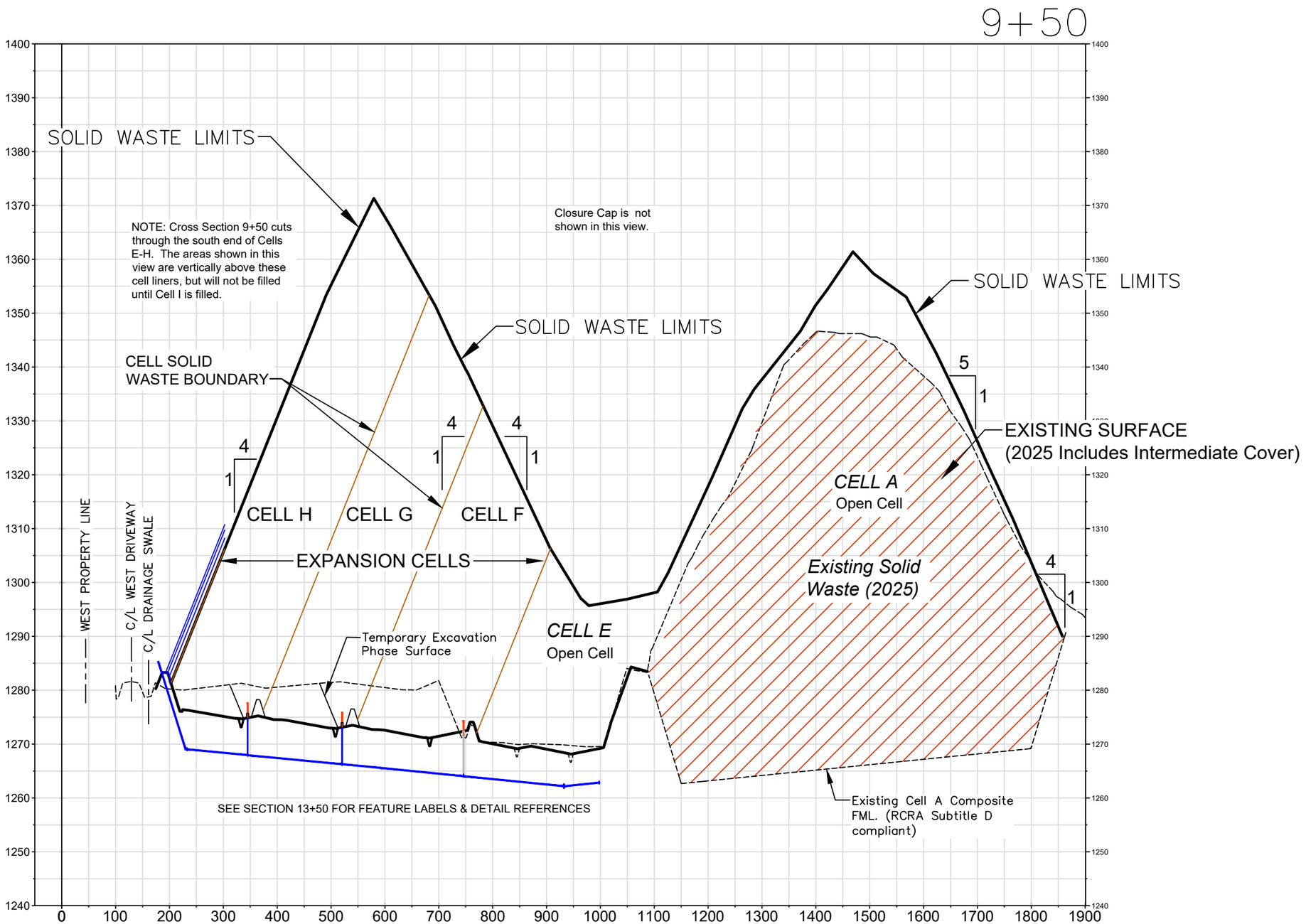

SECTION 9+50 - Looking North

SCALE: H 1" = 200', V 1" = 20'

SPENCER, IOWA
NORTHERN PLAINS REGIONAL LANDFILL
2026 EXPANSION PLAN
CROSS SECTION 9+50

REVISIONS		
DATE	ITEM	APP.

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APP.	JET	SCALE AS SHOWN	DRWG NO. 2026-X6
DRWN.	JET	DATE JAN. 15, 2026	

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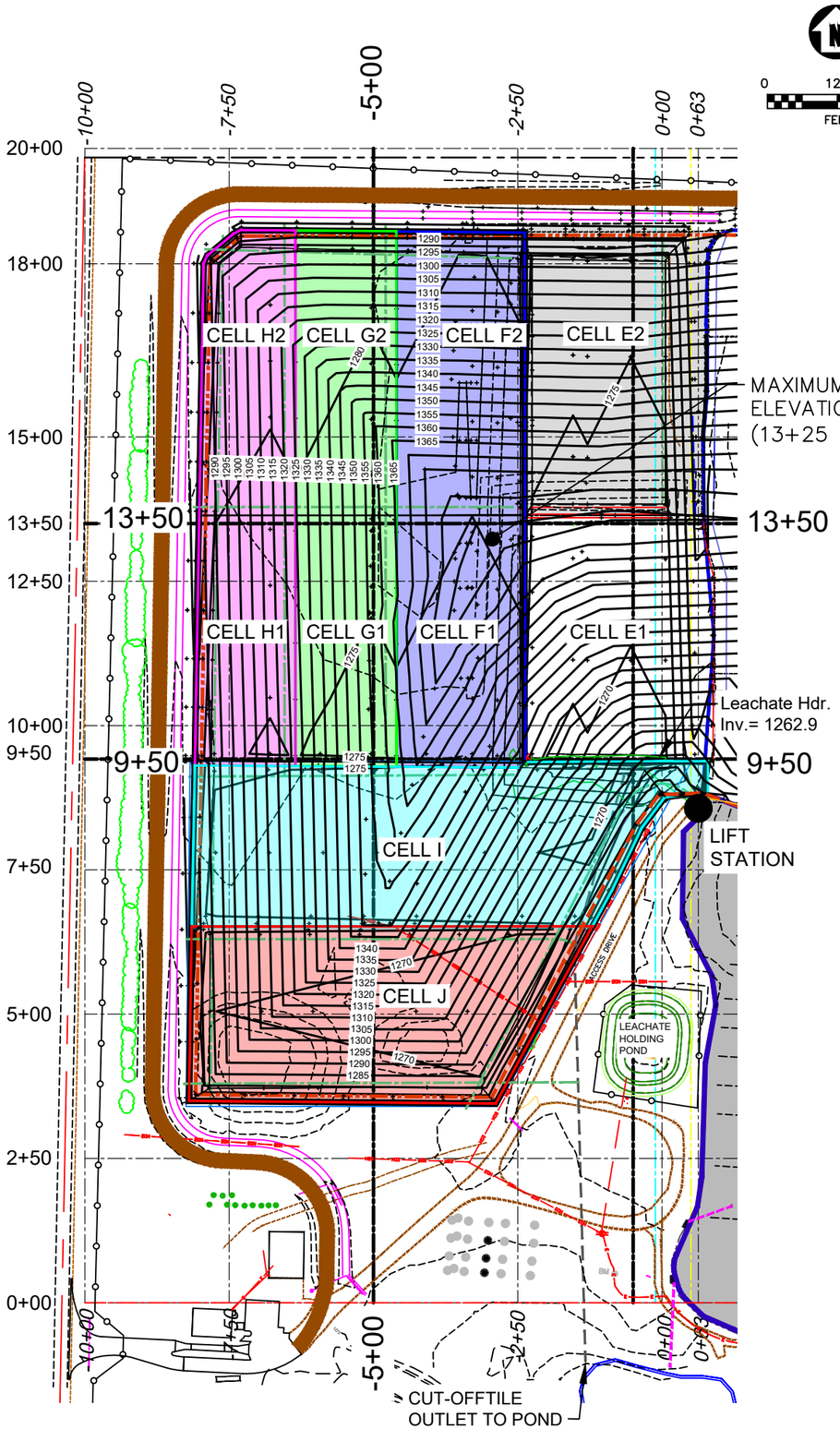

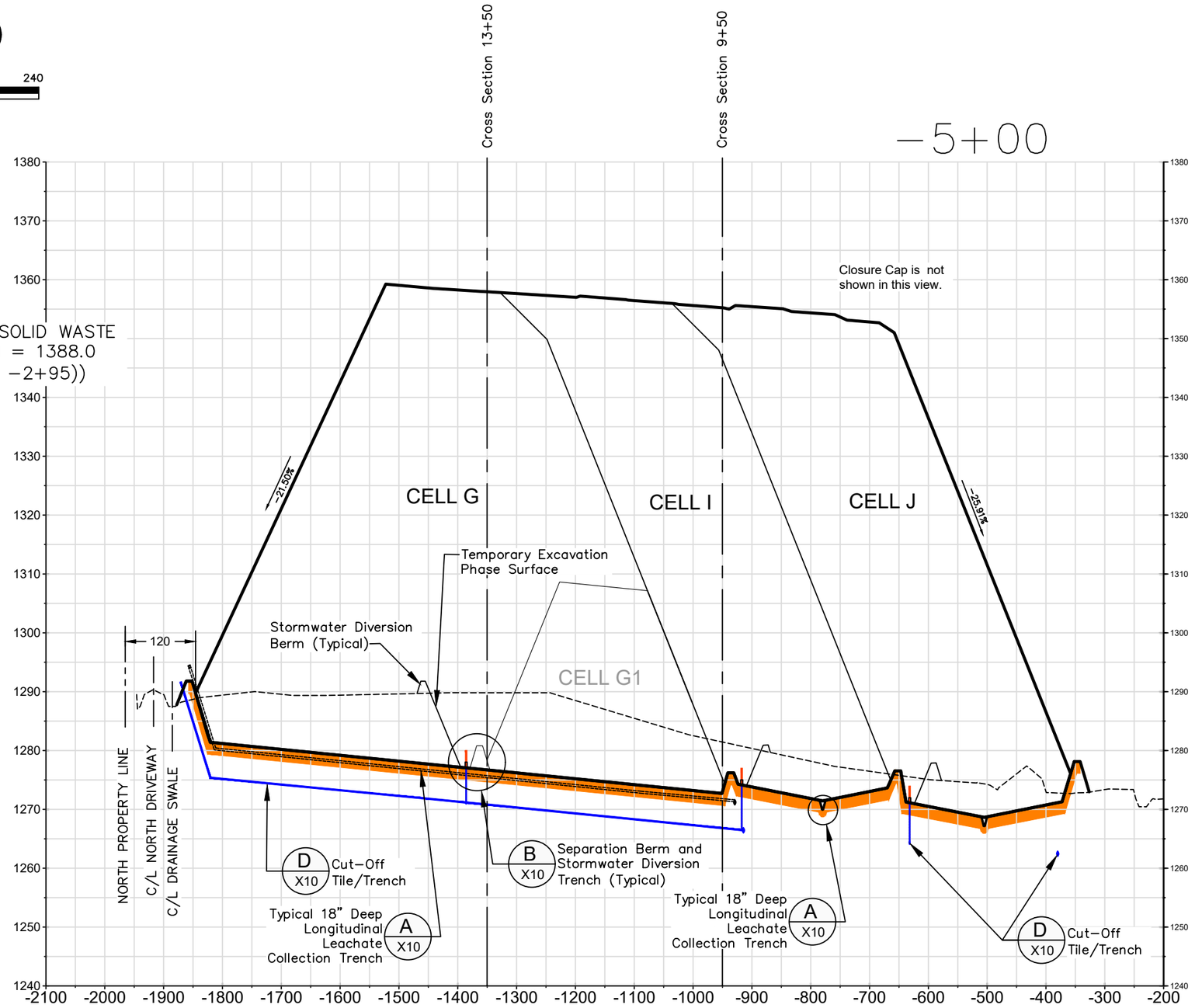

SECTION -5+00 - Looking East

SCALE: H 1" = 200', V 1" = 20'

SPENCER, IOWA
NORTHERN PLAINS REGIONAL LANDFILL
2026 EXPANSION PLAN
CROSS SECTION -5+00

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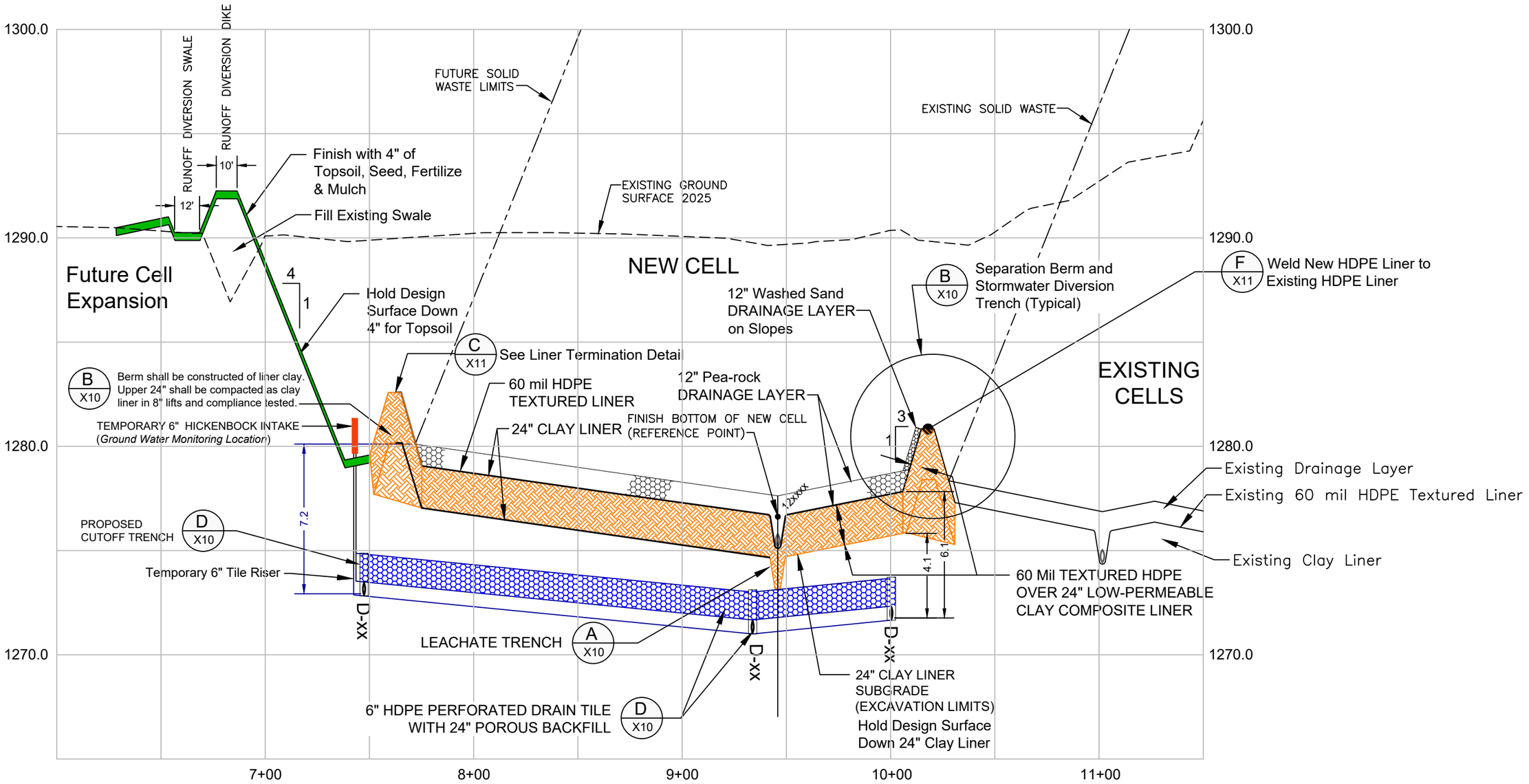
DRWN.	JET	DATE	JAN. 15, 2026	2026-X7



TYPICAL TRANSVERSE SECTION

SCALE: H 1" = 50', V 1" = 5'

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NORTHERN PLAINS REGIONAL LANDFILL 2026 EXPANSION PLAN TYPICAL CROSS-SECTION	
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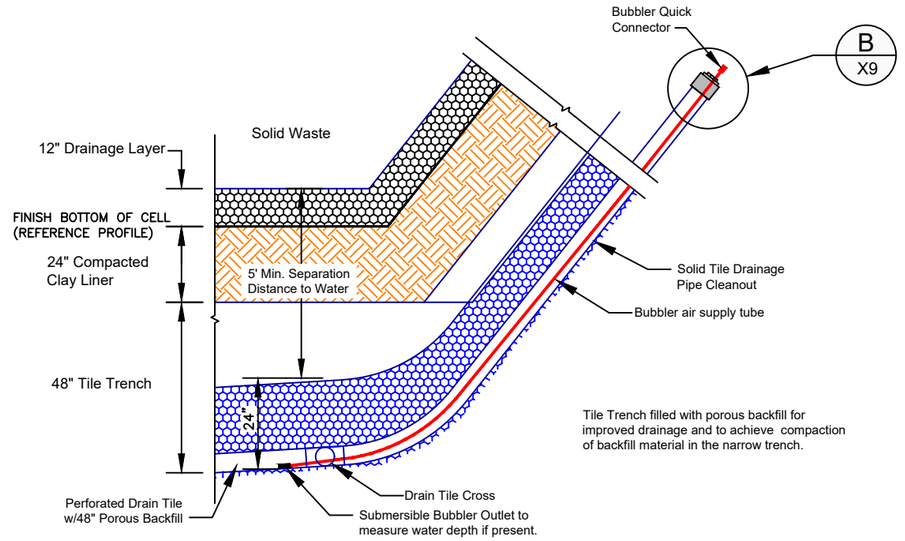
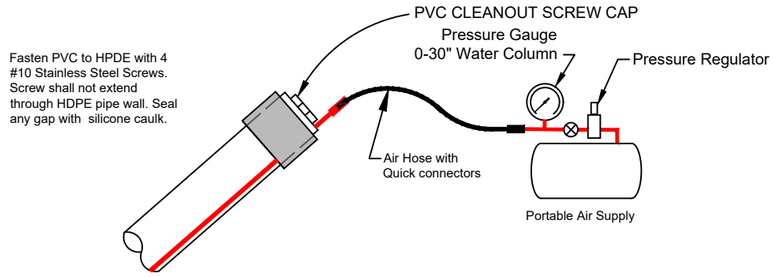


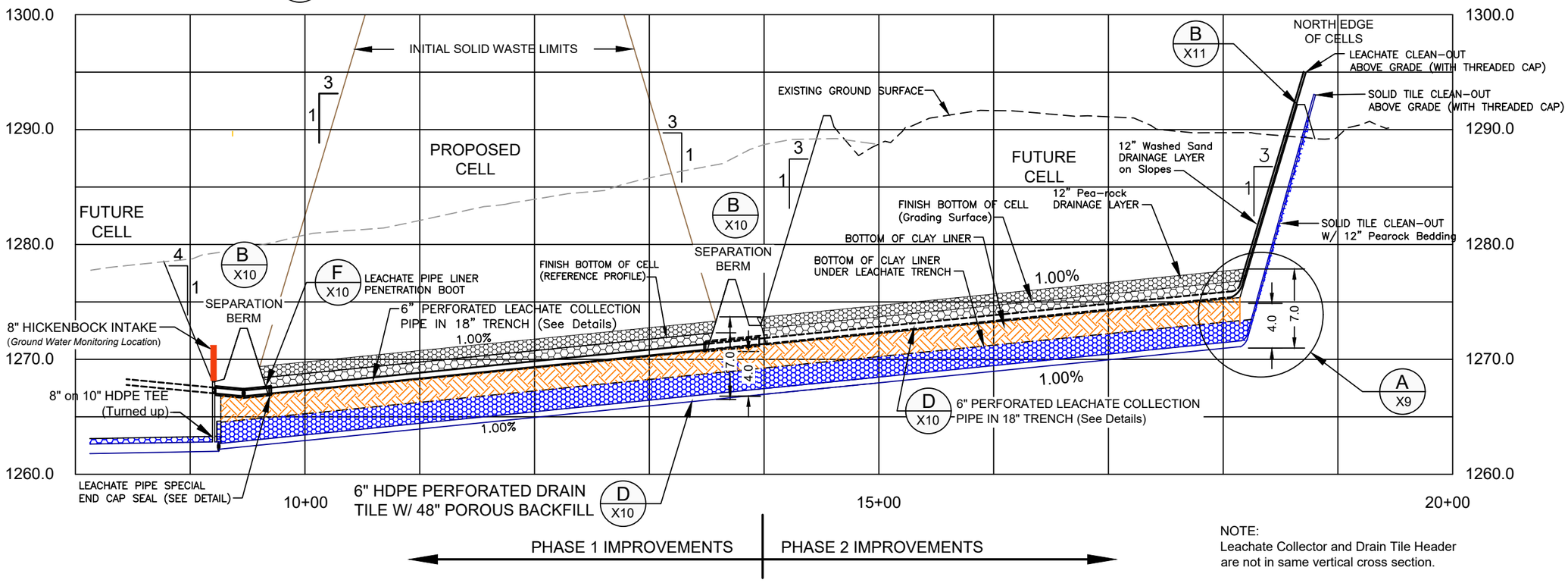
A X9 DRAIN TILE/GROUND WATER MONITORING

NO SCALE



B X9 THREADED CLEAN-OUT CAP

NTS



NOTE:
Leachate Collector and Drain Tile Header
are not in same vertical cross section.

TYPICAL LONGITUDINAL SECTION (F-H)

SCALE: H 1" = 100', V 1" = 10'

SPENCER, IOWA

NORTHERN PLAINS REGIONAL LANDFILL
2026 EXPANSION PLAN
TYPICAL LONGITUDINAL CROSS-SECTION

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4/20/26	Bubbler Detail	JET

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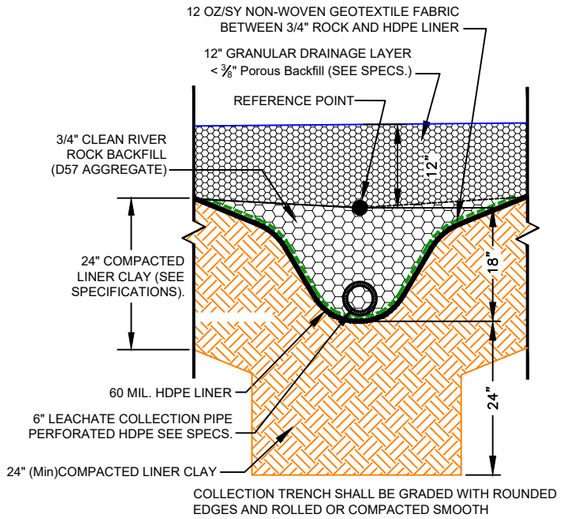
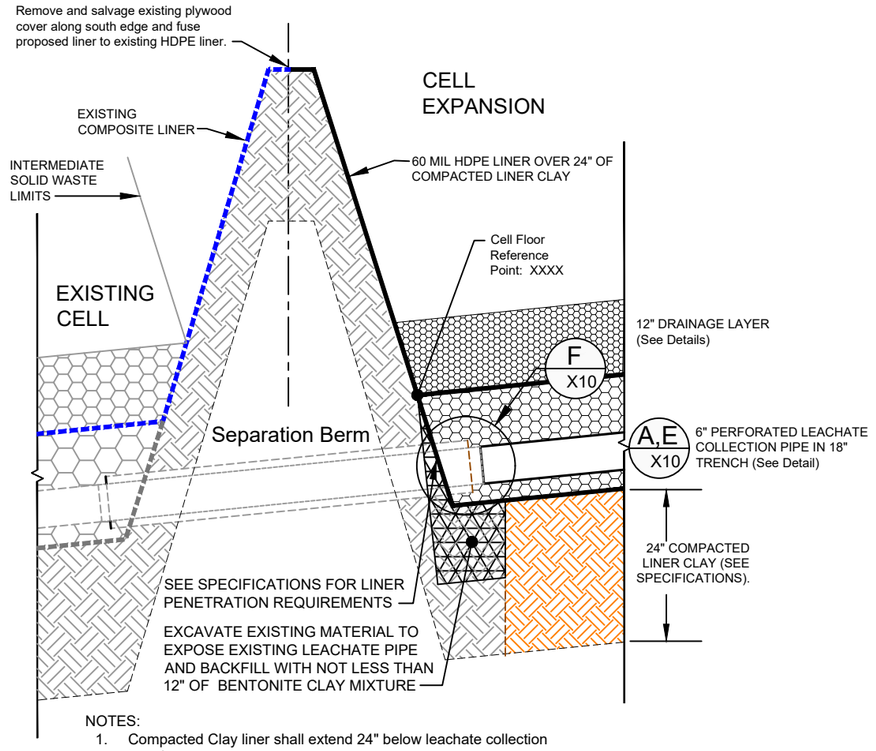
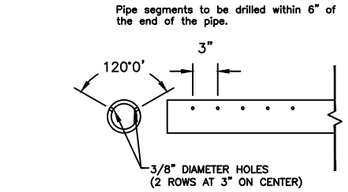


A X10 LEACHATE COLLECTION DETAIL
SCALE: 1" = 2'



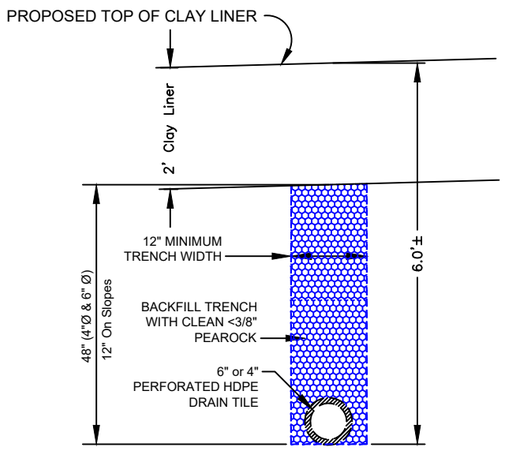
NOTES:
1. Compacted Clay liner shall extend 24" below leachate collection trench.
2. Berms to be Constructed of Compacted Liner Clay.

B X10 LEACHATE COLLECTION DETAIL
SCALE: 1" = 2'

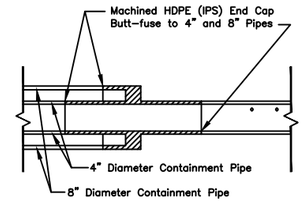


E X10 PIPE PERFORATION DETAIL
NO SCALE

C X10 STORM WATER DIVERSION TRENCH DETAIL
SCALE: Vert. 1" = 1', Horz. 1"=10'



D X10 TILE TRENCH DETAIL
NTS



F X10 SPECIAL END CAP SEAL DETAIL
NO SCALE

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NORTHERN PLAINS REGIONAL LANDFILL
2026 EXPANSION PLAN
STANDARD DRAWING SHEET NO. 1

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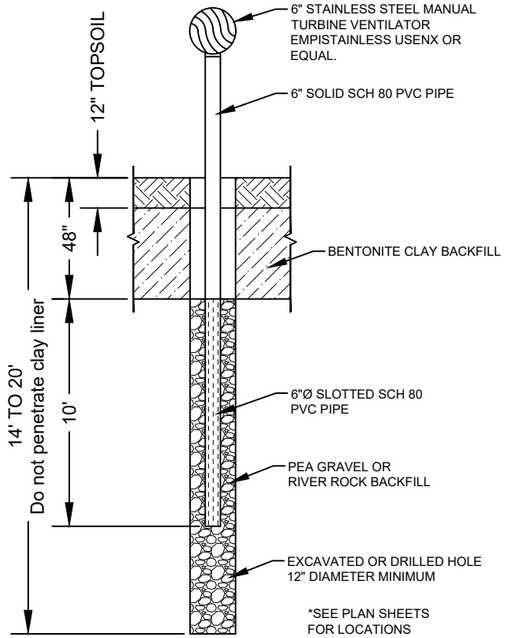
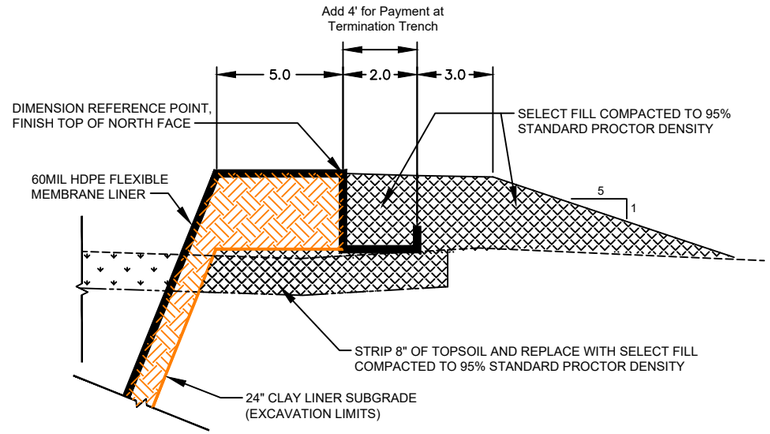
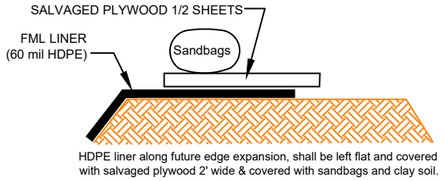


A X11 GAS VENT DETAIL
NTS



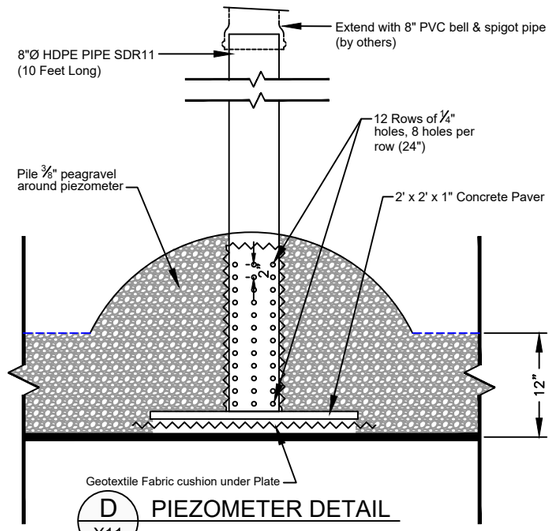
LINER TERMINATION ALONG EXTERIOR EDGE OF CELL

B X11 LINER TERMINATION TRENCH DETAIL
SCALE: None

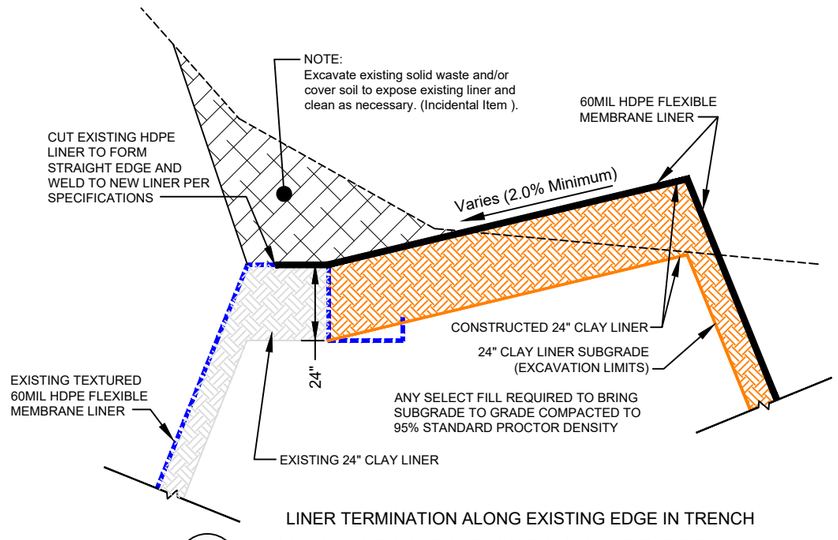


LINER TERMINATION, TOP OF BERM FOR FUTURE CONNECTION

C X11 LINER TERMINATION DETAIL

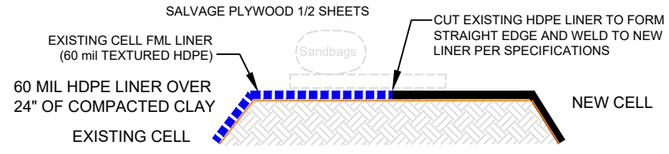


D X11 PIEZOMETER DETAIL



LINER TERMINATION ALONG EXISTING EDGE IN TRENCH

E X11 CONNECTION TO EXISTING LINER DETAIL
SCALE: 1" = 4'



LINER TERMINATION, TOP OF EXISTING BERM

F X11 LINER TERMINATION DETAIL

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NORTHERN PLAINS REGIONAL LANDFILL
2026 EXPANSION PLAN
STANDARD DRAWING SHEET NO. 2

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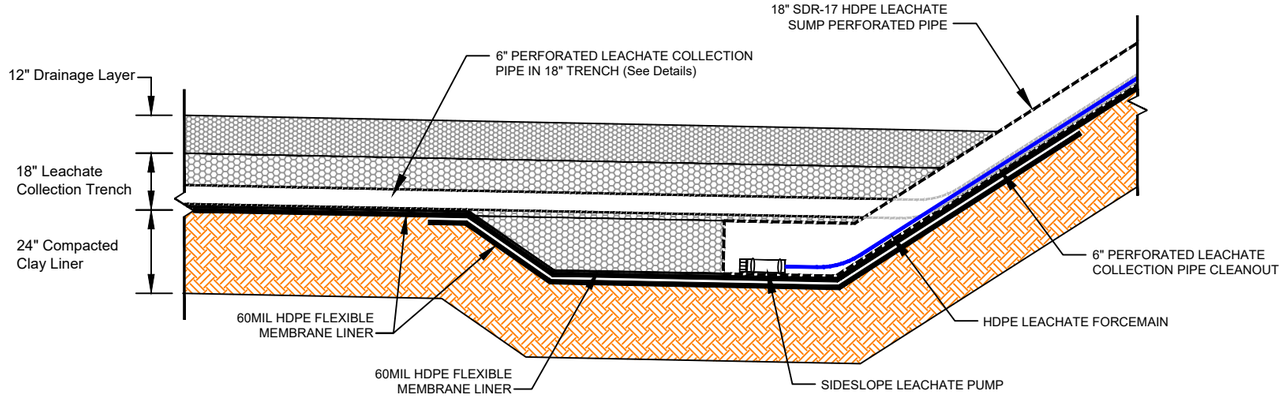
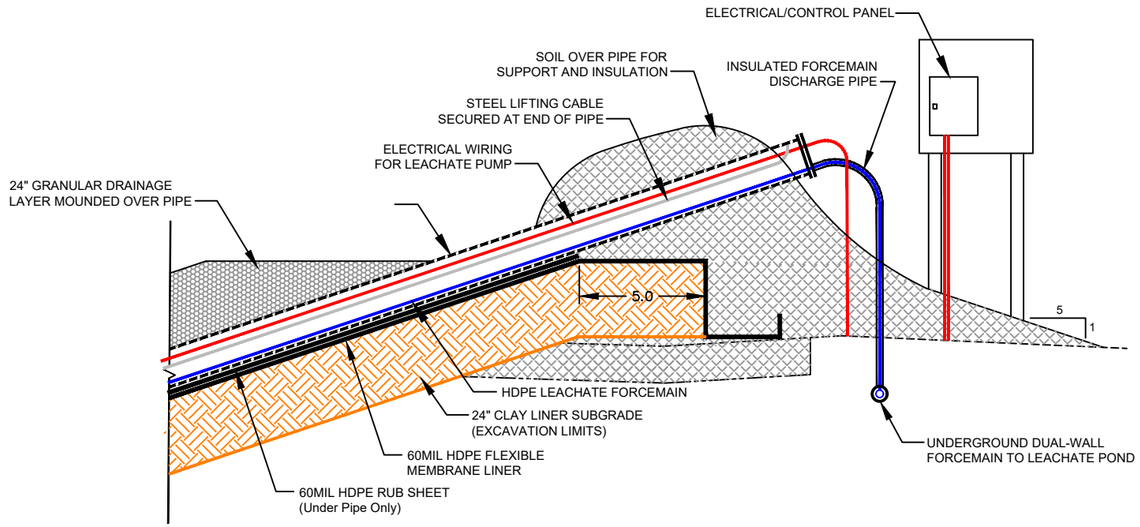


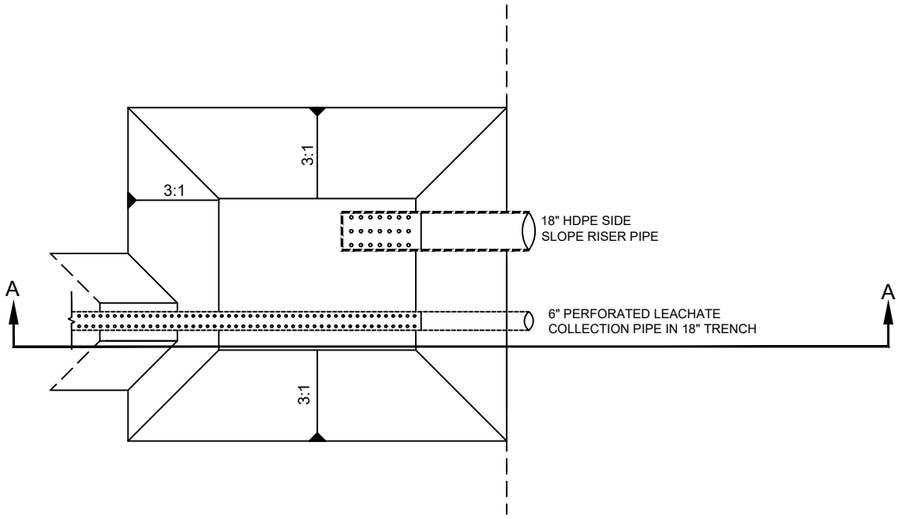
B X12 CROSS SECTION A-A

SCALE: H 1" = 4', V 1" = 2'



C X12 LEACHATE SIDESLOPE RISER PROFILE

SCALE: None



A X12 LEACHATE COLLECTION SUMP DETAILS

LEACHATE COLLECTION SUMP DETAILS

SPENCER, IOWA
NORTHERN PLAINS REGIONAL LANDFILL
2026 EXPANSION PLAN
STANDARD DRAWINGS SHEET NO. 3

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APPENDIX 3

HYDROGEOLOGICAL INVESTIGATION REPORT
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

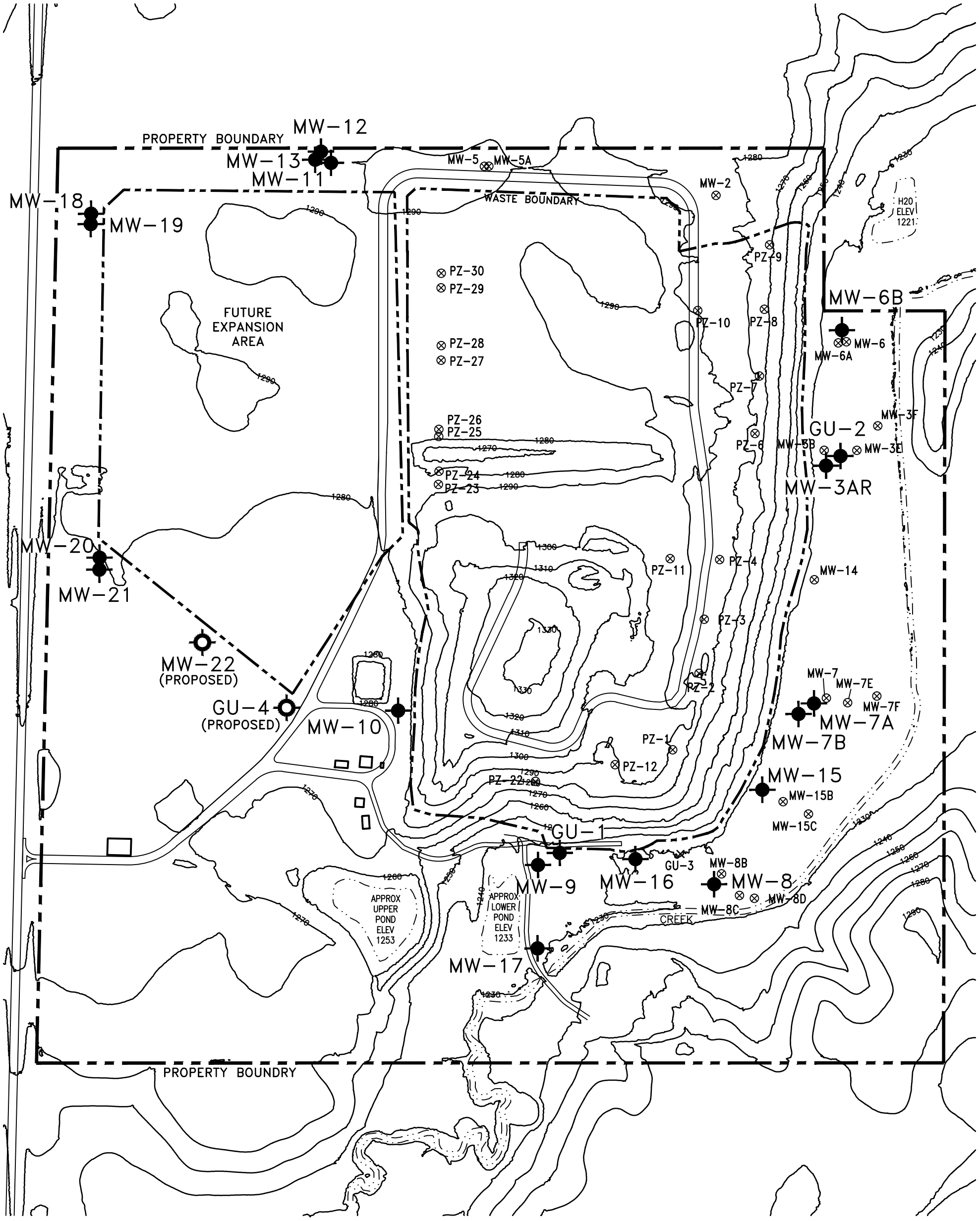
APPENDIX 4

HYDROLOGIC MONITORING SYSTEM PLAN
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

APPENDIX 8:

EXPLOSIVE GAS CONTROL PLAN
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

CITY OF SPENCER



HLW Engineering Group
204 West Broad Street, P.O. Box 314
Story City, Iowa 50248
Phone: (515) 733-4144
FAX: (515) 733-4146

HSMP MONITORING POINTS

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

FIGURE: 15

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 12-11-25

Hydrogeologic Investigation Report
&
Hydrologic Monitoring System Plan
&
Gas Monitoring System Plan

Northern Plains Regional Landfill
74-SDP-02-76P

Prepared for:
The City of Spencer
Spencer, Iowa

by:
HLW Engineering Group

September, 2020

HLW
HLW Engineering Group
Engineering *Management*

6021-20A.330

Hydrogeologic Investigation Report
&
Hydrologic Monitoring System Plan
&
Gas Monitoring System Plan

Northern Plains Regional Landfill
74-SDP-02-76P

Prepared for:
The City of Spencer
Spencer, Iowa

by:
HLW Engineering Group

Todd Whipple, CPG. 10-12-2020 Date

HYDROGEOLOGIC INVESTIGATION REPORT

HIR

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Site Location
Landfill Layout
Study to Date
Site Modifications

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Groundwater

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Geologic Setting
Hydrogeologic Setting

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HYDROLOGIC MONITORING SYSTEM PLAN

HMSP

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II. HYDROLOGIC MONITORING SYSTEM PLAN (HMSP) 1
Site Aquifer Descriptions/Groundwater Occurrence & Movement
Proposed HMSP Wells
Monitoring Frequency
Additional Monitoring
Sample Volume, Containers, Turbidity, and Method Selection
Sampling Methods
Data Management

III. MONITORING WELL MAINTENANCE PERFORMANCE REEVALUATION 7

GAS MONITORING SYSTEM PLAN

GMSP

I. Proposed GMSP Points 1

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Figure 8 - Cross Section E-E
Figure 9 - Cross Section F-F
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Figure 16 - GMSP Monitoring Point Requirements

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Table 3 - Hydraulic Conductivity Testing – Laboratory Results
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Table 5 - Horizontal Gradient Summary
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Appendix 2 - Water Well Inventory
Appendix 3 - Boring Logs – 1979 to 2013
Appendix 4 - Boring Logs – 2019 & Geotechnical Soil Testing Results
Appendix 5 - Monitoring Well Construction Documentation Forms
Appendix 6 - Hydraulic Conductivity Field Testing Results & Calculations
Appendix 7 - 1994 & 2004 Hydraulic Conductivity Lab Testing Data
Appendix 8 - April 27, 2020 - IDNR Field Sampling Form 542-1322

HYDROGEOLOGIC INVESTIGATION REPORT

I. INTRODUCTION

Site Location

The Northern Plains Regional Sanitary Landfill, operated by the City of Spencer, is located in the NW¼ of Section 21, T97N, R33W (approximately 152 acres). The facility is situated at 3032 420th Ave, Graettinger, Iowa.

Scale 1" = 1000'

Landfill Layout

As illustrated in Figure 1, the site is described as four (4) separate component areas designated: The Original Landfill (Phases 1-12 and 1A-4A); the Original RCRA Subtitle D Landfill (Phases 5A-21A); the Current RCRA Subtitle D Landfill (Expansion Cells A-D2), and the Future Expansion Area (Cells E-H). The facility operates under the Iowa Department of Natural Resources (IDNR) Permit Number 74-SDP-02-76P. The Operating Permit is included in Appendix 1.

The facility is located in a rural setting. Several farm homesteads exist peripheral to the landfill within a one (1) mile radius as illustrated in the photograph on page HIR-1.

Copies of the current water well inventory information are included in Appendix 2. Note that Hugh Flanagan (sic) water well information is specific to the landfill site proper, as Hugh J. Flannegan was the owner of the Original Landfill. The water well log for the landfill well (2002) is included in Appendix 2. Additionally, the water well inventory compiled November 1, 2004 by Kruse, Cate & Nelson is also included in Appendix 2. A water well is known to be located south-southwest of the site at the homestead west across the highway from the landfill entrance. This well is not included in the 2020 inventory information, but is included in the consideration of set-back distances for the Future Expansion Phases E-H.

Study to Date

The site proper includes land owned by the City of Spencer as illustrated in Figure 1. The footprint of the Original Landfill (Phases 1-12 and 1A-4A); the Original RCRA Subtitle D Landfill (Phases 5A-21A); the Current RCRA Subtitle D Landfill (Expansion Cells A-D2), and the Future Expansion Area (Cells E-H) are illustrated on Figure 1.

The 1995 Hydrogeologic Investigation Report (HIR) for the Original Sites (Doc #13602), was updated November 29, 2004 (Doc # 58862) to incorporate the portion of the site encompassing Expansion Cells A-D2 (the current RCRA Subtitle D Landfill). The 1995 Hydrologic Monitoring System Plan (HMSP) for the Original Sites (Doc # 13616) was updated May 28, 2010 (Doc # 57945) to incorporate the portion of the site encompassing Expansion Cells A- E (the current RCRA Subtitle D Landfill). The referenced reports include a comprehensive description of the regional and site-specific geology of the Original Landfill (Phases 1-12 and 1A-4A); the Original RCRA Subtitle D Landfill (Phases 5A-21A); and the Current RCRA Subtitle D Landfill (Expansion Cells A-D2). The Regional Geology study presented in the referenced documents is relied upon herein and is not reiterated.

This HIR/HMSP report addresses the Expansion Area that includes Cells F through I. Site Exploration in accordance with IAC 567, Chapter 113.6(3) has been completed in Cells E-H located in the northwest quadrant of the site (Figure 1) and is reported herein. Figure 2 is included to illustrate the location of the cross-section lines developed as part of this study.

Figure 3 illustrates the groundwater contours throughout the entire site based on the April 27, 2020 water elevation data.

All monitoring wells at the site are completed in the glacial till formation(s). An itemized listing of all existing site monitoring wells, piezometers, and tile line monitoring points are included in Table 1 below. The fate/use of each point is also included in Table 1.

Table 1 – Comprehensive Listing of Future, Current & Historic Monitoring Points (see Figure 1 & 2)

Point	Year Installed	Use	Formation	Screen Length (ft)
MW-2	1979	Water Level Only	Till	3.0
MW-3AR	1996	Downgradient	Alluvium	5.0
MW-3B	1994	Water Level Only	Alluvium	5.0
MW-3E	2013	Water Level Only	Alluvium	10.0
MW-3F	2013	Water Level Only	Alluvium	10.0
MW-5	1984	Water Level Only	Till	5.0
MW-5A	1995	Water Level Only	Till	5.0
MW-6	1988	Water Level Only	Alluvium	5.0
MW-6A	1994	Water Level Only	Alluvium	5.0
MW-6B	1994	Downgradient	Alluvium	3.0
MW-7	1988	Water Level Only	Alluvium	5.0
MW-7A	1994	Downgradient	Alluvium	3.0
MW-7B	1994	Downgradient	Alluvium	5.0
MW-7E	2013	Water Level Only	Alluvium	10.0
MW-7F	2013	Water Level Only	Alluvium	5.0
MW-8	1992	Downgradient	Alluvium	3.0
MW-8B	1996	Water Level Only	Alluvium	10.0
MW-8C	2013	Water Level Only	Alluvium	5.0
MW-8D	2013	Water Level Only	Alluvium	10.0
MW-9	1992	Downgradient	Alluvium	3.0
MW-10	1996	Downgradient	Till	5.0
MW-11	2004	**Background**	Till	10.0
MW-12	2004	**Background**	Till	20.0
MW-13	2004	Water Level Only	Till	10.0
MW-14	2008	Downgradient	Alluvium	5.0
MW-15	2008	Downgradient	Alluvium	5.0
MW-15B	2013	Water Level Only	Alluvium	5.0
MW-15C	2013	Water Level Only	Alluvium	5.0
MW-16	2008	Downgradient	Alluvium	5.0
MW-17	2012	**Background**	Alluvium	10.0
MW-18	2019	**Water Level Only - future**	Till	10.0
MW-19	2019	**Background - future**	Till	10.0
MW-20	2019	**Water Level Only - future**	Till	10.0
MW-21	2019	**Background – future Phases E-H**	Till	10.0
MW-22	***Future***	***Downgradient – future Phases E-H***	*Till*	*10.0*
GU-1	1994	Downgradient	Till	N/A
GU-2	2005	Downgradient	Till	N/A
GU-3	1979	Connected to LCS – 2015	Till	N/A
GU-4	***Future***	***Downgradient – future Phases E-H***	*Till*	N/A

Site Modifications

The development of the Original RCRA Subtitle D Landfill (Phases 5A-21A) and the Current RCRA Subtitle D Landfill (Expansion Cells A-D2) incorporates the installation of groundwater underdrain piping to maintain the required separation between the waste mass and the water table surface. The future construction of Expansion Cells E-H will also require groundwater underdrain piping to maintain the required groundwater separation from waste. The future monitoring point is designated GU-4, but may require additional GU in accordance with IAC 113.10(2)"a"(3).

The end of the groundwater underdrain existing below the south portion of the closed Original Landfill is connected to the gravity drained leachate conveyance pipe and discharges to the lift station manhole and is then pumped to the leachate holding lagoon (since 2015) and is treated as leachate pursuant IAC 113.10(2)"a"(3).

The underdrain piping (existing) exhibits control of the water table surface in the Original RCRA Subtitle D Landfill (Phases 5A-21A) and the Current RCRA Subtitle D Landfill (Expansion Cells A-D2). Review of the current water table map (Figure 3) indicates that control of the water table is currently maintained.

The addition of underdrain piping in the future Expansion Cells E-H will also exhibit control of the water table surface in the future area and will be incorporated into the future construction.

II. FIELD ACTIVITIES

Soils

Soil Boring & Sampling - Hydrogeologic assessment of the Original Landfill, the Original RCRA Subtitle D Landfill (Phases 5A-21A) and the Current RCRA Subtitle D Landfill (Expansion Cells A-D2) is reported in the 1995 Hydrogeologic Investigation Report (HIR) for the Original Sites (Doc #13602) and the November 29, 2004 HIR Update (Doc # 58862).

Hydrogeologic assessment of the future Expansion Cells E-H is reported herein.

Nine (9) soil borings were drilled. Four (4) perimeter monitoring wells were constructed along the west side of the future Expansion Cells E-H in June, 2019. The remaining soil borings that were not completed as monitoring wells were scattered throughout the future Expansion Cells E-H. The 2019 soil boring locations are designated SB-1 (MW-18 & MW-19), SB-2 (MW-20 & MW-21), and SB-3 through SB-9. Figure 2 illustrates the location of the soil borings and Monitoring Wells.

Soil testing was performed on the soil samples collected from the various soils encountered throughout the site as described in the following section. Boring logs for all historic boring logs (1979 to 2013) are included in Appendix 3, while the Boring Logs completed in 2019 are included in Appendix 4. Monitoring Well Construction Documentation Forms for all wells are included in Appendix 5.

All soil borings were continuously sampled. Thin walled Shelby tube samples were also collected at deliberate locations at and below the planned landfill base. The tube samples were sealed and transported to a qualified laboratory for testing. In addition, bag samples were collected and submitted for testing.

Laboratory Testing - Standard Proctor density and soil moisture were determined utilizing bag samples collected at the site. Falling head permeability tests were

performed on the undisturbed Shelby tube samples and on select soil samples compacted to 95% Standard Proctor. Grain size analyses were also performed on select soil samples. All test results are presented in Appendix 4.

Groundwater

Monitoring Wells - All wells on site consist of 2" PVC screen and riser pipe and conform to IAC 113.6. The well clusters are situated at 600± ft intervals around the downgradient perimeter of the landfill. The recently completed (2019) well clusters are situated at intervals of approximately 1,200± feet along the upgradient side of the expansion area within 50 ft of the proposed waste boundary. Additional monitoring wells may be required around the perimeter of the future Expansion Cells E-H to meet the 300 ft minimum spacing if required per IAC 113.6. It is anticipated that any supplemental wells will be constructed and added to the monitoring program in a phased approach in conformance with rule and the planned phased development of the future Expansion Cells E-H.

Water Level Monitoring - The top of casing elevation is recorded for each of the site monitoring wells. Water level readings were collected and recorded April 27, 2020. Water elevation data for April 27, 2020 is summarized on the Table on Figure 3. Figure 3 is a Groundwater Contour Map illustrating east-southeast flow across the site. Water elevation data is discussed further in the sections of this report that follow.

In-Situ Hydraulic Conductivity Testing – Slug/bail and recovery tests have been performed at each well on site one or more times since installation. The slug/bail and recovery tests are performed to estimate the horizontal hydraulic conductivity in the screened interval. The results of hydraulic conductivity testing are summarized in Table 2. The field data and the calculation of hydraulic conductivity for monitoring wells is included in Appendix 6. The results of available slug and/or bail tests indicate hydraulic conductivities in the range of $5.00x10^{-3}$ to $2.5x10^{-7}$ cm/sec, with an average value of $8.48x10^{-4}$ cm/sec.

Table 2 – In-Situ Hydraulic Conductivity Testing Results

Point	Year Installed	Formation	Hydraulic Conductivity Horizontal (cm/sec)
MW-3AR	1996	Alluvium	2020 - $3.48x10^{-4}$
MW-3E	2013	Alluvium	2013 - $1.25x10^{-4}$
MW-3F	2013	Alluvium	2013 - $6.41x10^{-4}$
MW-6B	1994	Alluvium	2020* - $1.00x10^{-4}$
MW-7A	1994	Alluvium	2020 - $7.65x10^{-4}$
MW-7B	1994	Alluvium	2020 - $1.15x10^{-4}$
MW-7E	2013	Alluvium	2013 - $1.02x10^{-5}$
MW-7F	2013	Alluvium	2013 - $5.18x10^{-4}$
MW-8	1992	Alluvium	2020 - $1.43x10^{-3}$
MW-8C	2013	Alluvium	2013 - $1.07x10^{-3}$
MW-8D	2013	Alluvium	2013 - $1.15x10^{-3}$

MW-9	1992	Alluvium	2020 - $1.49x10^{-3}$
MW-10	1996	Till	2020 - $8.00x10^{-5}$
MW-11	2004	Till	2004 - $5.00x10^{-3}$
MW-12	2004	Till	2004 - $2.50x10^{-4}$
MW-13	2004	Till	2004 - $4.40x10^{-4}$
MW-14	2008	Alluvium	2008 - $1.45x10^{-3}$
MW-15	2008	Alluvium	2008 - $2.80x10^{-3}$
MW-15B	2013	Alluvium	2013 - $2.57x10^{-4}$
MW-15C	2013	Alluvium	2013 - $1.07x10^{-3}$
MW-16	2008	Alluvium	2008 - $2.81x10^{-3}$
MW-17	2012	Alluvium	2020* - $1.00x10^{-4}$
MW-18	2019	Till	2019 - $1.41x10^{-4}$
MW-19	2019	Till	2019 - $2.50x10^{-7}$
MW-20	2019	Till	2019 - $3.21x10^{-4}$
MW-21	2019	Till	2019 - $3.99x10^{-4}$
		Average	**$8.48x10^{-4}$**

** No drawdown was realized. Hydraulic conductivity is estimated to exceed $1.00x10^{-4}$ cm/sec.*

Laboratory Hydraulic Conductivity Testing – Laboratory permeability testing was performed on Shelby Tube samples collected throughout various stratigraphic intervals across the site. The laboratory testing of the steel walled tube samples represents an estimate of the vertical hydraulic conductivity of the particular stratum. The results of 2019 laboratory hydraulic conductivity testing are summarized in Table 3 and in Appendix 4. The results of historic laboratory hydraulic conductivity testing are summarized in Table 3 and in Appendix 6. The results of laboratory hydraulic conductivity testing yield a range of $5.66x10^{-6}$ to $2.3x10^{-8}$ cm/sec.

Table 3 – Laboratory In-Situ Hydraulic Conductivity Testing Results

Location	**Depth (ft)**	**Interval**	**Hydraulic Conductivity Vertical (cm/sec)**
Boring 6 - 2019	19-21	Till/Clay	$2.3x10^{-8}$
Boring 7 - 2019	14-16	Till/Clay	$1.5x10^{-7}$
Boring 8 - 2019	9-11	Till/Sand	$1.1x10^{-6}$
Boring 8 - 2019	19-21	Till/Clay	$2.3x10^{-8}$
MW-6A - 1994	4-5	Colluvium	$7.61x10^{-8}$
MW-7A - 1994	3.5-4.5	Colluvium	$5.40x10^{-8}$
PSB-B - 2004	10-12	Till/Silt	$9.78x10^{-8}$
PSB-C - 2004	15-17	Till/Clay	$9.8x10^{-8}$
PSB-H - 2004	14-14.5	Till/Clay	$4.84x10^{-8}$
PSB-D - 2004	11.5-12.5	Till/Clay	$1.37x10^{-7}$
PSB-F - 2004	17-19.5	Till/Clay	$4.03x10^{-8}$
PSB-I - 2004	14-16.5	Till/Silt	$5.16x10^{-6}$
PSB-G - 2004	10-12.5	Till/Silt	$5.66x10^{-6}$
PSB-E - 2004	14-16.5	Till/Clay	$1.57x10^{-7}$
PSB-A - 2004	12-14	Till/Clay	$8.17x10^{-8}$
Average all			**$8.60x10^{-7}$**

Note: PSB-A through PSB-I were located in the Phase A-D2 Expansion Area.

Comparison of the vertical and horizontal hydraulic conductivities indicates that the average horizontal hydraulic conductivity is approximately 3 orders of magnitude greater than the average vertical hydraulic conductivity.

Calculated Vertical Gradients – The vertical gradients are examined by dividing the difference in feet water head (water surface elevation) by the difference in feet of the well screen center points for clustered wells. Vertical gradients are summarized in Table 4.

Table 4 – Vertical Gradient Summary - Future Expansion Area (Cells E-H)

Well	Screened Interval	Water Elevation (4-27-20)	Screen Midpoint Elevation	Vertical Gradient (Diff./Diff.)
MW-19	Shallow	1280.76	1265.55	
MW-18	Deep	1254.97	1216.42	
Difference (ft)		25.79	49.13	0.525
MW-21	Shallow	1275.72	1259.49	
MW-20	Deep	1254.82	1220.72	
Difference (ft)		20.90	38.77	0.539
MW-11	Shallow	1282.10	1273.6	
MW-13	Deep	1257.71	1220.8	
Difference (ft)		24.39	52.8	0.462

Review of the vertical gradient data indicates that all gradients are downward and that the average vertical gradient across the site is estimated to be **0.509** (no units).

Calculated Horizontal Gradients – The horizontal gradients are examined by dividing the difference in feet water head (water surface elevation) by the difference in feet of the horizontal well spacing across the site in the down-slope direction. The Horizontal Gradients are summarized in Table 5. Three (3) different horizontal gradient systems were evaluated.

The first system evaluated is the horizontal gradient in the area restricted to the Future Expansion Area (Cells E-H). This expansion is developed exclusively in the uplands at the site (northwest quadrant) where the land surface is significantly above the alluvial floodplain in the south and east portions of the site. The horizontal gradient across the Future Expansion Area (Cells E-H) is lowest in the expansion area proper (Average = 0.006).

The second system evaluated is the horizontal gradient across the Future Expansion Area (Cells E-H) and across the entire landfill area to the alluvial floodplain to the east and the south. The horizontal gradient across the Future Expansion Area (Cells E-H) into the alluvial floodplain below is greatest (Average = 0.0253).

The third system evaluated is the horizontal gradient across the site within the deep sand unit documented below the Future Expansion Area (Cells E-H) and hydraulically connected to the alluvial sediments in the alluvial floodplain lowlands to the east and the south. The horizontal gradient across the Future Expansion Area (Cells E-H) within the deep sand unit yields an average gradient of 0.0143.

Table 5a – Water Table - Horizontal Gradient Summary - Future Expansion Area (Cells E-H)

Well	Formation	Water Elevation (4-27-20)	Distance between wells (ft)	Horizontal Gradient (Diff./Diff.)
MW-19	Till	1280.76		
MW-10	Till	1270.70		
Difference (ft)		10.06	1635	0.006
MW-21	Till	1275.72		
MW-10	Till	1270.70		
Difference (ft)		5.02	950	0.005
MW-11	Till	1282.10		
MW-10	Till	1270.70		
Difference (ft)		11.4	1570	0.007
Average				***0.006***

Table 5b – Water Table - Horizontal Gradient Summary – Site Wide

Well	Formation	Water Elevation (4-27-20)	Distance between wells (ft)	Horizontal Gradient (Diff./Diff.)
MW-19	Till	1280.76		
MW-6B	Alluvium	1222.60		
Difference (ft)		58.16	2140	0.027
MW-21	Till	1275.72		
MW-14	Alluvium	1225.50		
Difference (ft)		50.22	2011	0.025
MW-11	Till	1282.10		
MW-17	Alluvium	1226.90		
Difference (ft)		55.2	2300	0.024
Average				***0.0253***

Table 5c – Deep Sand - Horizontal Gradient Summary - Site Wide

Well	Formation	Water Elevation (4-27-20)	Distance between wells (ft)	Horizontal Gradient (Diff./Diff.)
MW-18	Deep Sand	1254.97		
MW-6B	Alluvium	1222.60		
Difference (ft)		32.37	2140	0.015
MW-20	Deep Sand	1254.82		
MW-14	Alluvium	1225.50		
Difference (ft)		29.32	2011	0.015
MW-13	Deep Sand	1257.71		
MW-17	Alluvium	1226.90		
Difference (ft)		30.81	2300	0.013
Average				***0.0143***

Review of the horizontal gradient data indicates that the calculated gradients are consistent within each gradient system evaluated. The average horizontal gradient across the site is estimated to be **0.0152** (no units).

Comparison of the vertical and horizontal gradients indicates that the vertical gradients are generally steeper by a factor of approximately 20 to 30.

Calculated Flow Rates – An average flow rate (cubic meters/day) in the horizontal and vertical directions over an average area (square meters) can be estimated using Darcy's Equation (Q=K*i*A),

Where: $Q = m^3/day$
K = Hydraulic Conductivity (m/day)
i = Gradient
$A = Area\ (m^2)$

Assuming an average vertical hydraulic conductivity 8.60×10^{-7} cm/sec (7.43×10^{-4} m/day) and an average vertical gradient of 0.509, the average vertical flow is estimated at **3.78×10^{-4}** m^3/day.

Assuming an average horizontal hydraulic conductivity 8.48×10^{-4} cm/sec (7.32×10^{-1} m/day) and an average horizontal gradient of 0.0152, the average horizontal flow is estimated at **1.11×10^{-2}** m^3/day.

Comparison of the average flow rates indicates that flow in the horizontal direction is far greater than that in the vertical direction (by two (2) orders of magnitude), confirming that the native soils provide a significant restriction in the downward migration of water at this site.

III. SITE GEOLOGY

The Regional Geology study presented in the 1995 Hydrogeologic Investigation Report (HIR) (Doc # 13602) and 2004 HIR (Doc # 58862) is relied upon herein and is not reiterated. A summary is provided.

Physiographic Setting

The site is generally described as being developed in Wisconsinan tills in the higher elevation areas of the site (north, west, and central portions of the site) and by younger alluvial deposits along drainage ways (to the extreme south and east). The glacial till, which ranges from clay-rich to sandy and pebbly, is over 110 feet thick at the site. Lenses of silt and sand and gravel as much as 10 ft thick are encountered through the till. The alluvial sands and gravels in the drainage ways are as much as 25 ft thick.

The shallow bedrock in the area is assigned to the Dakota Formation (Cretaceous), which consists of shales and sandstones (Iowa Geological Survey, 1997). The Dakota Formation is a prolific regional aquifer in Northwest Iowa.

Geologic Setting

Approximately 110 feet of glacial tills soils of various ages blanket bedrock in the project area. Bedrock in the project area is documented as being Cretaceous in age.

Water well data compiled and interpreted by the Iowa Geologic Survey indicate that the surface of the bedrock can be irregular and may include buried bedrock channels.

Hydrogeologic Setting

Hydrogeologic Cross Sections (Figures 4-10) illustrate the distinct glacial stratigraphic units existing in the project area. The glacial sediments throughout the project area are typically saturated below an approximate depth of 10' and the water table surface generally mimics the topography. The drift sediments as a unit are predominantly clay and exhibit low hydraulic conductivities, a condition favorable for an elevated static water table in areas of low topographic relief. Sand layers and/or sand pockets were encountered during drilling at most locations throughout the expansion area. Shallow groundwater flow within the glacial sediments is generally east-southeast toward the alluvial system existing along the east and south sides of the site.

A water well survey in the immediate vicinity of the site (Appendix 2) support the interpretation that both buried glacial sands and the Cretaceous Dakota Formation comprise the residential aquifers in the project area.

IV. HYDROGEOLOGIC UNITS & FLOW PATHS

Hydrologic Units

Shallow Till – Shallow monitoring wells (<30 ft deep) within the upland tills indicate a static water table approximately 10' below grade. The shallow water table surface generally mimics the ground surface (Figure 3) and is further controlled by the existing groundwater underdrain piping at the site. The generalization is made that the shallow water table surface slopes to the east-southeast corner of the site.

Deep Till – Deep monitoring wells (>30 ft deep) within the upland tills indicate a potentiometric water surface that extends to within 25' to 35' of the ground surface. The deep water surface also slopes to the east-southeast.

The shallow and deep till soils are collectively considered a hydrologic unit with the water movement represented by the slope on the water table surface. Based on bail test/recovery testing performed on all monitoring wells on site, the water table aquifer exhibits horizontal hydraulic conductivities in the range of 5.00×10^{-3} to 2.5×10^{-7} cm/sec. The average horizontal conductivity is 8.48×10^{-4} cm/sec (Table 2).

Lateral water movement within sand is anticipated to be accelerated relative to both vertical or lateral movement of water within the clay till soils. This is anticipated to be true in both the buried sand pockets and stringers throughout the uplands, and in alluvial sediments within the alluvial valley to the east and south.

Vertical hydraulic conductivity values for the tills are determined by falling head methods on thin-walled tube samples collected from soil borings on site. The reported vertical hydraulic conductivity values range from 5.66×10^{-6} to 2.3×10^{-8} cm/sec, with an average value of 8.6×10^{-7} cm/sec (Table 3).

Residential/Commercial Aquifer - Residential and commercial water supply wells are completed in the deep (greater than 50 feet deep) glacial sand deposits and in the Cretaceous Dakota Formation throughout the area.

Flow Paths

Surface Water - Surface water run-on is well controlled at the site. Surface water flow in the developed portions of the site and the Future Expansion Area (Cells E-H) is routed to vegetated ditches that convey water to the alluvial floodplain below on the east and the south sides of the site

Groundwater - Based on the water level data collected on April 27, 2020 (Figure 3), groundwater in the till flows east-southeast. Downward movement of groundwater is controlled by the low permeability glacial clays. Lateral movement is controlled by the sand seams within the till soils. The Flow Net Sections (Figures 11-14) illustrate the flow characteristics based on available data. The greatest resistance to flow appears to be in the vertical direction, while the least resistance to flow appears to be horizontally. The saturated sand seams appear to accelerate horizontal flow.

V. INDUCED GROUNDWATER LEVEL VARIATIONS

Construction of the Future Expansion Area (Cells E-H) will affect the seasonal water table level in the area. Groundwater underdrain systems will be installed below the expansion area. The water table will remain lowered in the vicinity of the expansion areas due to the presence of the groundwater diversion system. The low permeability soils will also act to buffer the effects of heavy precipitation and/or drought on the water table levels.

HYDROLOGIC MONITORING SYSTEM PLAN

I. INTRODUCTION

The Hydrologic Monitoring System Plan (HMSP) for the Northern Plains Regional Landfill is the operational and maintenance plan for the hydrologic monitoring system. The purpose of the HMSP is to determine the impact, if any, the sanitary landfill is having on the adjacent groundwater through monitoring well placement, sampling, testing, and evaluation.

The HMSP has been prepared in accordance with Iowa Administrative Code (IAC) Rule 567, Chapter 113. This HMSP is intended to replace the May 28, 2010 HMSP (Doc #57945), approved in Permit Amendment #6 on July 23, 2012.

II. HYDROLOGIC MONITORING SYSTEM PLAN

Monitoring wells and tile monitoring points exist at appropriate locations around the downgradient perimeter of the Original Landfill (Phases 1-12 and 1A-4A); the Original RCRA Subtitle D Landfill (Phases 5A-21A); and the Current RCRA Subtitle D Landfill (Expansion Cells A-D2). Existing and Future Monitoring Points around the Future Expansion Area (Cells E-H) are illustrated on Figure 15.

Site "Aquifer" Descriptions/Groundwater Occurrence & Movement

A current groundwater contour map (Figure 3) is attached. Soil boring throughout Future Expansion Area (Cells E-H) confirms the presence of glacial till soils consistent with those documented in the borings/wells throughout the remainder of the site.

Geologic cross sections and flow net sections are included as Figures 4-14. The Cross Sections and Flow Net Sections encompassed the entirety of the site including Original Landfill (Phases 1-12 and 1A-4A); the Original RCRA Subtitle D Landfill (Phases 5A-21A); and the Current RCRA Subtitle D Landfill (Expansion Cells A-D2) and Future Expansion Area (Cells E-H). The sections confirm the continuous nature of the glacial till units across the site at and below all landfill development areas.

Proposed HMSP Wells

In order to collect representative water samples of the upper-most water around the perimeter of the fill areas in accordance with Iowa Administrative Code (IAC) 567, Chapter 113.10(2) and 113.10(3), monitoring point modifications will be required as part of the future HMSP as the Future Expansion Area (Cells E-H) is developed.

Current monitoring points include background monitoring wells MW-11, MW-12, and MW-17; and downgradient monitoring points MW-3AR, MW-6B, MW-7A, MW-7B, MW-8, MW-9, MW-10, MW14, MW-15, MW-16, GU-1, and GU-2.

Future HMSP monitoring points will include all current monitoring points with the addition of existing background wells MW-19 and MW-21 and proposed downgradient monitoring well MW-22 and future downgradient underdrain GU-4 (Figure 15).

Note that water elevation data will conclusively demonstrate whether the existing monitoring wells will continue to demonstrate an upgradient or downgradient position as the future cells are constructed in the Future Expansion Area (Cells E-H).

Monitoring Frequency

Detection monitoring, assessment monitoring, and corrective action monitoring (as warranted) are performed semi-annually. Permit Special Provision 4.e. establishes the frequency of full Appendix II assessment monitoring as once every five (5) years at assessment monitoring points that have at least two (2) annual episodes of analysis complete for the entire Appendix II list.

A "1 of 2 resample/retesting scheme" will be employed upon an initial indication of a Statistically Significant Increase (SSI) above background. The resample/retest will be collected within 90 days of the initial SSI indication. For those compounds typically below the reporting limit, the Double Quantification Rule (DQR) will be employed, with the resample collected within 90 days. This is in accordance with the IDNR Memo dated June 22, 2017.

Additional Monitoring

Water elevation data will be collected from each HMSP monitoring well semi-annually during the required water monitoring episodes. In addition, water elevation data will be collected semi-annually from each existing monitoring well/piezometer listed in Table 1.

Sample Volume, Containers, Turbidity, and Method Selection

Sample Volume Requirements

Based on current laboratory methods the containers and container volumes listed in Table 4 are required for the various analytes included in the full Appendix II parameter list. The Appendix I subset of the full Appendix II list requires the first four (4) listed containers.

Currently a total sample volume of 380 mL is typically collected for Appendix I analyses. Whereas a total sample volume of 6,000 mL is typically collected for Appendix II analyses. In cases where Appendix I analyses plus any additional Appendix II compounds are required as supplemental assessment monitoring, the sample volume may exceed the 380 mL required for Appendix I analyses alone.

Table 6 – Laboratory Container Requirements

Analyte	Volume (mL)	Preservative	Container Material
Field NTU	10	None	Clear GlassVial
Appendix I*	250	Nitric acid	Plastic
Appendix I*	40	HCL	Clear GlassVial
Appendix I*	40	HCL	Clear GlassVial
Appendix I*	40	HCL	Clear GlassVial
Appendix II	250	NaOH	Plastic
Appendix II	250	Zn Acetate	Plastic
Appendix II	40	None	Clear GlassVial
Appendix II	40	None	Clear GlassVial
Appendix II	40	None	Clear GlassVial
Appendix II	1000	None	Amber Glass
Appendix II	1000	None	Amber Glass
Appendix II	1000	None	Amber Glass
Appendix II	1000	None	Amber Glass
Appendix II	1000	None	Amber Glass

*Part of the full Appendix II analyte list

Sample Turbidity

Total metal compound concentrations can be affected by the turbidity of the water sample, especially mechanically induced turbidity. The metal compounds are analyzed from the water samples containerized in the 250 mL plastic nitric acid preserved container. Priority is given to collection of a low turbidity representative water sample for the metal compounds. For the balance of the sample volume that is required, the remaining Appendix I/Appendix II compounds are not sensitive to turbidity effects.

Method Selection Based on Volume & Turbidity

The various site monitoring wells proposed as the HMSP monitoring wells will be sampled by "no-purge" methods as the primary sampling method. The no-purge method precludes a mechanically induced increase in turbidity because surging and elevated water entrance velocities through the screen and gravel pack are eliminated. The no-purge method and equipment that are utilized will limit water sample volume to 440 mL when a 4 ft long sample device is utilized (110 mL per foot).

Based on information provided by the Analytical Laboratory, a minimum volume of 50 mL is required to analyze the Appendix I/Appendix II total metal compounds and meet the required reporting limits. The required volume increases to 150 mL if the total metals sample is required to be the Matrix Spike/Matrix Duplicate run. The 4 foot long sample devices yield a sample volume in excess of the 150 mL and are considered sufficient devices to meet the laboratory sample volume requirements.

Due to the limited volume of sample that can be collected by no-purge methods, a secondary, or follow-on sample collection method will be required at certain wells, particularly when sample volumes in excess of 440 mL (maximum volume of the no-purge sample device) are required for additional compounds beyond the Appendix I list. The IDNR Field Sampling Form 542-1322

has been modified to include pertinent information related to No-Purge sample collection including the interval of the sample, the volume of the sample collected, and the follow-up sampling technique used in the instances where additional sample quantity was required. The most recent (April 27, 2020) sample collection forms (IDNR Field Sampling Form 542-1322) are included in Appendix 8.

The underdrain monitoring points (GU-1, GU-2, and future GU-4) included in the proposed HMSP will be sampled when flowing. There is not an apparent limitation on sample volume. The sampling method will ensure turbidity is not increased due to the sample collection.

Sampling Methods

Groundwater Sampling

No-Purge Sampling Method – This method is the primary sample collection method at this facility.

No-purge sample collection will utilize a Solinst® Model 429 Point Source Sampler. The typical point source sampler employed is 1-inch in inside diameter by four (4.0) feet in length. This point source sampler yields a sample volume of 440 mL, or 110 mL per foot.

A static water level will be obtained and recorded for each well prior to commencement of any sampling in the well. The water level (to the nearest 0.01 ft) will be obtained using a Solinst® Model 101 water level tape measured from the top of PVC casing.

The point source sampler will be deployed to an approximate depth equal to one (1.0) foot above the bottom of the screen interval using a 4.0 ft by 1-inch diameter point source sampler. In order to accurately obtain this desired bottom depth of the sampler, the cordage will be accurately measured and cut to be 5.0 feet less than the previous well depth measurement (less 1 ft above bottom and less 4 ft for sampler length).

The sampler will slowly be lowered in the monitoring well to the desired sampling depth. Once final depth is reached, the sampler will be raised to the surface at a steady rate.

Holding the point source sampler vertical, the sample retrieval device will be inserted into the bottom of the point source sampler. The outlet of the sample retrieval device will be directed into the laboratory supplied container. Once the outlet is properly directed to the laboratory sample container, the trigger on the top of the point source sampling device will be pushed and the sample will be allowed to drain from the sampler into the laboratory containers.

As indicated above, the containers for Appendix I will be filled in the following order:
120 mL into 3x40 mL glass vials (VOC compounds)
10 mL into the 10 mL glass vial (field NTU)
250 mL into the 250 mL nitric preserved plastic (metals)

The sample volume that remains in the point source sampler (approximately 60 mL) will be retained until the collected sample containers are properly stored on ice in the sample transport ice chest and the field measurement of turbidity is completed. Upon successful storage of the sample container set, the excess sample water in the point source sampler will be discarded.

Upon completion of sample collection, the well depth will be measured and recorded for reference at the next sampling event and in order to meet IAC 113.10(2)"f"3.

The formation that is open to the monitoring well is defined herein to be equal to the sand packed portion of the well. The sand packed portion is required to be a minimum of 1.0 foot below the screen bottom to 1.5 feet above the top of the screen interval as per IAC 113.10(2)"b"7.1. For the purpose of this HMSP, the open formation is assumed to be 2.5 feet longer than the screen interval of each well.

No-purge sampling methods utilizing the 4.0 ft by 1-inch diameter point source sample is appropriate at all wells that have a sand pack length of 4.0 feet, or more. At this site, this includes all HMSP monitoring wells.

Purge & Sample Method – This method of sampling is the secondary sample collection method at this facility and will only be implemented in cases where a sample volume greater than the volume collected by No-Purge sampling is required. This method will not be employed for collection of any Appendix I containers.

Monitoring well purging will be performed using a Waterra inertial lift pumping system consisting of a Hydrolift 2 pump head, 0.5 inch inside diameter or 0.375 inch inside diameter tubing fitted with a D-25 or D-13 footvalve, respectively. The pump rate using the 0.5 inch tubing approximates 2,500 mL per minute, while the 0.375 inch tubing yields approximately 1,000 mL per minute.

A static water level (and the time) will be obtained and recorded for each well prior to commencement of any sampling in the well. The water level (to the nearest 0.01 ft) will be obtained using a Solinst® Model 101 water level tape measured from the top of PVC casing.

Based on the length of the water column in the well, three well volumes will be calculated. The purging using the inertial pump will then commence and will continue until three (3) well volumes have been removed, or the well becomes dry.

In wells that continue to yield more than three (3) well volumes of water, the supplemental sample volume will be collected by directly discharging the sample water from the tubing into the balance of laboratory supplied containers. In no circumstance will the total metals fraction of the sample be collected in this manner. The total metals fraction and the Appendix I VOC fractions will be collected exclusively by no-purge methods at each monitoring well. In wells that become dry during purging before three (3) well volumes of water have been removed, the monitoring wells will be allowed to recover before sample collection commences. Monitoring well recovery time will typically be in excess of 1 hours, but less than 6 hours.

Upon completion of purging, a water level and well depth (and the time) will be measured and recorded for reference at the next sampling event and in order to meet IAC 113.10(2)"f"3. The water level in the well at the time of sample collection will also be recorded (and the time) for all wells sampled by secondary Purge & Sample methods.

Underdrain Tile Sampling

The discharge sample collected from GU-1, GU-2, and future GU-4 will be collected directly from the discharge using an unpreserved laboratory supplied collection container. The water sample will then be immediately transferred to the appropriate laboratory supplied sample container that contains the required preservative. The time of sample collection and the flow volume of the tile discharge will be recorded.

Data Management

Statistical Methods

The statistical evaluation methods performed on the collected water quality data conforms to Iowa Administrative Code (IAC) 567, Chapter 113.10(5) and 113.10(6) and conform to the USEPA statistical guidance document Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance, March, 2009.

Each monitoring point is monitored at least semi-annually and analyzed for the appropriate detection or assessment monitoring parameters listed in 113.10(5) and/or 113.10(6). Statistical methodologies for detection monitoring includes interwell prediction limits and/or intrawell control charts.

Interwell prediction limits are appropriate when background and downgradient wells monitor the same formation water and when there is similar variability in the background and downgradient zones. Interwell statistical evaluations compare the current downgradient results to the site prediction limits based on data from the background wells. Interwell statistical evaluations test for exceedances of downgradient results above the prediction limits. Initially, the interwell prediction limit method is deemed appropriate for most site monitoring wells, as long as the distinct formation waters are appropriately separated and the separate systems have appropriate background data established for each formation.

A "1 of 2 resample/retesting scheme" will be employed upon an initial indication of a Statistically Significant Increase (SSI) above background. The resample/retest will be collected within 90 days of the initial SSI indication. For those compounds typically below the reporting limit, the Double Quantification Rule (DQR) will be employed, with the resample collected within 90 days. This is in accordance with the IDNR Memo dated June 22, 2017.

It may also be appropriate to perform statistical methodologies that include intrawell comparisons by control chart methods. It is proposed that the control chart comparisons occur after the interwell prediction limit evaluations in the event that the prediction limits may not be representative of formation background.

QA/QC Methods

Blind Duplicate Field Samples - Relative Percent Difference - A blind duplicate sample will be collected from one monitoring well during each full sampling event.

The purpose of the field duplicate will be to evaluate the precision of sample collection and analysis process from the field through the laboratory. The calculation of the Relative Percent Difference (RPD) for duplicate pair results will be used as a means to evaluate the precision.

The Quality Control (QC) limit for the RPD on field duplicates is established at thirty percent (30%) for duplicate pairs that have reported concentrations five (5) times greater than the laboratory Reporting Limit. For samples and respective duplicates with reported analyte concentrations nearer the Reporting Limit, the RPD calculations will demonstrate greater variability and the RPD can be very large. RPD values will be considered non-representative in the following conditions:

a) Both the original and the duplicate results are less than five (5) times the Reporting Limit.
b) One or both results are qualified, flagged, or estimated.
c) A result is non-detected.

Water Quality Data Evaluation Plan

A database has been compiled based on water quality results collected from numerous sampling events from numerous site monitoring points over time utilizing no-purge sample collection methods. Water quality data collected during the future sampling events will be added to the database. The VOC evaluations will be based on all historic data available in the database. Total metals evaluations will restrict the data to be exclusively "no-purge" data collected at the site.

III. WELL MAINTENANCE PERFORMANCE REEVALUATION PLAN

A monitoring well maintenance performance reevaluation plan (MWMPRP) is required by 567--113. The purpose of the plan is to ensure that all monitoring points remain reliable. The MWMPRP includes the components listed in 113.10 (2)"f".

GAS MONITORING SYSTEM PLAN (GMSP)

This revised GMSP is proposed as a single system that will suffice to monitor the entire facility along the property perimeter and in site structures. The recommended frequency of monitoring is quarterly. The proposed monitoring frequencies conform to rule (IAC 113.9(2)"b"(2)). The following buildings, subsurface tiles, and subsurface monitoring points are proposed for the GMSP, as illustrated on Figure 16.

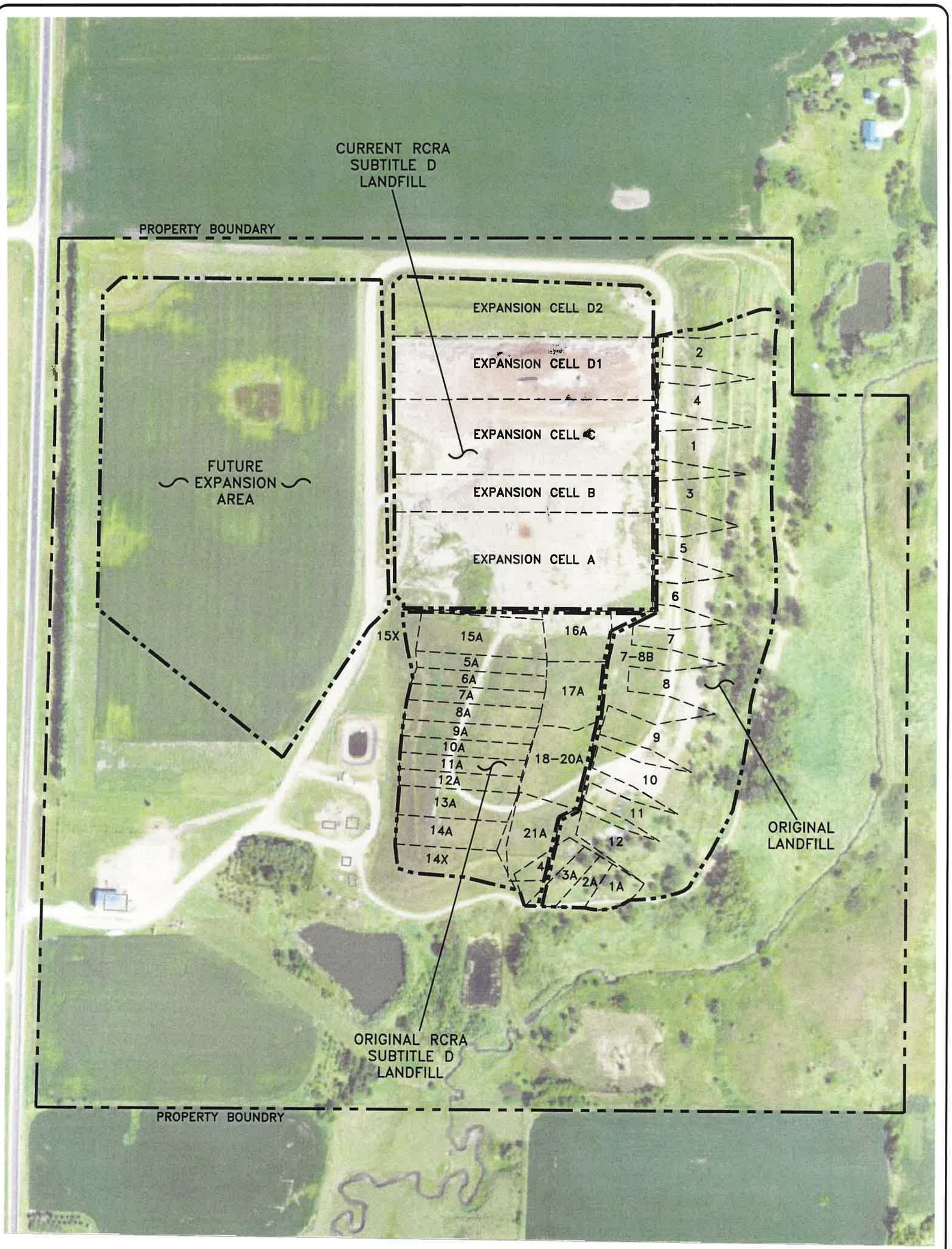
Proposed GMSP Points

Location	Description	Formation/Facility Monitored
Scale House -	site structure	indoor air
Leachate Pump House -	site structure	indoor air
GP-1 -	dedicated probe	subsurface/vadose zone
GP-2 -	dedicated probe	subsurface/vadose zone
GP-3 -	telephone pedestal	subsurface/vadose zone
GP-4 -	conduit on pole from buried electric line	subsurface/vadose zone
GP-5 -	conduit on pole from buried electric line	subsurface/vadose zone
GP-6 -	conduit on pole from buried electric line	subsurface/vadose zone
GP-7 - (future)	*Future Expansion Area (Cells E-H)*	*subsurface/vadose zone*
MW-3AR	Monitoring well with exposed screen	subsurface/vadose zone
MW-6B	Monitoring well with exposed screen	subsurface/vadose zone
MW-7A	Monitoring well with exposed screen	subsurface/vadose zone
MW-8	Monitoring well with exposed screen	subsurface/vadose zone
MW-11	Monitoring well with exposed screen	subsurface/vadose zone
GU-1 -	Phases 1-12; 1A-4A; 5A-21A	Groundwater Underdrain
GU-2 -	Expansion Areas A-D2	Groundwater Underdrain
GU-4 (future) -	*Future Expansion Areas E-H*	*Groundwater Underdrain*

The proposed points currently exist at the site and are part of the GMSP, except GP-7 and GU-4, which will be constructed as part of the Future Expansion Area (Cells E-H).

The quarterly gas monitoring will be reported annually in the Annual Water Quality Report that is due January 31 of each year.

FIGURES



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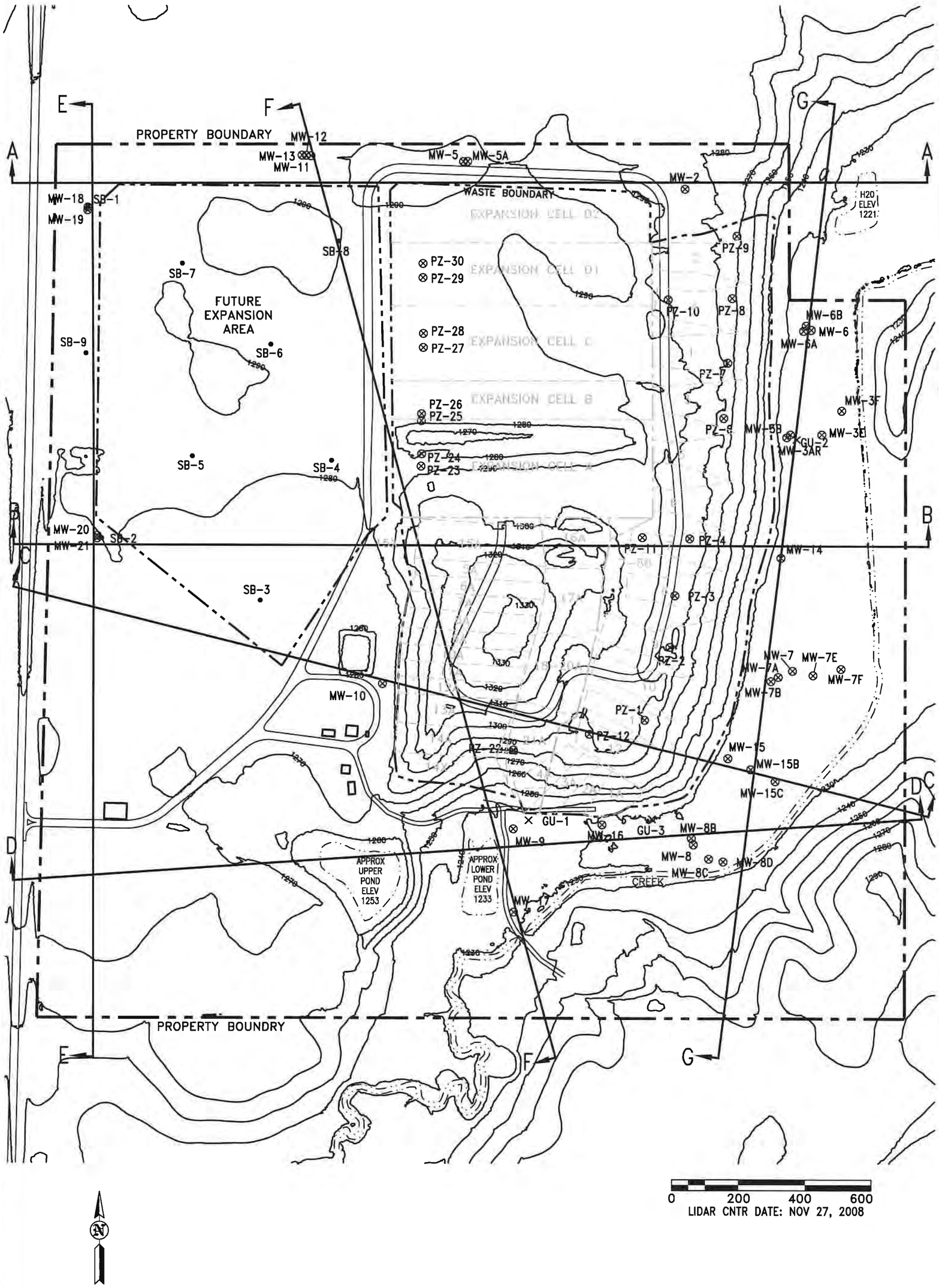
SITE PLAN AND LANDFILL AREAS

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER IOWA

FIGURE: 1		
REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 10-12-20



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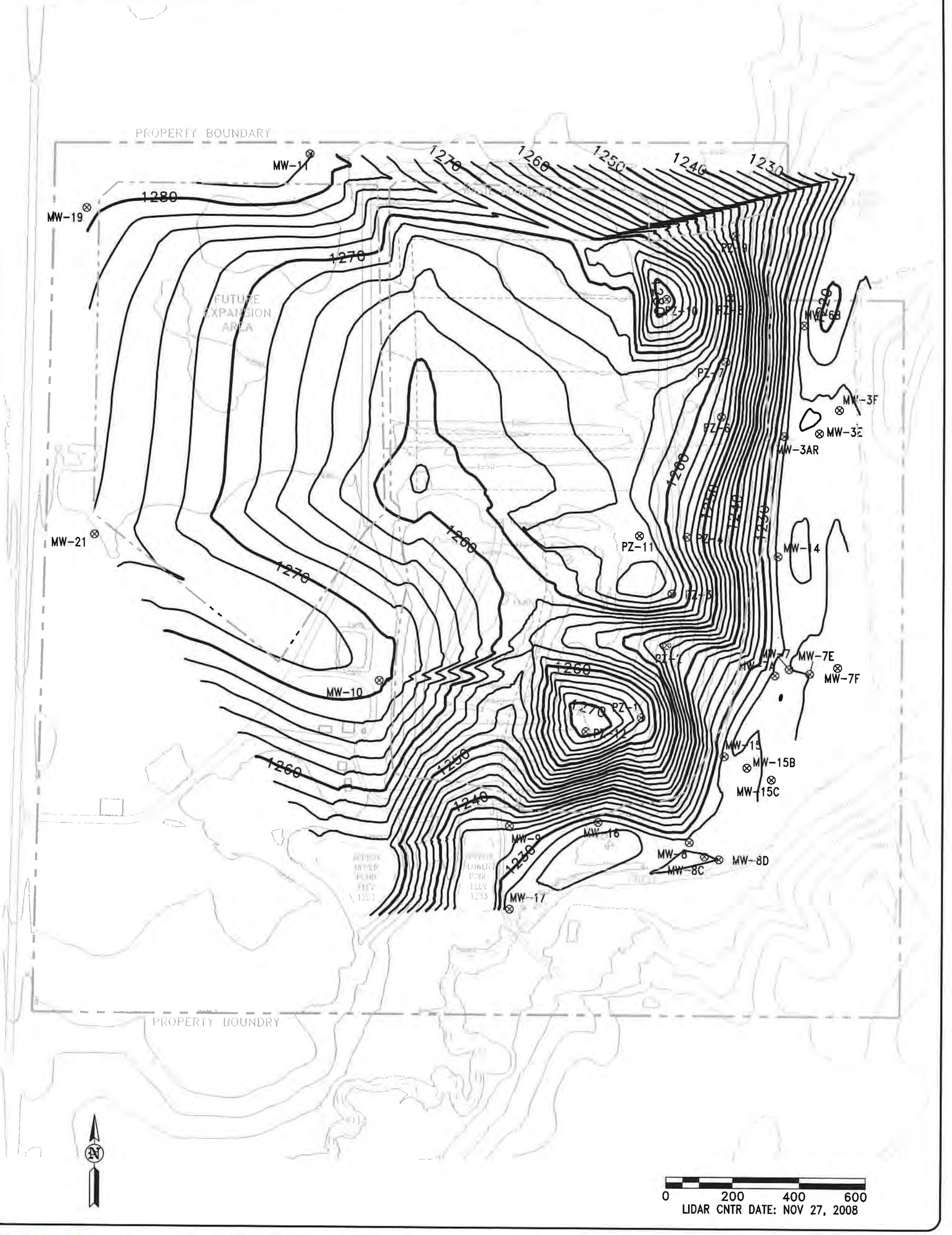
SITE PLAN AND CROSS SECTION KEY

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER IOWA

FIGURE:	2	
REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 10-12-20

WATER ELEVATION APRIL 27, 2020													
WELL	ELEV.	WELL	ELEV.	WELL	ELEV.	WELL	ELEV.	WELL	ELEV.	WELL	ELEV.	WELL	ELEV.
MW-3AR	1226.50	MW-7A	1225.30	MW-8D	1227.96	MW-15	1227.30	MW-19	1280.76	PZ-4	1255.30	PZ-9	1250.44
MW-3E	1225.16	MW-7E	1226.16	MW-9	1234.80	MW-15B	1226.99	MW-21	1275.72	PZ-6	1256.05	PZ-10	1281.31
MW-3F	1224.51	MW-7F	1227.25	MW-10	1270.70	MW-15C	1225.49	PZ-1	1264.62	PZ-7	1258.56	PZ-11	1265.16
MW-6B	1222.60	MW-8	1226.90	MW-11	1282.10	MW-16	1227.60	PZ-2	1245.15	PZ-8	1259.95	PZ-12	1271.36
MW-7	1225.90	MW-8C	1228.47	MW-14	1225.50	MW-17	1226.90	PZ-3	1264.54				



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GROUNDWATER CONTOUR MAP

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETINGER, IOWA

FIGURE: 3

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 8-27-20

WEST (A)

EAST (A)

WEST PROPERTY BOUNDARY

EAST PROPERTY BOUNDARY

SOIL BORING #1 (2019)

MW18 MW19

(2004)

MW13 MW12 MW11

SOIL BORING #11 (1984) (OUT OF SECTION)

MW5A MW5

(1979)

MW2

ROAD

CELL D2

Brown Clay

Brown Clayey Silt

Gray Clay

Gray Clay Silt

Sand

Clay

MW-19 KH=2.5E-7 KV=1.5E-7

MW-18 KH=1.41E-4

MW-11 KV=1.1E-6

MW-12 KV=2.31E-8

MW-13 KH=2.51E-4

MW-12 KH=4.41E-4

MW-5 MW-5A

APPROX. WATER TABLE

POND

1350 1340 1330 1320 1310 1300 1290 1280 1270 1260 1250 1240 1230 1220 1210 1200 1190 1180 1170 1160 1150 1140 1130

0 FT 500 FT 1000 FT 1500 FT 2000 FT 2500 FT 3000 FT

NOTES:
VIEW LOOKING NORTH.
ELEVATIONS HAVE BEEN SCALED UP BY A FACTOR OF 10.
KH AND KV IN CM/SEC.

FIGURE: 4

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 10-12-20

CROSS SECTION A - A

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

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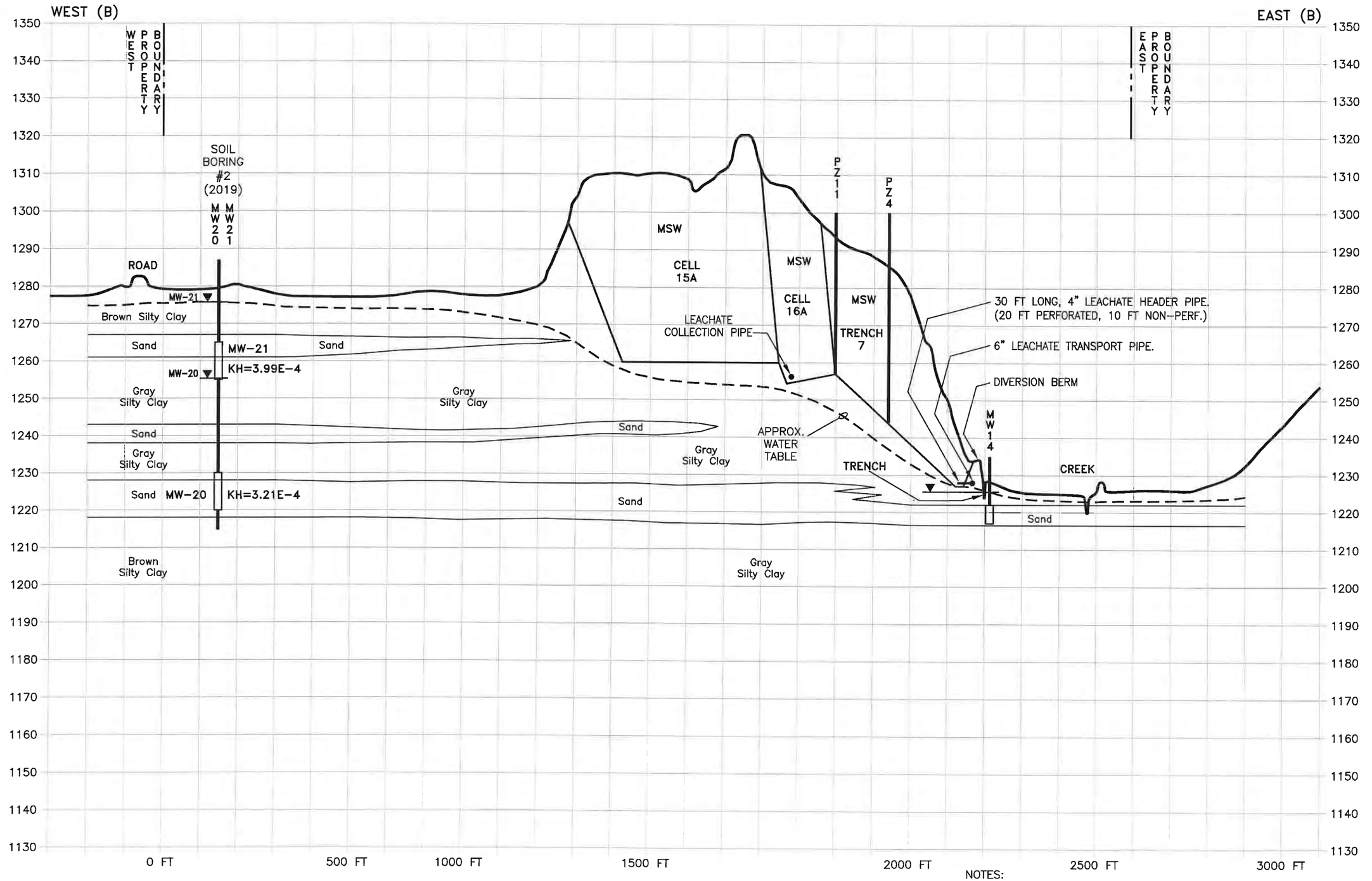

NOTES:
VIEW LOOKING NORTH.
ELEVATIONS HAVE BEEN SCALED UP BY A FACTOR OF 10.
KH IN CM/SEC.

FIGURE: 5

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 8-25-20

CROSS SECTION B - B

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

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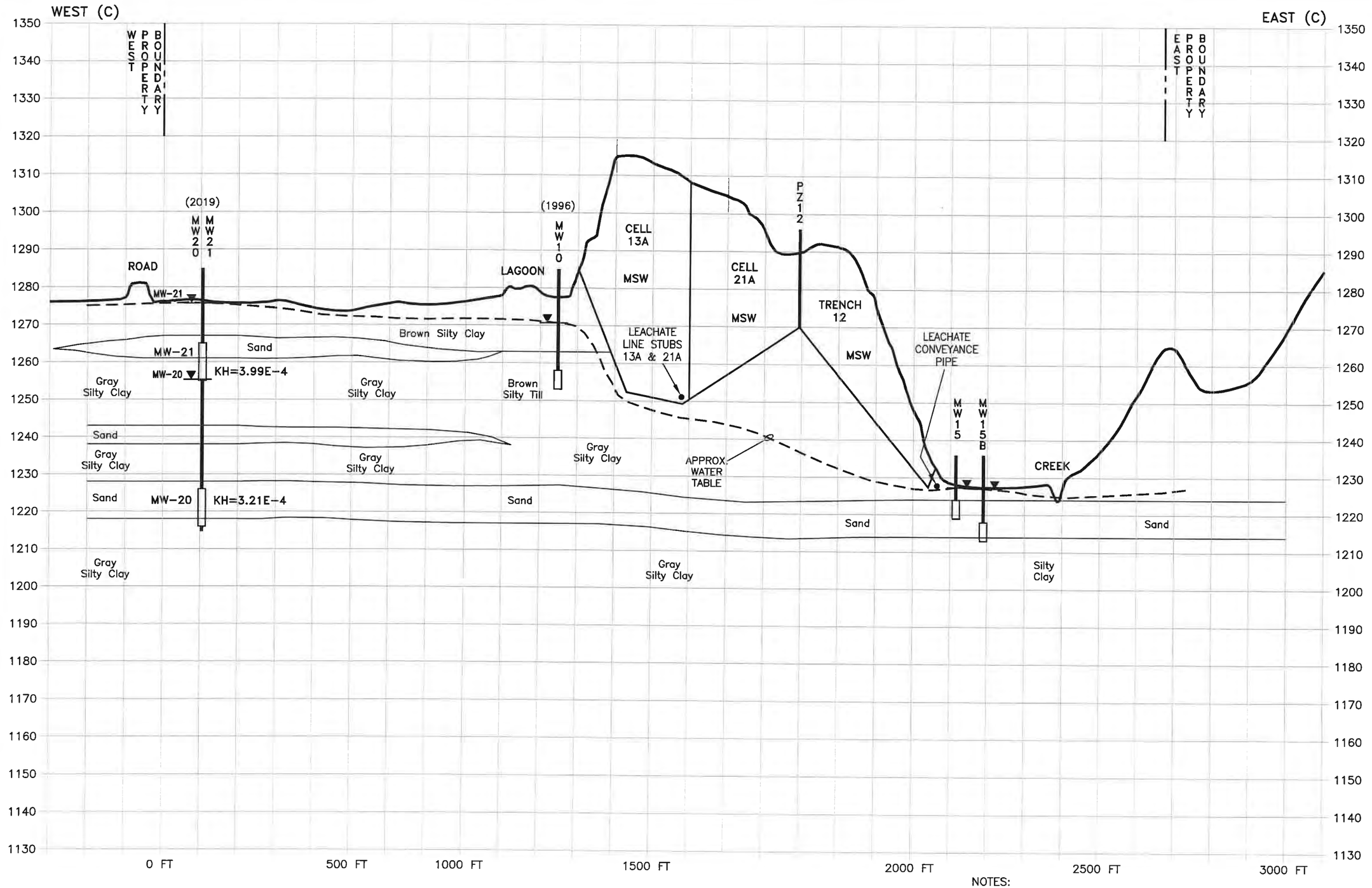

NOTES:
VIEW LOOKING NORTH.
ELEVATIONS HAVE BEEN SCALED UP BY A FACTOR OF 10.
KH IN CM/SEC.

FIGURE: 6

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 8-25-20

CROSS SECTION C - C

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

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WEST (D)

EAST (D

WEST PROPERTY BOUNDARY

EAST PROPERTY BOUNDARY

1350 1340 1330 1320 1310 1300 1290 1280 1270 1260 1250 1240 1230 1220 1210 1200 1190 1180 1170 1160 1150 1140 1130

ROAD

Clay

Sand

APPROX. WATER TABLE

POND

MW9

MW16

MW8 MW8B MW8C MW8D

POND

CREEK

1210

0 FT 500 FT 1000 FT 1500 FT 2000 FT 2500 FT 3000 FT

NOTES:
VIEW LOOKING NORTH.
ELEVATIONS HAVE BEEN SCALED UP BY A FACTOR OF 10.

FIGURE: 7

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 8-25-20

CROSS SECTION D - D

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

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SOUTH (E)

NORTH (E)

SOUTH PROPERTY BOUNDARY

NORTH PROPERTY BOUNDARY

SCALE HOUSE

MW 21 0

MW 19

MW 18

MW-21

MW-19

MW-20

MW-18

Brown Clay

Sand MW-21 KH=3.99E-4

MW-19 KH=2.5E-7 KV=1.5E-7

APPROX. WATER TABLE

Gray Clay

Sand

Clay

MW-20 KH=3.21E-4

MW-18 KH=1.41E-4

1350 1340 1330 1320 1310 1300 1290 1280 1270 1260 1250 1240 1230 1220 1210 1200 1190 1180 1170 1160 1150 1140 1130

0 FT 500 FT 1000 FT 1500 FT 2000 FT 2500 FT 3000 FT

NOTES:
VIEW LOOKING WEST.
ELEVATIONS HAVE BEEN SCALED UP BY A FACTOR OF 10.
KH AND KV IN CM/SEC.

FIGURE: 8

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 8-25-20

CROSS SECTION E - E

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

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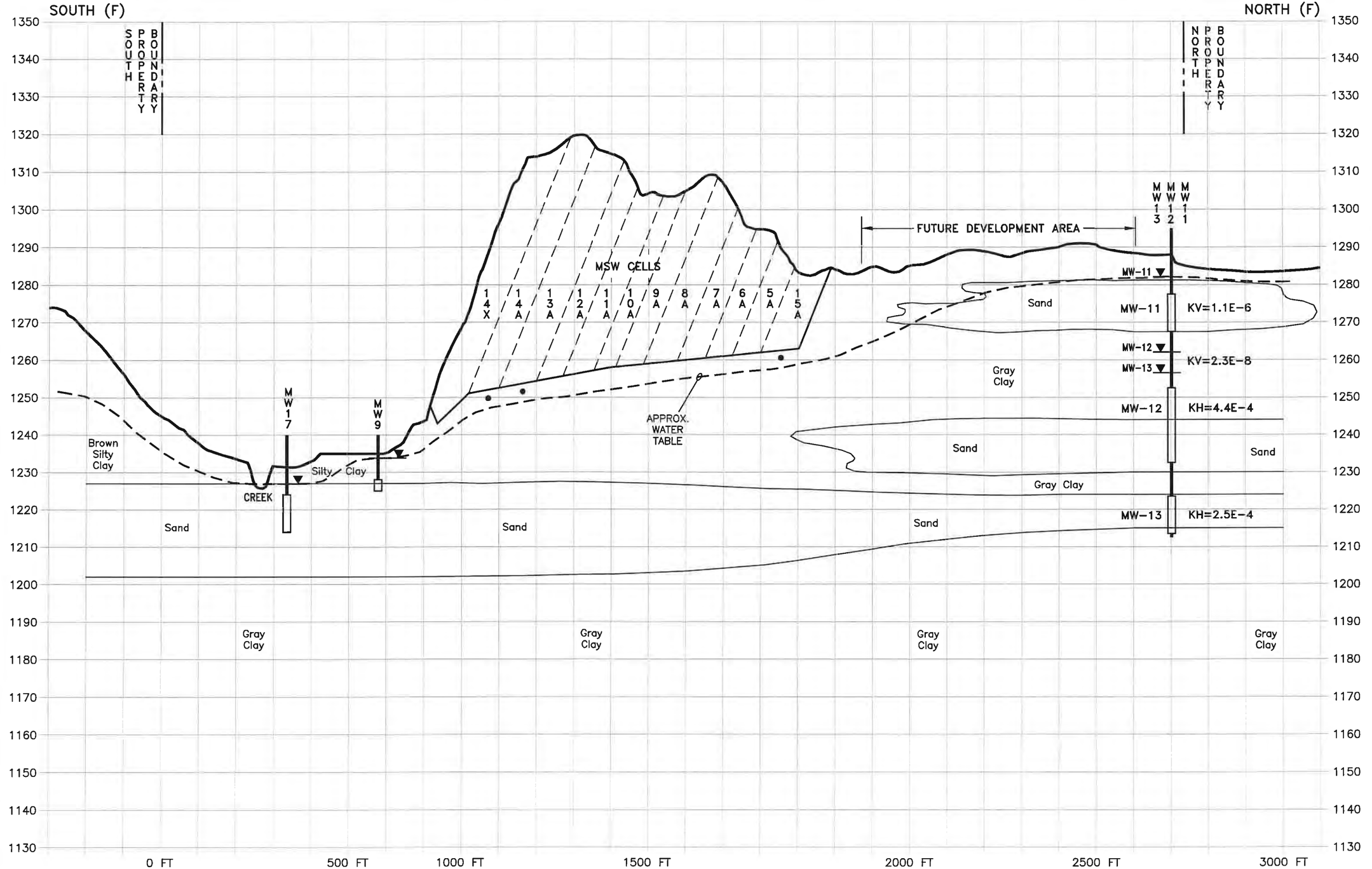

NOTES:
VIEW LOOKING WEST.
ELEVATIONS HAVE BEEN SCALED UP BY A FACTOR OF 10.
KH AND KV IN CM/SEC.

FIGURE: 9

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 8-25-20

CROSS SECTION F - F

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

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HLW Engineering Group

SOUTH (G)

NORTH (G)

SOUTH PROPERTY BOUNDARY

NORTH PROPERTY BOUNDARY

1350 1340 1330 1320 1310 1300 1290 1280 1270 1260 1250 1240 1230 1220 1210 1200 1190 1180 1170 1160 1150 1140 1130

APPROX. WATER TABLE

CREEK

MW15 MW15B MW7A MW7B MW14 MW3AR MW6A MW6B

MW-15B MW-15 MW-7A MW-7B MW-6B MW-6A

MW-15 MW-15B MW-7A MW-7B MW-6B MW-6A

Sand

Gray Clay

Clay

Sandy Till

Sand

Gray Clay

Sand

Sand

Sand

Gray Clay

0 FT 500 FT 1000 FT 1500 FT 2000 FT 2500 FT 3000 FT

NOTES:
VIEW LOOKING WEST.
ELEVATIONS HAVE BEEN SCALED UP BY A FACTOR OF 10.

FIGURE: 10

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 8-25-20

CROSS SECTION G - G

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

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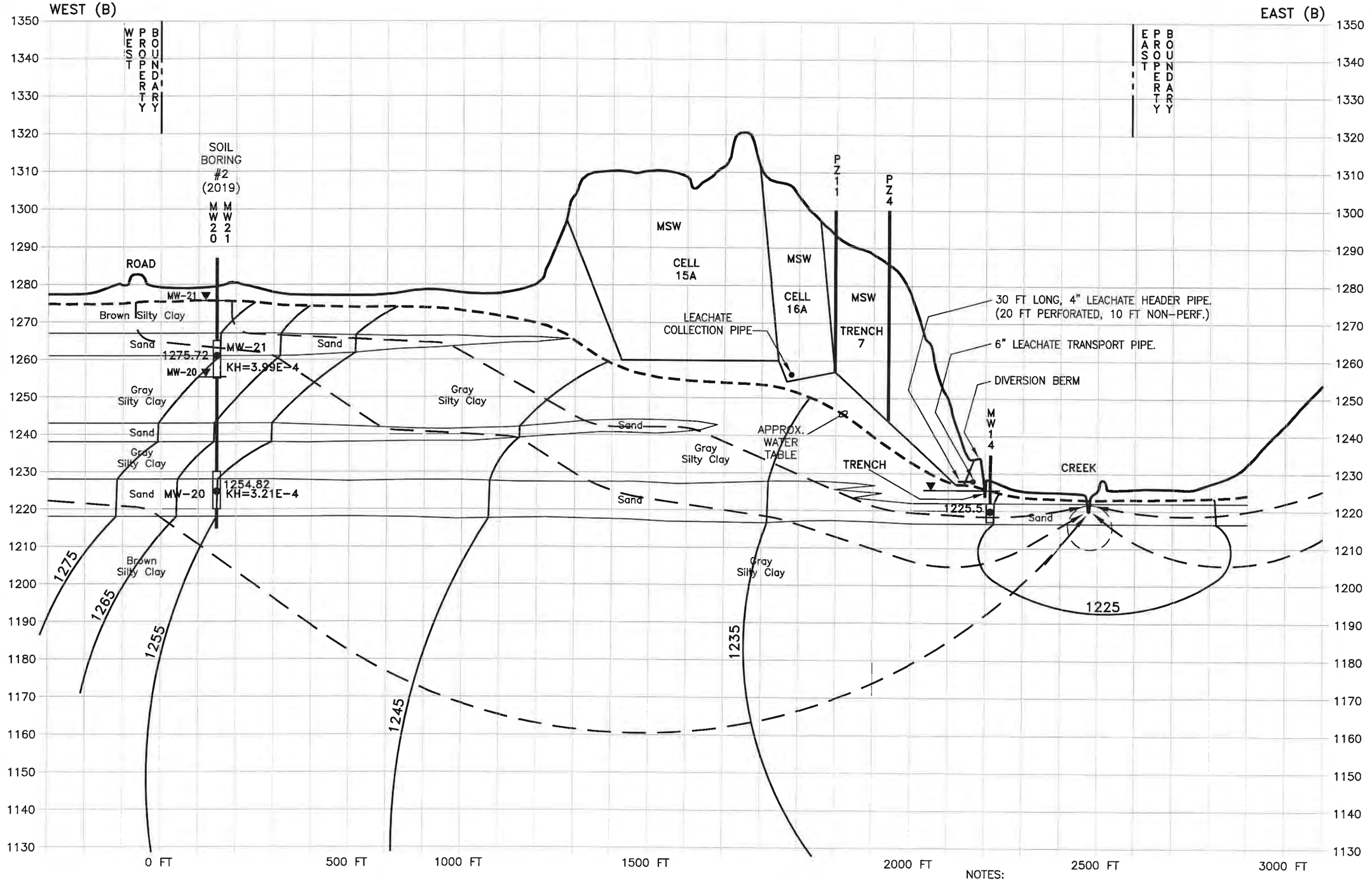

NOTES:
VIEW LOOKING NORTH.
ELEVATIONS HAVE BEEN SCALED UP BY A FACTOR OF 10.
KH IN CM/SEC.

FIGURE: 11

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 9-4-20

FLOW NET SECTION B - B

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

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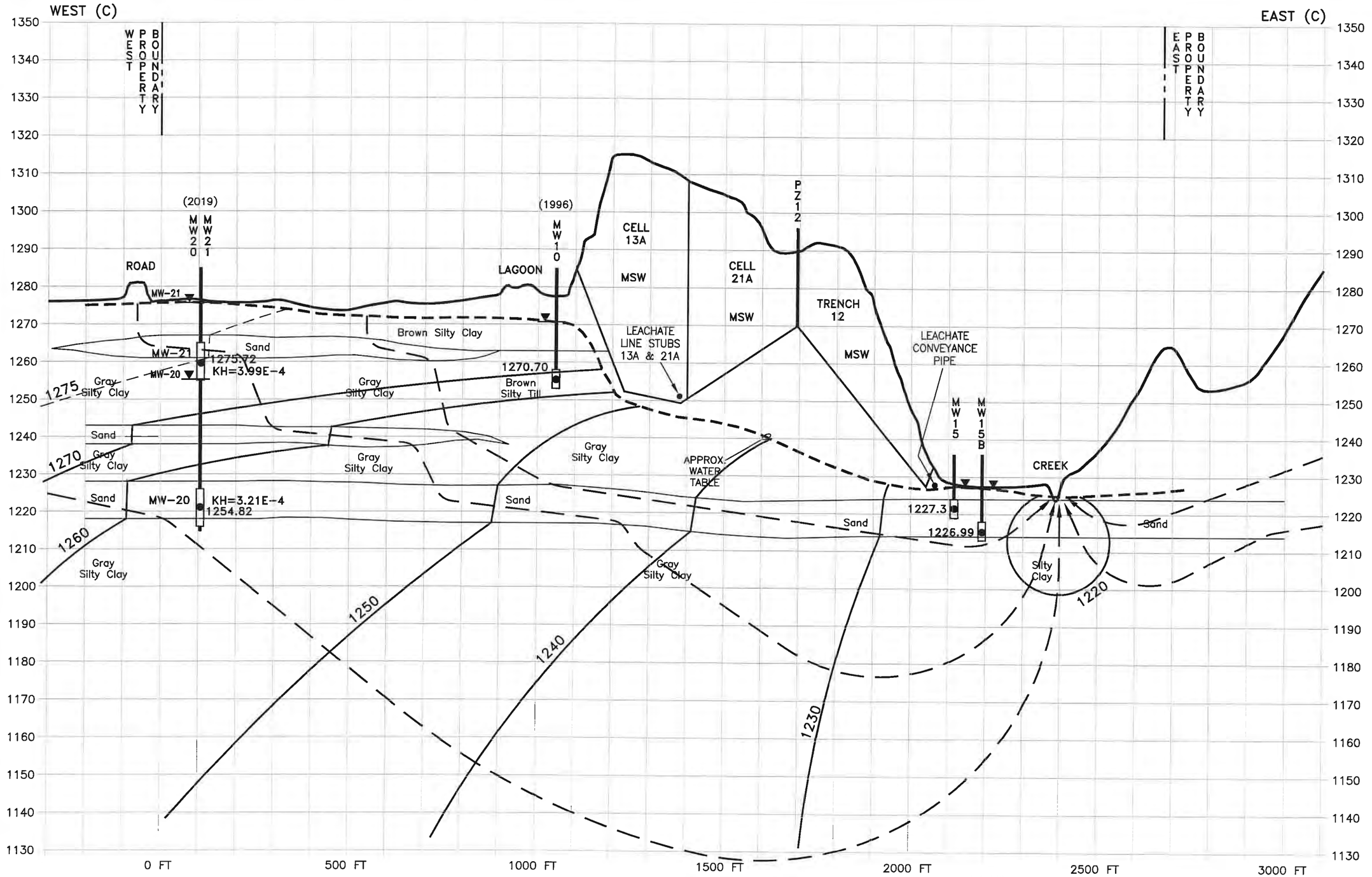

NOTES:
VIEW LOOKING NORTH.
ELEVATIONS HAVE BEEN SCALED UP BY A FACTOR OF 10.
KH IN CM/SEC.

FIGURE: 12

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 9-4-20

FLOW NET SECTION C - C

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

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HLW Engineering Group

SOUTH (E)

NORTH (E)

SOUTH PROPERTY BOUNDARY

NORTH PROPERTY BOUNDARY

SCALE HOUSE

MW 21 0

MW 19 8

MW-21

MW-19

MW-20

MW-18

Brown Clay

Sand MW-21 KH=3.99E-4

1275.72

MW-19 1280.76 KH=2.5E-7 KV=1.5E-7

APPROX. WATER TABLE

Gray Clay

Sand

Clay

1270

1280

1260

1220

1230

1240

1250

MW-20 KH=3.21E-4 1254.82

MW-18 1254.97 KH=1.41E-4

0 FT

500 FT

1000 FT

1500 FT

2000 FT

2500 FT

3000 FT

NOTES:
VIEW LOOKING WEST.
ELEVATIONS HAVE BEEN SCALED UP BY A FACTOR OF 10.
KH AND KV IN CM/SEC.

FLOW NET SECTION E - E

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

FIGURE: 13

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 9-2-20

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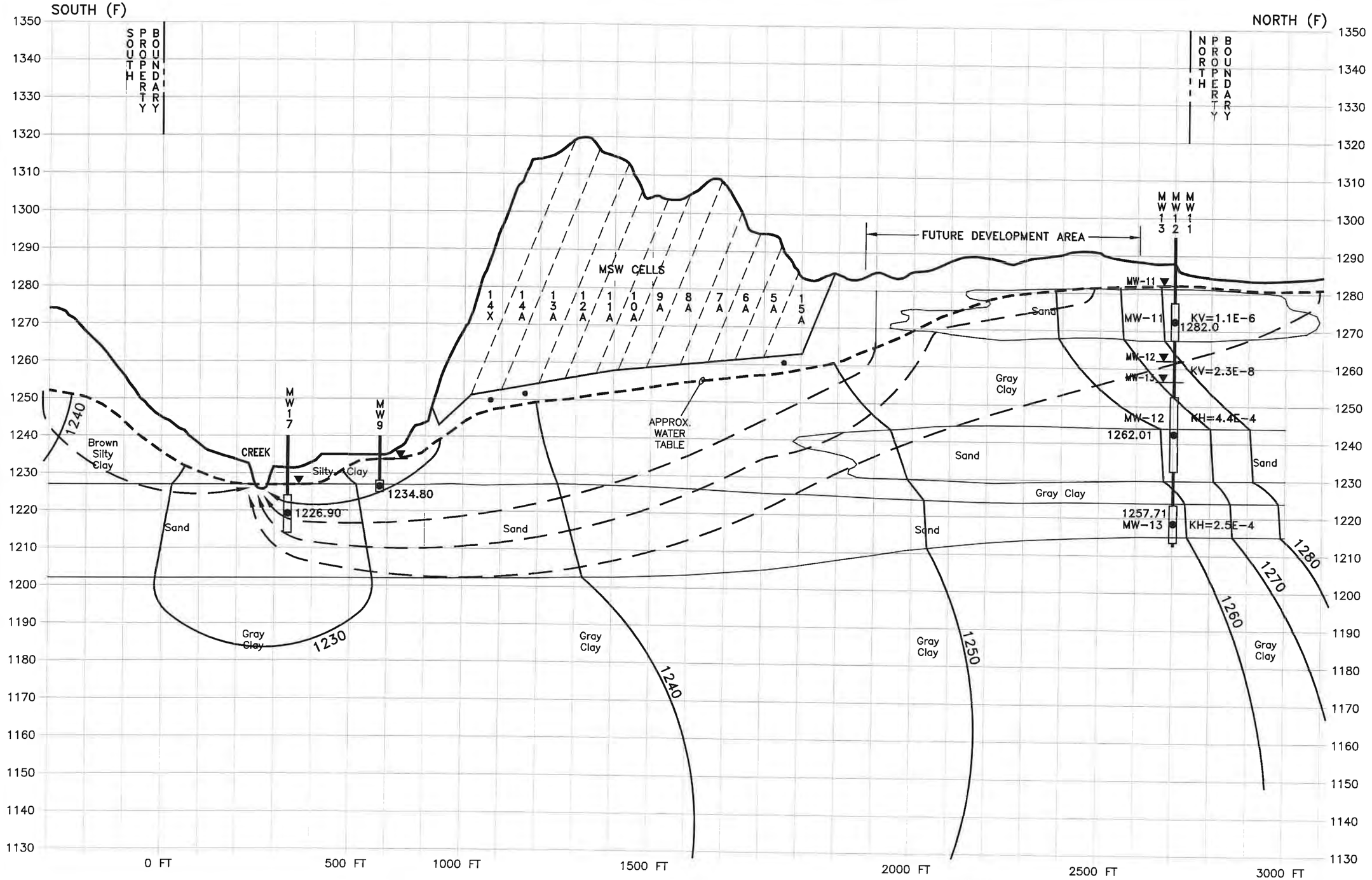

NOTES:
VIEW LOOKING WEST.
ELEVATIONS HAVE BEEN SCALED UP BY A FACTOR OF 10.
KH AND KV IN CM/SEC.

FIGURE: 14

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 9-4-20

FLOW NET SECTION F - F

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

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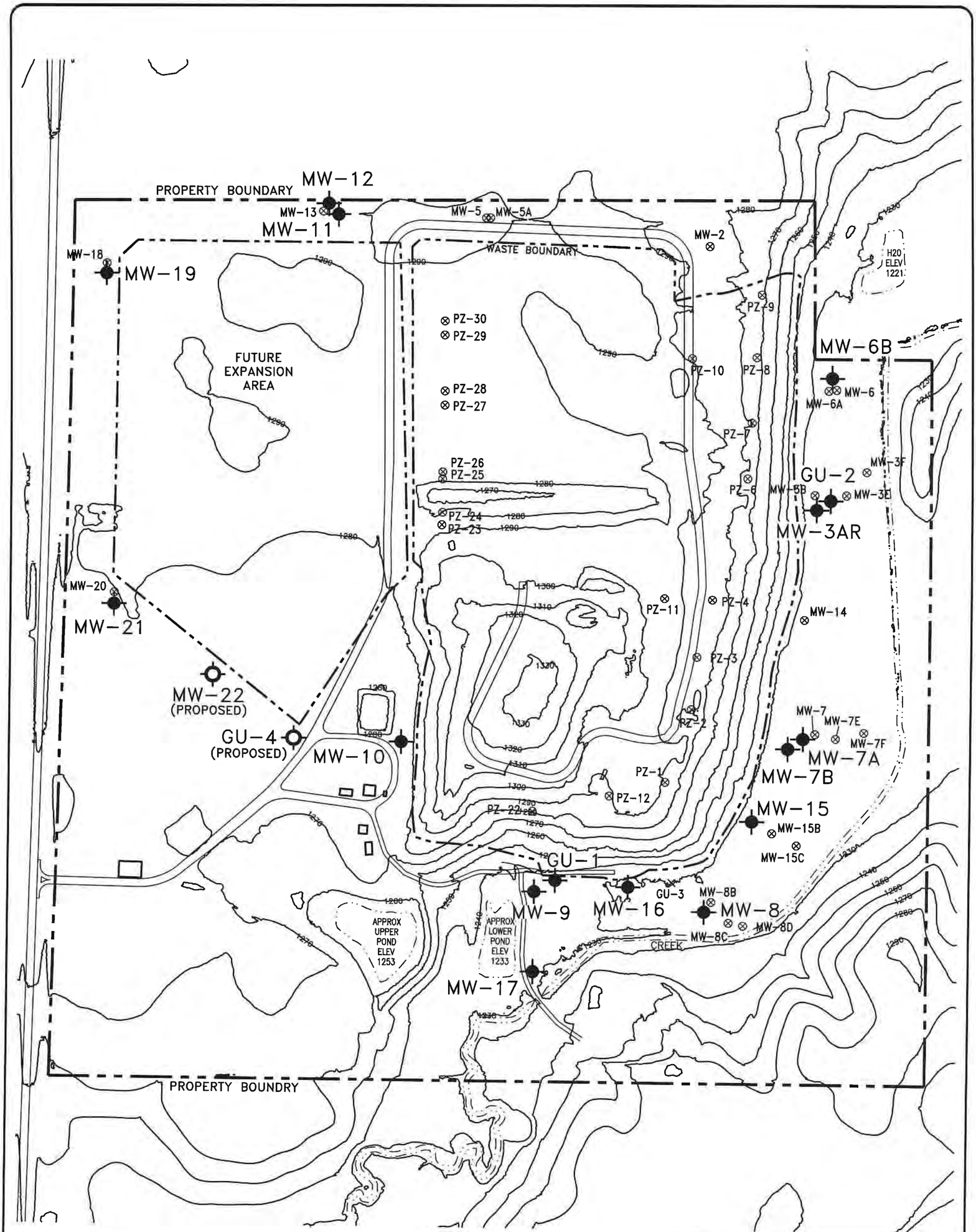
HLW Engineering Group



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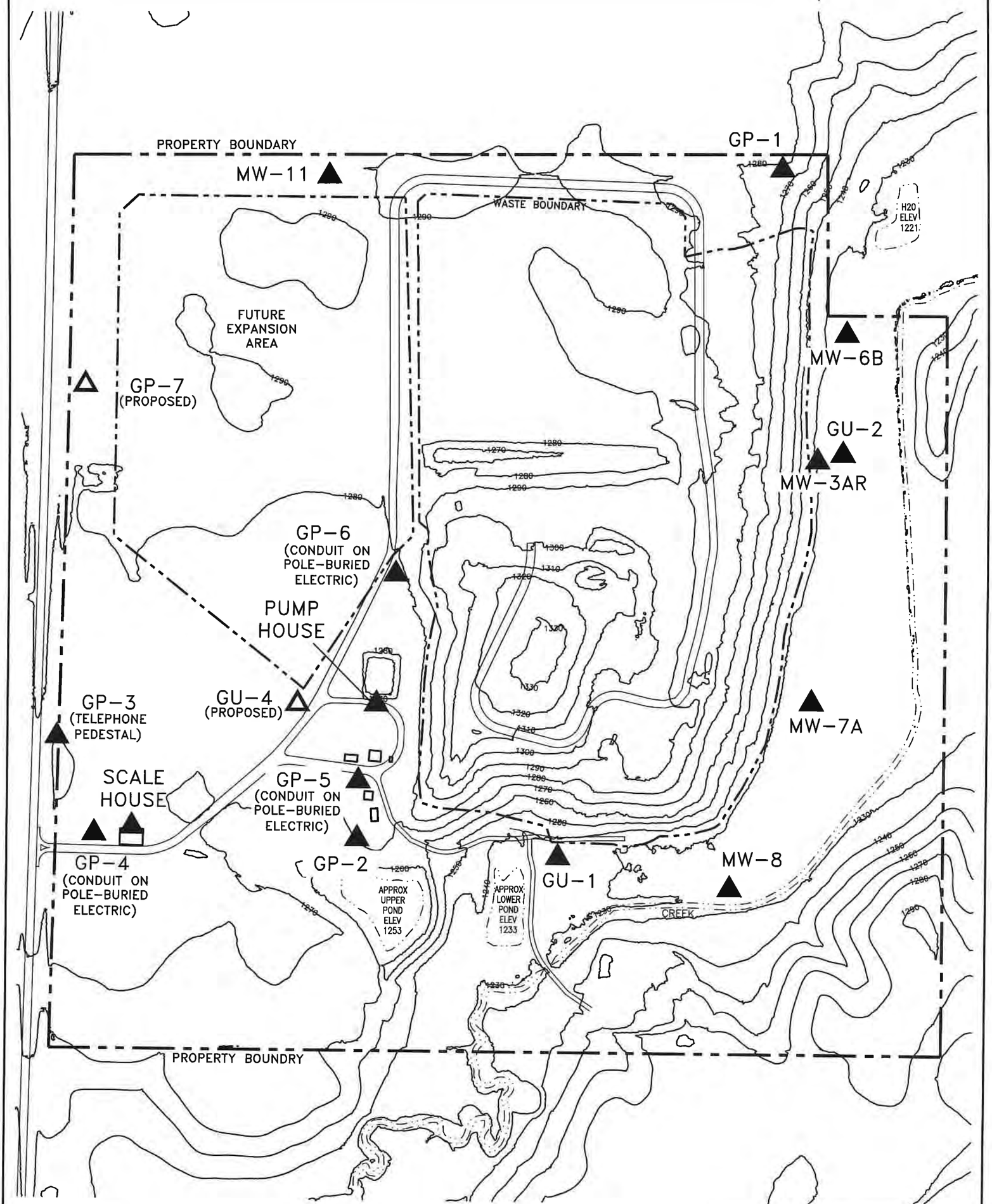
HSMP MONITORING POINTS

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

FIGURE: 15		
REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 9-4-20



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GSMP MONITORING POINTS

NORTHERN PLAINS REGIONAL SANITARY LANDFILL
GRAETTINGER, IOWA

FIGURE: 16

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6021	DATE 9-4-20

APPENDIX 1

Operating Permit

DEPARTMENT OF NATURAL RESOURCES

GOVERNOR KIM REYNOLDS
LT. GOVERNOR ADAM GREGG
DIRECTOR CHUCK GIPP

November 03, 2017

Con 12-1-1
Doc # 90724

MARK WHITE
PUBLIC WORKS DIRECTOR
CITY OF SPENCER
418 2ND AVENUE WEST
SPENCER IA 51301

RE: Northern Plains Regional Sanitary Landfill
Permit No. 74-SDP-02-76P
Revised Permit (Cell D1)

Dear Mr. White:

Enclosed is the revised permit for the Northern Plains Regional Landfill. The permit and the approved plans must be kept at the sanitary disposal project in accordance with the recordkeeping and reporting requirements of paragraph 113.11(1)"a". Please review the permit with your operators, as they must become familiar with it.

The Certification Report approval for Cell D1 is located in Special Provision 3 part "i."

Note that the permit contains special provisions that may require a response or action by you which, if not properly complied with, may prompt enforcement action by this department.

Please contact me at 515-725-8358 or geoffrey.spain@dnr.iowa.gov if you have any questions.

Sincerely,

Geoffrey Spain
Environmental Engineer

cc: Jim Thiesse
Kruse, Cate & Nelson, P.C.
1801 Highway Blvd.
Spencer, IA 51301

Chuck Duhn
Northern Plains Regional Landfill
P.O. Box 117
Graettinger, IA 51342

DNR Field Office #3, Spencer

IOWA DEPARTMENT OF NATURAL RESOURCES
SANITARY DISPOSAL PROJECT PERMIT

I.	**Permit Number:**	74-SDP-02-76P
II.	**Permitted Agency:**	Northern Plains Regional Landfill
III.	**Project Location:**	The NW 1/4 of Section 21, Township 97 North, Range 33 West of the 5th Principal Meridian, Palo Alto County, Iowa, except the northerly 470.00 feet of the easterly 350.00 feet of the Northwest Quarter, all located in Section 21, Township 97 North, Range 33 West of the 5th Principal Meridian, Palo Alto County, Iowa.
IV.	**Responsible Official**	
	Name:	Mark White
	Address:	Public Works Director City of Spencer, Iowa 418 2nd Avenue West Spencer, IA 51301
	Phone:	712-580-7200
	FAX:	712-580-7236
V.	**Licensed Design Engineer**	
	Name:	James E. Thiesse, PE
	Address:	Kruse, Cate & Nelson, P.C. 1801 Highway Blvd. Spencer, IA 51301
	Phone:	712-262-3468
	FAX:	
	Iowa License Number:	12304
VI.	**Date Permit Issued:**	November 4, 2015
VII.	**Permit Expiration Date:**	November 4, 2020
VIII.	**Issued by:**	_____ Iowa Department of Natural Resources

IX. General Provisions

The above named permitted agency is hereby authorized to operate a sanitary disposal project at the described location in conformance with Iowa Code section 455B, the rules pursuant thereto existing at the time of issuance, and any subsequent new rules which may be duly adopted, and any provisions contained in Section X of this permit.

The issuance of this permit in no way relieves the applicant of the responsibility for complying with all other local, state, and federal statutes, ordinances, and rules or other requirements applicable to the establishment and operation of this sanitary disposal project.

No legal or financial responsibility arising from the construction or operation of the approved project shall attach to the State of Iowa or the Department of Natural Resources (DNR) due to the issuance of this permit.

If title to this project is transferred, the new owner must apply to the DNR for a transfer of this permit within thirty days of the date of title transfer pursuant to subrule 113.4(3). This permit is void sixty days after the date of title transfer unless the DNR has transferred the permit.

The permit holder shall file a Quarterly Solid Waste Fee Schedule and Retained Fee Report utilizing the DNR's Form 542-3276 and remit tonnage fee payment, as applicable, for all wastes disposed at the sanitary disposal project in accordance with Iowa Code section 455B.310. The Reports will be due January 1, April 1, July 1 and October 1 for the quarters ending September 30, December 31, March 31 and June 30, respectively. The permit holder shall mail the completed report to the Solid Waste Section, Wallace State Office Building, 502 East Ninth Street, Des Moines, Iowa 50319. This reporting procedure supersedes any previous conflicting permit provisions.

The permit holder shall weigh all solid waste collection vehicles and solid waste transport vehicles on a scale certified by the Iowa Department of Agriculture and Land Stewardship. If conditions are such that make it impractical to provide an on-site scale, then off-site scale facilities may be used if justified and approved by the DNR. The permit holder shall comply with the waste weighing, record keeping and tonnage fee reporting requirements defined in rule 101.14(455B,455D). The scale weighing facilities shall comply with the certification and licensing requirements of the Iowa Department of Agriculture and Land Stewardship at all times. The permit holder shall maintain a current copy of the weighing scale facility licensing certificate issued by the Iowa Department of Agriculture and Land Stewardship at all times.

The permit holder shall comply with the gas control provisions of IAC 567 Chapters 20 through 31, including paragraph 23.1(2)"rrr" for the New Source Performance Standards and paragraph 23.1(5)"a" for the Emission Guidelines.

The permit holder shall ensure that the sanitary disposal project does not (1) cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirements of the Clean Water Act, including, but not limited to, the National Pollutant Discharge Elimination System (NPDES) requirements, pursuant to Section 402 of the Clean Water Act, and (2) cause the discharge of a nonpoint source of pollution into waters of the United States, including wetlands, that violates any requirement of an area wide or statewide water quality management plan that has been approved under Section 208 or 319 of the Clean Water Act.

The permit holder shall submit an updated Municipal Solid Waste Sanitary Landfill Financial Assurance Report Form no later than April 1st, annually, pursuant to rule 113.14(455B). Use of

this form provides permit holders a uniform means of submitting all required documentation to ensure that closure and postclosure cost estimates and applicable financial assurance instruments are updated as required.

Failure to comply with Iowa Code section 455B, or any rule of order promulgated pursuant thereto, or any provisions of this permit may result in 1) a civil penalty of up to $5000 for each day of violation, pursuant to Iowa Code section 455B.307, or 2) the suspension or revocation of this permit, pursuant to Iowa Code section 455B.305.

X. Special Provisions

1. The permit holder is authorized to accept solid waste for disposal in accordance with the approved *Northern Plains Regional Landfill* Comprehensive Planning Area). The Comprehensive Plan as approved by the DNR on 11/01/2013 and updated on 05/29/2015; any approved amendments to the plan; and the latest plan update, are hereby incorporated as permit plan documents.

   The permitted service area includes: All cities, and the unincorporated area in Emmet County; all cities, excluding West Bend, and the unincorporated area in Palo Alto County; all cities, excluding Fonda and Gilmore City, and the unincorporated area in Pocahontas County; the City of Whittemore in Kossuth County; the Cities of Superior and Terrill in Dickinson County; the City of Bode in Humboldt County; the City of Spencer in Clay County and the unincorporated area in Clay County.

   In accordance with subrule 101.13(2), the permit holder shall submit an updated Comprehensive Solid Waste Management Plan, to the DNR by *1/1/2016*.

2. The permit holder shall develop and operate the site in accordance with the approved Operation Plan, dated 3/1/2008 (docDNA #18210) as included in Appendix 1 of the permit renewal documents dated 4/30/2008 (docDNA #21137) and the Development and Operation Plan, dated 3/20/2015 (docDNA #81755), both as submitted by Kruse, Cate & Nelson, P.C.; and hereby approved, and the following:

   a. Waste disposal is limited to *Cell A, Cell B, and Cell C*. The site vertical height shall not exceed a maximum waste elevation of 1361 feet as shown on drawing no. 1717EXP-X1, submitted with the Permit Renewal Documents, dated October 30, 2014. Any further expansion beyond these cells shall require prior DNR approval.

   b. The permit holder shall collect leachate from the leachate control system and properly dispose of the leachate either by treatment in an on-site facility, discharge with an NPDES permit; or by discharge to the *City of Spencer* publicly owned treatment works (POTW). If the discharge is to a POTW with a pretreatment program approved by the DNR, the discharge must comply with the terms and conditions of a local permit issued for the discharge by the POTW. If the discharge is to a POTW without an approved pretreatment program a completed treatment agreement form shall be submitted to the DNR's Wastewater Section. Copies of the local permit or treatment agreement shall

be provided to the DNR's Solid Waste Section and the local Field office. The treatment agreement must be on DNR Form 31 (542-3221) and must comply with the requirements of subrule 64.3(5).

In addition, the permit holder shall *monthly* measure leachate head levels and elevations at all piezometers and daily at leachate piezometers in Cells A, B, and C in accordance with the Leachate Recirculation Operation Plan, dated February 28, 2014, and record the volume of leachate collected and transported to the treatment works and storage and operation checks in accordance with Leachate Control Plan – Amendment A, dated October 3, 2013. Records of leachate contaminants testing required by the treatment works and any NPDES permit for on-site treated leachate discharges shall be maintained.

The permit holder shall annually submit a Leachate Control System Performance Evaluation (LCSPE) Report pursuant to subparagraph 113.7(5)"b"(14) as a supplement to the facility Annual Water Quality Report, as defined in subrule 113.10(10).

c. The permit holder shall follow the approved Emergency Response and Remedial Action Plan (ERRAP) procedures during all emergencies pursuant to subrule 113.8(5). An updated ERRAP shall be submitted at the time of each permit renewal application. An updated ERRAP shall be included with any request for permit modification to incorporate a facility expansion or significant changes in facility operation that require modification of the currently approved ERRAP.

3. The permit holder shall submit prior to the next unit construction updated plans and specifications for the remainder of the expansion prepared in accordance with rule 113.7.

   a. The permit holder shall notify the Department and have the site inspected when the construction of a new MSWLF unit or significant components thereof has been completed, in accordance with subrule 113.4(6). Prior to the inspection, the QC&A officer shall submit a final report to the department that verifies compliance with the requirements of rule 113.7 and the approved plans and specifications. No waste disposal shall commence in any newly constructed unit or portion thereof until it has been inspected and approved by the Department.

   b. The Construction Certification Report, dated August 27, 2003, as prepared by James E. Thiesse, P.E. with Kruse, Cate & Nelson, PC. for the construction of Cells 18A, 19A, and 20A and approved August 29, 2003 is incorporated as part of the permit documents.

   c. The Construction Certification Report, dated October 28, 2004, as submitted by Kruse, Cate & Nelson, P.C. for the construction of Cell 21A and approved November 17, 2004 is incorporated as part of the permit documents.

   d. The Construction Certification Report, dated August 4, 2006, as prepared by James E. Thiesse, P.E. with Kruse, Cate & Nelson, P.C. for the construction of Cell A and approved on August 30, 2006 is incorporated as part of the permit documents.

e. The Quality Control & Assurance Plan Final Report and drawings certifying construction of Cell B, dated August 18, 2010, and approved on August 24, 2010, as submitted by Kruse, Cate, & Nelson, P.C., are hereby incorporated into the permit documents.

f. The Quality Control & Assurance Plan Final Report 2013 Cell C Expansion Project, dated October 16, 2013 and approved on October 25, 2013 as submitted by Kruse, Cate & Nelson, P.C., are hereby incorporated into the permit documents.

g. The Iowa Professional Engineer Certification of Alternative Landfill Liner System dated February 25, 1999 and contained in the Alternative Liner Evaluation Report for Flanagan Landfill, dated February 1999, as submitted by Jacobson-Westergard & Associates, Inc. and approved on November 5, 1999, is incorporated into the permit documents. The approved alternative liner system for this facility is applicable to Cells 15A, 16A and 17A. This liner consists of a four foot compacted soil liner with a coefficient of permeability of 1X10-7 cm/sec or less.

h. The permit holder is authorized to construct Cell D1 per the hereby approved plans and specifications, dated March 6, 2017, as submitted by Kruse, Cate, & Nelson, P.C.. Deviations from the approved plans and specifications shall be approved by the DNR prior to their construction. Any further construction beyond this area shall require prior DNR approval. No waste disposal shall commence in this cell until the construction certification report has been submitted and the cell has been inspected and approved by the Department.

i. The Certification Report for the completed Cell D1, dated October 2, 2017, as submitted by Kruse, Cate & Nelson, P.C., is hereby approved and incorporated into the permit documents. Cell D1 is approved for waste disposal.

4. Hydrologic monitoring at the site shall be conducted in accordance with the Hydrologic Monitoring System Plan (HMSP) dated 5/28/2012, as submitted by HLW Engineering Group and approved on 7/23/2012; and the following:

   a. The HMSP shall include groundwater monitoring points MW-11, MW-12, MW-3AR, MW-6B, MW-7A, MW-7B, MW-8, MW-9, MW-10, MW-14, MW-15, MW-16, GU-1, GU-2, and GU-3.

   b. Groundwater monitoring points MW-3B, MW-6A, MW-8B may be retained as water level measuring points.

   c. DNR construction documentation form 542-1277 and boring logs for all monitoring wells and piezometers shall be submitted within 30 days of installation. DNR construction documentation form 542-1323 shall be submitted within 30 days of establishing surface water monitoring points.

d. The permit holder shall conduct background and routine semiannual groundwater sampling and analysis; as well as perform statistical tests for the approved monitoring points for Appendix 1 in accordance with rule 113.10(455B). Groundwater samples shall **not** be field-filtered prior to laboratory analysis.

e. The frequency for full Appendix II analysis at monitoring points that are in assessment monitoring and have had at least two (2) rounds of analysis using the entire Appendix II list may be increased to once every (5) five years. If monitoring points exit assessment monitoring and later return to assessment monitoring an additional two (2) rounds of analysis using the entire Appendix II list is required.

f. The permit holder shall meet the requirements of DNR document Unnumbered Amendment Regarding Turbidity, dated July 10, 2014.

g. The permit holder shall measure groundwater elevations within 1/100 of a foot in each well and immediately prior to purging, each time groundwater is sampled.

h. An Annual Water Quality Report (AWQR) summarizing the effects the facility is having on groundwater quality shall be submitted to the DNR's Solid Waste Section by January 31 each year. This report shall be prepared in accordance with subrule 113.10(10) by a qualified groundwater scientist pursuant to paragraph 113.10(1) "d".

h. The permit holder shall meet the requirements of DNR document Unnumbered Amendment Regarding Semiannual Water Quality Reports (SAWQR), dated May 22, 2013.

i. Monitoring Well Construction Documentation Forms for monitoring wells MW-14, MW-15 and MW-16, October 30,2008 as included in Appendix C of the HMSP, dated May 28, 2010 are hereby incorporated into the permit documents.

j. The permit holder is authorized to perform the full Appendix II sampling for monitoring points MW-7A, MW-7B, MW-8, MW-14, MW-15, and GU-1 on a five year frequency rather than annually. Should additional constituents be detected during any full Appendix II sampling event that were not detected previously the frequency may be increased.

5. The permit holder is authorized to recirculate leachate in accordance with the *2015 Revised Leachate Recirculation Operation Plan* dated April 15, 2015, as submitted by Northern Plains Regional Landfill; and approved on April 22, 2015; and the following:

   a. The Leachate Control Plan, dated October 3, 2013, prepared by Kruse, Cate & Nelson, P.C., is hereby approved and incorporated into the permit.

   b. Leachate application is restricted to only those MSWLF units with a composite liner constructed in accordance with paragraph 113.7(5) "a". Additionally, the permit holder must maintain a 2:1 (horizontal : vertical) separation from the recirculation points and

the unlined waste area. As the waste elevation in Cells A, B, and C increase the horizontal setback will need to be increased. The recirculation area shall be staked annually by a professional engineer or surveyor licensed in the State of Iowa.

c. The leachate recirculation system shall not contaminate waters of the state, contribute to erosion, damage cover material, harm vegetation, or spray persons at the MSWLF facility, pursuant to paragraph 113.8(2)"h".

d. Leachate shall not be applied on user vehicle access areas.

e. Leachate shall not be applied to vegetated areas or frozen waste cover. A means of frost protection must be provided for all leachate control elements.

f. Leachate shall be applied evenly on the working area.

g. Leachate recirculation shall be conducted only during hours of operation and when an operator is on duty.

h. Leachate shall be applied in a manner such that ponding or runoff will not occur.

i. Leachate recirculation shall be controlled such that not more than one foot of leachate head will be allowed to accumulate above the MSWLF unit liner.

j. Records shall be maintained as to the time and quantities of leachate application and be submitted with the facility Annual Leachate Control System Performance Evaluation Report (LCSPER).

k. Leachate recirculation shall be immediately terminated if it causes ponding, runoff, excessive odor, vector control problems, vapor drift, ice formation, or operational problems. The DNR's local Field office shall be immediately notified if any of the above events occur.

6. The permit holder shall conduct subsurface gas monitoring in accordance with the *Gas Monitoring System Plan,* dated May 4, 2012, as submitted by HLW, and approved on July 23, 2012, and the following:

   a. The permit holder shall quarterly monitor and annually report site methane concentrations in accordance with rule 113.9(455B) at the locations shown on Figure 1 and MW-11.Specific actions, as defined in the rules, shall be taken in the event of methane gas level limit exceedances.

   b. The permit holder shall annually submit a report by January 31 summarizing the methane gas monitoring results and any action taken resulting from gas levels exceeding the specified limits during the previous 12 months as a supplement to the facility Annual Water Quality Report, as defined in subrule 113.10(10).

7. The Automobile Shredder Residue (ASR) as Alternative Daily Cover request, dated June 7, 2012, as submitted by Kruse, Cate & Nelson, P.C., and the subsequent electronic mail request to include Wire Shredder Residue dated, June 19, 2012, are both hereby approved and incorporated into the permit documents. The permit holder is authorized to use ASR and WSR (referred throughout as "Shredder Residue" from Shine Bros., Inc. of Spencer, Iowa as an alternative cover material, subject to the following:

   a. The permit holder is authorized to use Shredder Residue from Shine Bros., Inc. in Spencer, Iowa as an alternative cover material for a trial period of 90 calendar days from commencement. The 90 day trial period shall begin July 1, 2012.

   b. The permit holder is authorized to use the Shredder Residue as an alternative cover material without mixing with soil during this trial period.

   c. The permit holder shall remove all materials exceeding 1.5 inches in size before using as an alternative daily cover material. Quantities exceeding 2-weeks usage shall be disposed of in the workface area. Only Shredder Residue placed at a ratio of 3:1 (3 tons waste to 1 ton of approved Shredder Residue) will be considered alternative daily cover.

      Statewide tonnage fees shall be remitted quarterly in the amount of $5,000 to account for Shredder Residue used in excess of the 3:1 ratio. The first quarterly payment of $5,000 shall be remitted with the tonnage fee report that is due January 1, 2013. Tonnage fee payments for Shredder Residue shall be reevaluated at the time of next permit renewal, or sooner, if the total amount of waste disposed of at the landfill increases significantly to where all Shine Bros. waste can be used beneficially as ADC at the approved ratio.

   d. The Shredder Residue may be used in lieu of the 6-inch daily cover requirement. Shredder Residue shall not be used as a substitute for intermediate or final soil cover.

   e. The waste must be compacted before the Shredder Residue is applied, to provide an even surface to minimize ponding, prevent pockets, and to maximize uniform surface drainage.

   f. Shredder Residue shall be applied to the active waste face at the end of each day of operations and more frequently if necessary to control fire or fire hazards, blowing litter, odors, insects and rodents.

   g. The permit holder shall maintain in the landfill files appropriate quarterly laboratory analytical documentation that demonstrates that the Shredder Residue is not hazardous by TCLP metals test, contains no PCBs that equal or exceed 50 ppm, is not ignitable, and has certification from the generator that the material was processed according to the above noted specifications. Documentation reporting of such testing shall be submitted to both the Department's Main and local Field office.

h. The use as daily cover of Shredder Residue from any other generator than the one approved above shall be subject to specifications approval by the Department.

i. If the Shredder Residue is found by the Department not to be performing satisfactorily, its use shall be discontinued and the remaining materials shall be disposed in the working face.

j. Within 30 days after completion of the trial period, a report shall be submitted to the Department evaluating the effectiveness of the Shredder Residue as an alternative cover material in controlling fire or fire hazards, blowing litter, odor, insects, rodents and precipitation entry into the waste. The report shall include the amount necessary on a daily basis to achieve the effectiveness as described above. The report shall also include TCLP and PCB test results.

k. Provided the report is submitted by August 1, 2012, and the evaluation demonstrates that the Shredder Residue is effective as an alternative cover material, the permit holder may continue to use the Shredder Residue as cover material until the Department issues a decision relative to the permanent use of the Shredder Residue as an alternative daily cover material at this site.

8. The Automobile Shredder Residue (ASR)/Wire Shredder Residue (WSR) Alternative Daily Cover Demonstration - Final Report, dated October 18, 2012 as submitted by the City of Spencer for the Northern Plains Regional Landfill is hereby approved and incorporated into the permit documents.

9. The Automobile Shredder Residue (ASR) as Alternative Daily Cover (ADC) request, dated June 7, 2012, as submitted by Kruse, Cate & Nelson, P.C., and the subsequent electronic mail request to include Wire Shredder Residue dated, June 19, 2012, are both approved and incorporated into the permit documents. The permit holder is authorized to use ASR and WSR (referred throughout as "Shredder Residue" from Shine Bros., Inc. of Spencer, Iowa as an alternative cover material, subject to the following:

   a. The permit holder is authorized to use Shredder Residue from Shine Bros., Inc. in Spencer, Iowa as an alternative cover material without mixing with soil.

   b. The permit holder shall remove all materials exceeding 1.5 inches in size before using as an alternative daily cover material. Quantities exceeding 2-weeks usage shall be disposed of in the workface area. Only Shredder Residue placed at a ratio of 3:1 (3 tons waste to 1 ton of approved Shredder Residue) will be considered alternative daily cover.

      Statewide tonnage fees shall be remitted quarterly in the amount of $5,000 to account for Shredder Residue used in excess of the 3:1 ratio. Tonnage fee payments for Shredder Residue shall be reevaluated at the time of next permit renewal, or sooner, if the total amount of waste disposed of at the landfill increases significantly to where all Shine Bros. waste can be used beneficially as ADC at the approved ratio.

c. The Shredder Residue may be used in lieu of the 6-inch daily cover requirement. Shredder Residue shall not be used as a substitute for intermediate or final soil cover.

d. The waste must be compacted before the Shredder Residue is applied, to provide an even surface to minimize ponding, prevent pockets, and to maximize uniform surface drainage.

e. Shredder Residue shall be applied to the active waste face at the end of each day of operations and more frequently if necessary to control fire or fire hazards, blowing litter, odors, insects and rodents.

f. The permit holder shall maintain in the landfill files appropriate quarterly laboratory analytical documentation that demonstrates that the Shredder Residue is not hazardous by TCLP metals test, contains no PCBs that equal or exceed 50 ppm, is not ignitable, and has certification from the generator that the material was processed according to the above noted specifications. Documentation reporting of such testing shall be submitted to both the Department's Main and local Field office.

g. Acceptance of wire shredder residue from Shine Brothers, Spencer, Iowa is approved with the following conditions:

1. Annual sample testing of all 8 RCRA metals and total PCBs and quarterly samples to be tested for lead, shall be collected at the Shine facility, using the Sampling and Testing Protocol, dated March 18, 2010. As specified in the Sampling and Testing Protocol, the City of Spencer or the DNR may collect split samples.
2. Samples shall be prepared and tested by an Iowa certified laboratory using TCLP extraction method SW-846 1311 and testing solid waste method 6010B for RCRA metals and SW 8082 for PCBs.
3. The statistical evaluation referenced in the Sampling and Testing Protocol, dated March 18, 2010, must be completed each quarter and the permit holder shall submit copies documenting the sampling event, laboratory results with chain of custody, and the statistical evaluation, to the DNR with one copy retained in the landfill records within one week of receipt of laboratory results.
4. The upset condition response, as listed in the Sampling and Testing Protocol, dated March 18, 2010, is modified to include the following actions to be performed by the permit holder:
    a. Notify Shine Management, City of Spencer, and Iowa DNR.
    b. Refuse additional shipments of CWI.
    c. Stockpile unincorporated CWI and request prompt removal by Shine. Notify United States Environmental Protection Agency of the presence of hazardous waste on site if not promptly removed.
    d. Await notification from Shine that upset condition has been corrected as verified by sampling and evaluation.
    e. Resume sampling.
    f. Analyze samples for all eight (8) of the RCRA metals and total PCBs.
    g. Upon receipt of laboratory results perform actions in Item 3 above and if Shine certifies that the CWI is a non hazardous solid waste, as defined in 40 CFR 261.2 then accept shipments to the landfill.

h. Perform monthly sampling at the Shine facility through first quarter (total of three (3) samples in first three (3) months).
i. Return to Item 4 above with first quarter finished to sample next three (3) quarters.
j. If any sampling results fail for any subsequent sampling event after the initial upset condition, immediately stop receipt of additional shipments of CWI and contact DNR for discussion. Stockpile unincorporated CWI and request prompt removal by Shine. Notify United States Environmental Protection Agency of the presence of hazardous waste on site if not promptly removed.

h. The use as daily cover of Shredder Residue from any other generator than the one approved above shall be subject to approval by the Department.

i. If the Shredder Residue is found by the Department not to be performing satisfactorily, its use shall be discontinued and the remaining materials shall be disposed in the working face.

10. The permit holder is authorized to temporarily store white goods and scrap metal in an area designated by the operator. No discarded appliance may be stored for more than 270 days without being demanufactured. No scrap metal or discarded appliance may be stored for more than a total of twelve (12) months, including demanufacturing processing, prior to being recycled/salvaged. The operator and salvaging contractor shall comply with applicable provisions of IAC 567 Chapter 118 and the General Provisions of this permit. No scavenging shall be allowed.

11. The permit holder shall close the landfill site in accordance with the Closure/Post Closure Plan dated March 1, 2008, as submitted by Kruse, Cate, & Nelson, P.C., and approved on 1/28/2010; and the Development and Operation Plan, dated 3/20/2015, all as submitted by Kruse, Cate & Nelson, P.C.; and hereby approved the following:

a. The Construction Certification Report for Northern Plains, dated March 1, 2008, as submitted by Kruse, Cate & Nelson, P.C. and approved on 1/28/2010, is incorporated as part of the permit documents. The final cover was constructed over cells 5A-14A, 17A, and 18A-21A. In addition, the southwest approximately 3/4ths of Cell 15A and the south 1/3 of Cell 16A were permanently closed according to the Quality Control and Assurance Plan Final Report dated April 5, 2011 and approved on April 18, 2011.

b. Cells 1-12 and 1A-4A were capped with greater than 2 feet of compacted clay prior to October 25, 1989 meeting the rules that were in effect at the time of construction and are considered closed. The post-closure period for these areas will not begin until the remaining units at the site are closed.

c. Effective control of leachate in unlined units shall be evaluated on a case-by-case basis to determine how to achieve the lowest possible leachate head; and by complying with the environmental monitoring and corrective action requirements for groundwater and surface water.

XI. Permit Renewal and Revision History (OPTIONAL)

Date	Comment
11/03/17	Approval of Certification Report for Cell D1

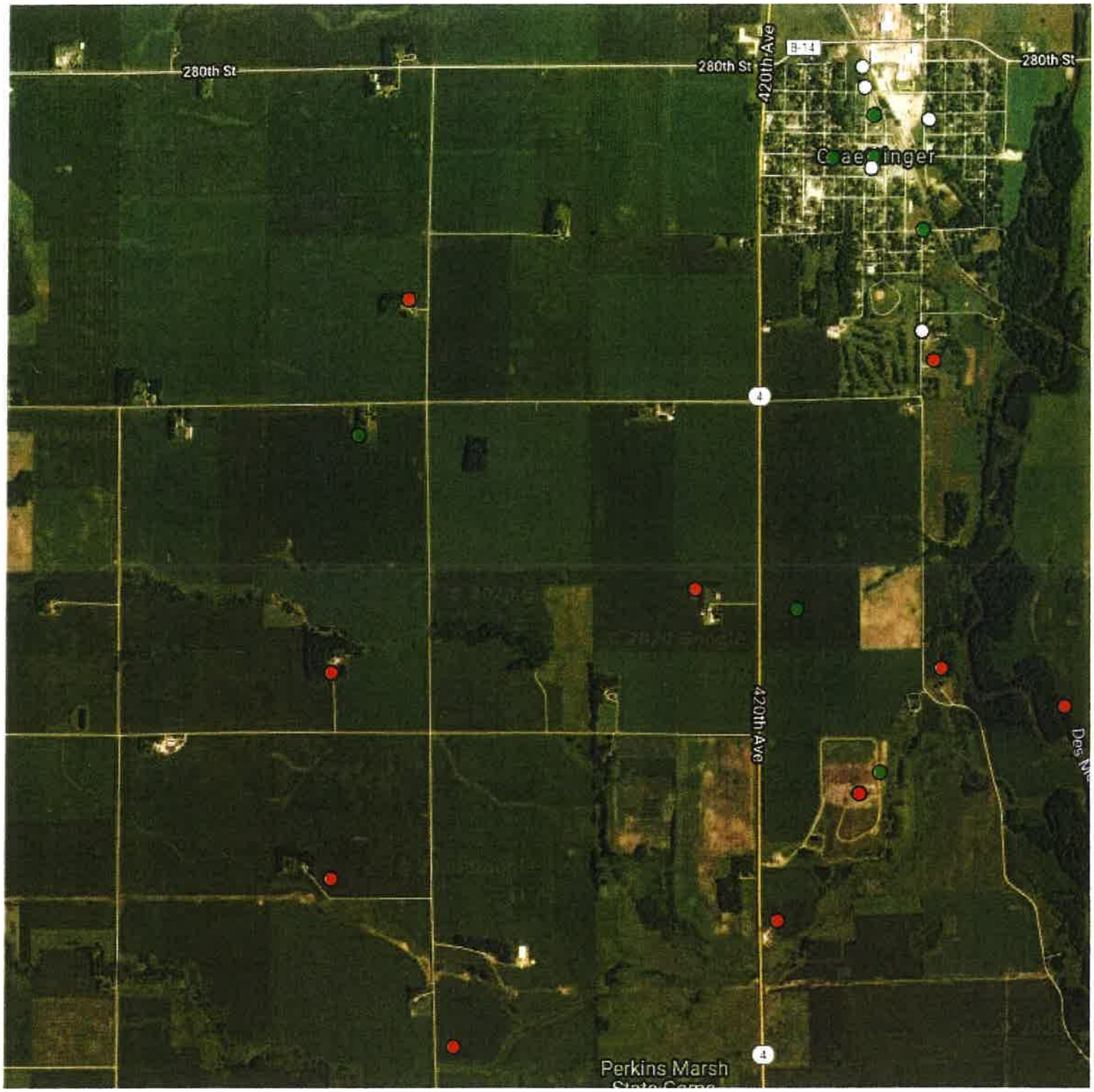
APPENDIX 2

Water Well Inventory

GeoSam

GeoSam (./)

MENU



NO DRILLER'S OR STRIP LOGS
DRILLER'S LOG
STRIP LOG
DRILLER'S AND STRIP LOGS

Search

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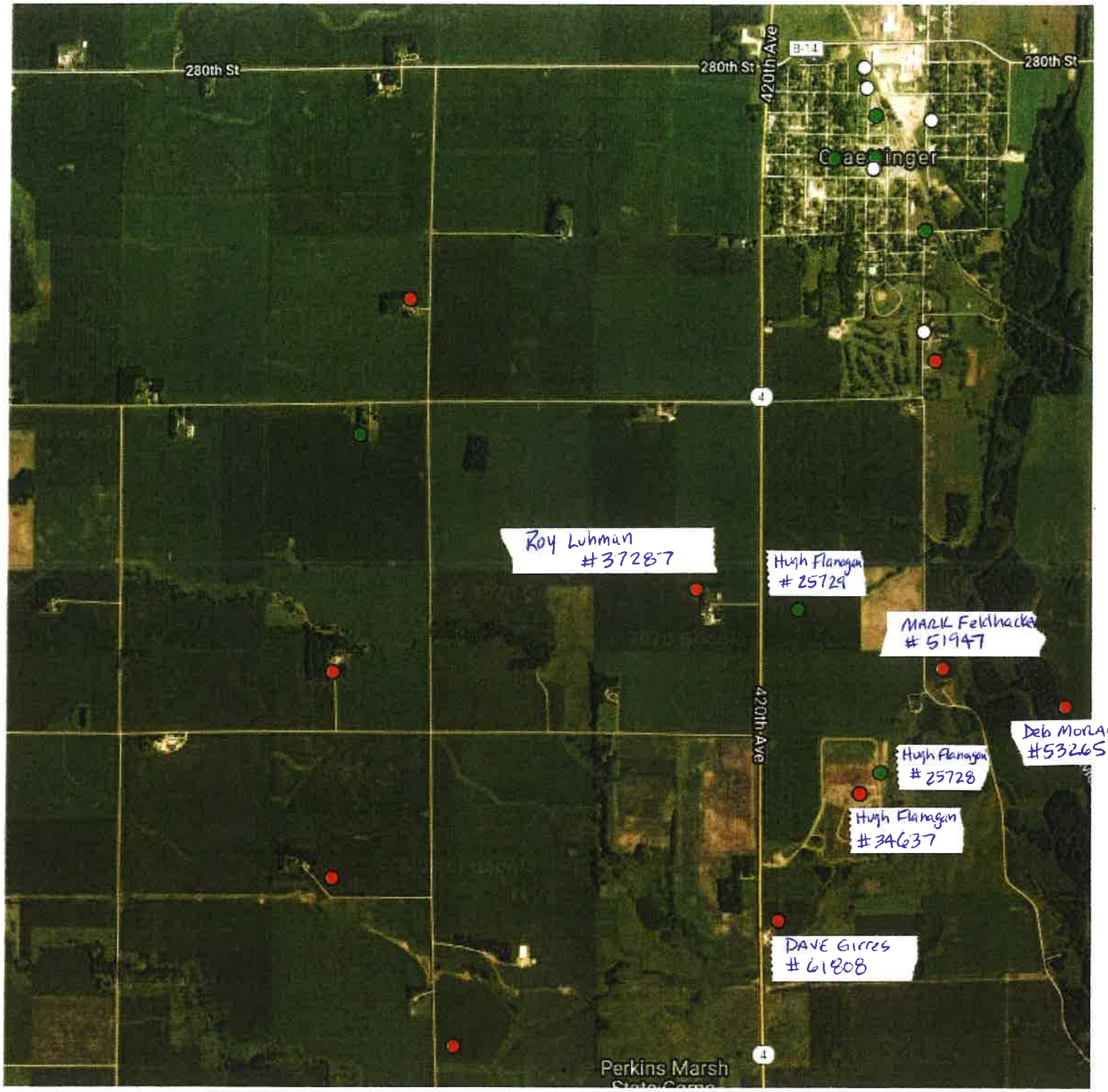
(https://maps.google.com/maps?ll=43.215309,-94.[illegible]), Maxar Technologies, USDA Farm Service Agency

GeoSam

GeoSam (./)

MENU



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Search

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(https://maps.google.com/maps?ll=43.215309,-94.[illegible]), Maxar Technologies, USDA Farm Service Agency

Iowa Department of Natural Resources Geological Survey Bureau
109 Trowbridge Hall Iowa City, Ia. 52242-1319 PH (319) 335-1575

WELL RECORD #37287

Permit No. [illegible]

Site identification

Property Owner ROY LUHMAN Well Number _____

Address BOX 475 GRAETTINGER IA 51342

Tenant _____

Well Depth 70 ft Date Completed 04 / 28 / 95

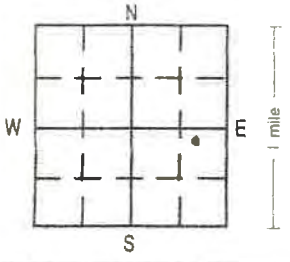
Location

County PALO ALTO

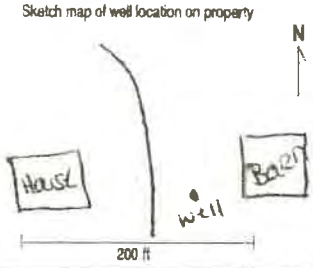
____ mi. N/S and ____ mi. E/W of intersection of _____ and _____

NW 1/4 of the NE 1/4 of the SE 1/4 of Sec 17 TWP 97 RNG 33 E/W

Show exact location of well in section grid with a dot (•).



Sketch map of well location on property



☐ upland ☐ hillside ☐ valley Elevation (if known) _____

Formation log

From	To	Color	Hardness	Formation description
0	1	BLK	SOFT	DIRT
1	36	BRN	MED	CLAY
36	51	BRN	SOFT	SAND
51	62	BLU	MED	CLAY
62	70	GRAY	MED	SAND

use additional sheets as needed

Remarks (including depth of lost drilling fluids, materials, or tools)

Well use

☒ Domestic ☐ Municipal ☐ Industrial
☐ Livestock ☐ Public Supply ☐ Monitoring
☐ Test Well ☐ Irrigation ☐ Other _____ (explain)

Drill method

☒ rotary ☐ auger ☐ cable other [illegible]

Hole size

9 inch from 0 ft to 70 ft

___ inch from ____ ft to ____ ft

hole size continued

___ inch from ____ ft to ____ ft

___ inch from ____ ft to ____ ft

Record all depth measurements from ground level (GL). Use (+) for above GL measurements

Casing

Drive shoe (yes / no) Pitless adaptor (yes / no)

Size (ID/OD)	Type / Wt	Depth top	Depth bottom	Amount (length)
5"	PVC 200#	0	65	65

Perforated or slotted casing? (yes / no)

Perforated / slotted from _____ ft to _____ ft

Perforated / slotted from _____ ft to _____ ft

Casing grouted? (yes / no)

Type	Depth Top	Depth Bottom	Amount
BENTONITE	0	50	6 BAGS

Well screen? (yes / no)

Diameter	Slot size	Depth Top	Depth Bottom	Length	Material
5"	18	65	70	5'	SS

Bottom capped (yes / no) with SS BOTTOM

Seals / Packers (yes / no) kind _____ depth _____ ft

Gravel packed (yes / no) from _____ ft to _____ ft

type _____ amount _____

Well developed? (yes / no)

Explain AIR LIFT & JET

Pump installed? (yes / no) Date 04 / 28 / 95

Installer's name JERRY'S WELL SERVICE INC.

Type of pump SUB. WEBTROL Depth to intake 50 ft

Pump diameter 4" Rated capacity 10 GPM

Water information

Aquifer: ☒ sand/gravel ☐ limestone ☐ sandstone

Main water-supply zone from 65 ft to 70 ft

Final water level (static water level) 40 ft (below / above) GL.

Pumping water level 45 ft below GL; ☐ tape ☐ airline ☐ E-line

At yield of 10 GPM; ☐ orifice ☐ volumetric ☒ estimate Date 4-28-95

Water quality test? (yes / no) Date tested ____ / ____ / ____

Tested by _____

Test results _____

Contractor JERRY'S WELL SERVICE INC.

Address 1776 570TH AVE ARMSTRONG IA 50514

Driller BOB CHRISTENSEN Certification no. 40144

white copy - Iowa DNR, Geological Survey Bureau blue copy: Well Contractor pink copy: Customer yellow copy: County Health Officer

Iowa Department of Natural Resources Geological Survey Bureau
109 Trowbridge Hall, Iowa City, IA 52242-1319 PH (319) 335-1575

WELL RECORD 53265 Permit No. _____

Site identification

Property Owner DEB MORAN Well Number _____

Address 3081 410TH AV., GRAETTINGER, IA.

Tenant _____

Well Depth 316 ft Date completed 12 / 17 / 99

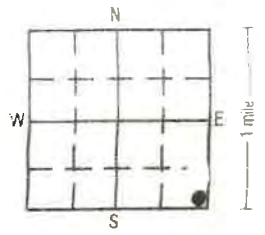
Location

County PALO ALTO

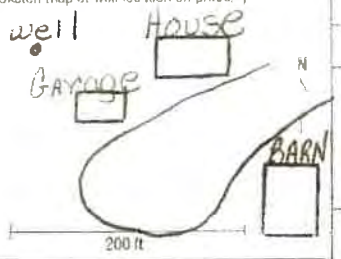
____ mi N/S and ____ mi E/W of intersection of _____ and _____

SE 1/4 of the SE 1/4 of the SE 1/4 of Sec 19 TWP 97 RNG 33 E/W

Show exact location of well in section grid with a dot (●)



Sketch map of well location on property



☐ upland ☐ hillside ☐ valley Elevation (if known) _____

Formation log

From	To	Color	Hardness	Formation description
0	1	BLACK	SOFT	DIRT
1	20	BROWN	SOFT	CLAY
20	41	BLUE	SOFT	CLAY
41	45	GRAY	SOFT	SAND & GRAVEL
45	130	BLUE	SOFT	CLAY
130	145	GREEN	HARD	CLAY
145	185	BROWN	HARD	CLAY
185	195	BLUE	HARD	CLAY & ROCK
195	200	BROWN	SOFT	SAND & CLAY
200	286	BLUE	HARD	CLAY
286	320	GRAY	HARD	SANDSTONE

use additional sheets as needed

Remarks (including depth of lost drilling fluids, materials, or tools)

Well use

☒ Domestic ☐ Municipal ☐ Commercial
☐ Livestock ☐ Public supply ☐ Monitoring
☐ Test well ☐ Irrigation ☐ Other _____ (explain)

Drill method

☒ rotary ☐ auger ☐ cable other _____

Hole size

9 inch from 0 ft to 320 ft

____ inch from ____ ft to ____ ft

hole size continued

____ inch from ____ ft to ____ ft

____ inch from ____ ft to ____ ft

Record all depth measurements from ground level (GL). Use (+) for above GL measurements.

Casing

Drive shoe (yes / no) Pitless adapter (yes / no)

Size (in. OD)	Type / Wt	Depth top	Depth bottom	Amount (length)
5"	200'	0	200'	
5"	250'	200'	310'	

Perforated or slotted casing? (yes / no)

Perforated / slotted from _____ ft to _____ ft

Perforated / slotted from _____ ft to _____ ft

Casing grouted? (yes / no) Placement method Tremie

Type	Depth Top	Depth bottom	Amount (vol/wt)
BENTONITE	0	310	14 BAGS

Well screen? (yes / no)

Diameter	Slot size	Depth Top	Depth Bottom	Length	Material
5"	0.18	311	316		
	0				

Bottom capped (yes / no) with SS Plate

Seals / Packers (yes / no) kind K Packer depth 311 ft

Gravel packed (yes / no) from 300 ft to 316 ft

type Pea Rock amount 1 yd.

Well developed? (yes / no)

Explain TEST PUMPED 30 GPM FOR 44HRS

(pumped / airlifted / bailed) for 44 hrs at 30 GPM.

Pump installed? (yes / no) Date 12 / 20 / 99

Installer's name Jerry's well Serv Inc

Type of pump 1025711B Depth to intake 127 ft

Pump diameter 4" Rated capacity 10 GPM

Water information

Aquifer: ☐ sand / gravel ☐ limestone ☒ sandstone

Main water-supply zone from 311 ft to 316 ft ☐ seepage well

Static water level 115 ft (below / above) GL; ☐ tape ☐ airline ☐ E-line ☐ estimate

Pumping water level 120 ft below GL; ☐ tape ☐ airline ☐ E-line ☐ estimate

At yield of 30 GPM; ☐ orifice ☐ volumetric ☐ estimate

Measurements taken at ____ ____ (AM / PM) Date 12 / 17 / 99

Water quality test? (yes / no) Date tested ___ / ___ / ___

Tested by _____

Contractor JERRY'S WELL SERVICE INC.

Address ARMSTRONG, IA. 50514

Driller JERRY ULRICH Certification no. 40223

white copy - Iowa DNR, Geological Survey Bureau pink copy - Well Contractor canary copy - Customer yellow copy - County Health Officer

Iowa Department of Natural Resources Geological Survey Bureau
109 Trowbridge Hall, Iowa City, IA 52242-1319 PH (319) 335-1575

WELL RECORD 51947

Permit No. 74-42800A-1

Site identification

Property Owner Mark Feldhacker Well Number ____

Address 2986 River Rd Graettinger Ia 51342

Tenant ____

Well Depth 56 ft Date completed 4 / 28 / 00

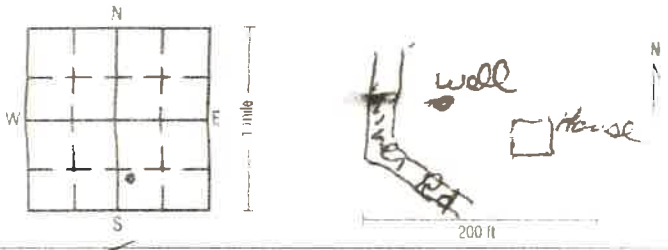
Location

County Palo Alto

¼ mi (N) and ½ mi (W) of intersection of B17 and Hwy 4

NW ¼ of the SW ¼ of the SE ¼ of Sec 16 TWP 97 RNG 33 (W)

Show exact location of well in section grid with a dot (●). Sketch map of well location on property



☐ upland ☑ hillside ☐ valley Elevation (if known) ____

Formation log

From	To	Color	Hardness	Formation description
0	2	BLK	Soft	Dirt
2	21	yel	Soft	clay
21	26			Gravel
26	37	Gray		Clay
37	57			Gravel Sand

use additional sheets as needed

Remarks (including depth of lost drilling fluids, materials, or tools)

Well use

☑ Domestic ☐ Municipal ☐ Commercial
☐ Livestock ☐ Public supply ☐ Monitoring
☐ Test well ☐ Irrigation ☐ Other ____ (explain)

Drill method

☑ rotary ☐ auger ☐ cable other ____

Hole size

8¾ inch from 0 ft to 71 ft ____ inch from ____ ft to ____ ft

____ inch from ____ ft to ____ ft ____ inch from ____ ft to ____ ft

Record all depth measurements from ground level (GL). Use (+) for above GL measurements.

Casing

Silver solder (yes / no) Pitless adapter (yes / no)

Size (ID/OD)	Type / Wt	Depth top	Depth bottom	Amount (length)
5	PVC 200	+1	51	50

Perforated or slotted casing? (yes / no)

Perforated / slotted from ____ ft to ____ ft

Perforated / slotted from ____ ft to ____ ft

Casing grouted? (yes / no) Placement method ____

Type	Depth Top	Depth bottom	Amount (vol/wt)
Bentonite	0	43	

Well screen? (yes / no)

Diameter	Slot size	Depth Top	Depth Bottom	Length	Material
5ps	0.018	51	56	5	SS.
	0 ___				

Bottom capped (yes / no) with Brass Plug

Seals / Packers (yes / no) kind ____ depth ____ ft

Gravel packed (yes / no) from ____ ft to ____ ft

type Silica Sand amount pea Rock

Well developed? (yes / no)

Explain Jet w/ water airlift until Clean

(pumped / airlifted / bailed) for 2 hrs at 30 GPM.

Pump installed? (yes / no) Date ____ / ____ / ____

Installer's name Not @ this time

Type of pump Sub Depth to intake 40 ft

Pump diameter 3 3/4 Rated capacity 15 GPM

Water information

Aquifer: ☑ sand / gravel ☐ limestone ☐ sandstone

Main water-supply zone from 51 ft to 56 ft ☐ seepage well

Static water level 29 ft (below / above) GL, ☑ tape ☐ airline ☐ E-line ☐ estimate

Pumping water level 30 ft below GL: ☐ tape ☐ airline ☐ E-line ☑ estimate

At yield of 30 GPM: ☐ orifice ☐ volumetric ☑ estimate

Measurements taken at 3:30 (AM / PM) Date 4 / 28 / 00

Water quality test? (yes / no) Date tested ____ / ____ / ____

Tested by Not @ this time

Contractor Ellert Bros well

Address Whittemore Ia 50598

Driller Rick Ellert Certification no. 40131

white copy – Iowa DNR, Geological Survey Bureau blue copy – Well Contractor pink copy – Customer yellow copy – County Health Officer

Iowa Department of Natural Resources Geological Survey Bureau
109 Trowbridge Hall, Iowa City, IA 52242-1319 PH (319) 335-1575

WELL RECORD

61803

Permit No. 21837

Site identification

Property Owner David Gittes Well Number 2116174

Address 3058 420th Ave Greenville 51342

Tenant

Well Depth 105 ft Date completed 3 / 3 / 06

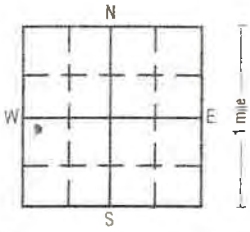
Location

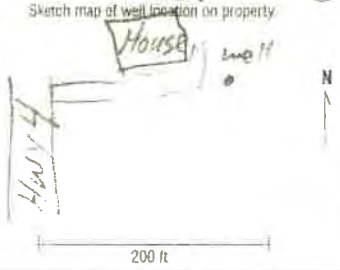
County Palo Alto

23/4 mi N and 0 mi E of intersection of Hwy 4 and B14

NW 1/4 of the NW 1/4 of the SW 1/4 of Sec 21 TWP 97 RNG 33 E W

Show exact location of well in section grid with a dot (●) Sketch map of well location on property





☑ upland ☐ hillside ☐ valley Elevation (if known)

Formation log

From	To	Color	Hardness	Formation description
0	2	BLK	S	Top Soil
2	6	yel	M	clay
6	19	yel	M	Gravel
19	74	BLK	H	Clay
74	98	gray	M	Clay
98	110	clear	S	Sand

use additional sheets as needed

Remarks (including depth of lost drilling fluids, materials, or tools)

43.2039 -94.75776

Well use

☒ Domestic ☐ Municipal ☐ Commercial
☐ Livestock ☐ Public supply ☐ Monitoring
☐ Test well ☐ Irrigation ☐ Other (explain)

Drill method

☒ rotary ☐ auger ☐ cable other

Hole size

9 inch from 0 ft to 110 ft

hole size continued

inch from ft to ft

inch from ft to ft

inch from ft to ft

Record all depth measurements from ground level (GL). Use (+) for above GL measurements

Casing

Drive shoe (yes / no) Pitless adapter (yes / no)

Size (ID/OD)	Type / Wt	Depth top	Depth bottom	Amount (length)
5	PVC 200	+1	100	101

Perforated or slotted casing? (yes / no)

Perforated / slotted from ft to ft

Perforated / slotted from ft to ft

Flowing well

Casing grouted? (yes / no) Placement method Poured it in

Type	Depth Top	Depth bottom	Amount (vol/wt)
Bentonite	0	56'	100#

Well screen? (yes / no)

Diameter	Slot size	Depth Top	Depth Bottom	Length	Material
5.6	0.018	100	105	5	SS
	0.___				

Bottom capped (yes / no) with Wash down plug

Seals / Packers (yes / no) kind depth ft

Gravel packed (yes / no) from 56 ft to 110 ft

type Pea Rock amount 500lbs

Well developed? (yes / no)

Explain pumped 75gpm +

(pumped, airlifted, bailed) for 2 hrs at 75+ GPM.

Pump installed? (yes / no) Date 3 / 8 / 06

Installer's name Bill Elbert

Type of pump Jet Depth to intake 10 ft

Pump diameter — Rated capacity 15 GPM

Water information

Aquifer: ☒ sand / gravel ☐ limestone ☐ sandstone

Main water-supply zone from 100 ft to 105 ft ☐ seepage well

Static water level +8 ft (below / above) GL; ☒ tape ☐ airline ☐ E-line ☐ estimate

Pumping water level +8 ft below GL; ☒ tape ☐ airline ☐ E-line ☐ estimate

At yield of +75 GPM; ☐ orifice ☐ volumetric ☐ estimate

Measurements taken at 2:00 (AM / PM) Date 3 / 3 / 06

Water quality test? (yes / no) Date tested ___ / ___ / ___

Tested by Sanitarian

Contractor Elbert Bros Well Drilling Inc

Address Whittemore

Driller Rick Elbert Certification no. 2335

white copy – **Iowa DNR, Geological Survey Bureau** blue copy – **Well Contractor** pink copy – **Customer** yellow copy – **County Health Officer**

FORM NO. 79—In stock and for sale by Ross-Martin Co., Tulsa.

1-25728

STATE
Iowa

Greatinger (Palo Alto)

NE, NW,
SEC.
21

Hugh Flanagan
#1

TWP. 97N RGE. 32W

COMMENCED Aug. 21, 1979 COMPLETED Aug. 24, 1979

Virgil Elbert

CASING RECORD

LOGGED Feb 12, 1980 BY M. J. Bauck

REMARKS

EL.-

T.D.- 35'

ODI-100

Auger

Soil, brn, silty, lt yel gr, oxid, uniform

ca
Silty, brn gr, unoxid, uniform, wet.

T.D. - 35'

50'

W-25729

FORM NO. 79—In stock and for sale by Ross-Martin Co., Tulsa.

STATE
Iowa

Greatinger (Palo Alto)

Hugh Flanagan

SEC.
16

2

TWP. 97N RGE. 2-W

COMMENCED
Aug. 22, 1979

COMPLETED
Aug. 22, 1979

Virgil Elbert

CASING RECORD

LOGGED
Feb. 12, 1980

BY
M.J. Bunk

REMARKS

EL-

T.D.- 60'

ADI-100 Auger

Soil, brn, sdy. Till, v.lt.yel, oxid, w/ ltch
Till as above.
Till, as, v.pale yel.

as, pale ang yel.

Till, as as sdy.
Till, ext. to mely sdy, possibly dirty outwash sd.
Gray, var. colored as Sd, var. colored, as A, as C, as D, etc.

50'

T.D. -60'

100'

25723

WELL RECORD

Well is located 1½ miles N E S W and ..... miles N E S W from

Gracetinger (Nearest Town) in Polk (County),

in the NW ¼ SW ¼ Sec. 16 T. 9N R. 22W

Owner Hugh Flanagan Well No. 2

Postoffice address Gracetinger Ia

Contractor Virgil P Elbert well Drlg

Address Whitemore Ia

Driller Glen Kollasch

Well begun Aug 22, 1929;

completed Aug 22, 1929

Rig used—Cable, Rotary, Jet, or Auger

Depth of well 52' (Feet)

Size of hole (note total amount of each size) 2"

.....

Main water supply at 46' - 52' (Feet below surface)

Final water head 38' (Feet above or below surface)

Is well pumped? no

Yield Test hole for water sample (Gallons per minute)

Water level when pumping .....

Position of well ..... (Upland, valley, side hill, etc.)

Correct & Change Plotting W-34636

Iowa Department of Natural Resources Geological Survey Bureau
109 Trowbridge Hall Iowa City, Ia. 52242-1319 PH (319) 335-1575

WELL RECORD Permit No. 34636

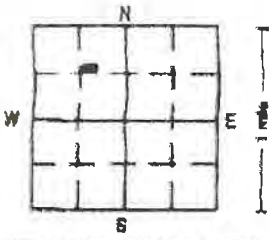
Site identification

Property Owner Hugh Flanagan Well Number 3463
Address Emmetsburg IA 50536
Tenant
Well Depth 110 ft Date Completed 5 / 17 / 94

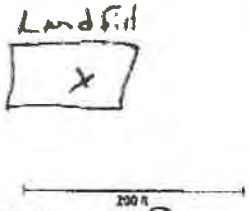
Location

County Palo Alto
2 1/8 mi. N/S and 0 mi. E/W of intersection of B14 and 9
SW 1/4 of the NE 1/4 of the NW 1/4 of Sec 21 TWP 97N RNG 33 E/W

Show exact location of well in section grid with a dot (•).



Sketch map of well location on property



☐ upland ☒ hillside ☐ valley Elevation (if known) ?

Formation log

From	To	Color	Hardness	Formation description
0	3	BLK	S	Topsoil
3	5	dkBr	S	Clay
5	10	Gray	S	Sand Coarse
10	15	Gray	S	Sand Course
15	20	"	"	Sand + Gravel
20	25	"	"	" "
25	30	"	"	" "
30	31	"	"	Sand Course
31	32	"	"	Silt
32	33	BLK	S	Shale
33	35	Blu	S	Clay
35	40	"	"	"
40	60	blu	Med	Clay
60	70	"	"	"
70	95	"	Hard	"
95	102	"	"	"
102	110	gel	"	"

use additional sheets as needed

Remarks (including depth of lost drilling fluids, materials, or tools)
None

Well use

☐ Domestic ☐ Municipal ☐ Industrial
☐ Livestock ☐ Public Supply ☐ Monitoring
☐ Test Well ☐ Irrigation ☒ Other boring (explain)

Drill method

☒ rotary ☐ auger ☐ cable other

Hole size
5 inch from 0 ft to 110 ft
___ inch from ___ ft to ___ ft

Hole size continued
___ inch from ___ ft to ___ ft
___ inch from ___ ft to ___ ft

Record all depth measurements from ground level (GL). Use (+) for above GL measurements.

Casing

Drive shoe (yes / no) Pitless adapter (yes / no)

Size (ID/OD)	Type / Wt	Depth top	Depth bottom	Amount (length)
0				

Perforated or slotted casing? (yes / no)
Perforated / slotted from ___ ft to ___ ft
Perforated / slotted from ___ ft to ___ ft

Casing grouted? (yes / no)

Type	Depth Top	Depth Bottom	Amount

Well screen? (yes / no)

Diameter	Slot size	Depth Top	Depth Bottom	Length	Material

Bottom capped (yes / no) with ___
Seals / Packers (yes / no) kind ___ depth ___ ft
Gravel packed (yes / no) from ___ ft to ___ ft
type ___ amount ___

Well developed? (yes / no)
Explain ___

Pump installed? (yes / no) Date 5 / 17 / 94
Installer's name ___
Type of pump ___ Depth to intake ___ ft
Pump diameter ___ Rated capacity ___ GPM

Water information

Aquifer: ☒ sand/gravel ☐ limestone ☐ sandstone
Main water-supply zone from 5 ft to 31 ft
Final water level (static water level) 6 ft (below / above) GL.
Pumping water level 30 ft below GL; ☐ tape ☒ airline ☐ E-line
At yield of 2 GPM; ☐ orifice ☐ volumetric ☒ estimate Date 5-17-94

Water quality test? (yes / no) Date tested ___ / ___ / ___
Tested by ___
Test results ___

Contractor Beemer Well Drilling
Address Rt 1 Box 2 Fairmont
Driller Tim Kollasch Certification no. 17647

Correct + Change Plotting

Iowa Department of Natural Resources Geological Survey Bureau
109 Trowbridge Hall Iowa City, Ia. 52242-1319 PH (319) 335-1575

WELL RECORD

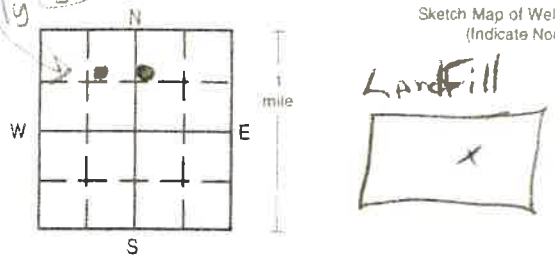
DNR
OCT 21 1994
GEOL. SURVEY

Site Identification

Property Owner Dwight Hannegan Well Number 34637
Address Emmetsburg IA 50536
Tenant
Well Depth 35 ft. Date Completed 5 / 18 / 94

Location

County Palo Alto
Well is 2½ mi. N and 0 mi. E of intersection of B14 and 4
S/W 1/4 of the N/E 1/4 of the N/W 1/4 of Sec 21 TWP 97N RNG 33 E
Show exact location of well in section grid with a dot (•).
Sketch Map of Well Location (Indicate North)



Well Use

☐ Domestic ☐ Municipal ☐ Industrial
☐ Livestock ☐ Public Supply ☒ Monitoring
☐ Test Well ☐ Irrigation ☐ Other

Measuring Point (MP)

All depth measurements are made from
☐ Ground Level ☐ KB/other 4 ft. (above/below) ground level

Hole Size

6 inch from 0 ft. to 35 ft.
___ inch from ___ ft. to ___ ft.
continued
___ inch from ___ ft. to ___ ft.
___ inch from ___ ft. to ___ ft.

Casing

(ID / OD)? Drive shoe? (yes / no) Pitless adaptor? (yes / no)

Size	Type / Wt.	Depth Top	Depth Bottom	Amount (length)
2"	PVC Sch 80	+4	31	31

Perforated or Slotted Casing?

(yes / no)
Perforated / Slotted from ___ ft. to ___ ft.
Perforated / Slotted from ___ ft. to ___ ft.

Casing Grouted?

(yes / no)
☐ Neat Cement ☒ Bentonite ☐ other
from 0 ft. to 22 ft.
from ___ ft. to ___ ft.

Well Screen?

(yes / no)

Diameter	Slot size	Depth Top	Depth Bottom	Amount	Type / Mfg.
2"	.010	31	36	5'	PVC Tim Co

Gravel packed? (yes / no) from 22 ft. to 36 ft.
Bottom capped? (yes / no) with PVC Plug
Seals / Packers? (yes / no) kind ___ depth ___ ft.

Formation Log

From	To	Color	Hardness	Description
0	3	BLK	S	Topsoil
3	5	DK Brn	S	Clay
5	10	Grey	S	Sand Coarse
10	15	"	S	" "
15	20	"	S	Sand + Gravel
20	25	"	S	" "
25	30	"	S	" "
30	31	"	S	Sand Coarse
31	32	"	S	Silt
32	33	BLK	S	Shale
33	35	Blk	S	Clay

use second sheet if needed

Water Information

Main water supply zone from 5 ft. to 31 ft.
Supply zone rock type (sand/gravel / limestone, sandstone) ___
Final water head (static water level) 6 ft. (below / above) the MP
Pumping water level 20 ft. below MP at yield of 2 GPM
Water quality tested? (yes / no) Date tested ___ / ___ / ___
Tested by ___
Parameters tested for: ___
Test results ___

Pump

Pump installed? (yes / no) Date ___ / ___ / ___
Type of pump ___ Manufacturer's name ___
Depth to intake ___ ft. Tail pipe? (yes / no) length ___ ft.
Pump diameter ___ inches Rated capacity ___ GPM

Remarks

(Topographic position, elevation, development, disinfection, water quality, etc.)

Contractor's name Beemer Well Drilling Registration no. 17647
Address Rt 1 Box 2 Fairmont Mn 56031
Driller's name Tim Kollasch Drill method (rotary / cable) ___

white copy - Iowa DNR, Geological Survey Bureau blue copy - Well Contractor pink copy - Customer yellow copy - County Health Officer

Fax Cover Sheet

Northern Plains Regional Landfill
P.O. Box 117
3032 420th Ave
Graettinger, IA 51342
Ph (712) 859-3185
Fax (712) 859-3185

Faxed on _____

Date: Monday Sept 15, 2014

Attn: Todd Whipple
Company: _____
Phone: _____
Fax: (515) 733-4446

From: Chuck Dike
Phone: _____

RE: Well Log

Pages including cover: 3

Comments:

_____
_____
_____
_____
_____
_____

If you feel you have received this fax by mistake please fax or call Northern Plains Regional Landfill

Thank You

WELL LOG

PERMIT #:
WELL #: To Be Assigned up electronic transmission of well log to DNR
COUNTY: ~~Pottawattamie~~ Palo Alto, Walnut, 21
WELL STATUS: Active

PROPERTY OWNER INFORMATION

NAME: First Paul | Middle | Last Mairath
COMPANY:
MAILING ADDRESS: 3032 420th Ave
CITY, STATE, ZIP: Grattinger, IA 51343
PHONE NUMBER: 712-889-3185

WELL LOCATION

PLS COORDINATES:
LATITUDE:
LONGITUDE:
PARCEL NUMBER:
SITE ADDRESS:

WELL DETAILS

DATE COMPLETED: 7-8-02
WELL DEPTH: 60'
TOPOGRAPHY: O Hillside ● Level Surface O Upland O Valley
ELEVATION IN FEET: Feet
CONSTRUCTION METHOD: O Auger O Cable O Driven O Dug O Jet O Other: O Pneumatic ● Rotary
WELL DRILLER: Bob Christensen
WELL COMPANY: Travis Well Service Inc.

WELL USE

O Monitoring Well — Descriptor _____
O Heat Pumps — Number of Wells _____
O Injection Well
O Irrigation
O Household
O Livestock
● Commercial
O Recreational
O Dewatering

WELL DEVELOPED

WELL WAS: O Airlifted O Bailed ● Pumped
FOR: 1½ Hours
AT: 60 GPM
EXPLAIN:

PUMP INSTALLED

PUMP INSTALLED? ● YES O NO
DATE INSTALLED: 7-9-02
TYPE OF PUMP: O Air Lift O Jet O Stroke ● Submersible O Turbine
PUMP DIAMETER: 4"
INSTALLER'S NAME: Karl
DEPTH TO INTAKE: 40 Feet
RATED CAPACITY: 10 GPM

WELL FORMATION LOG

FROM	TO	LITHOGRAPHIC DESCRIPTION (Use descriptions from chart)	COLOR (Use color from chart)
0	10	Clay	Brown
10	12	Sand	Brown
12	16	Clay	Brown
16	24	Clay	Blue
24	30	Clay + sand mix	Blue
30	47	Clay	Blue
47	61	Sand	Grey

REMARKS: (including depth of drilling, fluids, materials or tools, etc.)

WELL CONSTRUCTION LOG Use chart for Casing Type, Grout Type and Well Screen Material

LOG DETAILS FROM	LOG DETAILS TO	CASING HOLE SIZE	CASING DIAMETER	CASING TYPE	GROUT WGHT/STD	GROUT TYPE	GROUT LBS	WELL SCREEN DIAMETER	WELL SCREEN SLOT SIZE	WELL SCREEN MATERIAL	GRAVEL PACK TYPE	GRAVEL PACK LBS
0	61	9	5"	PVC		Bent	150	6" tele	18	SS	Pea Rock	500

GROUTING METHOD: O Haliburton with plug O Haliburton with shoe O Haliburton without plug O Haliburton without shoe ● Tremi O Tremi with shoe

BOTTOM CAPPED? ● Yes O No Cap on Screen

CAPPING MATERIAL:

SEALS/PACKERS? O Yes ● No

SEAL/PACKERS TYPES: O Figure K Packer O Shale Trap

WELL WATER INFORMATION

AQUIFER: O Limestone ● Sand/Gravel O Sandstone

MAIN WATER-SUPPLY ZONE: From 60 Feet To 61 Feet

STATIC WATER LEVEL: 35 O Feet Above Ground Level ● Feet Below Ground Level — MEASUREMENT METHOD: O Airline O Electric Line O Estimate ● Tape

PUMPING WATER LEVEL:: 45 Feet Below Ground Level O Feet Below Ground Level — MEASUREMENT METHOD: O Airline O Electric Line ● Estimate O Tape

A YIELD OF: 60 GPM — MEASUREMENT METHOD: ● Estimate O Orifice O Volumetric

MEASUREMENTS TAKEN AT: 3 Hour 30 Minutes O AM ● PM

Date 7-6-02

lgd. Plan Revisions - HMSP

$645 74-SDP-02-76P

KRUSE, CATE & NELSON, P.C.

ENGINEERING AND LAND SURVEYING SERVICE
SPENCER, IOWA 51301

LARRY R. NELSON
JAMES E. THIESSE

1801 HIGHWAY BOULEVARD
PHONE 712-262-3468
FAX 712-262-9468

November 1, 2004

Amy Hart - Solid Waste Division
Iowa Department of Natural Resources
Wallace Building
502 East 9th Street
Des Moines, IA 50319

Re: Northern Plains Regional Landfill
Development & Operations Plan
SDP Permit No. 74-SDP-02-76P

Dear Ms. Hart;

Enclosed please find one copy of the well search results to included in the Hydrologic Monitoring System Plan (HMSP) for the Northern Plains Regional Landfill as Exhibit "A".

If you have any questions or need any additional data, please contact our office at your convenience.

Very truly yours,

KRUSE, CATE & NELSON, P.C.

By: James E. Thiesse, PE, LS

1717L.doc

Iowa Department of Natural Resources
109 Trowbridge Hall
Iowa City, IA 52242-1319
319-335-1575
319-335-2754 (fax)

To: Jim Thiesse
Kruse, Cate & Nelson, P.C.
1801 Hwy Blvd
Spencer, IA 51301
712-262-3468

From: Robert Rowden

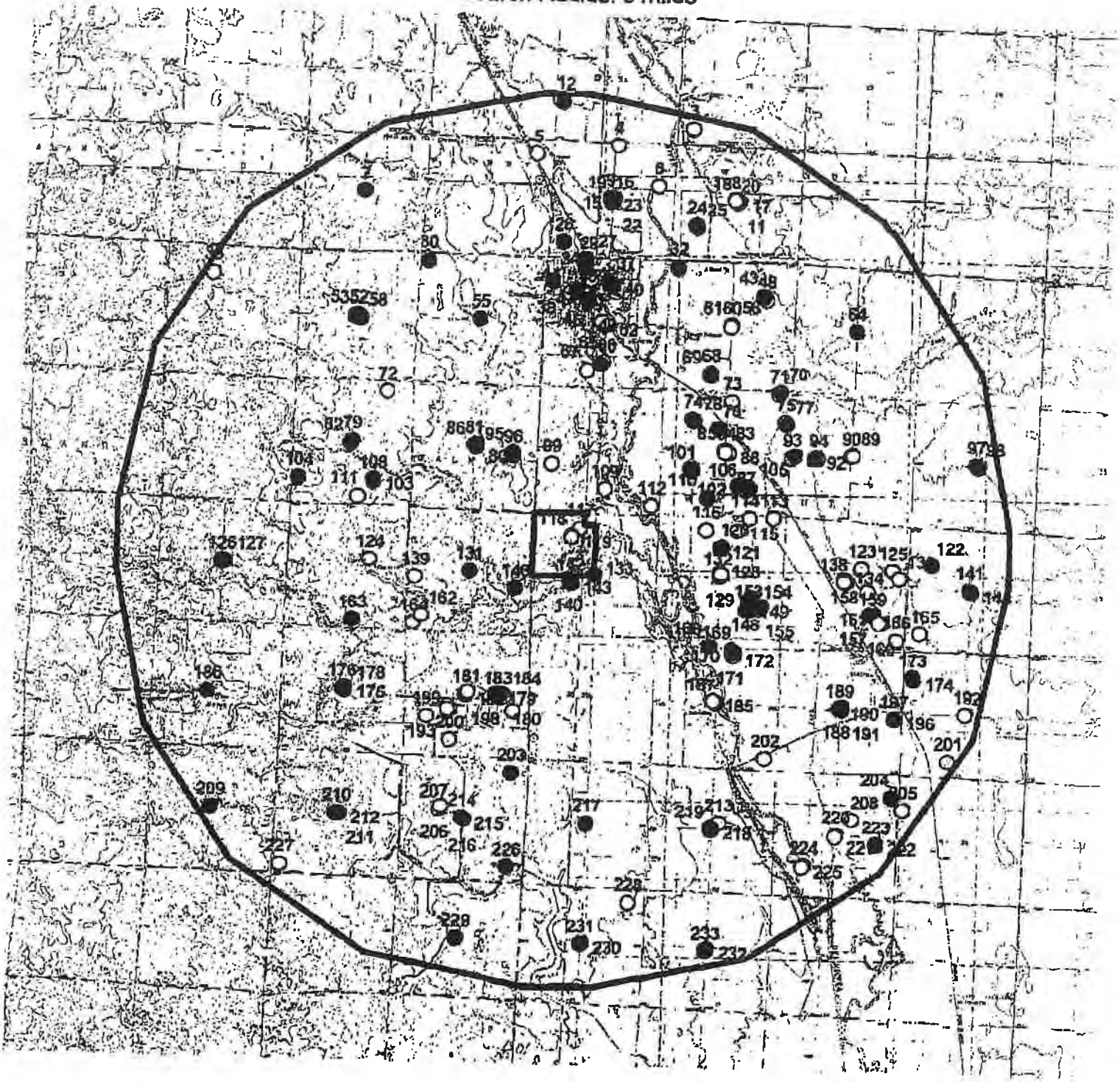
Date: 11/1/2004

Subject: Well search results

Included in search	No. of wells	Database
X	69	IGS well database general well database maintained by IGS, location accuracy varies 3,730 to 25 ft., last updated 8/2003.
X	5	Public wells (municipal) municipal well database maintained by IGS, location accuracy varies 3,730 to 25 ft., under development
X	26	Public wells (non-municipal) municipal well database maintained by IGS, location accuracy varies 3,730 to 25 ft., under development
X	0	Private well tracking system IDNR database management system for Grants-to-counties-covered wells. Locational accuracy unknown, assumed to be +/-17m., Last update 6/2004.
X	78	Wells registered for testing wells ***tested*** under Grant-to-Counties program. Locational accuracy varies 1150 to 150 m.; Last update 9/2001, no future updates planned.
X	20	Permitted private wells wells ***permitted*** under Grant-to-Counties program. Locational accuracy varies 1150 to 150 m.; Last update 9/2001, no future updates planned.
X	16	Registered abandoned wells wells ***abandoned*** under Grant-to-Counties program. Locational accuracy varies 1150 to 150 m.; Last update 9/2001, no future updates planned.
X	2	Public water supply wells and intakes locational accuracy 220 m., last updated 8/98
X	17	Water use permit facilities facilities permitted to withdraw >25,000 gallons per day, locational accuracy is +/- 3,750 ft.; last updated 10/96
X	0	Agricultural drainage wells locational accuracy 100m., last updated 4/98

IGS Well Search Results For Northern Plains Regional Landfill; Permit # 74-SDP-02-76P

Search Radius: 3 miles



1 0 1 2 Miles

Well search results
- IGS well database
- Public wells (municipal)
- Public water supply wells and intakes
- Public wells (non-municipal)
- Registered abandoned wells
- Permitted private wells
- Wells registered for testing
- Water use permit facilities

*Note: wells with identical locations have been shifted from their original locations for the purpose of preparing this map.

Iowa Geological Survey
109 Trowbridge Hall
Iowa City, IA 52242-1319
319-335-1575
319-335-2754 (fax)
November 1, 2004

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Well Search Results For Northern Plains Regional Landfill; Permit # 74-SDP-02-76P

IGS well database

1	37851	T. 98 N., R. 33 W., Sec. 33, SW, NW, SW, NW	28	10/20/1980	Torreson, Alice F.	Bedrock depth unkn
3	26822	T. 98 N., R. 33 W., Sec. 34, SW, SW	135	10/1/1979	Bates, James	Bedrock depth unkn
4	27115	T. 97 N., R. 33 W., Sec. 4, NE, NW, NW, NW	41	8/31/1983	Igs	Bedrock depth unkn; scanned log available
6	10758	T. 97 N., R. 33 W., Sec. 4, NE, SE	30	4/1/1859	Wickert, Clarence	Bedrock depth unkn; scanned log available
24	44080	unkn	40	unkn	Alesch, Tony	Bedrock depth unkn
29	39989	T. 97 N., R. 33 W., Sec. 9, NW, NE, NW	unkn	1/1/1964	Graettinger, City Of	Bedrock depth unkn
33	39990	T. 97 N., R. 33 W., Sec. 9	34	1/1/1950	Graettinger, City Of	Bedrock depth unkn
34	4330	T. 97 N., R. 33 W., Sec. 9, NW, NE, SW, NE	40	1/1/1950	Graettinger, City Of	Bedrock depth unkn; scanned log available
35	4331	T. 97 N., R. 33 W., Sec. 9, NW, NE, SW, NE	35	1/1/1950	Graettinger, City Of	Bedrock depth unkn; scanned log available
36	14451	T. 97 N., R. 34 W., Sec. 12, NW, NE, SW, SE	150	1/1/1961	Maxim, Ed	Bedrock depth unkn; scanned log available
37	39988	T. 97 N., R. 33 W., Sec. 9, NE, NW, SW	unkn	6/1/1977	Graettinger, City Of	Bedrock depth unkn
42	4329	T. 97 N., R. 33 W., Sec. 9, NW, SE, NW, NE	40	1/1/1950	Graettinger, City Of	Bedrock depth unkn; scanned log available
44	25011	T. 97 N., R. 33 W., Sec. 9, NW, SW, NE, NE	34	5/3/1977	Graettinger, City Of	Bedrock depth unkn; scanned log available
45	25010	T. 97 N., R. 33 W., Sec. 9, NW, SW, NE, NE	33	5/3/1977	Graettinger, City Of	Bedrock depth unkn; scanned log available
46	4328	T. 97 N., R. 33 W., Sec. 9, NW, SE, NW, NE	20	1/1/1950	Graettinger, City Of	Bedrock depth unkn; scanned log available
47	39992	T. 97 N., R. 33 W., Sec. 9	62	unkn	Graettinger, City Of	Bedrock depth unkn
48	42775	T. 97 N., R. 33 W., Sec. 10, NE, SE, NW, NW	268	1/1/1980	Herke, Willard	Bedrock depth unkn
49	39991	T. 97 N., R. 33 W., Sec. 9	276	1/1/1933	Graettinger, City Of	Bedrock depth unkn
59	4332	T. 97 N., R. 33 W., Sec. 9	35	1/1/1950	Graettinger, City Of	Bedrock depth unkn; scanned log available
65	42787	T. 97 N., R. 33 W., Sec. 9, SE, SW, NW, NW, SW	17	1/1/1975	Graettinger Developpenent Corp.	Bedrock depth unkn
68	44191	T. 97 N., R. 33 W., Sec. 10, SW, SE, SW, NE	36	unkn	Studer, John	Bedrock depth unkn
71	42768	T. 97 N., R. 33 W., Sec. 15, NE, NE, NE, NW	31	1/1/1977	Hoffman, John & Dale	Bedrock depth unkn
72	12344	T. 97 N., R. 33 W., Sec. 18, NE, NE, NW, SW	105	1/1/1950	Spies, Fred	Bedrock depth unkn; scanned log available
73	27123	T. 97 N., R. 33 W., Sec. 15, NE, NW, NW, SW	21	9/1/1953	Igs	Bedrock depth unkn; scanned log available
74	44192	T. 97 N., R. 33 W., Sec. 15, NW, SW, NE, NE, NE	43	unkn	Hoffman, Lambert	Bedrock depth unkn
75	42769	T. 97 N., R. 33 W., Sec. 15, NE, SE, NE, NE	20	1/1/1961	Hoffman, John & Dale	Bedrock depth unkn
93	42780	T. 97 N., R. 33 W., Sec. 14, SW, NW, NW, NW	28	unkn	Mocombs, Lloyd	Bedrock depth unkn
94	42781	T. 97 N., R. 33 W., Sec. 14, SW, NW, NE, NE	28	unkn	Mocombs, Lloyd	Bedrock depth unkn
98	37287	T. 97 N., R. 33 W., Sec. 17, SE, NE, NW	70	4/28/1995	Luhman, Roy	Bedrock depth unkn
99	25729	T. 97 N., R. 33 W., Sec. 16, SW, NW	60	8/22/1979	Flanagan, Hugh	Bedrock depth unkn; scanned log available
101	42772	T. 97 N., R. 33 W., Sec. 15, SW, NW, SE, NE, SE	48	1/1/1977	Hoffman, John & Dale	Bedrock depth unkn
105	42770	T. 97 N., R. 33 W., Sec. 15, SE, SW, NE, NE, SW	50	1/1/1977	Hoffman, John & Dale	Bedrock depth unkn
106	42771	T. 97 N., R. 33 W., Sec. 15, SE, SW, NW, NE, SE	30	1/1/1977	Hoffman, John & Dale	Bedrock depth unkn
108	41584	T. 97 N., R. 33 W., Sec. 18, SE, SW, NE	63	7/1/1998	Joyce, Paul	Bedrock depth unkn
109	51947	T. 97 N., R. 33 W., Sec. 16, SE, SW, NW	71	4/28/2000	Feldhacker, Mark	Bedrock depth unkn
112	53285	T. 97 N., R. 33 W., Sec. 16, SE, SE, SE	320	12/17/1999	Moran, Deb	Bedrock depth 286 ft.
113	27166	T. 97 N., R. 33 W., Sec. 22, NE, NE, NE, NW	20	10/18/1983	Igs	Bedrock depth unkn; scanned log available
114	27167	T. 97 N., R. 33 W., Sec. 22, NE, NW, NE, NE	21	10/18/1983	Igs	Bedrock depth unkn; scanned log available
116	42038	T. 97 N., R. 33 W., Sec. 22, NW, NE	54	6/14/1994	Herke, Richard	Bedrock depth unkn
117	25728	T. 97 N., R. 33 W., Sec. 21, NW, NE	35	8/21/1979	Flanagan, Hugh	Bedrock depth unkn; scanned log available
118	34936	T. 97 N., R. 33 W., Sec. 21, NW, NE, SW	110	5/17/1994	Flannegan, Hugh	Bedrock depth unkn
119	34637	T. 97 N., R. 33 W., Sec. 21, NW, NE, SW	35	5/18/1994	Flannegan, Hugh	Bedrock depth unkn
120	42773	T. 97 N., R. 33 W., Sec. 22, NE, SW, NW, NW, NW	58	12/1/1975	Herke, Richard	Bedrock depth unkn

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123	24452	T. 97 N., R. 33 W., Sec. 23, NE, SW	23	unkn	Soper, Harlan	Bedrock depth unkn
124	42655	T. 97 N., R. 33 W., Sec. 19, NE, SW, SE	87	1/21/1997	Sikora, Perry	Bedrock depth unkn
125	24500	T. 97 N., R. 33 W., Sec. 23, NE, SE	27	unkn	Soper, Harlan	Bedrock depth unkn
130	29116	T. 97 N., R. 33 W., Sec. 23, NE, SE, SE	66	8/28/1986	Herke, Doug	Bedrock depth unkn
148	42784	T. 97 N., R. 33 W., Sec. 22, SE, NW, SE, NE, SE	31	unkn	Soper Farms, Inc.	Bedrock depth unkn
149	42783	T. 97 N., R. 33 W., Sec. 22, SE, NW, SE, SE, SE	30	unkn	Soper Farms, Inc.	Bedrock depth unkn
153	42782	T. 97 N., R. 33 W., Sec. 22, SE, SW, NE, NE, NE	31	5/1/1976	Soper Farms, Inc.	Bedrock depth unkn
154	42786	T. 97 N., R. 33 W., Sec. 22, SE, SE, NW, NE, NW	25	unkn	Soper Farms, Inc.	Bedrock depth unkn
155	42785	T. 97 N., R. 33 W., Sec. 22, SE, SE, NW, NW	30	unkn	Soper Farms, Inc.	Bedrock depth unkn
159	44193	T. 97 N., R. 33 W., Sec. 23, SE, SW, NE, NE, NE	50	unkn	Tonderum, George	Bedrock depth unkn
160	47167	T. 97 N., R. 33 W., Sec. 23, SE, SE, NW	55	11/15/1998	Aldous, Steve & Jill	Bedrock depth unkn
164	36737	T. 97 N., R. 33 W., Sec. 20, SW, SW, SW	204	6/21/1995	Broam, Jr.	Bedrock depth unkn
166	45098	T. 97 N., R. 33 W., Sec. 23, SE, SE, SE	45	2/2/1998	Wilcoxin, Dale	Bedrock depth unkn
169	44186	T. 97 N., R. 33 W., Sec. 27, NE, NW, NW, NE	27	unkn	Schmidt, Shirley Zitterich	Bedrock depth unkn
172	44187	T. 97 N., R. 33 W., Sec. 27, NE, NW, NW, SE	27	unkn	Schmidt, Shirley Zitterich	Bedrock depth unkn
173	44078	T. 97 N., R. 33 W., Sec. 25, NW, NW, SW, SE, SW	37	1/1/1978	Peterson, Donald E	Bedrock depth unkn
183	44085	T. 97 N., R. 33 W., Sec. 29, SE, NW, NE, NE, NE	48	1/1/1981	Herke, Richard	Bedrock depth unkn
184	44086	T. 97 N., R. 33 W., Sec. 29, SE, NE, NW, NW, NE	60	unkn	Herke, Richard	Bedrock depth unkn
199	4761	T. 97 N., R. 33 W., Sec. 29, SW, NW, SE	255	6/1/1950	Lindgren, E.	Bedrock depth unkn; scanned log available
200	30304	T. 97 N., R. 33 W., Sec. 29, SW, SE	233	11/7/1966	Swanson, Eldon	Bedrock depth unkn
201	44821	T. 97 N., R. 33 W., Sec. 25, SW, SE	51	6/11/1997	Porth, Larry	Bedrock depth unkn
202	27157	T. 97 N., R. 33 W., Sec. 27, SE, SE, SE, NW	41	9/30/1983	lgs	Bedrock depth unkn; scanned log available
205	27124	T. 97 N., R. 33 W., Sec. 36, NW, SW, NW, NW	40	9/1/1983	lgs	Bedrock depth unkn; scanned log available
213	42020	T. 97 N., R. 33 W., Sec. 34, NE, SW, SW	75	5/20/1996	Emmetsburg Lumber	Bedrock depth unkn
223	42779	T. 97 N., R. 33 W., Sec. 35, SE, NE, NW, SE, NW	29	1/1/1980	Herke Farms, Inc.	Bedrock depth unkn
228	31914	T. 96 N., R. 33 W., Sec. 4, NE, NE	245	5/1/1990	Munson, James	Bedrock depth 115 ft.

Public wells (municipal)

27	39988	T. 97 N., R. 33 W., Sec. 9, NW, NE, NW	31	1/1/1964	Graettinger, City Of	Bedrock depth unkn; Well status: Primary; Local id: #4
31	39990	T. 97 N., R. 33 W., Sec. 9	34	1/1/1950	Graettinger, City Of	Bedrock depth unkn; Well status: Abandoned; Local id: #3
39	39989	T. 97 N., R. 33 W., Sec. 9, NE, NW, SW	30	1/1/1978	Graettinger, City Of	Bedrock depth unkn; Well status: Primary; Local id: #5
50	39991	T. 97 N., R. 33 W., Sec. 9	276	1/1/1933	Graettinger, City Of	Bedrock depth unkn; Well status: Abandoned; Local id: #2
51	39992	T. 97 N., R. 33 W., Sec. 9	42	unkn	Graettinger, City Of	Bedrock depth unkn; Local id: #1

Public wells (non-municipal)

2	37951	T. 98 N., R. 33 W., Sec. 33, SW, NW, SW, NW	28	10/20/1980	Torreson, Alice F.	Bedrock depth unkn; Well status: Primary
25	44080	unkn	40	unkn	Alesch, Tony	Bedrock depth unkn; Well status: Primary
43	42775	T. 97 N., R. 33 W., Sec. 10, NE, SE, NW, NW	268	1/1/1980	Herke, Willard	Bedrock depth unkn; Well status: Primary
66	42787	T. 97 N., R. 33 W., Sec. 9, SE, SW, NW, NW, SW	17	1/1/1975	Graettinger Development Corp.	Bedrock depth unkn; Well status: Primary
69	44191	T. 97 N., R. 33 W., Sec. 10, SW, SE, SW, NE	36	unkn	Studer, John	Bedrock depth unkn; Well status: Primary
70	42768	T. 97 N., R. 33 W., Sec. 15, NE, NE, NE, NW	31	1/1/1977	Hoffman, John & Dale	Bedrock depth unkn; Well status: Abandoned
76	44192	T. 97 N., R. 33 W., Sec. 15, NW, SW, NE, NE, NE	43	unkn	Hoffman, Lambert	Bedrock depth unkn; Well status: Primary
77	42769	T. 97 N., R. 33 W., Sec. 15, NE, SE, NE, NE	20	1/1/1981	Hoffman, John & Dale	Bedrock depth unkn; Well status: Abandoned
91	42780	T. 97 N., R. 33 W., Sec. 14, SW, NW, NW, NW	28	unkn	Mccombs, Lloyd	Bedrock depth unkn; Well status: Abandoned
92	42781	T. 97 N., R. 33 W., Sec. 14, SW, NW, NE, NE	28	unkn	Mccombs, Lloyd	Bedrock depth unkn; Well status: Primary

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100	42772	T. 97 N., R. 33 W., Sec. 15, SW, NW, SE, NE, SE	48	1/1/1977	Hoffman, John & Dale	Bedrock depth unkn; Well status: Primary
102	42771	T. 97 N., R. 33 W., Sec. 15, SE, SW, NW, NE, SE	30	1/1/1977	Huffman, John & Dale	Bedrock depth unkn; Well status: Standby
107	42770	T. 97 N., R. 33 W., Sec. 15, SE, SW, NE, NE, SW	50	1/1/1977	Hoffman, John & Dale	Bedrock depth unkn; Well status: Primary
121	42773	T. 97 N., R. 33 W., Sec. 22, NE, SW, NW, NW, NW	56	12/1/1975	Herke, Richard	Bedrock depth unkn; Well status: Primary
147	42784	T. 97 N., R. 33 W., Sec. 22, SE, NW, SE, NE, SE	31	unkn	Soper Farms, Inc.	Bedrock depth unkn; Well status: Primary
150	42783	T. 97 N., R. 33 W., Sec. 22, SE, NW, SE, SE, SE	30	unkn	Soper Farms, Inc.	Bedrock depth unkn; Well status: Primary
151	42786	T. 97 N., R. 33 W., Sec. 22, SE, SE, NW, NE, NW	25	unkn	Soper Farms, Inc.	Bedrock depth unkn; Well status: Primary
152	42785	T. 97 N., R. 33 W., Sec. 22, SE, SE, NW, NW	30	unkn	Soper Farms, Inc.	Bedrock depth unkn; Well status: Primary
156	42782	T. 97 N., R. 33 W., Sec. 22, SE, SW, NE, NE, NE	31	5/1/1976	Soper Farms, Inc.	Bedrock depth unkn; Well status: Primary
158	44193	T. 97 N., R. 33 W., Sec. 23, SE, SW, NE, NE, NE	50	unkn	Tonderum, George	Bedrock depth unkn; Well status: Primary
170	44187	T. 97 N., R. 33 W., Sec. 27, NE, NW, NW, SE	27	unkn	Schmidt, Shirley Zitterich	Bedrock depth unkn; Well status: Primary
171	44186	T. 97 N., R. 33 W., Sec. 27, NE, NW, NW, NE	27	unkn	Schmidt, Shirley Zitterich	Bedrock depth unkn; Well status: Primary
174	44078	T. 97 N., R. 33 W., Sec. 25, NW, NW, SW, SE, SW	37	1/1/1976	Peterson, Donald E	Bedrock depth unkn; Well status: Plugged
179	44085	T. 97 N., R. 33 W., Sec. 29, SE, NW, NE, NE, NE	48	1/1/1991	Herke, Richard	Bedrock depth unkn; Well status: Primary
180	44086	T. 97 N., R. 33 W., Sec. 28, SE, NE, NW, NW, NE	60	unkn	Herke, Richard	Bedrock depth unkn; Well status: Primary
222	42779	T. 97 N., R. 33 W., Sec. 35, SE, NE, NW, SE, NW	29	1/1/1980	Herke Farms, Inc.	Bedrock depth unkn; Well status: Plugged

Wells registered for testing

7	55824	T. 97 N., R. 33 W., Sec. 6	150	1910	Rose, Roy	Drilling method: Bored; Known well depth
8	55742	T. 97 N., R. 33 W., Sec. 3	35	1940	Bates, Jim	Drilling method: Bored; Known well depth
9	61894	T. 97 N., R. 33 W., Sec. 4	35	unkn	Wikert, Mrs. Ervin	Drilling method: Bored; Known well depth
10	66065	T. 97 N., R. 33 W., Sec. 4	20	unkn	Prather, Rich	Drilling method: Drilled; Known well depth
12	66064	T. 97 N., R. 33 W., Sec. 4	20	1995	Prather, Robert H.	Drilling method: Driven; Known well depth
13	61825	T. 97 N., R. 33 W., Sec. 4	35	unkn	Wikert, Mrs. Ervin	Drilling method: Bored; Known well depth
14	55760	T. 97 N., R. 33 W., Sec. 4	75	1998	James, Randy	Drilling method: Bored; Known well depth
15	46998	T. 97 N., R. 33 W., Sec. 4	25	1986	Petersen, Jane	Drilling method: Driven; Known well depth
16	46992	T. 97 N., R. 33 W., Sec. 4	20	unkn	Prather, Rich	Drilling method: Bored; Known well depth
17	55743	T. 97 N., R. 33 W., Sec. 3	35	1940	Bates, Jim	Drilling method: Bored; Known well depth
18	55639	T. 97 N., R. 33 W., Sec. 3	240	unkn	Alesch, Tony	Drilling method: Drilled; Known well depth
19	46993	T. 97 N., R. 33 W., Sec. 4	20	1993	Prather, Bob	Drilling method: Driven; Known well depth
20	55617	T. 97 N., R. 33 W., Sec. 3	80	unkn	Juchems, Mike	Drilling method: Drilled; Known well depth
21	66068	T. 97 N., R. 33 W., Sec. 4	20	unkn	Petersen, June M.	Drilling method: Driven; Known well depth
22	61795	T. 97 N., R. 33 W., Sec. 4	25	unkn	Lammers, Donald	Drilling method: Driven; Known well depth
23	46997	T. 97 N., R. 33 W., Sec. 4	39	1976	Wicks, Carl	Drilling method: Driven; Known well depth
26	21210	T. 97 N., R. 33 W., Sec. 4, SW, SW	41	unkn	Moren, Don	Drilling method: Unknown;
30	47011	T. 97 N., R. 33 W., Sec. 8, NW, NW, NW	68	1946	Cox, Jan	Drilling method: Unknown; Known well depth
32	51809	T. 97 N., R. 33 W., Sec. 10, NW, NW, NW	35	unkn	Hoffman, Dale	Drilling method: Driven; Known well depth
52	55823	T. 97 N., R. 33 W., Sec. 7	90	1980	Rose, Roger	Drilling method: Bored; Known well depth
53	66054	T. 97 N., R. 33 W., Sec. 7	105	1950	Graettinger, Ralph	Drilling method: Drilled; Known well depth
55	61695	T. 97 N., R. 33 W., Sec. 8	50	unkn	Vreeland, Loren	Drilling method: Bored; Known well depth
58	61896	T. 97 N., R. 33 W., Sec. 7	72	1974	Graettinger, Ron	Drilling method: Drilled; Known well depth
60	55632	T. 97 N., R. 33 W., Sec. 10	85	1970	Smith, Russell	Drilling method: Drilled; Known well depth
62	61787	T. 97 N., R. 33 W., Sec. 9	18	unkn	Masters, Bob	Drilling method: Driven; Known well depth
63	51424	T. 97 N., R. 33 W., Sec. 9	unkn	unkn	Totman, John	Drilling method: Bored; Well depth is uncertain
64	66055	T. 97 N., R. 33 W., Sec. 11	unkn	unkn	Gires, Tim	Drilling method: Unknown; Well depth is uncertain
76	21753	T. 97 N., R. 33 W., Sec. 15, NW, SE, NE	25	1930	Hoffman, Lambert	Drilling method: Driven;
79	66053	T. 97 N., R. 33 W., Sec. 18	75	1975	Graettinger, Ronald	Drilling method: Drilled; Known well depth

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60	61789	T. 97 N., R. 33 W., Sec. 17	50	1949	Johnson, Bruce	Drilling method: Bored; Known well depth
61	45390	T. 97 N., R. 33 W., Sec. 17	70	1995	Luhman, Roy E.	Drilling method: Bored;
62	72765	T. 97 N., R. 33 W., Sec. 18	60	1997	Joyce, Paul	Drilling method: Drilled; Known well depth
64	55820	T. 97 N., R. 33 W., Sec. 15	30	1980	Olesen, Steve	Drilling method: Drilled; Known well depth
65	61747	T. 97 N., R. 33 W., Sec. 15	25	1996	Hoffman, Dale	Drilling method: Driven; Known well depth
66	61790	T. 97 N., R. 33 W., Sec. 17	50	1949	Johnson, Bruce	Drilling method: Bored; Known well depth
90	55631	T. 97 N., R. 33 W., Sec. 14	120	1939	Lammers, Milo	Drilling method: Drilled; Known well depth
97	46991	T. 97 N., R. 33 W., Sec. 13	144	unkn	Hasbrouck, Charles	Drilling method: Drilled; Known well depth
98	47010	T. 97 N., R. 33 W., Sec. 13	180	unkn	Hovinga, Jerry	Drilling method: Drilled; Known well depth
110	33519	T. 97 N., R. 33 W., Sec. 15, SW, SE	30	1953	Hoffman, John	Drilling method: Bored; Known well depth
126	46996	T. 97 N., R. 34 W., Sec. 24	220	unkn	Ferris, Steve	Drilling method: Bored; Known well depth
127	55626	T. 97 N., R. 34 W., Sec. 24	60	1959	Christensen, Harold	Drilling method: Bored; Known well depth
131	51858	T. 97 N., R. 33 W., Sec. 20	175	unkn	Clark, James	Drilling method: Unknown; Known well depth
133	61279	T. 97 N., R. 33 W., Sec. 21	47	unkn	Gabrielsen, Joel	Drilling method: Bored; Known well depth
134	46987	T. 97 N., R. 33 W., Sec. 23	33	1998	Wilcoxson, Dale	Drilling method: Drilled; Known well depth
135	61788	T. 97 N., R. 33 W., Sec. 23	60	unkn	Donake, Jan	Drilling method: Drilled; Known well depth
137	61743	T. 97 N., R. 33 W., Sec. 23	51	1991	Herke, Doug	Drilling method: Drilled; Known well depth
138	41395	T. 97 N., R. 33 W., Sec. 23	60	1995	Herke, Doug	Drilling method: Bored; Known well depth
141	41285	T. 97 N., R. 33 W., Sec. 24	300	1990	Christensen, M.	Drilling method: Drilled;
144	41392	T. 97 N., R. 33 W., Sec. 24	18	1994	Herke, Edmund	Drilling method: Bored; Known well depth
146	21214	T. 97 N., R. 33 W., Sec. 20, SE, NE	175	unkn	Clark, Sharon	Drilling method: Drilled;
157	66039	T. 97 N., R. 33 W., Sec. 23, SE	35	1984	Louwagie, Thad	Drilling method: Drilled; Known well depth
168	33516	T. 97 N., R. 33 W., Sec. 27, NW, NE, NE	90	unkn	Schany, Richard	Drilling method: Drilled; Known well depth
175	61203	T. 97 N., R. 33 W., Sec. 30	50	unkn	Meneweren, Gary	Drilling method: Bored; Known well depth
178	55625	T. 97 N., R. 33 W., Sec. 30	50	1977	Moran, Mike	Drilling method: Drilled; Known well depth
181	46986	T. 97 N., R. 33 W., Sec. 29	230	1988	Swanson, Roger	Drilling method: Drilled; Known well depth
182	66063	T. 97 N., R. 33 W., Sec. 29	230	1988	Swanson, Roger	Drilling method: Drilled; Known well depth
187	61745	T. 97 N., R. 33 W., Sec. 27	70	unkn	Schany, Richard	Drilling method: Drilled; Known well depth
188	61783	T. 97 N., R. 33 W., Sec. 26	20	unkn	Van Cleave, Roger	Drilling method: Driven; Known well depth
189	41398	T. 97 N., R. 33 W., Sec. 26	50	unkn	Kinnetz, Elmer	Drilling method: Augered; Known well depth
190	61744	T. 97 N., R. 33 W., Sec. 26	50	unkn	Kinnetz, Elmer	Drilling method: Drilled; Known well depth
191	61746	T. 97 N., R. 33 W., Sec. 26	22	unkn	Joyce, Jerry	Drilling method: Driven; Known well depth
203	33510	T. 97 N., R. 33 W., Sec. 32, NE, NE	unkn	unkn	Dobbins, Steven	Drilling method: ; Well depth is uncertain
209	61697	T. 97 N., R. 34 W., Sec. 36	60	unkn	Moran, Marvin	Drilling method: Bored; Known well depth
210	41409	T. 97 N., R. 33 W., Sec. 31	unkn	unkn	Swanson, Gary	Drilling method: Unknown; Well depth is uncertain
211	51438	T. 97 N., R. 33 W., Sec. 31	90	1991	Brennan, Marty	Drilling method: Drilled; Known well depth
212	46973	T. 97 N., R. 33 W., Sec. 31	75	unkn	Titus, Dan	Drilling method: Bored; Known well depth
214	46972	T. 97 N., R. 33 W., Sec. 32	141	1991	Kinnetz, Cliff	Drilling method: Drilled; Known well depth
215	61204	T. 97 N., R. 33 W., Sec. 32	50	unkn	Christensen, Alice	Drilling method: Drilled; Known well depth
216	72786	T. 97 N., R. 33 W., Sec. 32	141	1991	Kinnetz, Cliff	Drilling method: ;
217	46971	T. 97 N., R. 33 W., Sec. 33	30	unkn	Currans, Martin	Drilling method: Bored; Known well depth
218	41282	T. 97 N., R. 33 W., Sec. 34	80	1978	Riha, Ron	Drilling method: Drilled;
219	35999	T. 97 N., R. 33 W., Sec. 34	75	1970	Currant, Emmet	Drilling method: Bored;
220	35992	T. 97 N., R. 33 W., Sec. 35	90	1996	Augsting, Helen	Drilling method: Drilled;
229	51422	T. 96 N., R. 33 W., Sec. 5	30	unkn	Davis, Val	Drilling method: Bored; Known well depth
230	46984	T. 96 N., R. 33 W., Sec. 4	250	1987	Munson, Jim	Drilling method: Bored; Known well depth
231	35633	T. 96 N., R. 33 W., Sec. 4	90	1989	Malm, Steven	Drilling method: Bored;
232	55816	T. 96 N., R. 33 W., Sec. 3	80	unkn	Allen, Maurice	Drilling method: Bored; Known well depth
233	46982	T. 96 N., R. 33 W., Sec. 3	50	unkn	Brown, Mary	Drilling method: Augered; Known well depth

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Permitted private wells

Map ID	Well ID	Location	Well depth	Completion date	Owner	Comments
5	14832	T. 97 N., R. 33 W., Sec. 5, NE, NE	40	3/25/1992	Unkn	Primary use: Industrial/Commercial
67	14838	T. 97 N., R. 33 W., Sec. 9, SW, SE	36	8/31/1989	Unkn	Primary use: Domestic/household
111	19114	T. 97 N., R. 33 W., Sec. 18, SE, SW, SW	unkn	7/8/1996	Beck	Primary use:
116	2217	T. 97 N., R. 33 W., Sec. 22, NENW	55	unkn	Herke, Richard	Primary use: Irrigation
139	27260	T. 97 N., R. 33 W., Sec. 20, SW, NW, NW	50	8/21/2000	Swine Graphics	Primary use: livestock
145	27263	T. 97 N., R. 33 W., Sec. 23, SE, NW, NE	50	8/21/2000	Swine Graphics	Primary use: livestock
161	23588	T. 97 N., R. 33 W., Sec. 23, SE, SE, NW	40	11/15/1998	Aldous	Primary use: livestock
162	17316	T. 97 N., R. 33 W., Sec. 20, SW, SW	200	unkn	Unkn	Primary use: Livestock/Agricultural
165	14875	T. 97 N., R. 33 W., Sec. 24, SW, SW	unkn	3/28/1989	Unkn	Primary use: Domestic/household
167	27261	T. 97 N., R. 33 W., Sec. 23, SE, SE, SE	50	8/21/2000	Swine Graphics	Primary use: livestock
193	14877	T. 97 N., R. 33 W., Sec. 29, SW, NE	unkn	10/26/1989	Unkn	Primary use:
194	14869	T. 97 N., R. 33 W., Sec. 29, SW, NE	unkn	5/15/1989	Unkn	Primary use: Domestic/household
195	14881	T. 97 N., R. 33 W., Sec. 29, SW, NE	254	10/26/1988	Unkn	Primary use:
198	822	T. 97 N., R. 33 W., Sec. 29, SENE	unkn	unkn	Palo Alto, County Of	Primary use: Domestic/household
206	14857	T. 97 N., R. 33 W., Sec. 32, NW, SE, SW	200	10/9/1990	Unkn	Primary use: Domestic/household
207	14848	T. 97 N., R. 33 W., Sec. 32, NW, SE, SW	200	10/9/1990	Unkn	Primary use: Domestic/household
208	14859	T. 97 N., R. 33 W., Sec. 35, NE, SW	35	7/28/1989	Unkn	Primary use: Irrigation
224	18699	T. 97 N., R. 33 W., Sec. 35, SW	unkn	6/14/1996	Augustine	Primary use:
225	18687	T. 97 N., R. 33 W., Sec. 35, SW	unkn	4/20/1996	Augustine	Primary use: household
227	14845	T. 97 N., R. 33 W., Sec. 31, SW, SW, SW	150	11/29/1990	Unkn	Primary use: Domestic/household

Registered abandoned wells

Map ID	Well ID	Location	Well depth	Completion date	Owner	Comments
38	4288	T. 97 N., R. 33 W., Sec. 9, NW, NW, SW	unkn	n.a.	Jacobson, Elanor	Well plugged: 10/16/1990; Well type: < 18" dia.
41	39779	T. 97 N., R. 33 W., Sec. 9, NW	unkn	n.a.	Ralg, Dan	Well plugged: 7/9/1999; Well type: other
95	23139	T. 97 N., R. 33 W., Sec. 17, SE, NE, NW	65	n.a.	Luhman Farms Inc, c/o Roy E. Luhma	Well plugged: 4/28/1995; Well type: < 18" dia.
103	25659	T. 97 N., R. 33 W., Sec. 18, SE, SW, NE	30	n.a.	Beck & Allen Farms, c/o Elizabeth Be	Well plugged: 7/3/1996; Well type: > 18" dia.
104	25663	T. 97 N., R. 33 W., Sec. 18, SW, SW, NW	93	n.a.	Joyce Ag & Co, c/o Paul Joyce	Well plugged: 7/31/1996; Well type: < 18" dia.
122	33221	T. 97 N., R. 33 W., Sec. 24, NW, SW, NE	80	n.a.	Herke, Edmund	Well plugged: 7/23/1998; Well type: < 18" dia.
140	19012	T. 97 N., R. 33 W., Sec. 21, SW, NE, NW	unkn	n.a.	Flannegan, Hugh	Well plugged: 5/18/1994; Well type: < 18" dia.
142	16812	T. 97 N., R. 33 W., Sec. 21, SW, NE, NW	110	n.a.	Flannegan, Hugh	Well plugged: 5/18/1994; Well type: < 18" dia.
143	16909	T. 97 N., R. 33 W., Sec. 21, SW, NE, NW	unkn	n.a.	Flannegan, Hugh	Well plugged: 5/18/1994; Well type: < 18" dia.
163	27624	T. 97 N., R. 33 W., Sec. 18, SE, SW, SW	70	n.a.	Sikora, Perry	Well plugged: 1/22/1997; Well type: < 18" dia.
176	25658	T. 97 N., R. 33 W., Sec. 30	30	n.a.	Appel, Dorothy	Well plugged: 6/29/1995; Well type: > 18" dia.
186	7655	T. 97 N., R. 34 W., Sec. 25, SW, NE, NE	65	n.a.	Peterson, Jim	Well plugged: 6/19/1989; Well type: < 18" dia.
196	28528	T. 97 N., R. 33 W., Sec. 26, SE, NE, NE	24	n.a.	Brownlee Management	Well plugged: 5/15/1997; Well type: < 18" dia.
197	28526	T. 97 N., R. 33 W., Sec. 26, SE, NE, NE	18	n.a.	Brownlee Management	Well plugged: 5/15/1997; Well type: < 18" dia
204	31617	T. 97 N., R. 33 W., Sec. 35, NE, NE, SE	10	n.a.	Iowa D.n.r.	Well plugged: 10/21/1997; Well type: < 18" dia.
226	24766	T. 97 N., R. 33 W., Sec. 32, SE, SE	60	n.a.	Anderson, Phillip	Well plugged: 6/1/1996; Well type: > 18" dia.

Public water supply wells and intakes

11/01/2004 03:05 17122625825 SPENCER ENGR

28	4924	T97N, R33W, Sec. 9	n.a.	n.a.	Graettinger	n.a.
49	4924	T97N, R33W, Sec. 9	n.a.	n.a.	Graettinger	n.a.

Water use permit facilities

11	5170	T. 97 N., R. 33 W., Sec. 3	n.a.	n.a.	Alesch, Tony	Source: Well, 1 wells authorized, Use: General farm crop irrigation
54	4924	T. 97 N., R. 33 W., Sec. 9	n.a.	n.a.	Graettinger, City Of	Source: Well, 3 wells authorized, Use: Municipal
56	5127	T. 97 N., R. 33 W., Sec. 10	n.a.	n.a.	Herke, Willard	Source: Well, 1 wells authorized, Use: General farm crop irrigation
57	5238	T. 97 N., R. 33 W., Sec. 9	n.a.	n.a.	Graettinger Development Corp.	Source: Well, 1 wells authorized, Use: Golf courses irrigation
61	5188	T. 97 N., R. 33 W., Sec. 10	n.a.	n.a.	Studer, John	Source: Well, 1 wells authorized, Use: General farm crop irrigation
83	3876	T. 97 N., R. 33 W., Sec. 15	n.a.	n.a.	Hoffman, John & Dale	Source: Well/Stream, 6 wells authorized, Use: General farm crop irrigation
87	5172	T. 97 N., R. 33 W., Sec. 15	n.a.	n.a.	Hoffman, Lambert	Source: Well, 1 wells authorized, Use: General farm crop irrigation
88	3876	T. 97 N., R. 33 W., Sec. 15	n.a.	n.a.	Hoffman, John & Dale	Source: Well/Stream, 6 wells authorized, Use: General farm crop irrigation
89	5159	T. 97 N., R. 33 W., Sec. 14	n.a.	n.a.	Mc Combs, Lloyd	Source: Well, 2 wells authorized, Use: General farm crop irrigation
128	5133	T. 97 N., R. 33 W., Sec. 22	n.a.	n.a.	Herke, Doug	Source: Well, 3 wells authorized, Use: General farm crop irrigation
129	5173	T. 97 N., R. 33 W., Sec. 22	n.a.	n.a.	Soper Farms, Inc.	Source: Well, 5 wells authorized, Use: General farm crop irrigation
132	4036	T. 97 N., R. 33 W., Sec. 22	n.a.	n.a.	Herke, Richard	Source: Well, 1 wells authorized, Use: General farm crop irrigation
136	5181	T. 97 N., R. 33 W., Sec. 23	n.a.	n.a.	Tonderum, George	Source: Well, 1 wells authorized, Use: General farm crop irrigation
177	5047	T. 97 N., R. 33 W., Sec. 29	n.a.	n.a.	Herke, Richard	Source: Well, 1 wells authorized, Use: General farm crop irrigation
185	5148	T. 97 N., R. 33 W., Sec. 27	n.a.	n.a.	Schmidt, Shirley Zitterich	Source: Well, 1 wells authorized, Use: General farm crop irrigation
192	5137	T. 97 N., R. 33 W., Sec. 25	n.a.	n.a.	Peterson, Donald E.	Source: Well, 1 wells authorized, Use: General farm crop irrigation
221	5156	T. 97 N., R. 33 W., Sec. 35	n.a.	n.a.	Herke Farms, Inc.	Source: Well, 4 wells authorized, Use: General farm crop irrigation

SPENCER REHLI 17122625825 11/01/2004 03:05

TOTAL P.08

11/01/04 MON 14:07 [TX/RX NO 7919] 009

APPENDIX 3

Boring Logs
1976-2013

W-25724

FORM NO. [illegible] printed and for sale by Ross-Martin Co., Tulsa.

STATE: Iowa

SEC.:

TWP.: 72N RGE.:

Greatinger (Palo Alto)

Hugh Flanagan

2

COMMENCED: Aug 22, 1979 COMPLETED: Aug 22, 1979

Virgil Elbert

CASING RECORD

LOGGED: Feb. 12, 1980 BY: M. J. Brock

REMARKS

EL-

T.D.- 60'

ODI-100 Auger

Soil, brn, sdy, Till, v. sft, yel, oxid, w/ lcb

Till, as above.

Till, as, v pale yel.

as, pale ony yel.

Till, as, sdy.

Till, extremely sdy, possibly dirty outwash sd.

gray, var. colored ss, var. colored, f-m R, (15-20% dirty

50'

Mnk

T.D. - 60'

100'

25 [illegible]

WELL RECORD

Well is located 1½ miles (N E S W) and ..... miles (N E S W) from

Graettinger (Nearest Town) in Dickinson (County),

in the NW ¼ SW ¼ Sec. 16 T. 97N R. 32W

Owner Hugh Flanagan Well No. 2

Postoffice address Graettinger Ia

Contractor Virgil P Ebert well Drlg

Address Whittemore Ia

Driller Glen Kollasch

Well begun Aug 22, 1929;

completed Aug 22, 1929

Rig used—Cable, Rotary, Jet, or Auger

Depth of well ~~60~~ 57' (Feet)

Size of hole (note total amount of each size) 2"

.....

Main water supply at 46 - 52' (Feet below surface)

Final water head 38' (Feet above or below surface)

Is well pumped? no

Yield Test hole for water sample (Gallons per minute)

Water level when pumping .....

Position of well ..... (Upland, valley, side hill, etc.)

SOIL BORING LOG & MONITORING WELL CONSTRUCTION DIAGRAM

Broing #3AR MW-3AR	Facility Name: *Flannegan Landfill*	Facility Address: *Grettinger, Iowa*
Boring Depth (Feet) x Diameter (Inches): *10' / 6.25"*		Drilling Method: *Hollowstem Auger*
Well Contractor Registration#: *40403*		Logged by: *Gary R. Steffen*
Date & Time Start: *11/25/96 1:00 pm..*	Date & Time End: *11/25/96 3:30 pm.*	Ground Surface Elevation (ASL): *1231.30'*

Depth in Feet	Well Construction Details	Blow Count (if applicable)	Sample No. Type	PID/FID (PPM)	Rock Formations, Soil, Color and Classifications, Observations such as moisture, etc.
1231.30'	3' Riser				0'
	Grout				*Black Top Soil*
					2'
	Grout				*3' Water Table*
					Brown Sandy Glacial Till
1228.30	2' Bentonite Plug				
1226.30					
	Gravel Pack				
0.10 Screen					
1211.30					10'
					Bottom of Boriong

MW-3AR

ST. 4 ft. Shelby Tube

Observations Water Levels							
	Date:	11/25/96					
	Level:	3.15'					
	Time:	4:00 pm.					

HLW Engineering Group
204 West Broad Street, P.O. Box 314
Story City, Iowa 50248

Telephone: (515) 733-4144
Fax: (515) 733-4146

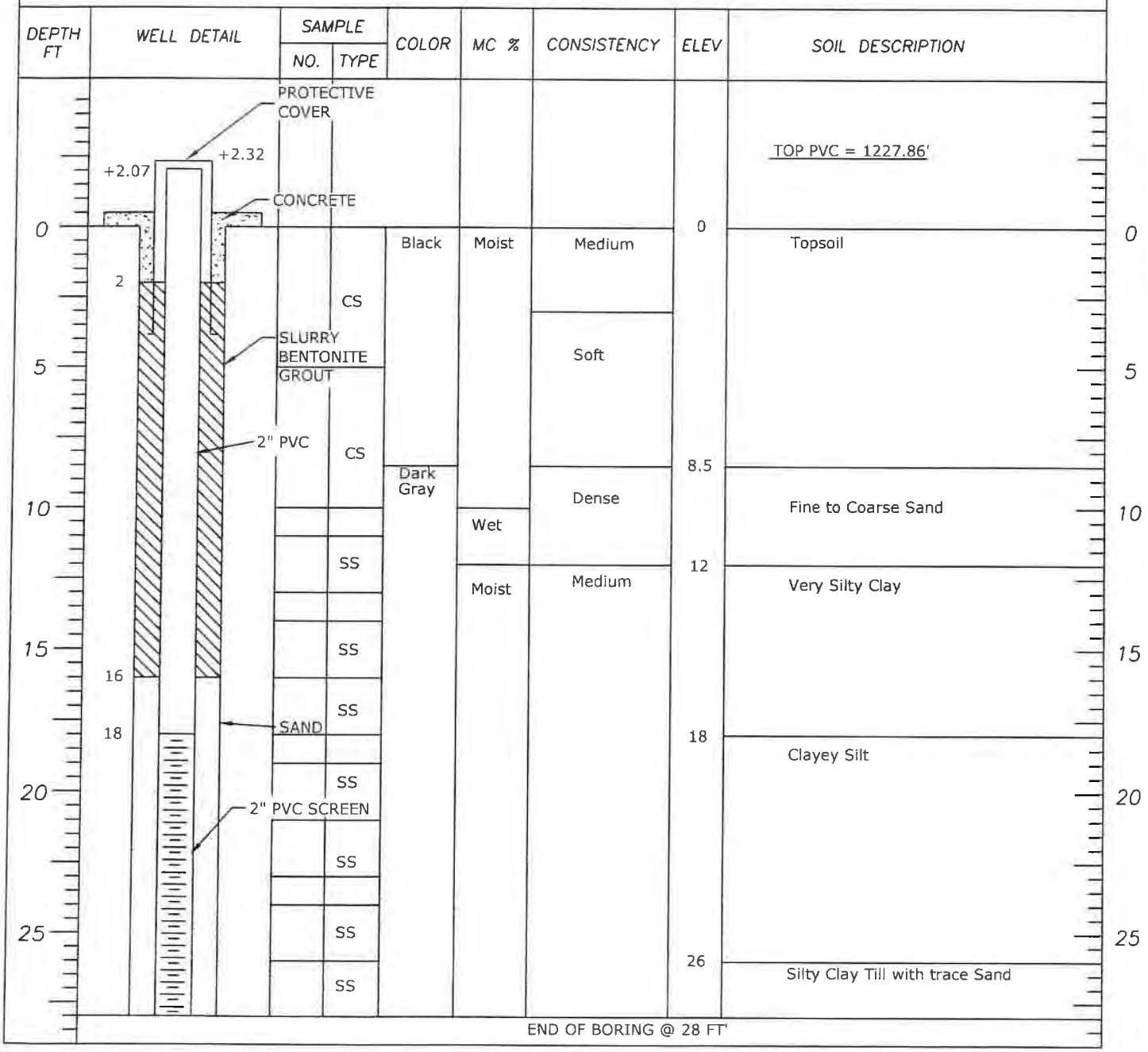
HLW Engineering Group

LOG OF TEST BORING

Drillers: Team Services - Don Carlson | Boring No.: MW 3E | HLW Observer: TDW | HLW Project No.: 6021-12A.200

Date Drilled: 8/8/13
Surface Elevation: 1225.79
Depth Drilled: 28 FT
Drilling Method: 7" HSA
Depth to Water _____ ft @ completion (▽), _____ ft @ _____ hrs. (▼), _____ ft @ _____ hrs.

Project: NORTHERN PLAINS REGIONAL LANDFILL
74-SDP-2-76P
ASSESSMENT OF CORRECTIVE MEASURES
PHASE 2



HLW Engineering Group
204 West Broad Street, P.O. Box 314
Story City, Iowa 50248

Telephone: (515) 733-4144
Fax: (515) 733-4146

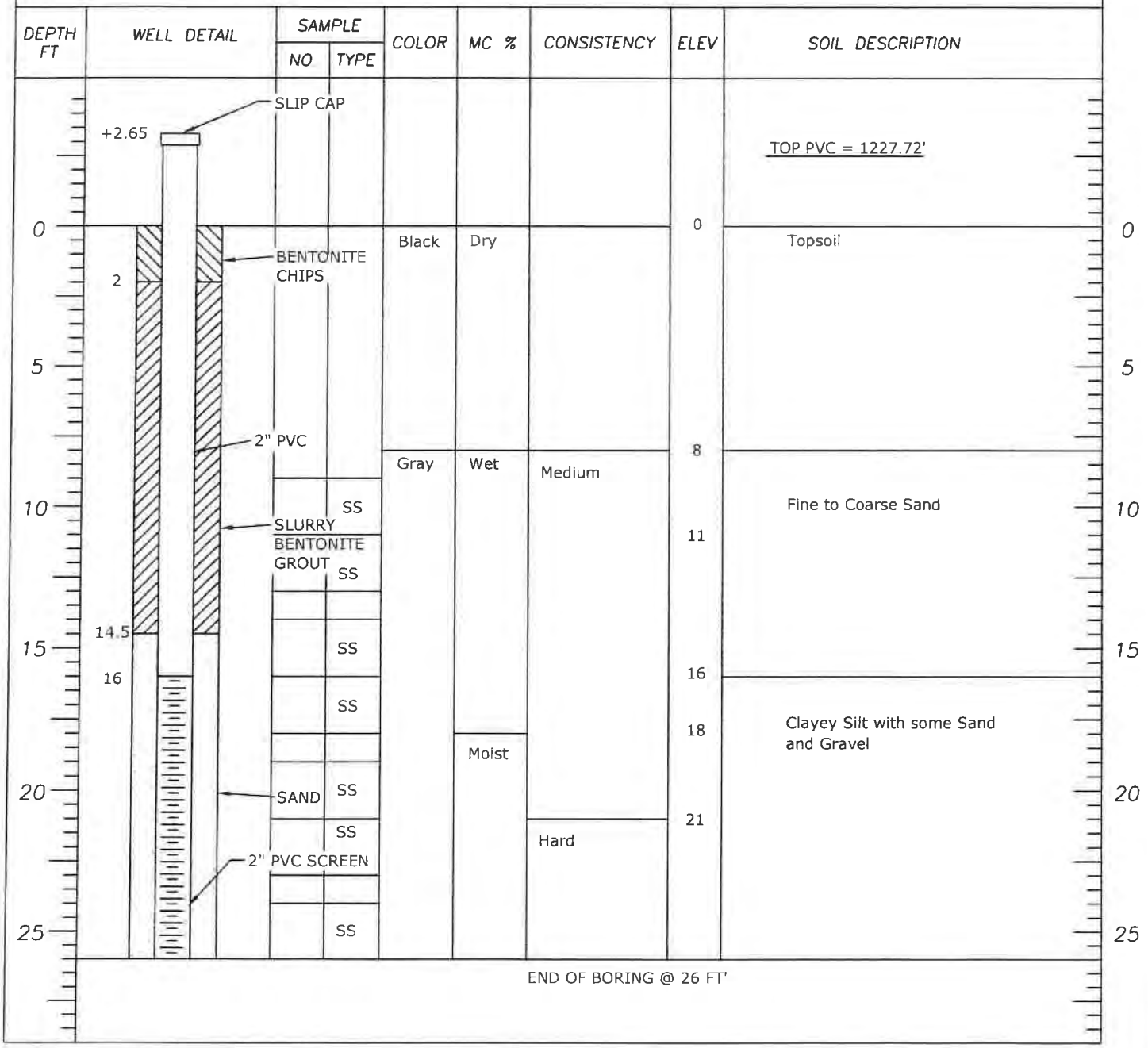
HLW Engineering Group

LOG OF TEST BORING

Drillers Team Services - Don Carlson Boring No. MW 3F HLW Observer TDW
HLW Project No. 6021-12A.200

Date Drilled 8/8/13
Surface Elevation 1225.07
Depth Drilled 26 FT
Drilling Method 7" HSA
Depth to Water _____ ft @ completion (▽), _____ ft @ _____ hrs.(▼), _____ ft @ _____ hrs.

Project NORTHERN PLAINS REGIONAL LANDFILL
74-SDP-2-76P
ASSESSMENT OF CORRECTIVE MEASURES
PHASE 2



LOG OF BORING NO. 11 (Page 1) Now Monitoring Well #5

OWNER: PALO ALTO COUNTY LANDFILL COMMISSION

ARCHITECT-ENGINEER: JACOBSON-WESTERGARD

SITE: NW 1/4, SEC. 21 [illegible] 33 FLANAGAN LANDFI[illegible]

PROJECT NAME:

Sample No	Type Sample	Sampling Distance	Recovery	Blows/ft	Unconfined Compressive Strength-lbs./ft.^{2}	Water Content-%	Dry Density-lbs./ft.^{3}	Unified Class Symbol	Depth	Elevation	Description
											Top of Well Elevation = 1295.8 Surface Elevation = 1293.3
	PA									1291.3	CLAYEY SILT (2.0) Dark Brown
1	AS							CL	5		SANDY CLAYEY SILT Grayish Brown
	PA										
2	AS							CL	10		
3	ST	24						CL		1281.3	(12.0)
	PA										SANDY CLAYEY SILT TRACE GRAVEL Gray
4	AS							CL	15		
	PA										
5	AS							CL	20		
	PA										
6	AS							CL	25		
	PA										
7	AS							CL	30		
	PA										
8	AS							CL	35		
	PA										Continued on Page 2

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IN SITU. THE TRANSITION MAY BE GRADUAL

WATER LEVEL OBSERVATIONS		
W.L.	14.0' W.S. OR W.D.	A.B.
W.L.	B.C.R.	A.C.R.
W.L.	28.0' at 24 hours	

Terracon Consultants, Inc.
Cedar Falls Cedar Rapids Davenport
Des Moines Storm Lake, IA
Kansas City Wichita, KS
Omaha, NE
Oklahoma City Tulsa, OK

BORING STARTED	4-25-84	
BORING COMPLETED	4-25-84	
RIG CME #4	FOREMAN PGC	
APPROVED CKD	JOB # 884703	

LOG OF BORING NO. 11 (Page 2) Now Monitoring Well #5

OWNER: PALO ALTO COUNTY LANDFILL COMMISSION

ARCHITECT-ENGINEER: JACOBSON-WESTERGARD

SITE: NW 1/4, SEC. 21 97 33 FLANAGAN LANDFILL SITE

PROJECT NAME:

Sample No	Type Sample	Sampling Distance	Recovery	Blows/ft	Unconfined Compressive Strength-lbs./ft.^{2}	Water Content-%	Dry Density-lbs./ft.^{3}	Unified Class. Symbol	Depth	Elevation	Description
	PA										
9	AS							CL	40		SANDY CLAYEY SILT TRACE GRAVEL
	PA										Gray
10	AS							CL	45		
	PA										
11	AS							CL	50	1243.3	(50.0)
											Bottom of Boring
											No. 5 Monitoring Well Details Screen with Gravel Pack Elevation 1250.7 to 1260.7 Auger Trailings to Surface

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IN SITU THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS

W.L.	14.0' W.S. OR W.D.	A.B.
W.L.	B.C.R.	A.C.R.
W.L.	28.0' at 24 hours	

Terracon Consultants, Inc.
Cedar Falls Cedar Rapids Davenport
Des Moines Storm Lake IA
Kansas City Wichita KS
Omaha NE
Oklahoma City Tulsa OK

BORING STARTED	4-25-84
BORING COMPLETED	4-25-84
RIG CME #4	FOREMAN PGG
APPROVED CKD	JOB # 884703

Iowa Department of Natural Resources Geological Survey Bureau
109 Trowbridge Hall Iowa City, Ia. 52242-1319 PH (319) 335-1575

WELL RECORD

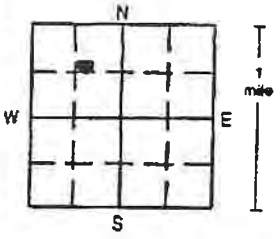
Site Identification

Property Owner Hugh Flannegan Well Number 7A
Address RR
Tenant Emmetsburg 50536
Well Depth 35' ft. Date Completed 5 / 18 / 94

Location

County Palo Alto
Well is 2 1/8 mi. N (S) and 0 mi. E (W) of intersection of B14 and B4
NW 1/4 of the NE 1/4 of the SW 1/4 of Sec 21 TWP 97N RNG 33 E (W)

Show exact location of well in section grid with a dot (●).



Sketch Map of Well Location (Indicate North)

Formation Log

From	To	Color	Hardness	Description
0	3	BLK	S	Topsoil
3	5	DKBrn	S	Clay
5	10	Gry	S	Sand Coarse
10	15	Gry	S	Sand Coarse
15	20	Gry	S	Sand+Gravel
20	25	Gry	S	Sand+Gravel
25	30	Gry	S	Sand+Gravel
30	31	Gry	S	Sand, Coarse
31	32	Gry	S	Silt
32	33	BLK	S	Shale
33	36	Blu	S	Clay

use second sheet if needed

Remarks (Topographic position, elevation, development, disinfection, water quality, etc.)

Well Use

☐ Domestic ☐ Municipal ☐ Industrial
☐ Livestock ☐ Public Supply ☒ Monitoring
☐ Test Well ☐ Irrigation ☐ Other

Measuring Point (MP)

All depth measurements are made from:
☐ Ground Level ☐ KB/other 4 ft (above/below) ground level

Hole Size

6 inch from 0 ft. to 36 ft.
___ inch from ___ ft. to ___ ft.
continued
___ inch from ___ ft. to ___ ft.
___ inch from ___ ft. to ___ ft.

Casing

(ID / OD)? Drive shoe? (yes / no) Pitless adaptor? (yes / no)

Size	Type / Wt.	Depth Top	Depth Bottom	Amount (length)
2	Sch80	+0	31	31

Perforated or Slotted Casing? (yes / no)

Perforated / Slotted from 31 ft. to 36 ft.
Perforated / Slotted from ___ ft. to ___ ft.

Casing Grouted? (yes / no)

☐ Neat Cement ☒ Bentonite ☐ other
from 0 ft. to 22' ft.
from ___ ft. to ___ ft.

Well Screen? (yes / no)

Diameter	Slot size	Depth Top	Depth Bottom	Amount	Type / Mfg.
2"	10	31	36	5	Timco

Gravel packed? (yes / no) from 22 ft. to 36 ft.
Bottom capped? (yes / no) with PVC
Seals / Packers? (yes / no) kind ___ depth ___ ft.

Water Information

Main water supply zone from 5 ft. to 31 ft.
Supply zone rock type (sand/gravel / limestone, sandstone) ___
Final water head (static water level) 6 ft. (below / above) the MP
Pumping water level 20 ft. below MP at yield of 2 GPM
Water quality tested? (yes / no) Date tested ___ / ___ / ___
Tested by ___
Parameters tested for: ___
Test results ___

Pump

Pump installed? (yes / no) Date ___ / ___ / ___
Type of pump ___ Manufacturer's name ___
Depth to intake ___ ft. Tail pipe? (yes / no) length ___ ft.
Pump diameter ___ inches Rated capacity ___ GPM

Contractor's name Beemer Well Drilling Registration no. 17647
Address Rt 1 Box 2 Fairmont Mn 56031
Driller's name Tim Kollasch Drill method (rotary / cable) ___

white copy - Iowa DNR, Geological Survey Bureau blue copy - Well Contractor

HLW Engineering Group
204 West Broad Street, P.O. Box 314
Story City, Iowa 50248

Telephone: (515) 733-4144
Fax: (515) 733-4146

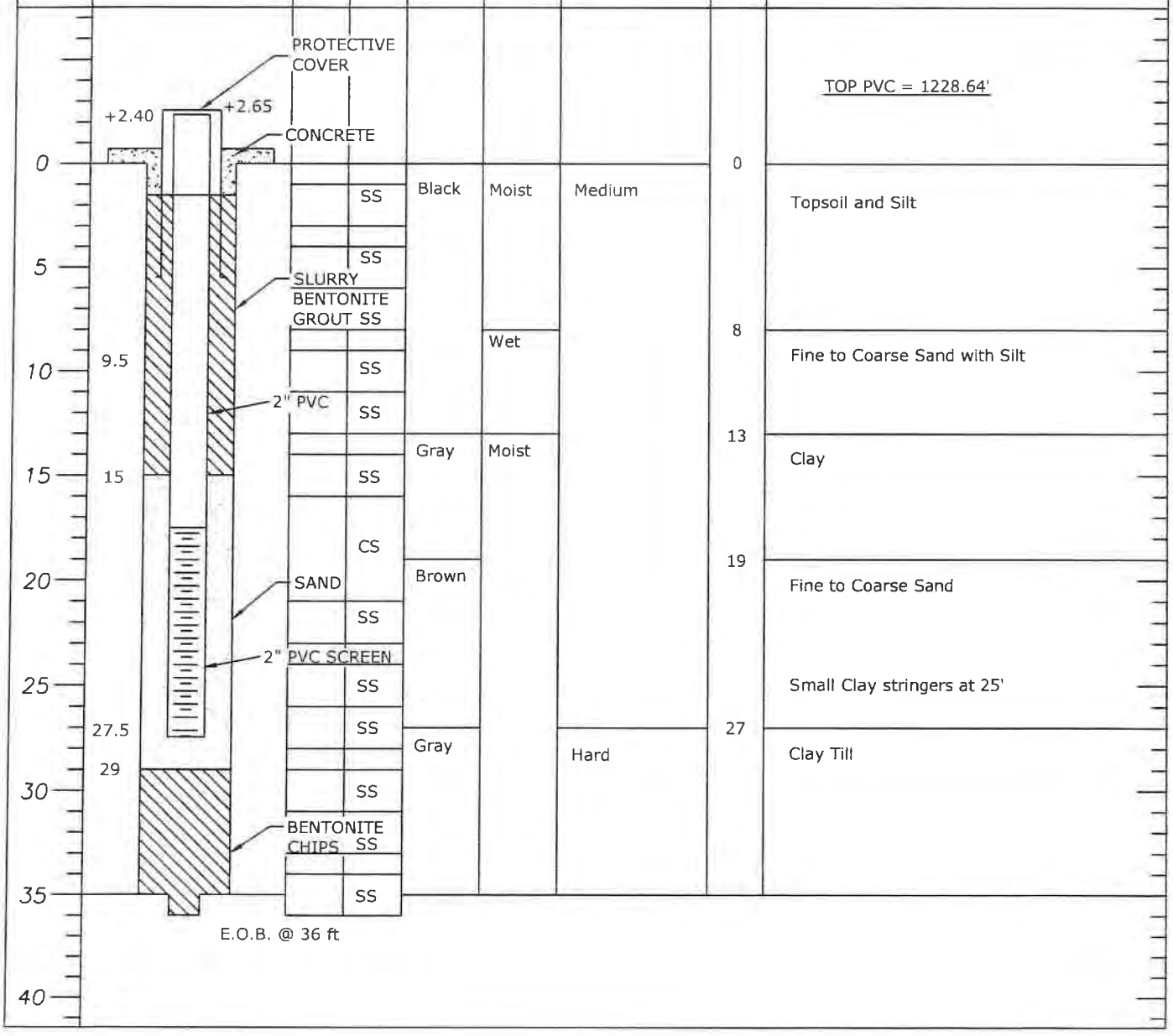
HLW Engineering Group

LOG OF TEST BORING

Drillers: Team Services - Don Carlson | Boring No.: MW 7E | HLW Observer: TDW | HLW Project No.: 6021-12A.200

Date Drilled: 8/7/13
Surface Elevation: 1226.24
Depth Drilled: 35 FT
Drilling Method: 7" HSA
Depth to Water _____ ft @ completion (▽), _____ ft @ _____ hrs. (▼), _____ ft @ _____ hrs.

Project: NORTHERN PLAINS REGIONAL LANDFILL
74-SDP-2-76P
ASSESSMENT OF CORRECTIVE MEASURES
PHASE 2



DEPTH FT	WELL DETAIL	SAMPLE NO.	SAMPLE TYPE	COLOR	MC %	CONSISTENCY	ELEV	SOIL DESCRIPTION
								TOP PVC = 1228.64'
0							0	
			SS	Black	Moist	Medium		Topsoil and Silt
5			SS					
					Wet		8	
10			SS					Fine to Coarse Sand with Silt
			SS					
				Gray	Moist		13	
15			SS					Clay
			CS					
20				Brown			19	
			SS					Fine to Coarse Sand
25			SS					Small Clay stringers at 25'
			SS	Gray		Hard	27	Clay Till
30			SS					
			SS					
35			SS					
40								

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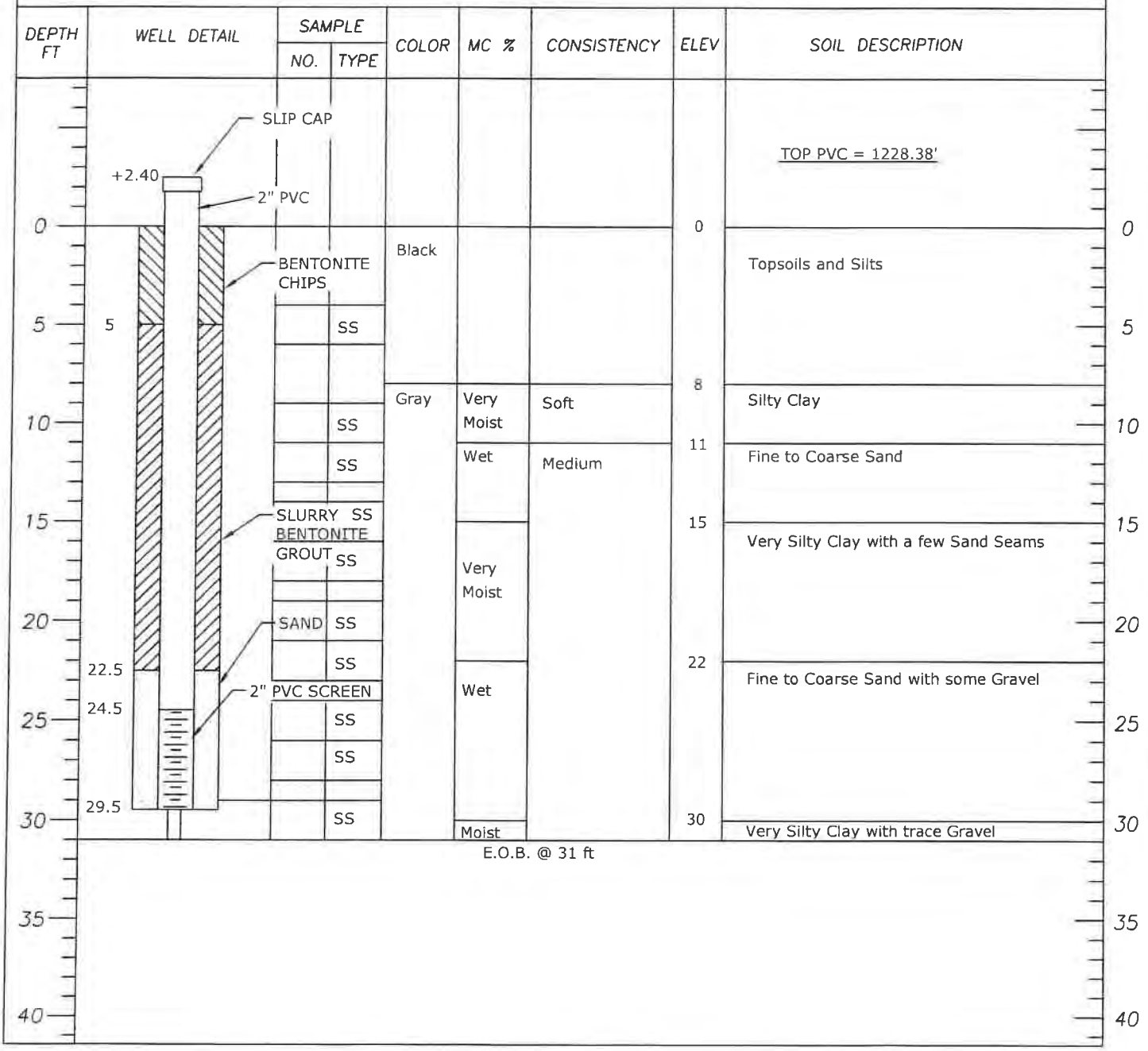
LOG OF TEST BORING

Drillers Team Services - Don Carlson Boring No MW 7F HLW Observer

HLW Project No. 6021-12A.200

Date Drilled 8/7/13
Surface Elevation 1225.98
Depth Drilled 31 FT
Drilling Method 7" HSA
Depth to Water _____ ft @ completion (▽), _____ ft @ _____ hrs.(▼), _____ ft @ _____ hrs

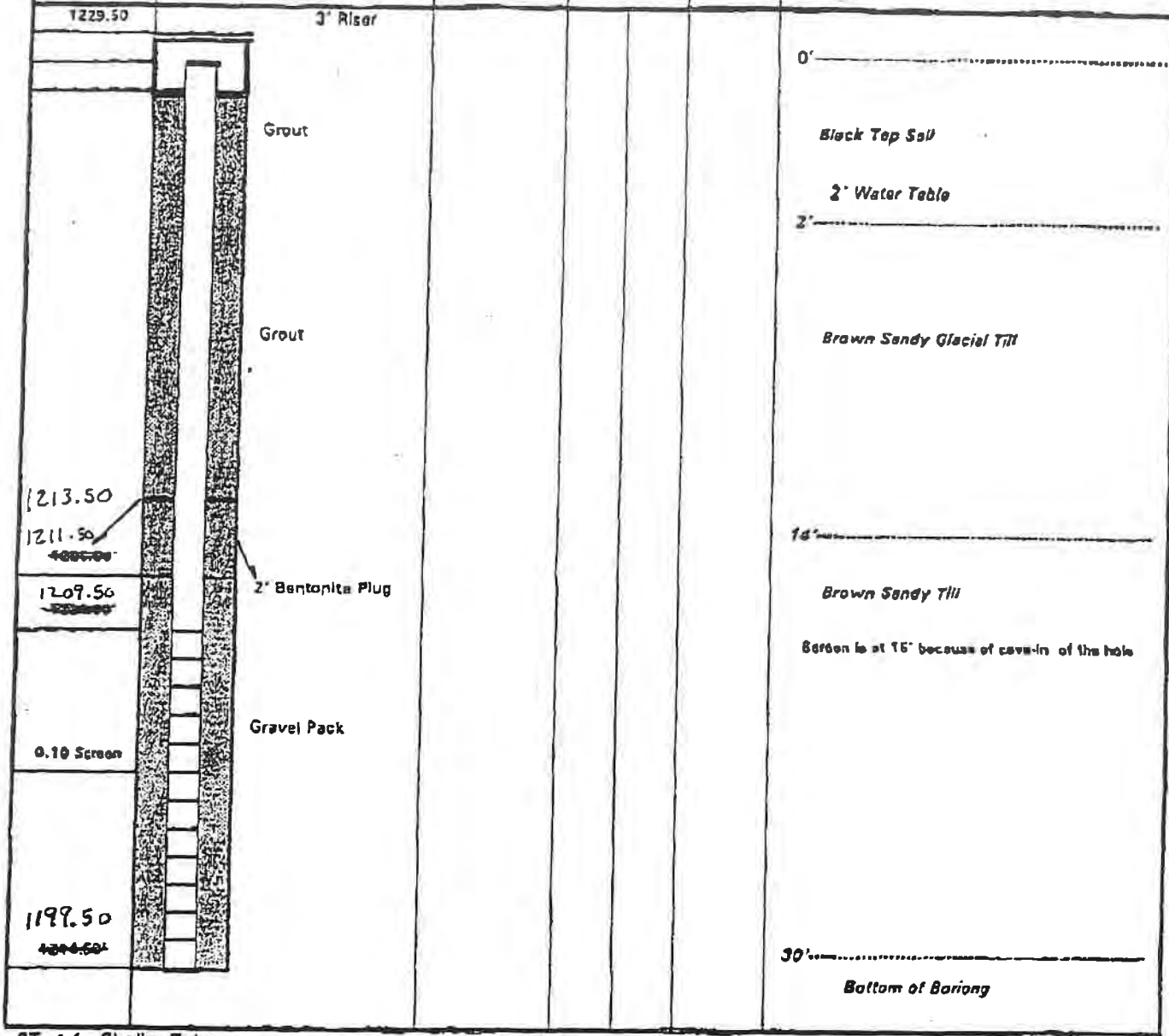
Project
NORTHERN PLAINS REGIONAL LANDFILL
74-SDP-2-76P
ASSESSMENT OF CORRECTIVE MEASURES
PHASE 2



DEPTH FT	WELL DETAIL	SAMPLE NO.	SAMPLE TYPE	COLOR	MC %	CONSISTENCY	ELEV	SOIL DESCRIPTION
								TOP PVC = 1228.38'
0				Black			0	Topsoils and Silts
5			SS					
				Gray	Very Moist	Soft	8	Silty Clay
10			SS					
			SS		Wet	Medium	11	Fine to Coarse Sand
15							15	Very Silty Clay with a few Sand Seams
			SS		Very Moist			
20			SS					
							22	Fine to Coarse Sand with some Gravel
25			SS		Wet			
			SS					
30			SS		Moist		30	Very Silty Clay with trace Gravel
35								E.O.B. @ 31 ft
40								

SOIL BORING LOG & MONITORING WELL CONSTRUCTION DIAGRAM

Broing #BB MW-BB	Facility Name: *Flannegan Landfill*	Facility Address: *Grettinger, Iowa*
Boring Depth (Feet) x Diameter (Inches): *30' / 6.25"*		Drilling Method: *Hollowstem Auger*
Well Contractor Registration#: *40403*		Logged by: *Gary R. Steffen*
Date & Time Start: *11/25/96 10:00 am*	Date & Time End: *11/25/96 12:00 pm.*	Ground Surface Elevation (ASL): *1229.50*



ST. 4 ft. Shelby Tube

Observations Water Levels							
	Date:	11/25/96					
	Level:	2.0'					
	Time:	12:00 pm.					

PAGE .01

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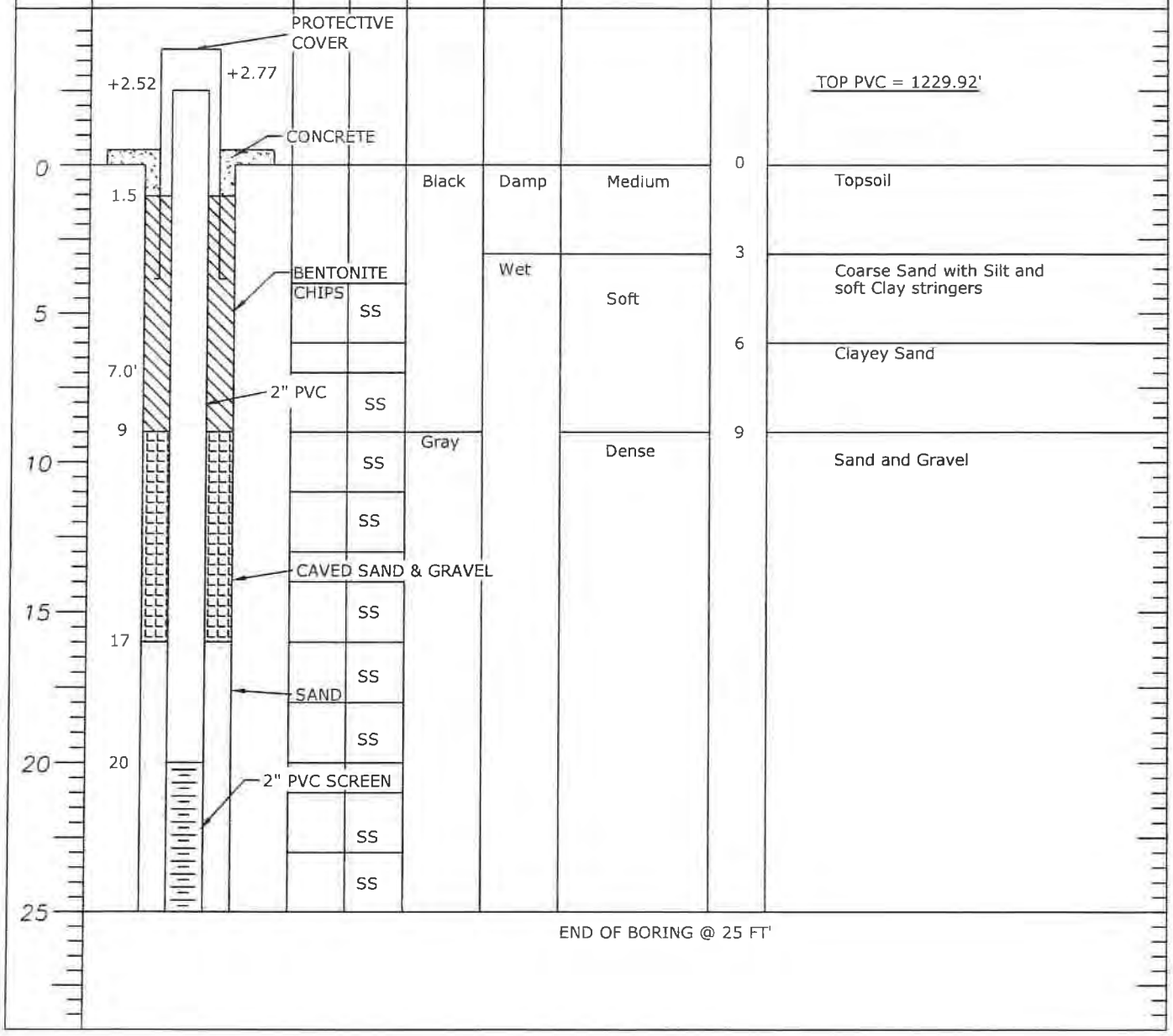
HLW Engineering Group

LOG OF TEST BORING

Drillers: Team Services - Don Carlson Boring No: MW 8C HLW Observer: TDW
HLW Project No: 6021-12A.200

Date Drilled: 8/6/13
Surface Elevation: 1227.41
Depth Drilled: 25 FT
Drilling Method: 7" HSA
Depth to Water _____ ft @ completion (▽), _____ ft @ _____ hrs.(▼), _____ ft @ _____ hrs.

Project: NORTHERN PLAINS REGIONAL LANDFILL
74-SDP-2-76P
ASSESSMENT OF CORRECTIVE MEASURES
PHASE 2



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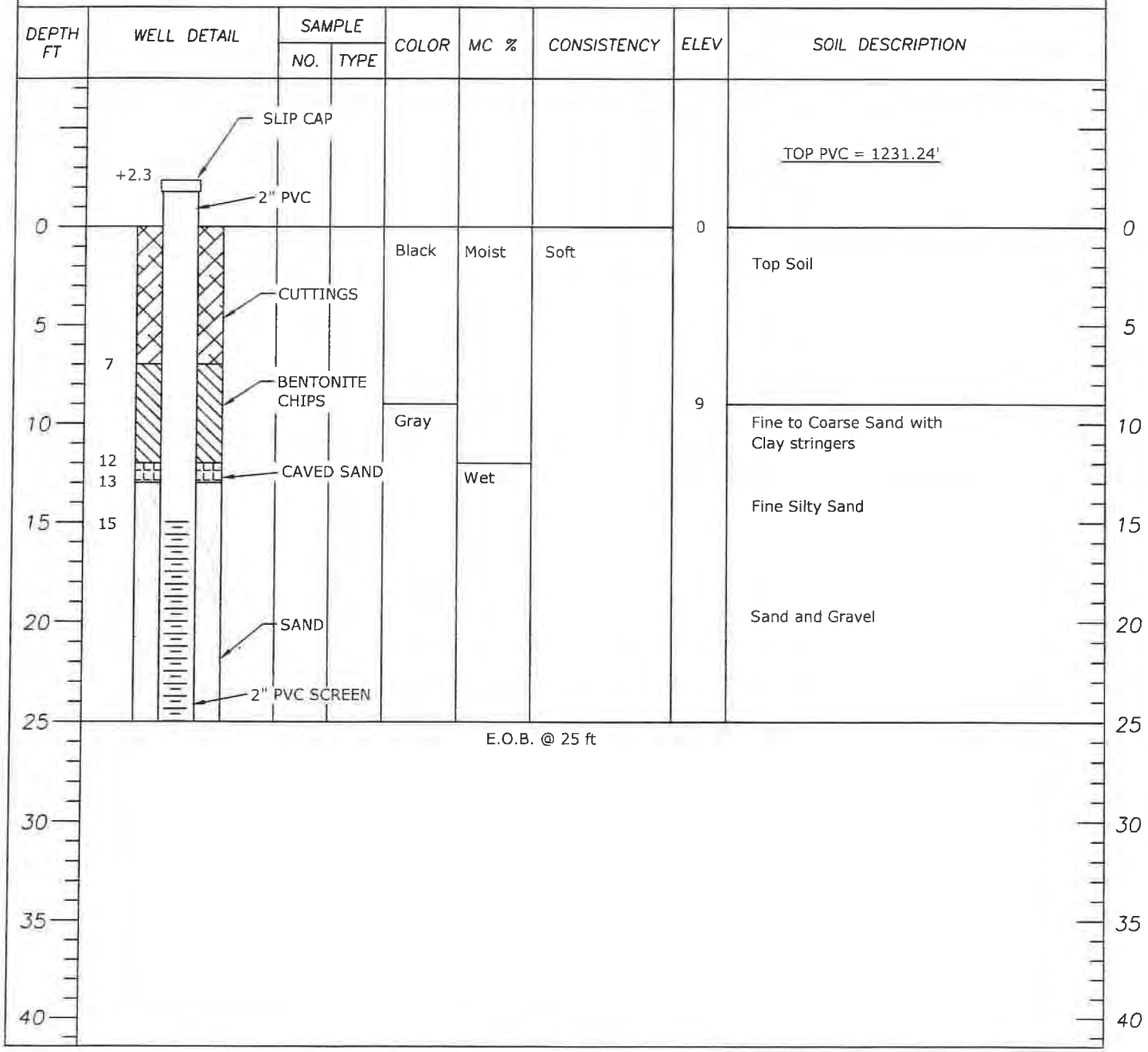
HLW Engineering Group

LOG OF TEST BORING

Drillers: Team Services - Don Carlson Boring No: TMW 8D HLW Observer: TDW
HLW Project No.: 6021-12A.200

Date Drilled: 8/6/13
Surface Elevation: 1228.94
Depth Drilled: 25 FT
Drilling Method: 7" HSA
Depth to Water: _____ ft @ completion (▽), _____ ft @ _____ hrs.(▼), _____ ft @ _____ hrs.

Project: NORTHERN PLAINS REGIONAL LANDFILL
74-SDP-2-76P
ASSESSMENT OF CORRECTIVE MEASURES
PHASE 2



SOIL BORING LOG & MONITORING WELL CONSTRUCTION DIAGRAM

Broing #10 MW-10	Facility Name *Flannegan Landfill*	Facility Address *Grettinger, Iowa*
Boring Depth (Feet) x Diameter (Inches) *24' / 6.25"*		Drilling Method *Hollowstem Auger*
Well Contractor Registration# *40403*		Logged by *Gary R. Steffen*
Date & Time Start *11/25/96 8:00 am.*	Date & Time End *11/25/96 10:00 am.*	Ground Surface Elevation (ASL) *1277.00'*

Depth in Feet	Well Construction Details	Blow Count (if applicable)	Sample No.	Sample Type	PID/FID (PPM)	Rock Formations, Soil, Color and Classifications, Observations such as moisture, etc.
1277.00'	3" Riser					0'
	Grout					*Black Top Soil*
						2'
	Grout					*Brown Glacial Till*
1271.00						
1264.50'	6.5' Bentonite Plug					
1258.00'						*13' Water Table*
						14'
	Gravel Pack					
0.10 Screen						*Brown Sandy Till*
1253.00'						24'
						Bottom of Boring

ST. 4 ft. Shelby Tube

Observations Water Levels							
	Date:	11/25/96					
	Level:	13.25'					
	Time:	10:00 am.					

LOG OF BORING NO. MW-13 11

OWNER	ARCHITECT/ENGINEER
SITE: Graettinger, Iowa	PROJECT: Northern Plains Regional Landfill

GRAPHIC LOG	DESCRIPTION		WELL DETAIL	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	SAMPLES: SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH KSF PCF
	TOP OF PIPE:	1288.6 ft										
	GROUND SURFACE ELEV.:	1287.5 ft										
	1.0 SILT, trace organic matter, dark brwon	1286.5										
	4.5 Lean CLAY, with organic matter, very dark gray	1283.0										
	Medium SAND, trace gravel, olive gray			5								
	8.0	1279.5										
	10.0 SAND, trace gravel, dark brown	1277.5		10								
	Fine to medium SAND, dark gray			15								
	20.0	1267.5		20								
	Bottom of Boring											

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: in
WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼ 5.3' 10/24/04
WL		
WL		

TEAM Services, Inc.

BORING STARTED	10-5-04		
BORING COMPLETED	10-5-04		
RIG	Rig 24	FOREMAN	DC
APPROVED	GDK	JOB #	1-1424

LOG OF BORING NO. MW-12

OWNER

ARCHITECT/ENGINEER

SITE
Graettinger, Iowa

PROJECT
Northern Plains Regional Landfill

GRAPHIC LOG	DESCRIPTION		WELL DETAIL	DEPTH (FT.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH KSF PCF
	TOP OF PIPE:	1289.1 ft										
	GROUND SURFACE ELEV.:	1287.5 ft										
	1.0 SILT, trace organic matter, dark brwon	1286.5										
	Lean CLAY, with organic matter, very dark gray 4.5	1283.0										
	Medium SAND, trace gravel, olive gray 8.0	1279.5										
	SAND, trace gravel, dark brown 10.0	1277.5										
	Fine to medium SAND, dark gray											
	20.0	1267.5										
	Sandy lean CLAY, trace gravel, dark gray											
	32.0	1255.5										
	Fine to medium SAND, trace gravel, dark gray											
	43.0	1244.5										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: in
WELL DIA.: in

WATER LEVEL OBSERVATIONS

WL	▽	▼ 28.5' 10/24/04
WL		
WL		

TEAM Services, Inc.

BORING STARTED	10-5-04		
BORING COMPLETED	10-5-04		
RIG	Rig 24	FOREMAN	DC
APPROVED	GDK	JOB #	1-1424

LOG OF BORING NO. MW-12

OWNER

ARCHITECT/ENGINEER

SITE
Graettinger, Iowa

PROJECT
Northern Plains Regional Landfill

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH KSF PCF
	Medium to coarse SAND, trace gravel, gray and brown mix		45								
			50								
	55.0 1232.5		55								
	Bottom of Boring										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

TEAM Services, Inc.

BORING STARTED	10-5-04		
BORING COMPLETED	10-5-04		
RIG	Rig 24	FOREMAN	DC
APPROVED	GDK	JOB #	1-1424

LOG OF BORING NO. MW-1X 13

OWNER	ARCHITECT/ENGINEER
SITE: Graettinger, Iowa	PROJECT: Northern Plains Regional Landfill

TOP OF PIPE: 1289.8 ft

GROUND SURFACE ELEV.: 1287.5 ft

DEPTH (FT.)	GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH KSF PCF	WELL DETAIL
0					HS						
1.0		SILT, trace organic matter, dark brwon — 1286.5									
4.5		Lean CLAY, with organic matter, very dark gray — 1283.0	CL	1	SS	7	7				
5					HS						
8.0		Medium SAND, trace gravel, olive gray — 1279.5									
10.0		SAND, trace gravel, dark brown ▽ — 1277.5	SP	2	SS	20	7				
10					HS						
		Fine to medium SAND, dark gray	SP	3	SS	20	8				
15					HS						
20.0		— 1267.5	SP	4	SS	25	20				
20					HS						
		Sandy lean CLAY, trace gravel, dark gray	CL	5	SS	20	14				
25					HS						
32.0		— 1255.5	CL	6	SS	19	16				
30					HS						
		Fine to medium SAND, trace gravel, dark gray ▼	SP	7	SS	15	11				
35					HS						
			SP	8	SS	14	10				
40					HS						
43.0		— 1244.5									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: in
WELL DIA.: in

WATER LEVEL OBSERVATIONS			
WL	▽ 9'	WD	▽ 33.5' 10/24/04
WL			
WL			

TEAM Services, Inc.

BORING STARTED	10-5-04		
BORING COMPLETED	10-5-04		
RIG	Rig 24	FOREMAN	DC
APPROVED	GDK	JOB #	1-1424

LOG OF BORING NO. MW-11 13

OWNER

ARCHITECT/ENGINEER

SITE
Graettinger, Iowa

PROJECT
Northern Plains Regional Landfill

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH KSF PCF
	Medium to coarse SAND, trace gravel, gray and brown mix		45	SP	9	SS	3	18			
						HS					
			50	SP	10	SS	10	15			
						HS					
				SP	11	SS					
			55			HS					
	57.0 1230.5										
	Sandy lean CLAY, dark brown			CL	12	SS	19	15			
			60			HS					
	63.0 1224.5										
	Medium to coarse SAND, trace gravel, yellowish brown			SP	13	SS	11	50/5"			
			65			HS					
			70								
	72.0 1215.5										
	Sandy lean CLAY, tracec gravel, dark gray			CL	15	SS		25			
	75.0 1212.5		75								
	Bottom of Boring										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS				
WL	▽ 9'	WD	▼	
WL				
WL				

TEAM Services, Inc.

BORING STARTED	10-5-04		
BORING COMPLETED	10-5-04		
RIG	Rig 24	FOREMAN	DC
APPROVED	GDK	JOB #	1-1424

HLW Engineering Group
204 West Broad Street, P.O Box 314
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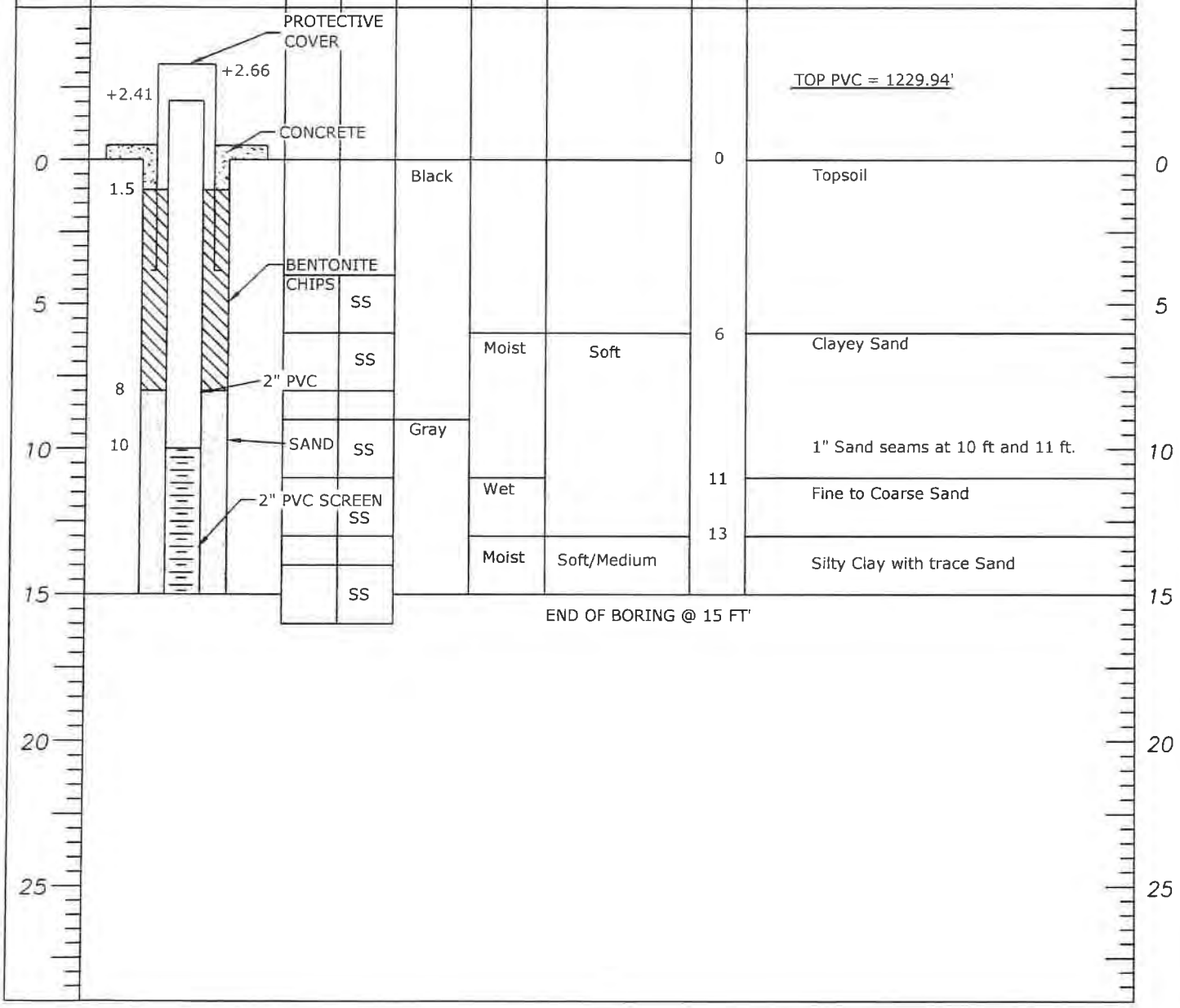
HLW Engineering Group

LOG OF TEST BORING

Drillers: Team Services - Don Carlson Boring No: MW 15B HLW Observer: TDW
HLW Project No: 6021-12A.200

Date Drilled: 8/6/13
Surface Elevation: 1227.53
Depth Drilled: 15 FT
Drilling Method: 7" HSA
Depth to Water _____ ft @ completion (▽), _____ ft @ _____ hrs.(▼), _____ ft @ _____ hrs.

Project: NORTHERN PLAINS REGIONAL LANDFILL
74-SDP-2-76P
ASSESSMENT OF CORRECTIVE MEASURES
PHASE 2



DEPTH FT	WELL DETAIL	SAMPLE NO.	SAMPLE TYPE	COLOR	MC %	CONSISTENCY	ELEV	SOIL DESCRIPTION
								TOP PVC = 1229.94'
0				Black			0	Topsoil
5			SS					
			SS		Moist	Soft	6	Clayey Sand
10			SS	Gray				1" Sand seams at 10 ft and 11 ft.
			SS		Wet		11	Fine to Coarse Sand
					Moist	Soft/Medium	13	Silty Clay with trace Sand
15			SS					END OF BORING @ 15 FT'

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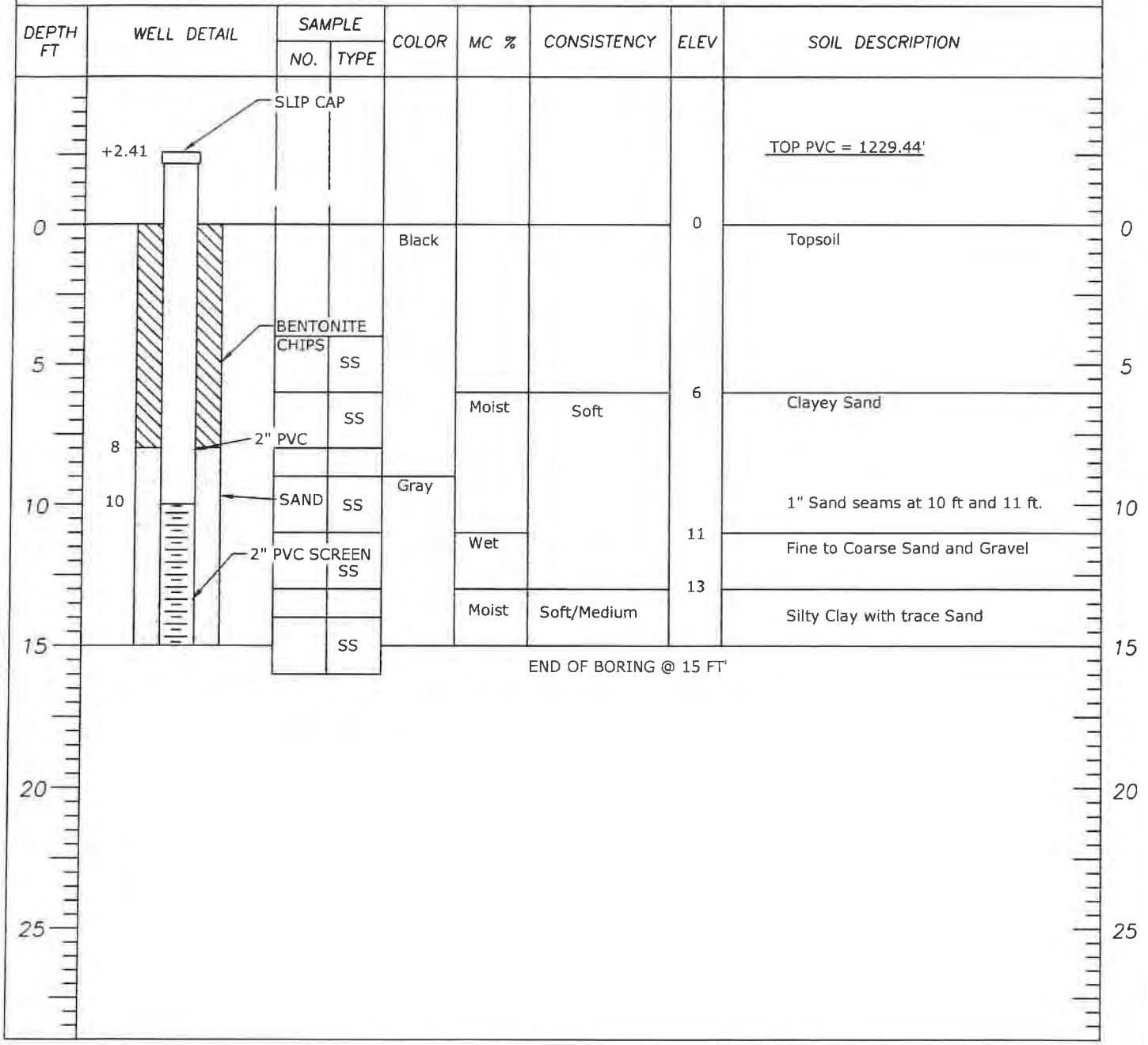
LOG OF TEST BORING

Drillers Team Services - Don Carlson Boring No MW 15C HLW Observer TDW
HLW Project No. 6021-12A.200

Date Drilled 8/6/13
Surface Elevation 1226.87
Depth Drilled 15 FT
Drilling Method 7" HSA
Depth to Water _____ ft @ completion (▽), _____ ft @ _____ hrs.(▼), _____ ft @ _____ hrs.

Project: NORTHERN PLAINS REGIONAL LANDFILL
74-SDP-2-76P
ASSESSMENT OF CORRECTIVE MEASURES
PHASE 2



DEPTH FT	WELL DETAIL	SAMPLE NO.	SAMPLE TYPE	COLOR	MC %	CONSISTENCY	ELEV	SOIL DESCRIPTION
	SLIP CAP, +2.41							TOP PVC = 1229.44'
0				Black			0	Topsoil
5	BENTONITE CHIPS		SS					
			SS		Moist	Soft	6	Clayey Sand
8	2" PVC							
10	SAND		SS	Gray				1" Sand seams at 10 ft and 11 ft.
	2" PVC SCREEN		SS		Wet		11	Fine to Coarse Sand and Gravel
					Moist	Soft/Medium	13	Silty Clay with trace Sand
15			SS					END OF BORING @ 15 FT'

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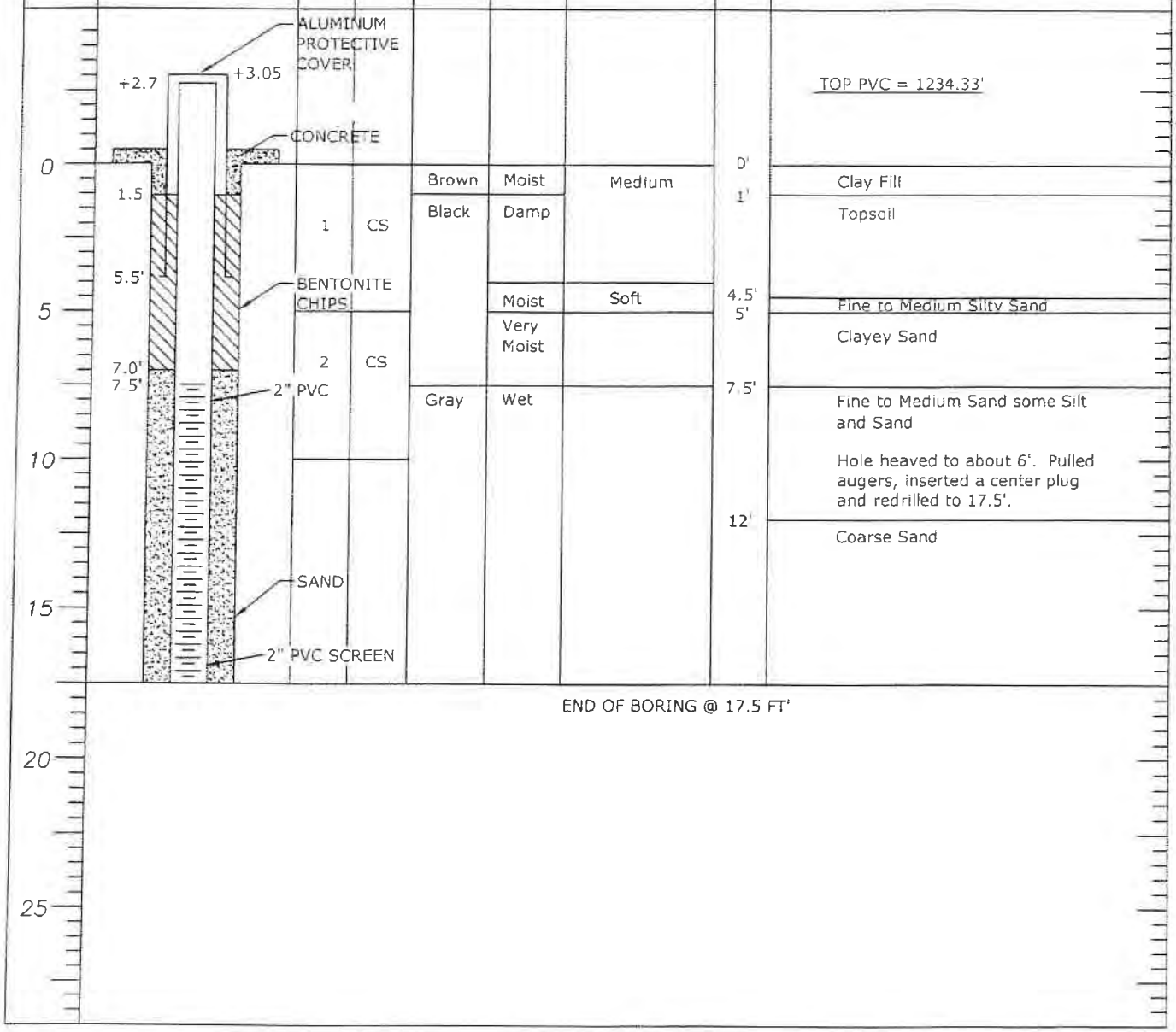
HLW Engineering Group

LOG OF TEST BORING

Drillers Rewerts - Justin Rewerts Boring No. MW-17 HLW Observer JGH
HLW Project No. 6021-12A.200

Date Drilled 3/30/12 Project NORTHERN PLAINS REGIONAL LANDFILL
Surface Elevation 1231.6 74-SDP-2-76P
Depth Drilled 17.5 FT ASSESSMENT OF CORRECTIVE MEASURES
Drilling Method 7" HSA
Depth to Water 7.6 ft @ completion (▽), 7.6 ft @ 3 hrs.(▼), _____ ft @ _____ hrs.



BORING LOG No. 1 MW-18 & MW-19

PROJECT Northern Plains Regional Landfill Expansion

SITE Graettinger, IA

Approx. Surface Elev.: 1286 1'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	DEPTH (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	Topsoil -- Lean CLAY, with sand, trace organics, very dark grayish brown	CL	0	1	AS						
	2.0 1284 1										
	Glacial Till – Sandy lean CLAY, trace gravel, light olive brown and gray stiff to very stiff	CL									
			5	2	ST	5		21 3		2500*	
	-- color change to olive brown and dark gray after 7'										
			10	3	SS	17	13				
	-- color change to dark gray after 12'										
			15	4	ST	16		17 9	111	3500*	
			20	5	SS	17	11				
			25	6	SS	18	15				
			30	7	SS	15	17				

Notes:

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

- 2 Ft. While Drilling
- Ft. After Drilling
- Ft. On

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 6-5-2019
Boring Completed: 6-5-2019
Rig: ATV | Foreman: DC
Approved | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

BORING LOG No. 1 MW-18 & MW-19

PROJECT Northern Plains Regional Landfill Expansion

SITE Graettinger, IA

Approx. Surface Elev.: 1286.1'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
			35	8	ST	11		16.9	114	6500*	
	38.0 1248.1										
	Glacial Outwash -- Silty fine to coarse SAND, with gravel dark gray medium dense	SM	40	9	SS	17	15				
	45.0 1241.1		45	10	SS	16	26				
	Glacial Till -- Sandy lean CLAY trace gravel, dark gray, very stiff	CL									
	47.0 1239.1										
	Glacial Outwash -- Fine to coarse SAND trace silt and gravel, gray, medium dense	SP	50	11	SS	16	28				
	52.0 1234.1										
	Glacial Till -- Sandy lean CLAY, trace gravel, dark gray very stiff	CL	55	12	SS	17	17				
	57.0 1229.1										
	Glacial Outwash -- Fine to coarse SAND with silt and gravel, gray and yellowish brown, very dense	SP-SM	60	13	SS	17	50/6"				
	67.0 1219.1		65	14	SS	17	56				
	Glacial Outwash -- Silty fine to coarse SAND, trace gravel, gray and yellowish brown, dense	SM									

Notes

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

- 2 Ft. While Drilling
- _____ Ft. After Drilling
- _____ Ft. On _____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 6-5-2019
Boring Completed: 6-5-2019
Rig ATV | Foreman DC
Approved: | Job # 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

BORING LOG No. 1 MW-18 & MW-19

PROJECT Northern Plains Regional Landfill Expansion

SITE Graettinger, IA

Approx. Surface Elev.: 1286 1
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	72 0 1214 1		70	15	SS	17	46				
	Glacial Till -- Sandy lean CLAY trace gravel, dark gray, very hard	CL									
			75	16	SS	17	57				
	76.0 1210 1										
	Bottom of Boring		80								
			85								
			90								
			95								
			100								

Notes

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

- 2 Ft. While Drilling
- Ft. After Drilling
- Ft. On

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 6-5-2019
Boring Completed: 6-5-2019
Rig ATV | Foreman DC
Approved: | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES, IS-SITU THE TRANSITION MAY BE GRADUAL

BORING LOG No. 2 MW-20 & MW-21

PROJECT Northern Plains Regional Landfill Expansion

SITE Graettinger, IA

Approx. Surface Elev.: 1280 2'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION		USCS SYMBOL	DEPTH (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	1 0 Topsoil -- Lean CLAY, with sand, trace organics, very dark grayish brown	1279 2	CL	0	1	AS						
	No geotech samples until 24 feet Field logs indicate glacial till Some sand seams near 13'			5								
	Bag sample 5'-15'			10								
				15								
				20								
	24 0	1256 2										
	Glacial Till -- Sandy lean CLAY, trace gravel, dark gray, very stiff		CL	25	2	ST	10		15 1	115	5000*	
				30	3	SS	17	19				

Notes:

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

13 Ft. While Drilling

____ Ft. After Drilling

____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 6-6-2019
Boring Completed: 6-6-2019
Rig ATV | Foreman DC
Approved | Job # 1-4610

THE STRATIFICATION LINES REPRESENT THE APPPOXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IS-SITU THE TRANSITION MAY BE GRADUAL

BORING LOG No. 2 MW-20 & MW-21

PROJECT Northern Plains Regional Landfill Expansion

SITE Graettinger, IA

Approx. Surface Elev.: 1280.2'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	37.0 1243.2		35	4	SS	18	15				
	Glacial Outwash -- Fine to coarse SAND trace gravel, medium dense	SP									
	42.0 1238.2		40	5	SS	17	16				
	Glacial Till – Sandy lean CLAY, trace gravel, dark gray, very stiff	CL									
	-- becomes stiff after 47'		45	6	SS	17	28				
	52.0 1228.2		50	7	SS	17	13				
	Glacial Outwash -- Silty fine to coarse SAND, trace gravel, dark gray medium dense	SM	55	8	SS	17	24				
	62.0 1218.2		60	9	SS	17	28				
	Glacial Till – Sandy lean CLAY, trace gravel, dark gray hard	CL									
	65.5 1214.7		65	10	SS	17	35				
	Bottom of Boring										

Notes:

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

13 Ft. While Drilling

____ Ft. After Drilling

____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 6-6-2019
Boring Completed: 6-6-2019
Rig: ATV | Foreman: DC
Approved: | Job # 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IS-SITU THE TRANSITION MAY BE GRADUAL

APPENDIX 4

Boring Logs – 2019 & Geotechnical Soil Testing Results

October 4, 2019

TEAM *Services*
Geotechnical and Construction Material Consultants

Kruse, Cate & Nelson, P.C.
1801 Highway Boulevard
Spencer, IA 51301

Attn: James Thiesse

Re: Data Report
Northern Plains Regional Landfill Expansion
Graettinger, IA
TEAM Project No. 1-4610

Dear Mr. Thiesse:

TEAM Services has conducted drilling and laboratory testing services for a landfill expansion site at the Northern Plains Regional Landfill. Results of tests conducted can be found on the attached table, Boring Logs, and datasheets. Tests were conducted in general accordance with ASTM standards. Permeability tests were performed with water permeation until readings stabilize but deviated from the standard by testing while confined by steel tubes without a back-pressure saturation step (per common local practice).

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service to you in any way, please do not hesitate to contact us.

Sincerely,
TEAM Services

Clinton Halverson, P.E.
Principal Engineer

Cc: Todd Whipple, HLW Engineering Group
Mark White, City of Spencer

ATTACHMENTS:
TABLE 1. MOISTURE, UNIT WEIGHT, AND POROSITY (1 pg)
BORINGS 1 through 8, L, K
PARTICLE SIZE DISTRIBUTION REPORTS (4 pgs)
PERMEABILITY TEST RESULTS (8 pgs)
MOISTURE-DENSITY RELATIONSHIP (Proctor) (4 pgs)

717 S.E. 6th St, Des Moines, IA 50309 (515) 282-8818 fax: (515) 282-8741 www.teamsvcs.com staff@teamsvcs.com
Des Moines • Fort Dodge • Spirit Lake • Mason City • Cedar Rapids • Waterloo • Davenport

Table 1. Moisture, unit weight, and porosity results *

Sample	Moisture Content (%)	Dry Unit Weight (pcf)	Porosity (%)
B1 (14-16)	17.9	111.0	33.6
B1 (34-36)	16.9	114.0	31.8
B2 (24-26)	15.1	115.0	31.2
B3 (14-15.5)	22.3	105.0	37.2
B6 (19-21)	16.4	116.0	30.6
B7 (14-16)	21.8	105.0	37.2
B8 (19-21)	17.9	111.0	33.6

* Only Shelby tube samples with dry unit weights are tabulated. Tabulated values of porosity are calculated from the soil's dry unit weight and assume a specific gravity of 2.68.

BORING LOG No. 1

PROJECT
Northern Plains Regional Landfill Expansion

SITE
Graettinger, IA

Approx. Surface Elev.: 1286.1'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	Topsoil -- Lean CLAY, with sand, trace organics, very dark grayish brown	CL	0	1	AS						
	2.0 1284.1										
	Glacial Till -- Sandy lean CLAY, trace gravel, light olive brown and gray, stiff to very stiff	CL									
			5	2	ST	5		21.3		2500*	
	-- color change to olive brown and dark gray after 7'										
			10	3	SS	17	13				
	-- color change to dark gray after 12'										
			15	4	ST	16		17.9	111	3500*	
			20	5	SS	17	11				
			25	6	SS	18	15				
			30	7	SS	15	17				

Notes:

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

2 Ft. While Drilling

____ Ft. After Drilling

____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 6-5-2019
Boring Completed: 6-5-2019
Rig: ATV | Foreman: DC
Approved: | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

BORING LOG No. 1

PROJECT
Northern Plains Regional Landfill Expansion

SITE
Graettinger, IA

Approx. Surface Elev.: 1286 1'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
			35	8	ST	11		16.9	114	6500*	
	38.0 1248.1										
	Glacial Outwash -- Silty fine to coarse SAND, with gravel, dark gray, medium dense	SM	40	9	SS	17	15				
	45.0 1241.1		45	10	SS	16	26				
	Glacial Till -- Sandy lean CLAY, trace gravel, dark gray, very stiff	CL									
	47.0 1239.1										
	Glacial Outwash -- Fine to coarse SAND, trace silt and gravel, gray, medium dense	SP	50	11	SS	16	28				
	52.0 1234.1										
	Glacial Till – Sandy lean CLAY, trace gravel, dark gray, very stiff	CL	55	12	SS	17	17				
	57.0 1229.1										
	Glacial Outwash -- Fine to coarse SAND, with silt and gravel, gray and yellowish brown, very dense	SP-SM	60	13	SS	17	50/6"				
	67.0 1219.1		65	14	SS	17	56				
	Glacial Outwash -- Silty fine to coarse SAND, trace gravel, gray and yellowish brown, dense	SM									

Notes:

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

2 Ft. While Drilling

____ Ft. After Drilling

____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 6-5-2019
Boring Completed: 6-5-2019
Rig: ATV | Foreman: DC
Approved: | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

BORING LOG No. 1

PROJECT
Northern Plains Regional Landfill Expansion

SITE
Graettinger, IA

Approx. Surface Elev.: 1286.1'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	72.0 1214.1		70	15	SS	17	46				
	Glacial Till – Sandy lean CLAY, trace gravel, dark gray, very hard	CL									
	76.0 1210.1		75	16	SS	17	57				
	Bottom of Boring		80								
			85								
			90								
			95								
			100								

Notes:

* Calibrated hand penetrometer
Hammer Type: Manual

Water Level:
2 Ft. While Drilling
____ Ft. After Drilling
____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 6-5-2019
Boring Completed: 6-5-2019
Rig: ATV | Foreman: DC
Approved: | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

BORING LOG No. 2

PROJECT
Northern Plains Regional Landfill Expansion

SITE
Graettinger, IA

Approx. Surface Elev.: 1280.2'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	1.0 Topsoil -- Lean CLAY, with sand, trace organics, very dark grayish brown 1279.2	CL	0	1	AS						
	No geotech samples until 24 feet. Field logs indicate glacial till. Some sand seams near 13'		5								
	Bag sample: 5'-15'		10								
			15								
			20								
	24.0 1256.2										
	Glacial Till -- Sandy lean CLAY, trace gravel, dark gray, very stiff	CL	25	2	ST	10		15.1	115	5000*	
			30	3	SS	17	19				

Notes:

* Calibrated hand penetrometer
Hammer Type: Manual

Water Level:
13 Ft. While Drilling
____ Ft. After Drilling
____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 6-6-2019
Boring Completed: 6-6-2019
Rig: ATV | Foreman: DC
Approved: | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

BORING LOG No. 2

PROJECT Northern Plains Regional Landfill Expansion

SITE Graettinger, IA

Approx. Surface Elev.: 1280.2'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

DESCRIPTION	USCS SYMBOL	DEPTH (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
37.0 1243.2		35	4	SS	18	15				
Glacial Outwash -- Fine to coarse SAND, trace gravel, medium dense	SP									
42.0 1238.2		40	5	SS	17	16				
Glacial Till – Sandy lean CLAY, trace gravel, dark gray, very stiff	CL									
-- becomes stiff after 47'		45	6	SS	17	28				
52.0 1228.2		50	7	SS	17	13				
Glacial Outwash -- Silty fine to coarse SAND, trace gravel, dark gray, medium dense	SM	55	8	SS	17	24				
62.0 1218.2		60	9	SS	17	28				
Glacial Till -- Sandy lean CLAY, trace gravel, dark gray, hard	CL									
65.5 1214.7		65	10	SS	17	35				
Bottom of Boring										

Notes:

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

13 Ft. While Drilling

____ Ft. After Drilling

____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 6-6-2019
Boring Completed: 6-6-2019
Rig: ATV Foreman: DC
Approved: Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

BORING LOG No. 3

PROJECT
Northern Plains Regional Landfill Expansion

SITE
Graettinger, IA

Approx. Surface Elev.: 1275.9'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION		USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	Topsoil -- Lean CLAY, with sand, trace organics, very dark grayish brown		CL	0	1	AS						
		2.0 1273.9										
	Glacial Till -- Sandy lean CLAY, trace gravel, light olive brown and gray, stiff		CL									
				5	2	SS	14	9				
		8.0 1267.9										
	Glacial Outwash -- Silty fine to coarse SAND, trace gravel, olive brown		SM									
		10.0 1265.9		10	3	SS	17					
	Glacial Till – Lean CLAY, olive brown and grayish brown, stiff		CL									
		12.0 1263.9										
	Glacial Till -- Sandy lean CLAY, trace gravel, light olive brown and gray, stiff		CL									
		15.5 1260.4		15	4A	ST	15		22.3	105	4000*	
	Glacial Outwash -- Fine to medium SAND, trace silt and gravel, olive brown		SP		4B	ST	2		16.6			
		17.0 1258.9										
	Glacial Till -- Sandy lean CLAY, trace gravel, dark gray, stiff		CL	20	5	SS	17	15				
		25.5 1250.4		25	6	SS	15	11				
	Bottom of Boring			30								

Notes:

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

9 Ft. While Drilling

6 Ft. After Drilling

____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 5-12-2019
Boring Completed: 5-12-2019
Rig: ATV | Foreman: DC
Approved: | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

BORING LOG No. 4

PROJECT
Northern Plains Regional Landfill Expansion

SITE
Graettinger, IA

Approx. Surface Elev.: 1281'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	Topsoil -- Sandy lean CLAY, trace organics, very dark grayish brown	CL	0	1	AS						
	2.0 1279.0										
	Glacial Outwash -- Silty fine to medium SAND, light olive brown and gray, loose	SM	5	2	SS	14	5				
	7.0 1274.0										
	Glacial Till -- Sandy lean CLAY, trace gravel, light olive brown, stiff to very stiff	CL	10	3	SS	14	9				
	-- color change to dark gray after 17'		15	4	SS	17	20				
			20	5	SS	14	7				
	25.5 1255.5		25	6	SS	15	6			5000*	
	Bottom of Boring		30								

Notes:

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

8 Ft. While Drilling

6 Ft. After Drilling

____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 5-13-2019

Boring Completed: 5-13-2019

Rig: ATV | Foreman: DC

Approved: | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

BORING LOG No. 5

PROJECT
Northern Plains Regional Landfill Expansion

SITE
Graettinger, IA

Approx. Surface Elev.: 1283 5'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	Topsoil -- Lean CLAY, trace sand and organics, very dark grayish brown Bag sample: 0'-2.5'	CL	0	1 2	AS ST	18		24.6			
	2.5 1281.0										
	Glacial Till -- Sandy lean CLAY, trace gravel, light olive brown and gray, stiff to very stiff	CL	5	3	SS	14	7				
			10	4	SS	12	11				
	-- color change to dark gray after 17'		15	5	SS	14	19				
			20	6	SS	17	12				
	25.5 1258.0		25	7	SS	14	7				
	Bottom of Boring		30								

Notes:

* Calibrated hand penetrometer
Hammer Type: Manual

Water Level:
8.5 Ft. While Drilling
13 Ft. After Drilling
____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 5-12-2019
Boring Completed: 5-12-2019
Rig: ATV | Foreman: DC
Approved: | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

BORING LOG No. 6

PROJECT
Northern Plains Regional Landfill Expansion

SITE
Graettinger, IA

Approx. Surface Elev.: 1288.4'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
Topsoil -- Sandy lean CLAY, trace organics, very dark grayish brown	CL	0	1	AS						
2.0 1286.4										
Glacial Till – Sandy lean CLAY, trace gravel, light olive brown and gray, medium stiff	CL									
		5	2	SS	12	4				
7.0 1281.4										
Glacial Till -- Lean CLAY, light olive brown and gray, very stiff	CL									
		10	3	SS	14	18				
12.0 1276.4										
Glacial Till -- Sandy lean CLAY, trace gravel, dark gray, very stiff	CL									
		15	4	SS	17	15				
Bag sample: 15'-24' (LL=37, PI=15)										
		20	5	ST	20		16.4	116	7000*	Atterberg Limits LL = 33 PI = 15
22.0 1266.4										
Glacial Outwash -- Fine to coarse SAND, with silt, trace gravel, dark gray, loose	SP-SM									
25.5 1262.9		25	6	SS	14	7				
Bottom of Boring										
		30								

Notes:

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

19 Ft. While Drilling

16 Ft. After Drilling

____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 5-13-2019

Boring Completed: 5-13-2019

Rig: ATV | Foreman: DC

Approved: | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

BORING LOG No. 7

PROJECT
Northern Plains Regional Landfill Expansion

SITE
Graettinger, IA

Approx. Surface Elev.: 1289.4'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION		USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	1.0 Topsoil -- Lean CLAY, with sand, trace organics, very dark grayish brown	1288.4	CL	0	1	AS						
	GLACIAL OUTWASH -- Layers of SILT, Lean CLAY, and SAND, yellowish brown		SC									
				5	2	SS	10					
				10	3	SS	14	10				
	11.0	1278.4										
	Glacial Till -- Sandy lean CLAY, trace gravel, dark gray Bag sample: 10'-15' (LL=33, PI=13)		CL	15	4	ST	23		21.8	105	6000*	Atterberg Limits LL = 33 PI = 13
				20	5	CS						
					6	CS						
	-- Sand seams noted by drillers near 23' -- color change to dark gray after 24'			25								
	25.0	1264.4										
	Bottom of Boring			30								

Notes:

* Calibrated hand penetrometer
Hammer Type: Manual

Water Level:
4 Ft. While Drilling
____ Ft. After Drilling
____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 5-13-2019
Boring Completed: 5-13-2019
Rig: ATV | Foreman: DC
Approved: | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

BORING LOG No. 8

PROJECT
Northern Plains Regional Landfill Expansion

SITE
Graettinger, IA

Approx. Surface Elev.: 1290.5'
Site Datum: Provided by Client
Drilling Method: HSA
Location:
Lat.: **Long.:**

DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
1.0 Topsoil -- Sandy lean CLAY, trace organics, very dark grayish brown 1289.5	CL	0	1	AS						
Glacial Till -- Sandy lean CLAY, trace gravel, light olive brown and gray, stiff	CL									
		5	2	SS	12	10				
8.0 Bag sample: 5'-10' (LL=35, PI=15) 1282.5										
Glacial Outwash -- Silty fine to medium SAND, trace gravel, yellowish brown	SM									
		10	3	ST	18		15.5		2500*	Atterberg Limits LL = 20 PI = 3
12.0 1278.5										
Glacial Till -- Sandy lean CLAY, trace gravel, dark gray	CL									
		15	4	SS	12	22				
Bag sample: 14'-25' (LL=33, PI=14)										
		20	5	ST	20		17.9	111	6000*	Atterberg Limits LL = 31 PI = 13
-- with fine sand seams after 23'										
25.5 1265.0		25	6	SS	17	20				
Bottom of Boring										
		30								

Notes:

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

24 Ft. While Drilling

____ Ft. After Drilling

____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 5-13-2019
Boring Completed: 5-13-2019
Rig: ATV Foreman: DC
Approved: Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

BORING LOG No. K

PROJECT
Northern Plains Regional Landfill Expansion

SITE
Graettinger, IA

Approx. Surface Elev.:
Site Datum:
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	Possible Fill – Sandy lean CLAY, trace gravel, dark grayish brown	CL	0	1	AS						
	2.0 -2.0										
	Glacial Till -- Lean CLAY, with sand, trace gravel, gray and trace yellowish brown, stiff	CL	5	2	SS	10	8			3000*	
	7.0 -7.0										
	Glacial Till -- Sandy lean CLAY, trace gravel, and silty sand seams, olive brown and dark gray, very stiff	CL	10	3	SS	14	16			6000*	
	12.0 -12.0										
	Glacial Outwash -- Silty SAND, trace gravel, olive brown and dark gray, medium dense	SM	15	4	SS	17	17				
	17.0 -17.0										
	Glacial Outwash -- Fine to coarse SAND, with silt, trace gravel, dark gray and dark grayish brown, medium dense	SP-SM	20	5	SS	17	15				
	-- contains trace silt after 22'										
	25.5 -25.5		25	6	SS	17	12				
	Bottom of Boring		30								

Notes:

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

- 14 Ft. While Drilling
- 10 Ft. After Drilling
- _____ Ft. On _____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 6-13-2019
Boring Completed: 6-13-2019
Rig: ATV | Foreman: DC
Approved: | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

BORING LOG No. L

PROJECT
Northern Plains Regional Landfill Expansion

SITE
Graettinger, IA

Approx. Surface Elev.:
Site Datum:
Drilling Method: HSA
Location:
Lat.: **Long.:**

GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	DEPTH (ft.)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	TESTS OTHER
	Topsoil -- Lean CLAY, with sand, trace gravel and organics, very dark grayish brown	CL	0	1	AS						
	2.0 -2.0										
	Glacial Outwash -- Clayey SAND, trace gravel, gray, loose	SC	5	2	SS	10	8				
	7.0 -7.0										
	Glacial Till – Sandy lean CLAY, trace gravel, light olive brown and gray, stiff	CL	10	3	SS	14	16			3000*	
	12.0 -12.0										
	Glacial Outwash -- Silty fine SAND, dark gray, medium dense	SM	15	4	SS	17	17				
			20	5	SS	17	15				
	22.0 -22.0										
	Glacial Outwash -- Fine to coarse SAND, with silt, trace gravel, dark gray, medium dense	SP-SM	25	6	SS	17	12				
	25.5 -25.5										
	Bottom of Boring		30								

Notes:

* Calibrated hand penetrometer

Hammer Type: Manual

Water Level:

10 Ft. While Drilling

17 Ft. After Drilling

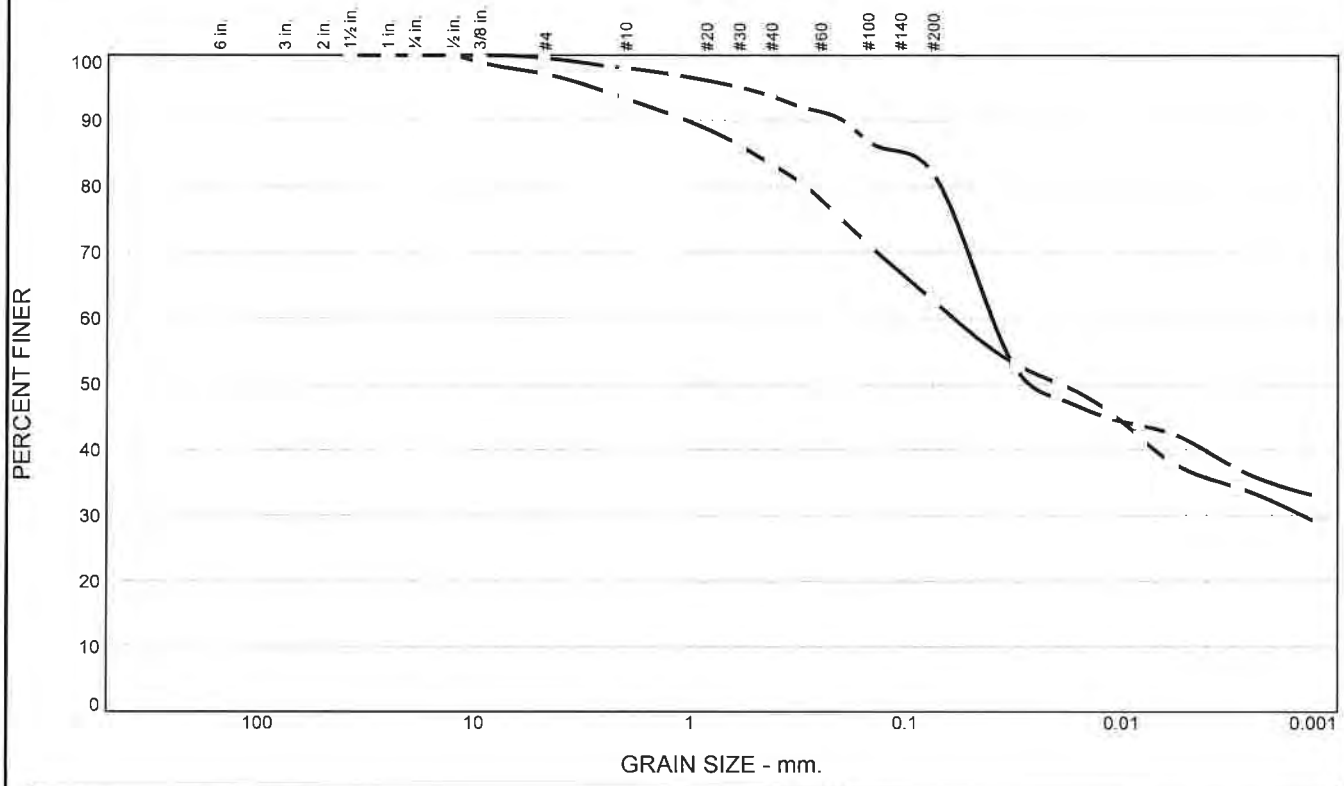
____ Ft. On ____

TEAM Services
Geotechnical and Construction Material Consultants

Boring Started: 6-13-2019
Boring Completed: 6-13-2019
Rig: ATV | Foreman: DC
Approved: | Job #: 1-4610

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES; IS-SITU, THE TRANSITION MAY BE GRADUAL

Particle Size Distribution Report



+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
0.0	0.5	17.4	40.6	41.5	CL	A-6(12)	22	37
0.0	3.0	34.2	30.6	32.2	CL	A-6(7)	18	33

SIEVE inches size	PERCENT FINER	
1-1/2"	100.0	100.0
1"	100.0	100.0
3/4"	100.0	100.0
1/2"	100.0	100.0
3/8"	100.0	98.9

GRAIN SIZE		
D_{60}	0.0398	0.0598
D_{30}		0.0014
D_{10}		

COEFFICIENTS	
C_c	
C_u	

SIEVE number size	PERCENT FINER	
#4	99.5	97.0
#8	98.3	94.1
#10	97.9	93.3
#16	96.9	90.6
#30	95.0	86.3
#40	93.7	83.4
#50	91.9	80.3
#70		75.7
#80	89.1	
#100	86.9	71.3
#200	82.1	62.8

Material Description

REMARKS:

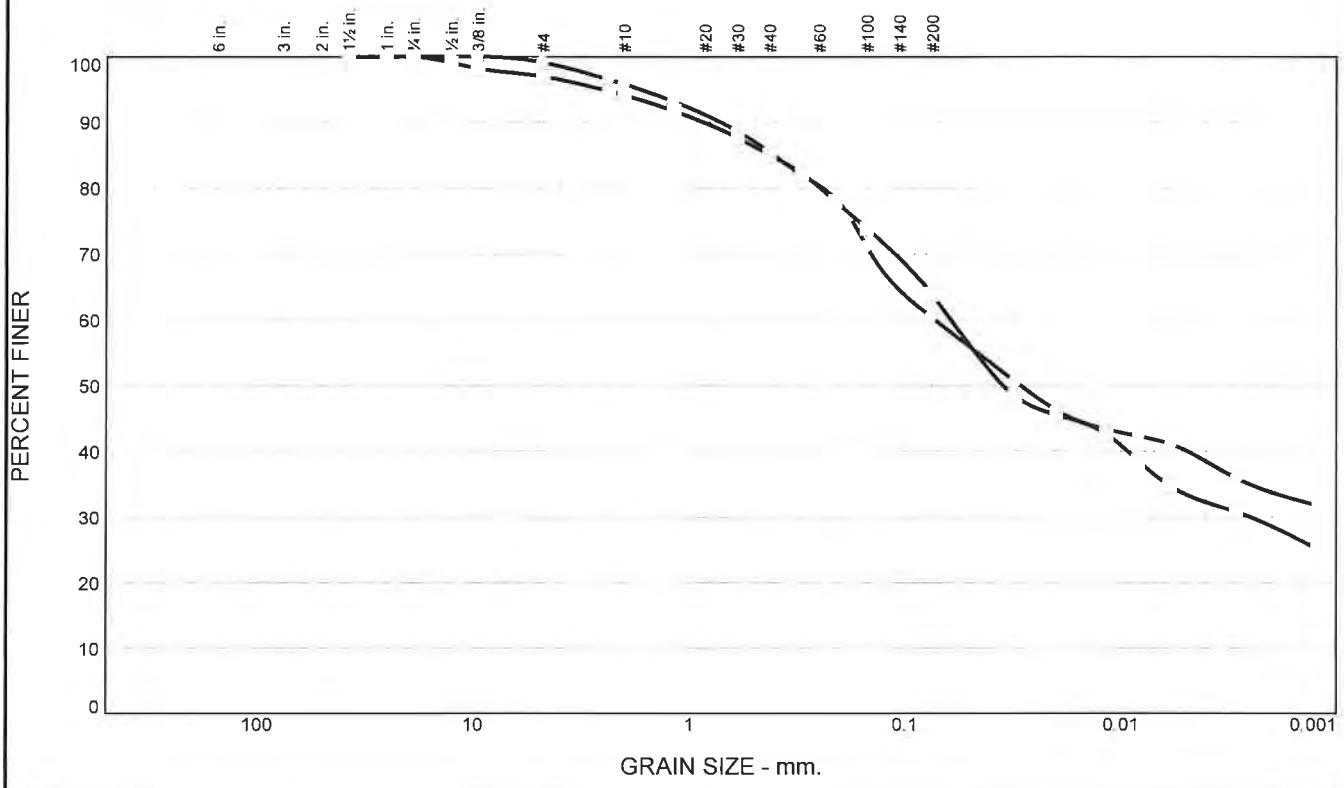
Location: B6, 15-24'
Location: B6, S6, 19-21'

TEAM Services
Geotechnical and Construction Material Consultants

Client:
Project: Northern Plains Regional Landfill Expansion
Project No.: 1-4610
Figure

Tested By: NG

Particle Size Distribution Report



+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
0.0	0.9	38.7	20.3	40.1	CL	A-6(5)	20	33
0.0	3.1	33.0	35.3	28.6	CL	A-6(6)	20	33

SIEVE inches size	PERCENT FINER	
1-1/2"	100.0	100.0
1"	100.0	100.0
3/4"	100.0	100.0
1/2"	100.0	99.0
3/8"	100.0	98.2

GRAIN SIZE		
D_{60}	0.0725	0.0610
D_{30}		0.0025
D_{10}		

COEFFICIENTS	
C_c	
C_u	

SIEVE number size	PERCENT FINER	
#4	99.1	96.9
#8	96.5	94.7
#10	95.8	94.1
#16	93.1	91.7
#30	88.6	87.6
#40	85.5	85.1
#50	82.0	82.2
#70		78.0
#80	75.7	
#100	71.0	73.9
#200	60.4	63.9

Material Description

REMARKS:

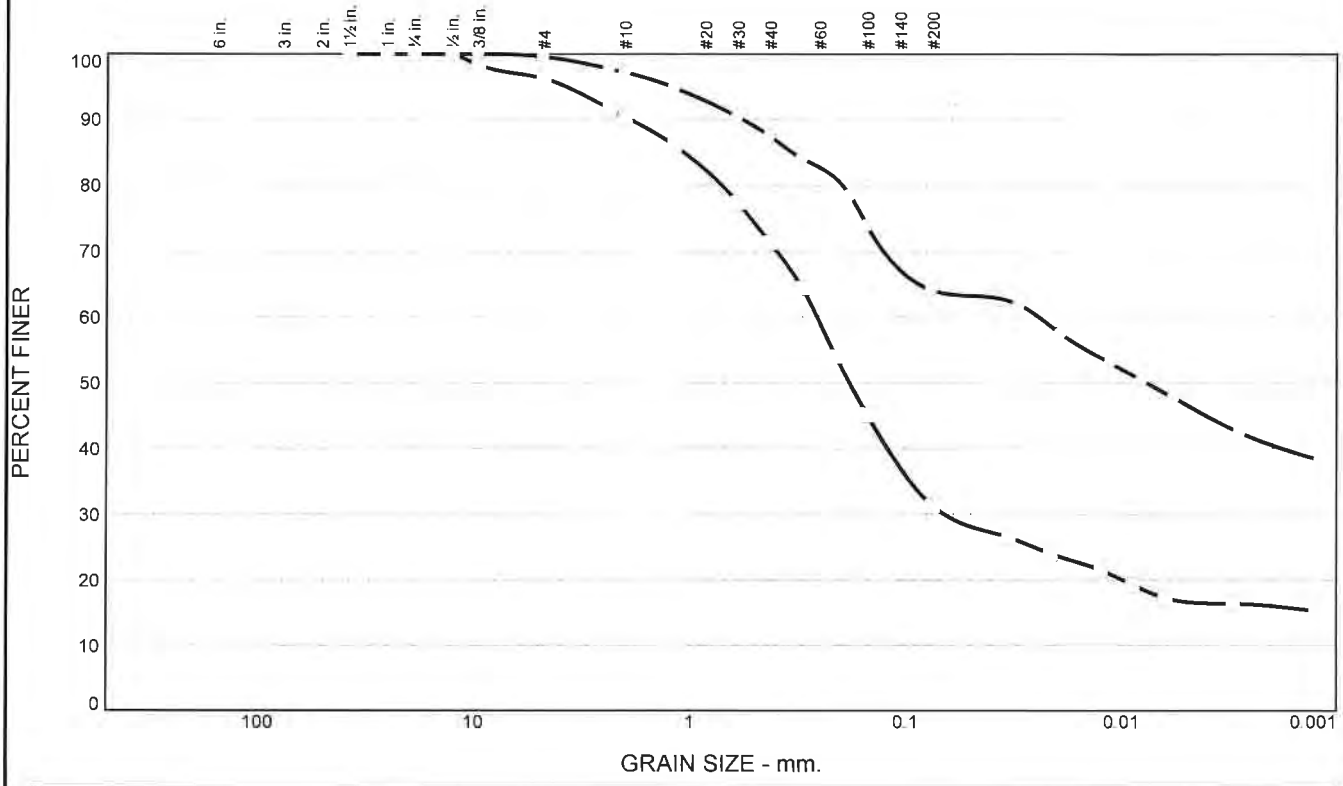
Location: B7, 10-15'
Location: B7, S4, 14-16'

TEAM Services
Geotechnical and Construction Material Consultants

Client:
Project: Northern Plains Regional Landfill Expansion
Project No.: 1-4610
Figure

Tested By: NG

Particle Size Distribution Report



+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
0.0	0.4	35.5	17.5	46.6	CL	A-6(8)	20	35
0.0	3.8	64.9	15.3	16.0	SM	A-2-4(0)	17	20

SIEVE inches size	PERCENT FINER	
1-1/2"	100.0	100.0
1"	100.0	100.0
3/4"	100.0	100.0
1/2"	100.0	100.0
3/8"	100.0	98.2

GRAIN SIZE		
D_{60}	0.0242	0.2561
D_{30}		0.0663
D_{10}		

COEFFICIENTS	
C_c	
C_u	

SIEVE number size	PERCENT FINER	
#4	99.6	96.2
#8	97.7	91.5
#10	97.1	90.3
#16	94.8	86.0
#30	90.4	77.4
#40	87.4	71.3
#50	84.0	64.4
#70		54.0
#80	78.4	
#100	73.8	45.2
#200	64.1	31.3

Material Description

REMARKS:

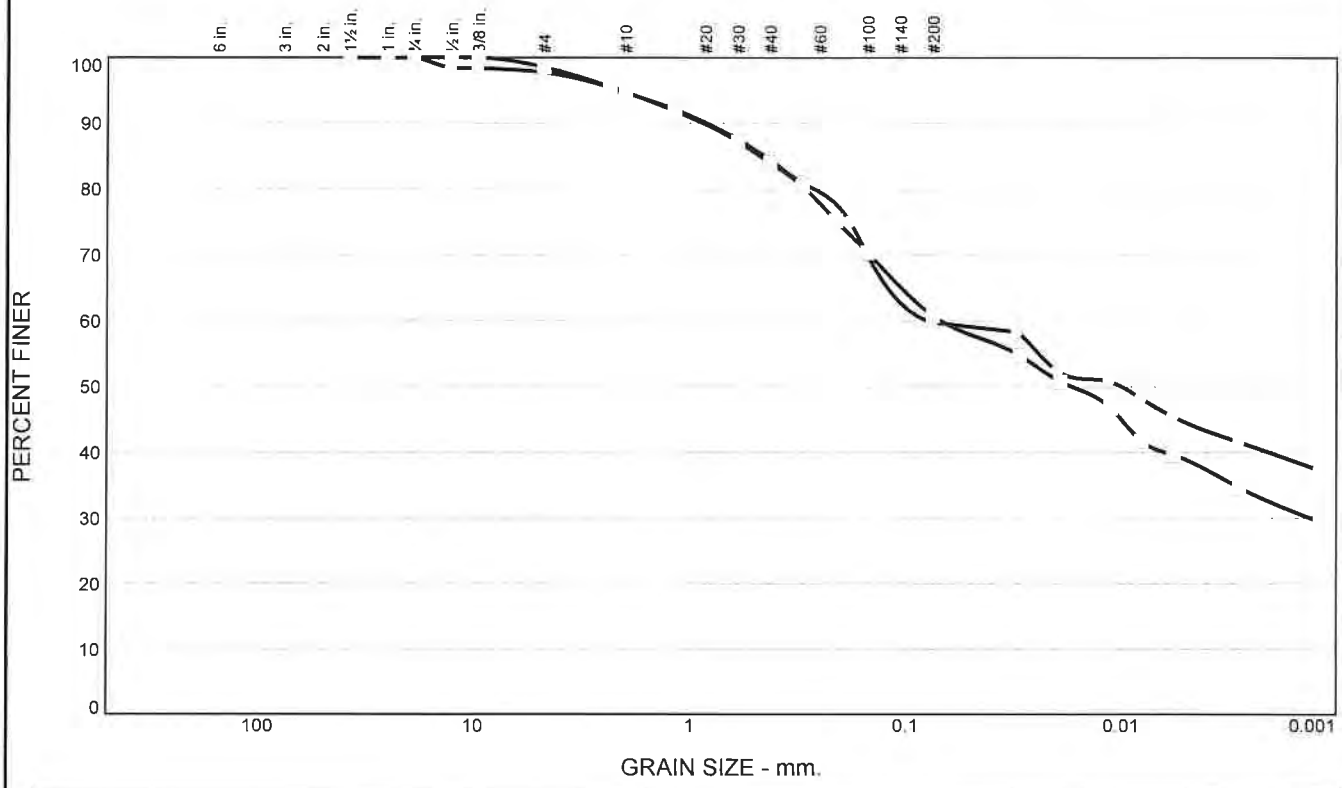
Location: B8, 5-10'
Location: B8, S3, 9-11'

TEAM Services
Geotechnical and Construction Material Consultants

Client:
Project: Northern Plains Regional Landfill Expansion
Project No.: 1-4610
Figure

Tested By: NG

Particle Size Distribution Report



+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
0.0	2.3	37.9	15.3	44.5	CL	A-6(6)	19	33
0.0	1.5	37.7	28.5	32.3	CL	A-6(5)	18	31

SIEVE inches size	PERCENT FINER	
1-1/2"	100.0	100.0
1"	100.0	100.0
3/4"	100.0	100.0
1/2"	98.4	100.0
3/8"	98.4	100.0

GRAIN SIZE		
D_{60}	0.0795	0.0688
D_{30}		0.0013
D_{10}		

COEFFICIENTS	
C_c	
C_u	

SIEVE number size	PERCENT FINER	
#4	97.7	98.5
#8	95.4	95.5
#10	94.6	94.7
#16	92.1	91.8
#30	87.5	87.2
#40	84.4	84.0
#50	80.9	80.4
#70		75.2
#80	74.9	
#100	69.9	70.3
#200	59.8	60.8

Material Description

REMARKS:

Location: B8, 14-25'
Location: B8, S6, 19-21'

TEAM Services
Geotechnical and Construction Material Consultants

Client:
Project: Northern Plains Regional Landfill Expansion
Project No.: 1-4610
Figure

Tested By: NG

PERMEABILITY TEST RESULTS
Falling Head

TEAM Services

Project Name: Northern Plains Regional Landfill Expansion
Project No.: 1-4610
Sample: Bag **Date Received:** 8/5/2019
Sample Location: B6 15-24'
Test Started: 8/5/2019 **Test Competed:** 8/19/2019
Test Procedure: ASTM D 5084 - 03 Falling Head Test (Method B)
Sample Description: Lean clay, with sand, dark gray - remolded

INITIAL SAMPLE DATA

Wet Weight (g)	1221.3
Non-cut Height (in)	5.92
Diameter (in)	2.875
Moisture Content (%)	18.6
Dry Unit Weight (pcf)	102.1

FINAL SAMPLE DATA

Wet Weight (g)	1128.1
Final Cut Height (in)	5.42
Diameter (in)	2.875
Moisture Content (%)	22.5
Dry Unit Weight (pcf)	99.6

TEST DATA

Elapsed Time (hr)	Initial Head (in)	Final Head (in)	Coefficient of Permeability, k (cm/s)
20.98	133.77	111.27	4.0E-07
23.00	133.77	129.58	6.3E-08
21.47	133.77	131.77	3.2E-08
25.77	133.77	131.52	3.0E-08
22.68	133.77	131.58	3.3E-08
48.33	133.77	128.52	3.7E-08
24.58	133.77	130.70	4.3E-08
26.72	133.77	130.39	4.3E-08
20.22	133.77	130.77	5.1E-08
24.98	133.77	130.02	5.1E-08
23.17	133.77	130.14	5.4E-08
26.27	133.77	129.64	5.4E-08
24.82	133.77	129.83	5.4E-08
Average of last	**3**	**readings**	**5.4E-08**

Proctor Data		
Maximum Dry Denisty	107.5	pcf
Optimum Moisture	16.5	%

Remolded Compaction		
Compaction	94.9	%
Moisture Deviation	2.1	%

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PERMEABILITY TEST RESULTS
Falling Head

TEAM Services

Project Name: Northern Plains Regional Landfill Expansion
Project No.: 1-4610
Sample: 5 **Date Received:** 7/10/2019
Sample Location: B6, 19-21'
Test Started: 7/11/2019 **Test Competed:** 7/24/2019
Test Procedure: ASTM D 5084 - 03 Falling Head Test (Method B)
Sample Description: Sandy lean clay, trace gravel, dark gray

INITIAL SAMPLE DATA

Wet Weight (g)	1370.2
Non-cut Height (in)	5.95
Diameter (in)	2.875
Moisture Content (%)	16.4
Dry Unit Weight (pcf)	116.2

FINAL SAMPLE DATA

Wet Weight (g)	1229.8
Final Cut Height (in)	5.45
Diameter (in)	2.875
Moisture Content (%)	17.3
Dry Unit Weight (pcf)	113.0

TEST DATA

Elapsed Time (hr)	Initial Head (in)	Final Head (in)	Coefficient of Permeability, k (cm/s)
16.92	133.74	122.99	2.2E-07
24.02	133.74	130.99	3.9E-08
26.92	133.74	131.68	2.6E-08
45.03	133.74	130.37	2.6E-08
25.00	133.74	131.68	2.8E-08
21.95	133.74	132.24	2.3E-08
27.43	133.74	132.12	2.0E-08
21.10	133.74	132.24	2.4E-08
24.23	133.74	131.99	2.47E-08
23.88	133.74	132.12	2.32E-08
23.77	133.74	132.12	2.34E-08
23.73	133.74	132.12	2.34E-08
Average of last	**3**	**readings**	**2.3E-08**

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PERMEABILITY TEST RESULTS
Falling Head

TEAM Services

Project Name: Northern Plains Regional Landfill Expansion
Project No.: 1-4610
Sample: bag **Date Received:** 8/5/2019
Sample Location: B7, 10-15'
Test Started: 8/5/2019 **Test Competed:** 8/15/2019
Test Procedure: ASTM D 5084 - 03 Falling Head Test (Method B)
Sample Description: Sandy lean clay, trace gravel, dark gray - remolded

INITIAL SAMPLE DATA

Wet Weight (g)	1250.7
Non-cut Height (in)	5.93
Diameter (in)	2.875
Moisture Content (%)	18.0
Dry Unit Weight (pcf)	105.0

FINAL SAMPLE DATA

Wet Weight (g)	1147.0
Final Cut Height (in)	5.43
Diameter (in)	2.875
Moisture Content (%)	20.8
Dry Unit Weight (pcf)	102.8

TEST DATA

Elapsed Time (hr)	Initial Head (in)	Final Head (in)	Coefficient of Permeability, k (cm/s)
20.98	133.76	119.64	2.4E-07
23.00	133.76	129.26	6.7E-08
21.47	133.76	131.45	3.7E-08
25.77	133.76	131.58	2.9E-08
22.68	133.76	131.70	3.1E-08
48.33	133.76	128.95	3.4E-08
24.58	133.76	131.33	3.4E-08
26.72	133.76	131.08	3.4E-08
20.22	133.76	131.76	3.4E-08
Average of last	**4**	**readings**	**3.4E-08**

Proctor Data		
Maximum Dry Denisty	110.6	pcf
Optimum Moisture	15.9	%

Remolded Compaction		
Compaction	94.9	%
Moisture Deviation	2.1	%

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PERMEABILITY TEST RESULTS
Falling Head

TEAM Services

Project Name: Northern Plains Regional Landfill Expansion
Project No.: 1-4610
Sample: 4 **Date Received:** 7/10/2019
Sample Location: B7, 14-16'
Test Started: 7/11/2019 **Test Competed:** 7/24/2019
Test Procedure: ASTM D 5084 - 03 Falling Head Test (Method B)
Sample Description: Sandy lean clay, trace gravel, dark gray

INITIAL SAMPLE DATA

Wet Weight (g)	1293.6
Non-cut Height (in)	5.90
Diameter (in)	2.875
Moisture Content (%)	21.8
Dry Unit Weight (pcf)	105.7

FINAL SAMPLE DATA

Wet Weight (g)	1168.3
Final Cut Height (in)	5.40
Diameter (in)	2.875
Moisture Content (%)	23.0
Dry Unit Weight (pcf)	103.2

TEST DATA

Elapsed Time (hr)	Initial Head (in)	Final Head (in)	Coefficient of Permeability, k (cm/s)
16.92	133.79	116.54	3.7E-07
24.02	133.79	120.79	1.9E-07
26.92	133.79	121.60	1.6E-07
45.03	133.79	114.10	1.6E-07
25.00	133.79	122.23	1.6E-07
21.95	133.79	123.98	1.6E-07
27.43	133.79	121.16	1.6E-07
21.10	133.79	124.29	1.6E-07
24.23	133.79	122.54	1.63E-07
23.88	133.79	123.48	1.51E-07
23.77	133.79	123.54	1.51E-07
23.73	133.79	123.54	1.51E-07
Average of last	**3**	**readings**	**1.5E-07**

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PERMEABILITY TEST RESULTS
Falling Head

TEAM Services

Project Name: Northern Plains Regional Landfill Expansion
Project No.: 1-4610
Sample: bag **Date Received:** 8/5/2019
Sample Location: B8, 5-10'
Test Started: 8/5/2019 **Test Competed:** 8/15/2019
Test Procedure: ASTM D 5084 - 03 Falling Head Test (Method B)
Sample Description: Sandy lean clay, trace gravel, lt olive brown and gray - remolded

INITIAL SAMPLE DATA

Wet Weight (g)	1275.9
Non-cut Height (in)	6.04
Diameter (in)	2.875
Moisture Content (%)	17.5
Dry Unit Weight (pcf)	105.5

FINAL SAMPLE DATA

Wet Weight (g)	1168.7
Final Cut Height (in)	5.54
Diameter (in)	2.875
Moisture Content (%)	19.0
Dry Unit Weight (pcf)	104.0

TEST DATA

Elapsed Time (hr)	Initial Head (in)	Final Head (in)	Coefficient of Permeability, k (cm/s)
20.98	133.64	132.14	2.5E-08
23.00	133.64	132.77	1.3E-08
21.47	133.64	132.96	1.1E-08
25.77	133.64	132.58	1.4E-08
22.68	133.64	132.71	1.4E-08
48.33	133.64	131.21	1.8E-08
24.58	133.64	132.39	1.8E-08
26.72	133.64	132.27	1.8E-08
20.22	133.64	132.58	1.8E-08
Average of last	**4**	**readings**	**1.8E-08**

Proctor Data		
Maximum Dry Denisty	111.0	pcf
Optimum Moisture	15.5	%

Remolded Compaction		
Compaction	95.0	%
Moisture Deviation	2.0	%

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PERMEABILITY TEST RESULTS
Falling Head

TEAM Services

Project Name: Northern Plains Regional Landfill Expansion
Project No.: 1-4610
Sample: 3 **Date Received:** 7/10/2019
Sample Location: B8, 9-11'
Test Started: 7/11/2019 **Test Competed:** 7/17/2019
Test Procedure: ASTM D 5084 - 03 Falling Head Test (Method B)
Sample Description: Silty sand, trace gravel, yellowish brown

INITIAL SAMPLE DATA

Wet Weight (g)	1318.7
Non-cut Height (in)	6.07
Diameter (in)	2.875
Moisture Content (%)	15.5
Dry Unit Weight (pcf)	110.3

FINAL SAMPLE DATA

Wet Weight (g)	1197.0
Final Cut Height (in)	5.57
Diameter (in)	2.875
Moisture Content (%)	45.7
Dry Unit Weight (pcf)	86.5

TEST DATA

Elapsed Time (hr)	Initial Head (in)	Final Head (in)	Coefficient of Permeability, k (cm/s)
16.92	133.61	74.74	1.6E-06
24.02	133.61	74.61	1.1E-06
26.92	133.61	71.61	1.1E-06
45.03	133.61	48.74	1.0E-06
25.00	133.61	74.61	1.1E-06
Average of last	**4**	**readings**	**1.1E-06**

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PERMEABILITY TEST RESULTS
Falling Head

TEAM Services

Project Name: Northern Plains Regional Landfill Expansion
Project No.: 1-4610
Sample: bag **Date Received:** 8/5/2019
Sample Location: B8, 14-25'
Test Started: 8/5/2019 **Test Competed:** 8/15/2019
Test Procedure: ASTM D 5084 - 03 Falling Head Test (Method B)
Sample Description: Sandy lean clay, trace gravel, dark gray - remolded

INITIAL SAMPLE DATA

Wet Weight (g)	1227.7
Non-cut Height (in)	5.95
Diameter (in)	2.875
Moisture Content (%)	18.6
Dry Unit Weight (pcf)	102.1

FINAL SAMPLE DATA

Wet Weight (g)	1151.1
Final Cut Height (in)	5.45
Diameter (in)	2.875
Moisture Content (%)	18.4
Dry Unit Weight (pcf)	104.7

TEST DATA

Elapsed Time (hr)	Initial Head (in)	Final Head (in)	Coefficient of Permeability, k (cm/s)
20.98	133.73	130.73	4.9E-08
23.00	133.73	132.86	1.3E-08
21.47	133.73	132.98	1.2E-08
25.77	133.73	132.36	1.8E-08
22.68	133.73	132.48	1.9E-08
48.33	133.73	130.86	2.0E-08
24.58	133.73	132.23	2.1E-08
26.72	133.73	132.11	2.1E-08
20.22	133.73	132.48	2.1E-08
Average of last	**4**	**readings**	**2.1E-08**

Proctor Data		
Maximum Dry Denisty	113.5	pcf
Optimum Moisture	14.5	%

Remolded Compaction		
Compaction	89.9	%
Moisture Deviation	4.1	%

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PERMEABILITY TEST RESULTS
Falling Head

TEAM Services

Project Name: Northern Plains Regional Landfill Expansion
Project No.: 1-4610
Sample: 5 **Date Received:** 7/10/2019
Sample Location: B8, 19-21'
Test Started: 7/11/2019 **Test Competed:** 7/24/2019
Test Procedure: ASTM D 5084 - 03 Falling Head Test (Method B)
Sample Description: Sandy lean clay, trace gravel, dark gray

INITIAL SAMPLE DATA

Wet Weight (g)	1391.4
Non-cut Height (in)	5.96
Diameter (in)	2.875
Moisture Content (%)	17.9
Dry Unit Weight (pcf)	116.2

FINAL SAMPLE DATA

Wet Weight (g)	1250.6
Final Cut Height (in)	5.46
Diameter (in)	2.875
Moisture Content (%)	16.0
Dry Unit Weight (pcf)	115.9

TEST DATA

Elapsed Time (hr)	Initial Head (in)	Final Head (in)	Coefficient of Permeability, k (cm/s)
16.92	133.73	123.23	2.2E-07
24.02	133.73	131.41	3.3E-08
26.92	133.73	131.60	2.7E-08
45.03	133.73	129.91	2.9E-08
25.00	133.73	131.48	3.1E-08
21.95	133.73	131.98	2.7E-08
27.43	133.73	131.85	2.3E-08
21.10	133.73	132.10	2.6E-08
24.23	133.73	132.10	2.30E-08
23.88	133.73	132.10	2.33E-08
23.77	133.73	132.10	2.34E-08
23.73	133.73	132.10	2.35E-08
Average of last	**4**	**readings**	**2.3E-08**

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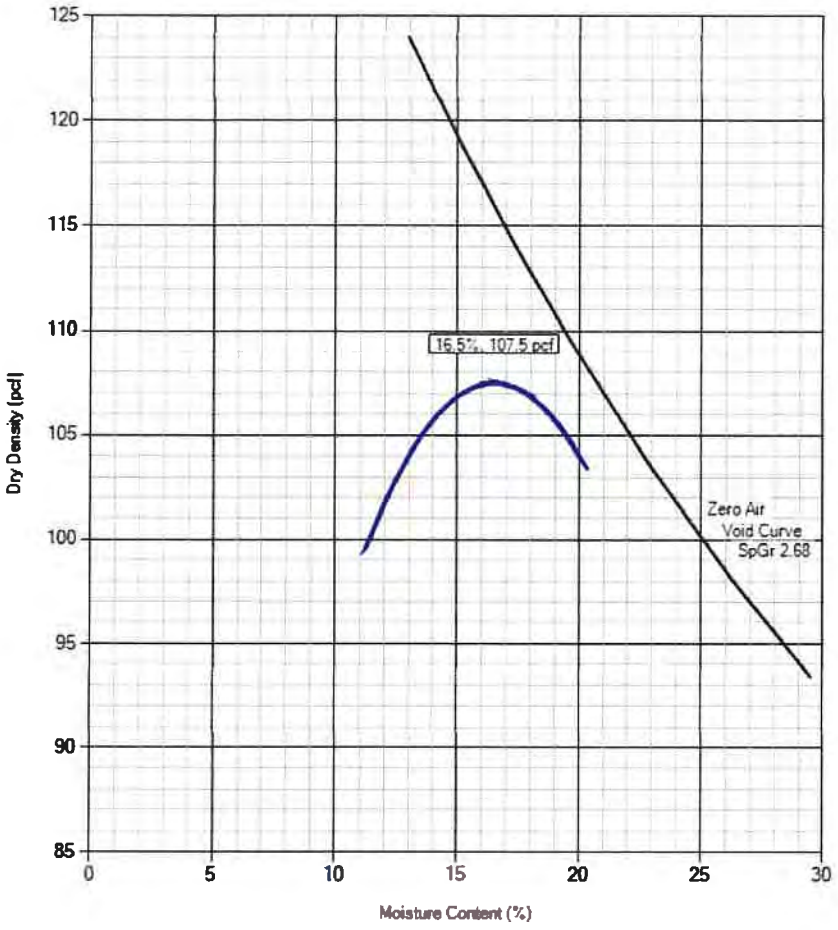
MOISTURE - DENSITY RELATIONSHIP

(Proctor Test)

ASTM D 698-12 Method A Standard

PROJECT: **Northern Plains Regional Landfill Expansion**
Graettinger, IA



PROJECT NO: 1-4610

PROCTOR ID: **4**

DATE RECEIVED: 07/25/2019

DATE TESTED: 07/28/2019

TESTED BY: JR

TEST RESULTS

MXIMUM DRY DENSITY (pcf)

107.5

OPTIMUM MOISTURE (%):

16.5

Prep Method: **Moist**

Rammer Type: **Mechanical**

Proctor Points available upon request.

SOURCE: B6 15-24'

SAMPLE DESCRIPTION: Lean CLAY, with sand

Notes/Remarks:

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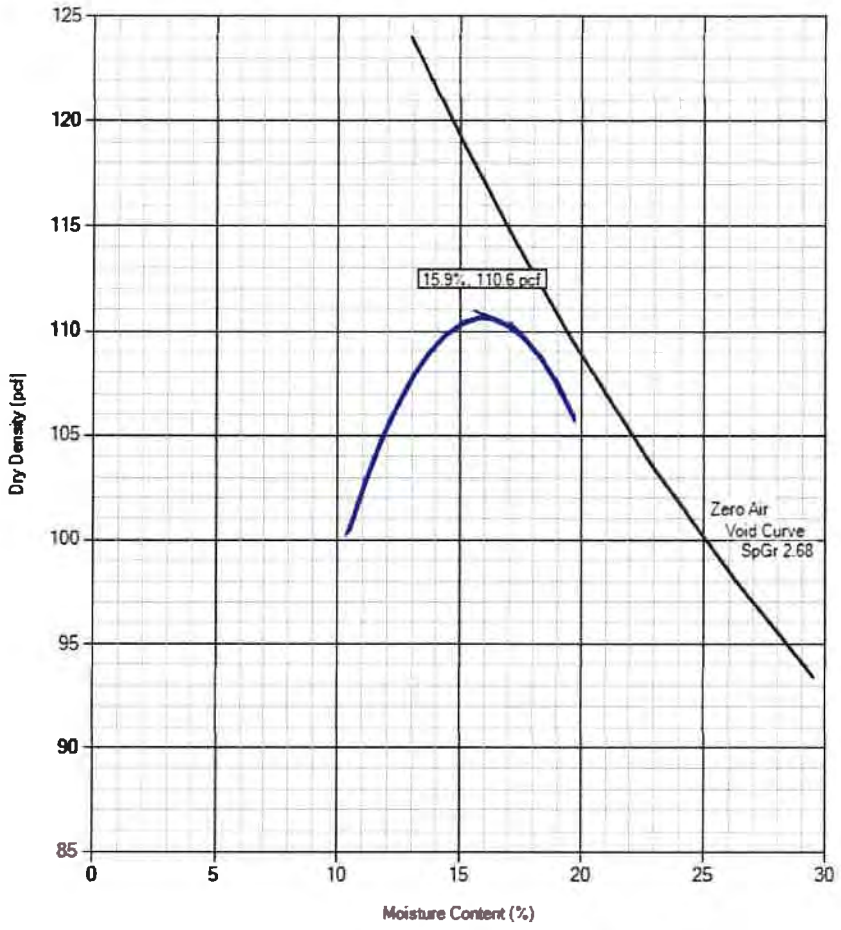
MOISTURE - DENSITY RELATIONSHIP

(Proctor Test)

ASTM D 698-12 Method A Standard

PROJECT: **Northern Plains Regional Landfill Expansion**
Graettinger, IA



PROJECT NO: 1-4610

PROCTOR ID: **2**

DATE RECEIVED: 07/25/2019

DATE TESTED: 07/28/2019

TESTED BY: JR

TEST RESULTS

MXIMUM DRY DENSITY (pcf)

110.6

OPTIMUM MOISTURE (%):

15.9

Prep Method: **Moist**

Rammer Type: **Mechanical**

Proctor Points available upon request.

SOURCE: B7 10-15'

SAMPLE DESCRIPTION: Sandy Lean CLAY

Notes/Remarks:

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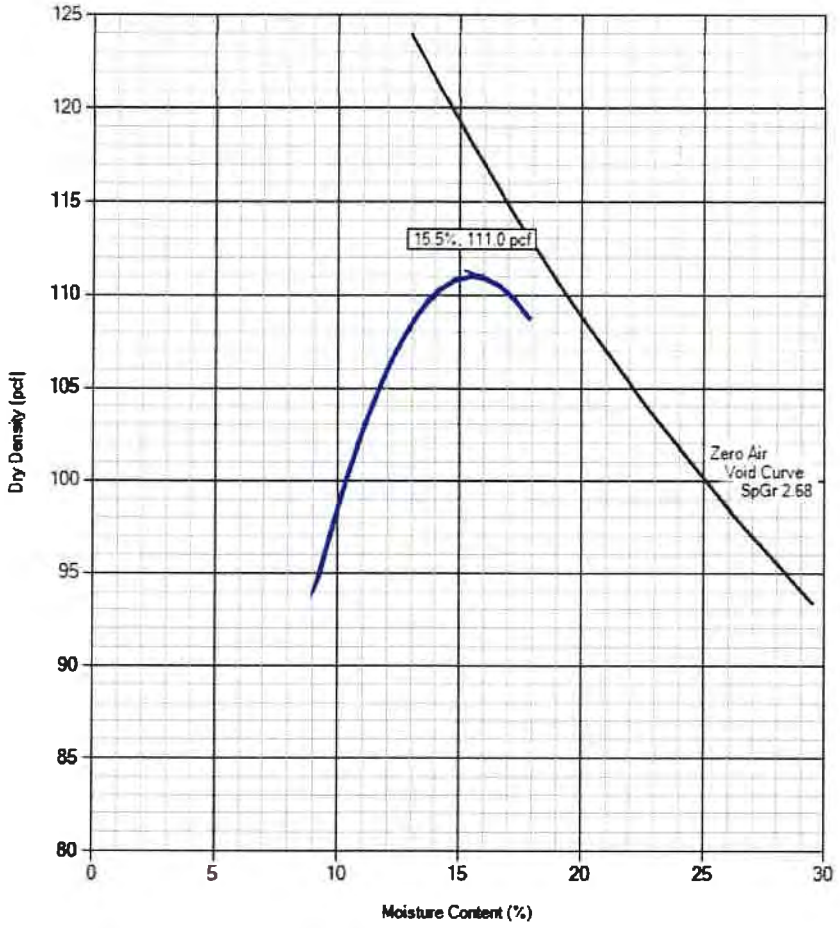
MOISTURE - DENSITY RELATIONSHIP

(Proctor Test)

ASTM D 698-12 Method A Standard

PROJECT: **Northern Plains Regional Landfill Expansion**
Graettinger, IA



PROJECT NO: 1-4610

PROCTOR ID: **1**

DATE RECEIVED: 07/25/2019

DATE TESTED: 07/28/2019

TESTED BY: JR

TEST RESULTS

MXIMUM DRY DENSITY (pcf)

111.0

OPTIMUM MOISTURE (%):

15.5

Prep Method: **Moist**

Rammer Type: **Mechanical**

Proctor Points available upon request.

SOURCE: B8 5-10'

SAMPLE DESCRIPTION: Sandy Lean CLAY

Notes/Remarks:

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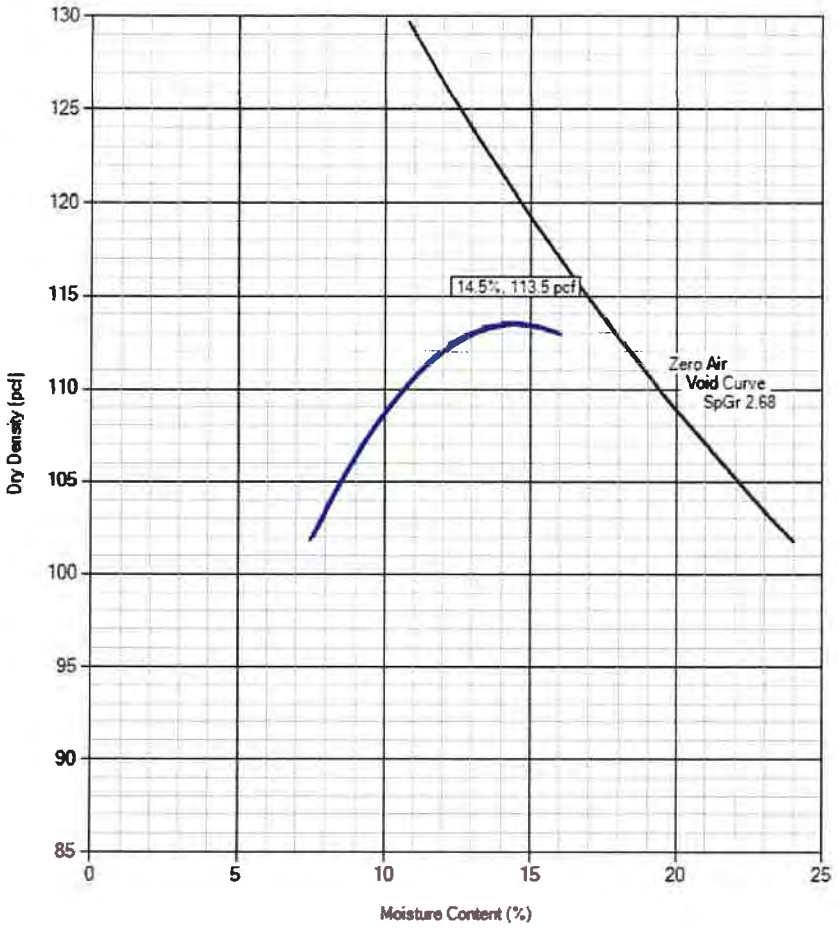
MOISTURE - DENSITY RELATIONSHIP

(Proctor Test)

ASTM D 698-12 Method A Standard

PROJECT: **Northern Plains Regional Landfill Expansion**
Graettinger, IA



PROJECT NO: 1-4610

PROCTOR ID: **3**

DATE RECEIVED: 07/25/2019

DATE TESTED: 07/28/2019

TESTED BY: JR

TEST RESULTS

MXIMUM DRY DENSITY (pcf)

113.5

OPTIMUM MOISTURE (%):

14.5

Prep Method: **Moist**

Rammer Type: **Mechanical**

Proctor Points available upon request.

SOURCE: B8 14-25'

SAMPLE DESCRIPTION: Sandy Lean CLAY

Notes/Remarks:

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APPENDIX 5

Monitoring Well Construction Documentation Forms

MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2 - 76 P
Well or Piezometer # MW 2 Date started 9-11-79 Date completed 9-11-79

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 653' West along North Boundary
Distance and direction from boundary to well 177' South

Elevations (± 0.01 ft. MSL):
Ground surface 1287.35
Top of protective casing *
Top of well casing 1291.00
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on Radio Tower Base

B. Soil Boring Information

Name and address of construction company Virgil P. Elbert Well Drilling, Inc. Whittemore, Iowa
Name of driller
Drilling method Hollow Stem Auger
Drilling fluid Water
Bore hole diameter 6"
Soil sampling method Disturbed
Depth of boring 47.85

C. Monitoring Well Installation

Casing material PVC
Length of casing 50.5
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type Screwed
Casing/screen joint type Screwed
Screen material PVC
Screen opening size 0.050"
Screen length 3'
Depth of well 46.85

Well Installation, continued:

Filter pack:
Material Sand/Gravel
Grain size
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite Grout
Placement method Tremie
Volume

Backfill (if different from seal):
Material
Placement Method
Volume

Surface seal design:
Material of protective casing: Steel - Shop Primed
Material of grout between protective casing and well casing: Concrete
Protective cap:
Material Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 41.65'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Up
Average depth of frostline 4'

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch X 11 inch map showing location of all monitoring wells and piezometers.

Form #542-1277

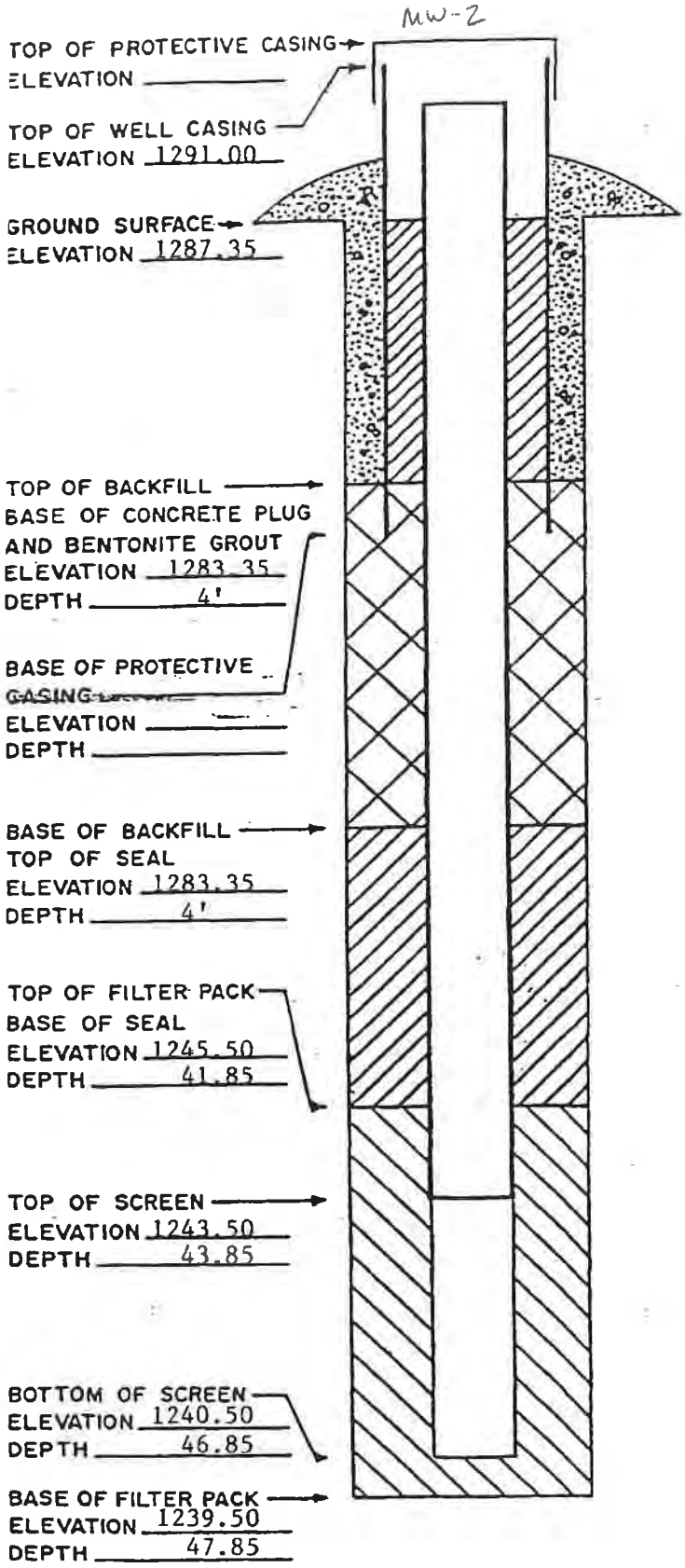
*Metal casings are scheduled to be installed by June 1, 1995. Elevations will be surveyed and recorded on these forms.

Printed on Recycled Paper

LEVATIONS: ± 0.01 FT. MSL

EPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2-76-P
Well or Piezometer # 3AR Date started 11/25/96 Date completed 11/25/96

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 319' west along North Boundary
Distance and direction from boundary to well 871' south

Elevations (± 0.01 ft. MSL):
Ground surface 1231.30
Top of protective casing 1234.80
Top of well casing 1234.30
Benchmark elevation 1275.22
Benchmark description Top of north bolt on radio tower base

B. Soil Boring Information

Name and address of construction company PSI
2917 Douglas Street
Omaha, NE
Name of driller Gary Steffan
Drilling method Hollow Stem Auger
Drilling fluid --
Bore hole diameter 6.25"
Soil sampling method Shelby Tube
Depth of boring 10'

C. Monitoring Well Installation

Casing material PVC
Length of casing 13'
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type screwed
Casing/screen joint type screwed
Screen material PVC
Screen opening size 0.10"
Screen length 5'
Depth of well 10'

Well Installation, continued:

Filter pack:
Material Gravel
Grain size 3/8"
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite
Placement method Tremie
Volume

Backfill (if different from seal):
Material Grout
Placement Method Tremie
Volume

Surface seal design:
Material of protective casing:
SCH 40 Steel
Material of grout between protective casing and well casing:
Concrete
Protective cap:
Material SCH 40 Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 6.15'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Down
Average depth of frostline 4.5'

Form #542-1277

Printed on Recycled Paper

MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2 - 76 P
Well or Piezometer # MW 3B Date started 10-24-94 Date completed 10-25-94

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 295' West along North Boundary
Distance and direction from boundary to well 911' South

Elevations (± 0.01 ft. MSL):
Ground surface 1227.40
Top of protective casing *
Top of well casing 1231.00
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on Radio Tower Base

B. Soil Boring Information

Name and address of construction company Jim's Well Service Pocahontas, IA
Name of driller Jim Barret
Drilling method Auger
Drilling fluid
Bore hole diameter 6"
Soil sampling method Disturbed
Depth of boring 20.95

C. Monitoring Well Installation

Casing material PVC
Length of casing 23.55
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type Screwed
Casing/screen joint type Screwed
Screen material PVC
Screen opening size 0.050"
Screen length 5'
Depth of well 19.95'

Well Installation, continued:

Filter pack:
Material Gravel
Grain size 3/8"
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite Grout
Placement method Tremie
Volume

Backfill (if different from seal):
Material
Placement Method
Volume

Surface seal design:
Material of protective casing: Steel - Shop Primed
Material of grout between protective casing and well casing: Concrete
Protective cap:
Material Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 7.8'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Down
Average depth of frostline 4'

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch X 11 inch map showing location of all monitoring wells and piezometers.

*Metal casings are scheduled to be installed by June 1, 1995. Elevations will be surveyed and recorded on these forms.

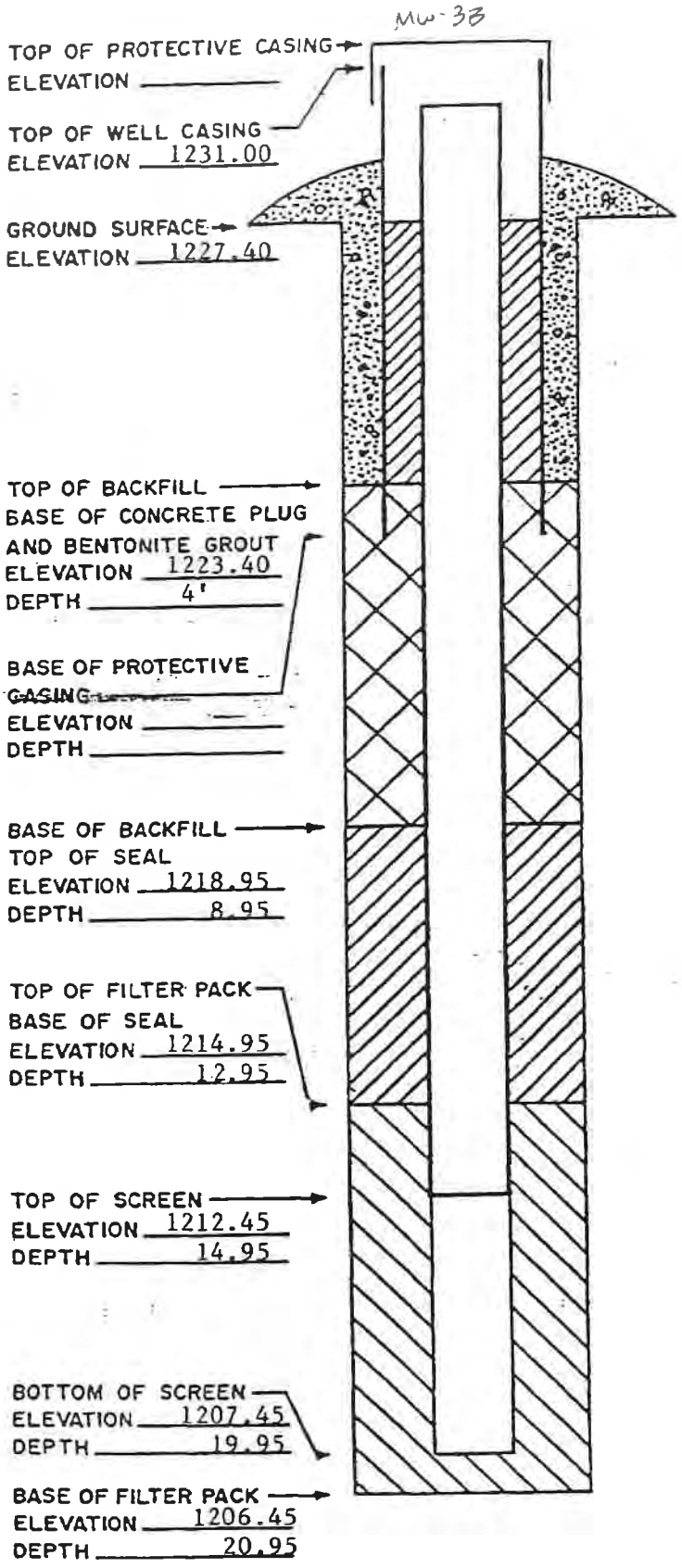
Form #542-1277

Printed on Recycled Paper

ELEVATIONS: ± 0.01 FT. MSL

DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



MONITORING WELL/PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name: NORTHERN PLAINS REGIONAL LANDFILL — Permit #: 74 SDP- 2 76 P
Well or Piezometer #: TMW-3E — Date Started: 8/8/13 — Date Completed: 8/8/13

A. Surveyed Locations and Elevations

Location (+/0.5 ft):

Specify corner of site	East Side
Distance and direction along boundary	N6710.1152
Distance and direction from boundary to well	E8542.8653

Elevations (+/0.01 ft. MSL):

Ground surface	1225.79
Top of protective casing	1228.11
Top of well casing	1227.86
Benchmark elevation	ON-SITE
Benchmark description	

B. Soil Boring Information

Name and address of construction company
Team Services, Inc
717 SE 6th Street
Des Moines, Iowa 50309

Name of driller	Don Carlson
Drilling method	HAS
Drilling fluid	N/A
Bore hole diameter	7-inch
Soil sampling method	CONTINUOUS
Depth of boring	29 ft

C. Monitoring Well Installation

Casing material	PVC
Length of casing	19.7
Outside casing diameter	2.375
Inside casing diameter	2.067
Casing joint type	FLUSH THREADED
Casing/screen joint type	FLUSH THREADED
Screen material	PVC
Screen opening size	0.010"
Screen length	10 ft
Depth of well	29.7 ft FROM TOP PVC

Well Installation, continued:

Filter pack:

Material	SILICA SAND
Grain size	0.65
Volume	2.6 CUBIC FEET

Seal (minimum 3 ft. lenth above) filter pack:

Material	Bentonite Chips 3/8"
Placement method	POURED THROUGH HAS
Volume	0.5 CUBIC FT

Backfill (if different from seal):

Material	High Solids Bentonite
Placement method	Slurry through Tremie Pipe
Volume	3.0 cubic ft

Surface seal design:
Material of protective casing: Steel
Material of grout between protective casing and well casing: cement & bentonite
Protective cap:

Material	None			
Vented?	[X]	Yes	[ ]	No
Locking?	[X]	Yes	[ ]	No

Well cap:

Material	PVC			
Vented?	[X]	Yes	[ ]	No

D. Groundwater Measurement

Water level (+/0.01 ft. below top of inner well casing)	7.25
Stabilization time	8 hrs
Well development method	pumped - surged multiple episodes

[ ] Upgradient Well [X] Downgradient Well
(See piezometric map from Hydrogeolic study)
Average depth of frostline

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch x 11 inch map showing location of all monitoring wells and piezometers.

WELL OR PIEZOMETER# TMW-3E

ELEVATION +/0 01 FT. MSL
DEPTHS: +/0 1 FT. FROM
TOP PVC

TOP OF PROTECTIVE CASING
ELEVATION 1228.11

TOP OF WELL CASING
ELEVATION 1227.86

GROUND SURFACE
ELELVATION 1225.79

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 1223.79
DEPTH 2.0 FROM GROUND

BASE OF PROTECTIVE
CASING
ELEVATION 1221.11
DEPTH 4.68 FROM GROUND

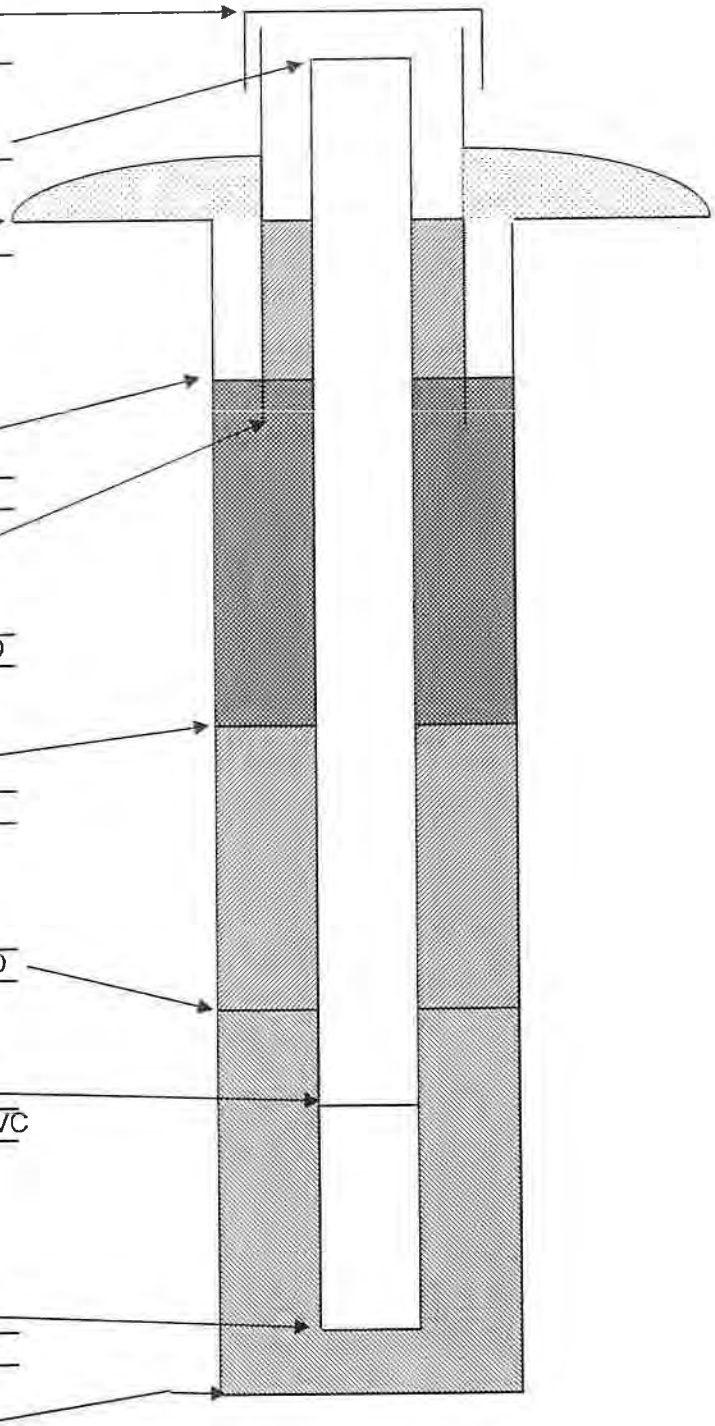
BASE OF BACKFILL
TOP OF SEAL
ELEVATION 1223.79
DEPTH 2.0 FROM GROUND

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 1209.79
DEPTH 16.0 FROM GROUND

TOP OF SCREEN
ELEVATION 1208.16
DEPTH 19.7 ft FROM TOP PVC

BOTTOM OF SCREEN
ELEVATION 1198.16
DEPTH 29.7 ft FROM TOP PVC

BASE OF FILTER PACK
ELEVATION 1196.79
DEPTH 29ft FROM GROUND



MONITORING WELL/PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name: NORTHERN PLAINS REGIONAL LANDFILL — Permit #: 74 SDP- 2 76 P
Well or Piezometer #: TMW-3F — Date Started: 8/8/13 — Date Completed: 8/8/13

A. Surveyed Locations and Elevations

Location (+/0.5 ft):

Specify corner of site	East Side
Distance and direction along boundary	N6780.8459
Distance and direction from boundary to well	E8602.9107

Elevations (+/0.01 ft. MSL):

Ground surface	1225.07
Top of protective casing	
Top of well casing	1227.72
Benchmark elevation	ON-SITE
Benchmark description	

B. Soil Boring Information

Name and address of construction company
Team Services, Inc
717 SE 6th Street
Des Moines, Iowa 50309

Name of driller	Don Carlson
Drilling method	HAS
Drilling fluid	N/A
Bore hole diameter	7-inch
Soil sampling method	CONTINUOUS
Depth of boring	29 ft

C. Monitoring Well Installation

Casing material	PVC
Length of casing	19.25
Outside casing diameter	2.375
Inside casing diameter	2.067
Casing joint type	FLUSH THREADED
Casing/screen joint type	FLUSH THREADED
Screen material	PVC
Screen opening size	0.010"
Screen length	10 ft
Depth of well	29.25 ft FROM TOP PVC

Well Installation, continued.

Filter pack:

Material	SILICA SAND
Grain size	0.65
Volume	3.0 CUBIC FEET

Seal (minimum 3 ft. lenth above) filter pack:

Material	Bentonite Chips 3/8"
Placement method	POURED THROUGH HAS
Volume	0.5 CUBIC FT

Backfill (if different from seal):

Material	High Solids Bentonite
Placement method	Slurry through Tremie Pipe
Volume	2.5 cubic ft

Surface seal design:
Material of protective casing:
None
Material of grout between protective casing and well casing:
None
Protective cap:
Material: None
Vented? [ ] Yes [ ] No
Locking? [X] Yes [ ] No
Well cap:
Material: PVC
Vented? [X] Yes [ ] No

D. Groundwater Measurement

Water level (+/0.01 ft. below top of inner well casing)	7.15
Stabilization time	3 hrs
Well development method	pumped - surged multiple episodes

[ ] Upgradient Well [X] Downgradient Well
(See piezometric map from Hydrogeolic study)
Average depth of frostline

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch x 11 inch map showing location of all monitoring wells and piezometers.

WELL OR PIEZOMETER# TMW-3F

ELEVATION: +/0.01 FT. MSL
DEPTHS: +/0 1 FT FROM
TOP PVC

TOP OF PROTECTIVE CASING
ELEVATION _____

TOP OF WELL CASING
ELEVATION 1227.72

GROUND SURFACE
ELELVATION 1225.07

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 1223.07
DEPTH 2.0 FROM GROUND

BASE OF PROTECTIVE
CASING
ELEVATION None
DEPTH _____

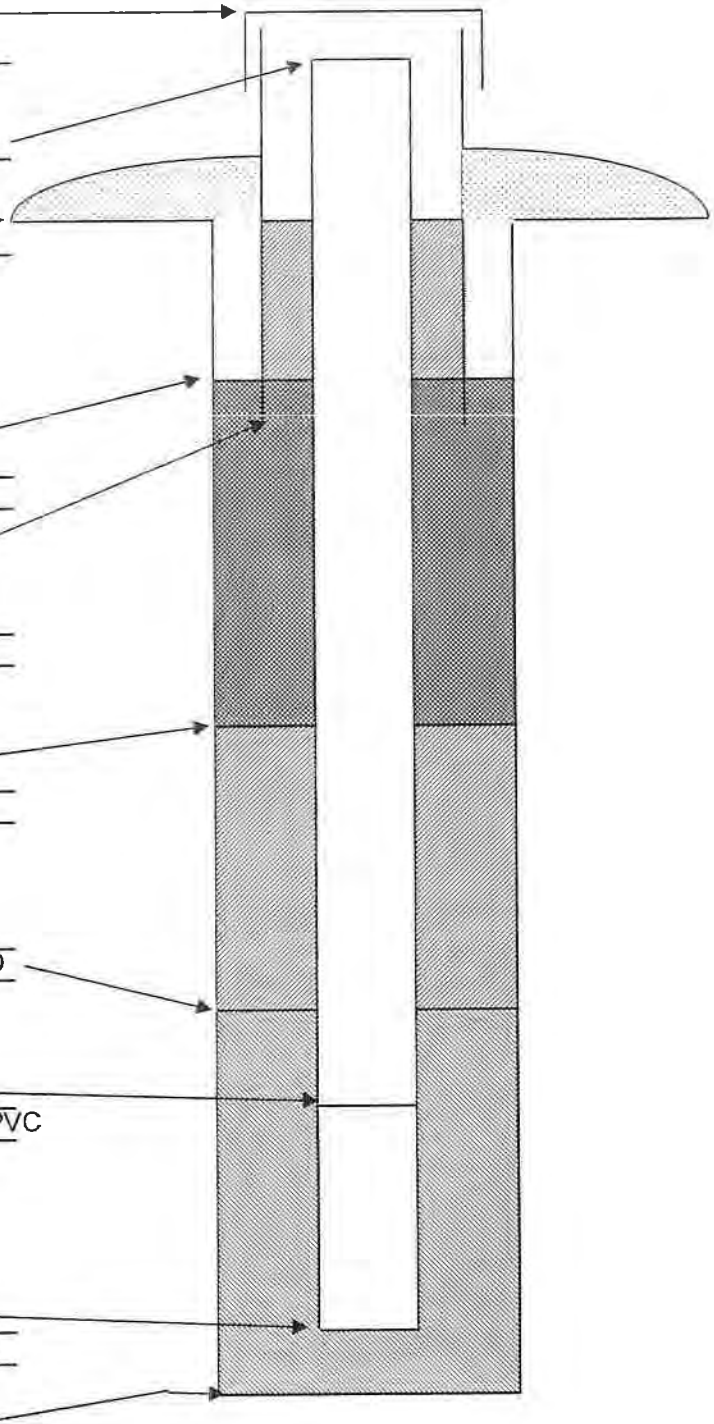
BASE OF BACKFILL
TOP OF SEAL
ELEVATION 1223.07
DEPTH 2.0 FROM GROUND

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 1210.57
DEPTH 14.5 FROM GROUND

TOP OF SCREEN
ELEVATION 1208.47
DEPTH 19.25 ft FROM TOP PVC

BOTTOM OF SCREEN
ELEVATION 1198.47
DEPTH 29.25 ft FROM TOP PVC

BASE OF FILTER PACK
ELEVATION 1197.07
DEPTH 28 ft FROM GROUND



MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2 - 76 P
Well or Piezometer # MW 5 Date started 4-25-84 Date completed 4-25-84

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 1326' West along North Boundary
Distance and direction from boundary to well 155' South

Elevations (± 0.01 ft. MSL):
Ground surface 1293.37
Top of protective casing *
Top of well casing 1297.00
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on Radio Tower Base

B. Soil Boring Information

Name and address of construction company Terracon Consultants Cedar Rapids, IA
Name of driller
Drilling method Auger
Drilling fluid -
Bore hole diameter 6"
Soil sampling method
Depth of boring 43.3'

C. Monitoring Well Installation

Casing material PVC
Length of casing 45.93
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type Screwed
Casing/screen joint type Screwed
Screen material PVC
Screen opening size 0.050"
Screen length 5'
Depth of well 42.3'

Well Installation, continued:

Filter pack:
Material Gravel
Grain size
Volume

Seal (minimum 3 ft. length above filter pack):
Material Concrete Grout
Placement method Tremie
Volume 4'

Backfill (if different from seal):
Material Bentonite Grout
Placement Method
Volume Full

Surface seal design:
Material of protective casing: Steel - Shop Primed
Material of grout between protective casing and well casing: Concrete
Protective cap:
Material Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 24.65
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Up
Average depth of frostline 4'

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch X 11 inch map showing location of all monitoring wells and piezometers.

*Metal casings are scheduled to be installed by June 1, 1995. Elevations will be surveyed and recorded on these forms.

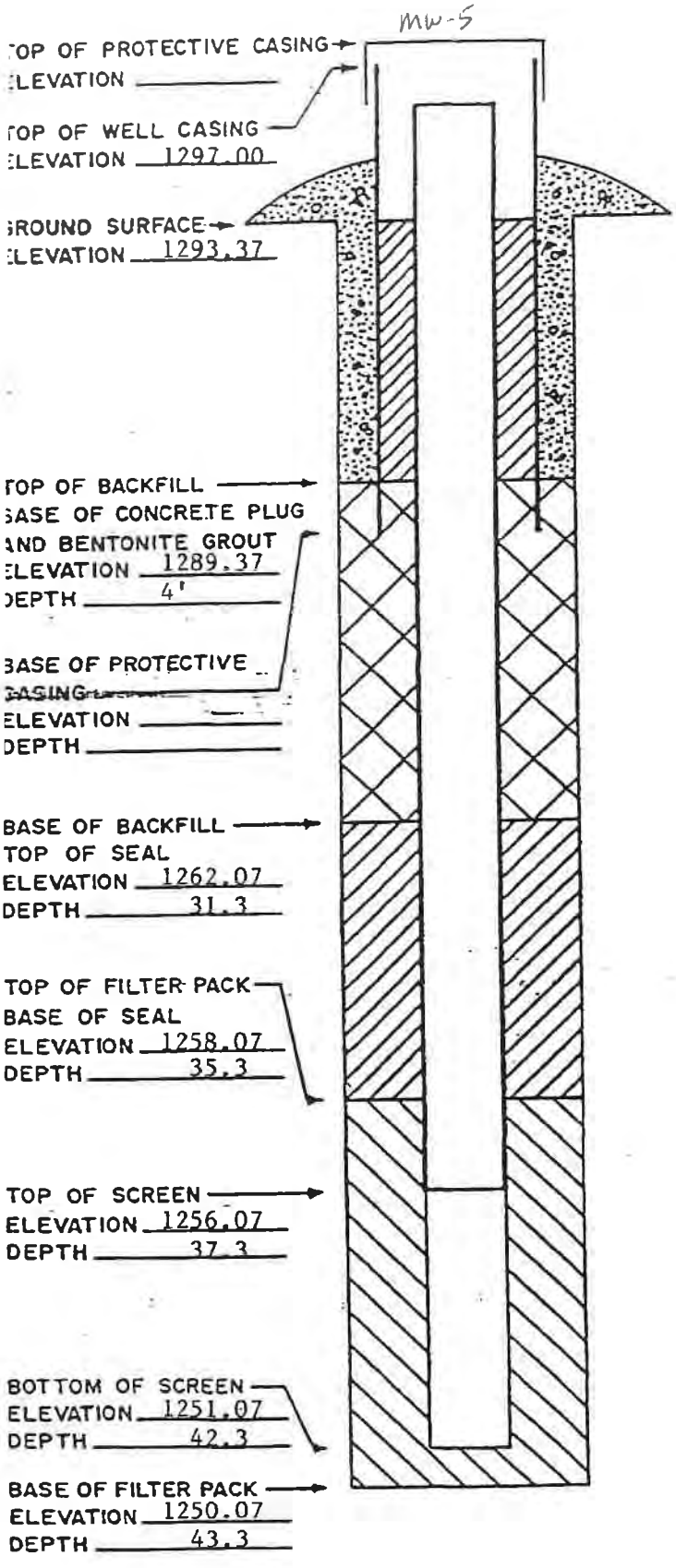
Form #542-1277

Printed on Recycled Paper

ELEVATIONS: ± 0.01 FT. MSL

DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2 - 76 P
Well or Piezometer # MW5A Date started 3-21-95 Date completed 3-21-95

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 1316' West along North Boundary
Distance and direction from boundary to well 155' South

Elevations (± 0.01 ft. MSL):
Ground surface 1292.85
Top of protective casing *
Top of well casing 1297.00
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on Radio Tower Base

B. Soil Boring Information

Name and address of construction company Flannegan Conservation Service Emmetsburg, IA 50536

Name of driller Steve Flannegan
Drilling method Auger
Drilling fluid -
Bore hole diameter 6"
Soil sampling method Disturbed
Depth of boring 24.7'

C. Monitoring Well Installation

Casing material PVC
Length of casing 27.85
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type Screwed
Casing/screen joint type Screwed
Screen material PVC
Screen opening size 0.050"
Screen length 5'
Depth of well 20.12

Well Installation, continued:

Filter pack:
Material Pea Gravel
Grain size 3/8"
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite Grout
Placement method Tremie
Volume

Backfill (if different from seal):
Material Bentonite Grout
Placement Method
Volume Full

Surface seal design:
Material of protective casing: Steel - Shop Primed
Material of grout between protective casing and well casing: Concrete
Protective cap:
Material Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 21.77
Stabilization time 24 hours
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Up
Average depth of frostline 4'

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch X 11 inch map showing location of all monitoring wells and piezometers.

*Metal casings are scheduled to be installed by June 1, 1995. Elevations will be surveyed and recorded on these forms.

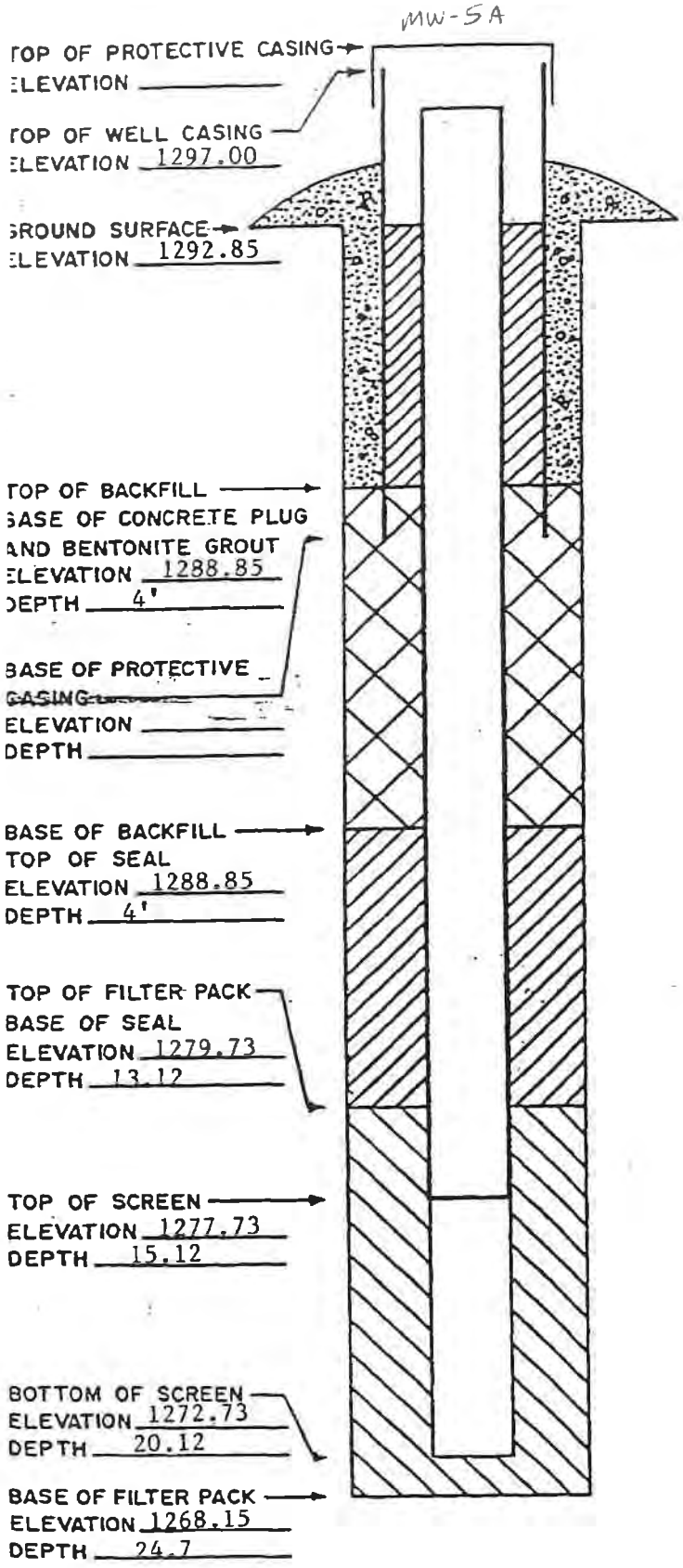
Form #542-1277

Printed on Recycled Paper

LEVATIONS: ± 0.01 FT. MSL

EPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2 - 76 P
Well or Piezometer #MW 6 Date started 1988 Date completed 1988

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 251' West along North Boundary
Distance and direction from boundary to well 576' South

Elevations (± 0.01 ft. MSL):
Ground surface 1227.00
Top of protective casing *
Top of well casing 1229.50
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on Radio Tower Base

B. Soil Boring Information

Name and address of construction company Elberts Well Drilling, Inc. Whittemore, IA
Name of driller
Drilling method Hollow Stem Auger
Drilling fluid Water
Bore hole diameter 6"
Soil sampling method -
Depth of boring 17.9

C. Monitoring Well Installation

Casing material PVC
Length of casing 19.4'
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type Screwed
Casing/screen joint type Screwed
Screen material PVC
Screen opening size 0.050"
Screen length 5'
Depth of well 16.9'

Well Installation, continued:

Filter pack:
Material Gravel
Grain size
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite
Placement method Tremie
Volume

Backfill (if different from seal):
Material
Placement Method
Volume

Surface seal design:
Material of protective casing: Steel - Shop Primed
Material of grout between protective casing and well casing: Concrete
Protective cap:
Material Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 7.3'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Down
Average depth of frostline 4'

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch X 11 inch map showing location of all monitoring wells and piezometers.

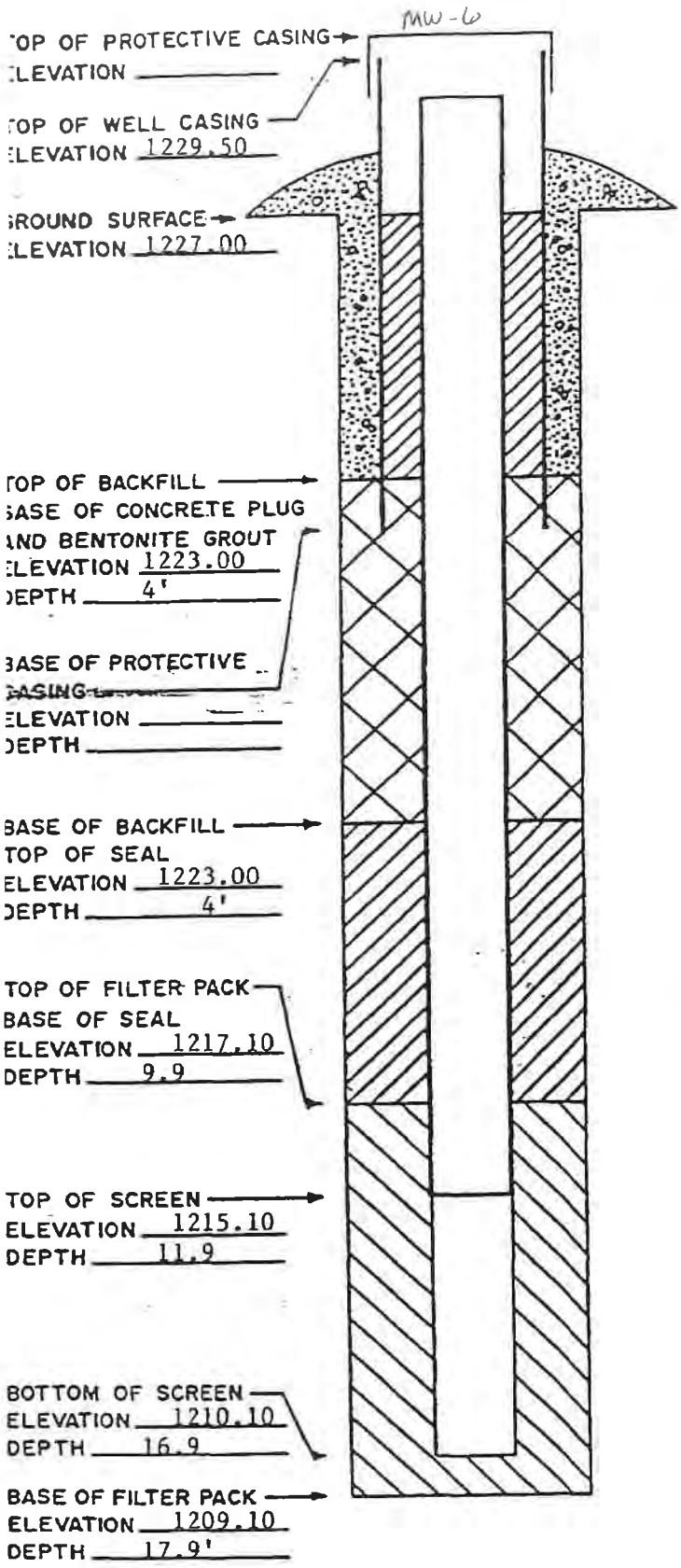
*Metal casings are scheduled to be installed by June 1, 1995. Elevations will be surveyed and recorded on these forms.

Form #542-1277

Printed on Recycled Paper

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2 - 76 P
Well or Piezometer # MW6A Date started 10-25-94 Date completed 10-25-94

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 271' West along North Boundary
Distance and direction from boundary to well 576' South

Elevations (± 0.01 ft. MSL):
Ground surface 1227.00
Top of protective casing *
Top of well casing 1231.00
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on Radio Tower Base

B. Soil Boring Information

Name and address of construction company Jim's Well Service Pocahontas, IA
Name of driller Jim Barret
Drilling method Auger
Drilling fluid
Bore hole diameter 6"
Soil sampling method Disturbed
Depth of boring 20.90

C. Monitoring Well Installation

Casing material PVC
Length of casing 23.9'
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type Screwed
Casing/screen joint type Screwed
Screen material PVC
Screen opening size 0.050"
Screen length 5'
Depth of well 19.90'

Well Installation, continued:

Filter pack:
Material Gravel
Grain size 3/8"
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite Grout
Placement method Tremie
Volume

Backfill (if different from seal):
Material
Placement Method
Volume

Surface seal design:
Material of protective casing: Steel - Shop Primed
Material of grout between protective casing and well casing: Concrete
Protective cap:
Material Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 8.7'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Down
Average depth of frostline 4'

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch X 11 inch map showing location of all monitoring wells and piezometers.

*Metal casings are scheduled to be installed by June 1, 1995. Elevations will be surveyed and recorded on these forms.

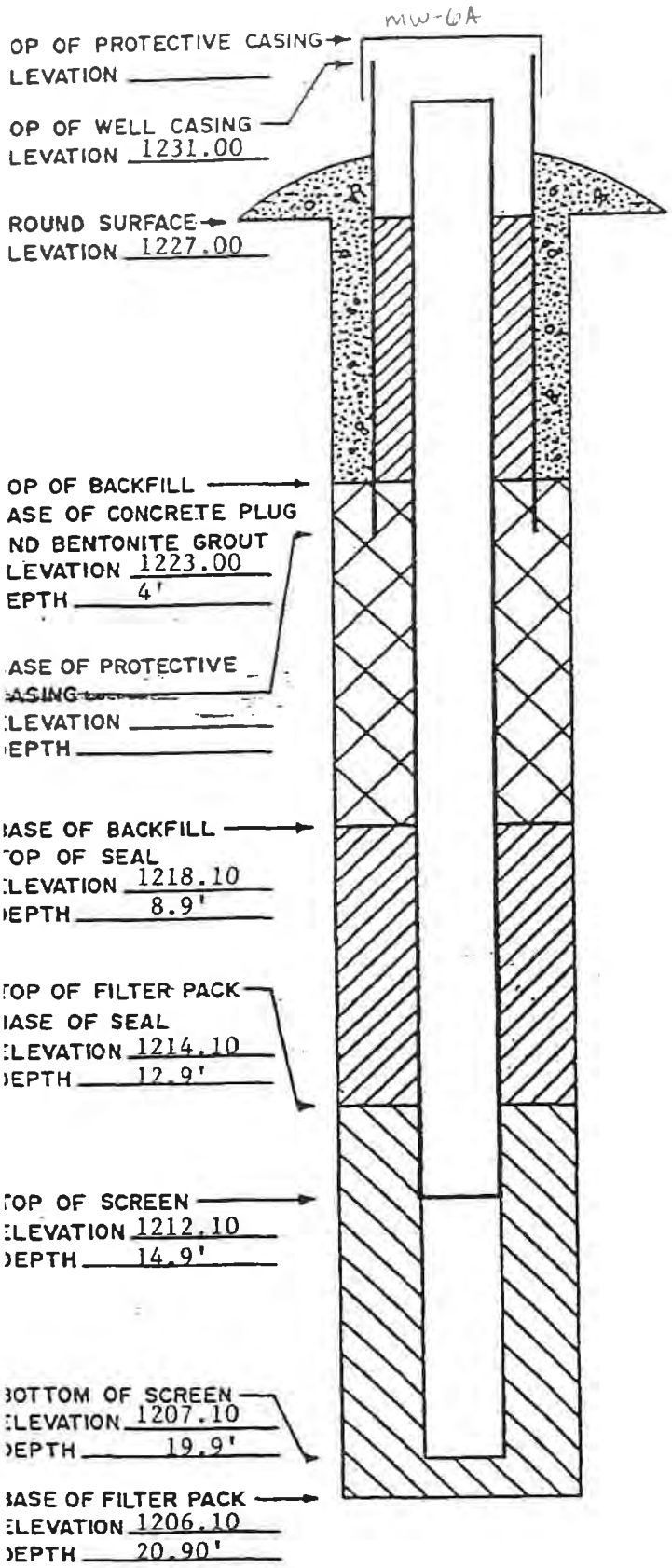
Form #542-1277

Printed on Recycled Paper

EVATIONS: ± 0.01 FT. MSL

PTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2 - 76 P
Well or Piezometer # MW 6B Date started 10-25-94 Date completed 10-26-94

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 267' West along North Boundary
Distance and direction from boundary to well 569' South

Elevations (± 0.01 ft. MSL):
Ground surface 1227.00
Top of protective casing *
Top of well casing 1231.00
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on Radio Tower Base

B. Soil Boring Information

Name and address of construction company Jim's Well Service Pocahontas, IA
Name of driller Jim Barret
Drilling method Auger
Drilling fluid
Bore hole diameter 6"
Soil sampling method Disturbed
Depth of boring 9.2'

C. Monitoring Well Installation

Casing material PVC
Length of casing 12.20'
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type Screwed
Casing/screen joint type Screwed
Screen material PVC
Screen opening size 0.050"
Screen length 3'
Depth of well 8.2'

Well Installation, continued:

Filter pack:
Material Gravel
Grain size 3/8"
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite Grout
Placement method Tremie
Volume

Backfill (if different from seal):
Material
Placement Method
Volume

Surface seal design:
Material of protective casing: Steel - Shop Primed
Material of grout between protective casing and well casing: Concrete
Protective cap:
Material Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 8.7'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Down
Average depth of frostline 4'

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch X 11 inch map showing location of all monitoring wells and piezometers.

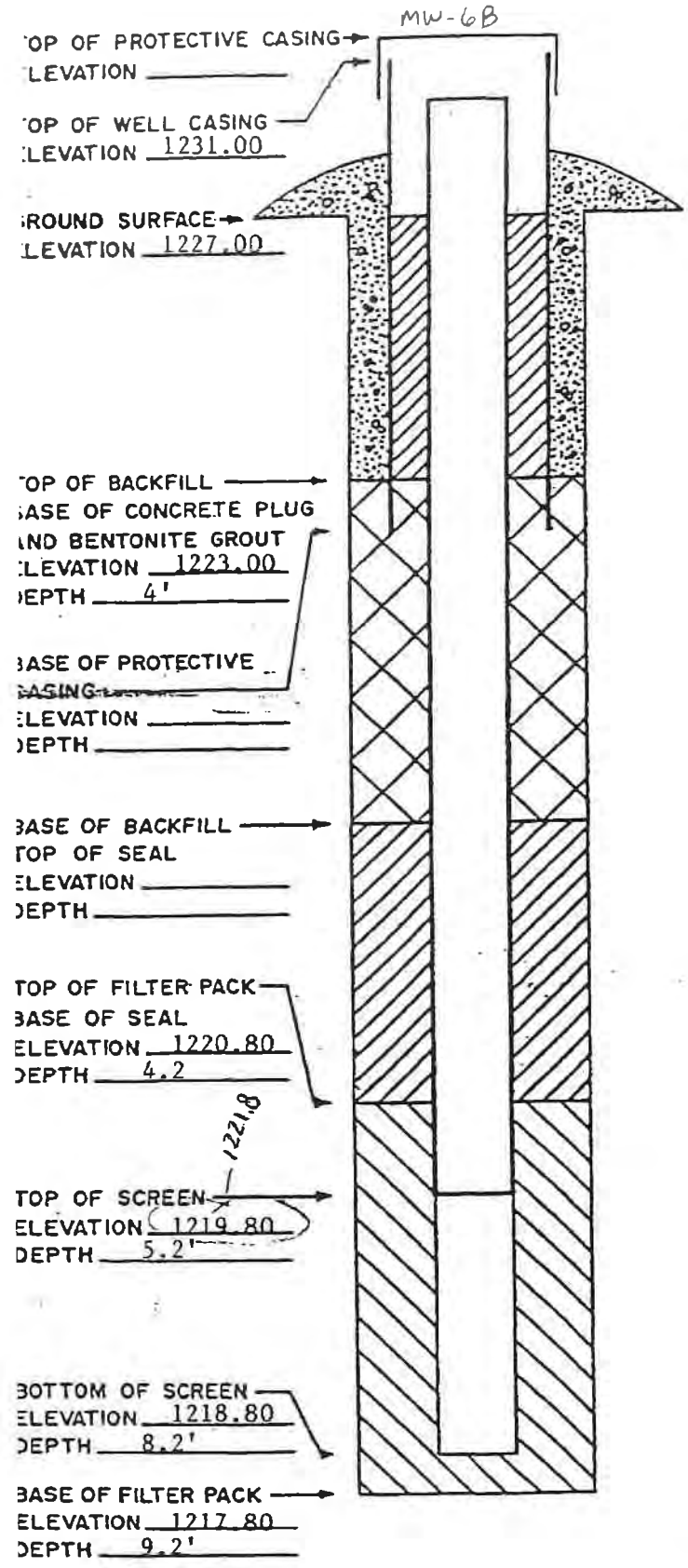
*Metal casings are scheduled to be installed by June 1, 1995. Elevations will be surveyed and recorded on these forms.

Form #542-1277

Printed on Recycled Paper

LEVATIONS: ± 0.01 FT. MSL
EPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2 - 76 P
Well or Piezometer # MW 7 Date started 9-28-88 Date completed 9-28-88

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 245' West along North Boundary
Distance and direction from boundary to well 1607' South

Elevations (± 0.01 ft. MSL):
Ground surface 1228.80
Top of protective casing *
Top of well casing 1230.00
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on Radio Tower Base

B. Soil Boring Information

Name and address of construction company Elberts Well Drilling, Inc. Whittemore, IA
Name of driller
Drilling method Hollow Stem Auger
Drilling fluid Water
Bore hole diameter 6"
Soil sampling method Disturbed
Depth of boring 19.8'

C. Monitoring Well Installation

Casing material PVC
Length of casing 20'
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type Screwed
Casing/screen joint type Screwed
Screen material PVC
Screen opening size 0.050"
Screen length 5'
Depth of well 18.8'

Well Installation, continued:

Filter pack:
Material Gravel
Grain size
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite Grout
Placement method Tremie
Volume

Backfill (if different from seal):
Material
Placement Method
Volume

Surface seal design:
Material of protective casing: Steel - Shop Primed
Material of grout between protective casing and well casing: Concrete
Protective cap:
Material Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 6.25'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Down
Average depth of frostline 4'

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch X 11 inch map showing location of all monitoring wells and piezometers.

*Metal casings are scheduled to be installed by June 1, 1995. Elevations will be surveyed and recorded on these forms.

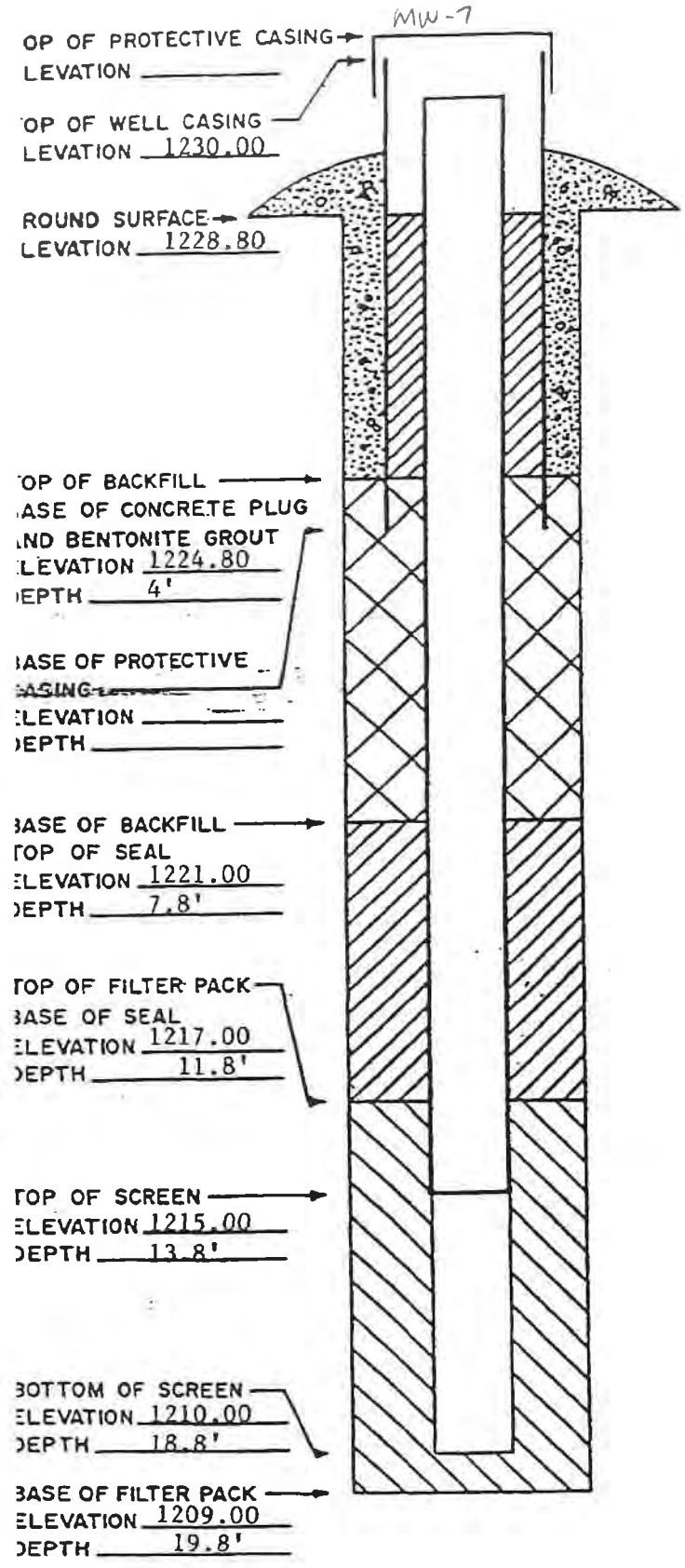
Form #542-1277

Printed on Recycled Paper

.EVATIONS: ± 0.01 FT. MSL

:PTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2 - 76 P
Well or Piezometer # MW 7A Date started 10-26-94 Date completed 10-26-94

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 286' West along North Boundary
Distance and direction from boundary to well 1628' South

Elevations (± 0.01 ft. MSL):
Ground surface 1227.40
Top of protective casing *
Top of well casing 1232.00
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on Radio Tower Base

B. Soil Boring Information

Name and address of construction company Jim's Well Service Pocahontas, IA
Name of driller Jim Barret
Drilling method Auger
Drilling fluid
Bore hole diameter 6"
Soil sampling method Disturbed
Depth of boring 7.2'

C. Monitoring Well Installation

Casing material PVC
Length of casing 10.80'
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type Screwed
Casing/screen joint type Screwed
Screen material PVC
Screen opening size 0.050"
Screen length 3'
Depth of well 6.2'

Well Installation, continued:

Filter pack:
Material Gravel
Grain size 3/8"
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite Grout
Placement method Tremie
Volume

Backfill (if different from seal):
Material
Placement Method
Volume

Surface seal design:
Material of protective casing: Steel - Shop Primed
Material of grout between protective casing and well casing: Concrete
Protective cap:
Material Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 8.35'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Down
Average depth of frostline 4'

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch X 11 inch map showing location of all monitoring wells and piezometers.

*Metal casings are scheduled to be installed by June 1, 1995. Elevations will be surveyed and recorded on these forms.

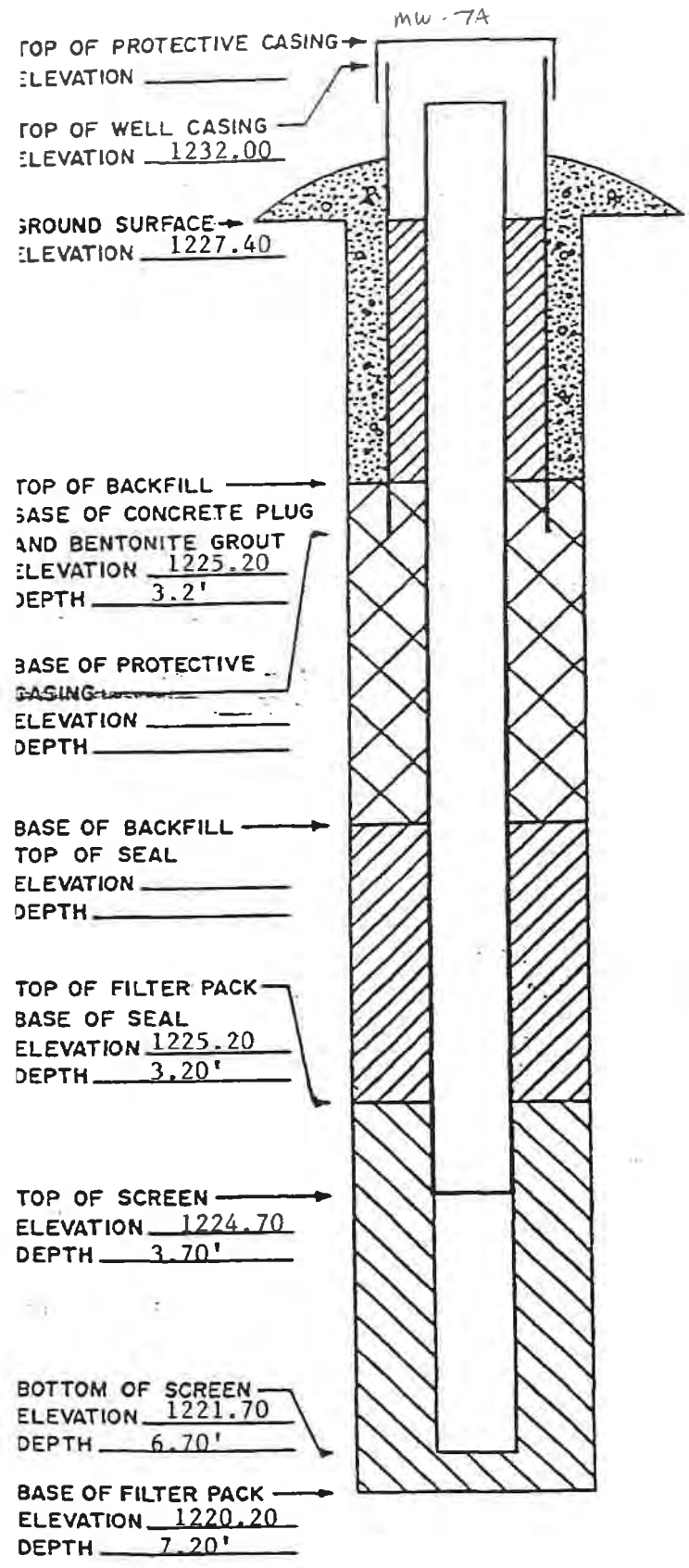
Form #542-1277

Printed on Recycled Paper

LEVATIONS: ± 0.01 FT. MSL

EPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2 - 76 P
Well or Piezometer # MW 7B Date started 10-26-94 Date completed 10-26-94

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 306' West along North Boundary
Distance and direction from boundary to well 1642' South

Elevations (± 0.01 ft. MSL):
Ground surface 1227.50
Top of protective casing *
Top of well casing 1231.00
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on Radio Tower Base

B. Soil Boring Information

Name and address of construction company Jim's Well Service Pocahontas, IA
Name of driller Jim Barret
Drilling method Auger
Drilling fluid
Bore hole diameter 6"
Soil sampling method Disturbed
Depth of boring 31.40'

C. Monitoring Well Installation

Casing material PVC
Length of casing 33.90
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type Screwed
Casing/screen joint type Screwed
Screen material PVC
Screen opening size 0.050"
Screen length 5'
Depth of well 30.40

Well Installation, continued:

Filter pack:
Material Gravel
Grain size 3/8"
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite Grout
Placement method Tremie
Volume

Backfill (if different from seal):
Material
Placement Method
Volume

Surface seal design:
Material of protective casing: Steel - Shop Primed
Material of grout between protective casing and well casing: Concrete
Protective cap:
Material Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 7.0'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Down
Average depth of frostline 4'

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch X 11 inch map showing location of all monitoring wells and piezometers.

*Metal casings are scheduled to be installed by June 1, 1995. Elevations will be surveyed and recorded on these forms.

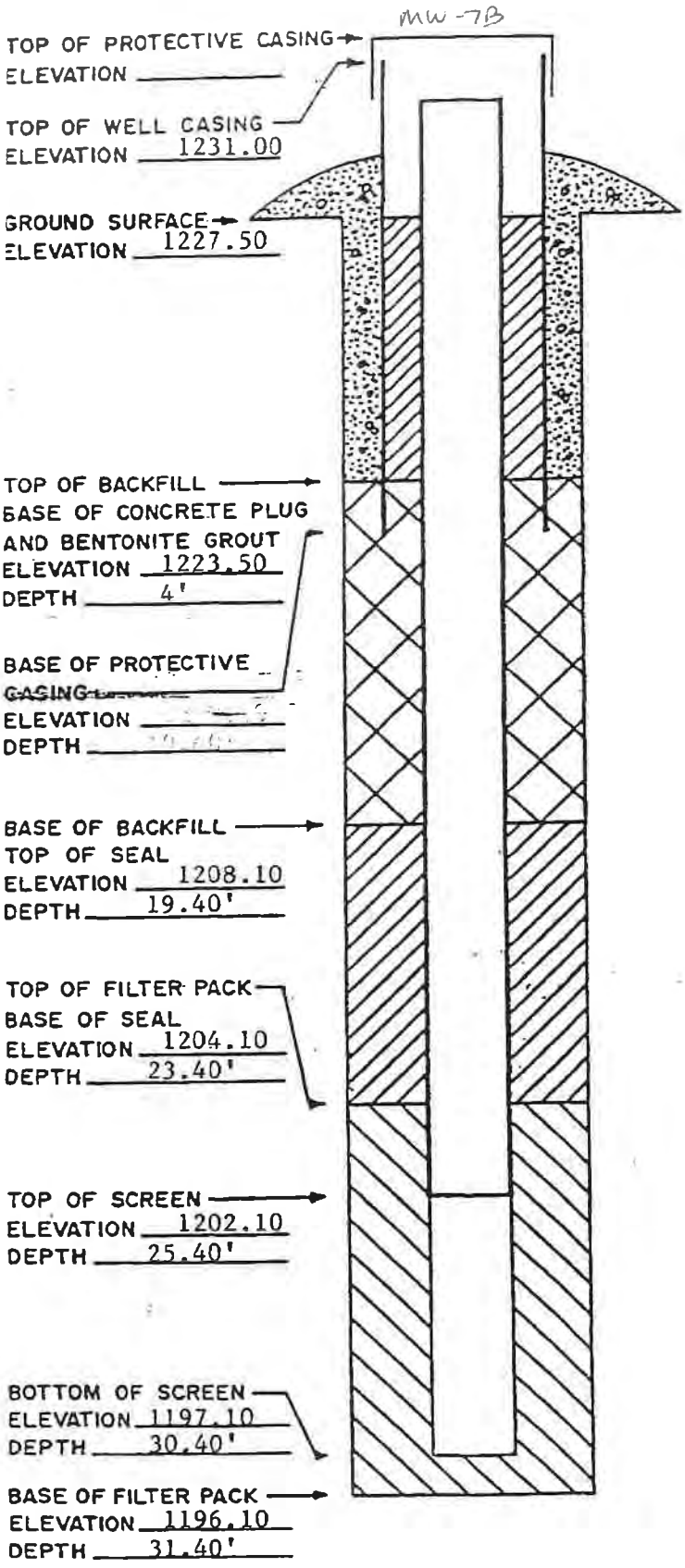
Form #542-1277

Printed on Recycled Paper

LEVATIONS: ± 0.01 FT. MSL

EPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



MONITORING WELL/PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name: NORTHERN PLAINS REGIONAL LANDFILL — Permit #: 74 SDP- 2 76 P
Well or Piezometer #: TMW-7E — Date Started: 8/7/13 — Date Completed: 8/7/13

A. Surveyed Locations and Elevations

Location (+/0.5 ft):

Specify corner of site	East Side
Distance and direction along boundary	N5980.9064
Distance and direction from boundary to well	E8516.1806

Elevations (+/0.01 ft. MSL):

Ground surface	1226.24
Top of protective casing	1228.89
Top of well casing	1228.64
Benchmark elevation	ON-SITE
Benchmark description	

B. Soil Boring Information

Name and address of construction company
Team Services, Inc
717 SE 6th Street
Des Moines, Iowa 50309

Name of driller	Don Carlson
Drilling method	HAS
Drilling fluid	N/A
Bore hole diameter	7-inch
Soil sampling method	CONTINUOUS
Depth of boring	36 ft

C. Monitoring Well Installation

Casing material	PVC
Length of casing	19.2 ft
Outside casing diameter	2.375
Inside casing diameter	2.067
Casing joint type	FLUSH THREADED
Casing/screen joint type	FLUSH THREADED
Screen material	PVC
Screen opening size	0.010"
Screen length	10 ft
Depth of well	29.2 ft FROM TOP PVC

Well Installation, continued:

Filter pack:

Material	SILICA SAND
Grain size	0.65
Volume	2.8 CUBIC FEET

Seal (minimum 3 ft. lenth above) filter pack:

Material	Bentonite Chips 3/8"
Placement method	POURED THROUGH HAS
Volume	0.5 CUBIC FT

Backfill (if different from seal):

Material	High Solids Bentonite
Placement method	Slurry through Tremie Pipe
Volume	2.6 cubic ft

Surface seal design:
Material of protective casing:
Steel
Material of grout between protective casing and well casing:
cement & bentonite
Protective cap:

Material	None			
Vented?	[X]	Yes	[ ]	No
Locking?	[X]	Yes	[ ]	No

Well cap:

Material	PVC			
Vented?	[X]	Yes	[ ]	No

D. Groundwater Measurement

Water level (+/0.01 ft. below top of inner well casing) .8.1 7.25
Stabilization time: 3 hrs
Well development method: pumped - surged multiple episodes

[ ] Upgradient Well [X] Downgradient Well
(See piezometric map from Hydrogeolic study)
Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch x 11 inch map showing location of all monitoring wells and piezometers.

WELL OR PIEZOMETER# TMW-7E

ELEVATION +/0.01 FT MSL
DEPTHS: +/0 1 FT FROM
TOP PVC

TOP OF PROTECTIVE CASING
ELEVATION 1228.89

TOP OF WELL CASING
ELEVATION 1228.64

GROUND SURFACE
ELELVATION 1226.24

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 1224.24
DEPTH 2.0 FROM GROUND

BASE OF PROTECTIVE
CASING
ELEVATION
DEPTH None

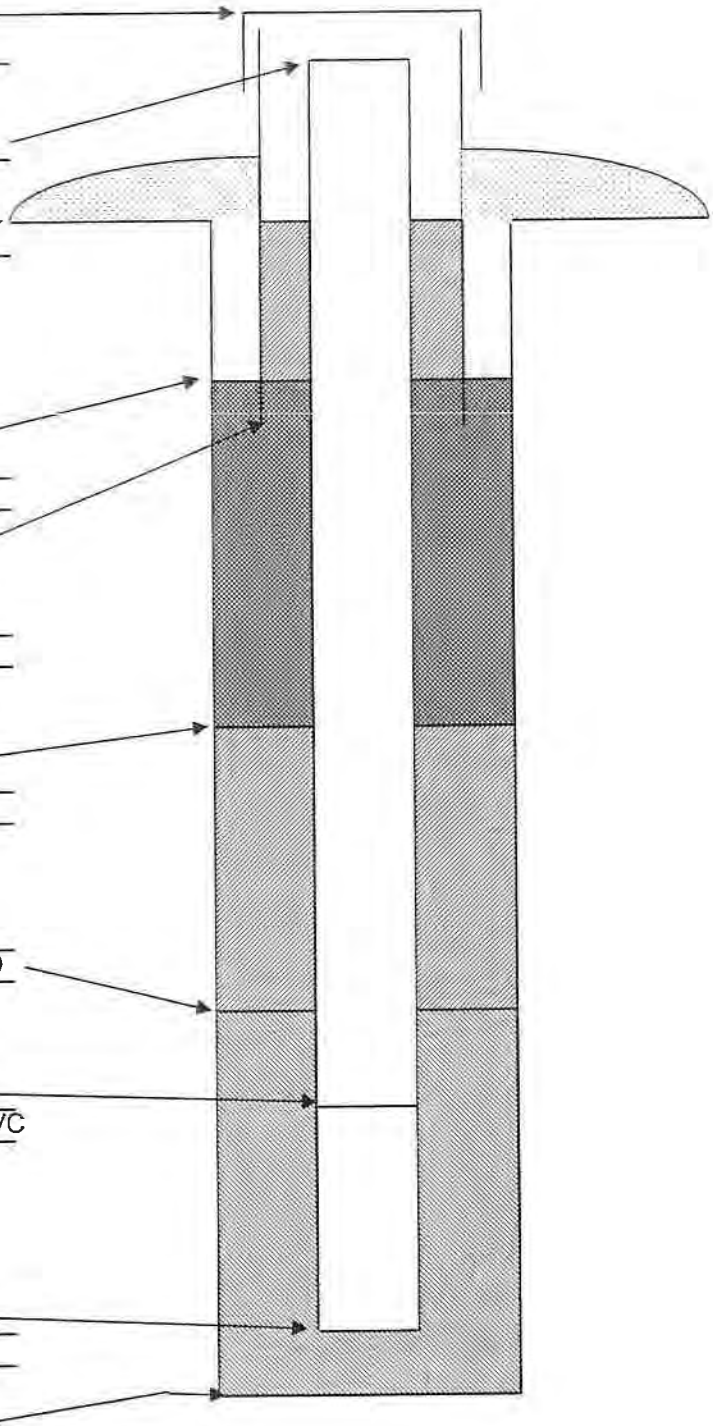
BASE OF BACKFILL
TOP OF SEAL
ELEVATION 1224.24
DEPTH 2.0 FROM GROUND

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 1211.24
DEPTH 15.0 FROM GROUND

TOP OF SCREEN
ELEVATION 1209.44
DEPTH 19.2 ft FROM TOP PVC

BOTTOM OF SCREEN
ELEVATION 1199.44
DEPTH 29.2 ft FROM TOP PVC

BASE OF FILTER PACK
ELEVATION 1197.24
DEPTH 29ft FROM GROUND



MONITORING WELL/PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name: NORTHERN PLAINS REGIONAL LANDFILL
Permit #: 74 SDP- 2 76 P
Well or Piezometer #: TMW-7F
Date Started: 8/7/13
Date Completed: 8/8/13

A. Surveyed Locations and Elevations

Location (+/0.5 ft):
- Specify corner of site: East Side
- Distance and direction along boundary: N6000.2680
- Distance and direction from boundary to well: E8600.5414

Elevations (+/0.01 ft. MSL):
- Ground surface: 1225.98
- Top of protective casing:
- Top of well casing: 1228.38
- Benchmark elevation: ON-SITE
- Benchmark description:

B. Soil Boring Information

Name and address of construction company
Team Services, Inc
717 SE 6th Street
Des Moines, Iowa 50309

- Name of driller: Don Carlson
- Drilling method: HAS
- Drilling fluid: N/A
- Bore hole diameter: 7-inch
- Soil sampling method: CONTINUOUS
- Depth of boring: 31 ft

C. Monitoring Well Installation

- Casing material: PVC
- Length of casing: 26.6 ft
- Outside casing diameter: 2.375
- Inside casing diameter: 2.067
- Casing joint type: FLUSH THREADED
- Casing/screen joint type: FLUSH THREADED
- Screen material: PVC
- Screen opening size: 0.010"
- Screen length: 5 ft
- Depth of well: 31.6 ft FROM TOP PVC

Well Installation, continued:

Filter pack:
- Material: SILICA SAND
- Grain size: 0.65
- Volume: 1.5 CUBIC FEET

Seal (minimum 3 ft. lenth above) filter pack:
- Material: Bentonite Chips 3/8"
- Placement method: POURED THROUGH HAS
- Volume: 0.5 CUBIC FT

Backfill (if different from seal):
- Material: High Solids Bentonite
- Placement method: Slurry through Tremie Pipe
- Volume: 4.5 cubic ft

Surface seal design:
- Material of protective casing: None
- Material of grout between protective casing and well casing: None
- Protective cap:
  - Material: None
  - Vented? [ ] Yes [ ] No
  - Locking? [X] Yes [ ] No
- Well cap:
  - Material: PVC
  - Vented? [X] Yes [ ] No

D. Groundwater Measurement

- Water level (+/0.01 ft. below top of inner well casing): 4.15
- Stabilization time: 8 hrs
- Well development method: pumped - surged multiple episodes

[ ] Upgradient Well [X] Downgradient Well
(See piezometric map from Hydrogeolic study)
Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch x 11 inch map showing location of all monitoring wells and piezometers.

WELL OR PIEZOMETER# TMW-7F

ELEVATION: +/0.01 FT. MSL
DEPTHS. +/0 1 FT. FROM
TOP PVC

TOP OF PROTECTIVE CASING
ELEVATION

TOP OF WELL CASING
ELEVATION 1228.38

GROUND SURFACE
ELELVATION 1225.98

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 1225.98
DEPTH 0 ft FROM GROUND

BASE OF PROTECTIVE
CASING
ELEVATION None
DEPTH

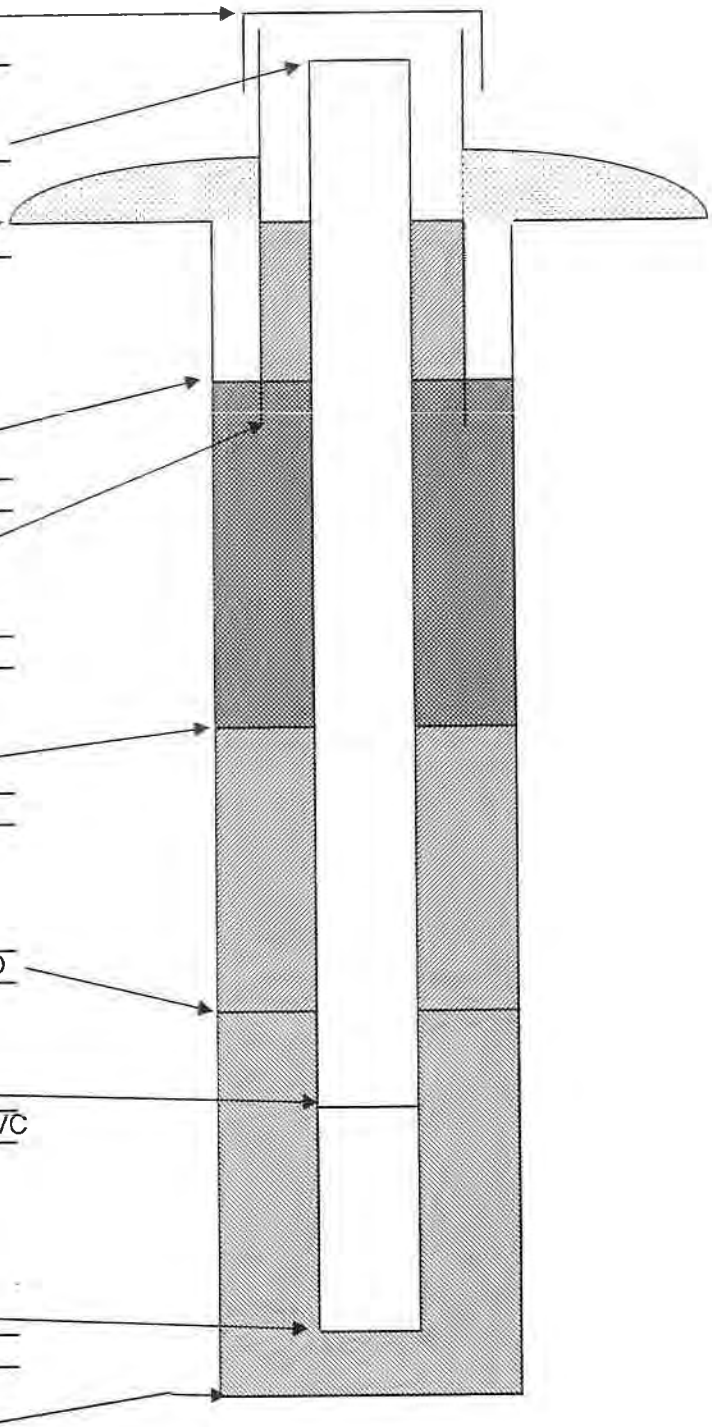
BASE OF BACKFILL
TOP OF SEAL
ELEVATION 1225.98
DEPTH 0 ft FROM GROUND

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 1203.48
DEPTH 22.5 FROM GROUND

TOP OF SCREEN
ELEVATION 1201.78
DEPTH 26.6 ft FROM TOP PVC

BOTTOM OF SCREEN
ELEVATION 1196.78
DEPTH 31.6 ft FROM TOP PVC

BASE OF FILTER PACK
ELEVATION 1194.98
DEPTH 31 ft FROM GROUND



MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2 - 76 P
Well or Piezometer # MW 8 Date started 5-22-92 Date completed 5-22-92

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 507' West along North Boundary
Distance and direction from boundary to well 2151' South

Elevations (± 0.01 ft. MSL):
Ground surface 1229.50
Top of protective casing *
Top of well casing 1232.00
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on Radio Tower Base

B. Soil Boring Information

Name and address of construction company Jim's Well Service Pocahontas, IA
Name of driller Jim Barret
Drilling method Auger
Drilling fluid
Bore hole diameter 4"
Soil sampling method Disturbed
Depth of boring 10.2'

C. Monitoring Well Installation

Casing material PVC
Length of casing 11.70'
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type Screwed
Casing/screen joint type Screwed
Screen material PVC
Screen opening size 0.050"
Screen length 3'
Depth of well 9.2'

Well Installation, continued:

Filter pack:
Material Gravel
Grain size
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite Grout
Placement method Tremie
Volume

Backfill (if different from seal):
Material
Placement Method
Volume

Surface seal design:
Material of protective casing: Steel - Shop Primed
Material of grout between protective casing and well casing: Concrete
Protective cap:
Material Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 3.30'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Down
Average depth of frostline 4'

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch X 11 inch map showing location of all monitoring wells and piezometers.

*Metal casings are scheduled to be installed by June 1, 1995. Elevations will be surveyed and recorded on these forms.

Form #542-1277

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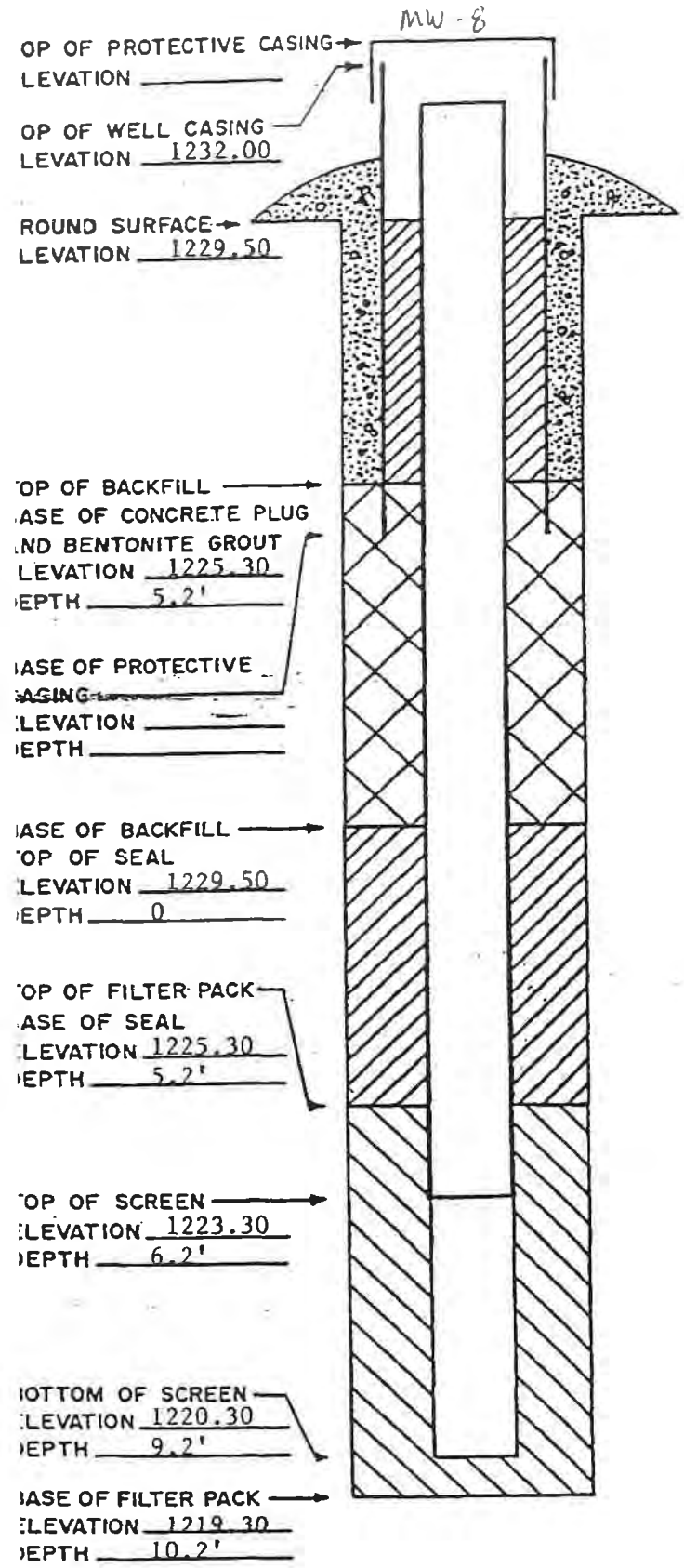
ELEVATIONS: ± 0.01 FT. MSL

DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2-76-P
Well or Piezometer # 8B Date started 11/25/96 Date completed 11/25/96

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 523' West Along North Boundary
Distance and direction from boundary to well 2097' South

Elevations (± 0.01 ft. MSL):
Ground surface 1229.50
Top of protective casing 1233.00
Top of well casing 1232.50
Benchmark elevation 1275.22
Benchmark description Top of North bolt on radio tower

B. Soil Boring Information

Name and address of construction company PSI
2917 Douglas Street
Omaha, NE
Name of driller Gary Steffan
Drilling method Hollow Stem Auger
Drilling fluid --
Bore hole diameter 6.25"
Soil sampling method Shelby Tube
Depth of boring 30'

C. Monitoring Well Installation

Casing material PVC
Length of casing 33'
Outside casing diameter 2.375'
Inside casing diameter 2"
Casing joint type screwed
Casing/screen joint type screwed
Screen material PVC
Screen opening size 0.10"
Screen length 10'
Depth of well 30'

Well Installation, continued:

Filter pack:
Material Gravel
Grain size 3/8"
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite
Placement method Tremie
Volume

Backfill (if different from seal):
Material Grout
Placement Method Tremie
Volume

Surface seal design:
Material of protective casing:
SCH 40 Steel
Material of grout between protective casing and well casing:
Concrete
Protective cap:
Material SCH 40 Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 5.0'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Down
Average depth of frostline 4.5'

Form #542-1277

Printed on Recycled Paper

MONITORING WELL/PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name: NORTHERN PLAINS REGIONAL LANDFILL — Permit #: 74 SDP- 2 76 P
Well or Piezometer #: TMW-8C — Date Started: 8/6/13 — Date Completed: 8/6/13

A. Surveyed Locations and Elevations

Location (+/0.5 ft):

Specify corner of site	East Side
Distance and direction along boundary	N5424.2663
Distance and direction from boundary to well	E8203.5973

Elevations (+/0.01 ft. MSL):

Ground surface	1227.41
Top of protective casing	1230.18
Top of well casing	1229.92
Benchmark elevation	ON-SITE
Benchmark description	

B. Soil Boring Information

Name and address of construction company
Team Services, Inc
717 SE 6th Street
Des Moines, Iowa 50309

Name of driller	Don Carlson
Drilling method	HAS
Drilling fluid	N/A
Bore hole diameter	7-inch
Soil sampling method	CONTINUOUS
Depth of boring	25 ft

C. Monitoring Well Installation

Casing material	PVC
Length of casing	22.1 ft
Outside casing diameter	2.375
Inside casing diameter	2.067
Casing joint type	FLUSH THREADED
Casing/screen joint type	FLUSH THREADED
Screen material	PVC
Screen opening size	0.010"
Screen length	5 ft
Depth of well	27.1 ft FROM TOP PVC

Well Installation, continued:

Filter pack:

Material	SILICA SAND
Grain size	0.65
Volume	1.6 CUBIC FEET

Seal (minimum 3 ft. lenth above) filter pack:

Material	Bentonite Chips 3/8"
Placement method	POURED THROUGH HAS
Volume	1.5 CUBIC FT

Backfill (if different from seal):

Material	N/A
Placement method	
Volume	

Surface seal design:
Material of protective casing:
Steel
Material of grout between protective casing and well casing:
cement & bentonite
Protective cap:

Material	None			
Vented?	X	Yes		No
Locking?	X	Yes		No

Well cap:

Material	PVC			
Vented?	X	Yes		No

D. Groundwater Measurement

Water level (+/0.01 ft. below top of inner well casing)	4.81
Stabilization time	24 hr
Well development method	pumped - surged multiple episodes

	Upgradient Well	X	Downgradient Well

(See piezometric map from Hydrogeolic study)
Average depth of frostline

Attachments: Driller's log. Pipe schedules and grouting schedules 8 1/2 inch x 11 inch map showing location of all monitoring wells and piezometers.

WELL OR PIEZOMETER# TMW-8C

ELEVATION: +/0 01 FT. MSL
DEPTHS: +/0.1 FT. FROM
TOP PVC

TOP OF PROTECTIVE CASING
ELEVATION 1230.18

TOP OF WELL CASING
ELEVATION 1229.92

GROUND SURFACE
ELELVATION 1227.41

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 1225.91
DEPTH 1.5 FROM GROUND

BASE OF PROTECTIVE
CASING
ELEVATION 1223.81
DEPTH 4.23 ft FROM GROUND

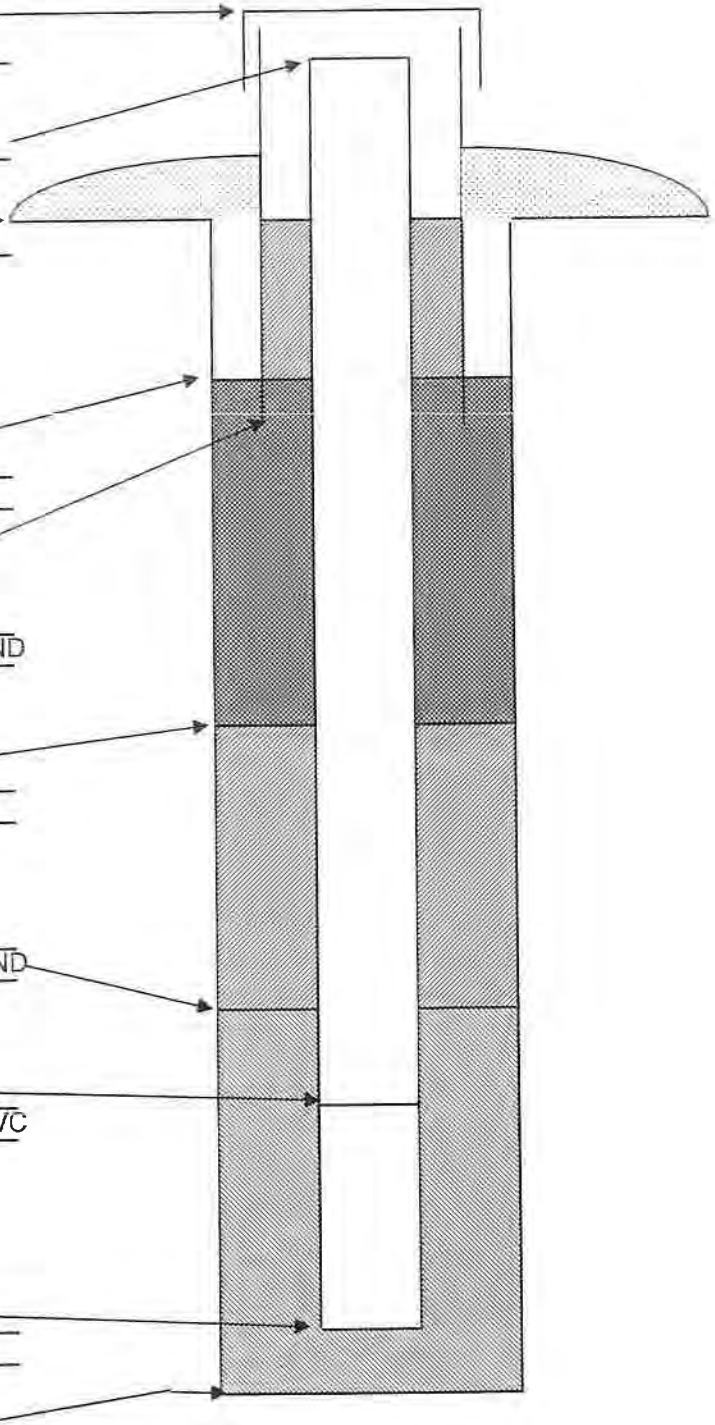
BASE OF BACKFILL
TOP OF SEAL
ELEVATION 1225.91
DEPTH 1.5 FROM GROUND

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 1210.41
DEPTH 17.0 ft FROM GROUND

TOP OF SCREEN
ELEVATION 1207.82
DEPTH 22.1 ft FROM TOP PVC

BOTTOM OF SCREEN
ELEVATION 1202.82
DEPTH 27.1 ft FROM TOP PVC

BASE OF FILTER PACK
ELEVATION 1202.41
DEPTH 25 ft FROM GROUND



MONITORING WELL/PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name: NORTHERN PLAINS REGIONAL LANDFILL — Permit #: 74 SDP- 2 76 P
Well or Piezometer #: TMW-8D — Date Started: 8/6/13 — Date Completed: 8/6/13

A. Surveyed Locations and Elevations

Location (+/0.5 ft):
- Specify corner of site: East Side
- Distance and direction along boundary: N5415.8906
- Distance and direction from boundary to well: E8246.8117

Elevations (+/0.01 ft. MSL):
- Ground surface: 1228.94
- Top of protective casing:
- Top of well casing: 1231.24
- Benchmark elevation: ON-SITE
- Benchmark description:

B. Soil Boring Information

Name and address of construction company
Team Services, Inc
717 SE 6th Street
Des Moines, Iowa 50309

- Name of driller: Don Carlson
- Drilling method: HAS
- Drilling fluid: N/A
- Bore hole diameter: 7-inch
- Soil sampling method: CONTINUOUS
- Depth of boring: 26 ft

C. Monitoring Well Installation

- Casing material: PVC
- Length of casing: 17.4 ft
- Outside casing diameter: 2.375
- Inside casing diameter: 2.067
- Casing joint type: FLUSH THREADED
- Casing/screen joint type: FLUSH THREADED
- Screen material: PVC
- Screen opening size: 0.010"
- Screen length: 10 ft
- Depth of well: 27.4 ft FROM TOP PVC

Well Installation, continued:

Filter pack:
- Material: SILICA SAND
- Grain size: 0.65
- Volume: 2.6 CUBIC FEET

Seal (minimum 3 ft. lenth above) filter pack:
- Material: Bentonite Chips 3/8"
- Placement method: POURED THROUGH HAS
- Volume: 1.2 CUBIC FT

Backfill (if different from seal):
- Material: N/A
- Placement method:
- Volume:

Surface seal design:
- Material of protective casing: None
- Material of grout between protective casing and well casing: None

Protective cap:
- Material: None
- Vented? [ ] Yes [ ] No
- Locking? [X] Yes [ ] No

Well cap:
- Material: PVC
- Vented? [X] Yes [ ] No

D. Groundwater Measurement

- Water level (+/0.01 ft. below top of inner well casing): 5.50
- Stabilization time: 18 hrs
- Well development method: pumped - surged multiple episodes

[ ] Upgradient Well [X] Downgradient Well
(See piezometric map from Hydrogeolic study)
Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch x 11 inch map showing location of all monitoring wells and piezometers.

WELL OR PIEZOMETER# TMW-8D

ELEVATION: +/0 01 FT MSL
DEPTHS: +/0.1 FT. FROM
TOP PVC

TOP OF PROTECTIVE CASING
ELEVATION _____

TOP OF WELL CASING
ELEVATION 1231.24

GROUND SURFACE
ELELVATION 1228.94

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 1228.94
DEPTH 0.0 ft FROM GROUND

BASE OF PROTECTIVE
CASING
ELEVATION None
DEPTH _____

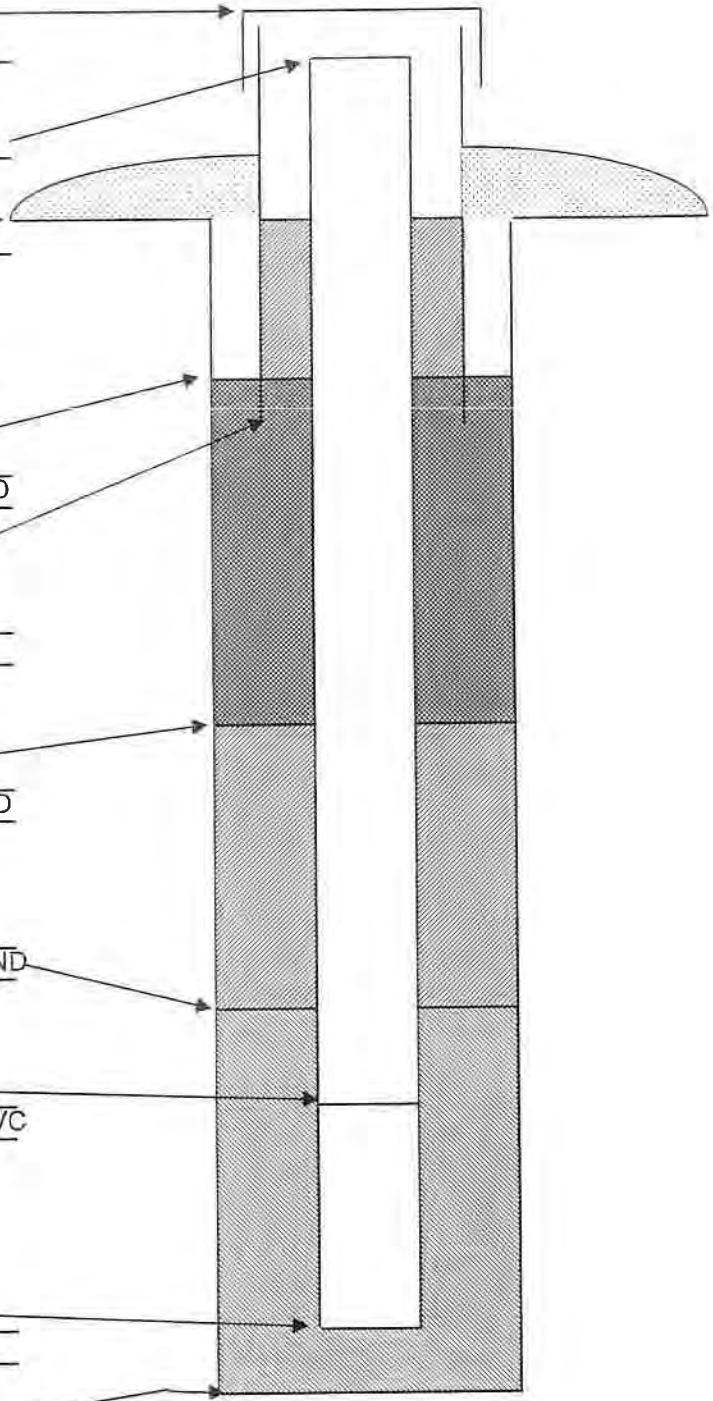
BASE OF BACKFILL
TOP OF SEAL
ELEVATION 1221.94
DEPTH 7.0 ft FROM GROUND

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 1215.94
DEPTH 13.0 ft FROM GROUND

TOP OF SCREEN
ELEVATION 1213.84
DEPTH 17.4 ft FROM TOP PVC

BOTTOM OF SCREEN
ELEVATION 1203.84
DEPTH 27.4 ft FROM TOP PVC

BASE OF FILTER PACK
ELEVATION 1202.94
DEPTH 26 ft FROM GROUND



MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2 - 76 P
Well or Piezometer # MW 9 Date started 5-22-92 Date completed 5-23-92

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 1053' West along North Boundary
Distance and direction from boundary to well 2138' South

Elevations (± 0.01 ft. MSL):
Ground surface 1235.50
Top of protective casing *
Top of well casing 1238.50
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on Radio Tower Base

B. Soil Boring Information

Name and address of construction company Jim's Well Service Pocahontas, IA
Name of driller Jim Barret
Drilling method Auger
Drilling fluid
Bore hole diameter 4"
Soil sampling method Disturbed
Depth of boring 10.9'

C. Monitoring Well Installation

Casing material PVC
Length of casing 12.9'
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type Screwed
Casing/screen joint type Screwed
Screen material PVC
Screen opening size 0.050"
Screen length 3'
Depth of well 9.9'

Well Installation, continued:

Filter pack:
Material Gravel
Grain size
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite Grout
Placement method Tremie
Volume

Backfill (if different from seal):
Material
Placement Method
Volume

Surface seal design:
Material of protective casing: Steel - Shop Primed
Material of grout between protective casing and well casing: Concrete
Protective cap:
Material Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 6.1'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) Down
Average depth of frostline 4'

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch X 11 inch map showing location of all monitoring wells and piezometers.

*Metal casings are scheduled to be installed by June 1, 1995. Elevations will be surveyed and recorded on these forms.

Form #542-1277

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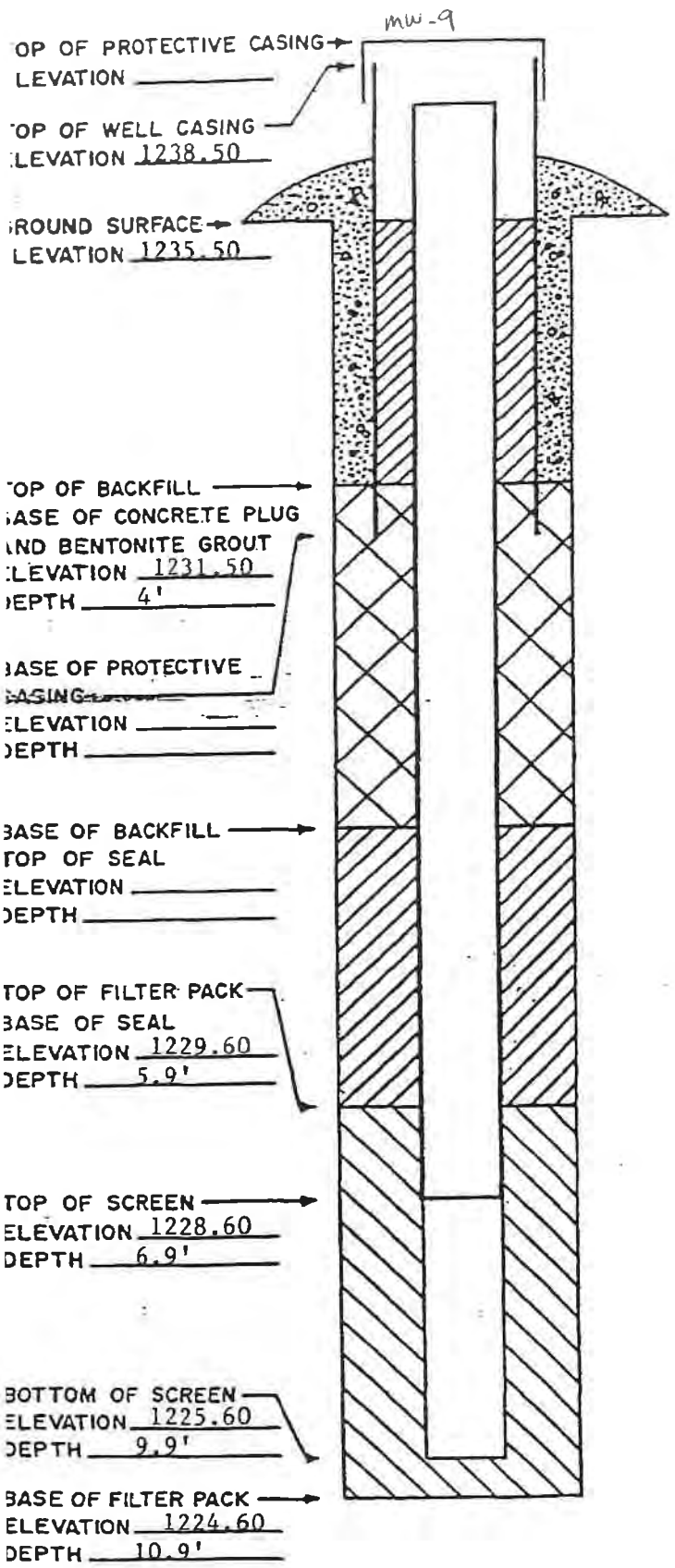
.EVATIONS: ± 0.01 FT. MSL

:PTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



MONITORING WELL / PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name Hugh J. Flannegan Landfill Permit # 74 -SDP- 2-76-P
Well or Piezometer # 10 Date started 11-25-96 Date completed 11-25-96

A. Surveyed Locations and Elevations

Locations (± 0.5 ft.):
Specify corner of site NE corner
Distance and direction along boundary 1491' West Along North Boundary
Distance and direction from boundary to well 1595' South

Elevations (± 0.01 ft. MSL):
Ground surface 1277.00
Top of protective casing 1280.50
Top of well casing 1280.00
Benchmark elevation 1275.22
Benchmark description Top of North Bolt on radio tower

B. Soil Boring Information

Name and address of construction company RSI
2917 Douglas Street
Omaha, NE
Name of driller Gary Steffan
Drilling method Hollow Stem Auger
Drilling fluid --
Bore hole diameter 6.25"
Soil sampling method Shelby Tube
Depth of boring 24'

C. Monitoring Well Installation

Casing material PVC
Length of casing 27'
Outside casing diameter 2.375"
Inside casing diameter 2"
Casing joint type screwed
Casing/screen joint type screwed
Screen material PVC
Screen opening size 0.10"
Screen length 5'
Depth of well 24'

Well Installation, continued:

Filter pack:
Material Gravel
Grain size 3/8"
Volume

Seal (minimum 3 ft. length above filter pack):
Material Bentonite
Placement method Tremie
Volume

Backfill (if different from seal):
Material Grout
Placement Method Tremie
Volume

Surface seal design:
Material of protective casing:
SCH 40 Steel
Material of grout between protective casing and well casing:
Concrete
Protective cap:
Material SCH 40 Steel
Vented? Y/N Y Locking? Y/N Y
Well cap:
Material PVC
Vented? Y/N Y

D. Groundwater Measurement

Water level (± 0.01 ft. below top of inner well casing) 16.25'
Stabilization time
Well development method

Upgradient or downgradient well? (see piezometric map from Hydrogeologic study) UP
Average depth of frostline 4.5'

Form #542-1277

Printed on Recycled Paper

MONITORING WELL/PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name: NORTHERN PLAINS REGIONAL LANDFILL — Permit #: 74 SDP- 2 76 P
Well or Piezometer #: MW-14 — Date Started: 10-30-08 — Date Completed: 10-30-08

A. Surveyed Locations and Elevations

Location (+/0.5 ft):

Specify corner of site	East
Distance and direction along boundary	N6337.34
Distance and direction from boundary to well	E8419.55

Elevations (+/0.01 ft. MSL):

Ground surface	1227.34
Top of protective casing	1230.01
Top of well casing	1229.76
Benchmark elevation	ON-SITE
Benchmark description	

B. Soil Boring Information

Name and address of construction company
REWERTS WELL COMPANY
1133 NINTH STREET
NEVADA, IOWA 50201

Name of driller	JUSTIN REWERTS
Drilling method	HAS
Drilling fluid	N/A
Bore hole diameter	8.25"
Soil sampling method	CONTINUOUS
Depth of boring	10.5

C. Monitoring Well Installation

Casing material	PVC
Length of casing	7.5
Outside casing diameter	2.375
Inside casing diameter	2.067
Casing joint type	FLUSH THREADED
Casing/screen joint type	FLUSH THREADED
Screen material	PVC
Screen opening size	0.010"
Screen length	5.0
Depth of well	12.5 FROM TOP PVC

Well Installation, continued:

Filter pack:

Material	SILICA SAND
Grain size	0.65
Volume	2.5 CUBIC FEET

Seal (minimum 3 ft. lenth above) filter pack:

Material	Bentonite Chips 3/8"
Placement method	POURED THROUGH HAS
Volume	1.5 CUBIC FT

Backfill (if different from seal):

Material	N/A
Placement method	N/A
Volume	N/A

Surface seal design:
Material of protective casing: ALUMINUM
Material of grout between protective casing and well casing: CEMENT
Protective cap:
Material: STEEL
Vented? [X] Yes [ ] No
Locking? [X] Yes [ ] No
Well cap:
Material: PVC
Vented? [X] Yes [ ] No

D. Groundwater Measurement

Water level (+/0.01 ft. below top of inner well casing)	5.0 ft
Stabilization time	2 HOURS
Well development method	HAND BAILING

[ ] Upgradient Well [X] Downgradient Well
(See piezometric map from Hydrogeolic study)
Average depth of frostline

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch x 11 inch map showing location of all monitoring wells and piezometers.

WELL OR PIEZOMETER# MW-14

ELEVATION: +/0.01 FT. MSL
DEPTHS: +/0.1 FT. FROM
TOP PVC

TOP OF PROTECTIVE CASING
ELEVATION 1230.01

TOP OF WELL CASING
ELEVATION 1229.76

GROUND SURFACE
ELELVATION 1227.34

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 1226.34
DEPTH 1.0FT

BASE OF PROTECTIVE
CASING
ELEVATION 1223.01
DEPTH 4.33 ft

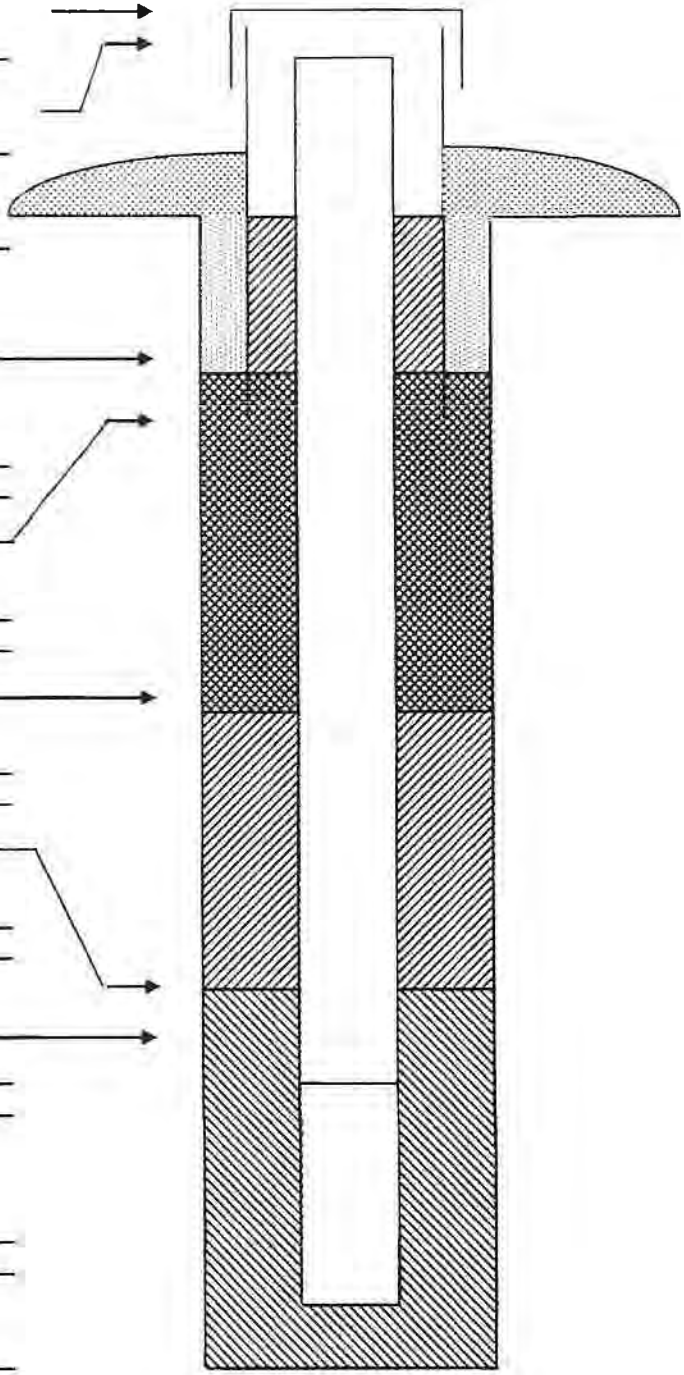
BASE OF BACKFILL
TOP OF SEAL
ELEVATION 1226.34
DEPTH 1.0 ft

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 1222.84
DEPTH 4.5 FROM GROUND

TOP OF SCREEN
ELEVATION 1222.26
DEPTH 7.5 FROM TOP PVC

BOTTOM OF SCREEN
ELEVATION 1217.26
DEPTH 12.5 FROM TOP PVC

BASE OF FILTER PACK
ELEVATION 1216.84
DEPTH 10.5 FROM GROUND



MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal site name: NORTHERN PLAINS REGIONAL LANDFILL
Permit #: 74 SDP- 2 76 P
Well or Piezometer #: MW-15
Date Started: 10-30-08
Date Completed: 10-30-08

A. Surveyed Locations and Elevations

Location (+/0.5 ft):

- Specify corner of site: East
- Distance and direction along boundary: N5728.88
- Distance and direction from boundary to well: E8262.45

Elevations (+/0.01 ft. MSL):

- Ground surface: 1228.80
- Top of protective casing: 1231.47
- Top of well casing: 1231.22
- Benchmark elevation: ON-SITE
- Benchmark description:

B. Soil Boring Information

Name and address of construction company:
REWERTS WELL COMPANY
1133 NINTH STREET
NEVADA, IOWA 50201

- Name of driller: JUSTIN REWERTS
- Drilling method: HAS
- Drilling fluid: N/A
- Bore hole diameter: 8.25"
- Soil sampling method: CONTINUOUS
- Depth of boring: 10.5

C. Monitoring Well Installation

- Casing material: PVC
- Length of casing: 7.5
- Outside casing diameter: 2.375
- Inside casing diameter: 2.067
- Casing joint type: FLUSH THREADED
- Casing/screen joint type: FLUSH THREADED
- Screen material: PVC
- Screen opening size: 0.010"
- Screen length: 5.0
- Depth of well: 12.5 FROM TOP PVC

Well Installation, continued:

Filter pack:

- Material: SILICA SAND
- Grain size: 0.65
- Volume: 2.5 CUBIC FEET

Seal (minimum 3 ft. lenth above) filter pack:

- Material: Bentonite Chips 3/8"
- Placement method: POURED THROUGH HAS
- Volume: 1.5 CUBIC FT

Backfill (if different from seal):

- Material: N/A
- Placement method: N/A
- Volume: N/A

Surface seal design:

Material of protective casing: ALUMINUM

Material of grout between protective casing and well casing: CEMENT

Protective cap:

- Material: STEEL
- Vented? [X] Yes [ ] No
- Locking? [X] Yes [ ] No

Well cap:

- Material: PVC
- Vented? [X] Yes [ ] No

D. Groundwater Measurement

- Water level (+/0.01 ft. below top of inner well casing): 4.0 ft
- Stabilization time: 2 HOURS
- Well development method: HAND BAILING

[ ] Upgradient Well [X] Downgradient Well
(See piezometric map from Hydrogeolic study)
Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch x 11 inch map showing location of all monitoring wells and piezometers.

WELL OR PIEZOMETER# MW-15

ELEVATION: +/0.01 FT. MSL
DEPTHS: +/0.1 FT. FROM
TOP PVC

TOP OF PROTECTIVE CASING
ELEVATION 1231.47

TOP OF WELL CASING
ELEVATION 1231.22

GROUND SURFACE
ELELVATION 1228.80

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 1227.80
DEPTH 1.0FT

BASE OF PROTECTIVE
CASING
ELEVATION 1227.14
DEPTH 4.33 ft

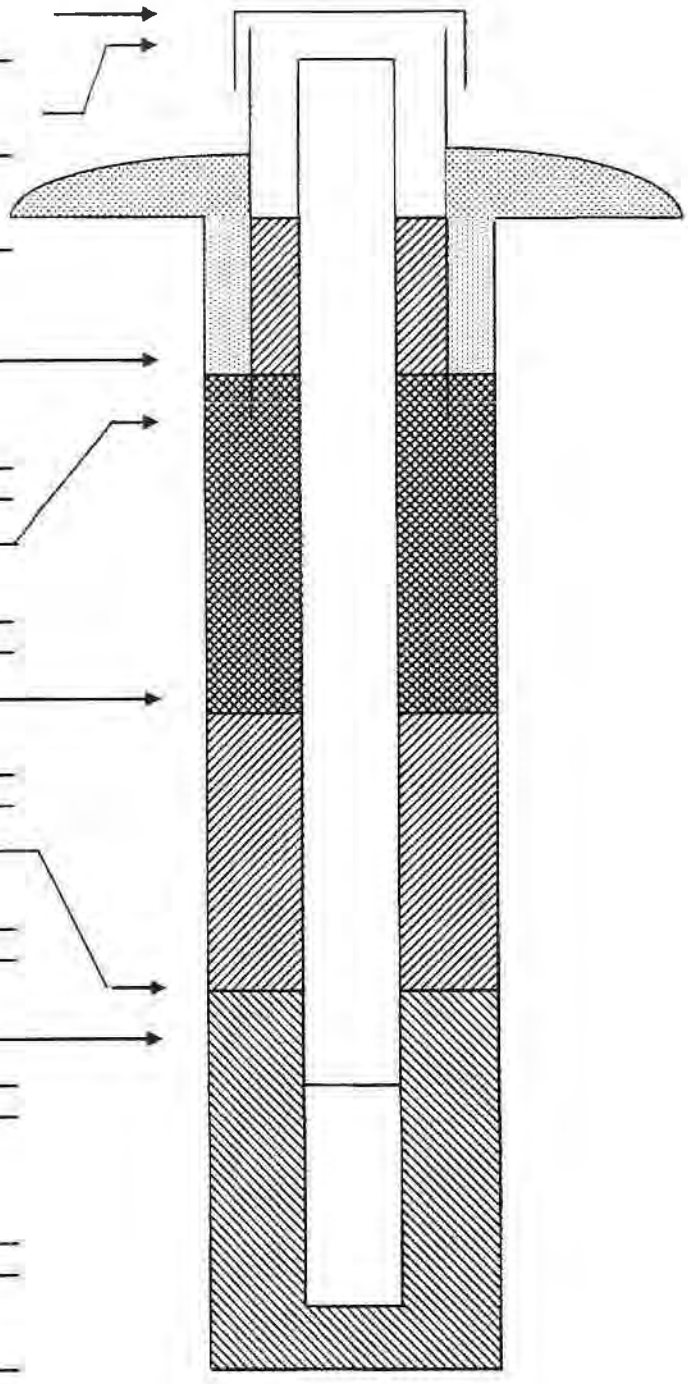
BASE OF BACKFILL
TOP OF SEAL
ELEVATION 1227.80
DEPTH 1.0 ft

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 1224.30
DEPTH 4.5 FROM GROUND

TOP OF SCREEN
ELEVATION 1223.72
DEPTH 7.5 FROM TOP PVC

BOTTOM OF SCREEN
ELEVATION 1218.72
DEPTH 12.5 FROM TOP PVC

BASE OF FILTER PACK
ELEVATION 1218.30
DEPTH 10.5 FROM GROUND



MONITORING WELL/PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name: NORTHERN PLAINS REGIONAL LANDFILL — Permit #: 74 SDP- 2 76 P
Well or Piezometer #: TMW-15B — Date Started: 8/6/13 — Date Completed: 8/6/13

A. Surveyed Locations and Elevations

Location (+/0.5 ft):

Specify corner of site	East Side
Distance and direction along boundary	N5659.3610
Distance and direction from boundary to well	E8329.4401

Elevations (+/0.01 ft. MSL):

Ground surface	1227.53
Top of protective casing	1230.19
Top of well casing	1229.94
Benchmark elevation	ON-SITE
Benchmark description	

B. Soil Boring Information

Name and address of construction company
Team Services, Inc
717 SE 6th Street
Des Moines, Iowa 50309

Name of driller	Don Carlson
Drilling method	HAS
Drilling fluid	N/A
Bore hole diameter	7-inch
Soil sampling method	CONTINUOUS
Depth of boring	16 ft

C. Monitoring Well Installation

Casing material	PVC
Length of casing	11.55
Outside casing diameter	2.375
Inside casing diameter	2.067
Casing joint type	FLUSH THREADED
Casing/screen joint type	FLUSH THREADED
Screen material	PVC
Screen opening size	0.010"
Screen length	5 ft
Depth of well	16.55 ft FROM TOP PVC

Well Installation, continued:

Filter pack:

Material	SILICA SAND
Grain size	0.65
Volume	1.6 CUBIC FEET

Seal (minimum 3 ft. lenth above) filter pack:

Material	Bentonite Chips 3/8"
Placement method	POURED THROUGH HAS
Volume	1.3 CUBIC FT

Backfill (if different from seal):

Material	N/A
Placement method	
Volume	

Surface seal design:
Material of protective casing: Steel
Material of grout between protective casing and well casing: cement & bentonite
Protective cap:

Material	None			
Vented?	X	Yes		No
Locking?	X	Yes		No

Well cap:

Material	PVC			
Vented?	X	Yes		No

D. Groundwater Measurement

Water level (+/0.01 ft. below top of inner well casing)	7.30
Stabilization time	18 hrs
Well development method	pumped - surged multiple episodes

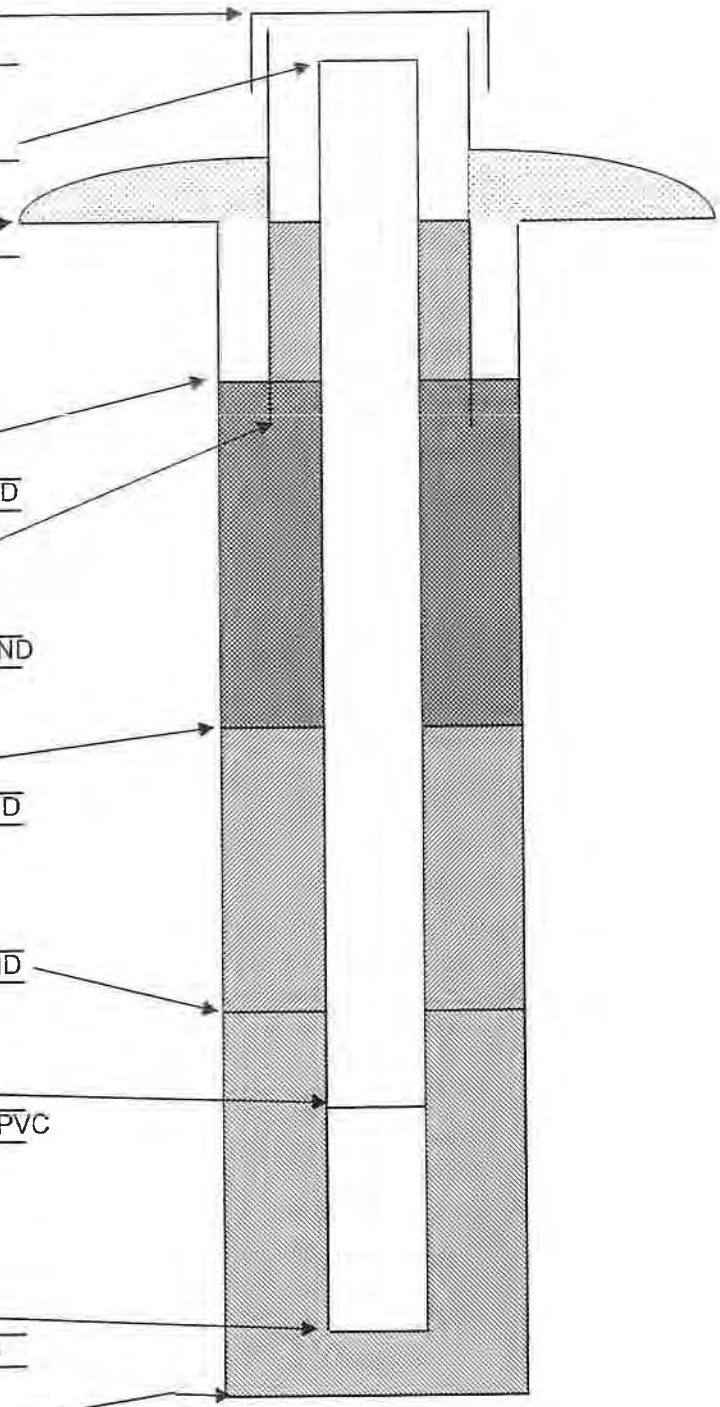
	Upgradient Well	X	Downgradient Well

(See piezometric map from Hydrogeolic study)
Average depth of frostline

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch x 11 inch map showing location of all monitoring wells and piezometers.

WELL OR PIEZOMETER# TMW-15B

ELEVATION: +/0.01 FT. MSL
DEPTHS: +/0.1 FT. FROM
TOP PVC



TOP OF PROTECTIVE CASING
ELEVATION 1230.19

TOP OF WELL CASING
ELEVATION 1229.94

GROUND SURFACE
ELELVATION 1227.53

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 1226.03
DEPTH 1.5 ft FROM GROUND

BASE OF PROTECTIVE
CASING
ELEVATION 1223.19
DEPTH 4.34 ft FROM GROUND

BASE OF BACKFILL
TOP OF SEAL
ELEVATION 1226.03
DEPTH 1.5 ft FROM GROUND

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 1219.53
DEPTH 8.0 ft FROM GROUND

TOP OF SCREEN
ELEVATION 1218.39
DEPTH 11.55 ft FROM TOP PVC

BOTTOM OF SCREEN
ELEVATION 1213.39
DEPTH 16.55 ft FROM TOP PVC

BASE OF FILTER PACK
ELEVATION 1211.53
DEPTH 16 ft FROM GROUND

MONITORING WELL/PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name: NORTHERN PLAINS REGIONAL LANDFILL — Permit #: 74 SDP- 2 76 P
Well or Piezometer #: TMW-15C — Date Started: 8/8/13 — Date Completed: 8/8/13

A. Surveyed Locations and Elevations

Location (+/0.5 ft):

Specify corner of site	East Side
Distance and direction along boundary	N5659.6350
Distance and direction from boundary to well	E8402.9187

Elevations (+/0.01 ft. MSL):

Ground surface	1226.87
Top of protective casing	
Top of well casing	1229.44
Benchmark elevation	ON-SITE
Benchmark description	

B. Soil Boring Information

Name and address of construction company
Team Services, Inc
717 SE 6th Street
Des Moines, Iowa 50309

Name of driller	Don Carlson
Drilling method	HAS
Drilling fluid	N/A
Bore hole diameter	7-inch
Soil sampling method	CONTINUOUS
Depth of boring	16 ft

C. Monitoring Well Installation

Casing material	PVC
Length of casing	11.85
Outside casing diameter	2.375
Inside casing diameter	2.067
Casing joint type	FLUSH THREADED
Casing/screen joint type	FLUSH THREADED
Screen material	PVC
Screen opening size	0.010"
Screen length	5 ft
Depth of well	16.85 ft FROM TOP PVC

Well Installation, continued:

Filter pack:

Material	SILICA SAND
Grain size	0.65
Volume	1.6 CUBIC FEET

Seal (minimum 3 ft. lenth above) filter pack:

Material	Bentonite Chips 3/8"
Placement method	POURED THROUGH HAS
Volume	1.6 CUBIC FT

Backfill (if different from seal):

Material	N/A
Placement method	
Volume	

Surface seal design:
Material of protective casing: None
Material of grout between protective casing and well casing: None
Protective cap:

Material	None			
Vented?	[ ]	Yes	[ ]	No
Locking?	[X]	Yes	[ ]	No

Well cap:

Material	PVC			
Vented?	[X]	Yes	[ ]	No

D. Groundwater Measurement

Water level (+/0.01 ft. below top of inner well casing)	6.70
Stabilization time	18 hrs
Well development method	pumped - surged multiple episodes

[ ] Upgradient Well [X] Downgradient Well
(See piezometric map from Hydrogeolic study)
Average depth of frostline

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch x 11 inch map showing location of all monitoring wells and piezometers.

WELL OR PIEZOMETER# TMW-15C

ELEVATION: +/0.01 FT. MSL
DEPTHS: +/0.1 FT FROM TOP PVC

TOP OF PROTECTIVE CASING ELEVATION _____

TOP OF WELL CASING ELEVATION 1229.44

GROUND SURFACE ELELVATION 1226.87

TOP OF BACKFILL
BASE OF CONCRETE PLUG AND BENTONITE GROUT
ELEVATION 1226.87
DEPTH 0.0 ft FROM GROUND

BASE OF PROTECTIVE CASING
ELEVATION None
DEPTH _____

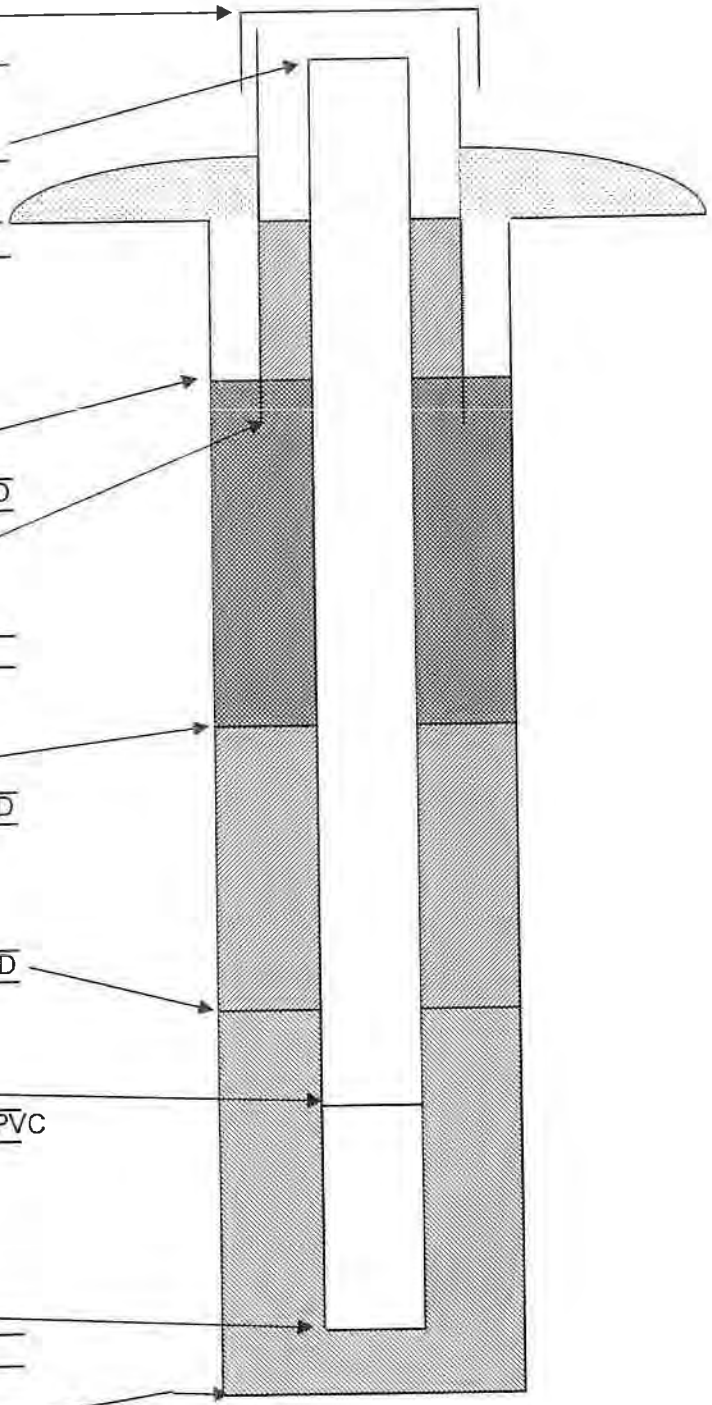
BASE OF BACKFILL
TOP OF SEAL
ELEVATION 1226.87
DEPTH 0.0 ft FROM GROUND

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 1218.80
DEPTH 8.0 ft FROM GROUND

TOP OF SCREEN
ELEVATION 1217.59
DEPTH 11.85 ft FROM TOP PVC

BOTTOM OF SCREEN
ELEVATION 1212.59
DEPTH 16.85 ft FROM TOP PVC

BASE OF FILTER PACK
ELEVATION 1210.87
DEPTH 16 ft FROM GROUND



MONITORING WELL/PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name: NORTHERN PLAINS REGIONAL LANDFILL — Permit #: 74 SDP- 2 76 P
Well or Piezometer #: MW-16 — Date Started: 10-30-08 — Date Completed: 10-30-08

A. Surveyed Locations and Elevations

Location (+/0.5 ft):

Specify corner of site	South
Distance and direction along boundary	N5527.37
Distance and direction from boundary to well	E7882.82

Elevations (+/0.01 ft. MSL):

Ground surface	1230.10
Top of protective casing	1232.68
Top of well casing	1232.43
Benchmark elevation	ON-SITE
Benchmark description	

B. Soil Boring Information

Name and address of construction company:
REWERTS WELL COMPANY
1133 NINTH STREET
NEVADA, IOWA 50201

Name of driller	JUSTIN REWERTS
Drilling method	HAS
Drilling fluid	N/A
Bore hole diameter	8.25"
Soil sampling method	CONTINUOUS
Depth of boring	10.5

C. Monitoring Well Installation

Casing material	PVC
Length of casing	7.5
Outside casing diameter	2.375
Inside casing diameter	2.067
Casing joint type	FLUSH THREADED
Casing/screen joint type	FLUSH THREADED
Screen material	PVC
Screen opening size	0.010"
Screen length	5.0
Depth of well	12.5 FROM TOP PVC

Well Installation, continued:

Filter pack:

Material	SILICA SAND
Grain size	0.65
Volume	2.5 CUBIC FEET

Seal (minimum 3 ft. lenth above) filter pack:

Material	Bentonite Chips 3/8"
Placement method	POURED THROUGH HAS
Volume	1.5 CUBIC FT

Backfill (if different from seal):

Material	N/A
Placement method	N/A
Volume	N/A

Surface seal design:

Material of protective casing: ALUMINUM

Material of grout between protective casing and well casing: CEMENT

Protective cap:

Material	STEEL			
Vented?	[X]	Yes	[ ]	No
Locking?	[X]	Yes	[ ]	No

Well cap:

Material	PVC			
Vented?	[X]	Yes	[ ]	No

D. Groundwater Measurement

Water level (+/0.01 ft. below top of inner well casing)	2.0 ft
Stabilization time	2 HOURS
Well development method	HAND BAILING

[ ] Upgradient Well [X] Downgradient Well
(See piezometric map from Hydrogeolic study)
Average depth of frostline

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch x 11 inch map showing location of all monitoring wells and piezometers.

WELL OR PIEZOMETER# MW-16

ELEVATION: +/0.01 FT. MSL
DEPTHS: +/0.1 FT. FROM
TOP PVC

TOP OF PROTECTIVE CASING
ELEVATION 1232.68

TOP OF WELL CASING
ELEVATION 1232.43

GROUND SURFACE
ELELVATION 1230.10

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 1229.10
DEPTH 1.0FT

BASE OF PROTECTIVE
CASING
ELEVATION 1225.68
DEPTH 4.42 ft

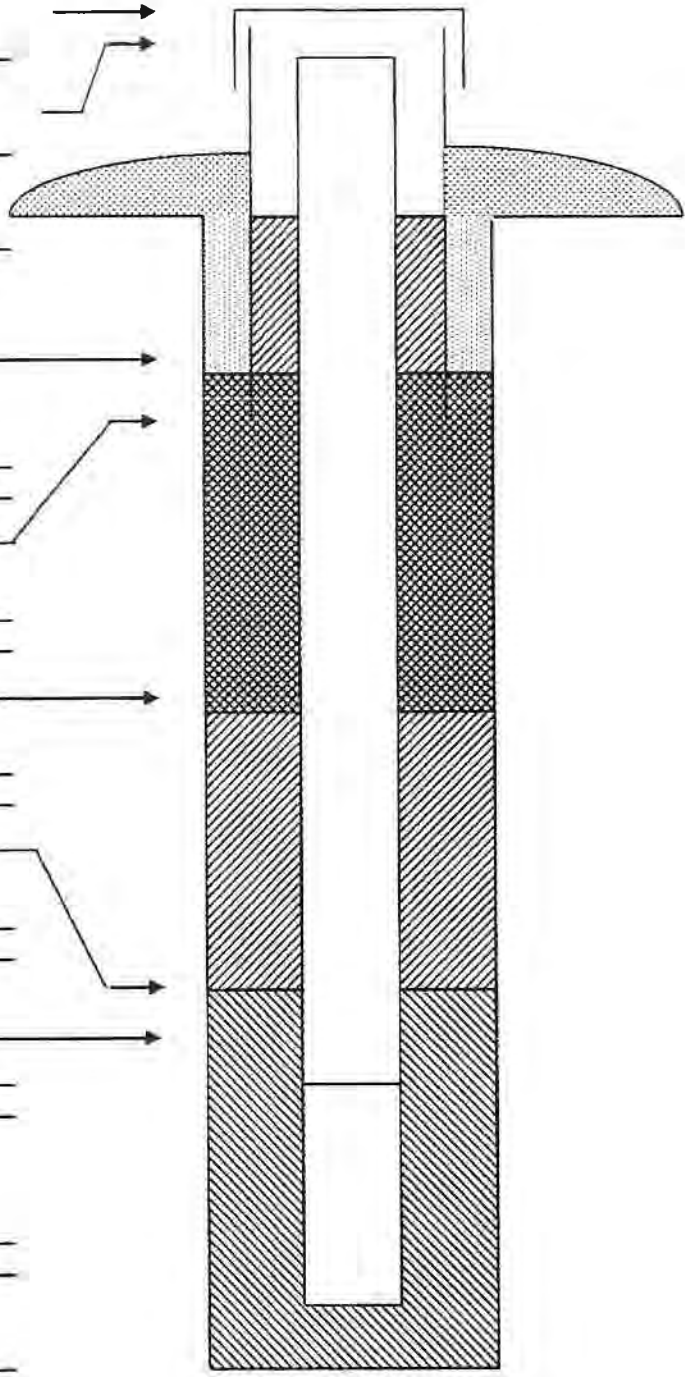
BASE OF BACKFILL
TOP OF SEAL
ELEVATION 1229.10
DEPTH 1.0 ft

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 1225.60
DEPTH 4.5 FROM GROUND

TOP OF SCREEN
ELEVATION 1224.93
DEPTH 7.5 FROM TOP PVC

BOTTOM OF SCREEN
ELEVATION 1219.93
DEPTH 12.5 FROM TOP PVC

BASE OF FILTER PACK
ELEVATION 1219.60
DEPTH 10.5 FROM GROUND



MONITORING WELL/PIEZOMETER CONSTRUCTION
DOCUMENTATION FORM

Disposal site name: NORTHERN PLAINS REGIONAL LANDFILL
Permit #: 74 SDP- 2 76 P
Well or Piezometer #: MW-17
Date Started: 3-30-12
Date Completed: 3-30-12

A. Surveyed Locations and Elevations

Location (+/0.5 ft):

Specify corner of site	East
Distance and direction along boundary	N5261.83
Distance and direction from boundary to well	E7615.58

Elevations (+/0.01 ft. MSL):

Ground surface	1231.60
Top of protective casing	1234.68
Top of well casing	1234.33
Benchmark elevation	ON-SITE
Benchmark description	

B. Soil Boring Information

Name and address of construction company
REWERTS WELL COMPANY
1133 NINTH STREET
NEVADA, IOWA 50201

Name of driller	JUSTIN REWERTS
Drilling method	HAS
Drilling fluid	N/A
Bore hole diameter	8.25"
Soil sampling method	CONTINUOUS
Depth of boring	17.5

C. Monitoring Well Installation

Casing material	PVC
Length of casing	10.2
Outside casing diameter	2.375
Inside casing diameter	2.067
Casing joint type	FLUSH THREADED
Casing/screen joint type	FLUSH THREADED
Screen material	PVC
Screen opening size	0.010"
Screen length	10.0
Depth of well	20.2 FROM TOP PVC

Well Installation, continued:

Filter pack:

Material	SILICA SAND
Grain size	0.65
Volume	4.5 CUBIC FEET

Seal (minimum 3 ft. lenth above) filter pack:

Material	Bentonite Chips 3/8"
Placement method	POURED THROUGH HAS
Volume	3.5 CUBIC FT

Backfill (if different from seal):

Material	N/A
Placement method	N/A
Volume	N/A

Surface seal design:

Material of protective casing: ALUMINUM

Material of grout between protective casing and well casing: CEMENT

Protective cap:

Material	STEEL			
Vented?	X	Yes		No
Locking?	X	Yes		No

Well cap:

Material	PVC			
Vented?	X	Yes		No

D. Groundwater Measurement

Water level (+/0.01 ft. below top of inner well casing)	7.6 ft
Stabilization time	2 HOURS
Well development method	Waterra pumped 30 gallons

X	Upgradient Well		Downgradient Well

(See piezometric map from Hydrogeolic study)
Average depth of frostline

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 1/2 inch x 11 inch map showing location of all monitoring wells and piezometers.

WELL OR PIEZOMETER# MW-17

ELEVATION: +/0.01 FT. MSL
DEPTHS: +/0.1 FT. FROM
TOP PVC

TOP OF PROTECTIVE CASING
ELEVATION 1234.68

TOP OF WELL CASING
ELEVATION 1234.33

GROUND SURFACE
ELELVATION 1231.60

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 1230.60
DEPTH 1.0FT

BASE OF PROTECTIVE
CASING
ELEVATION 1226.65
DEPTH 4.95

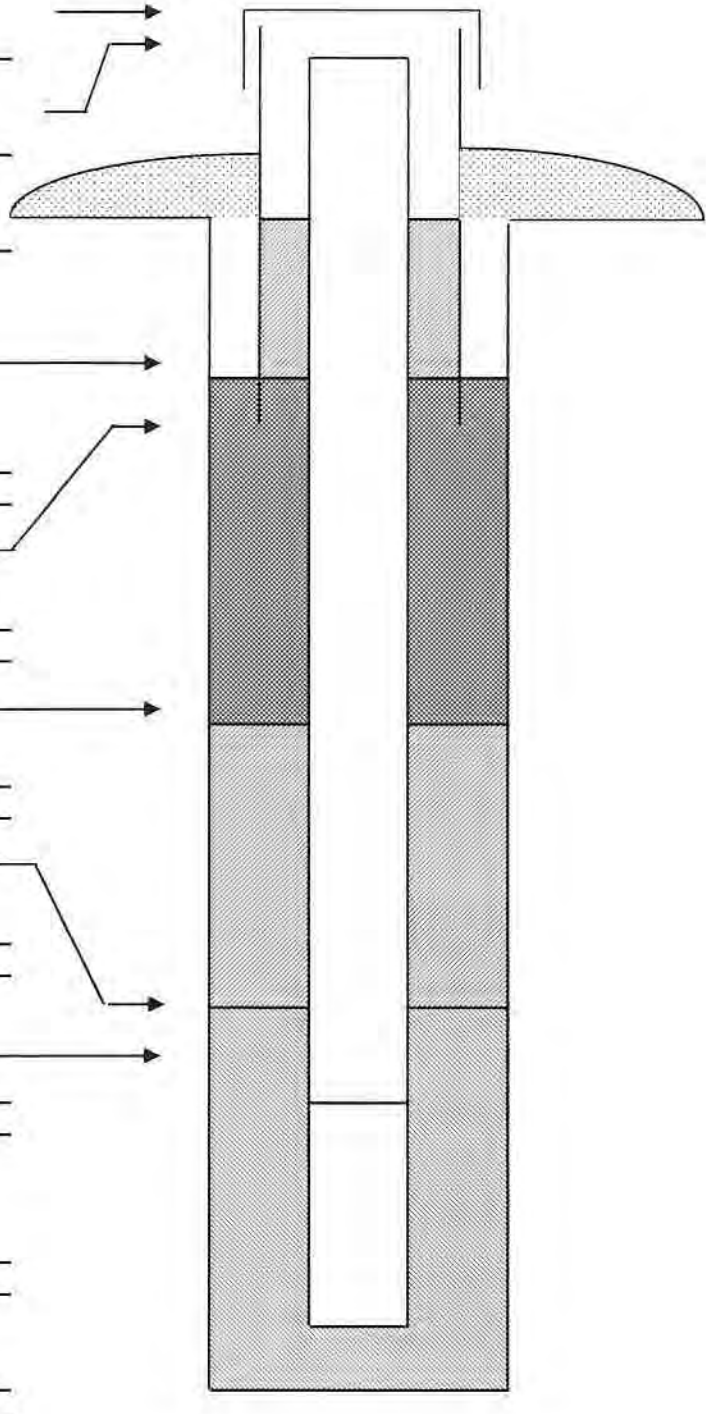
BASE OF BACKFILL
TOP OF SEAL
ELEVATION 1224.60
DEPTH 7.0

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 1224.60
DEPTH 7.0 FROM GROUND

TOP OF SCREEN
ELEVATION 1224.13
DEPTH 10.2 FROM TOP PVC

BOTTOM OF SCREEN
ELEVATION 1214.13
DEPTH 20.2 FROM TOP PVC

BASE OF FILTER PACK
ELEVATION 1214.10
DEPTH 17.5 FROM GROUND



MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Northern Plains Regional Landfill | Permit No.: 74-SDP-02-76P

Well or Piezometer No.: MW-18 | Dates Started: 6-5-2019 | Date Completed: 6-5-2019

A. SURVEYED LOCATION AND ELEVATION OF POINT (+0.5 ft.)

Specify corner of site: NW | Distance and direction along boundary:

Distance and direction from boundary to surface monitoring well: N7393.921 - E6330.557

Elevation (+0.01 ft. MSL):

Ground Surface: 1285.261 | Top of protective casing: 1288.274

Top of well casing: 1288.024 | Benchmark elevation: 1283.290

Benchmark description: Point #12

B. SOIL BORING INFORMATION

Construction Company Name: Team Services

Address: 717 SE 6th | City, State, Zip Code: Des Moines, Iowa 50309

Name of driller: Don Carlson

Drilling method: Hollow Stem Augers | Drilling fluid: None | Bore Hole diameter: 8 inch

Soil sampling method: Split-Spoon Sampler | Depth of boring: 76

C. MONITORING WELL INSTALLATION

Casing material: PVC

Length of casing: 66.6

Outside casing diameter: 2.375 inch

Inside casing diameter: 2.0 inch

Casing joint type: Flush Threaded

Casing/screen joint type: Flush Threaded

Screen material: PVC

Screen opening size: 0.006 inch

Screen length: 10.0 ft

Depth of Well: 76.6 ft

Filter Pack: Unimin

Material: Silica Sand

Grain Size: 0.25 mm effective size

Volume: 3.3 cubic ft

Seal (minimum 3 ft. length above filter pack):

Material: Bentonite

Placement method: Tremied through Hollow Stem Augers

Volume: 24 cubic ft

Backfill (if different from seal): Same

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: Concrete

Protective cap:

Material: Steel

Vented?: ☒ Y ☐ N | Locking?: ☒ Y ☐ N

Well cap:

Material: PVC

Vented?: ☒ Y ☐ N

D. GROUNDWATER MEASUREMENT (±0.01 foot below top of inner well casing)

Water level: 2.0 | Stabilization time: during drilling

Well development method: Pumping & surging on 6/27/2019

Average depth of frost line: 48 inch

DRILLER'S CERTIFICATION

I certify under penalty of law I believe the information reported above is true, accurate, and complete.

Signature: [signature] | Certification #: 1812 | Date: 8-21-20

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E. 9th St, Des Moines, IA 50319.

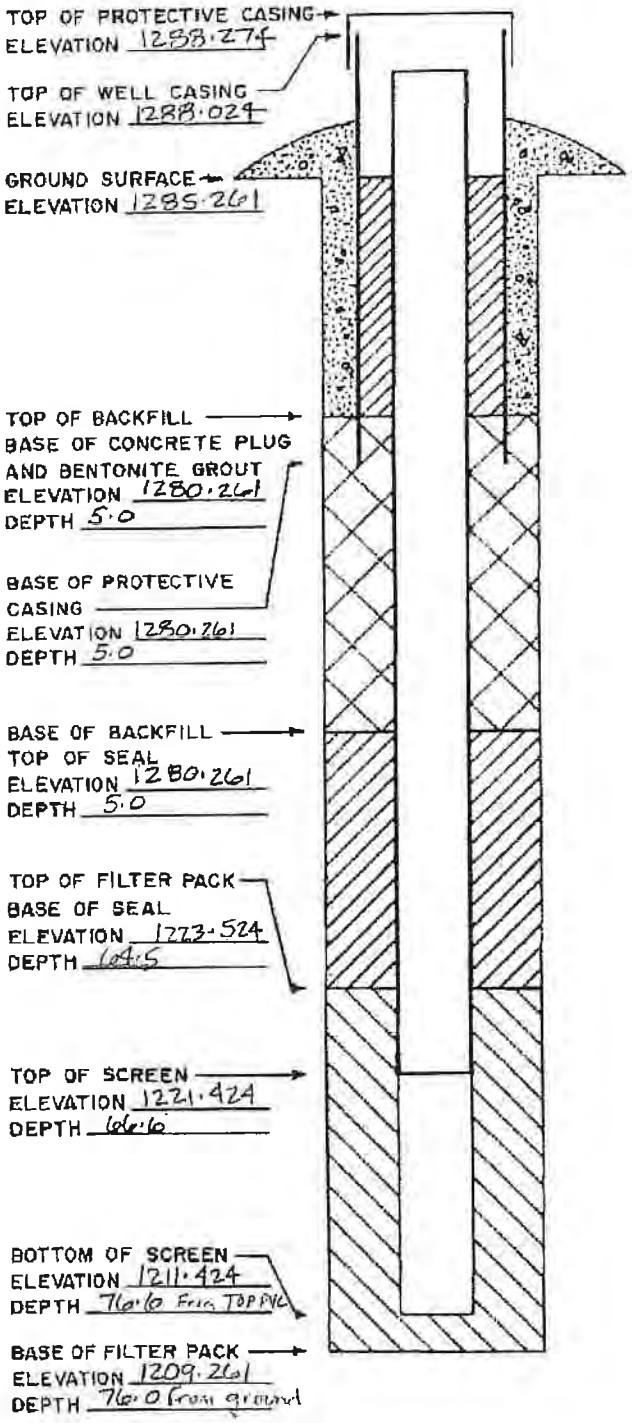
Questions? Call or Email: Nina Booker Environmental Engineer Sr., 515-725-8309, nina.booker@dnr.iowa.gov

ELEVATIONS: ± 0.01 FT. MSL

DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-18



MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Northern Plains Regional Landfill | Permit No.: 74-SDP-02-76P

Well or Piezometer No.: MW-19 | Dates Started: 6-6-2019 | Date Completed: 6-6-2019

A. SURVEYED LOCATION AND ELEVATION OF POINT (+0.5 ft.)

Specify corner of site: NW | Distance and direction along boundary:

Distance and direction from boundary to surface monitoring well: N7385.207 - E6329.994

Elevation (+0.01 ft. MSL)

Ground Surface: 1285.261 | Top of protective casing: 1288.600

Top of well casing: 1288.350 | Benchmark elevation: 1283.290

Benchmark description: Point #12

B. SOIL BORING INFORMATION

Construction Company Name: Team Services

Address: 717 SE 6th | City, State, Zip Code: Des Moines, Iowa 50309

Name of driller: Don Carlson

Drilling method: Hollow Stem Augers | Drilling fluid: None | Bore Hole diameter: 8 inch

Soil sampling method: Split-Spoon Sampler | Depth of boring: 25

C. MONITORING WELL INSTALLATION

Casing material: PVC

Length of casing: 17.8

Outside casing diameter: 2.375 inch

Inside casing diameter: 2.0 inch

Casing joint type: Flush Threaded

Casing/screen joint type: Flush Threaded

Screen material: PVC

Screen opening size: 0.006 inch

Screen length: 10.0 ft

Depth of Well: 27.8 ft

Filter Pack: Unimin

Material: Silica Sand

Grain Size: 0.25 mm effective size

Volume: 3.3 cubic ft

Seal (minimum 3 ft. length above filter pack):

Material: Bentonite

Placement method: Tremied through Hollow Stem Augers

Volume: 6.5 cubic ft

Backfill (if different from seal): Same

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: Concrete

Protective cap:

Material: Steel

Vented?: ☒ Y ☐ N | Locking?: ☒ Y ☐ N

Well cap:

Material: PVC

Vented?: ☒ Y ☐ N

D. GROUNDWATER MEASUREMENT (±0.01 foot below top of inner well casing)

Water level: 2.0 | **Stabilization time:** during drilling

Well development method: Pumping & surging on 6/27/2019

Average depth of frost line: 48 inch

DRILLER'S CERTIFICATION

I certify under penalty of law I believe the information reported above is true, accurate, and complete.

Signature | **Certification #** 1812 | **Date** 8-21-20

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E. 9th St, Des Moines, IA 50319.

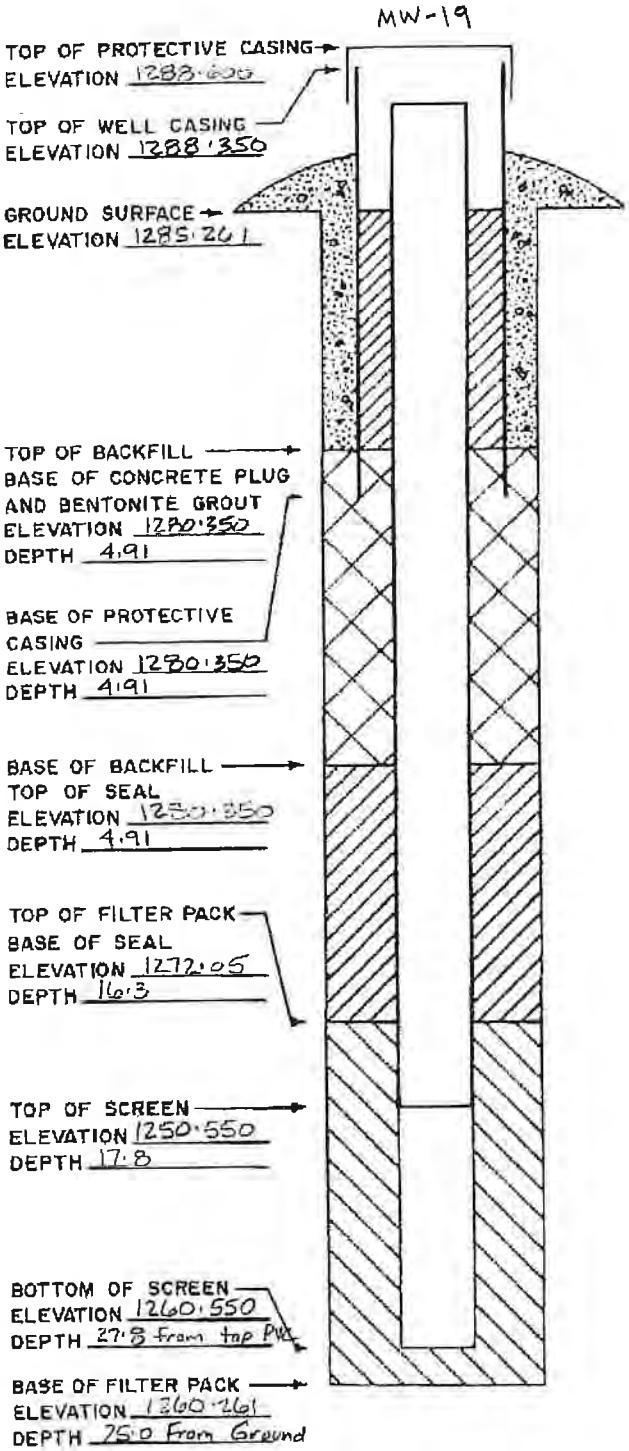
Questions? Call or Email: Nina Booker Environmental Engineer Sr., 515-725-8309, nina.booker@dnr.iowa.gov

ELEVATIONS: ± 0.01 FT. MSL

DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)

MW-19



MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Northern Plains Regional Landfill | Permit No.: 74-SDP-02-76P

Well or Piezometer No.: MW-20 | Dates Started: 6-6-2019 | Date Completed: 6-6-2019

A. SURVEYED LOCATION AND ELEVATION OF POINT (+0.5 ft.)

Specify corner of site: West | Distance and direction along boundary:

Distance and direction from boundary to surface monitoring well: N6400.456 - E6355.056

Elevation (+0.01 ft. MSL)

Ground Surface: 1278.982 | Top of protective casing: 1282.521

Top of well casing: 1282.271 | Benchmark elevation: 1283.290

Benchmark description: Point #12

B. SOIL BORING INFORMATION

Construction Company Name: Team Services

Address: 717 SE 6th | City, State, Zip Code: Des Moines, Iowa 50309

Name of driller: Don Carlson

Drilling method: Hollow Stem Augers | Drilling fluid: None | Bore Hole diameter: 8 inch

Soil sampling method: Split-Spoon Sampler | Depth of boring: 63

C. MONITORING WELL INSTALLATION

Casing material: PVC

Length of casing: 56.55

Outside casing diameter: 2.375 inch

Inside casing diameter: 2.0 inch

Casing joint type: Flush Threaded

Casing/screen joint type: Flush Threaded

Screen material: PVC

Screen opening size: 0.006 inch

Screen length: 10.0 ft

Depth of Well: 66.55 ft

Filter Pack: Unimin

Material: Silica Sand

Grain Size: 0.25 mm effective size

Volume: 3.3 cubic ft

Seal (minimum 3 ft. length above filter pack):

Material: Bentonite

Placement method: Tremied through Hollow Stem Augers

Volume: 20.5 cubic ft

Backfill (if different from seal): Same

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: Concrete

Protective cap:

Material: Steel

Vented?: ☒ Y ☐ N | Locking?: ☒ Y ☐ N

Well cap:

Material: PVC

Vented?: ☒ Y ☐ N

D. GROUNDWATER MEASUREMENT (+0.01 foot below top of inner well casing)

Water level: 13.0 | Stabilization time: during drilling

Well development method: Pumping & surging on 6/27/2019

Average depth of frost line: 48 inch

DRILLER'S CERTIFICATION

I certify under penalty of law I believe the information reported above is true, accurate, and complete.

Signature: [signature] | Certification #: 1812 | Date: 8-21-20

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E. 9th St, Des Moines, IA 50319.

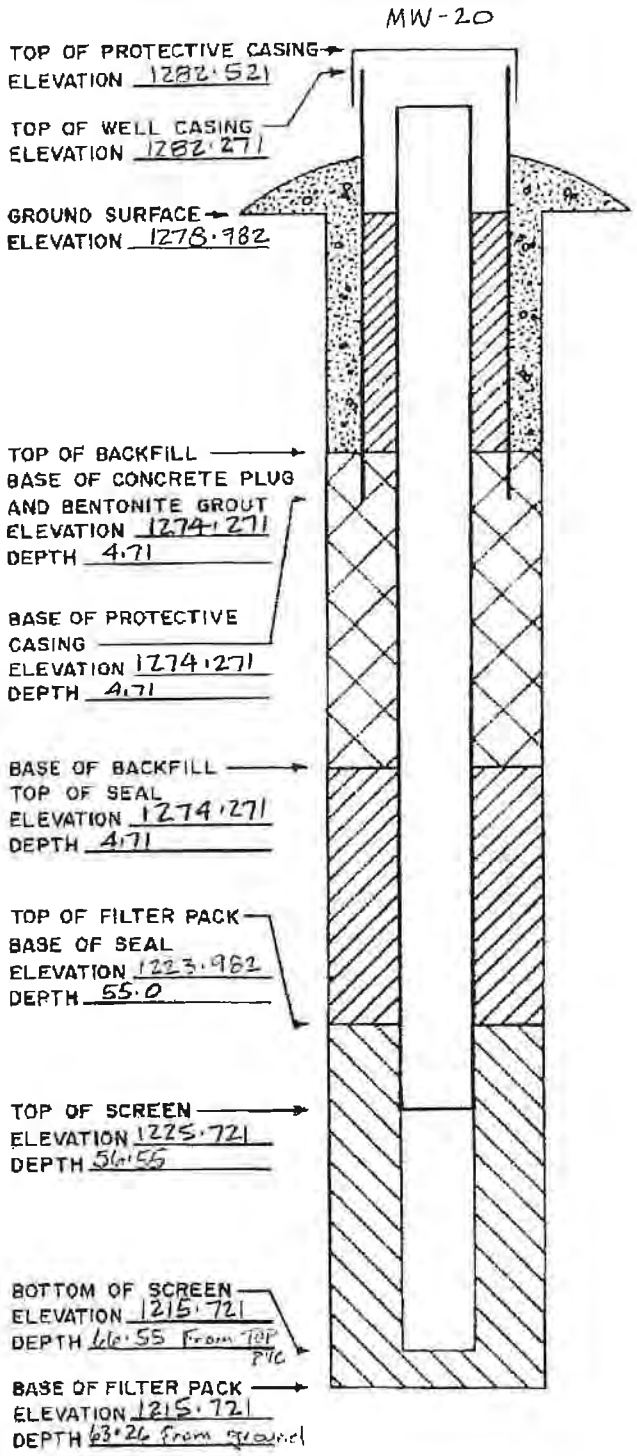
Questions? Call or Email: Nina Booker Environmental Engineer Sr., 515-725-8309, nina.booker@dnr.iowa.gov

ELEVATIONS: ± 0.01 FT. MSL

DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)

MW-20



MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Northern Plains Regional Landfill — Permit No.: 74-SDP-02-76P

Well or Piezometer No.: MW-21 — Dates Started: 5-12-2019 — Date Completed: 5-12-2019

A. SURVEYED LOCATION AND ELEVATION OF POINT (+0.5 ft.)

Specify corner of site: West — Distance and direction along boundary:

Distance and direction from boundary to surface monitoring well: N6392.465 - E6354.917

Elevation (+0.01 ft. MSL)

Ground Surface: 1278.982 — Top of protective casing: 1282.536

Top of well casing: 1282.286 — Benchmark elevation: 1283.290

Benchmark description: Point #12

B. SOIL BORING INFORMATION

Construction Company Name: Team Services

Address: 717 SE 6th — City, State, Zip Code: Des Moines, Iowa 50309

Name of driller: Don Carlson

Drilling method: Hollow Stem Augers — Drilling fluid: None — Bore Hole diameter: 8 inch

Soil sampling method: Split-Spoon Sampler — Depth of boring: 25.0

C. MONITORING WELL INSTALLATION

Casing material: PVC

Length of casing: 17.8

Outside casing diameter: 2.375 inch

Inside casing diameter: 2.0 inch

Casing joint type: Flush Threaded

Casing/screen joint type: Flush Threaded

Screen material: PVC

Screen opening size: 0.006 inch

Screen length: 10.0 ft

Depth of Well: 27.8 ft

Filter Pack: Unimin

Material: Silica Sand

Grain Size: 0.25 mm effective size

Volume: 3.3 cubic ft

Seal (minimum 3 ft. length above filter pack):

Material: Bentonite

Placement method: Tremied through Hollow Stem Augers

Volume: 6.5 cubic ft

Backfill (if different from seal): Same

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: Concrete

Protective cap:

Material: Steel

Vented?: ☒ Y ☐ N — Locking?: ☒ Y ☐ N

Well cap:

Material: PVC

Vented?: ☒ Y ☐ N

D. GROUNDWATER MEASUREMENT (+0.01 foot below top of inner well casing)

Water level: 13.0 — **Stabilization time:** during drilling

Well development method: Pumping & surging on 6/27/2019

Average depth of frost line: 48 inch

DRILLER'S CERTIFICATION

I certify under penalty of law I believe the information reported above is true, accurate, and complete.

Signature: [signature] — **Certification #:** 1812 — **Date:** 8-21-20

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E. 9th St, Des Moines, IA 50319.

Questions? Call or Email: Nina Booker Environmental Engineer Sr., 515-725-8309, nina.booker@dnr.iowa.gov

09/2017 cmc

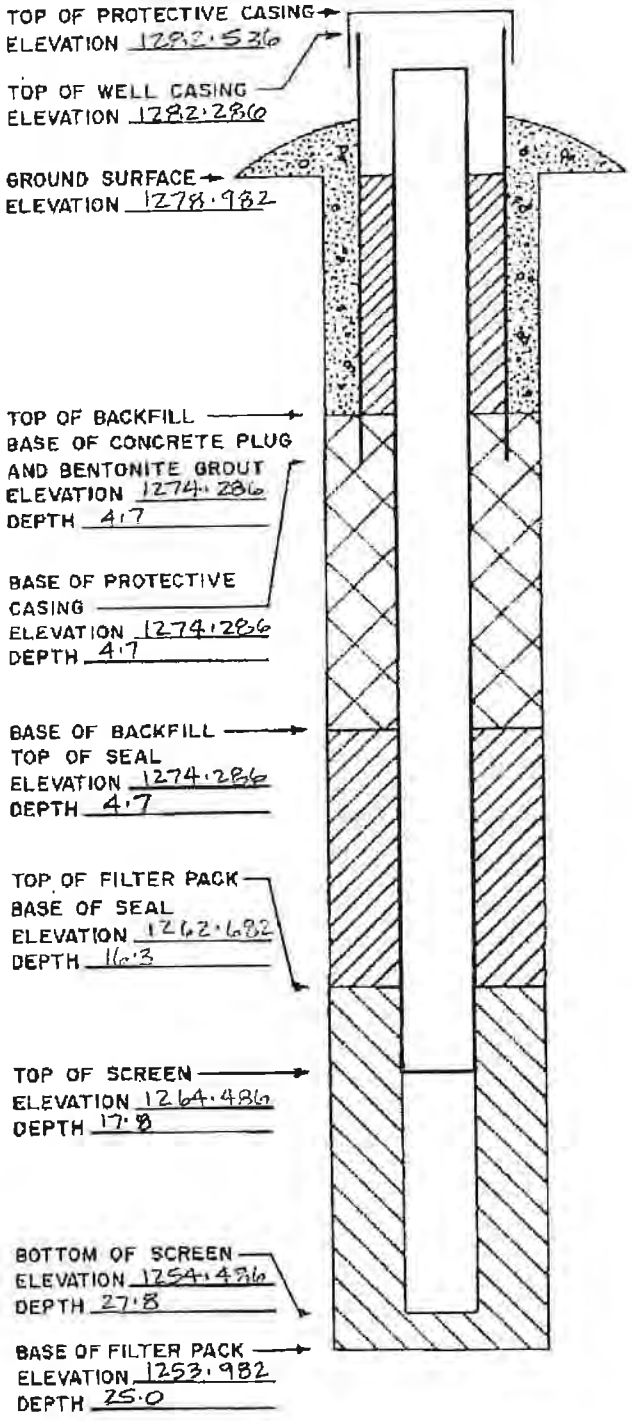
DNR Form 542-1277

ELEVATIONS: ± 0.01 FT. MSL

DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-21



APPENDIX 6

Hydraulic Conductivity Field Testing Results and Calculations

2004
TEAM *Services*

Project Name Northern Plains Regional Landfill
TEAM Project No. 1-1424

Slug Test Summary

Test 1

rc	1
rw	2.25
Match point	
α	0.0001
β	3
t	25
B (ft)	9

MW-13

T	S	k	k
0.12	2E-05	0.0011111	**0.00044**
in^2/sec		in/sec	**cm/s**

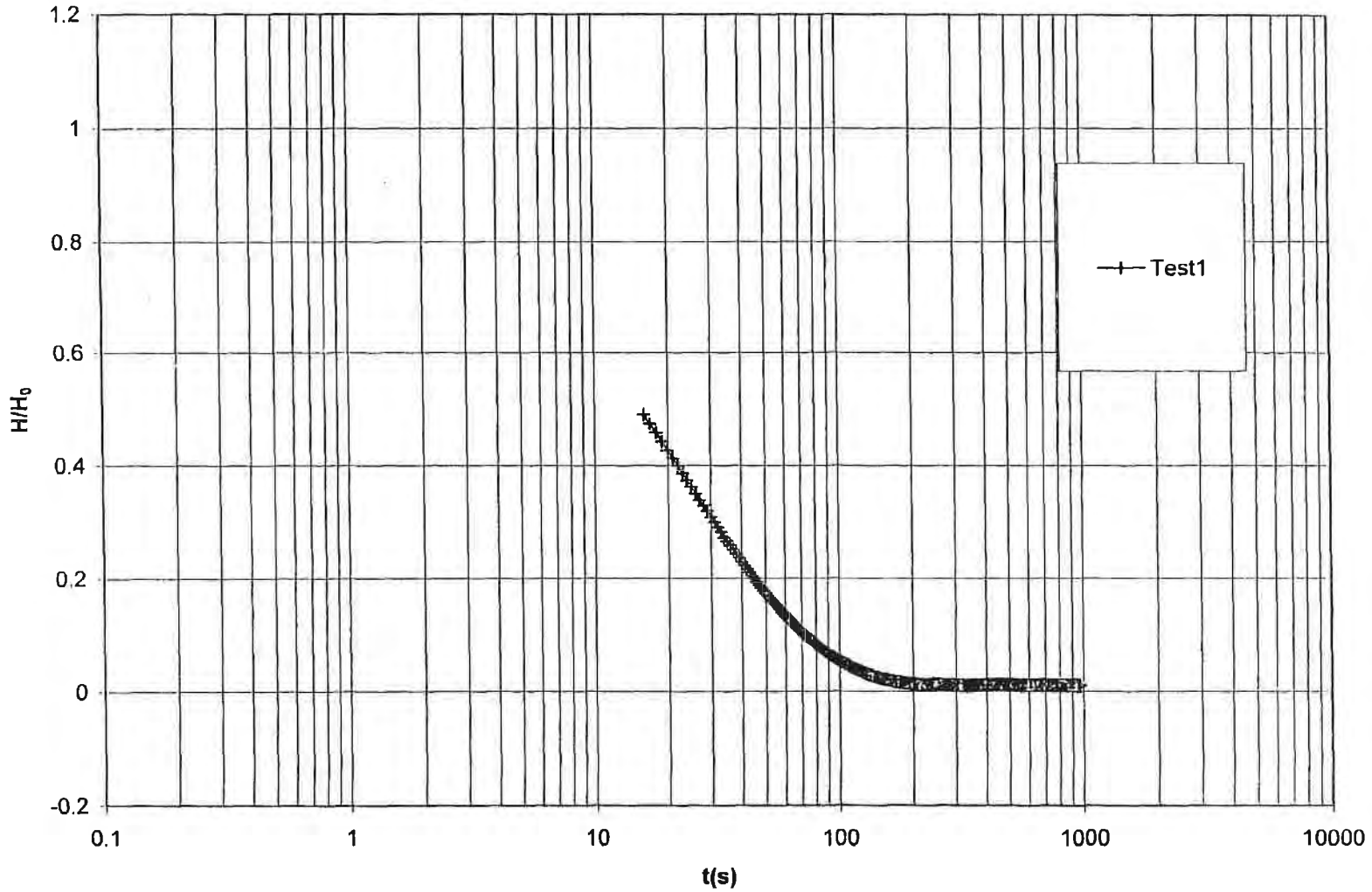
Test 3

rc	1
rw	2.25
Match point	
α	0.00005
β	4
t	31
B (ft)	17

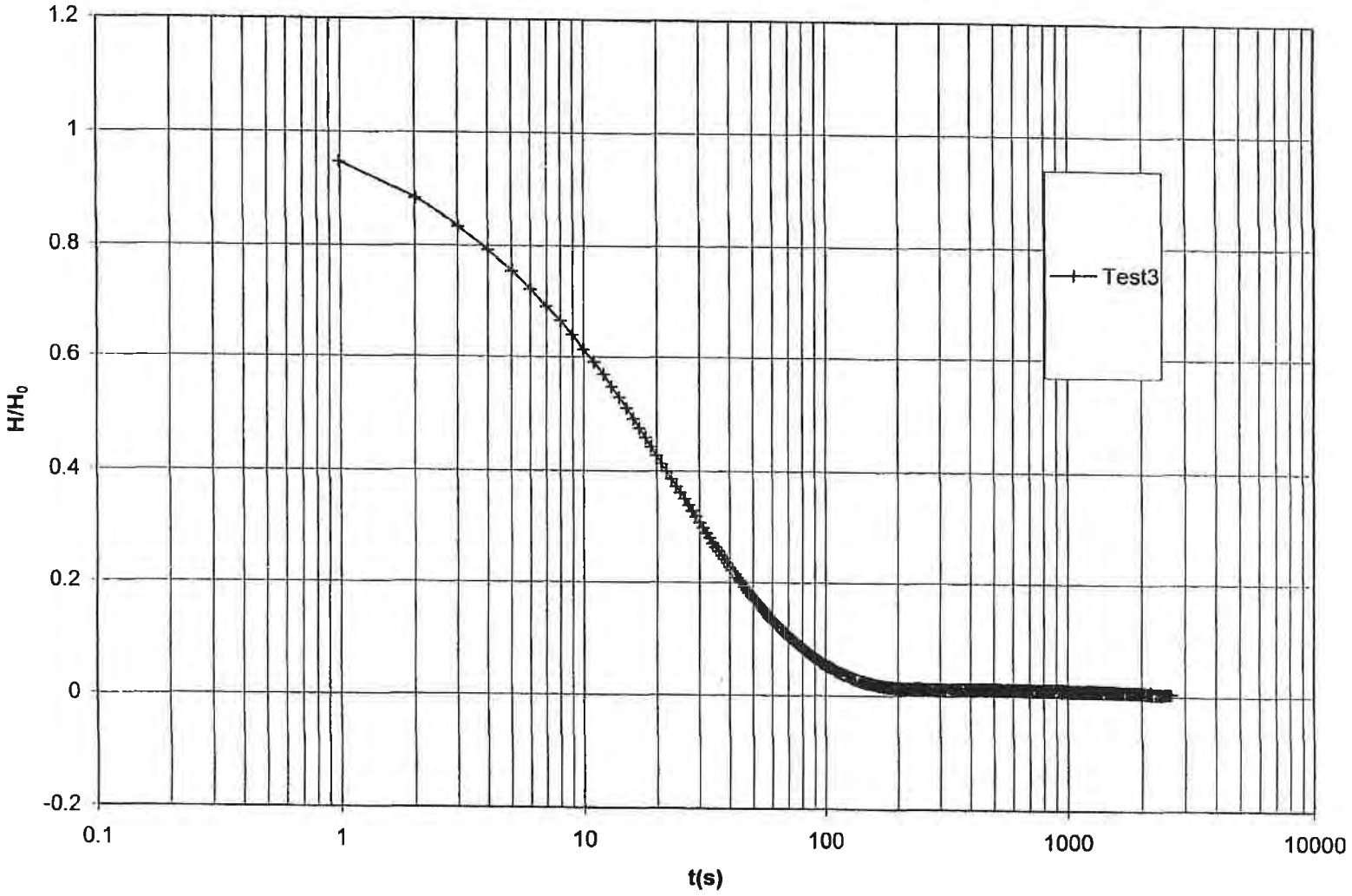
MW-12

T	S	k	k
0.12903	9.9E-06	0.0006325	**0.00025**
in^2/sec		in/sec	**cm/s**

Test 1 Plot



Test 3 Plot



BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2008

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 0.00145 cm/sec
Monitoring Well: MW-14
Test Date: 10/31/2008
Field Testing by: TDW
Test Analysis by: TDW

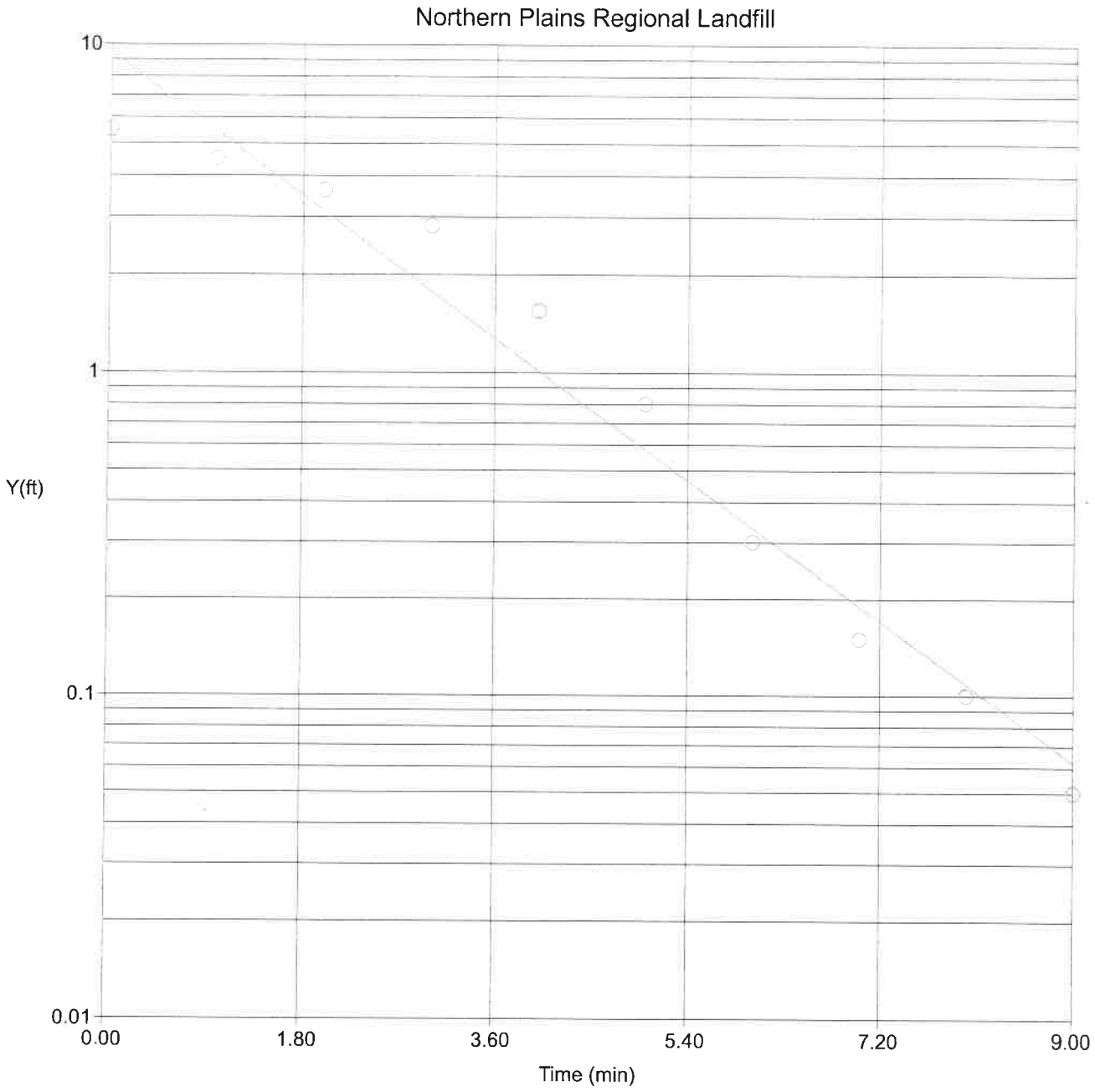
WELL GEOMETRY
H: 17.8 ft
Lw: 7.8 ft
Le: 5.0 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 1.84

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -9.31e-03
Intercept: 5.67

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	5.5	Use	5.5	9.47
1	4.5	Use	4.5	5.42
2	3.6	Use	3.6	3.1
3	2.8	Use	2.8	1.77
4	1.55	Use	1.55	1.01
5	0.8	Use	0.8	0.579
6	0.3	Use	0.3	0.331
7	0.15	Use	0.15	0.189
8	0.1	Use	0.1	0.108
9	0.05	Use	0.05	0.062



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 0.00145 cm/sec	Well: MW-14	Slug Test Date: 10/31/2008
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2008

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 0.0028 cm/sec
Monitoring Well: MW-15
Test Date: 10/31/2008
Field Testing by: TDW
Test Analysis by: TDW

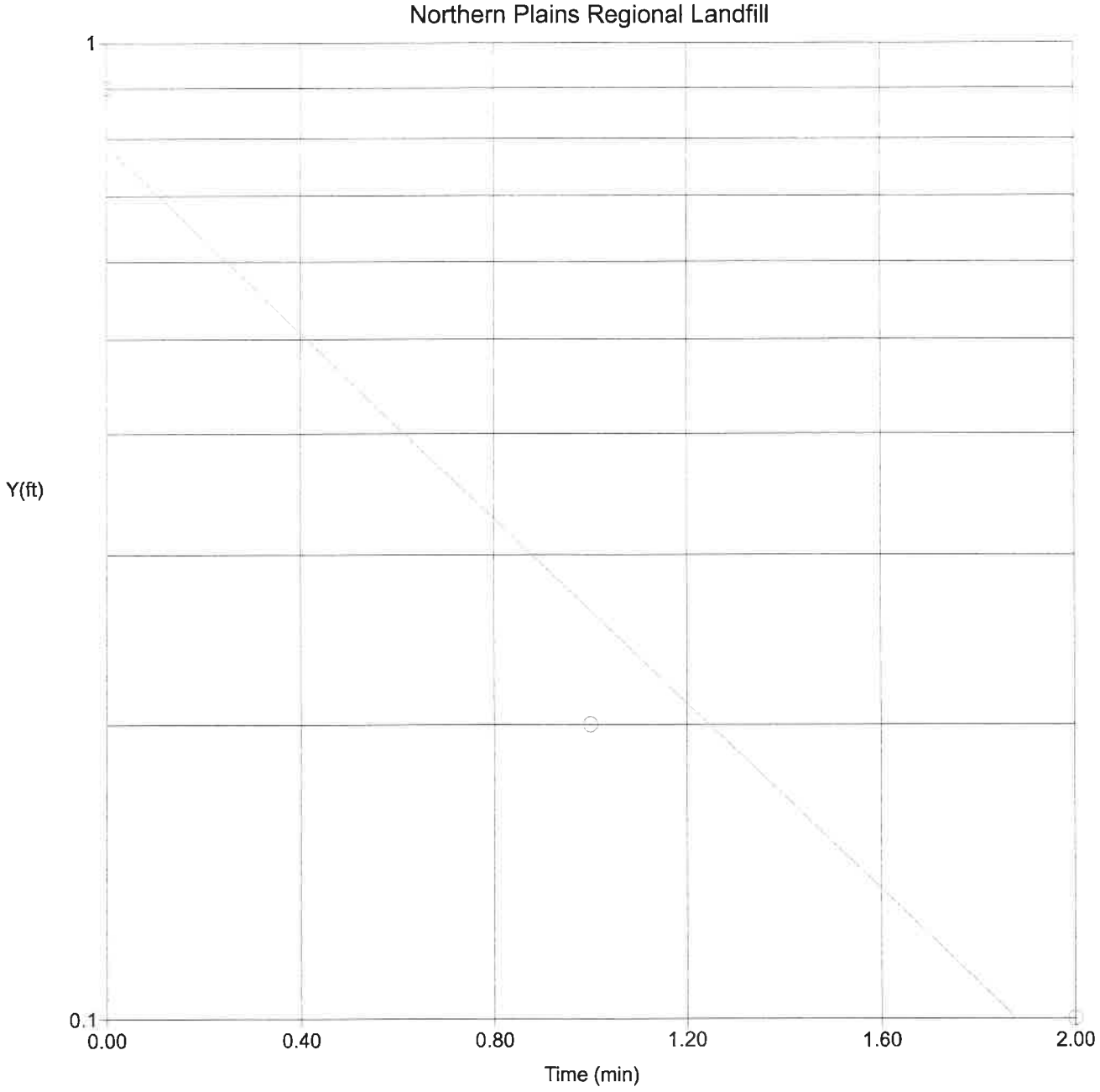
WELL GEOMETRY
H: 17.1 ft
Lw: 7.1 ft
Le: 5.0 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 1.81

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -1.83e-02
Intercept: 3.18

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	0.9	Use	0.9	0.786
1	0.2	Use	0.2	0.262
2	0.1	Use	0.1	0.0874



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 0.0028 cm/sec	Well: MW-15	Slug Test Date: 10/31/2008
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2008

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 0.00281 cm/sec
Monitoring Well: MW-16
Test Date: 10/31/2008
Field Testing by: TDW
Test Analysis by: TDW

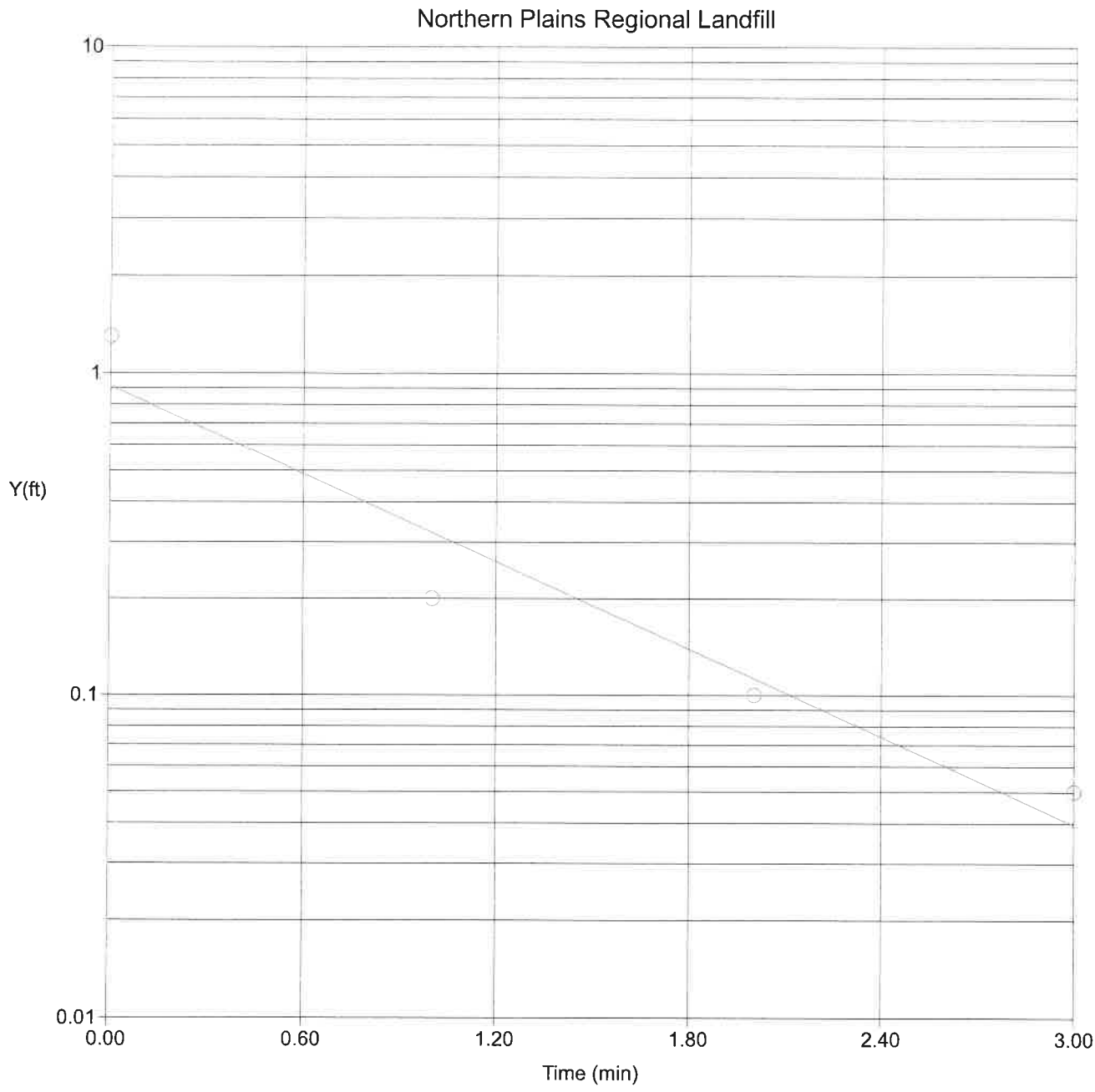
WELL GEOMETRY
H: 19.3 ft
Lw: 9.3 ft
Le: 5.0 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 1.91

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -1.74e-02
Intercept: 3.33

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	1.3	Use	1.3	0.913
1	0.2	Use	0.2	0.32
2	0.1	Use	0.1	0.113
3	0.05	Use	0.05	0.0395



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 0.00281 cm/sec	Well: MW-16	Slug Test Date: 10/31/2008
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2013

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 1.25e-04 cm/sec
Monitoring Well: MW-3E
Test Date: 08/09/2013
Field Testing by: TDW
Test Analysis by: TDW

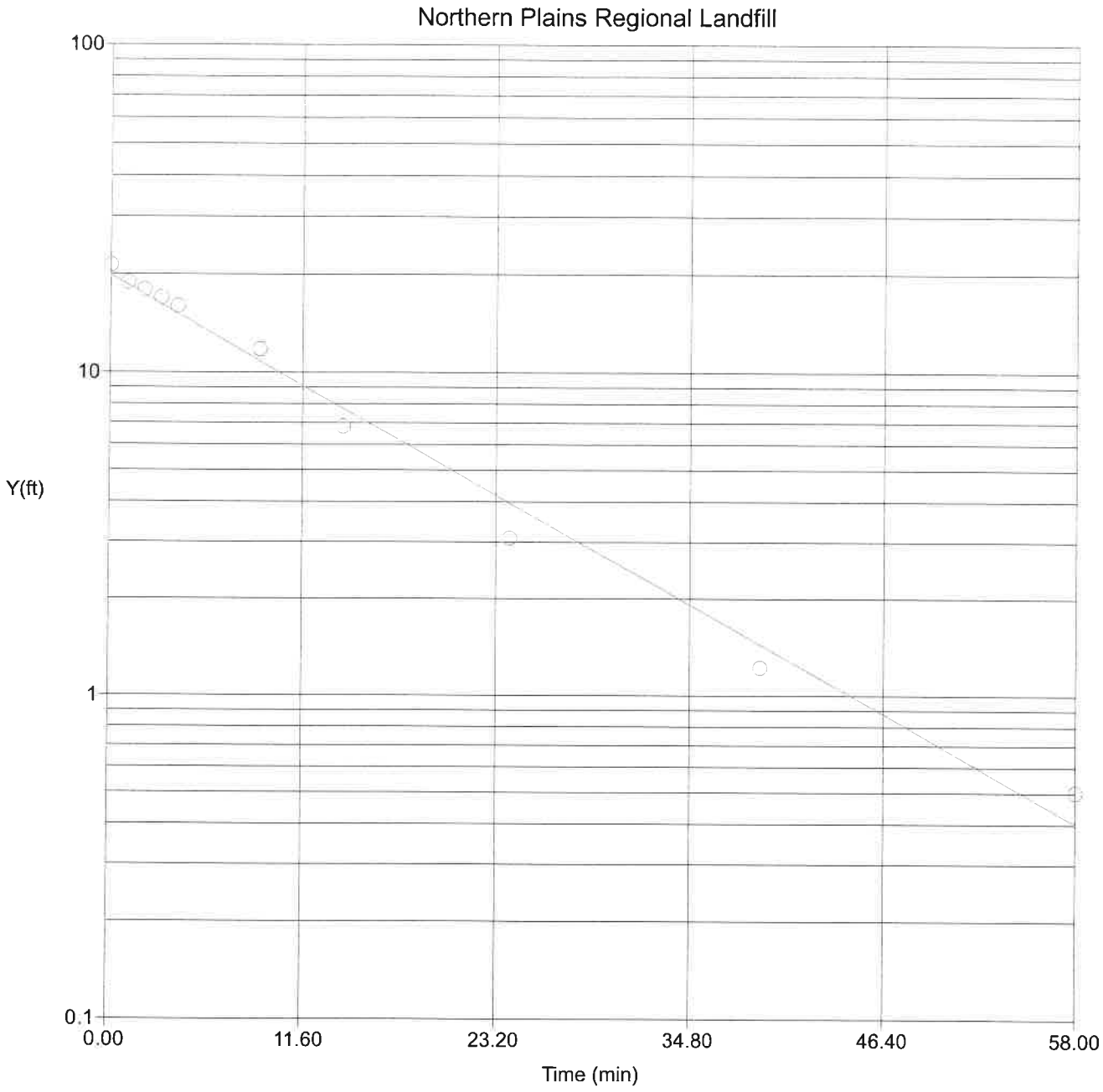
WELL GEOMETRY
H: 33.3 ft
Lw: 23.3 ft
Le: 10 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 30.0
A: 2.42
B: 0.35
C: 2.0
Ln(Re/rw): 2.64

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -1.12e-03
Intercept: 6.4

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	21.2	Use	21.2	19.7
1	18.85	Use	18.85	18.5
2	17.9	Use	17.9	17.3
3	16.87	Use	16.87	16.1
4	15.95	Use	15.95	15.1
9	11.75	Use	11.75	10.8
14	6.8	Use	6.8	7.71
24	3.08	Use	3.08	3.94
39	1.22	Use	1.22	1.44
58	0.5	Use	0.5	0.401



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 1.25e-04 cm/sec	Well: MW-3E	Slug Test Date: 08/09/2013
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2013

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 6.41e-04 cm/sec
Monitoring Well: MW-3F
Test Date: 08/09/2013
Field Testing by: TDW
Test Analysis by: TDW

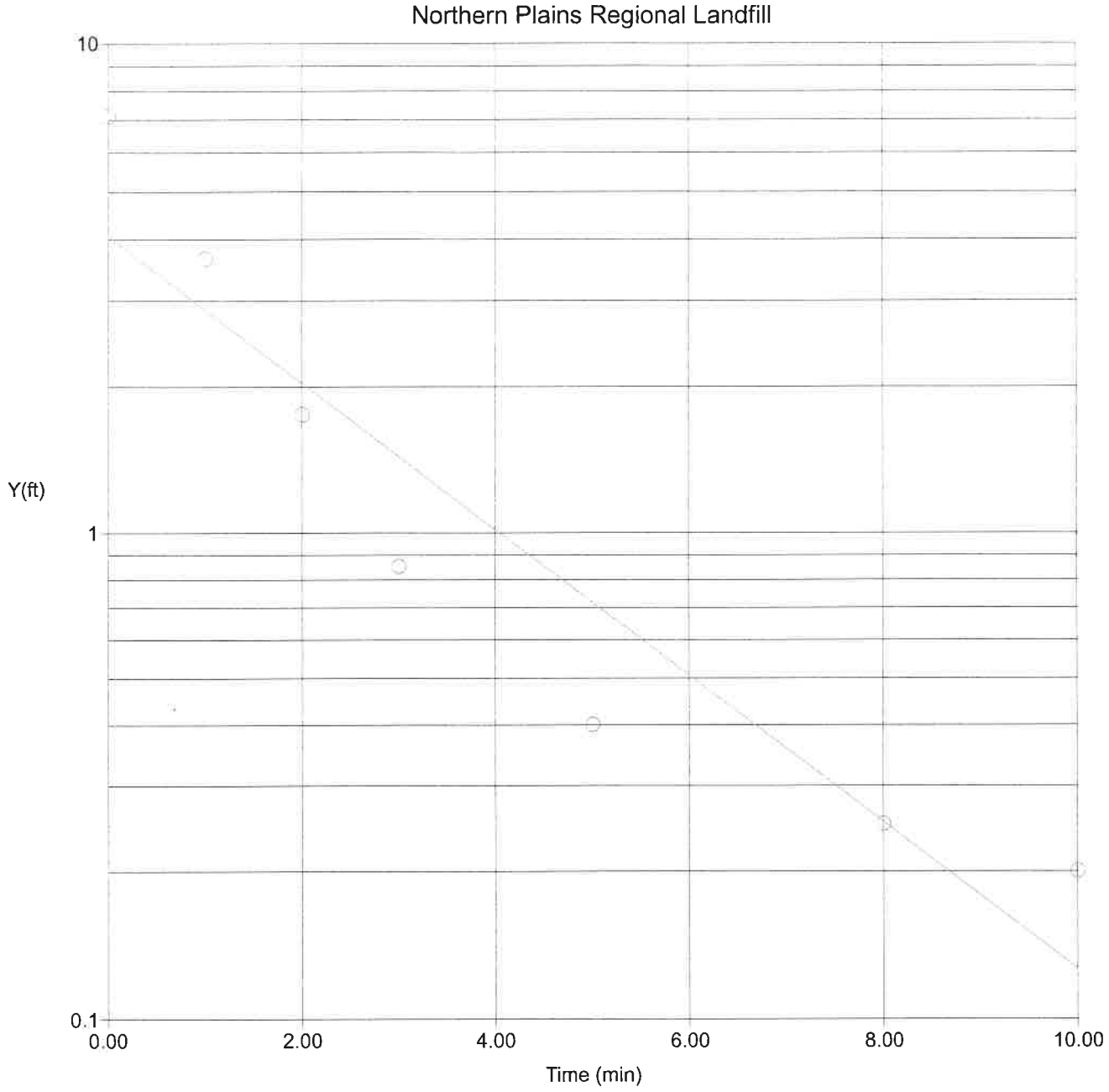
WELL GEOMETRY
H: 32.2 ft
Lw: 22.2 ft
Le: 10 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 30.0
A: 2.42
B: 0.35
C: 2.0
Ln(Re/rw): 2.62

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -5.79e-03
Intercept: 4.82

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	7.1	Use	7.1	4.06
1	3.65	Use	3.65	2.87
2	1.75	Use	1.75	2.03
3	0.85	Use	0.85	1.43
5	0.40	Use	0.4	0.716
8	0.25	Use	0.25	0.253
10	0.2	Use	0.2	0.126



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 6.41e-04 cm/sec	Well: MW-3F	Slug Test Date: 08/09/2013
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2013

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 1.02e-05 cm/sec
Monitoring Well: MW-7E
Test Date: 08/09/2013
Field Testing by: TDW
Test Analysis by: TDW

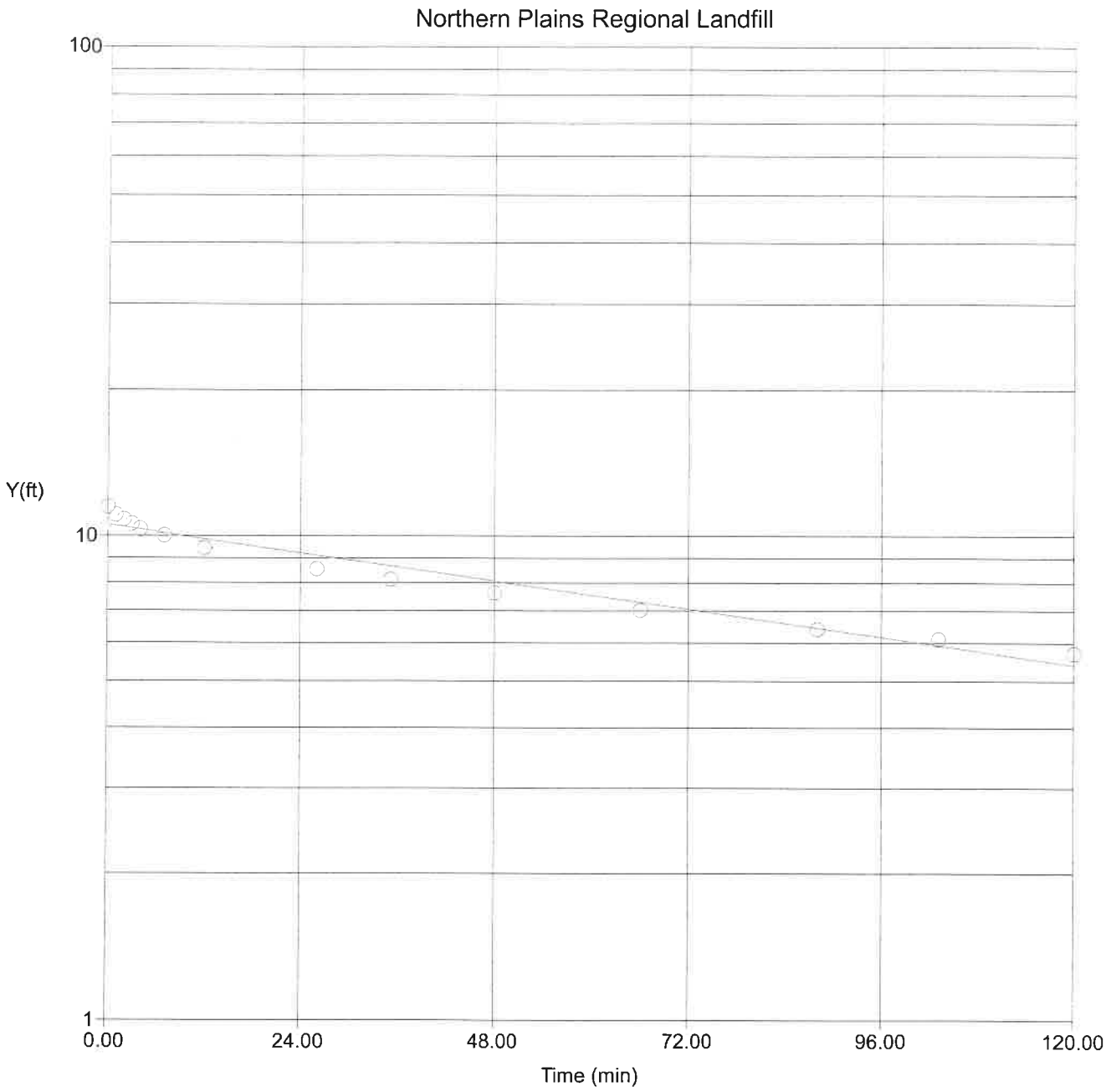
WELL GEOMETRY
H: 31.1 ft
Lw: 21.1 ft
Le: 10 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 30.0
A: 2.42
B: 0.35
C: 2.0
Ln(Re/rw): 2.59

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -9.28e-05
Intercept: 5.77

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	11.45	Use	11.45	10.5
1	11	Use	11	10.4
2	10.75	Use	10.75	10.4
3	10.54	Use	10.54	10.3
4	10.3	Use	10.3	10.3
7	9.97	Use	9.97	10.1
12	9.42	Use	9.42	9.82
26	8.5	Use	8.5	9.08
35	8.1	Use	8.1	8.64
48	7.6	Use	7.6	8.04
66	7.0	Use	7	7.27
88	6.4	Use	6.4	6.43
103	6.1	Use	6.1	5.92
120	5.7	Use	5.7	5.38



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 1.02e-05 cm/sec	Well: MW-7E	Slug Test Date: 08/09/2013
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2013

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 5.18e-04 cm/sec
Monitoring Well: MW-7F
Test Date: 08/09/2013
Field Testing by: TDW
Test Analysis by: TDW

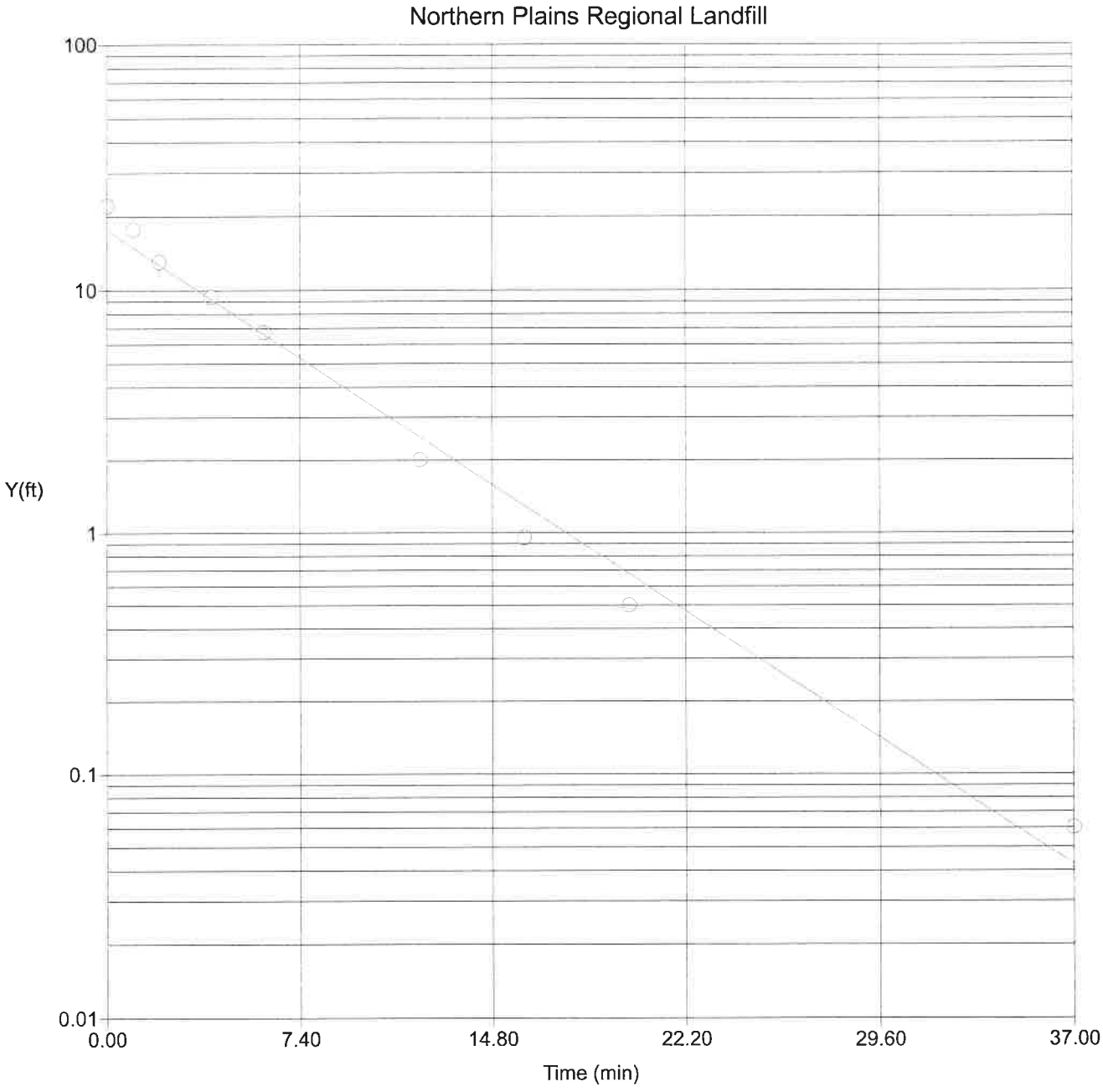
WELL GEOMETRY
H: 37.4 ft
Lw: 27.4 ft
Le: 5 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 2.25

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -2.72e-03
Intercept: 6.28

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	22.0	Use	22	17.5
1	17.6	Use	17.6	14.9
2	13.0	Use	13	12.6
4	9.35	Use	9.35	9.12
6	6.7	Use	6.7	6.59
12	2.0	Use	2	2.48
16	0.95	Use	0.95	1.29
20	0.5	Use	0.5	0.673
37	0.06	Use	0.06	0.0422



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 5.18e-04 cm/sec	Well: MW-7F	Slug Test Date: 08/09/2013
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2013

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 0.00107 cm/sec
Monitoring Well: MW-8C
Test Date: 08/07/2013
Field Testing by: TDW
Test Analysis by: TDW

WELL GEOMETRY
H: 32.29 ft
Lw: 22.29 ft
Le: 5 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

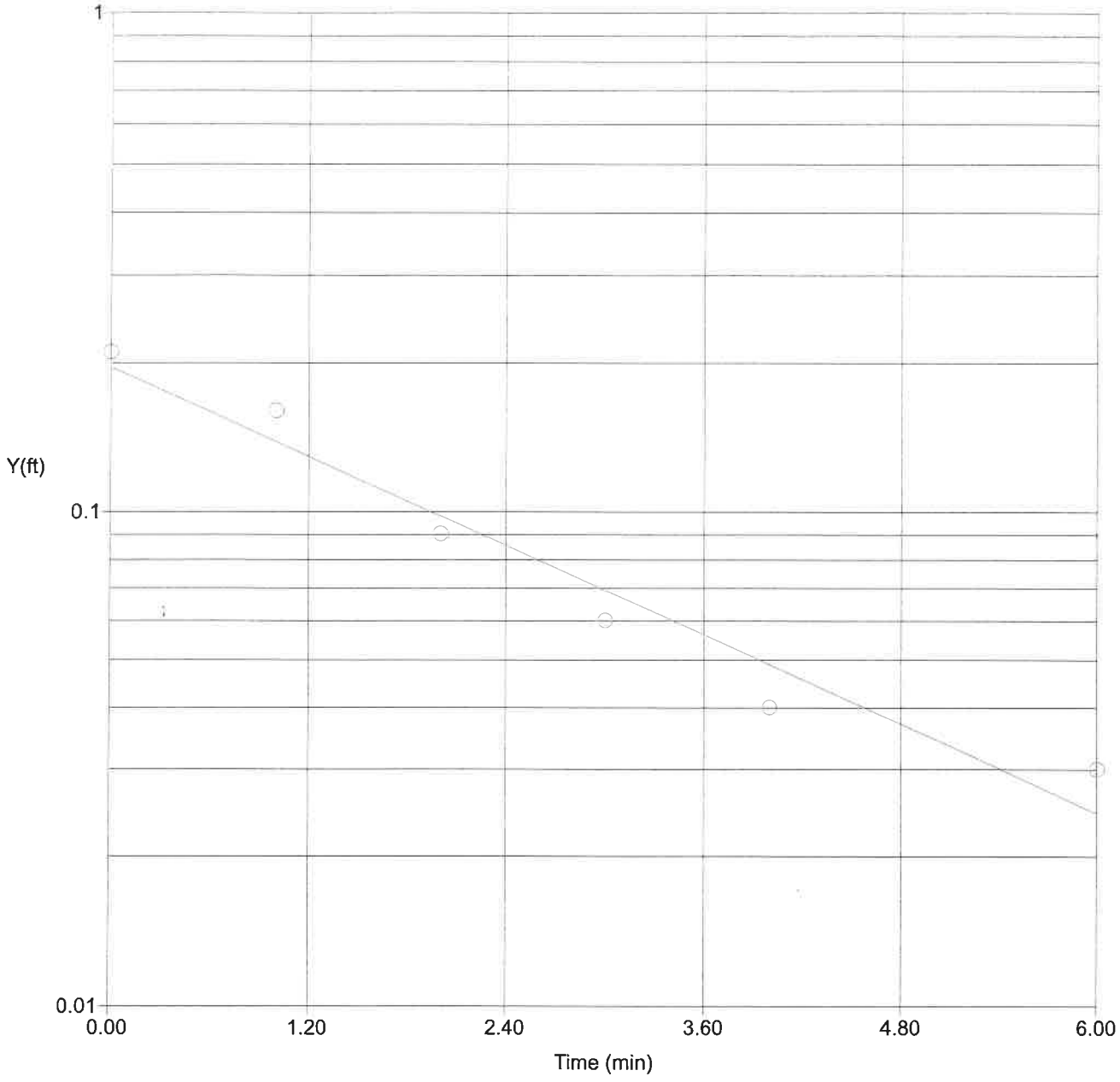
BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 2.19

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -5.78e-03
Intercept: 1.79

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	0.21	Use	0.21	0.196
1	0.16	Use	0.16	0.138
2	0.09	Use	0.09	0.0978
3	0.06	Use	0.06	0.0691
4	0.04	Use	0.04	0.0488
6	0.03	Use	0.03	0.0244

Northern Plains Regional Landfill



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 0.00107 cm/sec	Well: MW-8C	Slug Test Date: 08/07/2013
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2013

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 0.00115 cm/sec
Monitoring Well: MW-8D
Test Date: 08/07/2013
Field Testing by: TDW
Test Analysis by: TDW

WELL GEOMETRY
H: 31.9 ft
Lw: 21.9 ft
Le: 10 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

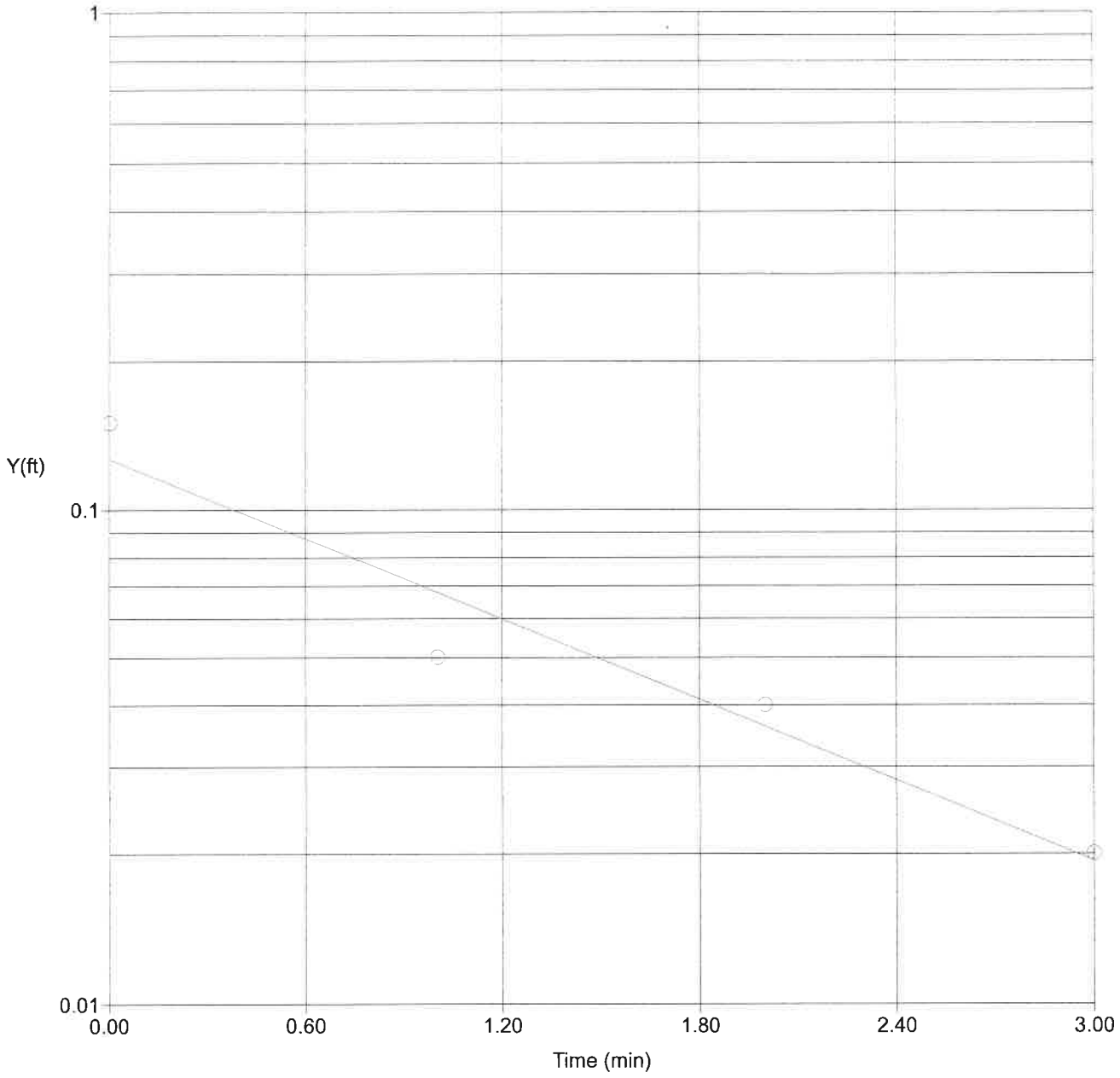
BOUWER-RICE COEFFICIENTS
Le/rw: 30.0
A: 2.42
B: 0.35
C: 2.0
Ln(Re/rw): 2.61

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -1.04e-02
Intercept: 1.35

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	0.15	Use	0.15	0.127
1	0.05	Use	0.05	0.0677
2	0.04	Use	0.04	0.0362
3	0.02	Use	0.02	0.0193

Northern Plains Regional Landfill



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 0.00115 cm/sec	Well: MW-8D	Slug Test Date: 08/07/2013
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2013

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 2.57e-04 cm/sec
Monitoring Well: MW-15B
Test Date: 08/07/2013
Field Testing by: TDW
Test Analysis by: TDW

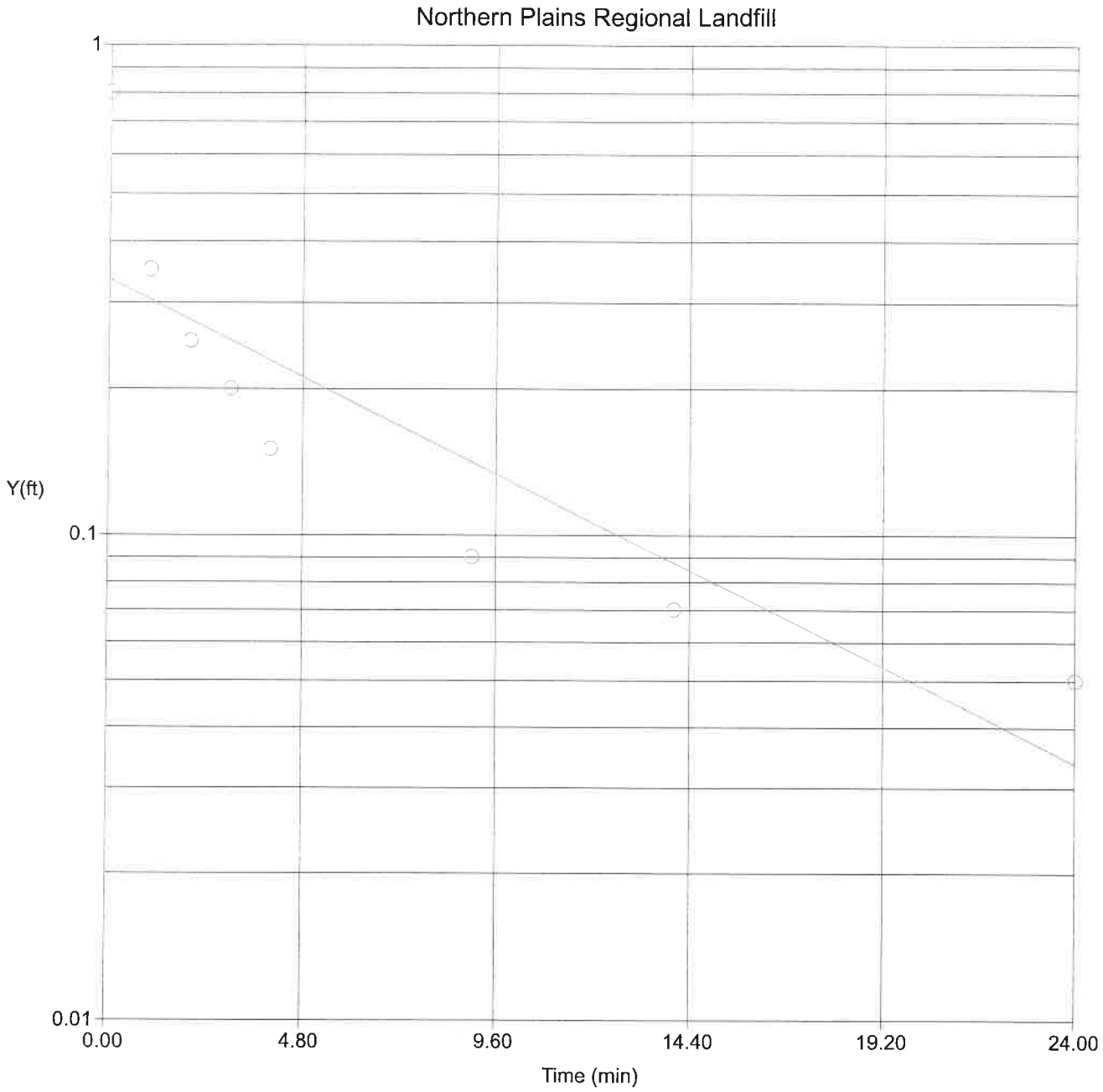
WELL GEOMETRY
H: 19.25 ft
Lw: 9.25 ft
Le: 5 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 1.9

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -1.60e-03
Intercept: 2.32

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	0.8	Use	0.8	0.334
1	0.35	Use	0.35	0.304
2	0.25	Use	0.25	0.276
3	0.2	Use	0.2	0.251
4	0.15	Use	0.15	0.228
9	0.09	Use	0.09	0.141
14	0.07	Use	0.07	0.0874
24	0.05	Use	0.05	0.0336



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 2.57e-04 cm/sec	Well: MW-15B	Slug Test Date: 08/07/2013
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2013

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 0.00107 cm/sec
Monitoring Well: MW-15C
Test Date: 08/07/2013
Field Testing by: TDW
Test Analysis by: TDW

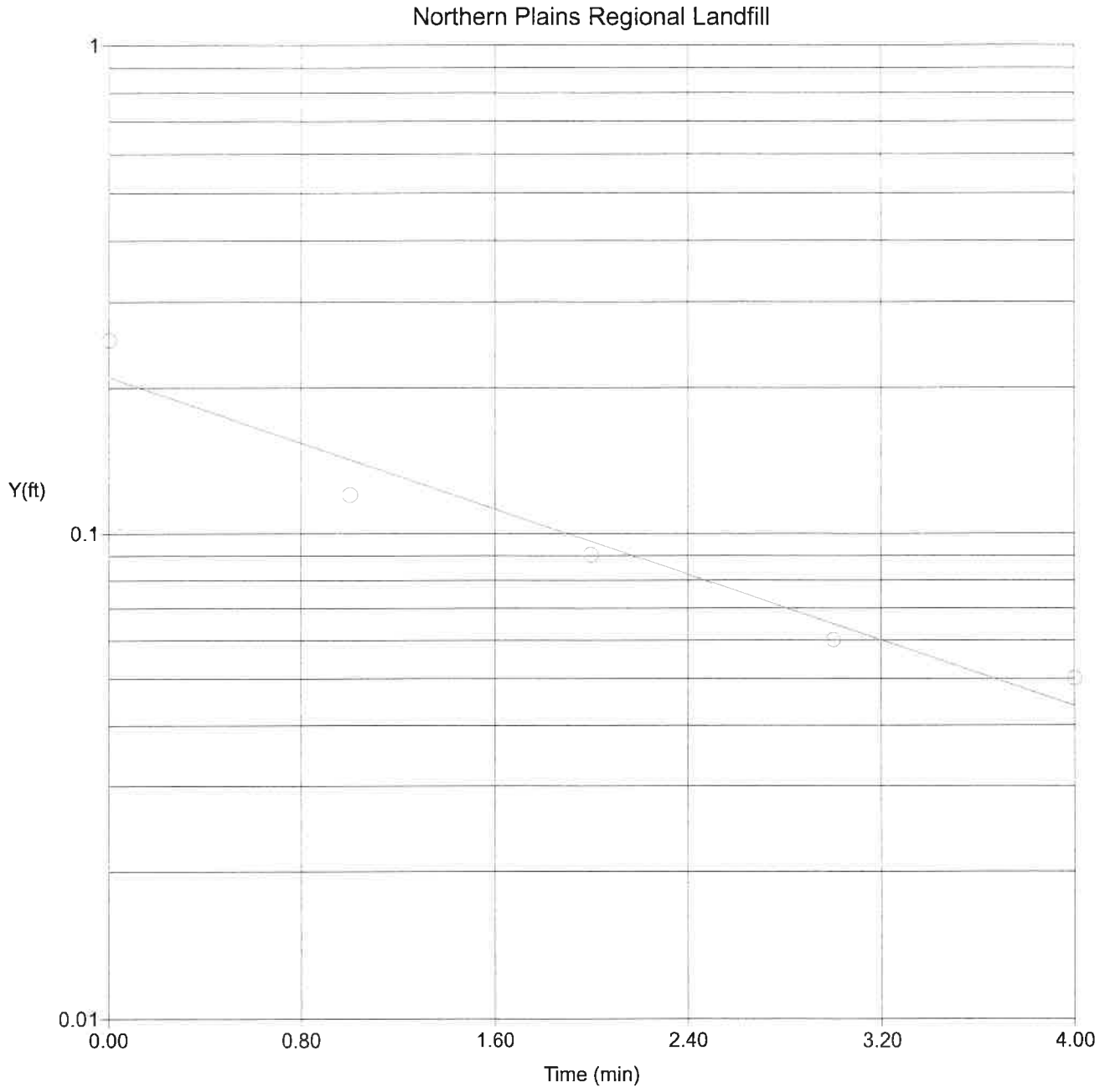
WELL GEOMETRY
H: 20.15 ft
Lw: 10.15 ft
Le: 5 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 1.94

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -6.52e-03
Intercept: 1.85

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	0.25	Use	0.25	0.21
1	0.12	Use	0.12	0.142
2	0.09	Use	0.09	0.0959
3	0.06	Use	0.06	0.0648
4	0.05	Use	0.05	0.0438



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 0.00107 cm/sec	Well: MW-15C	Slug Test Date: 08/07/2013
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2019

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 1.41e-04 cm/sec
Monitoring Well: MW-18
Test Date: 06/27/2019
Field Testing by: TDW
Test Analysis by: TDW

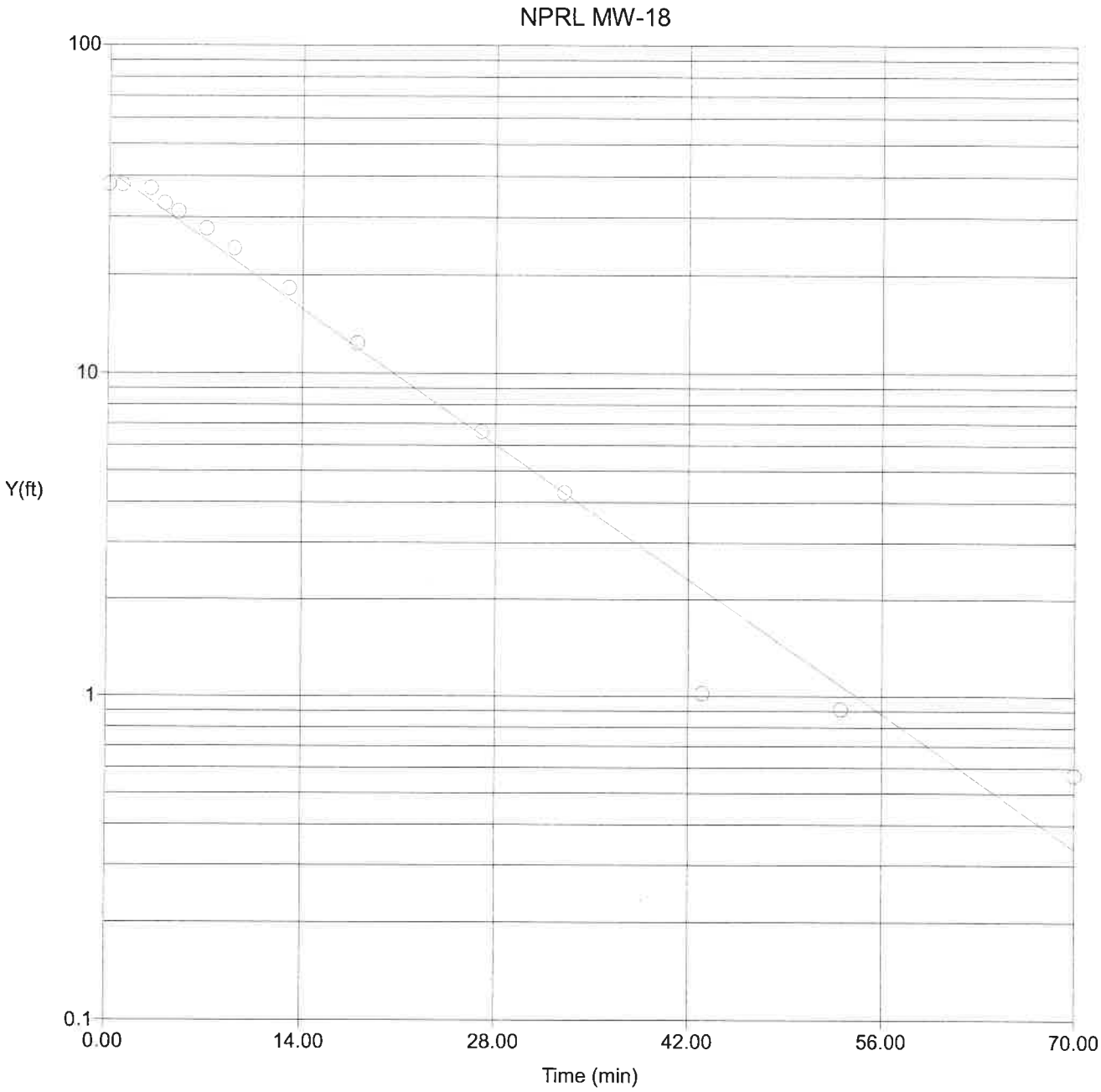
WELL GEOMETRY
H: 55.49 ft
Lw: 45.49 ft
Le: 10.0 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 30.0
A: 2.42
B: 0.35
C: 2.0
Ln(Re/rw): 2.91

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -1.14e-03
Intercept: 7.13

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	37.79	Use	37.79	41.2
1	37.64	Use	37.64	38.4
3	36.59	Use	36.59	33.5
4	32.94	Use	32.94	31.3
5	31.14	Use	31.14	29.2
7	27.59	Use	27.59	25.5
9	24.04	Use	24.04	22.2
13	18.19	Use	18.19	16.9
18	12.35	Use	12.35	12.0
27	6.61	Use	6.61	6.45
33	4.28	Use	4.28	4.27
43	1.02	Use	1.02	2.15
53	0.91	Use	0.91	1.08
70	0.57	Use	0.57	0.337



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 1.41e-04 cm/sec	Well: MW-18	Slug Test Date: 06/27/2019
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2019

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 2.50e-07 cm/sec
Monitoring Well: MW-19
Test Date: 06/27/2019
Field Testing by: TDW
Test Analysis by: TDW

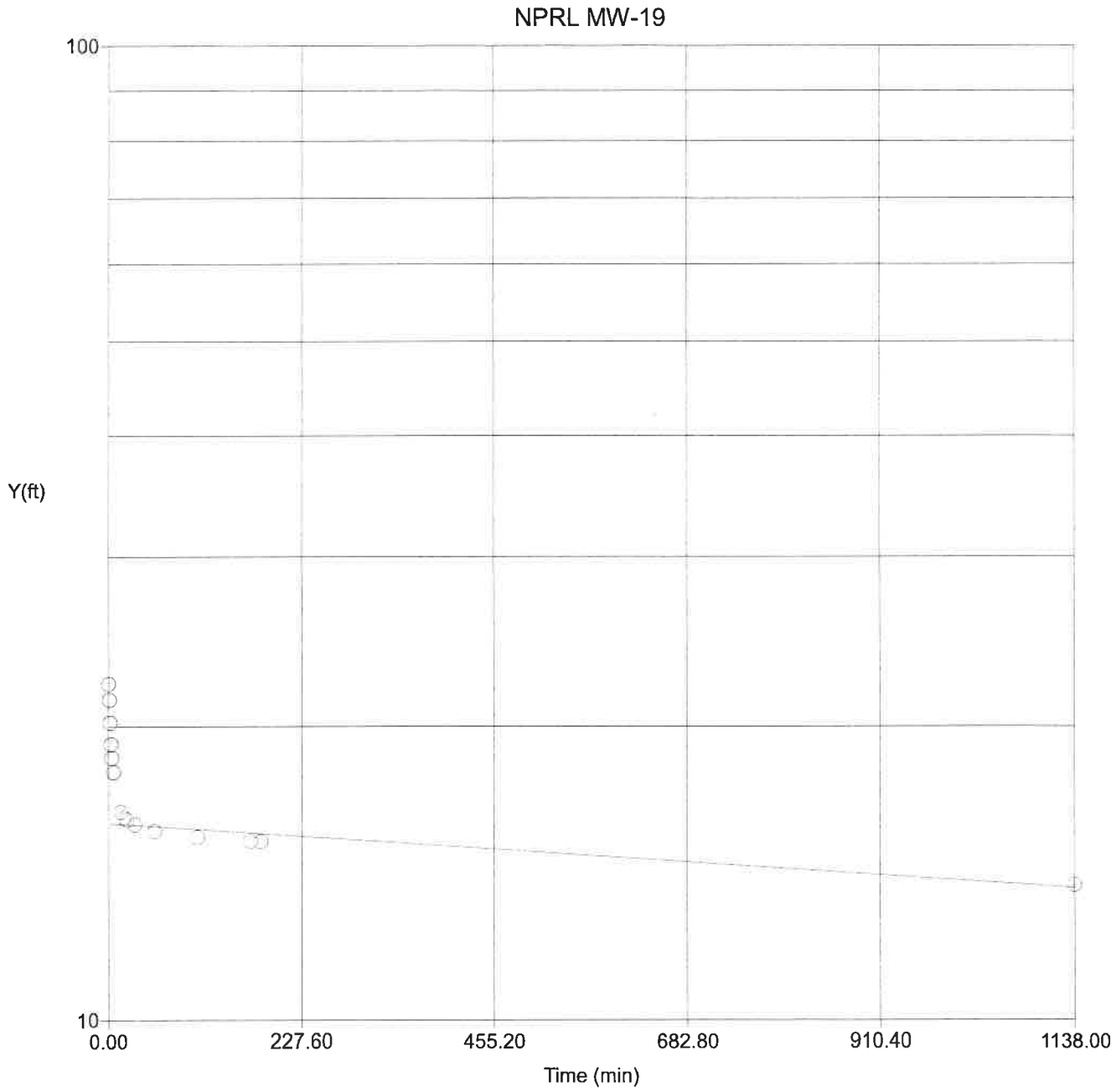
WELL GEOMETRY
H: 33.18 ft
Lw: 23.18 ft
Le: 10.0 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 30.0
A: 2.42
B: 0.35
C: 2.0
Ln(Re/rw): 2.63

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -2.24e-06
Intercept: 6.18

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	22.13	Ignore	22.13	15.9
1	21.32	Ignore	21.32	15.9
2	20.18	Ignore	20.18	15.9
3	19.17	Ignore	19.17	15.9
4	18.57	Ignore	18.57	15.9
6	17.94	Ignore	17.94	15.9
15	16.33	Use	16.33	15.9
19	16.11	Use	16.11	15.8
22	16.03	Use	16.03	15.8
32	15.85	Use	15.85	15.8
55	15.6	Use	15.6	15.8
106	15.38	Use	15.38	15.7
168	15.24	Use	15.24	15.5
180	15.23	Use	15.23	15.5
1138	13.73	Use	13.73	13.6



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 2.50e-07 cm/sec	Well: MW-19	Slug Test Date: 06/27/2019
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2019

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 3.21e-04 cm/sec
Monitoring Well: MW-20
Test Date: 06/27/2019
Field Testing by: TDW
Test Analysis by: TDW

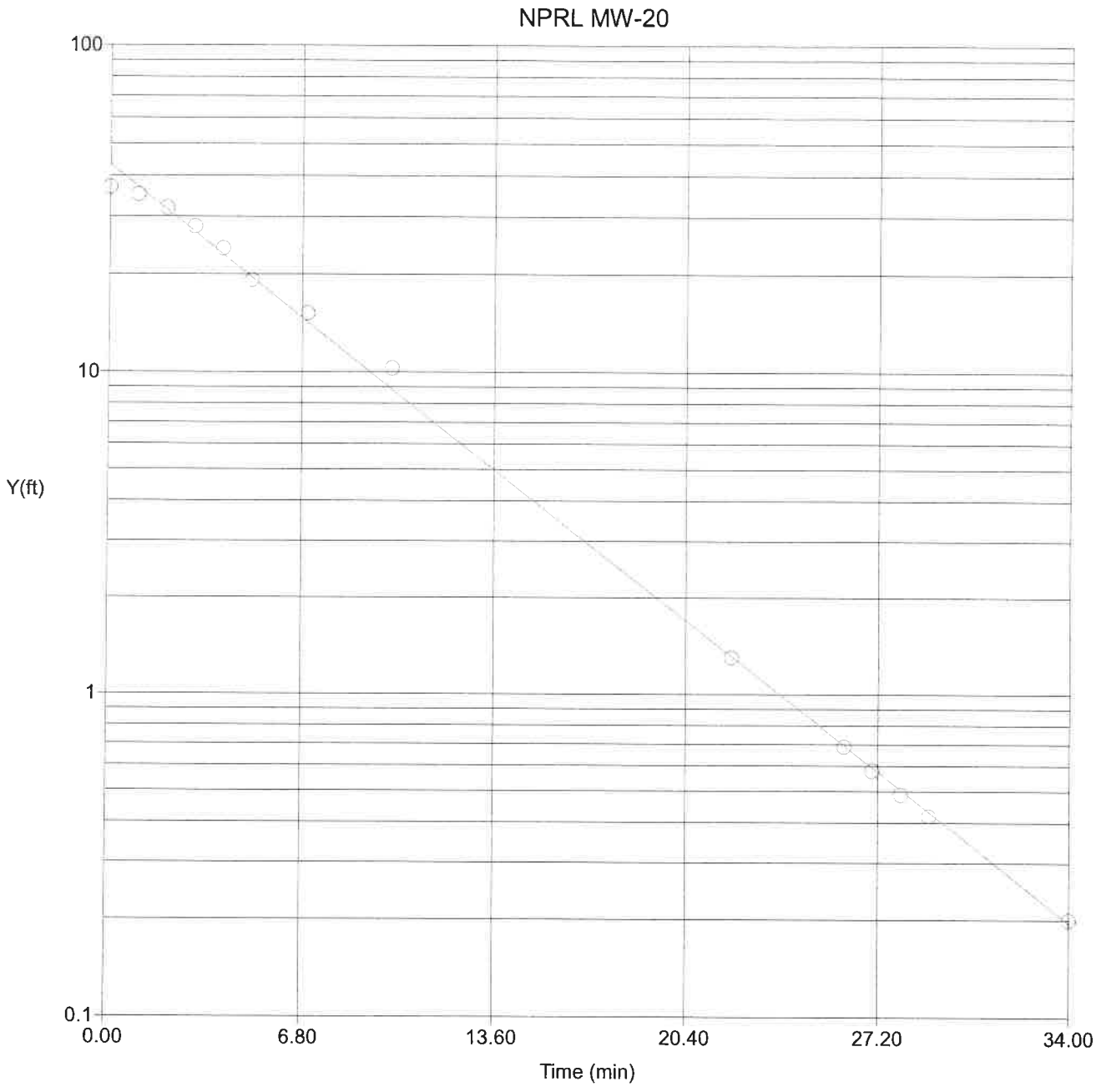
WELL GEOMETRY
H: 50.72 ft
Lw: 40.72 ft
Le: 10.0 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 30.0
A: 2.42
B: 0.35
C: 2.0
Ln(Re/rw): 2.86

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -2.65e-03
Intercept: 7.18

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	36.87	Use	36.87	43.2
1	35.02	Use	35.02	36.9
2	31.85	Use	31.85	31.5
3	27.93	Use	27.93	26.8
4	23.97	Use	23.97	22.9
5	19.17	Use	19.17	19.5
7	15.17	Use	15.17	14.2
10	10.28	Use	10.28	8.83
22	1.3	Use	1.3	1.31
26	0.69	Use	0.69	0.696
27	0.58	Use	0.58	0.594
28	0.49	Use	0.49	0.507
29	0.42	Use	0.42	0.432
34	0.2	Use	0.2	0.196



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 3.21e-04 cm/sec	Well: MW-20	Slug Test Date: 06/27/2019
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2019

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 3.99e-04 cm/sec
Monitoring Well: MW-21
Test Date: 06/27/2019
Field Testing by: TDW
Test Analysis by: TDW

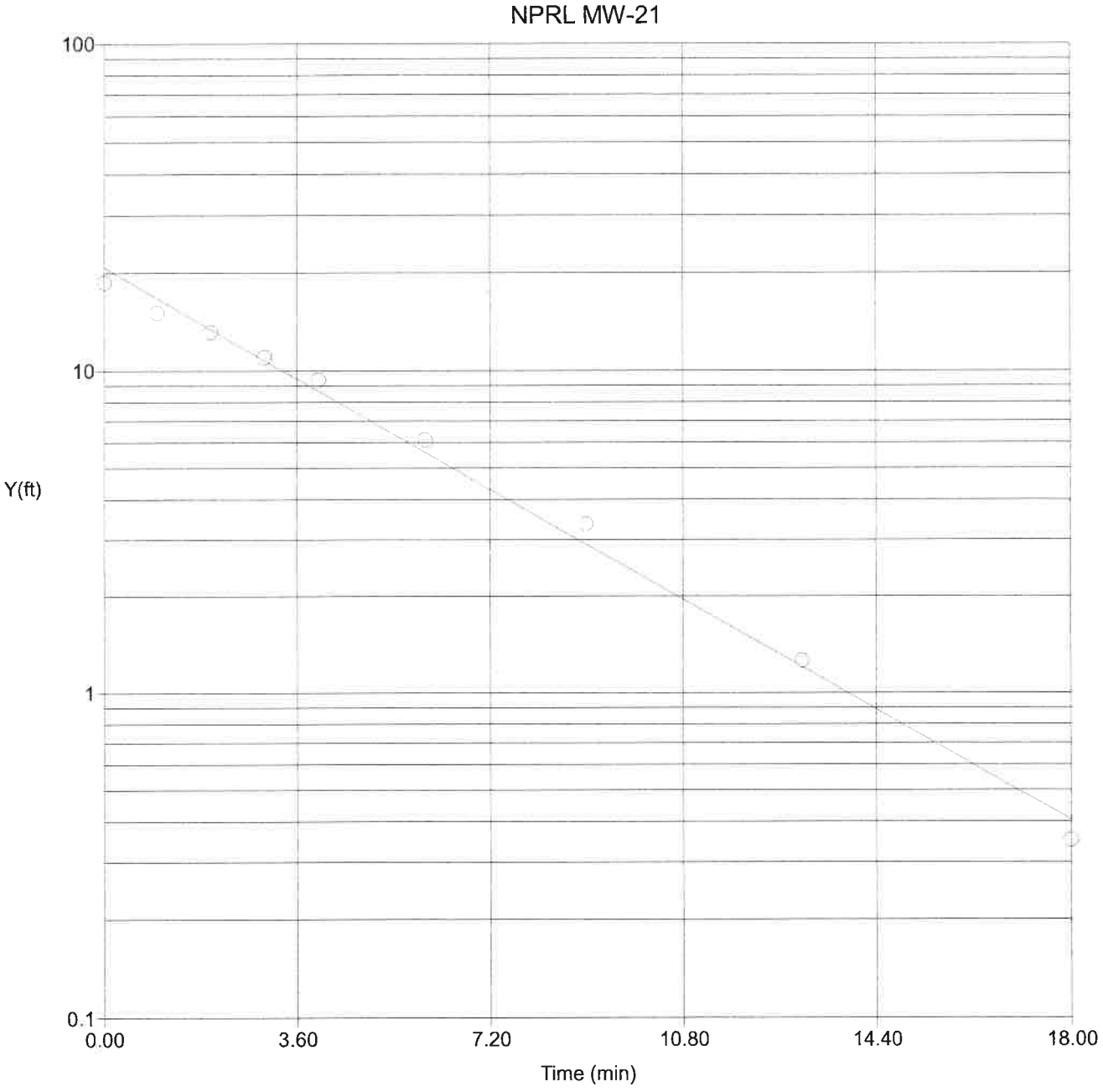
WELL GEOMETRY
H: 30.7 ft
Lw: 20.7 ft
Le: 10.0 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 30.0
A: 2.42
B: 0.35
C: 2.0
Ln(Re/rw): 2.59

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -3.65e-03
Intercept: 6.45

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	18.7	Use	18.7	20.8
1	15	Use	15	16.7
2	13.15	Use	13.15	13.4
3	11.03	Use	11.03	10.8
4	9.38	Use	9.38	8.66
6	6.1	Use	6.1	5.59
9	3.35	Use	3.35	2.9
13	1.26	Use	1.26	1.21
18	0.35	Use	0.35	0.405



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 3.99e-04 cm/sec	Well: MW-21	Slug Test Date: 06/27/2019
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2020

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 3.48e-04 cm/sec
Monitoring Well: MW-3AR
Test Date: 04/27/2020
Field Testing by: JGH
Test Analysis by: TDW

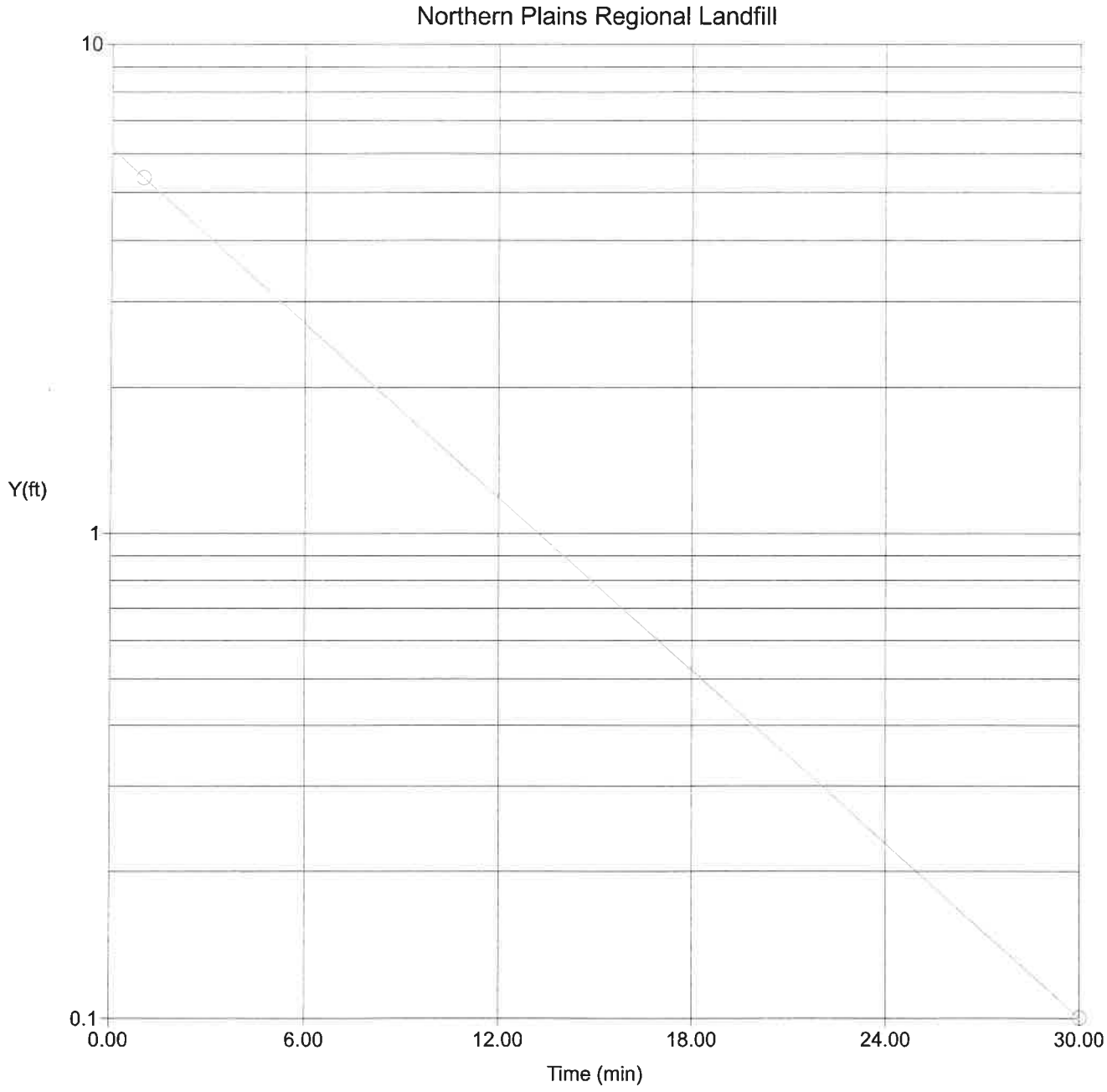
WELL GEOMETRY
H: 16.95 ft
Lw: 6.95 ft
Le: 5 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 1.8

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -2.29e-03
Intercept: 5.23

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
1	5.35	Use	5.35	5.35
30	0.1	Use	0.1	0.1



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 3.48e-04 cm/sec	Well: MW-3AR	Slug Test Date: 04/27/2020
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2020

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 7.65e-04 cm/sec
Monitoring Well: MW-7A
Test Date: 04/27/2020
Field Testing by: JGH
Test Analysis by: TDW

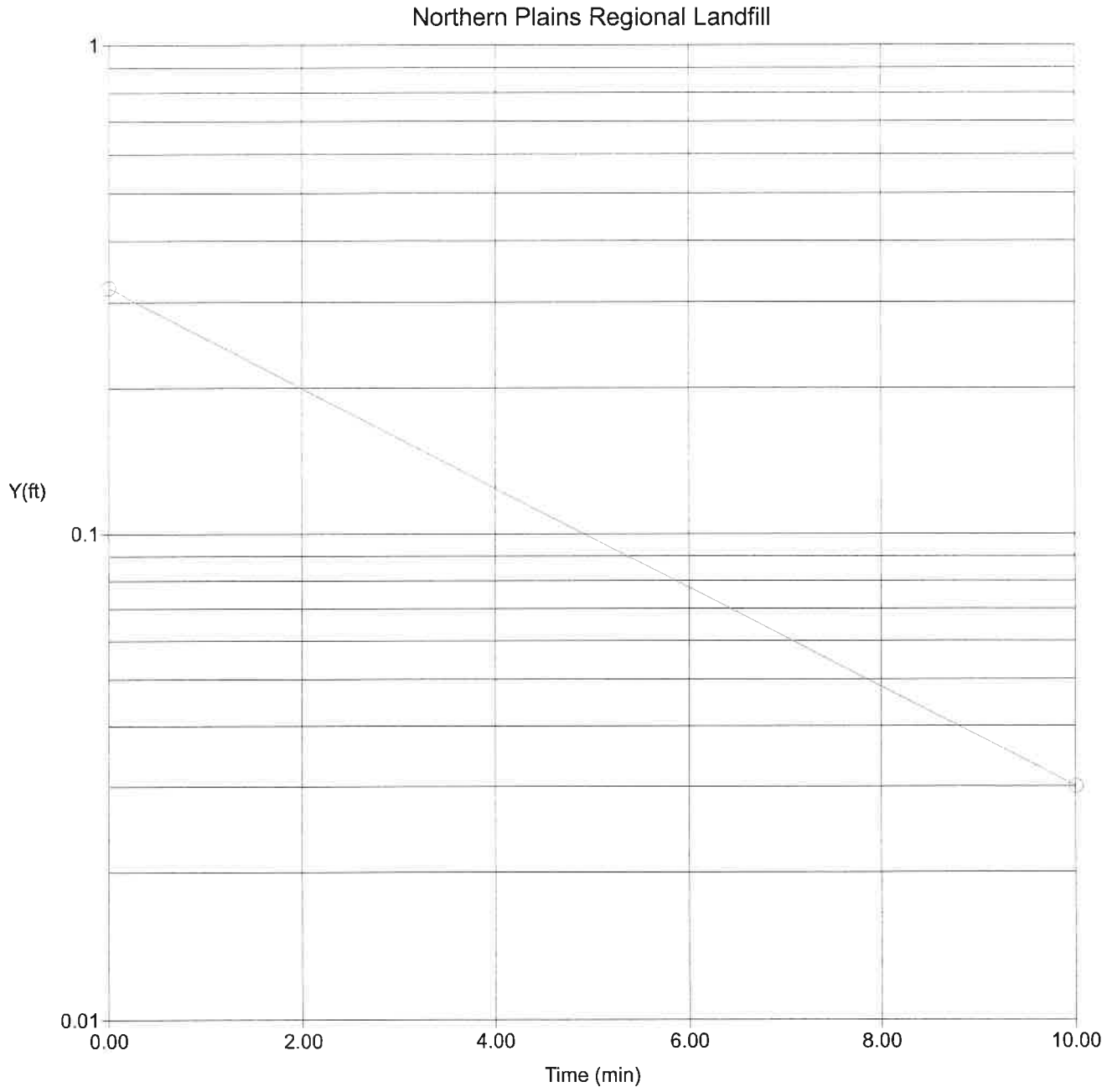
WELL GEOMETRY
H: 14.17 ft
Lw: 4.17 ft
Le: 3.0 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 9.0
A: 1.84
B: 0.232
C: 0.958
Ln(Re/rw): 1.37

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -3.95e-03
Intercept: 2.28

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	0.32	Use	0.32	0.32
10	0.03	Use	0.03	0.03



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 7.65e-04 cm/sec	Well: MW-7A	Slug Test Date: 04/27/2020
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2020

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 1.15e-04 cm/sec
Monitoring Well: MW-7B
Test Date: 04/27/2020
Field Testing by: JGH
Test Analysis by: TDW

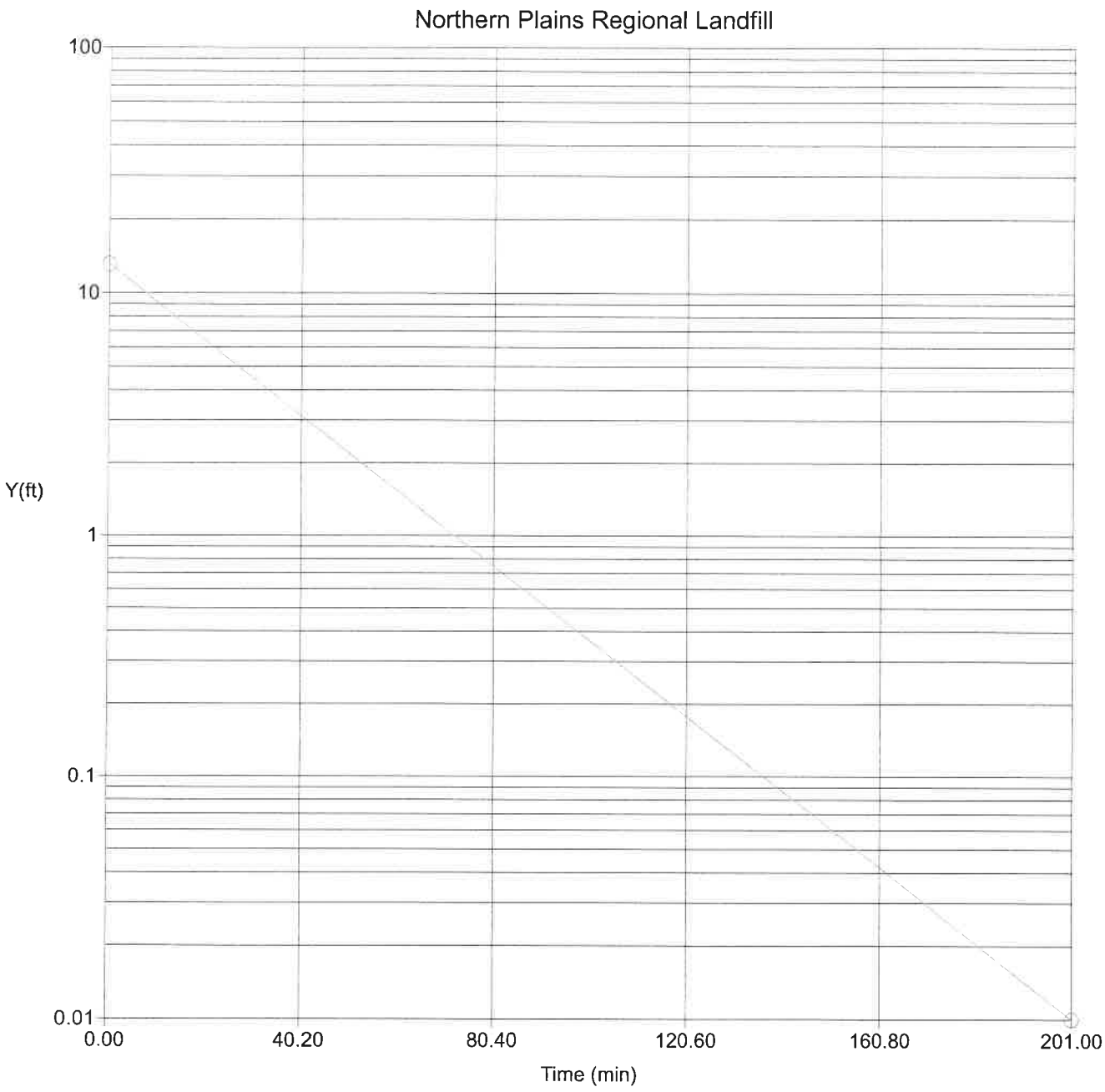
WELL GEOMETRY
H: 39.48 ft
Lw: 29.48 ft
Le: 5.0 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 2.27

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -5.95e-04
Intercept: 5.99

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	13.08	Use	13.08	13.1
201	0.01	Use	0.01	0.01



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 1.15e-04 cm/sec	Well: MW-7B	Slug Test Date: 04/27/2020
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2020

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 0.00143 cm/sec
Monitoring Well: MW-8
Test Date: 04/27/2020
Field Testing by: JGH
Test Analysis by: TDW

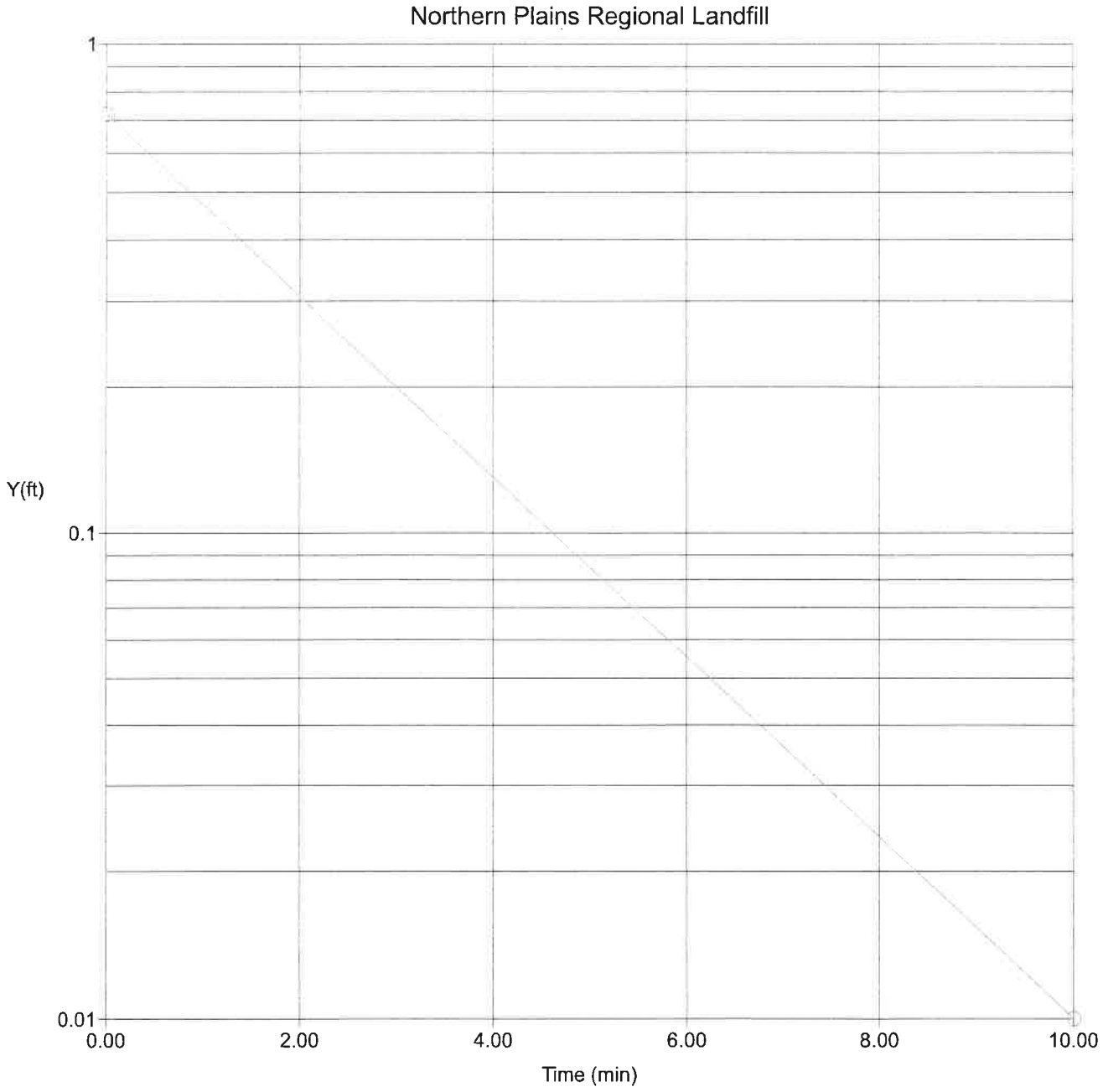
WELL GEOMETRY
H: 14.85 ft
Lw: 4.85 ft
Le: 3.0 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 9.0
A: 1.84
B: 0.232
C: 0.958
Ln(Re/rw): 1.42

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -7.13e-03
Intercept: 3.09

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	0.72	Use	0.72	0.72
10	0.01	Use	0.01	0.01



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 0.00143 cm/sec	Well: MW-8	Slug Test Date: 04/27/2020
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2020

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 0.00149 cm/sec
Monitoring Well: MW-9
Test Date: 04/27/2020
Field Testing by: JGH
Test Analysis by: TDW

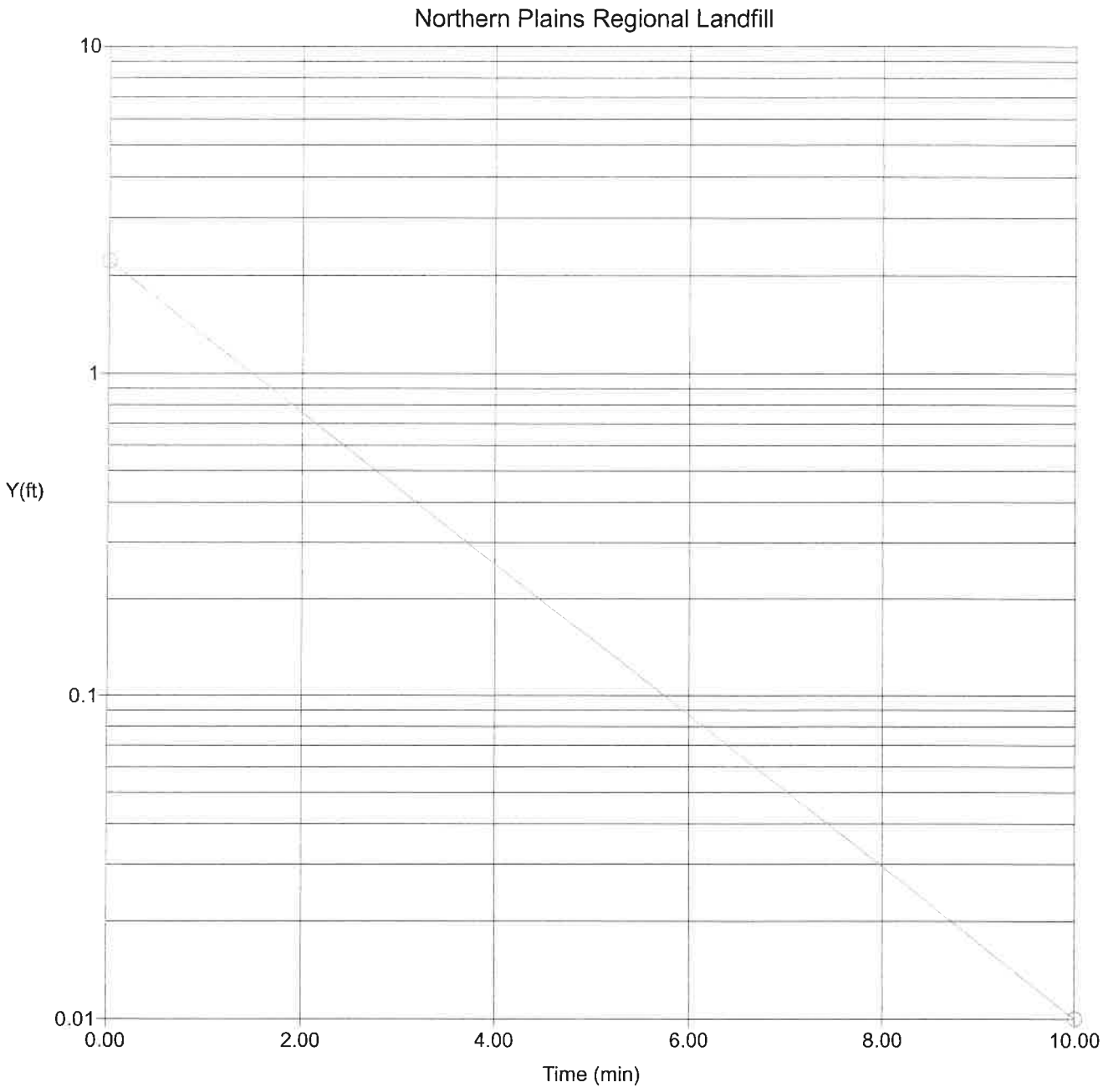
WELL GEOMETRY
H: 20.67 ft
Lw: 10.67 ft
Le: 5.0 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 1.95

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -9.00e-03
Intercept: 4.21

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	2.22	Use	2.22	2.22
10	0.01	Use	0.01	0.01



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 0.00149 cm/sec	Well: MW-9	Slug Test Date: 04/27/2020
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2020

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 8.00e-05 cm/sec
Monitoring Well: MW-10
Test Date: 04/27/2020
Field Testing by: JGH
Test Analysis by: TDW

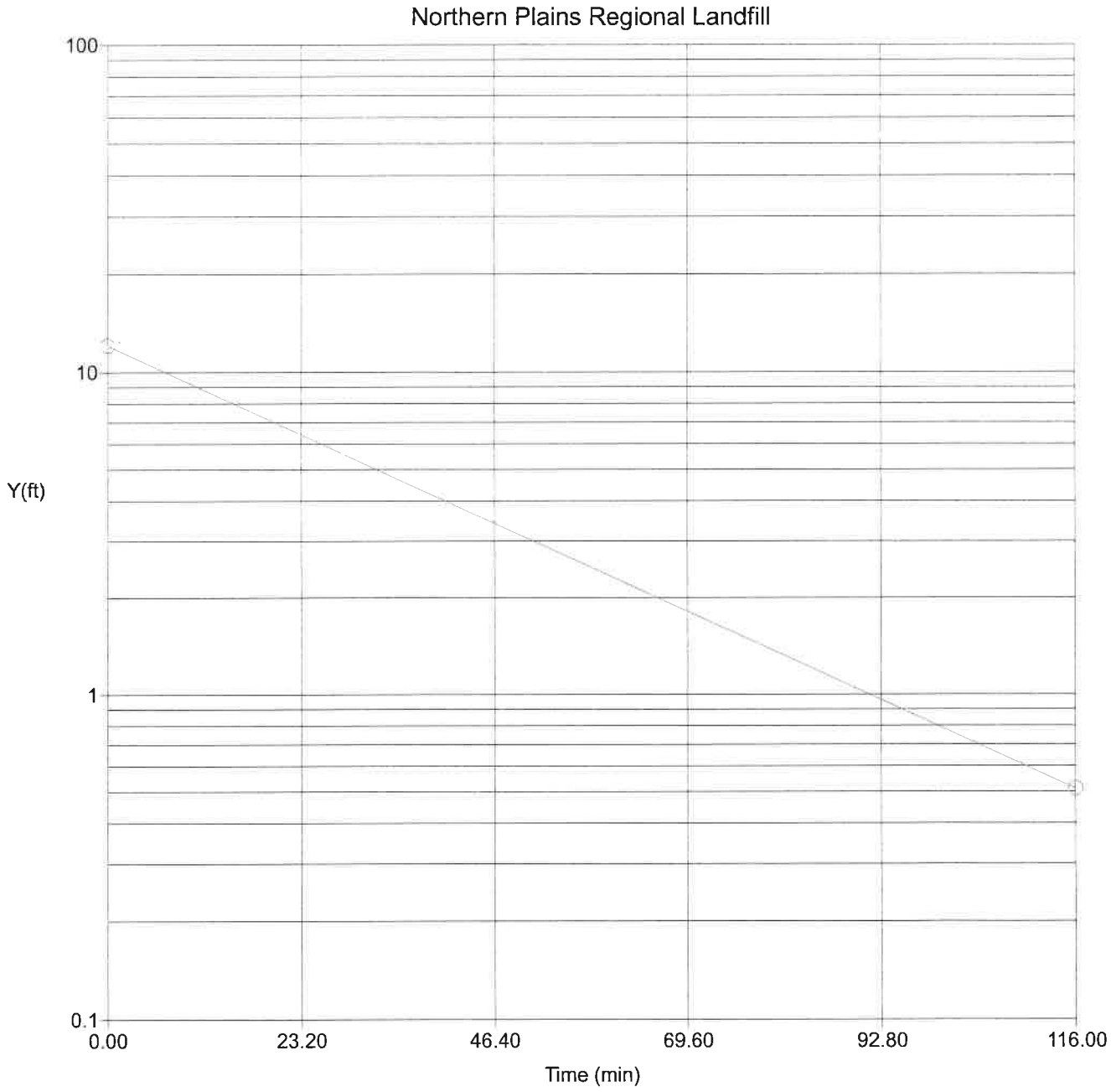
WELL GEOMETRY
H: 25.49 ft
Lw: 15.49 ft
Le: 5.0 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 2.08

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -4.54e-04
Intercept: 5.91

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	12.04	Use	12.04	12.0
116	0.51	Use	0.51	0.51



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 8.00e-05 cm/sec	Well: MW-10	Slug Test Date: 04/27/2020
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2020

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 0.00165 cm/sec
Monitoring Well: MW-14
Test Date: 04/27/2020
Field Testing by: JGH
Test Analysis by: TDW

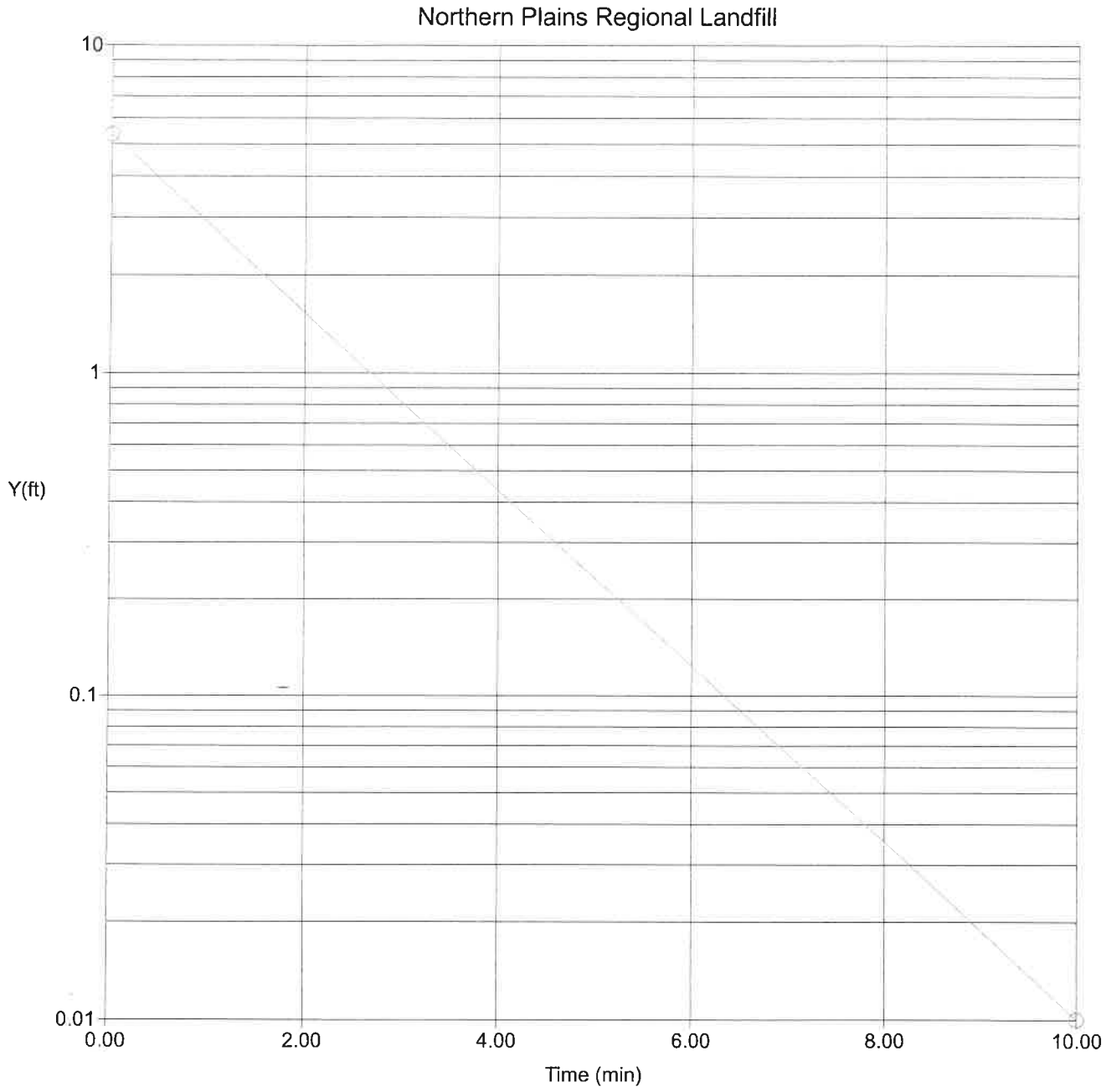
WELL GEOMETRY
H: 18.19 ft
Lw: 8.19 ft
Le: 5 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 1.86

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -1.05e-02
Intercept: 5.09

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	5.35	Use	5.35	5.35
10	0.01	Use	0.01	0.01



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 0.00165 cm/sec	Well: MW-14	Slug Test Date: 04/27/2020
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2020

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 8.06e-04 cm/sec
Monitoring Well: MW-15
Test Date: 04/27/2020
Field Testing by: JGH
Test Analysis by: TDW

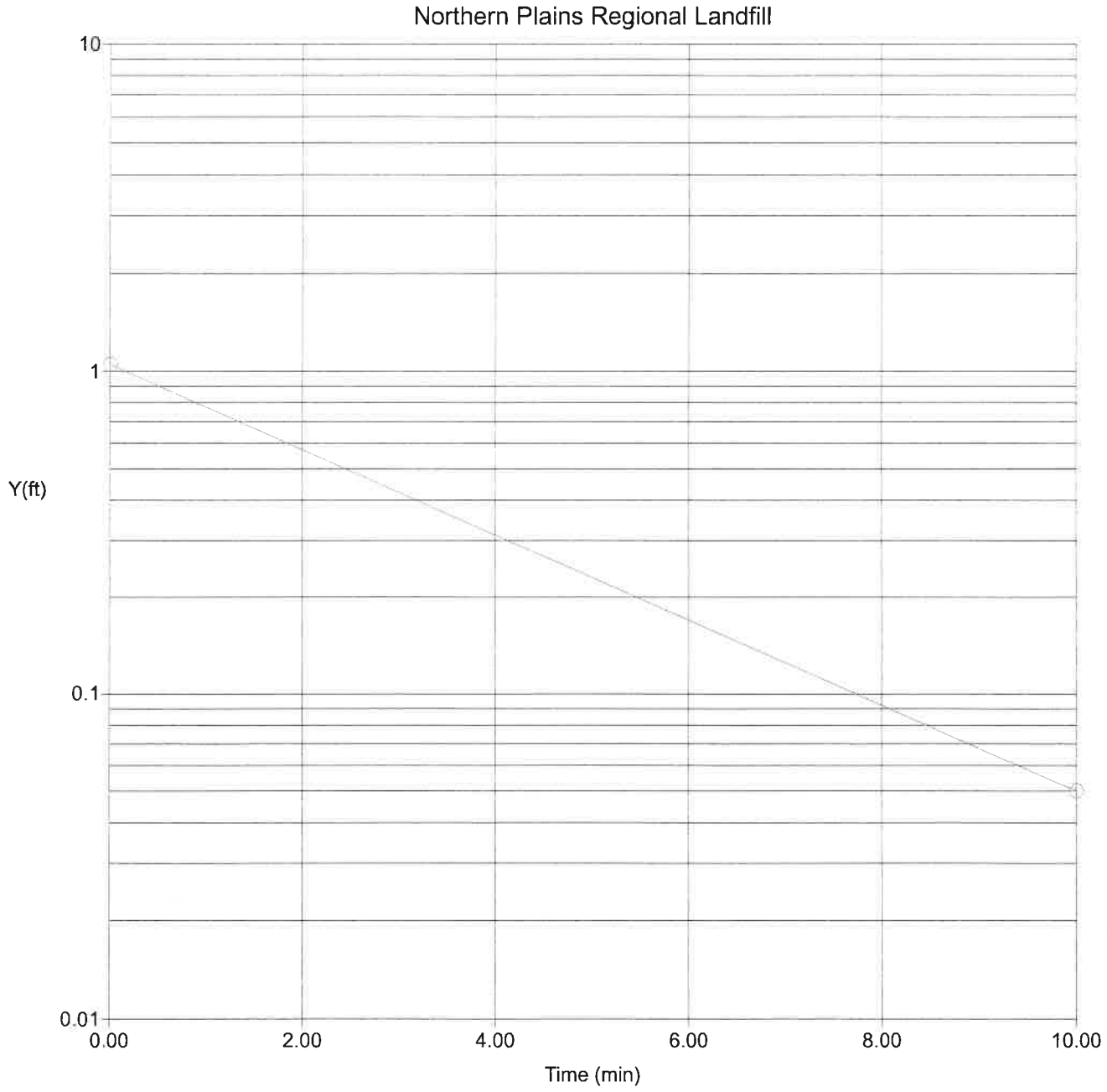
WELL GEOMETRY
H: 18.6 ft
Lw: 8.6 ft
Le: 5 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 1.88

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -5.07e-03
Intercept: 3.47

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	1.05	Use	1.05	1.05
10	0.05	Use	0.05	0.05



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 8.06e-04 cm/sec	Well: MW-15	Slug Test Date: 04/27/2020
HLW Engineering Group	CGWP:	

BOUWER-RICE SLUG TEST ANALYSIS

SITE
Norther Plains Regional Landfill
Graettinger, Iowa

CLIENT
Northern Plains Regional Landfill
Job/Account: 6021 2020

CONSULTANT
HLW Engineering Group

SLUG TEST
Hydraulic Conductivity: 7.37e-04 cm/sec
Monitoring Well: MW-16
Test Date: 04/27/2020
Field Testing by: JGH
Test Analysis by: TDW

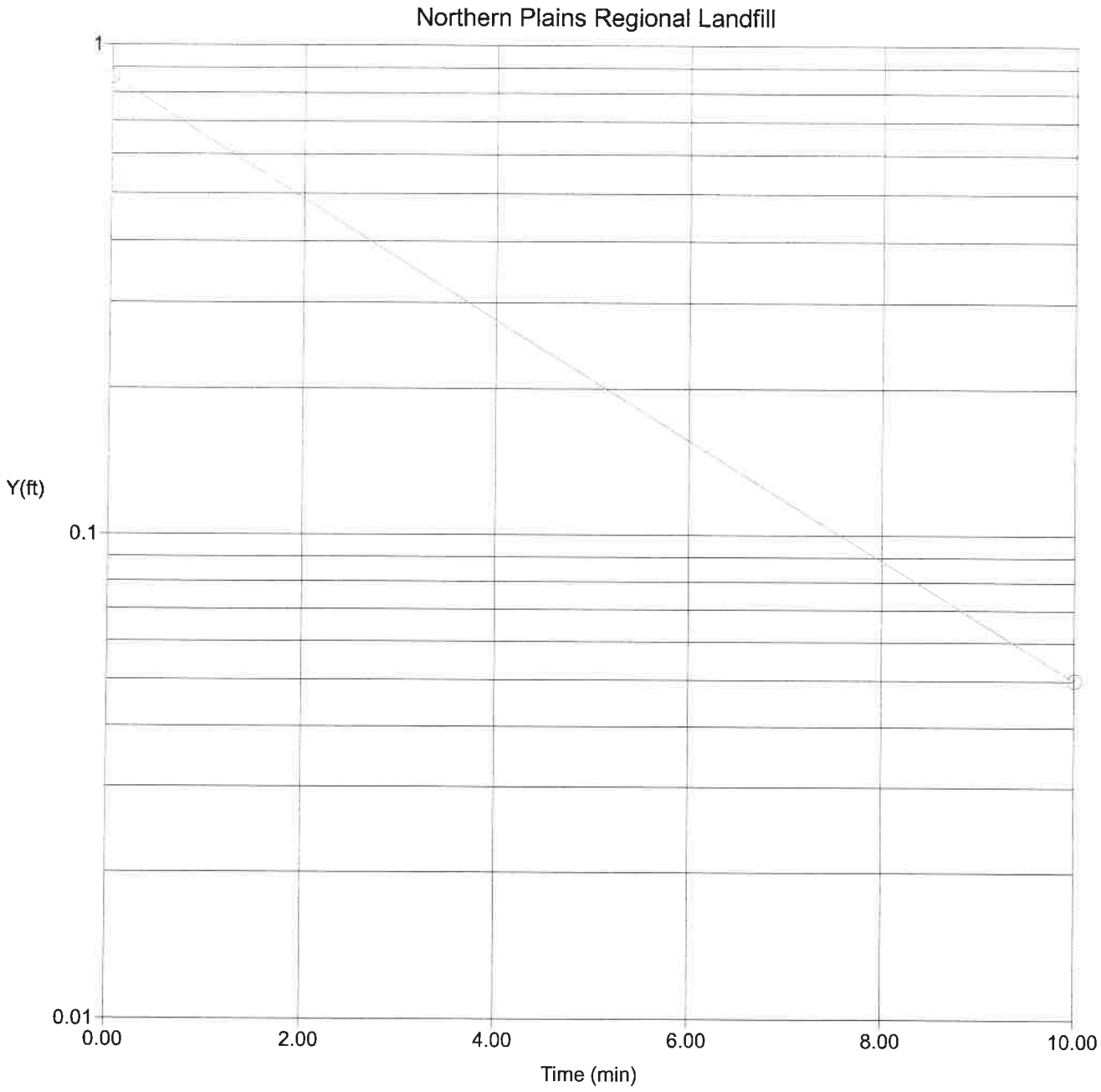
WELL GEOMETRY
H: 17.71 ft
Lw: 7.71 ft
Le: 5 ft
dw: 0.66667 ft, rw: 0.333 ft
dc: 0.16667 ft, rc: 0.0833 ft
Drained Filter Pack Porosity (%): 20
Effective Radius (re): 0.167 ft
Slug Volume(L):

BOUWER-RICE COEFFICIENTS
Le/rw: 15.0
A: 2.0
B: 0.269
C: 1.26
Ln(Re/rw): 1.84

LEAST SQUARES BEST FIT
Ln(Y)-cm versus Time-sec
Slope: -4.74e-03
Intercept: 3.27

Slug Test Type: Rising head
Recovery Data Type: Y: Change in Head
Static Water Level: Not Applicable

Time (min)	Recovery:Y(ft)	Fit Criteria	Y(ft)	Fit Y(ft)
0	0.86	Use	0.86	0.86
10	0.05	Use	0.05	0.05



LUST No.:	Site Name: Norther Plains Regional Landfill	
Hydraulic Conductivity: 7.37e-04 cm/sec	Well: MW-16	Slug Test Date: 04/27/2020
HLW Engineering Group	CGWP:	

APPENDIX 7

1994 & 2004 Hydraulic Conductivity Lab Testing Data

COEFFICIENT OF PERMEABILITY

FALLING HEAD TEST

Project No. Flannegan Hydro/Geo Sample M.W. 6A 4' Depth

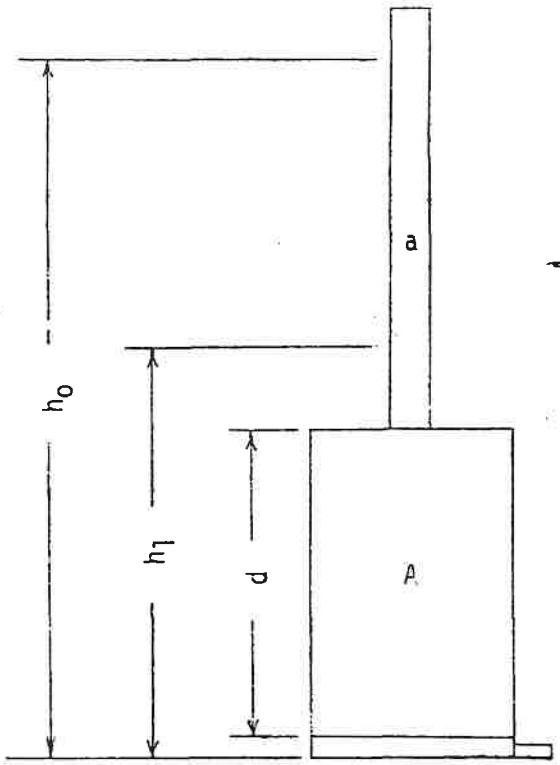
Owner or Engineer Flannegan Landfill Date 11-15-94

Sample Location M.W. #6A Technician M.T.

Coefficient of Permeability K = 7.61×10^{-8} cm.sec.

Inside diameter of tube	=	0.3125 in.
Area of tube (a)	=	0.076699 in^2
Sample diameter	=	1.3125 in
Sample area (A)	=	1.352971 in^2
Sample length (d)	=	2.8125 in
Initial head (h_o)	=	18.45 in
Final head (h_1)	=	17.81 in
Time Elapsed (t_1)	=	5575 min.
Sample weight	=	
Specific Gravity	=	
Vol. Solids, V_s	=	
Vol. Voids, $Ad - V_s$	=	
Void ratio, e_1	=	
Moisture Content	=	

$$K = \frac{ad}{At_1} \log_e \frac{h_o}{h_1}$$



JACOBSON-WESTERGARD & ASSOC., INC.
105 S Sixth St Estherville, Iowa 51334

PROJECT No.

COEFFICIENT OF PERMEABILITY

FALLING HEAD TEST

Project No. Flannegan Hydro/Geo Sample MW 7A 3.5' Depth

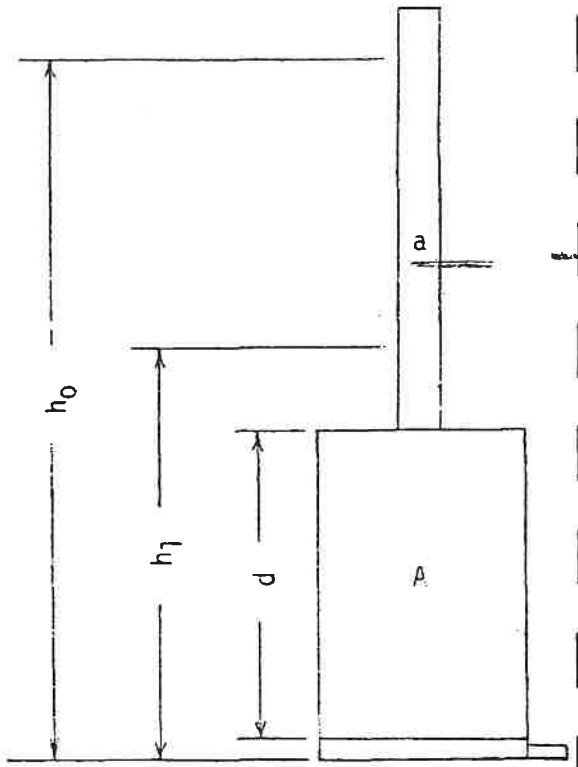
Owner or Engineer Flannegan Landfill Date 11-17-94

Sample Location M.W. 7A Technician M.T.

Coefficient of Permeability K = 5.40×10^{-8} cm/sec

Inside diameter of tube	=	0.3125 in
Area of tube (a)	=	0.076699 in^2
Sample diameter	=	1.3125 in
Sample area (A)	=	1.352971 in^2
Sample length (d)	=	2.8125 in
Initial head (h_o)	=	17.91 in
Final head (h_1)	=	16.82 in
Time Elapsed (t_1)	=	7646 min.
Sample weight	=	
Specific Gravity	=	
Vol. Solids, V_s	=	
Vol. Voids, $Ad - V_s$	=	
Void ratio, e_1	=	
Moisture Content	=	

$$K = \frac{ad}{At_1} \log_e \frac{h_o}{h_1}$$



JACOBSON-WESTERGARD
& ASSOC., INC.
105 S Sixth St Estherville. Iowa 51334

PROJECT No.

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill Project No.: 1-1424

Sample: 1 Started: 6/12/04 Completed: 6/13/04

Sample Location: Boring PSB-B, Sample 2, 10-12'

Test Procedure: ASTM D-5084

Sample Description: SILT with Sand light orange brown trace gray

Head Pressure: 15.8 psi Back Pressure: 50.0 psi Confining Pressure: 60.6 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (cm^3)**	**Flow Rate (cm^3/s)**
Weight (g)	1150.8	0	3.50	-
Height (in)	5.750	420	4.05	0.001309524
Diameter (in)	2.875	1020	4.40	0.00058333
Area (cm^2)	41.883	1500	4.70	0.000625
Volume (cm^3)	611.7	2100	5.10	0.00066667
Water Content (%)	22.5	2820	5.60	0.00069444
Dry Unit Weight (pcf)	95.879	3420	6.00	0.00066667
Initial Dial Reading (in)	0.598	4320	6.60	0.00066667
Final Dial Reading (in)	0.643	4860	6.95	0.00064815
Sample Finals		5580	7.40	0.000625
Weight (g)	1153.3	6240	7.90	0.00075758
Height (in)	5.705			
Diameter (in)	2.8525			
Area (cm^2)	41.23			
Volume (cm^3)	597.45			
Water Content (%)	30.0			
Dry Unit Weight (pcf)	92.703			
Difference of Head Pressure (psi)	34.2		**Average Flow Rate Based on last 8 Readings (cm^3/s)**	0.00066877
			Coefficient of Permeability k (cm/s)	**9.78e-08**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill Project No.: 1-1424

Sample: 2 Started: 6/12/04 Completed: 6/13/04

Sample Location: Boring PSB-C, Sample 4, 15-17'

Test Procedure: ASTM D-5084

Sample Description: Sandy Lean CLAY trace Gravel orange brown rust stained

Head Pressure: 15.1 psi Back Pressure: 49.8 psi Confining Pressure: 60.5 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (cm^3)**	**Flow Rate (cm^3/s)**
Weight (g)	1279.5	0	8.75	-
Height (in)	5.750	660	9.50	0.001136364
Diameter (in)	2.875	1320	9.85	0.0005303
Area (cm^2)	41.883	2220	10.40	0.00061111
Volume (cm^3)	611.7	3960	11.45	0.00060345
Water Content (%)	18.0	4740	12.05	0.00076923
Dry Unit Weight (pcf)	110.67	5640	12.65	0.00066667
Initial Dial Reading (in)	0.544	6300	13.05	0.00060606
Final Dial Reading (in)	0.571	7200	13.85	0.00088889
Sample Finals		7740	14.20	0.00064815
Weight (g)	1286.6	8340	14.60	0.00066667
Height (in)	5.723			
Diameter (in)	2.8615			
Area (cm^2)	41.49			
Volume (cm^3)	603.12			
Water Content (%)	18.3			
Dry Unit Weight (pcf)	112.58			
Difference of Head Pressure (psi)	34.7		**Average Flow Rate Based on last 8 Readings (cm^3/s)**	0.00068253
			Coefficient of Permeability k (cm/s)	**9.80e-08**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill Project No.: 1-1424

Sample: 3 Started: 6/12/04 Completed: 6/13/04

Sample Location: Boring PSB-H, Sample 3, 14-14.5'

Test Procedure: ASTM D-5084

Sample Description: Lean CLAY with Sand trace Gravel dark gray

Head Pressure: 15.1 psi Back Pressure: 49.8 psi Confining Pressure: 60.5 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (cm^3)**	**Flow Rate (cm^3/s)**
Weight (g)	1278.1	0	8.50	-
Height (in)	5.750	660	9.20	0.001060606
Diameter (in)	2.875	1320	9.50	0.00045455
Area (cm^2)	41.883	1920	9.70	0.00033333
Volume (cm^3)	611.7	2520	9.90	0.00033333
Water Content (%)	17.6	3300	10.10	0.00025641
Dry Unit Weight (pcf)	110.92	4200	10.45	0.00038889
Initial Dial Reading (in)	0.477	5160	10.75	0.0003125
Final Dial Reading (in)	0.500	5760	11.00	0.00041667
Sample Finals		6360	11.20	0.00033333
Weight (g)	1279.4	7140	11.45	0.00032051
Height (in)	5.727			
Diameter (in)	2.8635			
Area (cm^2)	41.548			
Volume (cm^3)	604.38			
Water Content (%)	18.0			
Dry Unit Weight (pcf)	112			
Difference of Head Pressure (psi)	34.7		**Average Flow Rate Based on last 8 Readings (cm^3/s)**	0.00033687
			Coefficient of Permeability k (cm/s)	**4.84e-08**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill Project No.: 1-1424

Sample: 4 Started: 6/13/04 Completed: 6/14/04

Sample Location: Boring PSB-D, Sample 3, 11.5-12.5'

Test Procedure: ASTM D-5084

Sample Description: Lean CLAY with Sand trace Gravel dark gray-brown

Head Pressure: 16.9 psi Back Pressure: 50.5 psi Confining Pressure: 60.6 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (cm^3)**	**Flow Rate (cm^3/s)**
Weight (g)	1249.7	0	4.90	-
Height (in)	5.750	600	5.50	0.001
Diameter (in)	2.875	1200	6.00	0.00083333
Area (cm^2)	41.883	1800	6.65	0.001083333
Volume (cm^3)	611.7	2400	7.05	0.00066667
Water Content (%)	21.5	3000	7.60	0.00091667
Dry Unit Weight (pcf)	104.98	3780	8.30	0.00089744
Initial Dial Reading (in)	0.605	4440	8.90	0.00090909
Final Dial Reading (in)	0.650	5040	9.50	0.001
Sample Finals		5640	10.10	0.001
Weight (g)	1244.2	6240	10.65	0.00091667
Height (in)	5.705			
Diameter (in)	2.8525			
Area (cm^2)	41.23			
Volume (cm^3)	597.45			
Water Content (%)	20.1			
Dry Unit Weight (pcf)	108.25			
Difference of Head Pressure (psi)	33.6		**Average Flow Rate Based on last 8 Readings (cm^3/s)**	0.00092373
			Coefficient of Permeability k (cm/s)	**1.37e-07**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill Project No.: 1-1424

Sample: 5 Started: 6/13/04 Completed: 6/14/04

Sample Location: Boring PSB-F, Sample 4, 17-19.5'

Test Procedure: ASTM D-5084

Sample Description: Sandy Lean CLAY trace Gravel dark blue-gray

Head Pressure: 15.6 psi Back Pressure: 50.4 psi Confining Pressure: 60.5 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (cm^3)**	**Flow Rate (cm^3/s)**
Weight (g)	1295.0	0	4.45	-
Height (in)	5.750	600	5.05	0.001
Diameter (in)	2.875	1200	5.40	0.00058333
Area (cm^2)	41.883	1980	5.70	0.00038462
Volume (cm^3)	611.7	3120	6.10	0.00035088
Water Content (%)	17.8	4080	6.40	0.0003125
Dry Unit Weight (pcf)	112.2	5400	6.70	0.00022727
Initial Dial Reading (in)	0.577	6300	6.95	0.00027778
Final Dial Reading (in)	0.585	7560	7.20	0.00019841
Sample Finals		8640	7.45	0.00023148
Weight (g)	1294.3	9540	7.70	0.00027778
Height (in)	5.742			
Diameter (in)	2.871			
Area (cm^2)	41.766			
Volume (cm^3)	609.15			
Water Content (%)	17.1			
Dry Unit Weight (pcf)	113.28			
Difference of Head Pressure (psi)	34.8		**Average Flow Rate Based on last 8 Readings (cm^3/s)**	0.00028259
			Coefficient of Permeability k (cm/s)	**4.03e-08**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill Project No.: 1-1424

Sample: 6 Started: 6/13/04 Completed: 6/14/04

Sample Location: Boring PSB-I, Sample 3, 14-16.5'

Test Procedure: ASTM D-5084

Sample Description: Sandy SILT medium gray-brown

Head Pressure: 15.5 psi Back Pressure: 50.5 psi Confining Pressure: 60.4 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (cm^3)**	**Flow Rate (cm^3/s)**
Weight (g)	1164.0	0	4.25	-
Height (in)	5.750	120	8.70	0.0370833333
Diameter (in)	2.875	180	10.90	0.0366666667
Area (cm^2)	41.883	240	13.10	0.0366666667
Volume (cm^3)	611.7	300	15.25	0.0358333333
Water Content (%)	29.0	360	17.40	0.0358333333
Dry Unit Weight (pcf)	92.092	420	19.60	0.0366666667
Initial Dial Reading (in)	0.507	480	21.80	0.0366666667
Final Dial Reading (in)	0.529	540	23.95	0.0358333333
Sample Finals		600	26.10	0.0358333333
Weight (g)	1160.4	660	28.30	0.0366666667
Height (in)	5.728			
Diameter (in)	2.864			
Area (cm^2)	41.563			
Volume (cm^3)	604.7			
Water Content (%)	29.2			
Dry Unit Weight (pcf)	92.725			
Difference of Head Pressure (psi)	35.0		**Average Flow Rate Based on last 8 Readings (cm^3/s)**	0.03625
***			**Coefficient of Permeability k (cm/s)**	**5.16e-06**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill Project No.: 1-1424

Sample: 7 Started: 6/14/04 Completed: 6/15/04

Sample Location: Boring PSB-G, Sample 3, 10-12.5'

Test Procedure: ASTM D-5084

Sample Description: Sandy SILT medium gray-brown

Head Pressure: 17.0 psi Back Pressure: 51.1 psi Confining Pressure: 60.2 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (cm^3)**	**Flow Rate (cm^3/s)**
Weight (g)	1138.6	0	5.90	-
Height (in)	5.750	60	8.40	0.0416666667
Diameter (in)	2.875	120	10.70	0.0383333333
Area (cm^2)	41.883	180	13.10	0.04
Volume (cm^3)	611.7	240	15.50	0.04
Water Content (%)	25.1	300	17.80	0.0383333333
Dry Unit Weight (pcf)	92.891	360	20.10	0.0383333333
Initial Dial Reading (in)	0.585	420	22.40	0.0383333333
Final Dial Reading (in)	0.610	480	24.70	0.0383333333
Sample Finals		540	27.10	0.04
Weight (g)	1128.2	600	29.30	0.0366666667
Height (in)	5.725			
Diameter (in)	2.8625			
Area (cm^2)	41.519			
Volume (cm^3)	603.75			
Water Content (%)	28.7			
Dry Unit Weight (pcf)	90.645			
Difference of Head Pressure (psi)	34.1		**Average Flow Rate Based on last 8 Readings (cm^3/s)**	0.03875
***			**Coefficient of Permeability k (cm/s)**	**5.66e-06**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill Project No.: 1-1424

Sample: 8 Started: 6/14/04 Completed: 6/15/04

Sample Location: Boring PSB-E, Sample 3, 14-16.5'

Test Procedure: ASTM D-5084

Sample Description: Sandy Lean CLAY trace Gravel medium brown rust stained

Head Pressure: 16.0 psi Back Pressure: 50.9 psi Confining Pressure: 60.4 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (cm^3)**	**Flow Rate (cm^3/s)**
Weight (g)	1249.0	0	4.65	-
Height (in)	5.750	480	5.00	0.00072917
Diameter (in)	2.875	900	5.45	0.001071429
Area (cm^2)	41.883	1440	5.80	0.00064815
Volume (cm^3)	611.7	2640	7.20	0.001166667
Water Content (%)	20.4	3060	7.70	0.001190476
Dry Unit Weight (pcf)	105.88	3600	8.20	0.00092593
Initial Dial Reading (in)	0.570	3900	8.70	0.001666667
Final Dial Reading (in)	0.601	4380	9.20	0.001041667
Sample Finals		4740	9.60	0.001111111
Weight (g)	1247.1	5220	10.10	0.001041667
Height (in)	5.719			
Diameter (in)	2.8595			
Area (cm^2)	41.432			
Volume (cm^3)	601.86			
Water Content (%)	20.5			
Dry Unit Weight (pcf)	107.35			
Difference of Head Pressure (psi)	34.9		**Average Flow Rate Based on last 8 Readings (cm^3/s)**	0.001099041
			Coefficient of Permeability k (cm/s)	**1.57e-07**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill Project No.: 1-1424

Sample: 9 Started: 6/14/04 Completed: 6/15/04

Sample Location: Boring PSB-A, Sample 3, 12-14'

Test Procedure: ASTM D-5084

Sample Description: Very Sandy Lean CLAY trace Gravel medium brown

Head Pressure: 15.7 psi Back Pressure: 51.0 psi Confining Pressure: 60.9 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (cm^3)**	**Flow Rate (cm^3/s)**
Weight (g)	1254.4	0	2.95	-
Height (in)	5.750	600	3.40	0.00075
Diameter (in)	2.875	1320	3.80	0.00055556
Area (cm^2)	41.883	1800	4.05	0.00052083
Volume (cm^3)	611.7	2700	4.55	0.00055556
Water Content (%)	23.0	3180	4.80	0.00052083
Dry Unit Weight (pcf)	104.09	3780	5.00	0.00033333
Initial Dial Reading (in)	0.469	4140	5.35	0.00097222
Final Dial Reading (in)	0.494	4920	5.80	0.00057692
Sample Finals		5640	6.20	0.00055556
Weight (g)	1244.2	6060	6.45	0.00059524
Height (in)	5.725			
Diameter (in)	2.8625			
Area (cm^2)	41.519			
Volume (cm^3)	603.75			
Water Content (%)	19.4			
Dry Unit Weight (pcf)	107.75			
Difference of Head Pressure (psi)	35.3		**Average Flow Rate Based on last 8 Readings (cm^3/s)**	0.00057881
			Coefficient of Permeability k (cm/s)	**8.17e-08**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill, Graettinger, IA

Project No.: 2-2284

Sample ID: 1 Started: 8/29/04 Completed: 9/1/04

Sample Location: Native - Sample 3 near PSB-B **(REVISED)**

Test Procedure: ASTM D-5084/Geotest Panel

Sample Description: Sandy lean CLAY, trace iron staining, light gray/brown

Remolded at 100% Proctor Effort, 3.3% Over Optimum moisture

Head Pressure: 25.0 psi Back Pressure: 20.0 psi Confining Pressure: 40.0 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (0.1Xcm³)**	**Flow Rate (cm³/s)**
Weight (g)	1165.6	0	16.40	-
Height (in)	5.75	120	17.30	0.00075
Diameter (in)	2.875	240	17.75	0.000375
Area (cm²)	41.883	360	18.05	0.00025
Volume (cm³)	611.7	480	18.25	0.00016667
Water Content (%)	19.3	600	18.55	0.00025
Dry Unit Weight (pcf)	99.716	720	18.65	0.00016667
Initial Dial Reading (in)	0.357	840	18.80	0.000125
Final Dial Reading (in)	0.260	960	18.90	0.0000833
Sample Finals		1080	19.05	0.000125
Weight (g)	1170.5	1200	19.20	0.000125
Height (in)	5.653			
Diameter (in)	2.8265			
Area (cm²)	40.481			
Volume (cm³)	581.26			
Water Content (%)	20.9			
Dry Unit Weight (pcf)	103.98			
Difference of Head Pressure (psi)	5.0		**Average Flow Rate Based on last 6 Readings (cm³/s)**	0.00014583
			Coefficient of Permeability k (cm/s)	**1.47e-07**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill, Graettinger, IA

Project No.: 2-2284

Sample ID: 2 Started: 8/29/04 Completed: 9/1/04

Sample Location: Native - Sample 3 near PSB-B **(REVISED)**

Test Procedure: ASTM D-5084/Geotest Panel

Sample Description: Sandy lean CLAY, trace iron staining, light gray/brown

Remolded at 100% Proctor Effort, -1.5% Under Optimum moisture

Head Pressure: 25.0 psi Back Pressure: 20.0 psi Confining Pressure: 40.0 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (0.1Xcm³)**	**Flow Rate (cm³/s)**
Weight (g)	1188.4	0	3.60	-
Height (in)	5.75	120	7.50	0.00325
Diameter (in)	2.875	240	10.00	0.002083333
Area (cm²)	41.883	360	12.95	0.002458333
Volume (cm³)	611.7	480	14.45	0.00125
Water Content (%)	14.5	600	15.90	0.001208333
Dry Unit Weight (pcf)	105.93	720	17.75	0.001375
Initial Dial Reading (in)	0.628	840	19.25	0.00125
Final Dial Reading (in)	0.592	960	20.95	0.001416667
Sample Finals		1080	22.55	0.001333333
Weight (g)	1221.3	1200	24.05	0.00125
Height (in)	5.714			
Diameter (in)	2.857			
Area (cm²)	41.36			
Volume (cm³)	600.28			
Water Content (%)	18.0			
Dry Unit Weight (pcf)	107.64			
Difference of Head Pressure (psi)	5.0		**Average Flow Rate Based on last 6 Readings (cm³/s)**	0.001305556
			Coefficient of Permeability k (cm/s)	**1.30e-06**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill, Graettinger, IA

Project No.: 2-2284

Sample ID: 3 Started: 9/1/04 Completed: 9/7/04

Sample Location: Native - Sample 1 adjacent to Cell 21-A

Test Procedure: ASTM D-5084

Sample Description: Sandy lean CLAY, trace iron staining, light gray/brown

Remolded approx. 95% Proctor Effort (20 blows) near Optimum Moisture

Head Pressure: 25.0 psi Back Pressure: 20.0 psi Confining Pressure: 40.0 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (0.1Xcm³)**	**Flow Rate (cm³/s)**
Weight (g)	1190.2	0	18.75	-
Height (in)	5.75	120	18.90	0.000125
Diameter (in)	2.875	240	19.05	0.000125
Area (cm²)	41.883	360	19.15	0.0000833
Volume (cm³)	611.7	480	19.25	0.0000833
Water Content (%)	16.6	600	19.35	0.0000833
Dry Unit Weight (pcf)	104.18	720	19.45	0.0000833
Initial Dial Reading (in)	0.390	840	19.50	0.0000417
Final Dial Reading (in)	0.309	960	19.60	0.0000833
Sample Finals		1080	19.70	0.0000833
Weight (g)	1223.0	1200	19.80	0.0000833
Height (in)	5.669			
Diameter (in)	2.8345			
Area (cm²)	40.711			
Volume (cm³)	586.21			
Water Content (%)	19.8			
Dry Unit Weight (pcf)	108.72			
Difference of Head Pressure (psi)	5.0		**Average Flow Rate Based on last 8 Readings (cm³/s)**	0.0000781
			Coefficient of Permeability k (cm/s)	**7.86e-08**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill, Graettinger, IA

Project No.: 2-2284

Sample ID: 4 Started: 9/1/04 Completed: 9/7/04

Sample Location: Native - Sample 1 adjacent to Cell 21-A

Test Procedure: ASTM D-5084

Sample Description: Sandy lean CLAY, trace iron staining, light gray/brown

Remolded approx. 100% Proctor Effort near Optimum Moisture

Head Pressure: 25.0 psi Back Pressure: 20.0 psi Confining Pressure: 40.0 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (0.1Xcm³)**	**Flow Rate (cm³/s)**
Weight (g)	1250.1	0	14.50	-
Height (in)	5.75	120	14.65	0.000125
Diameter (in)	2.875	240	14.75	0.0000833
Area (cm²)	41.883	360	14.80	0.0000417
Volume (cm³)	611.7	480	14.85	0.0000417
Water Content (%)	16.6	600	14.85	0
Dry Unit Weight (pcf)	109.42	720	14.90	0.0000208
Initial Dial Reading (in)	0.646	840	14.95	0.0000417
Final Dial Reading (in)	0.615	960	15.00	0.0000417
Sample Finals		1080	15.00	0
Weight (g)	1276.4	1200	15.05	0.0000417
Height (in)	5.719			
Diameter (in)	2.8595			
Area (cm²)	41.432			
Volume (cm³)	601.86			
Water Content (%)	18.7			
Dry Unit Weight (pcf)	111.54			
Difference of Head Pressure (psi)	5.0		**Average Flow Rate Based on last 8 Readings (cm³/s)**	0.0000286
			Coefficient of Permeability k (cm/s)	**2.86e-08**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill, Graettinger, IA

Project No.: 2-2284

Sample ID: 5 Started: 9/8/04 Completed: 9/11/04

Sample Location: Import - Sample 2 Near PSB-A

Test Procedure: ASTM D-5084

Sample Description: Sandy SILT, light gray/brown, iron stained

Remolded approx. 95% Proctor Effort near Optimum Moisture

Head Pressure: 25.0 psi Back Pressure: 20.0 psi Confining Pressure: 40.0 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (0.1Xcm³)**	**Flow Rate (cm³/s)**
Weight (g)	1235.2	0	17.30	-
Height (in)	5.75	120	18.30	0.00083333
Diameter (in)	2.875	240	18.80	0.00041667
Area (cm²)	41.883	360	19.30	0.00041667
Volume (cm³)	611.7	480	19.55	0.00020833
Water Content (%)	15.7	600	19.80	0.00020833
Dry Unit Weight (pcf)	108.96	720	20.10	0.00022917
Initial Dial Reading (in)	0.347	840	20.40	0.00025
Final Dial Reading (in)	0.285	960	20.65	0.00020833
Sample Finals		1080	20.80	0.000125
Weight (g)	1258.2	1200	21.05	0.00020833
Height (in)	5.688			
Diameter (in)	2.844			
Area (cm²)	40.984			
Volume (cm³)	592.12			
Water Content (%)	18.2			
Dry Unit Weight (pcf)	112.23			
Difference of Head Pressure (psi)	5.0		**Average Flow Rate Based on last 7 Readings (cm³/s)**	0.00020536
			Coefficient of Permeability k (cm/s)	**2.06e-07**

PERMEABILITY TEST RESULTS

Project Name: Northern Plains Regional Landfill, Graettinger, IA

Project No.: 2-2284

Sample ID: 6 Started: 9/8/04 Completed: 9/11/04

Sample Location: Import - Sample 2 Near PSB-A

Test Procedure: ASTM D-5084

Sample Description: Sandy SILT, light gray/brown, iron stained

Remolded approx. 100% Proctor Effort near Optimum Moisture

Head Pressure: 25.0 psi Back Pressure: 20.0 psi Confining Pressure: 40.0 psi

SAMPLE DATA		TEST DATA		
Sample Initials		**Elapsed Time (s)**	**Burette (0.1Xcm³)**	**Flow Rate (cm³/s)**
Weight (g)	1270.8	0	15.25	-
Height (in)	5.75	120	15.55	0.00025
Diameter (in)	2.875	240	15.75	0.00016667
Area (cm²)	41.883	360	15.90	0.000125
Volume (cm³)	611.7	480	16.00	0.0000833
Water Content (%)	15.5	600	16.15	0.000125
Dry Unit Weight (pcf)	112.29	720	16.25	0.00010417
Initial Dial Reading (in)	0.655	840	16.40	0.000125
Final Dial Reading (in)	0.602	960	16.50	0.0000833
Sample Finals		1080	16.60	0.0000833
Weight (g)	1286.1	1200	16.70	0.0000833
Height (in)	5.697			
Diameter (in)	2.8485			
Area (cm²)	41.114			
Volume (cm³)	594.94			
Water Content (%)	17.2			
Dry Unit Weight (pcf)	115.15			
Difference of Head Pressure (psi)	5.0		**Average Flow Rate Based on last 7 Readings (cm³/s)**	0.0000982
			Coefficient of Permeability k (cm/s)	**9.84e-08**

APPENDIX 8

April 27, 2020 - IDNR Field Sampling Form 542-1322

Northern Plains Sanitary Landfill
PERMIT # 74-SDP-02-76P

4/27/2020 Sampled by: G. Hunter Weather conditions: Overcast 55 degrees

IDNR Form 542-1322

Monitoring Well: MW-3AR (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1234.3
Well Depth	14.83
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1234.3
Well Depth	14.83
Top Screen	1226.30
Bottom Screen	1219.47
Bottom Well	1219.47
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	8.00
Top sample	1226.30
Bottom sample	1222.30
Turbidity(NTU)	5.10

Date	Time	Water Level	Water Elevation	Notes
4/27/2020	11:56	7.85	1226.45	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		5.10
Appendix I	Metals	250	250		5.10
Appendix I	VOC	120	120		5.10
Full Appendix II	10 more containers	5620			
TSS	TSS	1000			
Supplemental	BEHP	2-QT			
Supplemental		250			
Total			380	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1234.3	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	14.83	Before purging	4/27/2020	11:56	7.85	1226.45	2	1.8	NO
		After purging	4/27/2020	12:00	13.20	1221.10			
		Top of Screen 1996				1226.30			
						-5.20	feet above (+) or below (-) top screen		
		Bottom of Well 1996				1219.47			
		Bottom of Well	4/27/2020		14.80	1219.50			
						0.03	feet sedimentation		
		Before Sampling				1234.30			
		Recovery				1234.30			
		Recovery				1234.30			
		Recovery				1234.30			
		Recovery	4/27/2020	17:16	7.85	1226.45			

IDNR Form 542-1322

Monitoring Well: MW-3E (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1227.86
Well Depth	29.70
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1227.86
Well Depth	29.70
Top Screen	1208.16
Bottom Screen	1198.16
Bottom Well	1196.79
Sampler Length (ft)	
Sampler Volume (mL)	440.00
Feet cordage	
Top sample	1227.86
Bottom sample	1227.86
Turbidity(NTU)	

Date	Time	Water Level	Water Elevation	Notes

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10			
Appendix I	Metals	250			
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
TSS	TSS	1000			
Supplemental					
Supplemental					
Total			0	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1227.86	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	29.70	Before purging				1227.86	0	0.0	yes
		After purging				1227.86			
		Top of Screen 1996				1208.16			
						19.70	feet above (+) or below (-) top screen		
		Bottom of Well 1996				1198.16			
		Bottom of Well				1227.86			
						29.70	feet sedimentation		
		Recovery				1227.86			
		Recovery				1227.86			
		Recovery				1227.86			
		Recovery				1227.86			
		Before Sampling				1227.86			

IDNR Form 542-1322

Monitoring Well: MW-6B (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1231
Well Depth	12.48
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1231
Well Depth	12.48
Top Screen	1228.40
Bottom Screen	1218.52
Bottom Well	1218.52
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	8.00
Top sample	1223.00
Bottom sample	1219.00
Turbidity(NTU)	1.15

Date	Time	Water Level	Water Elevation
4/27/2020	11:40	8.36	1222.64

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		1.15
Appendix I	Metals	250	250		1.15
Appendix I	VOC	120	120		1.15
Full Appendix II	10 more containers	5620		5620	
TSS	TSS	1000			
Supplemental	BEHP				
Supplemental					
Total			380	5620	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1231	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	12.48	Before purging	4/27/2020	11:40	8.36	1222.64	2	3.0	No
		After purging	4/27/2020	11:42	8.66	1222.34			
		Top of Screen 1994				1228.40			
						-6.06	feet above (+) or below (-) top screen		
		Bottom of Well 1994				1218.52			
		Bottom of Well	4/27/2020		12.30	1218.70			
						0.18	feet sedimentation		
		Before Sampling				1231.00	App I		
		Before Sampling				1231.00	App II		
		Recovery				1231.00			
		Recovery				1231.00			
		Recovery	4/27/2020	17:16	8.40	1222.60			

IDNR Form 542-1322

Monitoring Well: MW-7A (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1232
Well Depth	11.20
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1232
Well Depth	11.20
Top Screen	1225.80
Bottom Screen	1220.80
Bottom Well	1220.80
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	6.00
Top sample	1226.00
Bottom sample	1222.00
Turbidity(NTU)	2.58

Date	Time	Water Level	Water Elevation
4/27/2020	13:20	6.73	1225.27

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		2.58
Appendix I	Metals	250	250		2.58
Appendix I	VOC	120	120		2.58
Full Appendix II	10 more containers	5620		5620	
TSS	TSS	1000			
Supplemental					
Supplemental					
Total			380	5620	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1232	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	11.20	Before purging	4/27/2020	13:20	6.73	1225.27	2	2.7	no
		After purging	4/27/2020	13:28	7.05	1224.95	Too dry to sample		
		Top of Screen 1994				1225.80			
						-0.85	feet above (+) or below (-) top screen		
		Bottom of Well 1994				1220.80			
		Bottom of Well	4/27/2020		10.90	1221.10			
						0.30	feet sedimentation		
		Before Sampling				1232.00			
		Recovery				1232.00			
		Recovery				1232.00			
		Recovery				1232.00			
		Recovery	4/27/2020	17:19	6.70	1225.30			

IDNR Form 542-1322

Monitoring Well: MW-7B (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1231
Well Depth	34.00
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1231
Well Depth	34.15
Top Screen	1202.00
Bottom Screen	1197.00
Bottom Well	1197.00
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	28.00
Top sample	1203.00
Bottom sample	1199.00
Turbidity(NTU)	11.00

Date	Time	Water Level	Water Elevation
4/27/2020	13:42	5.02	1225.98

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		11.00
Appendix I	Metals	250	250		11.00
Appendix I	VOC	120	120		11.00
Full Appendix II	10 more containers	5620		5620	
TSS	TSS	1000			
Supplemental					
Supplemental					
Total			380	5620	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1231	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	34.00	Before purging	4/27/2020	13:42	5.02	1225.98	15	3.2	No
		After purging	4/27/2020	13:58	18.10	1212.90			
		Top of Screen 1994				1202.00			
						10.90	feet above (+) or below (-) top screen		
		Bottom of Well 1994				1197.00			
		Bottom of Well	4/27/2020		34.50	1196.50			
						-0.50	feet sedimentation		
		Before Sampling				1231.00			
		Recovery				1231.00			
		Recovery				1231.00			
		Recovery				1231.00			
		Recovery	4/27/2020	17:19	5.03	1225.97			

IDNR Form 542-1322

Monitoring Well: MW-7E (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1228.64
Well Depth	29.20
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1228.64
Well Depth	27.20
Top Screen	1209.44
Bottom Screen	1199.44
Bottom Well	1197.24
Sampler Length (ft)	
Sampler Volume (mL)	440.00
Feet cordage	
Top sample	1228.64
Bottom sample	1228.64
Turbidity(NTU)	

Date	Time	Water Level	Water Elevation
			1228.64

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10			
Appendix I	Metals	250			
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
TSS	TSS	1000			
Supplemental					
Supplemental					
Total			0	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1228.64	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	29.20	Before purging				1228.64	0	0.0	yes
		After purging				1228.64			
		Top of Screen 1994				1209.44			
						19.20	feet above (+) or below (-) top screen		
		Bottom of Well 1994				1199.44			
		Bottom of Well				1228.64			
						29.20	feet sedimentation		
		Recovery				1228.64			
		Recovery				1228.64			
		Recovery				1228.64			
		Recovery				1228.64			
		Before Sampling				1228.64			

IDNR Form 542-1322

Monitoring Well: MW-8 (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1229.7
Well Depth	10.05
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1229.7
Well Depth	10.05
Top Screen	1224.51
Bottom Screen	1219.51
Bottom Well	1219.51
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	5.00
Top sample	1224.70
Bottom sample	1220.70
Turbidity(NTU)	7.07

Date	Time	Water Level	Water Elevation
4/27/2020	14:50	5.15	1224.55

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		7.07
Appendix I	Metals	250	250		7.07
Appendix I	VOC	120	120		7.07
Full Appendix II	10 more containers	5620		5620	
TSS	TSS	1000			
Supplemental	Sulfide	250	0		
Supplemental					
Total			380	5620	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1229.7	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	10.05	Before purging	4/27/2020	14:50	5.15	1224.55	3	3.8	No
		After purging	4/27/2020	14:56	5.87	1223.83			
		Top of Screen 1992				1224.51			
						-0.68	feet above (+) or below (-) top screen		
		Bottom of Well 1992				1219.51			
		Bottom of Well	4/27/2020		10.00	1219.70			
						0.19	feet sedimentation		
		Before Sampling				1229.70			
		Recovery				1229.70			
		Recovery				1229.70			
		Recovery				1229.70			
		Recovery	4/27/2020	17:21	5.15	1224.55			

IDNR Form 542-1322

Monitoring Well: MW-8C (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1229.92
Well Depth	27.10
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1229.92
Well Depth	27.10
Top Screen	1207.82
Bottom Screen	1202.82
Bottom Well	1202.41
Sampler Length (ft)	
Sampler Volume (mL)	440.00
Feet cordage	
Top sample	1229.92
Bottom sample	1229.92
Turbidity(NTU)	

Date	Time	Water Level	Water Elevation
			1229.92

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10			
Appendix I	Metals	250			
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
TSS	TSS	1000			
Supplemental					
Supplemental					
Total			0	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1229.92	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	27.10	Before purging				1229.92	0	0.0	no
		After purging				1229.92			
		Top of Screen 1992				1207.82			
						22.10	feet above (+) or below (-) top screen		
		Bottom of Well 1992				1202.82			
		Bottom of Well				1229.92			
						27.10	feet sedimentation		
		Recovery				1229.92			
		Recovery				1229.92			
		Recovery				1229.92			
		Recovery				1229.92			
		Before Sampling				1229.92			

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Monitoring Well: MW-9 (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1238.5
Well Depth	12.96
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1238.5
Well Depth	12.96
Top Screen	1230.54
Bottom Screen	1225.54
Bottom Well	1225.54
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	8.00
Top sample	1230.50
Bottom sample	1226.50
Turbidity(NTU)	49.80

Date	Time	Water Level	Water Elevation
4/27/2020	11:00	3.73	1234.77

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		49.80
Appendix I	Metals	250	250		49.80
Appendix I	VOC	120	120		49.80
Full Appendix II	10 more containers	5620			
TSS	TSS	1000			
Supplemental					
Supplemental					
Total			380	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1238.5	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	12.96	Before purging	4/27/2020	11:00	3.73	1234.77	3	2.0	No
		After purging	4/27/2020	11:03	5.95	1232.55			
		Top of Screen 1992				1230.54			
						2.01	feet above (+) or below (-) top screen		
		Bottom of Well 1992				1225.54			
		Bottom of Well	4/27/2020		14.40	1224.10			
						-1.44	feet sedimentation		
		Before Sampling				1238.50			
		Recovery				1238.50			
		Recovery				1238.50			
		Recovery				1238.50			
		Recovery	4/27/2020	17:10	3.73	1234.77			

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Monitoring Well: MW-10 (ug)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1280
Well Depth	25.12
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1280
Well Depth	25.12
Top Screen	1265.00
Bottom Screen	1255.00
Bottom Well	1255.00
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	18.00
Top sample	1262.00
Bottom sample	1258.00
Turbidity(NTU)	1.01

Date	Time	Water Level	Water Elevation
4/27/2020	15:25	9.31	1270.69

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		1.01
Appendix I	Metals	250	250		1.01
Appendix I	VOC	120	120		1.01
Full Appendix II	10 more containers	5620			
TSS	TSS	1000			
Supplemental	BEHP	946		946	
Supplemental					
Total			380	946	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1280
Well Depth	25.12

2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Before purging	4/27/2020	15:25	9.31	1270.69	2	0.8	NO
After purging	4/27/2020	15:28	21.35	1258.65			
Top of Screen 1996				1265.00			
				-6.35	feet above (+) or below (-) top screen		
Bottom of Well 1996				1255.00			
Bottom of Well	4/27/2020		24.80	1255.20			
				0.20	feet sedimentation		
Before Sampling				1280.00			
Recovery				1280.00			
Recovery				1280.00			
Recovery				1280.00			
Recovery	4/27/2020	17:24	9.82	1270.18			

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Monitoring Well: MW-11 (ug)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1289.8
Well Depth	20.00
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1289.8
Well Depth	20.00
Top Screen	1279.80
Bottom Screen	1269.80
Bottom Well	1269.80
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	14.00
Top sample	1275.80
Bottom sample	1271.80
Turbidity(NTU)	0.86

Date	Time	Water Level	Water Elevation
4/27/2020	10:09	7.7	1282.1

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		0.86
Appendix I	Metals	250	250		0.86
Appendix I	VOC	120	120		0.86
Full Appendix II	10 more containers	5620			
TSS	TSS	1000			
Supplemental					
Supplemental					
Total			380	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1289.8	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	20.00	Before purging	4/27/2020	10:09	7.70	1282.10	3	1.5	No
		After purging	4/27/2020	10:12	7.97	1281.83			
		Top of Screen 2004				1279.80			
						2.03	feet above (+) or below (-) top screen		
		Bottom of Well 2004				1269.80			
		Bottom of Well	4/27/2020		20.10	1269.70			
						-0.10	feet sedimentation		
		Before Sampling				1289.80			
		Recovery				1289.80			
		Recovery				1289.80			
		Recovery				1289.80			
		Recovery	4/27/2020	17:08	7.70	1282.10			

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Monitoring Well: MW-12 (ug)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1289.1
Well Depth	57.20
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1289.1
Well Depth	57.20
Top Screen	1251.90
Bottom Screen	1231.90
Bottom Well	1231.90
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	50.00
Top sample	1239.10
Bottom sample	1235.10
Turbidity(NTU)	3.83

Date	Time	Water Level	Water Elevation
4/27/2020	10:20	27.09	1262.01

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		3.83
Appendix I	Metals	250	250		3.83
Appendix I	VOC	120	120		3.83
Full Appendix II	10 more containers	5620			
TSS	TSS	1000			
Supplemental					
Supplemental					
Total			380	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1289.1	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	57.20	Before purging	4/27/2020	10:20	27.09	1262.01	3	0.6	NO
		After purging	4/27/2020	10:24	27.09	1262.01			
		Top of Screen 2004				1251.90			
						10.11	feet above (+) or below (-) top screen		
		Bottom of Well 2004				1231.90			
		Bottom of Well	4/27/2020		56.20	1232.90			
						1.00	feet sedimentation		
		Before Sampling				1289.10			
		Recovery				1289.10			
		Recovery				1289.10			
		Recovery				1289.10			
		Recovery				1289.10			

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Monitoring Well: MW-14 (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1229.76
Well Depth	12.50
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1229.76
Well Depth	12.50
Top Screen	1222.26
Bottom Screen	1217.26
Bottom Well	1217.26
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	6.00
Top sample	1223.76
Bottom sample	1219.76
Turbidity(NTU)	119.00

Date	Time	Water Level	Water Elevation
4/27/2020	12:31	4.31	1225.45

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		119.00
Appendix I	Metals	250	250		119.00
Appendix I	VOC	120	120		119.00
Full Appendix II	10 more containers	5620		5620	
TSS	TSS	1000			
Supplemental		2 - QT			
Supplemental	Sulfide	250	250		
Total			630	5620	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1229.76	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	12.50	Before purging	4/27/2020	12:31	4.31	1225.45	6	4.5	no
		After purging	4/27/2020	12:44	5.65	1224.11			
		Top of Screen 2008				1222.26			
						1.85	feet above (+) or below (-) top screen		
		Bottom of Well 2008				1217.26			
		Bottom of Well	4/27/2020		12.25	1217.51			
						0.25	feet sedimentation		
		Before Sampling				1229.76			
		Recovery				1229.76			
		Recovery				1229.76			
		Recovery				1229.76			
		Recovery	4/27/2020	17:18	4.32	1225.44			

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Monitoring Well: MW-15 (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1231.22
Well Depth	12.50
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1231.22
Well Depth	12.50
Top Screen	1223.92
Bottom Screen	1218.72
Bottom Well	1218.72
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	8.00
Top sample	1223.22
Bottom sample	1219.22
Turbidity(NTU)	3.37

Date	Time	Water Level	Water Elevation
4/27/2020	14:23	3.9	1227.32

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		3.37
Appendix I	Metals	250	250		3.37
Appendix I	VOC	120	120		3.37
Full Appendix II	10 more containers	5620		5620	
TSS	TSS	1000			
Supplemental	Sulfide	250	0		
Supplemental					
Total			380	5620	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1231.22	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	12.50	Before purging	4/27/2020	14:23	3.90	1227.32	4	2.9	no
		After purging	4/27/2020	14:29	4.95	1226.27			
		Top of Screen 2008				1223.72			
						2.55	feet above (+) or below (-) top screen		
		Bottom of Well 2008				1218.72			
		Bottom of Well	4/27/2020		12.20	1219.02			
						0.30	feet sedimentation		
		Before Sampling				1231.22			
		Recovery				1231.22			
		Recovery				1231.22			
		Recovery				1231.22			
		Recovery	4/27/2020	17:20	3.95	1227.27			

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Monitoring Well: MW-15B (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1229.94
Well Depth	16.55
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1229.94
Well Depth	16.55
Top Screen	1218.39
Bottom Screen	1213.39
Bottom Well	1213.39
Sampler Length (ft)	
Sampler Volume (mL)	440.00
Feet cordage	
Top sample	1229.94
Bottom sample	1229.94
Turbidity(NTU)	

Date	Time	Water Level	Water Elevation
			1229.94

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10			
Appendix I	Metals	250			
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
TSS	TSS	1000			
Supplemental					
Supplemental					
Total			0	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1229.94	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	16.55	Before purging				1229.94	0	0.0	No
		After purging				1229.94			
		Top of Screen 2008				1218.39			
						11.55	feet above (+) or below (-) top screen		
		Bottom of Well 2008				1213.39			
		Bottom of Well				1229.94			
						16.55	feet sedimentation		
		Recovery				1229.94			
		Recovery				1229.94			
		Recovery				1229.94			
		Recovery				1229.94			
		Before Sampling				1229.94			

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Monitoring Well: MW-16 (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1232.43
Well Depth	12.50
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1232.43
Well Depth	12.50
Top Screen	1224.93
Bottom Screen	1219.43
Bottom Well	1219.43
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	5.00
Top sample	1227.43
Bottom sample	1223.43
Turbidity(NTU)	25.30

Date	Time	Water Level	Water Elevation
4/27/2020	15:15	4.79	1227.64

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		25.30
Appendix I	Metals	250	250		25.30
Appendix I	VOC	120	120		25.30
Full Appendix II	10 more containers	5620			
TSS	TSS	1000			
Supplemental					
Supplemental					
Total			380	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1232.43	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	12.50	Before purging	4/27/2020	15:15	4.79	1227.64	3	2.4	No
		After purging	4/27/2020	15:18	5.65	1226.78			
		Top of Screen 2008				1224.93			
						1.85	feet above (+) or below (-) top screen		
		Bottom of Well 2008				1219.93			
		Bottom of Well	4/27/2020		11.90	1220.53			
						0.60	feet sedimentation		
		Before Sampling				1232.43			
		Recovery				1232.43			
		Recovery				1232.43			
		Recovery				1232.43			
		Recovery	4/27/2020	17:22	4.79	1227.64			

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Monitoring Well: MW-17 (ug)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1234.33
Well Depth	20.20
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1234.33
Well Depth	20.20
Top Screen	1224.13
Bottom Screen	1214.13
Bottom Well	1214.13
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	14.00
Top sample	1220.33
Bottom sample	1216.33
Turbidity(NTU)	79.30

Date	Time	Water Level	Water Elevation
4/27/2020	10:48	7.47	1226.86

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		79.30
Appendix I	Metals	250	250		79.30
Appendix I	VOC	120	120		79.30
Full Appendix II	10 more containers	5620			
TSS	TSS	1000			
Supplemental					
Supplemental					
Total			380	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1234.33	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	20.20	Before purging	4/27/2020	10:48	7.47	1226.86	3	1.4	NO
		After purging	4/27/2020	10:51	7.67	1226.66			
		Top of Screen 2008				1224.13			
						2.53	feet above (+) or below (-) top screen		
		Bottom of Well 2008				1214.13			
		Bottom of Well	4/27/2020		20.10	1214.23			
						0.10	feet sedimentation		
		Before Sampling				1234.33			
		Recovery				1234.33			
		Recovery				1234.33			
		Recovery				1234.33			
		Recovery	4/27/2020	17:10	7.46	1226.87			

Northern Plains Sanitary Landfill
PERMIT # 74-SDP-02-76P

4/27/2020 Sampled by: G. Hunter Weather conditions: Overcast 55 degrees

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	Date	Time	Type	Flowing	Quantity	Discolored	Odor	Litter
GU#1	4/27/2020	11:10	grd water underdrain	Yes	250ml/10 sec	No	No	No

pH	Conductivity	Temp.(C)	Turbidity(NTU)
			6.01

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	Date	Time	Type	Flowing	Quantity	Discolored	Odor	Litter
GU#2	4/27/2020	12:08	groundwater underdrain	Yes	2000ml/min	No	No	No

pH	Conductivity	Temp.(C)	Turbidity(NTU)
			16.90

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	Date	Time	Type	Flowing	Quantity	Discolored	Odor	Litter
GU#3			groundwater underdrain			No	No	No

CONNECTED TO LEACHATE COLLECTION SYSTEM PER APPROVED PLAN

pH	Conductivity	Temp.(C)	Turbidity(NTU)

APPENDIX 5:

LEACHATE CONTROL PLAN

NORTHERN PLAINS REGIONAL LANDFILL

SDP PERMIT NO. 74-SDP-02-76P

April 20, 2026

CITY OF SPENCER

#1717-2026

CERTIFICATE

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.

James E Thiesse 4/20/26

James E. Thiesse, License No. 12304 Date

My license renewal date is December 31, 2027.

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LEACHATE CONTROL PLAN

1.0 INTRODUCTION

Because the original document has been updated multiple times, this new document was created to serve as the facility. This document replaces the previous "Appendix 5: Leachate Control Plan for Northern Plains Regional Landfill (NPRL), Palo Alto County, SDP Permit No. 74-SDP-02-76-P", dated December 6, 2004 previously submitted (#28913 thru 28922), updated several times, most recently in 2020 (#98741).

This plan is required pursuant to **Iowa Administrative Code (IAC) 567—Chapter 113.7(5)**. Any future updates or revisions shall be submitted with SDP permit renewal applications.

This report describes the leachate collection, storage, treatment, and disposal systems designed to protect human health and the environment from the adverse impacts of leachate contamination. The report also includes quality assurance and quality control procedures necessary for effective operation and maintenance of the leachate collection systems.

For the purposes of this report, the NPRL leachate control system is divided into two classifications:

1. Existing containment, collection, and storage systems constructed between 1996 and 2024.
2. Proposed improvements to serve future horizontal expansion as new cells are developed.

2.0 EXISTING LEACHATE CONTROL SYSTEM DESCRIPTION

The existing leachate collection system consists of three components:

- The **Upper System**, serving Cells 5A–21A, including a collection header along the east side of Cells 15A–5A.
- The **Lower System**, serving Cells 1–12 and Cells 1A–4A, located along the east and southeast perimeter of the closed cells.
- **Lift Station No. 3**, constructed in 2006, serving Cells A–E and designed to accommodate future Cells F–I. Cell J will be equipped with a dedicated pump system.

Additional details are available in the 1995 Leachate Control Plan, the 1999 Leachate Control Plan Update, the 1999 Leachate Collection System Plans, and the 1999 Development and Operational Plan Update.

2.1 UPPER SYSTEM

2.1.1 Containment Method (Lift Station No. 2)

The upper system includes both clay-lined and composite-lined cells. Cells 13A–17A were constructed with a 4-foot-thick compacted clay liner separating waste from native soils. Records indicate that cell

floors are at least 5 feet above the natural water table and slope toward perforated leachate collection laterals. Used tire drainage layers were installed beneath Cells 16A and 17A.

Liner details for Cells 5A–13A are not fully documented; however, native soils consist of sandy clay suitable for liner construction.

Cells 18A–21A were constructed with composite liners consisting of a 60-mil HDPE liner over 2 feet of compacted clay meeting Subtitle D requirements. Cell floors slope toward leachate collection piping, and a 12-inch layer of 3/8-inch pea rock was used for drainage.

2.1.2 Upper Leachate Collection System

Construction began in 1995 and included a 6-inch HDPE transport header with 4-inch perforated HDPE lateral lines installed during cell development (Cells 13A–20A). Laterals were stubbed approximately 20 feet into existing Cells 5A–12A and backfilled with rock.

The header slopes north to south at a minimum grade of 1.44 percent to Lift Station No. 2. Collection laterals were installed in 18-inch-deep trenches near cell centers and backfilled with clean gravel. Cleanouts are located west of Cells 13A–15A. A separate HDPE line extends through Cell 21A into Cell 20A, terminating at a proposed cleanout.

2.1.3 Lift Station No. 2

Lift Station No. 2 consists of a 36-inch-diameter HDPE manhole with a ½-hp, 2-inch submersible pump rated at 22 gpm at 52 feet of head (measured at 18 gpm in 2025). The station is approximately 6 feet deep and includes isolation valves, float controls, a high-level alarm, and an hour meter.

Leachate is pumped via a 2-inch HDPE force main encased in a 4-inch HDPE containment pipe to the storage pond. Lift Station No. 2 also receives leachate from Lift Station No. 1.

2.2 LOWER SYSTEM

2.2.1 Containment Method (Lift Station No. 1)

Liner details for Cells 1–12 and 1A–4A are not fully documented. Native soils consist of sandy clay providing limited containment. The 1999 LCP Update indicates that cell floors were constructed with a minimum slope of 4 percent toward the east.

2.2.2 Lower Leachate Collection System

Constructed in 1999, the lower system includes a 6-inch HDPE transport header along the east and southeast perimeter of closed cells. Laterals were stubbed approximately 20 feet into Cells 1–12 and 1A–4A and backfilled with rock. The header slopes to Lift Station No. 1 and includes cleanouts at both ends.

2.2.3 Lift Station No. 1

Lift Station No. 1 consists of a 48-inch-diameter HDPE manhole with a ½-hp, 2-inch submersible pump rated at 22 gpm at 52 feet of head (measured at 25 gpm in 2025). The station is approximately 8 feet deep and includes isolation valves, float controls, a high-level alarm, and an hour meter. Leachate is pumped to Lift Station No. 2 via a 2-inch HDPE force main within a 4-inch containment pipe.

2.3 LIFT STATION NO. 3 SYSTEM (CELLS A–J)

2.3.1 Containment System

Cells A–E (and future Cells F–J) utilize composite liners consisting of a 60-mil HDPE flexible membrane liner over a 24-inch compacted clay layer with a permeability of $\leq 1 \times 10^{-7}$ cm/sec. Liner construction complies with **40 CFR 258, Subpart D**.

Cell floors slope between 2 and 10 percent toward collection laterals, and side slopes are typically 3H:1V (33 percent).

2.3.2 Drainage Layer

A 12-inch drainage layer of clean 3/8-inch pea rock is placed on slopes less than 10 percent, with clean sand on side slopes. The drainage layer has a minimum permeability of 1×10^{-2} cm/sec and protects the HDPE liner. Leachate recirculation is permitted. See Appendix 5B for HELP model analysis.

2.3.3 Collection Trench Construction

Leachate laterals are installed in 18-inch-deep lined trenches. A minimum of 2 feet of compacted clay is maintained beneath trench bottoms. Trenches are lined with 12 oz/sy non-woven geotextile and backfilled with ¾-inch clean rock.

2.3.4 Leachate Collection Pipe

Collection pipes are 6-inch IPS SDR 11 HDPE, fused joints, perforated, jet-cleanable, and designed to withstand anticipated static and dynamic loads.

2.3.5 Leachate Transport Header Pipe

Transport headers are 8-inch IPS SDR 11 HDPE, non-perforated, jet-cleanable, and installed within secondary containment piping where located outside lined cells. Interstitial spaces are leak-tested prior to installation. Isolation valves are provided for operational flexibility.

2.3.6 Lift Station No. 3

Lift Station No. 3 consists of a 48-inch precast concrete manhole with epoxy liner and a ½-hp, 2-inch submersible pump measured at 28 gpm in 2025 at approximately 40 feet of head. Leachate is pumped to the storage pond via a 2-inch HDPE force main within containment piping. Pump upgrades may be implemented as future expansion cells are developed.

2.4 LEACHATE STORAGE POND

The leachate storage pond was expanded in 2017 and has a total capacity of 630,000 gallons. With 2 feet of freeboard, the working capacity is approximately 452,000 gallons. The pond is lined with a 60-mil HDPE liner over compacted clay and is accessible year-round.

HELP model projections estimate annual leachate generation of approximately 566,800 gallons for 65 acres, providing more than one year of storage capacity. During extreme wet conditions, the pond provides between 10 and 13 days of storage.

2.5 LEACHATE TREATMENT AND DISPOSAL

Leachate is transported to the Spencer Wastewater Treatment Plant (WWTP) under a treatment agreement dated July 17, 2025. Permitted limits are summarized below:

Parameter	Average	Maximum
Flow (MGD)	0.05	0.10
BOD_5 (lbs/day)	40	60
TSS (lbs/day)	25	80

Leachate is pumped from the pond to City-owned trailers and hauled to the WWTP for controlled discharge.

3.0 PROPOSED LEACHATE CONTROL SYSTEM

Future expansion cells will utilize the Lift Station No. 3 system, with Cell J requiring a dedicated pump due to elevation constraints. System components will mirror existing design standards and regulatory requirements.

3.1 Lift Station No. 3 Leachate Containment System (Cells F–J)

Future expansion Cells F–J will provide leachate containment using a composite liner system consisting of a flexible membrane liner (FML) over a 24-inch-thick compacted clay layer with a permeability of less than 1×10^{-7} cm/sec. The FML will consist of a 60-mil HDPE liner installed in direct contact with the compacted clay subgrade.

Liner surfaces will be graded toward a perforated leachate collection trench at slopes ranging from 2 percent to 10 percent. Lined cell side slopes will typically be 33 percent (3H:1V). Specifications for liner construction are included in Appendix 5B. The intent of this specification is to comply with federal regulations under 40 CFR Part 258, Subpart D.

3.2 Drainage Layer

The composite liner will be overlain by a high-permeability drainage layer consisting of a 12-inch layer of 3/8-inch-diameter clean rock (pea gravel) on slopes less than 10 percent, and clean sand on the 33 percent side slopes. Specifications for drainage layer construction are included in Appendix 5A.

The drainage layer shall have a coefficient of permeability of 1×10^{-2} cm/sec or greater. In addition to providing drainage, the 12-inch rock layer protects the HDPE liner and is approved for leachate recirculation. Refer to Appendix 5B for HELP model calculations showing head levels well below the 12" limit.

3.3 Leachate Collection Header Trench Construction

A leachate collection lateral pipe will be installed in an 18-inch-deep trench within the liner system floor of each cell as it is developed. The FML within the leachate collection pipe trench shall be protected with a 12 oz/SY nonwoven geotextile filter fabric cushion. The trench shall be backfilled with 3/4-inch-diameter clean rock to provide pipe protection, promote free drainage, and prevent the intrusion of fines into the pipe. A minimum 2-foot thickness of compacted clay liner shall be maintained below the bottom of the trench.

3.4 Leachate Collection Pipe

Leachate collection pipes shall be sized to convey the anticipated flow; however, in no case shall the pipe diameter be less than 4 inches (all existing collection pipes at this facility are 6 inches nominal diameter). Pipe capacity shall be determined using published pipe nomographs or pipe-sizing software.

Leachate collection pipes shall be chemically resistant to substances typically found in landfill leachate. HDPE pipe is currently the most widely accepted material for leachate collection systems and is used at this facility. Pipes shall be perforated, capable of cleaning by pressure jetting, and of sufficient strength to withstand anticipated static and dynamic loads.

Refer to Appendix 5A for leachate collection pipe specifications and data sheets.

3.5 Leachate Transport Header Pipe

The leachate transport header pipe shall be sized to convey the anticipated combined flow from individual cell collection pipes by gravity to Lift Station No. 3 and shall not be less than 4 inches in nominal diameter. Pipe capacity shall be determined using published pipe nomographs or pipe-sizing software.

Leachate transport pipes shall be chemically resistant to chemicals typically found in landfills. HDPE pipe is used at this facility. The transport pipe shall be non-perforated, capable of being cleaned by pressure jetting, and designed to withstand anticipated static and dynamic loads.

Where the transport pipe is located outside the lined cells, it shall be installed within a secondary containment pipe. The interstitial space between the carrier pipe and containment pipe shall be leak-tested prior to installation. The existing transport header will be extended west to serve expansion Cells F–H as those cells are developed.

3.6 Lift Station No. 3 Modifications

Upon completion of Expansion Cells E–I, the Lift Station No. 3 pump capacity may be increased to reduce the time required to remove precipitation-induced leachate, if necessary. Consideration will be given to installing automatic variable frequency drive (VFD) controls to allow the pump(s) to operate over a range of flow rates consistent with leachate generation.

3.7 Cell J Transport System

Development of Cell J is proposed to include a dedicated pump and transport system to accommodate leachate depths exceeding those that can be conveyed by gravity flow to Lift Station No. 3. In Cell J, the leachate collection pipe trench will terminate in a sump equipped with a dedicated submersible pump controlled by a float or transducer. The pump will be installed within an 18-inch-diameter side-slope riser pipe.

The lower end of the riser pipe will be perforated within the sump, and the upper end will be sealed and insulated as necessary to prevent freezing. Leachate will be pumped from the cell to the existing storage pond via a 2-inch HDPE force main encased within an HDPE containment pipe.

The system will be designed to facilitate removal and maintenance of the pump and level control equipment.

4.0 LEACHATE CONTROL SYSTEM OPERATION

This section describes system startup, IDNR approval procedures, operational controls, monitoring requirements, and contingency measures to ensure regulatory compliance and environmental protection.

4.1 New Leachate Control System Improvement Start-Up

4.1.1 Engineering Report

Upon completion of the leachate control system improvements, the Owner's Engineer shall submit an engineering report documenting the quality control testing and quality assurance procedures performed during and after construction. The report shall certify that all materials and equipment used in construction of the leachate control system were installed in accordance with the approved plans and specifications.

The report shall include all test results, descriptions of corrective actions taken to address any failures, and the results of retesting conducted following completion of corrective measures. The engineering report shall be submitted in triplicate to the IDNR Solid Waste Engineer, with additional copies provided to the City of Spencer Public Works Department, the Landfill, and the IDNR local field office in Spencer.

4.1.2 IDNR Inspection

Following completion and submission of the engineering report to the IDNR field office, an inspection of the completed improvements shall be requested. The purpose of the field inspection is to verify that the leachate control system has been constructed in accordance with the approved design.

4.1.3 IDNR Approval

After review of the engineering report and completion of the field inspection, the IDNR will issue a Permit Amendment authorizing use of the improvements. This approval typically allows placement of solid waste in the newly constructed cells.

4.2 Leachate Control System Operation

The objective of the new leachate control system improvements (Lift Station No. 3 and Cell J) is to collect and manage all leachate generated at the landfill. The operational objective of the existing retrofit leachate control systems (Lift Stations No. 1 and No. 2) is to minimize potential environmental impacts associated with landfill leachate.

Pursuant to 567 IAC 113.26(12)b(2), retrofit systems are required to reduce leachate levels above the liner to the lowest practicable level and include a method for measuring leachate depth. The operator shall remain aware that precipitation is the primary source of leachate generation and shall manage site operations accordingly.

4.2.1 Precipitation Runoff Diversion

Effective runoff diversion is a critical component of leachate control. Runoff from the expansion area is conveyed in a waterway 3 feet deep with a 12-foot bottom width, located along the north and west sides of the expansion area to a series of existing ponds that eventually discharge into the creek on the site. See Appendix 5C for runoff diversion waterway calculations that show the waterway capacity exceeds the maximum 25-year, 24-hour storm runoff rate.

Throughout the operational life of the facility and during the post-closure period, the operator shall:

- Maintain positive surface drainage from all areas.
- Maintain cover soils with positive slopes away from lined areas;
- Eliminate low areas that allow ponding of surface water; and
- Maintain vegetation on all non-working slopes.

Surface runoff entering newly constructed cells represents the largest potential source of leachate generation. Until temporary cover is placed to divert runoff, precipitation falling within a cell becomes leachate. Immediately following new cell construction, the operator shall:

- Install temporary berms, dikes, and swales to prevent runoff from adjacent slopes from entering the active cell;

- Cover the drainage layer with solid waste and daily cover as soon as practicable;
- Place initial waste to establish positive drainage toward the lowest discharge point outside the cell;
- Apply temporary fill over initial waste, compacted and graded to direct runoff outside the cell; and
- Prevent precipitation from infiltrating through solid waste to the extent practicable.

During the active life of a cell, the operator shall implement the following practices to minimize leachate generation:

- Minimize the size of active working faces;
- Maintain runoff diversion features adjacent to the working face;
- Maintain impervious daily cover to the extent practicable; and
- Use additional impervious cover when precipitation is forecast (temporary cover may be removed and reused).

4.2.2 Leachate Level Monitoring (Piezometers)

Despite implementation of infiltration control measures, some leachate generation is unavoidable. To monitor leachate levels within the landfill cells, piezometers have been installed to allow measurement of leachate depth.

The operator shall measure leachate depth monthly by measuring from the top of the piezometer to the liquid surface and recording the measurement to the nearest 0.01 foot. Comparison of monthly measurements will indicate whether leachate levels are increasing, stable, or declining. If rising leachate levels are observed, the operator shall investigate and address the cause.

Most piezometers at this facility consist of an outer 8-inch PVC protective casing with a 2-inch PVC piezometer installed inside. The protective casing allows the piezometer to be extended as the cell is filled and protects it from damage.

Potential causes of rising leachate levels include:

- Increased leachate generation due to precipitation infiltration (verify surface drainage conditions);
- Piezometer damage due to settlement or ground movement (repair or replace piezometer);
- Plugging or fouling of the collection system (clean collection lines);
- Collection system failure (excavate and replace where feasible); and
- Groundwater influence (compare levels with groundwater monitoring wells).

4.2.3 Monitoring Well Testing

Groundwater monitoring wells are used to collect water samples for evaluation of potential leachate impacts outside the landfill cells. The wells are installed within the upper two water-bearing strata and are sampled semi-annually for regulated constituents in accordance with the Hydrologic Monitoring Systems Plan (HMSP), included as Appendix 4 of the Development and Operations Plan (DOP).

Analytical results are reviewed semi-annually and reported to the IDNR in the Annual Water Quality Report submitted each November. Based on review of the results, the IDNR will determine whether additional follow-up actions are required. If a significant leachate release is identified, the IDNR may require preparation and implementation of a Groundwater Quality Assessment Plan.

4.2.4 Lift Station Monitoring

Lift stations shall be checked daily for alarm conditions. During normal operating conditions, pump hour meters shall be read at least twice per week and preferably daily. During wet weather or periods of increased leachate generation, hour meters shall be read daily and lift stations inspected to confirm proper operation.

In the event of a lift station failure, the operator shall immediately notify the Public Works Director and initiate corrective action. The IDNR Spencer Field Office shall also be notified. If the pump cannot be repaired within a reasonable timeframe, temporary pumping from the manhole to a transport tank shall be initiated. A backup pump shall be available at all times.

4.2.5 Annual Report

A Leachate Control System Performance Evaluation shall be submitted as part of the Annual Water Quality Report each November. The evaluation shall summarize system operation during the preceding year, document the condition and performance of leachate piezometers, present monthly leachate generation volumes, and provide recommendations for system improvements.

4.3 On-Site Leachate Storage Pond Management

4.3.1 Pond Level Monitoring

The operator shall measure and record the on-site leachate storage pond level at least three times per week year-round and daily during wet weather or periods of increasing leachate generation. Target operating pond levels are summarized below:

Operating Condition	Depth from Bottom (ft)	Available Volume (gal)
Winter (≤ 35°F)	5.0	366,000
Summer (> 35°F)	3.0*	412,000

* When recirculating leachate, maintain a water depth of approximately 2.5 feet above the submerged pump.

Available volume calculations maintain a minimum of 2 feet of freeboard below the top of the pond and include a reserve capacity of approximately 178,000 gallons.

4.3.2 Rising Pond Level – Plan of Action

Using the City's 8,000-gallon semi-tanker truck, approximately 32,000 gallons can be transported during an 8-hour workday. With use of backup equipment, additional personnel, or overtime staffing, the City has previously transported up to 55,000 gallons within a 24-hour period.

If the pond level indicates a rise of 30,000 gallons or more within a 24-hour period (refer to the attached volume-versus-depth chart), the operator shall notify the Public Works Department. If the pond level exceeds 7 feet and continues to rise, the operator shall contact contract haulers to confirm equipment and personnel availability.

If pond levels cannot be stabilized or reduced through increased hauling, contract hauling shall be initiated before the pond level reaches 11 feet (approximately 138,000 gallons of remaining net storage capacity). A list of approved contract haulers is included as an appendix to this document. Contract hauling shall continue until pond levels fall below 7 feet and leachate generation decreases to a rate manageable by City hauling capacity (approximately 32,000 gallons per day).

4.3.3 Wastewater Treatment Plant (WWTP) Limitations

During extreme events in which leachate hauling exceeds the allowable discharge rate to the WWTP under the current treatment agreement, leachate shall be discharged to the 8-million-gallon combined sewer overflow (CSO) equalization basin located at the WWTP. Leachate shall then be released to the treatment system at a controlled rate.

The landfill operator shall maintain continuous communication with WWTP personnel during all leachate hauling and discharge activities.

Figure 4.3.1 LEACHATE STORAGE POND VOLUME TABLE

NPRL LEACHATE STORAGE POND VOLUME TABLE

Leachate Depth	Freeboard	Surface Area (SF)	Gross Storage Available (Gallons)	gal/foot	Depth	NET STORAGE AVAILABLE	Elevation	TOTAL Gallons
0	15	916	630,318		0	452,157	1270	
1	14	1,546	621,211	9,107	1	443,051	1271	9,107
2	13	2,177	607,855	13,356	2	429,695	1272	22,463
3	12	2,807	590,478	17,378	3	412,317	1273	39,840
4	11	3,437	569,207	21,271	4	391,046	1274	61,111
5	10	4,067	544,129	25,078	5	365,968	1275	86,189
6	9	4,698	515,305	28,823	6	337,145	1276	115,013
7	8	5,328	482,784	32,521	7	304,623	1277	147,534
8	7	5,958	446,602	36,182	8	268,442	1278	183,716
9	6	6,588	406,791	39,811	9	228,631	1279	223,527
10	5	7,219	363,377	43,414	10	185,217	1280	266,941
11	4	7,849	316,383	46,995	11	138,222	1281	313,935
12	3	9,276	252,408	63,974	12	74,248	1282	377,910
13	**2**	**10,704**	**178,161**	**74,248**	**13**	**-**	**1283**	452,157
14	1	12,131	93,946	84,215	14	Freeboard	1284	536,372
15	0	13,558	-	93,946	15	Freeboard	1285	630,318

5.0 LEACHATE CONTROL SYSTEM MAINTENANCE

In addition to maintaining precipitation runoff diversion controls, the operator shall perform the following maintenance activities:

- Daily inspection of lift stations
- Daily recording of pump hour meters
- Periodic inspection and cleaning of leachate pipes
- Monthly piezometer measurements
- Groundwater monitoring per HMSP
- Semiannual pond liner inspections
- Replacement of damaged piezometers

END OF LEACHATE CONTROL PLAN

APPENDICES

- Appendix 5A: Typical Specifications and Quality Control Assurance Plan
- Appendix 5B: Drainage Layer HELP analysis
- Appendix 5C: Runoff diversion Waterway Calculations.

2025 LANDFILL CELL E2 EXPANSION PROJECT,
NORTHERN PLAINS REGIONAL LANDFILL,
SPENCER, IOWA

PART A, GENERAL PROVISIONS

INTENT

It is the intent of these specifications that the Contractor shall furnish all labor, material, construction equipment and construction processes necessary to construct the "2025 LANDFILL CELL E2 EXPANSION PROJECT, NORTHERN PLAINS REGIONAL LANDFILL, SPENCER, IOWA", as shown on the plans, and as specified herein. The omission of specific reference to any minor items of work reasonably necessary to provide a complete job will not release the Contractor from the responsibility of furnishing and/or performing same.

It is further intended by these specifications that workmanship in construction and installation shall be first-class throughout and that the finished construction meets the requirements of the Iowa Department of Natural Resources pertaining to municipal solid waste landfills.

The craftsmen used for performing the work shall be experienced in the crafts for which they are employed and shall perform their skills in such manner as to accomplish a sound and workmanlike product. Failure to provide skilled labor shall be cause for breach of contract proceedings against the Contractor.

ARRANGEMENT OF DETAILED SPECIFICATIONS

Part A, General Provisions
Part B, Site Work

This partition of the specifications has been made for convenience of the Contractor. Information and/or instructions contained in each part shall also pertain to the other parts where applicable.

SCHEDULING OF CONSTRUCTION

The Contractor shall schedule his work as not to interrupt access to and from the active landfill cells or operational area. The Contractor shall work continuously on the project once work on site has commenced. The contractor shall not suspend work on the project for more than 5 days without written permission from the engineer. During the time when work is suspended, the project site shall be left in a presentable condition that is at least as safe as it was prior to commencing work and shall cause a minimum of inconvenience

or disruption to the landfill operations.

See the Notice for project completion dates.

The Start of work includes the moving of equipment and materials onto the site if said equipment and supplies create a nuisance or hazard to the landfill operator. The work includes backfilling, finish grading and cleanup.

SUBMITTALS BY CONTRACTOR

The Contractor shall submit to the Engineer for his review, testing and/or use the following information and/or material when applicable and when requested by the Engineer. The cost of initial tests will be paid for by the Owner.

1. Samples of, but not limited to, pipe, gaskets, boots, HDPE liner, aggregates, etc.

2. Manufacturer's certificates, when requested by the Engineer, showing that the materials incorporated in the work meet these specifications.

3. All quality control test data required by this specification and by the Iowa Department of Natural Resources for flexible membrane liner installation for municipal solid waste landfills.

Sampling of materials for acceptance testing purposes will be done by the Engineer and/or under his personal supervision. Methods of sampling will be in accordance with good engineering practice but not necessarily in accordance with the methods specified by the IDOT.

If initial samples of material fail to meet the requirements of the specifications and additional samples are required to be tested, the cost of the additional tests, including transportation charges on the samples, shall be paid by the Contractor.

If the Owner and/or the Engineer choose not to sample and test the materials used on the project it will in no way eliminate or modify the Contractor's responsibility to provide materials meeting the requirements of the plans and specifications.

CONSTRUCTION RIGHT-OF-WAY

The Contractor shall schedule and carry out all construction work within the street right-of-ways, construction limits and/or easements (See General Conditions "Lands by Owner").

It shall be the contractor's responsibility to locate all such limits in the field. In the event that the construction limits and/or public right-of-ways are not readily discernible by reasonable means, the contractor shall request, in writing, that said limits be located and marked in the field by the Owner.

With permission of property Owner(s), adjacent property may be used. The Contractor shall be responsible for obtaining permission for use of private property by his forces. (See General Conditions "Lands by Contractor").

EXISTING UTILITIES

Existing utilities, including tiles and pipes, shown on the plans are shown in their approximate location only. The plans do not show all existing utilities. It will be the Contractor's responsibility to contact utility companies, private property owners and appropriate City, County and State officials well in advance of bidding and in advance of construction to verify the location of existing underground utility lines, including privately and publicly owned drain tile, and structures along the route of the proposed improvement (project). The Contractor will not be compensated for investigating the location of existing utilities in advance of bidding and in advance of construction but shall consider it as an obligatory expense to bidding and construction. (See Instructions to Bidders "Utility Locate").

The Contractor shall, not less than 48 hours before commencing any excavation, notify all parties that have utilities along the route of the proposed project, of his intention to investigate subsurface conditions and of his intention to commence work on the project. The Contractor shall cooperate with such parties to avoid any damage to said utilities and will be responsible for any damage he inflicts thereon.

Prior to any excavation, an excavator shall contact the notification center (Iowa One Call) and provide notice of the planned excavation. This notice must be given at least forty-eight hours prior to the commencement of the excavation, excluding Saturdays, Sundays, and legal holidays. The notification center has established a toll-free telephone number to allow excavators to provide the notice (1-800-292-8989).

Before performing earthwork or excavation within three hundred feet of an existing pipeline (water, gas, fuel etc.), the Contractor shall notify the pipeline company or its representative by calling the pipeline company (see Section 479.47 of current Iowa Code).

Damaged utilities (including other items such as, but not limited to, drain tile) shall be repaired by the Contractor at no cost to the Owner. Information as to the location of damaged and repaired utilities (stationing) and the method, which method shall be subject to the Engineer's approval, of repair shall be given to the engineer in writing as a prerequisite to final payment for the project. The Engineer shall be given the opportunity to inspect repairs prior to their being backfilled.

The Contractor shall, after he has been awarded a contract, locate, by making whatever excavation is necessary, utilities along the routing of the proposed work in advance of construction.

The cost of locating utilities along the route of the proposed work shall be incidental to the project cost and shall not be paid for as a separate item of work.

It is understood and agreed that the Contractor will not be entitled to additional compensation for delays in his construction operations because of unexpected conflicts with existing utilities; however, any conflict that causes a delay of one or more days shall be considered reasonable cause to request an extension of the project's completion date.

The Owner (City) retains the right of having the Owner of utilities, located on and along the project site, supervise the work associated directly with preserving and/or repositioning said utilities. Such supervision will not curtail the working hours and/or days that the Contractor chooses to work with subject utilities. Such supervision will in no way relieve the Contractor of his responsibility of protecting existing utilities and of his responsibility of saving the Owner and Engineer harmless from the Contractor's operations under this contract.

When operating beneath, adjacent to or in the vicinity of electrical conductors and/or other utilities the Contractor shall contact the Owner thereof and will be responsible for protecting said utilities from damage by his construction operations. The Contractor will not be entitled to any additional compensation due to the inconvenience of working beneath, adjacent to and/or in the vicinity of existing utilities located along the route of the project. This paragraph shall apply to utilities located both above ground, such

as electrical cables supported by poles, and to utilities located below ground.

BARRICADES

The Contractor shall provide, erect and maintain throughout the reaches of his operation adequate barricades, fences, warning lights, signs and flag persons to protect both his work and the public from harm.

Barricades shall be adequately ballasted to prevent displacement due to natural wind and traffic wash.

Said warning lights and barricades shall be erected wherever a need exists and wherever pavements, streets, alleys and/or walks have been excavated or worked upon in such a manner as to constitute a hazard to the normal flow of vehicular and/or pedestrian travel.

The Contractor shall provide a reasonable amount of access to and from the property located along the line of work. Warning lights shall consist of electrically operated flashing yellow lights designed for this purpose. Under no circumstances shall open flame, oil or gas flares or lanterns be used.

All barricades and warning lights, and the locations thereof, shall conform as near as is practical to current State, County and City requirements.

The Contractor shall consult the latest edition of "U.S. Department of Transportation Federal Highway Administration Manual on Uniform Traffic Control Devices for Streets and Highways" for information pertaining to type, size, color, location, etc., of traffic control devices, (See Iowa Code Section 321.252-321.260).

It will not be the responsibility of the Owner and/or the Engineer to approve or inspect the barricading of the construction site; however, any deficiencies brought to the attention of the Contractor by the Owner and/or the Engineer shall be remedied immediately. Failure to instigate remedial action shall be cause to shut down construction work until deficiencies are corrected.

MAINTENANCE OF TRAFFIC

The Contractor shall be responsible for maintenance, control, and the safeguarding of traffic within and immediately abutting the project. The Contractor shall cooperate with City officials in establishing barricades and warning lights to adequately protect the public and his work and to direct traffic around the work site.

The contractor shall remove dirt, mud and/or construction debris (originating from the project site) from driveways public roadways adjacent to the project site at the end of each day. In the event that the contractor fails to properly clean up said streets within 48 hours of being requested to do so, the Owner may cause the roadway to be cleaned at the contractor's expense and such monies as necessary to pay for the clean up shall be deducted from the contractor's next payment.

NIGHT OPERATIONS

Construction work shall not be performed when darkness will prevent good workmanship. Unless otherwise specifically approved by the Engineer, the performance of construction work under artificial light will not be permitted, and the work shall be organized accordingly. Work shall be scheduled to be concluded not less than 30 minutes prior to sunset.

Normal construction work shall be performed during the hours between 7:00 A.M. and 7:00 P.M. Exceptions to this requirement will be made for emergency repair work, time sensitive work such as joint sawing, and when authorized in writing by the Engineer.
Equipment having internal combustion engines shall be muffled so as not to be disturbing to near by occupants of residences, commercial establishments, etc.

RESTRICTION OF OPERATION BECAUSE OF WEATHER

Construction work shall not be performed when storm or inclement weather, including dry heat, will prevent good workmanship.

SANITARY PROVISIONS

The Contractor shall provide at the job site sanitary accommodations for his employees in the form of a portable rest room facility or provide for the use of privately owned rest room facilities in the immediate vicinity of the project site. The portable rest room shall be maintained in a neat and sanitary condition meeting the requirements of the State, County and City.

STOCKPILING OF MATERIALS

When it is necessary to stockpile excavated materials it shall not be stored in piles with side slopes steeper than the angle of repose of said material. The angle of repose being the angle that the surface of free standing material makes with a horizontal plane without the material slipping or sliding. If, after the removal of material with an end loader or similar equipment, the resulting surface of a stockpile is steeper than the angle of repose, the Contractor shall, before leaving the stockpile unattended, reshape the pile in such manner as to have side slopes no steeper than the angle of repose.

ENVIRONMENTAL PROTECTION

The Contractor shall comply with all Federal, State, and local laws and regulations controlling pollution of the environment. He shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, bitumens, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

No open burning shall be allowed except for trees and brush and only at a location designated by the Landfill Operator.

The control of dust and other air pollutants shall be the responsibility of the Contractor. The Contractor will not be paid separately for the control of air pollutants but shall consider the cost thereof as incidental to the project cost.

Pollutants such as fuels, lubricants, raw sewage, and/or other harmful materials shall not be discharged into or near rivers, streams, and impoundments or into natural or man-made channels leading thereto.

STORM WATER RUNOFF

The Contractor shall control storm water runoff from the site in a manner acceptable to local authorities and shall obtain any State or Federal Storm Water Discharge Permits that apply to the work on the site.

EXCESS MATERIALS

Excess materials, resulting from the Contractor ordering more material than actually used on the project, will not be paid for by the Owner. Quantities shown on the plans and proposal are approximate only.

HANDLING OF SOLID WASTE

The Contractor is hereby advised that during the construction of this project he will at times be excavating solid waste or soils contaminated with solid waste previously placed in the landfill. Said solid waste was placed by the previous landfill operator and the City of Spencer makes no statement as to the type or quantities of materials disposed of at this facility. The Contractor shall be responsible for the proper handling of solid waste and shall take any and all necessary precautions to protect his personnel and equipment for harm associated with the handling solid waste. No special payment shall be made for handling solid waste. Payment for excavating solid waste will be made as "Unclassified Excavation".

MOBILIZATION

Mobilization may include but is not limited to administrative and preparatory work including submittals, the bond and the movement of materials, equipment and personnel to the project site. Mobilization shall be limited to not more than the percentage of the subtotal amount shown on the proposal. In the event that a bidder exceeds the mobilization percentage shown, he will be given the option to forfeit his bid security and withdraw his bid or enter into the contract at the specified mobilization percentage.

The contractor shall be compensated for mobilization based on his unit bid price per lump sum based on the following schedule: A partial payment of mobilization will be made after receipt of a signed contract totaling 10% of the contract price for this item. When 5% of the original project sum is earned, 25% of the contract price for this item will be paid. When 10% of the original project sum is earned, 50% of the contract price for this item will be paid. When 50% of the original project sum is earned, 100% of the contract price for this item will be paid.

BID ITEMS, PART A

There are no items covered by Part A of the specifications, except mobilization. The cost of all work covered by this Part A of the specifications shall be incidental to the project cost and shall be included with appropriate bid items.

END OF PART A, GENERAL PROVISIONS

2025 LANDFILL CELL E2 EXPANSION PROJECT,
NORTHERN PLAINS REGIONAL LANDFILL,
SPENCER, IOWA

PART B, SITE WORK

SCOPE

Part "B" of these specifications pertains to the construction of a landfill cell expansion in accordance with Iowa Administrative Code (IAC) Chapter 567-113 *Sanitary Landfills For Municipal Solid Waste: Groundwater Protection Systems For The Disposal Of Nonhazardous Wastes* (MSWLF) using a composite liner meeting the requirements of paragraph 567-113.7(5) consisting of a 60 mil *textured and smooth* high-density polyethylene (HDPE) flexible membrane liner (FML) directly over a 2 foot thick layer of re-compacted clay soil having an in-place coefficient of permeability equal to or less than 1 X 10^{-7} cm/sec. A new leachate collection system shall be constructed to serve the cell expansion along with a drain tile dewatering system.

Upon completion the work shall meet all IDNR requirements for Municipal Solid Waste Landfill construction.

QUALITY CONTROL AND ASSURANCE PLAN

All work performed under this contract is subject to the construction procedures and testing described in the "Quality Control and Assurance Plan" contained in these contract documents.

CONSTRUCTION STAKING

Construction control stakes consisting of no more than 4 baselines with a spacing of not less than 100 feet will be provided by the Engineer, at no cost to the Contractor. The cut or fill shown for construction stakes will be to the top of the liner surface.

Control stakes damaged and/or destroyed by the Contractor's construction operations will be replaced by the Engineer at the Contractor's expense.

The Contractor shall provide all additional construction staking necessary to complete the grading portion of the project.

To assist in creating a digital basis for machine control, a digital terrain model of the finished liner surface breakpoints (X,Y,Z) will be provided to the Contractor, including the control points shown on the plans.

Neither the Owner nor Engineer makes any warranty, implied or stated, as to the accuracy of the digital information provided. It shall be the Contractor's responsibility to verify that the digital information represents the design concepts shown on the plans or as revised in the field by the Engineer. Should a discrepancy be discovered, the Contractor shall request clarification from the engineer prior to proceeding with that portion of the work in question and the Engineer shall endeavor to provide such clarification with 24 hours.

The Engineer will provide offset stakes for the construction of all pipes, tiles and culverts.

No separate payment will be made for construction staking or digital machine control.

EXCAVATION

The Contractor shall make all excavation as is necessary to construct the composite liner to the lines and grades shown on the plans and as designated by the construction stakes provided by the Engineer.

Excavation shall consist of the removal from that portion of the site upon which the liner is to be constructed all material lying above the bottom of the proposed composite liner section and all material lying above the finished slope adjacent to the liner.

All boulders, solid waste, debris, sand lenses and other unsuitable material capable of deteriorating in situ material strength or of creating a preferential pathway for contaminants shall be completely removed or sealed off prior to construction of the clay liner. In the event that the grading of the site exposes such unsuitable material above the plan grade, and when it has been authorized by the Engineer, the contractor shall excavate and transport all soil contaminated with solid waste to the active cell. The placement of the material in the cell shall be above the liner and the unsuitable material shall be compacted by the Owner. The excavation left after removing solid waste shall backfilled with compacted fill.

The Contractor will be compensated for over excavating unsuitable material located between the bottom of the proposed clay liner and the over excavated surface and the placement or disposal of said material as specified, on the basis of his unit bid price per cubic yard for "Unclassified Excavation".

The Contractor will be compensated for excavating that material located between the bottom of the proposed composite liner and the bottom of the existing topsoil surface and the placement or disposal of said material as specified on the basis of his unit bid price per cubic yard for "Unclassified Excavation". Payment shall be based on the plan quantity shown unless the cell dimensions or grades are changed by the Engineer to generate additional fill material or better match field conditions, whereby quantities shall be based on field measured conditions. No allowance will be made in the payment quantity for over excavation necessary to bench slopes for compaction.

The Contractor will be compensated for excavating that material located above the finished slope adjacent to the liner and the bottom of the topsoil layer on the basis of his unit bid price per cubic yard for "Unclassified Excavation".

The Contractor will be compensated for excavating topsoil, stockpiling the topsoil and the placement of said material as shown on the plans on the basis of his unit bid price per cubic yard for "Strip, Stockpile and Place Topsoil". Payment shall be based on the measured horizontal area times the authorized depth. Said depth may be changed by the Engineer to generate additional topsoil fill material where topsoil is plentiful. The Contractor will be compensated for excavating topsoil and stockpiling of topsoil on the basis of his unit bid price per cubic yard for "Strip and Stockpile Topsoil".

The Contractor will be compensated for excavation volume (cut) by cubic yard one time only.

The Contractor will be compensated additionally by the square yard for compacting and manipulating excavated clay soil used to construct the “24” Low Permeability Compacted Clay Liner” in the Cell as described below.

The Contractor will be compensated additionally for compacting and manipulating excavated clay soil used to construct the “Place Intermediate Cover Soil”. Said compensation shall be by the square yard measured in place upon completion. The cover shall be considered complete when it has been graded smooth and uniform to the contours designated by the Engineer and is ready for seeding.

The Contractor will be compensated additionally by the square yard for compacting and manipulating excavated clay soil used to construct the “24” Low Permeability Compacted Clay Liner” on the bank of the Leachate Holding Pond extension as shown on the plans.

The Contractor will be compensated additionally to fill existing swales and low areas below the design surface. Said compensation shall be by the cubic yard, computed from the plans, in place upon completion.

The Contractor will not be compensated separately for hauling and stockpiling excess excavated material on the site.

INTERMEDIATE COVER

Required fill soil for Intermediate Cover shall be obtained from the job site during the excavation for the proposed cell and adjacent slopes.

The Landfill Operator may designate areas of the working cell that are filled to capacity and ready for intermediate cover to provide separation between solid waste and storm water runoff. Said material shall be placed in 8" lifts to a depth of 16". The material shall be compacted to not less than 92% of maximum standard proctor density (ASTM D698). See Drawing 2185E2-02-05 for soil summary.

The Contractor will be compensated additionally for compacting and manipulating excavated clay soil used to construct the "Place Intermediate Cover (If Required)". Said compensation shall be by the cubic yard measured in place upon completion. The cover shall be considered complete when it has been graded smooth and uniform to the contours designated by the Engineer and is ready for seeding.

DEWATERING

All work shall be performed in excavations free from water, unless written permission to the contrary is given by the Engineer.

The Contractor shall provide and operate all necessary equipment and materials required to keep the excavation free from water until the work has reached the point where it will not be damaged.

The Contractor shall include the cost of dewatering with his unit bid prices for the different items of construction requiring dewatering.

DISPOSAL OF EXCESS MATERIAL

That portion of the material resulting from excavation for cell construction not needed at the site for cover or embankment construction shall be stockpiled in the areas shown on the plans as "Existing Suitable or Unsuitable Soil Stockpiles" or in locations as directed by the landfill operator.

The Contractor shall not be compensated separately for the disposal of excess soil material excavated from the proposed cell being developed, but shall include the cost thereof in his bid price for "Unclassified Excavation".

In the event that contaminated soils or soil otherwise unsuitable for use as fills or cover soil are encountered during cell excavation, said material shall be stockpiled on the site in a location designated by the Owner or Engineer.

SUBGRADE PREPARATION

Subgrade Preparation shall be completed in sections to minimize erosion and degradation of the prepared subgrade. In the event that the subgrade is damaged, the Contractor shall restore the subgrade at his expense. The subgrade shall not be constructed in or with frozen soil.

After excavation is complete, the entire cell surface shall be scarified to a depth of 8" and compacted to not less than 98% of maximum standard proctor density (ASTM D698) with moisture control.

The contractor shall test roll the subgrade prior to placement of the composite liner with a loaded tandem axle dump truck in the presence of the engineer per SUDAS 2010.3.06.B. Areas considered unsuitable shall be corrected by the contractor at no cost to the Owner.

The surface of the compacted subgrade shall be fine graded with a motor grader or similar approved equipment to provide a smooth, dense, uniform, stable subgrade.

The Contractor shall not be paid separately for blading and shaping the above areas but shall consider such work as incidental to Subgrade Preparation.

Subgrade grading tolerance shall be **+0.0'**, -0.25' from the design elevations or the revised grades provided by the Engineer. Subgrade preparation of the side slopes of the cells may commence simultaneously with the placement of the compacted clay liner. The

subgrade may be over excavated as necessary to maintain a horizontal surface (bench) upon which compaction equipment can be safely and effectively operated. The grading shall be such that not less than 24" of compacted clay liner will remain after final grading. The exposed surface of the bench shall be compacted rolled with a sheep's-foot roller or other suitable method to not less than 96% of maximum standard proctor density with moisture control.

The compacted low permeability clay liner shall immediately be constructed on each subgrade bench as it is completed. The clay liner shall extend past the finish profile of the cell and shall be trimmed to grade as the work progresses up the slope. Care shall be taken to prevent contaminating the liner soil with subgrade soil or solid waste.

The Contractor shall be compensated for Cell E2 subgrade preparation on the basis of his unit price bid per square yard of finished surface for "Subgrade Preparation - Cell E2". Said price shall include all grading, trimming and disposal of resulting spoil, along with the cost of any necessary subgrade moisture correction necessary to properly prepare, compact, proof roll and maintain the subgrade for the placement of the composite liner.

No special payment will be made for over-excavation to construct benches for clay liner placement.

COMPACTED LOW PERMEABILITY CLAY LINER TEST PAD

Clay and sandy clay soils for the clay liner shall be obtained from the site. It is anticipated that the soil excavated to develop the cell will be suitable for use in constructing the clay liner (unclassified excavation). The Contractor shall use suitable clay excavated from the cell construction.

To verify the suitability of the soil and the Contractor's methods to produce a Low Permeability Clay Liner with a permeability (hydraulic conductivity) equal to or less than 1×10^{-7} cm/sec, the Contractor shall construct a 20' by 80' test pad using this material and his proposed compaction methods.

The Contractor shall select representative soil, with the concurrence of the Engineer and Geotechnical Engineer, to be used to construct the test pad.

The test pad may be constructed on the prepared subgrade or some other location approved by the Engineer. The Contractor shall notify the Engineer (QCAO)not less than 48 hours in advance of his intent to complete the test pad so that arrangements may be made to

observe the construction process and for the Geotechnical Engineer to obtain 5 Shelby Tube samples upon completion of the test pad by the. Samples from the test pad to be used to develop Moisture/Density/Permeability relationship target values required to meet the 1 x 10-7 cm/sec. permeability limit required.

Initial laboratory permeability and pad density testing costs shall be paid for by the Owner. The 5 samples shall be used to develop a target density/moisture/permeability relationship. The Contractor shall allow 10 days for this testing. Past permeability tests at this facility indicate that a target density exceeding 96% standard proctor density should be anticipated.

COMPACTED LOW PERMEABILITY CLAY LINER

The Contractor shall construct a Compacted Low Permeability Clay Liner in the location shown on the plans. The liner shall consist of compacted clay with a thickness of not less than 24" and permeability (hydraulic conductivity) equal to or less than 1 X 10^{-7} cm/sec.

The Contractor shall use suitable clay excavated from the cell construction. In the event that additional clay soil is needed to complete the clay liner, clay soil may be obtained from the existing soil stockpiles.

Soils used to construct the liner shall be of the same physical properties as those used to construct the test pad. It shall be the Contractor's responsibility to identify and segregate the most suitable clay soil for use in constructing the clay liner as the work progresses.

The clay liner shall be constructed over the prepared subgrade after the subgrade has been inspected and approved. Immediately prior to placement of the clay liner, the subgrade shall be wetted.

The clay liner shall be constructed in lifts not more than 8" thick with moisture and density control to produce a finished liner with permeability equal to or less than 1 X 10^{-7} cm/sec. The density and moisture content required to produce the specified permeability shall be determined by Shelby Tube analysis of Test Pad samples. Past permeability tests at this facility indicate that a target density in excess of 96% should be anticipated.

The moisture/permeability relationship favors a soil moisture content above optimum for density. The Contractor shall be prepared to wet the grade by sprinkling and disking as necessary to maintain the correct moisture content at time of placement and upon

completion. Water for this use may be obtained from the ponds located on the site.

Each lift of clay soil used to construct the liner shall be thoroughly manipulated using a self-propelled soil stabilizer (pulverizer) designed to break the soil into small fragments. Alternate methods may be used if the Contractor can demonstrate that he can meet the permeability requirements without the use of a soil stabilizer.

Each lift of compacted clay liner shall be tested for in-place density a minimum of five times per 8-inch lift per acre to verify that the correct density, as correlated to permeability by a laboratory analysis, has been achieved. Laboratory hydraulic conductivity testing of Shelby tube samples from the constructed soil liner, or field hydraulic conductivity testing of the constructed soil liner, or other methods approved by the IDNR, may be utilized to verify the permeability of the liner. Initial testing costs shall be paid for by the Owner.

Compacted soil that does not meet the specified density-moisture-permeability shall be removed, re-compacted and retested at the Contractor's expense until acceptable test results are obtained.

The finish surface of the completed clay liner shall be free of stones larger than 1" and debris that could damage the HDPE liner. The surface shall be rolled smooth and maintained in proper moisture condition and shall not be allowed to dry out.

The Contractor shall be compensated for renting a self-propelled soil stabilizer (pulverizer)on the basis of his unit bid price per week for Soil Pulverizer rental (If Necessary). Said compensation shall include all expenses associated with the transport and operation of the machine.

The Contractor shall be compensated for wetting, drying, placing and compacting clay excavated from the site on the basis of his unit bid price per square yard for "24" Low Permeability Compacted Clay Liner". Said price shall include all work necessary to control moisture and density and shall include any manipulation necessary to meet in-place density, moisture and permeability requirements.

HDPE LINER

The 24" Low Permeability Compacted Clay Liner shall be completely covered with a 60 mil thick high-density polyethylene (HDPE) flexible membrane liner (FML). Smooth liner may be used on the floor of the cell, textured liner shall be used on the sloped sides of the cell. Textured liner may be used on the entire cell at the Contractor's option.

The manufacture, installation and testing of the liner shall be in accordance with Section 02700 POLYETHYLENE GEOMEMBRANE LINER, made a part of this specification in Appendix A.

The HDPE liner materials shall meet the requirements of the Geosynthetic Research Institute specification GRI Test Method GM13 (current revision), made a part of this specification by reference.

The CONTRACTOR shall maintain the liner in good condition, free from defects or damage until the installation is finished, all test results are acceptable and the project is accepted by the OWNER.

The Contractor shall be compensated for HDPE geomembrane Liner construction the basis of his unit price bid per square foot of net lined surface area for "60 mil HDPE Liner". Said compensation shall include furnishing all labor, material, tools, equipment, testing, reporting and incidentals for a complete HDPE liner. Net lined surface area shall be per square foot, as measured parallel to liner surface, including designed anchor trench material (4').

HDPE PIPE

Solid pipe used for leachate transport or groundwater-dewatering outlet shall be shall be High Density Polyethylene (HDPE) pipe meeting the requirements of these specifications.

Perforated pipe used for groundwater drain tile or leachate collection pipe, as shown on the plans, shall be High Density Polyethylene (HDPE) pipe meeting the requirements of these specifications.

High Density Polyethylene (HDPE) pipe shall be composed of very high molecular weight, high density ethylene/hexene copolymer ASTM PE4710 polyethylene virgin resin exhibiting a cell classification of PE445474C as determined by ASTM D3350 with an established hydostatic-design-basis of 1600 psi for water at 73.4°F.

The pipe supplied under this specification shall have the following characteristics:

Standard Dimension Ratio (SDR)	11.0
Working Pressure Rating (WRP)	160 psi minimum
Iron Pipe Sizing (IPS)	
Standard Industrial Grade	ASTM F714

The supplier of pipe for this project shall certify that a quality control program meeting the requirements of ASTM D3035 and F714 is in use and that the pipe supplied does meet the physical properties specified herein. Certified laboratory test results may be requested to verify the material properties.

Sections of polyethylene pipe shall be joined into one continuous length by butt fusion in strict conformance with the manufacturer's recommendations. The butt fusion equipment shall be capable of developing a 500°F temperature and 150 psi interfacial fusion pressure while maintaining the correct alignment. The fused joint shall have a joint weld strength equal to or greater than that of the tensile strength of the pipe.

All pipe supplied shall be continuously marked with the size, dimension ratio, pressure rating, type, material classification, certification basis, test category, plant, extruder number, date, operator number, shift letter, resin supplier code, etc.

The pipes shall be constructed of one continuous length of HDPE pipe without the use of fittings. Where it is necessary to deflect (curve) the pipe, said deflection shall not exceed that recommended by the pipe manufacturer (bend radius > 30 times outside pipe diameter).

Where shown on the plans fittings for HDPE pipe shall be factory fabricated out of the same material and thickness class as specified for HDPE pipe. The fused joint shall have joint weld strength equal to or greater than that of the tensile strength of the pipe.

Threaded Clean-out fittings located above grade may be SCH 80 PVC.

The Contractor shall be instructed and approved by the pipe manufacturer for fusing the pipe being used on this project.

The Contractor shall be aware of the thermal stresses developed by HDPE and shall take all precautions to prevent damage to the piping system due to temperature changes.

The Contractor shall include the cost of joining (fusing) pipe segments with the appropriate pipe bid items as an incidental expense of laying the pipe. No special payment shall be made for

fusing pipe segments or providing connecting adapters.

All buried pipe shall be installed in accordance with ASTM D-2321, Underground installation of flexible thermoplastic sewer pipe.

HDPE leachate collection pipe located in the collection trench and all perforated drainage tile pipe shall be perforated with three (3) rows of 3/8" diameter holes located 120° apart and spaced at 3" center to center.

The perforations on the leachate collection pipe shall stop 2' from one end of a pipe segment for use at the liner penetration.

The drainage tile pipe shall be provided with a heavy grade fabric sock suitable for landfill use that is designed to prevent soil migration into the pipe.

No sock will be used on the leachate collection pipe.

Perforated Leachate Collection pipe installed under this contract shall be bedded and backfilled with consolidated 3/4" diameter rock backfill. Pipe backfill material shall be washed river rock meeting IDOT section 4109 gradation No. 3 (D57) and shall be free of dirt, clay or debris and have permeability (hydraulic conductivity) greater than 1×10^{-2} cm/sec.

Leachate collection pipe rock bedding shall be placed on a non-woven Geotextile (12 oz/SY) cushion over the HDPE liner as shown on the plans.

Perforated Drain Tile installed under this contract shall be bedded and backfilled with consolidated 3/8" diameter pea gravel backfill meeting the requirements specified below for Granular Drainage Layer.

A sample of the proposed pipe backfill shall be submitted to the Engineer for approval prior to placement.

The Contractor will be compensated for trenching, furnishing, installing and backfilling 4" or 6" Perforated HDPE Drain Tile, including fabric sock and granular backfill on the basis of his unit bid price per linear foot for "4" or 6" Perforated or Solid HDPE Drain Tile".

All pipe measured payment lengths shall include the length of fittings included in the pipe run being measured. Pipes will be measured from center of Tees to the end of caps or plugs and no deduction in length will be made for fittings.

Where shown on the plans the leachate collection pipe shall be fused to a second secondary dual containment pipe starting just inside the new cell liner and extending and fused to the Leachate collection header dual containment pipe.

The termination at the HDPE liner shall be made using a SCH 80 PVC Threaded Clean-out fittings located above grade.

The Contractor will be compensated for installing, fusing, backfilling 6" and backfill on the basis of his unit bid price per linear foot for "6" Perforated HDPE Leachate Collector Pipe".

HDPE PIPE FITTINGS AND PIPE FUSING

Pipe Fitting as shown on the plans shall be fabricated from High Density Polyethylene (HDPE) pipe meeting the requirements of these specifications for HDPE Pipe.

Fabricated elbows, tees, reducing tees, and end caps shall be produced and tested in accordance with ASTM F2206 - "Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene Plastic Pipe".

Pipe fittings shall be prefabricated prior to shipment to the jobsite. No on-site fabrication to the pipe, fittings or system shall be allowed without express written consent of the engineer and the piping supplier.

Pipe fittings shall be manufactured by an ISO 9001 certified manufacturer. The pipe manufacturer shall have a minimum 10 years of experience in manufacturing and production of HDPE piping and related fittings.

All Fusion Equipment, whether new or used, rented or owned, shall be approved by the piping system supplier. The butt fusion equipment used to join the pipe shall be capable of meeting all normal butt fusion requirements: alignment, heating, trimming and fusion pressure.

All HDPE pipe and fittings shall be joined and installed in accordance with the manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel trained in working with dual containment polyethylene pipe systems.

The pipe supplier shall provide written simultaneous butt fusion welding procedure as part of the submittal package. The procedure should identify quality checks and incorporate principles outlined in ASTM F2620 or PPI TR-33. The procedure shall identify how the simultaneous butt fusion pressure is determined.

Electro-fusion couplers may be used with written permission of the Engineer to join HDPE pipes in locations that are not accessible to butt fusion equipment.

For containment sizes 6” and larger pipe sizes, McElroy DataLogger or equivalent fusion data recorder shall be used to record all fusion welds on hydraulically operated fusion machines. The device shall be capable of meeting the requirements of ASTM F3124, “Standard Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings”. The device, or combination of devices, shall record the following variables of each fused joint:

1. Heater surface temperature- immediately before inserting the heater plate, measure with a pyrometer and manually enter into the weld record.
2. Gauge pressure during the initial heat cycle
3. Gauge pressure and elapsed time during the heat-soak cycle
4. Heater removal (dwell) time
5. Gauge pressure and elapsed time during the fusing/cool cycle
6. Drag pressure
7. Pipe diameter(s) and wall thickness(es)
8. Type of HDPE material(Specification and Classification) and manufacturer
9. Fusion Machine Identification

The device shall record the operator name and a unique operator ID number, along with the date and time of each weld.

Records showing the device is up to date on all required calibration should be available for review when requested.

All fusion welds should be traceable to the report (via operator and weld ID) with an indentation weld stamp or by permanent paint marker/pen next to fusion weld.

The Contractor shall be compensated for all HDPE fittings furnished and installed under this contract at the Contractor’s Lump Sum bid for HDPE fittings.

No separate payment shall be made for butt fusing of pipes or fittings.

HDPE PIPE TESTING

All solid wall HDPE pipe including the carrier and containment pipe shall be subjected to both a pressure test and a visual test. Testing shall be the responsibility of the contractor in the presence of the Engineer who shall witness the test. The Engineer shall be notified at least 24 hours in advance of such tests. See ASTM F1417, Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air for more information.

Pressure Test: After the pipe has been installed, fusion completed, and the trench partially backfilled (leaving the joints exposed for examination), the carrier pipe shall be filled with air. The pipeline shall be subjected to a test pressure of 10 psi for a period of at least 20 minutes. *Air is a compressible gas and is very dangerous*. The Contractor shall use extreme caution when working around pressurized pipe. Always build and release pressure slowly. The internal pressure should be allowed to stabilize 10 minutes before starting the test period. If the final gauge pressure is within 5% of the starting pressure, the pipe has passed the test

Containment Pipe Testing: The carrier pipe shall be brought up to and held at the system test pressure while the containment pipe is leak tested. Air pressure of 6 psi shall be used for containment pipe testing. Extreme caution should be used to insure that the annular space is not over pressurized. The pipe shall be brought up to test pressure and held for 20 minutes or until the pressure stabilizes.

The test shall begin when the pressure stabilizes and lasts for 20 minutes. If the final gauge pressure is within 5% of the starting pressure, the pipe has passed the test.

Retesting: If any deficiencies are revealed during the test, such deficiencies shall be corrected. The tests shall be re-conducted until the results of the tests are within specified allowances with no additional cost to the owner.

The pressure gauge supplied by the Contractor shall be designed and calibrated in such manner that a differential of not less than 0.25 psig and preferably 0.125 psig can be readily and accurately ascertained.

At his option the Contractor may test the pipe in accordance with F 2164 – 02 American National Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure at 50% of the rated pipe pressure.

Visual Test: All exposed joints, fittings, and valves shall be examined for leaks. Visible leaks shall be stopped and/or the defective pipe, fitting, joint, or valve shall be replaced.

The Contractor will not be paid separately for providing air testing equipment or for testing sewer but shall include the cost thereof in his bid prices for HDPE pipe.

LEACHATE PIPE LINER PENETRATIONS

The penetration where the leachate collection pipe crosses the HDPE liner shall be made using a prefabricated pipe boot specifically made for the purpose of providing a watertight pipe penetration or may be field fabricated by experienced personnel (proof of field fabrication experience shall be provided). The boot manufacture or fabrication and installation shall be in accordance with ASTM D-6497-02 "Standard Guide for the Mechanical Attachment of Geomembranes to Penetrations or Structures".

The Contractor will be compensated for furnishing and installing all materials, fusing and incidentals to construct a watertight seal, on the basis of his unit bid price per each for "Leachate Pipe Liner Penetrations".

DRAINAGE LAYER

Immediately after the HDPE liner is installed and accepted as complete, the Contractor shall cover the liner bottom, as shown on the plans, with a granular drainage layer not less than 12" thick.

Granular material used for the drainage layer on horizontal surfaces shall consist of clean river rock (not crushed) meeting IDOT specification 4109 gradation No. 20 or 21 for "pea gravel" cover aggregate or No. 29 porous backfill all with a permeability (hydraulic conductivity) greater than 1 X 10^{-2} cm/sec.

Granular material used for the drainage layer on sloped surfaces shall consist of clean pit run or washed sand with a permeability (hydraulic conductivity) greater than 1 X 10-2 cm/sec. The supplier shall submit gradations and permeability test results indicating compliance prior to delivery of materials.

The drainage layer shall be placed in one 12" lift using tracked equipment with a low ground pressure to avoid excessive loading of the HDPE liner. The granular drainage material shall be placed in a manner such that aggregate rolls onto the liner and is not pushed across or slid on the liner. No equipment shall be allowed to operate directly on the HDPE liner. The Contractor shall use care

to prevent damaging the liner system and shall repair any such damage at no cost to the Owner. Under no circumstances will wheel loaders, tractor backhoes or trucks be allowed to operate on the drainage layer. During the placing and spreading, sufficient care shall be taken to prevent the incorporation of foreign material into the drainage layer.

The Contractor shall be compensated for furnishing, hauling, placing and spreading the granular material specified on the basis of his unit bid price per square foot for "12" Thick Granular Layer (3/8" Pearock" or "12" Thick Granular Layer (Sand on Slopes)". The surface area for payment shall be per square foot, as measured in the field parallel to liner surface

GEOTEXTILE

A geotextile cushion shall be required over the flexible membrane liner (FML) below the ¾" diameter granular drainage media located in the leachate collection trench. The geotextile's mass shall be determined based on the allowable pressure on the geomembrane.

Geotextile fabric shall be non-woven polyester or polypropylene fabric meeting the requirements of IDOT Specification 4196.01-3 and the properties listed in following table:

Geotextile		
Unit Weight, oz/ yd2	ASTM D 5261	12
Grab Tensile, lb	ASTM D 4632	300
Puncture, lb	ASTM D 6241	800
AOS	ASTM D 4751	100 sieve

The above property values, unless otherwise specified, are the minimum acceptable average test results for any roll based on the specified test methods and do not refer to an individual test specimen.

CULVERT WORK

The Contractor shall furnish and install drainage culverts, inlet/outlet pipes and appurtenances in the sizes and configurations shown on the plans.

Culverts and inlet/outlet pipes shall be corrugated steel pipe meeting the requirements of AASHTO M36/M 36M and IDOT Section 4141 and IDOT IM 441.

Installation shall be in accordance with IDOT section 2417 Corrugated Culverts.

The Contractor will be compensated for trenching, furnishing, installing and backfilling corrugated metal pipes (CMP) on the basis of his unit bid price per linear foot for the various size pipes listed on the proposal form.

OWNERSHIP OF COMPLETED IMPROVEMENT

Ownership of the completed and accepted landfill liner and closure cap shall be in the name of the City of Spencer, Iowa.

BID ITEMS, PART B

The Contractor will be compensated the work described in Part B of the these specifications, including all necessary miscellaneous items of work necessary for a complete installation, on the basis of the unit and lump sum bid prices listed on the proposal form.

END OF PART B, SITE WORK

2025 LANDFILL CELL E2 EXPANSION PROJECT,
NORTHERN PLAINS REGIONAL LANDFILL,
SPENCER, IOWA

SECTION 02700 POLYETHYLENE GEOMEMBRANE LINER

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Specifications and guidelines for MANUFACTURING and INSTALLING geomembrane.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. D 6392 Standard Test Method for Determining the Integrity of Non-reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
2. See Appendix B for a list of additional References used.

1.3 DEFINITIONS

A. Lot- A quantity if resin (usually the capacity of one rail car) used in the manufacture of polyethylene geomembrane rolls. The finished roll will be identified by a roll number traceable to the resin lot used.

B. Construction Quality Assurance Consultant (CONSULTANT)- Third Party, independent from MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to quality assurance during the lining system construction.

C. ENGINEER- The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.

D. Geomembrane Manufacturer (MANUFACTURER)- The party responsible for manufacturing the geomembrane rolls.

E. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY)- Party, independent from the OWNER, MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.

F. INSTALLER- Party responsible for field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.

G. Panel- Unit area of a geomembrane that will be seamed in the field that is larger than 100 square feet.

H. Patch- Unit area of a geomembrane that will be seamed in the field that is less than 100 square feet.

I. Subgrade Surface- Soil layer surface which immediately underlies the geosynthetic material(s).

1.4 SUBMITTALS POST-AWARD

A. Furnish the following product data, in writing, to ENGINEER prior to installation of the geomembrane material:
   1. Resin Data shall include the following.
      a. Certification stating that the resin meets the specification requirements
   2. Geomembrane Roll
      a. Statement certifying no reclaimed polymer is added to the resin (product run may be recycled).

B. The INSTALLER shall furnish the following information to the ENGINEER and OWNER prior to installation:
   1. Installation layout drawings
      a. Must show proposed panel layout including field seams and details
      b. Must be approved prior to installing the geomembrane
         1) Approved drawings will be for concept only and the exact panel placement, with the permission of the ENGINEER, may be modified to meet actual site conditions.
   2. Installer's Geosynthetic Field Installation Quality Assurance Plan

C. The INSTALLER will submit the following to the ENGINEER upon completion of installation:
   1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents
   2. Material and installation warranties
   3. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail

1.5 QUALITY ASSURANCE

A. MANUFACTURER

1. The Manufacturer shall provide Manufacturing Quality Control (MQC) in accordance with GRI GM13 (or current revision) to assure compliance with these specifications.

B. INSTALLATION

1. The OWNER may at his option engage and pay for the services of a Geosynthetic Quality Assurance Consultant and Laboratory to monitor geomembrane installation.

1.6 QUALIFICATIONS

A. MANUFACTURER
1. Geomembrane shall be manufactured by the following:
   a. GSE Lining Technology, Inc.
   b. Poly-Flex, Inc.
   c. approved equal
2. MANUFACTURER shall meet the Manufacturing Quality Control (MQC) requirements of GRI GM13 attached as appendix B.

B. INSTALLER
1. Installation shall be performed by one of the following installation companies(or approved equal)
   a. Liner Manufacturer's Employees.
   b. Liner Manufacturer's Approved Dealer/Installers
2. INSTALLER shall have installed a minimum of 200,000 square feet of HDPE geomembrane during the last 2 years.
3. INSTALLER shall have worked in a similar capacity on at least 2 projects similar in complexity to the project described in the contract documents, and with at least 100,000 square feet of HDPE geomembrane installation on each project.
4. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
5. The INSTALLER shall provide a minimum of one Master Seamer for work on the project.
   a. Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

1.7 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

A. Labeling - Each roll of geomembrane delivered to the site shall be labeled by the MANUFACTURER. The label will identify:
   a. manufacturer's name
   b. product identification
   c. thickness
   d. length
   e. width
   f. roll number

B. Delivery- Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading. Liner rolls shall be at least 20' in width

C. Storage- The on-site storage location for geomembrane material, provided by the CONTRACTOR, shall protect the geomembrane from punctures, abrasions and excessive dirt and moisture, should have the following characteristics:
   a. level (no wooden pallets)
   b. smooth
   c. dry
   d. protected from theft and vandalism
   e. adjacent to the area being lined

D. Handling- Materials are to be handled so as to prevent damage.

1.8 WARRANTY

A. Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 5 years from the date of geomembrane installation.

B. Installation shall be warranted against defects in workmanship for a period of 2 years from the date of geomembrane acceptance by the City of Spencer.

PART 2 - MATERIAL SPECIFICATIONS

2.1 GEOMEMBRANE

A. Material shall be textured high density polyethylene geomembrane as shown on the drawings, table 1.1, and shall meet the requirements of the attached GRI GM13 (current revision) specifications (Appendix B).

B. Gasket material shall be neoprene, closed cell medium, ¼" thick, 2 inches wide with adhesive on one side, or other compatible material as approved.

C. Metal battens or banding and hardware shall be stainless steel.

D. Water cut-off mastic shall be Neoprene Flashing Cement as supplied by the HDPE manufacturer.

E. Sealant shall be General Electric Silicone, RTV 103 or equal.

2.2 GEOMEMBRANE ROLLS

A. Geomembrane material is to be supplied in roll form. Each roll is to be labeled.

B. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.

C. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.

D. All liner produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in GRI GM13, and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected prior to installation.

PART 3 - INSTALLATION

3.1 TRANSPORTATION

A. Geomembrane rolls shall be delivered to the site by flatbed trailer. The rolls shall be stored so as to protect them from damage due to puncture, dirt, grease, moisture or excessive heat. Rolls shall not be placed on pallets, but shall be stored on flat level ground. Do not stack more than two rolls high.

3.2 SITE PREPARATION

A. The installer shall inspect the Compacted Clay Liner for defects, sharp objects, rocks, weak or soft areas or debris of any kind. All surfaces shall be smooth with slightly rounded corners and gradual grade changes. Standing water or excessive moisture shall prohibit HDPE liner placement.

B. The installer shall, on a daily basis approve the surface upon which the liner is to be installed.

C. The installer shall seek and receive the approval of the Engineer for all surfaces to be covered with a HDPE liner prior to liner placement. The Installer shall provide not less than 8 hours advance notice to the Engineer for said field inspection.

3.3 DEPLOYMENT

A. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be in accordance with the shop drawings, but may be adjusted at the job site.

B. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.

C. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:

1. Unroll geomembrane panels using methods that will not damage geomembrane and will protect underlying surface from damage (i.e., spreader bar, protected equipment bucket).
2. Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift.
3. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage the geomembrane. Smoking will not be permitted on the geomembrane.
4. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 6 psi.
5. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.
6. Ambient temperature shall be between 34° F and 100° F. Placement shall not take place during precipitation, fog, heavy dew or in the presence of excessive wind.

D. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

3.4 FIELD SEAMING EQUIPMENT

A. Welding equipment and accessories shall meet the following requirements:
1. Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.
2. An adequate number of welding apparatus shall be available to avoid delaying the work.
3. Power source capable of providing constant voltage under combined line load shall be used.

3.5 FIELD SEAMING

A. Seams shall meet the following requirements:
1. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.
2. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
3. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.
4. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the ENGINEER and INSTALLER.
5. Align seam overlaps consistent with the requirements of the welding equipment being used. A 6-inch overlap is commonly suggested.
6. Solvents shall not be used without the MANUFACTURER'S written approval.
7. Seams shall be aligned to prevent wrinkles and "fishmouths". Any such defects shall be relieved and cap-stripped.

B. During Welding Operations
1. Provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

C. Extrusion Welding
1. Hot-air tack adjacent pieces together using procedures that do not damage geomembrane.
2. Clean geomembrane surfaces by disc grinder or equivalent.
3. Purge welding apparatus of heat-degraded extrudate before welding.

D. Hot Wedge Welding
1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
2. Clean seam area of dust, mud, moisture and debris immediately ahead of the hot wedge welder.
3. Protect against moisture build-up between sheets.

E. Trial Welds

1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
3. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.
4. Cut four, one-inch wide by six-inch long test strips from the trial weld.
5. Quantitatively test specimens for peel adhesion, and then for bonded seam strength (shear).
6. Trial weld specimens shall pass when the results shown in Table 3 are achieved in both peel and shear test.
   a. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).
   b. The break is ductile.
7. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
8. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

F. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. INSTALLER shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

G. Defects and Repairs
1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

3.6 FIELD QUALITY ASSURANCE

A. MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the Owner's quality assurance program. CONTRACTOR shall be responsible for assuring this participation.

B. Quality assurance requirements are as specified in this Section and in the Field Installation Quality Assurance Manual if it is included in the contract.

C. Field Testing
1. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.
   a. Vacuum Testing
      1) Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber (Vacuum Box).
   b. Air Pressure Testing
      1) Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
   c. Other approved methods.
2. Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)
   a. Location and Frequency of Testing
      1) Collect destructive test samples at a frequency of one per every 1,000 lineal feet of seam length.
      2) Test locations will be determined after seaming.
      3) Exercise Method of Attributes as described by GRI GM-14 (Geosynthetics Institute, http://www.geosynthetic-institute.org) to minimize test samples taken.
   b. Sampling Procedures are performed as follows:
      1) INSTALLER shall cut samples at locations designated by the CONSULTANT as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
      2) CONSULTANT will number each sample, and the location will be noted on the installation as-built.
      3) Samples shall be twelve (12) inches wide by minimal length with the seam centered lengthwise.
      4) Cut a 2-inch wide strip from each end of the sample for field-testing.
      5) Cut the remaining sample into two parts for distribution as follows:
         a) One portion for INSTALLER, 12-inches by 12 inches
         b) One portion for the Third Party laboratory, 12-inches by 18-inches
         c) Additional samples may be archived if required.
      6) Destructive testing shall be performed in accordance with ASTM D6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
      7) INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.

8) Repair and test the continuity of the repair in accordance with these Specifications.

3. Failed Seam Procedures
   1) If the seam fails, INSTALLER shall follow one of two options:
      a) Reconstruct the seam between any two passed test locations.
      b) Trace the weld to an intermediate location at least 10 feet minimum or to where the seam ends in both directions from the location of the failed test.
   2) The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10 feet long.
   3) If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
   4) If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

3.7 REPAIR PROCEDURES

A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

B. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.

C. INSTALLER shall be responsible for repair of defective areas.

D. Agreement upon the appropriate repair method shall be decided between ENGINEER and INSTALLER by using one of the following repair methods:
   1. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
   2. Abrading and Re-welding- Used to repair short section of a seam.
   3. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
   4. Capping- Used to repair long lengths of failed seams.
   5. Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.
   6. Remove the unacceptable seam and replace with new material.

E. The following procedures shall be observed when a repair method is used:
   1. All geomembrane surfaces shall be clean and dry at the time of repair.
   2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness within 10 minutes of welding.
   3. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

F. Repair Verification
   1. Number and log each patch repair (performed by INSTALLER).
   2. Non-destructively test each repair using methods specified in this Specification.

Table 1.1: Minimum Weld Values for HDPE Geomembranes

Property	Test Method	30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)	120 (3.0)
Peel Strength (fusion), ppi (kN/m)	ASTM D 6392	45 (7.9)	60 (10.5)	91 (15.9)	121 (21.2)	151 (26.4)	181 (31.7)
Peel Strength (extrusion), ppi (kN/m)	ASTM D 6392	39 (6.8)	52 (9.0)	78 (13.6)	104 (18.2)	130 (22.8)	156 (27.2)
Shear Strength (fusion & ext.), ppi (kN/m)	ASTM D 6392	57 (10)	80 (14)	120 (21)	160 (28)	200 (35)	240 (42)

Table 1.1: Minimum Values for Coextruded Textured HDPE Geomembranes

Property	Test Method[1]					
Thickness, mil (mm)	ASTM D 5994					
Minimum Average		30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)
Lowest Individual Reading		27 (0.69)	36 (0.91)	54 (1.4)	72 (1.8)	90 (2.3)
Density, g/cm^3	ASTM D 1505	0.94	0.94	0.94	0.94	0.94
Carbon Black Content[2], %	ASTM D 1603, modified	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0
Carbon Black Dispersion	ASTM D 5596	*Note 4*	*Note 4*	*Note 4*	*Note 4*	*Note 4*
Tensile Properties[2]:	ASTM D 638					
(each direction)	Type IV, 2 ipm					
Strength at Yield, lb/in (kN/m)		63 (11)	84 (15)	126 (22)	168 (29)	210 (37)
Strength at Break, lb/in (kN/m)		45 (8)	60 (11)	90 (16)	120 (21)	150 (27)
Elongation at Yield, %	(1.3" gauge length)	12	12	12	12	12
Elongation at Break, %	(2.0" gauge length)	100	100	100	100	100
Tear Resistance, lb (N)	ASTM D 1004	21 (93)	28 (124)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	45 (200)	60 (267)	90 (400)	120 (534)	150 (667)
Notched Constant Tensile Load [3], hours	ASTM D 5397, appendix	400	400	400	400	400
Oxidative Induction Time, min.	ASTM D 3895	100	100	100	100	100

[1] Some test procedures have been modified for application to geosynthetics.
[2] The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variations of test results. Therefore, these tensile properties are minimum average roll values.
[3] NCTL on coextruded textured product is conducted on representative smooth membrane samples.
[4] Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3

QUALITY CONTROL AND ASSURANCE PLAN

PROJECT: 2025 LANDFILL CELL E2 EXPANSION PROJECT
Northern Plains Regional Landfill - SDP Permit No. 71-SDP-02-76P

OWNER: City of Spencer, Iowa

QUALITY CONTROL AND ASSURANCE OFFICER: James E Thiesse, PE (IA)
Kruse, Cate & Nelson, PC.
2303 W18th Street
Spencer, IA 51301
712-240-3468

DESIGN ENGINEER: Kruse, Cate & Nelson, PC, Spencer, Iowa

GEOTECHNICAL ENGINEER: To Be Determined

DATE: 1/7/2025

This document describes the testing procedures to be used to assure that the liner and cap constructed as part of this project complies with IAC 567-113.7.

SUBGRADE PREPARATION. The Quality Control and Assurance officer (QCAO) or his designated representative shall observe the preparation of the subgrade for liner construction as specified on pages DSB 6-7.

Subgrade density. After the subgrade is scarified and compacted by the Contractor, the QCAO shall request the Contractor to test roll the prepared subgrade with a fully loaded tandem axel truck of sufficient weight to detect deficiencies in the subgrade. Any soft or otherwise unsuitable material shall be removed and replaced with suitable compacted fill. In addition to proof rolling of the subgrade, the QCAO may order density testing of the compacted subgrade to confirm that the specified density (95%) has been achieved.

Subgrade surface profile. The subgrade surface will be checked for plan grading tolerance by survey prior to acceptance. GPS control stakes and benchmarks will be provided by the Engineer.

CELL LINER SYSTEM. The QCAO or his designated representative shall observe the construction of the composite clay liner system. Soils density and permeability shall be performed by the Geotechnical Engineer, FML destructive testing shall be performed by the third party independent Construction Quality Assurance Consultant (CQAC).

Low Permeability Clay Liner. The Contractor, Engineer and Geotechnical Engineer shall identity suitable materials from the cell excavation to be used to construct the clay liner and barrier components.

Target Values. In the event that the identified soil differs from the soils from which the historical Moisture/Density/Permeability relationship target values were previously established for this facility, new soil samples from the proposed excavation shall obtained and used to develop new Moisture/Density/Permeability relationship target values required to meet the 1 x 10^{-7} cm/sec. permeability limit required.

Compacted Low Permeability Clay Liner Test Pad. To verify the suitability of the soil selected and the Contractor's methods to produce a Low Permeability Clay Liner with a permeability (hydraulic conductivity) equal to or less than 1 X 10-7 cm/sec, the Contractor shall construct a 20' by 80' test pad using the material and his proposed compaction methods, under the observation of the QCAO. The Contractor shall provide not less than 48 hours notice to the QCAO and Geotechnical Engineer prior to the start of test pad construction.

The test pad may be constructed on the prepared subgrade or some other location approved by the Engineer. The Geotechnical Engineer will obtain Shelby Tube samples upon completion of the test pad. Samples from the test pad to be used to develop Moisture/Density/Permeability relationship target values required to meet the 1 x 10-7 cm/sec. permeability limit required.

Clay Liner Construction. After the subgrade has been approved and the target Moisture/Density/Permeability relationships established, the Geotechnical Engineer shall perform 5 field moisture density tests per 8-inch lift per acre of clay liner constructed. Field density tests shall include moisture content measurements. In the event that field density tests fail to meet the target values, the contractor shall correct the deficiency by adjusting the moisture content and re-compacting the material, or removing the material and replacing the failed area with suitable compacted material. All failed areas shall be re-tested until satisfactory tests are achieved. The Geotechnical Engineer and CQ&A Officer shall document the horizontal and vertical location of all tests and retests.

Clay Liner/Barrier surface profile. The liner/Barrier surface will be checked for plan grading tolerance by survey prior to acceptance. GPS location control stakes and benchmarks will be provided by the Engineer. The QCAO or his designated representative will observe the completed liner/barrier surface after it has been rolled smooth by the Contractor to verify that it is be free of stones larger than 1" and debris that could damage the HDPE liner and that it is suitable for FML installation.

FML Liner/Barrier. The Contractor shall submit shop drawings and material product data that certifies material compliance with the specifications and reference standards (GRI GM13). In addition, the installer shall provide panel layout drawings and the Installer's Geosynthetic Field Installation Quality Assurance Plan for approval prior to commencing with the installation. After the construction is completed the installer shall submit a certificate of compliance with the contract documents, installation and materials warranties and as-built drawings.

The FML Installer shall be approved by the FML supplier when applicable.

The installer and QCAO shall inspect the clay liner surface profile and condition and shall certify that the surface is suitable for FML deployment.

See Appendix A for complete FML testing requirements. All field tests shall be witnessed by the QCAO or his designated representative.

One destructive seam test per 1,000 foot of seam shall be performed by a third party Consultant to assure compliance with the specifications and referenced standards. Field weld seams shall be tested in accordance with ASTM D6392. Samples for destructive testing shall be obtained from the side slopes.

Not less than 2 trail seam welds shall be tested daily to assure proper function of welding equipment.

All field seams shall be air pressure tested or vacuum tested for integrity in the presence of the OCAO.

Failed seams shall be reconstructed or capped and re-tested until compliance is achieved per Appendix A.

The repair of FML defects shall be per Appendix A 02700.3.7 Repair Procedures, including retesting.

LEACHATE COLLECTION SYSTEM. The QCAO shall observe the construction of the leachate collection system.

HDPE Pipe. The Contractor shall submit shop drawings and material product data that certifies material compliance with the specifications and reference standards. The Contractor fusing pipe segments in the field shall be trained and approved by the pipe supplier.

Solid carrier and containment pipe, used for leachate transport outside of the cell liner, shall be subjected to pressure testing and visual inspection by the QCAO.

Drainage Layer. The Contractor shall submit a gradation report certifying that the granular material meets the specified requirements. The QCAO shall observe the material as placed to the proper depth and shall sample and test any material that appears to deviate.

CORRECTION OF DEFECTS

The specifications call for the correction of all defects in the materials and/or workmanship for a period of two years from the date of completion. In addition, the Contractor will provide a performance and payment bond to guarantee that corrective action will take place.

Northern Plains Regional Landfill
Storm Water Conveyance Waterway (Along North and West perimeter)
4/1/2026

The Rational method is based upon the following formula:

$$QT=CiTA$$

Where:
QT = estimate of the peak rate of runoff (cfs) for some recurrence interval, T
C = runoff coefficient; fraction of runoff that runsoff the contributing drainage area.
iT = average rainfall intensity (in/hr) for some recurrence interval, T during that period of time equal to Tc.
A= the contributing tributary drainage area in acres which produces the maximum peak rate of runoff
Tc = rainfall intensity averaging time in minutes
Rainfall intensity averaging time is used as the definition of Tc in this instance because it more accurately describes

Contributing Area A =	21.4	Acres	
Runoff Coefficient C =	0.4	From ISWMM Chapter 3, Section 4 Steep slopes, poor stand of grass.	
Time of concentration =	44.5	500' @ 20%, 2422' @ 0.10%	
Rainfall intensity iT =	3.25	inches/hour	(From Table 2)
Runoff Q_{25} =	**27.82**	**CFS**	
Runoff Q_{100} =	**36.38**	**CFS**	

Q = (1.486/n)*AR^(2/3)*S^.5 CFS

n =	0.06	Grass Waterway
SLOPE S =	0.001	FT/FT
BOTTOM WIDTH W =	12	FT
FORESLOPE(F) =	4	/1
BACKSLOPE(B)=	4	/1
DEPTH =	Y	FT
AVG. VELOCITY =	V	FT/S

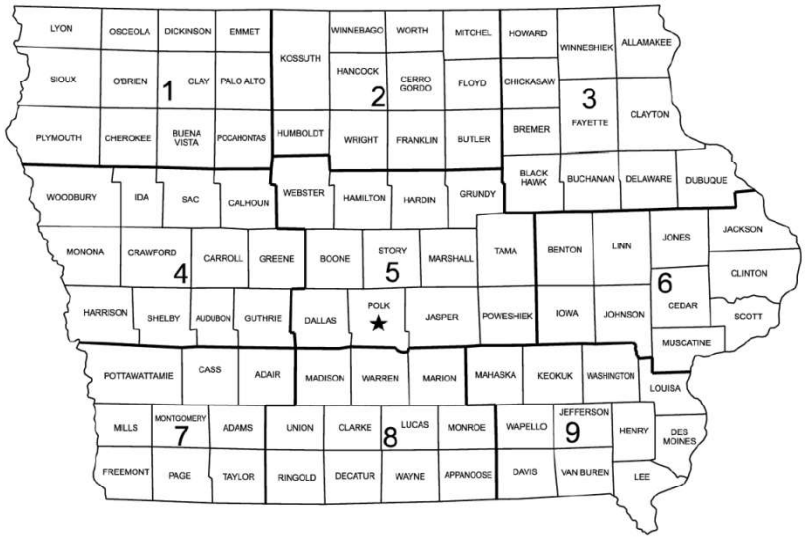
A = Y*(W+.5FY+.5BY)
P = W+Y((1^2+F^2)^.5)+Y((1^2+B^2)^.5)
R = A/P

	Y	A	P	R	AR^(2/3)	Q	V
	0.5	7	16.1231	0.4342	4.0136	3.1434	0.45
	0.6	8.64	16.9477	0.5098	5.5138	4.3183	0.50
	0.7	10.36	17.7723	0.5829	7.2294	5.6620	0.55
	0.8	12.16	18.5970	0.6539	9.1607	7.1746	0.59
	0.9	14.04	19.4216	0.7229	11.3089	8.8571	0.63
	1.0	16	20.2462	0.7903	13.6764	10.7112	0.67
	1.1	18.04	21.0708	0.8562	16.2657	12.7392	0.71
	1.2	20.16	21.8955	0.9207	19.0801	14.9434	0.74
	1.3	22.36	22.7201	0.9842	22.1231	17.3266	0.77
	1.4	24.64	23.5447	1.0465	25.3984	19.8918	0.81
Less than 3.0' depth	**1.5**	27	24.3693	1.1080	28.9097	22.6418	0.84
Waterway Capacity Exceeds 25 yr Runoff	1.6	29.44	25.1939	1.1685	32.6612	25.5800	0.87
	1.7	31.96	26.0186	1.2284	36.6569	28.7093	0.90
	1.8	34.56	26.8432	1.2875	40.9010	32.0333	0.93
Less than 3.0' depth	**1.9**	37.24	27.6678	1.3460	45.3976	35.5550	0.95
	2.0	40	28.4924	1.4039	50.1511	39.2779	0.98
	2.1	42.84	29.3170	1.4613	55.1657	43.2053	1.01
	2.2	45.76	30.1417	1.5182	60.4457	47.3405	1.03

Table 2: Rainfall Intensities (inches/hour) for Recurrence Intervals of 2 to 100 years[1].

* Sectional code (see map)

1-Northwest	4-West Central	7-Southwest
2-North Central	5-Central	8-South Central
3-Northeast	6-East Central	9-Southeast



*section	duration	recurrence interval					
		2 year	5 year	10 year	25 year	50 year	100 year
		intensity in/hr	intensity in/hr	intensity in/hr	intensity in/hr	intensity in/hr	intensity in/hr
1	5 min	5.53	6.92	8.11	9.69	10.9	12.1
1	10 min	4.06	5.07	5.92	7.09	8.00	8.91
1	15 min	3.29	4.12	4.82	5.77	6.50	7.24
1	30 min	2.30	2.89	3.38	4.05	4.56	5.08
1	1 hr	1.48	1.86	2.18	2.64	3.01	3.38
1	2 hr	0.90	1.13	1.34	1.63	1.87	2.11
1	3 hr	0.66	0.83	0.99	1.22	1.40	1.60
1	6 hr	0.38	0.48	0.57	0.72	0.84	0.96
1	12 hr	0.21	0.27	0.32	0.41	0.48	0.56
1	24 hr	0.12	0.15	0.18	0.22	0.26	0.31
1	48 hr	0.06	0.08	0.10	0.12	0.14	0.16
1	3 day	0.05	0.06	0.07	0.08	0.10	0.11
1	4 day	0.04	0.04	0.05	0.06	0.08	0.09
1	7 day	0.02	0.03	0.03	0.04	0.05	0.05
1	10 day	0.02	0.02	0.02	0.03	0.03	0.04
2	5 min	5.53	6.93	8.18	9.96	11.4	12.9
2	10 min	4.04	5.07	5.98	7.29	8.35	9.45
2	15 min	3.28	4.12	4.87	5.92	6.79	7.68
2	30 min	2.33	2.94	3.47	4.23	4.85	5.50
2	1 hr	1.52	1.92	2.27	2.80	3.23	3.69
2	2 hr	0.93	1.18	1.41	1.74	2.02	2.31
2	3 hr	0.69	0.88	1.05	1.30	1.52	1.74
2	6 hr	0.40	0.51	0.61	0.76	0.89	1.03
2	12 hr	0.22	0.28	0.34	0.43	0.50	0.58
2	24 hr	0.12	0.15	0.18	0.23	0.27	0.32
2	48 hr	0.07	0.08	0.10	0.12	0.14	0.17
2	3 day	0.05	0.06	0.07	0.09	0.10	0.12
2	4 day	0.04	0.05	0.06	0.07	0.08	0.09
2	7 day	0.02	0.03	0.04	0.04	0.05	0.06
2	10 day	0.02	0.02	0.03	0.03	0.04	0.04

[1] Based on NOAA *Atlas 14: Precipitation-Frequency Atlas of the United States, Volume 8 Version 2.0: Midwestern States*. National Oceanic and Atmospheric Administration. Rainfall intensities for each climatic section were calculated by averaging the intensities for the counties included in each climatic section.

Peak Values Summary

Title: NPRL
Simulated on: 4/20/2026 11:43

	Peak Values for Years 1 - 5*		
	(inches)		(cubic feet)
Precipitation	2.10		7,628.2
Runoff	0.000		0.0000
Subprofile1			
Drainage Recirculated into Layer 3	0.1959		711.3
Drainage collected from Layer 3	0.7838		2,845.1
Drainage recirculated from Layer 3	0.1959		711.3
Percolation/leakage through Layer 5	0.000021		0.0752
Average head on Layer 4	5.0424		---
Maximum head on Layer 4	7.4700		---
Location of maximum head in Layer 3	45.32	(feet from drain)	
Other Parameters			
Snow water	1.7078		6,199.3
Maximum vegetation soil water	0.2443	(vol/vol)	
Minimum vegetation soil water	0.0403	(vol/vol)	

Average Annual Totals Summary

Title: NPRL
Simulated on: 4/20/2026 11:43

	Average Annual Totals for Years 1 - 5*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	31.06	[2.01]	112,761.3	100.00
Runoff	0.000	[0]	0.0000	0.00
Evapotranspiration	24.274	[2.251]	88,115.5	78.14
Subprofile1				
Recirculation into Layer 3	1.5888	[0.6758]	5,767.2	5.11
Lateral drainage collected from Layer 3	6.3551	[2.7031]	23,069.0	20.46
Drainage recirculated from Layer 3	1.5888	[0.6758]	5,767.2	5.11
Percolation/leakage through Layer 5	0.000200	[0.000079]	0.7258	0.00
Average Head on Top of Layer 4	0.1119	[0.0476]	---	---
Water storage				
Change in water storage	0.4342	[0.6008]	1,576.2	1.40

* Note: Average inches are converted to volume based on the user-specified area.

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: NPRL **Simulated On:** 4/20/2026 11:42

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
FSL - Fine Sandy Loam
Material Texture Number 7

Thickness	=	6	inches
Porosity	=	0.473	vol/vol
Field Capacity	=	0.222	vol/vol
Wilting Point	=	0.104	vol/vol
Initial Soil Water Content	=	0.1773	vol/vol
Effective Sat. Hyd. Conductivity	=	5.20E-04	cm/sec

Layer 2

Type 1 - Vertical Percolation Layer (Waste)
MSW with Channeling
Material Texture Number 19

Thickness	=	120	inches
Porosity	=	0.168	vol/vol
Field Capacity	=	0.073	vol/vol
Wilting Point	=	0.019	vol/vol
Initial Soil Water Content	=	0.0692	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-03	cm/sec

Layer 3

Type 2 - Lateral Drainage Layer
G - Gravel
Material Texture Number 21

Thickness	=	12	inches
Porosity	=	0.397	vol/vol
Field Capacity	=	0.032	vol/vol
Wilting Point	=	0.013	vol/vol
Initial Soil Water Content	=	0.032	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-01	cm/sec
Slope	=	2	%
Drainage Length	=	175	ft

Note: 20% of drainage collected from Layer 3 is recirculated into this layer.
Note: 20% of drainage collected from this layer is recirculated into Layer 3.

Layer 4

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.06	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	5	Holes/Acre
FML Installation Defects	=	5	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5

Type 3 - Barrier Soil Liner
Liner Soil (High)
Material Texture Number 16

Thickness	=	24	inches
Porosity	=	0.427	vol/vol
Field Capacity	=	0.418	vol/vol
Wilting Point	=	0.367	vol/vol
Initial Soil Water Content	=	0.427	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	89.3	
Fraction of Area Allowing Runoff	=	0	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	24	inches
Initial Water in Evaporative Zone	=	1.918	inches
Upper Limit of Evaporative Storage	=	5.862	inches
Lower Limit of Evaporative Storage	=	0.966	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	19.997	inches
Total Initial Water	=	19.997	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	43.25	Degrees
Maximum Leaf Area Index	=	1	
Start of Growing Season (Julian Date)	=	120	days
End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	11	mph
Average 1st Quarter Relative Humidity	=	85	%
Average 2nd Quarter Relative Humidity	=	75	%
Average 3rd Quarter Relative Humidity	=	80	%
Average 4th Quarter Relative Humidity	=	75	%

Note: Evapotranspiration data was obtained for Graettinger, Iowa

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
0.85603	0.681399	1.696324	4.074576	3.515005	3.945585
3.674199	4.323145	3.159539	1.433481	2.796624	0.907825

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 43.25/-94.74

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
21.6	28.7	24.6	51.6	59.8	75.6
83.5	77.9	67.4	57.2	42.4	32.7

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 43.25/-94.74
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 43.25/-94.74

Final Water Storage in Landfill Profile at End of Simulation Period

Title: NPRL
Simulated on: 4/21/2026 11:44
Simulation period: 5 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	2.5330	0.4222
2	9.0027	0.0750
3	0.3840	0.0320
4	0.0000	0.0000
5	10.2480	0.4270
Snow water	0.0000	---

APPENDIX 6:
EMERGENCY RESPONSE
AND REMEDIAL ACTION PLAN (ERRAP)
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P
CITY OF SPENCER

 # 1717
April 16, 2026

CERTIFICATE

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.

James E. Thiesse, License No. 12304 Date

My license renewal date is December 31, 2027

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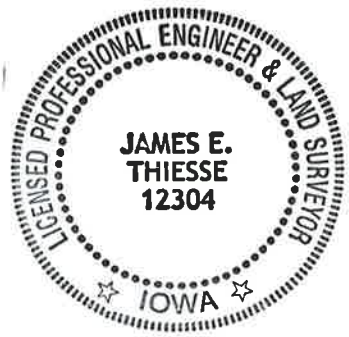
Pages 1-21



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Supplemental Information:

IDNR Chapter 131 Notification of Hazardous Conditions
IDNR Written Report for Hazardous Conditions
EPA Hazardous Substance Designations and Release Notifications (website)

See Landfill Fire Risk Management Plan (Doc#116678), Appendix H for Site Maps

1.0 FACILITY INFORMATION

1.1 Document Identification

This document serves as the facility Emergency Response and Remedial Action Plan (ERRAP) pursuant to 567 IAC, Chapter 113.8(5) of the Iowa Code. A new plan is required for permit renewal in accordance with Iowa Code section 455B306(6).

This document includes references to the Landfill Fire Risk Management Plan dated March of 2025 prepared by SCS Engineers.

1.2 Purpose of Document

To prepare employees for emergencies that may reasonably be expected in the workplace (e.g., fire, explosion, toxic chemical release, tornado, thunder storm, blizzard, electrical power failure, bomb threat, violence in the workplace, floods, spills or releases of regulated substances), by having an emergency action plan to more effectively achieve employee and public safety, health and well-being in an emergency. This document also identifies proper authorities and describes procedures for reporting incidents to said authorities.

1.3 Facility Description

The Northern Plains Regional Landfill is a Sanitary Disposal Project (SDP) consisting of a multi-cell Sanitary Solid Waste Landfill with clay or composite liner, leachate collection system and synthetic lined leachate storage basin. The facility also includes an above ground scale, office and maintenance building, and cold storage building. The purpose of the facility is to entomb municipal solid waste to prevent environmental contamination.

1.4 Permitted Agency: CITY OF SPENCER, IOWA
101 W 5th Street, Spencer, Iowa 51301

1.5 IDNR Permit Number: 74-SDP-02-76P

1.7 Responsible Official: Mark Krieg, Assistant Spencer Public Works Director
712-580-7200

1.6 Certified Operator: Dan Chism Office: 712-859-3185 Cell: 712-480-3298

1.7 Facility Location 3032 420th Avenue, Graettinger, IA, 51342

NW 1/4, Section 21, T97N, R33W, of the 5th P.M., Palo Alto County, Iowa. Located approximately 2 miles south of Graettinger, Iowa on Iowa Highway 4.

2.0 UTILITY FAILURES

2.1 Power (Electricity) Interruption.

The operator should check the circuit breaker load center (breaker box) to determine if the power interruption is a result of a tripped circuit breaker or loss of incoming power from the electric utility. If power loss is a result of a tripped circuit breaker, the operator should look for any obvious equipment failures and contact the Public Works Director for further instruction. Electrical repairs should be performed by a qualified electrician.

All electrical service interruptions should be recorded in the operator's log and reported to the electrical supplier:

Iowa Lakes Electric Cooperative
1-800-225-4532
1-712-362-7870

2.1.1 Short-term, (less than 4 hours), power failure caused by a power service interruption can be expected to have the following minimal impact on the operation of the facility:

Power loss will result in the loss of use of lights, scale, computers, heaters and other electrical devices in the office. Should multiple interruptions occur, (repeated on/off cycling of power), all electrical devices should be turned off until stable electrical service is restored. Leachate lift station pumps will not operate.

Should the scale become inoperable for any reason, the operator will need to make alternative arrangements to weigh incoming solid waste. Said arrangements include having the trucks weighed at local grain elevator scales prior to transport to the facility. Should a load arrive that was not weighed, the weight should be estimated by converting truck box capacity in cubic yards to tons.

2.1.2 Long-term power outages lasting more than 4 hours may impact additional operations at the facility including leachate lift station pump operation. Because of the downstream location of the lift station, it is possible for the leachate to overflow the pump station manhole and spill onto the surrounding soil. If left uncontrolled, the leachate spill could also contaminate the lower pond and possibly the creek. During a long-term power outage, the operator should:

1. Monitor leachate level in wet well. Close inlet valves if a spill resulting from a rising leachate level is imminent or use portable pump to load directly into transport truck or to recirculate leachate into cells until power is restored.

2. Monitor air temperatures in facilities with plumbing to prevent freezing of pipes.

3. Manually turn off electrical equipment until power is restored.

2.2 Liquid Propane Shortage

In the event of a propane outage, the operator should contact the current propane supplier. If the facility is out of propane for more than 8 hours (during freezing temperatures), auxiliary heat sources may be required to prevent damage to office plumbing due to freezing. It may also be possible to prevent pipes from freezing by allowing a trickle of water to run from all faucets and toilets. Contact the Public Works Director for additional instructions.

In the event of a propane leak, all persons should evacuate the area being careful not to create a source of ignition. ***Do not switch any electrical devices on or off. Do not start or operate any vehicles or equipment located in or around the gas plume.*** Once a safe distance is reached, contact the local fire department and the current propane supplier.

Additional information regarding propane hazards is available from the current propane supplier, **New Cooperative, Spencer, IA: (712) 262-6650**.

2.3 Well Failure

The facility uses a water well located near the office building to supply water to the combination office/shop building. A bottled water cooler in the office provides drinking water. Well water is used for washing and for toilet flushing. If the well fails, the operator will have contact the Public Works Director to make arrangements to rent a temporary portable toilet.

Do not drink the water from any faucet at this facility. ***Drink only the water from the bottled water cooler.***

3.0 WEATHER EVENTS

Natural weather phenomenon such as thunderstorms, tornados, blizzards and windstorms may have a negative impact on the facility and pose a danger to persons at the facility. Personnel should remain in close contact with each other during extreme weather events to keep all parties informed as to the danger of impending weather events. All personnel should monitor the media for storm alerts, watches and warnings.

During adverse weather all personnel should seek shelter in the designated areas inside the office as shown on the site map. In the event of a tornado warning or sighting, all personnel should seek refuge in the free standing tornado shelter located east of the Office Building (see site plan).

3.1 Lightning Strikes

Do not operate machinery in open areas during a lightning storm. *Stay in vehicle and head for shelter.* Lightning strikes at the site or nearby can cause power outages or damage to electrical equipment. Should the operator suspect an equipment failure due to lighting strike, he should review the owner's manual for the device in question. In addition to total failure, lightning damage to sensitive electrical equipment is sometimes evident by erratic operation. Sensitive devices (such as the GPS monitoring system) should be protected by surge arresting devices designed to protect from electrical surges. Circuit breakers provide limited protection, but are sometimes tripped by lightning induced power surges. As a precaution, the operator should shut down and unplug sensitive equipment such as computers during local thunderstorms. In addition, direct lightning strikes can cause ignition of combustible materials resulting in fires. Should the operator suspect a nearby lightning strike, after the danger has past he should make a visual inspection of the facility for damage or fires started by lightning. Special attention should be paid to the scale and the leachate pump station. Fires caused by lightning should be reported by calling 911.

3.2 Heavy Rains

Heavy rains have the potential to cause localized slope failure and/or erosion of hillsides. Steep, non-vegetated slopes or soils saturated by previous rains are most likely to be damaged by heavy rains. The potential for slope failure can be reduced by maintaining slopes at an angle flatter than the natural angle of repose for the material being piled. Slope failures that result in damage to equipment, test wells, gas vents (if any), etc. should be reported to the Public Works Director who will oversee the repair of said equipment. Care should be exercised when repairing failed slopes to determine that the slope is stable and damage or damage to repair equipment and personnel is avoided.

Extended periods of heavy rains will add water to the leachate pond. In addition, prolonged period of wet weather could increase the landfill's production of leachate. For these reasons, the leachate pond should be operated in accordance with the "Appendix 5: Leachate Control Plan" which calls for a target depth from bottom of 5.0 feet during winter months and 3.0 feet during the wet summer months.

Heavy rains will also cause saturated soils to become soft. Special care should be taken to avoid operating heavy equipment and transport vehicles in saturated, weak soils. Drainage of haul roads should be maintained at all times. Should soft spots develop that can not be corrected by grading, the Public Works Director may authorize the placement of stabilizing rock to bridge weak spots in the grade.

Operators of dump trucks with elevated boxes should take special precautions to assure themselves that the truck is on solid ground prior to raising the box to avoid overturning the truck.

The existing creek is subject to flash flooding during intense rainfall events.

3.3 Windstorms

Windstorms may disperse litter from refuse not yet covered. It is important to place cover as soon as possible during windy days. This may require cover to be placed immediately upon dumping if conditions warrant. ***During extreme wind events, the operator should declare the landfill closed and halt dumping until winds subside***. After winds have subsided, the site should be traversed and debris and litter returned to the active cell and disposed of. High winds can cause high profile vehicles and trailers to be overturned. Avoid operating equipment with a large surface area during high winds.

3.4 Blizzards

Blizzards will create the same hazards as summer windstorms with additional hazards caused by blowing snow and freezing temperatures. Should reduced visibility hamper safe operation at the landfill or pose a threat to those traveling to or from the landfill, the operator shall contact the Public Works Director for further instruction. In addition, the Iowa Department of Transportation and County Sheriff's office should be consulted for road conditions. It may be advisable to close the landfill should blizzard conditions warrant. When working outside during blizzard conditions, the operator is reminded to dress warmly and watch for frostbite of exposed skin. ***Personnel should remain in continuous contact with each other when outside during extreme weather events.***

3.5 Tornado

When weather conditions are favorable for the formation of tornados, personnel should monitor the weather reports for tornado watches or warnings. ***In the event of a tornado warning or sighting, all personnel should seek refuge in the free standing tornado shelter located east of the Office Building (see site plan).*** If you cannot reach the office shelter, lie flat in a ditch or depression and cover yourself with a blanket, cardboard or whatever is available to provide protection from flying debris. Avoid overhead power lines, trees, or other objects, which may fall or attract lightning. Be aware of areas subject to flash flooding. When traveling in a vehicle, try to get to the nearest substantial building if you can do so safely. If not, abandon the vehicle and follow the above outdoor rules. Never try to out-drive a tornado! Do not take shelter under your vehicle. When a tornado is spotted or a warning is issued remain calm, seek immediate shelter, and cover your head with a heavy blanket or coat. Stay away from windows, brick walls and chimneys. Do not seek shelter in an area where a heavy object is above your head.

If you spot a tornado and it is possible, give the following information to the radio station:

1. Your name and location.
2. What you saw, the time the activity began and/or ended.
3. The direction the funnel is from you and an estimation of how far away it is as well as the direction it is traveling.

After the threat of danger has past, the site should be assessed for damage to determine what remedial action is required.

3.6 Flooding

Due to the topography of the site, widespread flooding should not be experienced. The existing creek is subject to flash flooding during intense rainfall events. The existing culvert and surrounding approaches are subject to erosion and failure. ***Never drive or walk through water over the haul road.***

3.7 Event and Post Event Conditions

During a weather related emergency situation, landfill personnel should make an effort to remain in contact with other personnel at the facility. Personal safety should be placed above other concerns. After the danger of the weather event passes, landfill personnel should gather at the emergency assembly point (EAP). Once at the EAP, call 911 to contact necessary outside emergency response personnel as necessary. After calling 911 and assisting others, the operators should assess the condition of the site and make a list of property damage that is found. If during the inspection, additional dangers are discovered; the operators should secure the area and contact additional help to address the danger. Once the site is secured and all personnel are accounted for, the operator should contact the Public Works Department and report the findings from his site inspection.

4.0 FIRE OR EXPLOSION

4.1 General Fire or Explosion Procedure

Additional information regarding landfill fires can be found in the "LANDFILL FIRE MANAGEMENT PLAN" dated March, 2025, prepared by SCS Engineering for the NPRL (IDNR Doc # 116678). Said plan shall be considered a supplement to this ERRAP and should be periodically reviewed by all landfill personnel. In addition, landfill personnel should follow the recommended training regimen outlined in the management plan.

In the event of a fire or explosion, personnel should:

1. Seek an immediate escape route to safety; alert others as you escape.
2. If not in immediate danger, check the site for injured personnel. If others are in danger, *help get them out if you can do so safely*. Because solid waste fires may involve chemical fires, use special precautions to avoid toxic fumes.
3. If small fires cannot be easily extinguished with fire extinguishers, evacuate the area and contact emergency response center by calling 911. *Do not attempt to extinguish a fire yourself unless you are properly trained and can do so without risk to your safety*.
4. All personnel should assemble in the emergency assembly point (EAP) as shown on the site plan.
5. Put personnel safety above all else.
6. Secure the site so that unauthorized persons are not allowed onto the site.

The following information is found in Section "6.1.1 General Fire Response Plan" of the "LANDFILL FIRE MANAGEMENT PLAN";

Each fire can be managed if the following steps are followed and good judgment is used when making decisions. The most crucial aspect of effective fire management is to remain calm so that successful initiation of the steps below can occur.

- Evacuate the area of all non-essential personnel. Alert all other employees and activate the fire alarm system if one is in place.
- Once clear, the fire needs to be assessed to decide whether it can be managed by site personnel. If the answer is no, or even maybe, call 911 and request assistance from the fire department
- Be clear when explaining the nature of the fire to the fire department. Include known details regarding possible causes, where the fire is located (on site structure, vehicle, or landfill), what the fuel is, whether it is a surface or subsurface fire, and if it poses a spreading risk. These details will allow firefighters to respond in the appropriate manner.
- Begin initiating communication up the chain of command. Notify the site commander or the IC by phone or in person.
- If site personnel choose to fight the fire, never do so alone. Always let someone know your plan of action.
- When fighting a fire, always consider your safety over the loss of property or equipment.
- If a fire has outside energy sources, like electricity or landfill gas, these utilities should be shut down immediately (see locations shown on Figure H-3 & H-6).

- If the fire is small, extinguish with the proper fire extinguisher. Always maintain an escape path in case you fail to extinguish the fire and need to vacate the area.
- Always avoid the smoke when around a fire. Smoke is toxic.
- Always work with the fire department once they arrive. If it is a structure fire, the fire department will handle all aspects of extinguishment.
- Prepare a fire incident report and submit it to the supervisor.
- Notify the Department at the appropriate time based on the incident type occurring.

CALLING 911 – Supply this information:

1. Facility name: **NORTHERN PLAINS REGIONAL LANDFILL**

2. Address: **3032 420th Avenue, Graettinger, IA, 51342**

3. Phone No.: **712-859-3185**

4. **Your name**

5. **Type of fire (explosion, chemical, structure, etc.) and general location** on site; if possible have someone meet emergency responders near the entrance.

6. Extent of emergency:
   * Fire in control / fire out of control
   *Explosion occurred / explosion likely
   *Toxic fumes likely
   *Evacuation may be needed
   *Trapped personnel

7. Injuries:
   *How many injured
   *Extent of injuries:
   -conscious or unconscious?
   -bleeding?
   -not breathing?
   -in shock?
   -burns?

If there are injured personnel, begin administering first aid and stay with injured personnel until medical personnel arrive. See first aid manual.

Alert the Public Works Director as soon as possible after personnel needs are met.

Begin an incident report.

After the fire is extinguished and emergency personnel declare the area safe, the site should be assessed for damage and clean-up operations commenced when authorized by authorities. Should the fire damage prevent operations from resuming, the solid waste haulers, transfer stations, etc. should be immediately notified that the landfill is closed until further notice and solid waste is to be diverted to other nearby landfills.

It is important that clean-up operations be coordinated with emergency response officials to avoid hampering their investigation if applicable.

4.2 Specific Fire Procedures

Follow the procedures found in the latest "LANDFILL FIRE MANAGEMENT PLAN", for specific types of fires in addition to the General Fire or Explosion Procedures described in section 4.1.

4.2.1 Garbage Fires.

Follow the procedures found in the "LANDFILL FIRE MANAGEMENT PLAN".

If possible *without endangering personnel*, remove equipment from the cell to a safe upwind location free of combustible materials.

Provide Stockpiled Cover Soil.

Stockpiled cover soil is necessary to control solid waste fires. Keep an ample supply of dirt available at all times near the working face for fighting fires. When working in the upper portions of the landfill where hauling soil is time consuming, maintain a minimum of 500 cubic yards in a stockpile adjacent to the working area to allow the construction of a fire break if necessary.

To extinguish a surface fire using cover soil, place soil as close to fire as safely possible using a loader or excavator, generally working from a cross wind direction. Operating equipment from a downwind direction may cause the operator to be overcome by toxic smoke. The goal is to spread the dirt over the burning or exposed solid waste (or ASR) in a layer approximately 6' deep to smother the fire.

To prevent the spread of a surface fire too large to extinguish, it may be necessary to create a fire break using cover soil. In this scenario cover soil should be placed in a band ahead of the advancing fire, taking care not to become engulfed in smoke or flames. The width of the band required will vary with the intensity of the fire and the velocity of the wind. Strong winds will produce larger, more intense fires that will spread more rapidly and require wider fire breaks.

Notify Palo Alto County EMC ……..…Kayla Hagen ……712-852-4997

The Local Emergency Management Coordinator (EMC) must be notified:

- whenever there is a fire, spill, or other emergency whose effect will be felt outside the boundaries of the facility.
- whenever a spill or release exceeds the Reportable Quantity, whether or not it extends beyond the facility boundary.

Notify Spencer IDNR field office at 712-262-4177 for all solid waste fires.

4.2.2 Building Fires

Office Fire. Use halon type fire extinguishers in office space for small fires to minimize damage to office equipment. Be sure to read all warning labels for this type of extinguisher.

Electric Fire. Use Class C fire extinguisher.

If possible *without endangering personnel*, remove equipment and records from the building to a safe upwind location free of combustible materials.

After the fire is extinguished and emergency personnel declare the area safe, the site should be assessed for damage and clean-up operations commenced. To reduce the potential for vandalism, work with fire officials to take temporary measures to secure the building such as covering doorways, chaining doors shut, as may be necessary.

4.2.3 Equipment/Facility Fires

Engine Fires. Use Class B fire extinguisher.

Battery Fire. Use Class B fire extinguisher. Use water with care. Battery acid may splatter.

Shut off power or fuel source to equipment damaged by fire.

If equipment is damaged such that it can no longer be used, the Public Works Director will make alternative equipment arrangements.

4.2.4 Fuel Fires

Use Type B fire extinguisher for small fires. Do not use water. Small fuel fires on the ground can be smothered by covering with earth.

Be reminded that heated fuel vapors are extremely volatile and can reignite easily.

Containers and fuel tanks holding fuel or fuel vapors may explode if heated**.**

Contact Public Works Director to report all fuel spills or incidents involving fuel handling.

Do not use fuel that has been exposed to contamination from fire extinguishing materials.

Additional information regarding fuel hazards is available from the current fuel supplier, New Cooperative, West Bend, IA: (515) 200-1362.

4.2.5 Hot Load Fires

The driver and operator should attempt to safely dump the load in an open area down wind from combustible materials. Once the load is clear of the truck, move the truck to safety and cover the load with stockpiled soil if it can be done safely, otherwise call "911". After the fire is extinguished and emergency personnel declare the area safe, the remaining debris should be disposed of in the active cell. Wait a minimum of 8 hours before placing debris in contact with combustible materials.

4.2.6 Waste gas fire/explosion

Personnel should evacuate the facility immediately, call 911 and close the landfill until emergency responders declare it safe to resume operations.

Notify parties listed under Garbage Fires. Follow instructions given by officials.

After the area is declared safe, ignition sources should be eliminated. Restoration should begin only after officials completed their investigations.

4.2.7 Grass Fires

If fire is small and non-threatening, notify other on-site personnel and attempt to extinguish the fire. Move equipment out of harms way before attempting to extinguish a fire.

Small grass fires can be extinguished by smothering with earth, by fire extinguisher or with water if available. Note grass fires can quickly grow out of control under windy conditions. Typically, the fire department should be contacted to assist in extinguishing all grass fires.

4.3 Explosive Devices

In the event that a suspected explosive device is discovered at the facility, the operator should evacuate the immediate area immediately and notify all personnel at the facility. The operator should call 911 to report the device and follow all instructions given. See section 4.1 "General Fire or Explosion Procedure".

The landfill should be closed until the site is declared safe by the appropriate authorities.

5.0 REGULATED WASTE SPILLS AND RELEASES

A "release" or "spill" is defined for this document as the unintentional release, spill, leak, escape or discharge of a regulated substance from containment into the environment.

Regulated substances that may be encountered in this facility include: leachate, waste gas, solid waste, fuels, etc.

Spills/releases are further broken down into "on-site" or "off-site" spills or releases.

THE IDNR MUST BE CALLED BEFORE 6 HOURS ELAPSE AFTER A CHEMICAL SPILL. ASK THE IDNR WHO ELSE SHOULD BE CALLED (515-725-8694).

5.1 Leachate System

The greatest potential for a spill/release (both on-site and off-site) rests with the leachate from the landfill. The leachate system is designed to collect the leachate from the bottom of the cells, transport it by gravity to the lift pump station and then pump it to the containment lagoon. As conditions warrant, the leachate is to be transported by tanker truck to the Spencer Waste Water Treatment Plant (WWTP). The leachate recovery system is to be operated in strict compliance with the approved "Leachate Control Plan" and subsequent updates.

The landfill site is monitored for leachate contamination of the soils, surface water and/or groundwater in and around the site in accordance with the current "Hydrologic Monitoring System Planning Report". In addition, an "Annual Water Quality Report" is issued each year that tabulates monitoring results for the year. Any changes in water quality that exceed action levels need to be addressed as described in these documents. A "Leachate Collection System Performance Effectiveness Report" (LCSPER) is prepared on an annual basis that should be reviewed for changes that may indicate a leachate release.

If the operator suspects a change in conditions that may indicate a release or spill of leachate, the Public Works Director and the Spencer field office of the IDNR should be contacted to make a follow-up investigation.

The operator should inspect the lift stations at least twice a week to insure proper operation. Any malfunction should be reported to the Public Works Director. If the pump station becomes inoperable, the inlet valve to the pump station should be closed to prevent overflowing the pump station manhole. Should the pump station be inoperable for an extended period such that leachate is "backed up" appreciably, it will be necessary to pump leachate from the lift station into a transport truck until the pump station is repaired. Leachate should be transported to the holding lagoon or transported directly to Spencer WWTP.

The operator should also inspect the route of the pump stations' discharge 2" forcemain for evidence of leaks. In addition, the operator should check the 4" carrier pipe that surrounds the forcemain. This pipe can be checked for leachate at the connection with the lift station. This carrier pipe provides secondary containment and the annular space between the pipes should be dry.

5.1.1 Lagoon failure

The leachate lagoon is constructed with a HDPE liner to prevent the discharge of liquid. If the liner or dikes fail, the operator should make an effort to contain the spill to as small an area as possible by constructing emergency dikes or grading swales away from the natural drainage routes. The lift stations should be shut down to prevent pumping of additional leachate. The operator should contact the Spencer field office of the IDNR and Public Works Director.

5.1.2 Leachate Transportation

Leachate is disposed of by transporting in tank trucks to Spencer WWTP. If a spill occurs on site during truck loading, the Spencer field office of the IDNR should be contacted.

If a spill occurs off-site during transportation of the leachate to the WWTP, the Palo Alto or Clay Emergency Management Coordinator should be contacted immediately depending on location of the spill. In addition, the Spencer field office of the IDNR needs to be contacted as well as the Iowa Highway Patrol and Iowa Department of Transportation.

5.2 Waste Gas

The facility currently does not emit detectable levels of waste gas. Should waste gas be detected through required monitoring, the operator should contact the Spencer field office of the IDNR. Waste gas needs to be analyzed for pollutant content and subsequent treatment may be necessary. Continuous production of waste gas may require venting and/or burning-off.

5.3 Waste Stockpiles/Storage Facilities

There are no designated **waste stockpiles** or storage facilities at this location. Wire fluff and car shredder waste is stockpiled for use as daily cover. These materials should be inspected regularly for signs of erosion.

5.4 Solid Waste Transportation

Solid waste received at the facility is transported in trucks from the contributing transfer stations. If a spill occurs on site during transporting, the spilled solid waste should be collected and transported to eth working face. Any soil contaminated should also be excavated and transported to the working face.

If a spill occurs off-site during transportation of solid waste, the Palo Alto or Clay Emergency Management Coordinator should be contacted immediately depending on location of the spill. In

addition, the Spencer field office of the IDNR needs to be contacted as well as the Iowa Highway Patrol and Iowa Department of Transportation.

5.6 Litter and Airborne Particulates

Close monitoring of dumping, timely compaction and daily cover of solid waste should keep litter and airborne particulates to a minimum. Should events occur such that litter or debris are scattered on the site, this material should be collected and returned to the landfill. In the event that airborne debris are deposited on adjacent property, the operator should contact the adjacent property owner for permission to retrieve said debris. The names and phone numbers are shown on the vicinity map.

Haul road dust should be controlled by applying water to the gravel haul roads as necessary to control off site discharge of roadway dust.

5.7 Site Drainage Systems

The site drainage system is monitored for the presence of leachate as part of the Hydrogeological System Monitoring Plan (HSMP). In the event that system monitoring indicates leachate is present, notify the IDNR.

If a spill occurs on the site near drainage facilities, where safely possible, the operator should attempt to prevent the spill from entering the surface drainage system or subsurface tile system by constructing temporary earthen berms or swales.

If a liquid spill occurs that enters the surface drainage system or subsurface tile system, the operator should attempt to contain the spill to the site by constructing temporary earthen berms.

5.8 Off-Site Releases

See paragraph “5.1 Leachate System”, regarding off-site releases of leachate from the landfill property.

See paragraph “5.1.2 Leachate Transportation”, regarding off-site spills during transport of leachate.

See paragraph “5.4 Solid Waste Transportation”, regarding solid waste spills during transport.

See paragraph “5.6 Litter and Airborne Particulates” regarding dust and litter discharges.

See paragraph “5.7 Site Drainage Systems” regarding surface drainage system spills.

6.0 HAZARDOUS MATERIALS

This facility does not intentionally accept hazardous materials. This facility is not permitted to accept liquid wastes such as fuels, liquid chemicals, fertilizers, waste water, etc. Do not accept suspected hazardous waste at the landfill. Refer persons in possession of suspected hazardous materials to the IDNR Spencer Field Office, 712-262-4177.

6.1 Load Check Points

Most of the material accepted by the landfill originates at the transfer stations that contract with the landfill to dispose of solid waste. The transfer stations are required not to accept hazardous materials (as defined by the CERCLA) in the waste stream. However, this may not prevent all hazardous materials from entering the landfill. As a second defense, all operators are certified by the State of Iowa and have been trained to identify and separate potentially hazardous materials. Each load is visually inspected during the dumping and compacting process.

In the event that hazardous waste is suspected in a load, do not handle or move the suspected hazardous waste. The operator should contact the Spencer field office of the IDNR (or after hours call state IDNR emergency response 515-281-8694) to report any hazardous waste and to determine procedures for the disposal or transport of said wastes if necessary. Prevent suspected hazardous waste materials from being mixed with other materials. If possible, the hazardous waste should be separated from the load and the area keep secure to prevent the spread of the hazardous material or the contamination of other permitted waste material.

Some types of hazardous waste, such as petroleum-contaminated soils, may be disposed of by surface spreading. Any such disposal shall be done in strict compliance with IDNR regulations, including IDNR reporting requirements.

7.0 MASS MOVEMENT OF LAND AND WASTE

The site is not within 200 feet of a ground fault and is not located within a seismic impact zone. As such the risk of an earthquake is considered minimal.

If cells are improperly constructed, slope failure caused by exceeding the natural angle of repose of the material being placed is conceivable. This should be prevented by following the approved Development and Operational Plan.

Likewise, waste subsistence, shifting or settling should be avoided by proper placement and compaction of materials. Should settlement of existing covered cells occur such that rain water does not run off effectively, low areas should be filled with appropriate soils obtained from the site.

Mass failures such as landslides that expose previously covered waste should be referred to the landfill engineer for analysis.

8.0 EMERGENCY & RELEASE NOTIFICATIONS & REPORTING

All Emergencies		**911**
Palo Alto Communications Center		**712-852-3535**
Palo Alto County Emergency Management Coordinator	**Kayla Hagen**	**712-852-4997**
Clay County Communications Center		**712-262-2151**
Clay County Emergency Management Coordinator	**Eric Tigges**	**712-260-2216(Cell)** **712-264-3987**
Spencer IDNR Field Office	**Jennifer Christian**	**712-262-4177**
State DNR	**(Spill Reporting)**	**515-725-8694**
Environmental Protection Agency	**(Hazardous Waste)**	**800-424-8802**
Graettinger Fire Department	**(Palo Alto Com. Center)**	**712-262-3535**
State Fire Marshall's Office		**712-262-5849**
City of Spencer Public Works Director	**Mark White**	**712-580-7200**
Palo Alto County Hospital		**712-852-5500**
Spencer Municipal Hospital		**712-264-6100**
Spencer Family Clinic	**(Doctor)**	**712-264-3500**
Palo Alto County Sheriff	**(Palo Alto Com. Center)**	**712-852-3535**

NEWS MEDIA	**Radio Stations:**	
KICD	**Spencer 107.7 FM / 1240 AM**	**712-262-1240**
KEMB	**Spencer/Emmetsburg 100.1 FM**	**712-264-1074**
KILR	**Estherville 95.5 FM / 1070 AM**	**712-362-2644**
	Newspapers:	
	Emmetsburg Democrat & Reporter	**712-852-2323**
	Graettinger Times	**712-859-3780**
	Spencer Daily Reporter	**712-262-6610**

Refer to the "SIMPLIFIED RESPONSE PLAN BASED ON FIRE TYPE" found in the LANDFILL FIRE MANAGEMENT PLAN for more information.

CALLING 911 – Supply this information:

1. Facility name: **NORTHERN PLAINS REGIONAL LANDFILL**
(former Flannegan Landfill)

2. Address: **3032 420th Avenue, Graettinger, IA, 51342**

3. Phone number: **712-859-3185**

4. **Your name**

5. **Type of emergency (accident, fire, explosion, chemical, structure, etc.) and general location** on site, if possible have someone meet emergency responders near the entrance.

6. Extent of emergency: * Fire in control / fire out of control
*Explosion occurred / likely
*Toxic fumes likely
*Evacuation may be needed
*Trapped personnel

7. Injuries: *How many injured
*Extent of injuries: -conscious or unconscious?
-bleeding?
-not breathing?
-in shock?
-burns?

DIRECTIONS TO PALO ALTO COUNTY HOSPITAL:

1. Go south (right) on US Highway 4 to US Highway 18 (five mile corner).

2. Turn left to head east on US Highways 4 & 18 to Emmetsburg (five miles).

3. After the river bridge, the highway curves to head south.

4. Turn left to go east on 1st Street, (the second left intersection past the bridge).

5. Follow 1st Street east to Hospital (approximately ¾ mile).

6. 3201 1st Street, Emmetsburg, Iowa. 712-852-5500.

9.0 EMERGENCY WASTE MANAGEMENT PROCEDURES

Should events occur at the landfill that prevent the facility from operating, the garbage haulers, transfer stations, etc. should be immediately notified that the landfill is closed until further notice and solid waste is to be diverted to other nearby landfills. The operator should contact the public works director prior to closing the landfill.

Transfer Stations:

ECCOG (Emmet County Council of Governments)	712-362-5250
Palo Alto County Transfer Station	712-852-2482
Pocahontas County Transfer Station	712-335-4069
Town of Bode, Iowa	515-379-1486
Town of Whittemore	515-884-9141
Shine Brothers (Spencer)	712-262-5579

The operator should refer to the current Comprehensive Plan for a list of communities served by the landfill that should be notified.

In addition, contact the IDNR Spencer field office 712-262-4177.

Should there be waste in transit to the landfill, the loads should be diverted to nearby landfills. The Public Works Director will coordinate the arrangements.

The operator should attempt to cover the active face of the cell if possible prior to shutting down the facility.

10.0 PRIMARY EMERGENCY EQUIPMENT

The following equipment is stationed at the landfill and is available for emergency response:

- 2023-2011 Al-Jon Model 525 self propelled compactor, 525 Horsepower
- 2020 John Deere 850L Dozer
- 2019 Caterpillar 963K Track Loader, 43,000 pounds, 2 Cubic Yard Bucket
- 2018 John Deere 250G Excavator
- 2000 IH single axle Dump Truck, 4900
- 1999 IH single axle Dump Truck, 4900
- 1993 Cat D6H XL Dozer
- 1990 644E John Deere Wheel Loader
- 1984 1845 Case Skid loader
- Caterpillar Self-Elevating Scrapper
- 1976 Cat 140 G motor Grader

Fire Hydrants and water sources. There are no fire hydrants on the site. Water can be pumped from the two small ponds located in the southwest corner of the site. *Leachate should not be used for fire fighting.*

Off-Site Equipment. The Graettinger Fire Department is the closest fire department. Additional fire support equipment can be called in from Emmetsburg, Estherville or Spencer.

11.0 EMERGENCY AID

11.1 Responder Contacts

For all emergencies contact 911.

For questions on procedures or non-emergency situations see the list of emergency contacts for individual organizations and contact names. Most situations will be coordinated through the Palo Alto County Emergency Management Coordinator, Kayla Hagen, 712-852-4997.

11.2 Medical services

For all emergencies contact 911.

For non-emergency situations contact your personal physician or clinic. For job related incidents, contact the Public Works Director or City Manager.

11.3 Contracts or Agreements

There are no EMS contracts at this time.

12.0 ERRAP TRAINING REQUIRMENTS

ERRAP Training of personnel will be completed through the City's contract with the Northwest Iowa Planning and Development Commission's SHIELD program. The trainer is Micheal Rayner. This training will be completed on an annual basis and as needed with new employees.

Micheal Rayner (NWIDC) currently keeps records of the procedures for this training.

Additional fire management training is available to landfill operators in the marketplace and landfill operators should refresh their training at a minimum of every 5 years.

13.0 EMERGENCY CONTACT LIST

All Emergencies		**911**
Palo Alto Communications Center		**712-852-3535**
Palo Alto County Emergency Management Coordinator	**Kayla Hagen**	**712-852-4997**
Clay County Communications Center		**712-262-2151**
Clay County Emergency Management Coordinator	**Eric Tigges**	**712-260-2216(Cell)** **712-264-3987**
Spencer IDNR Field Office	**Jennifer Christian**	**712-262-4177**
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NEWS MEDIA

Radio Stations:

KICD	**Spencer 107.7 FM / 1240 AM**	**712-262-1240**
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Newspapers:

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Graettinger Times	**712-859-3780**
Spencer Daily Reporter / NW Iowa Shopper	**712-262-6610**

Refer to the "SIMPLIFIED RESPONSE PLAN BASED ON FIRE TYPE" found in the LANDFILL FIRE MANAGEMENT PLAN for more information.

14.0 LANDFILL MANAGEMENT NOTIFICATION LIST

PUBLIC OFFICIAL IN CHARGE:	
Spencer Public Works Director:	Mark White 712-580-7200
LANDFILL SITE MANAGER:	
Assistant Spencer Public Works Director:	Mark Krieg 712-580-7200 712-260-4364(Cell)
After Hours, Call	712-262-2151
LANDFILL OPERATOR:	
On Site	Dan Chism 712-859-3185 712-480-3298(Cell)
LANDFILL ENGINEER:	Ross McWhirter 712-262-3468
Iowa DNR Permit Engineer	Mike Smith 515-229-8356

Northern Plains Regional Landfill Spill Reporting Notification Form

Sheet 1 of 2 - Incident details. Yellow cells are intended for user entry.

INVOLVED PARTIES			
Your name		Today's date	
Facility Name		Location	
Date and time of incident			
Emergency coordinator notified by		Time	
Spill found by (Name)			

INCIDENT DESCRIPTION			
Nature of incident	Option	Mark (X)	Other detail
	Fire		
	Spill		
	Gas or vapor release		
	Liquid Release		
	Other		
Description of incident			
Point of origin (fire)/source/(spill)/release)			
Cause, if known			
Duration of incident			
Location of spill/release			
Wind direction and velocity at time of release			
Weather conditions at time of release			

MATERIALS			
Name of hazardous substance(s) or chemical(s) involved			
Quantity of material released			
Is the spilled or released material on the CERCLA Hazardous Substance list in 40 CFR 302.4? If yes, what is the final reportable quantity (RQ) given in Table 302.4?		Listed?	
		RQ (lbs.)	
Is the spilled or released material on the Extremely Hazardous Substance list in 40 CFR 355, Appendix A or B? If yes, what is the reportable quantity given in Appendix A or B?		Listed?	
		RQ (lbs.)	

RESPONSE ACTION(S)			
Describe response measure(s) taken			
Quantity of material recovered			
Is cleanup completed		Date completed	

IMPACT			
What area(s) might be affected, based on the factors on the preceding page			
Damage to health, property, and environment within and beyond facility			
Nature of injuries			
Name of injured employee(s)			
Employer of injured employee(s)			
Operations curtailed			
Road blocks required		Locations:	
Date and time emergency ended			
Date and time operations resumed			

Appendix 6 Page 22 of 22

IOWA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL SERVICES DIVISION
FIELD SERVICES & COMPLIANCE BUREAU

Iowa Administrative Code Chapter 131
Notification of Hazardous Conditions

24 hour number for release reporting
515/725-8694

Summary of Key Points and Definitions

Definitions

"Hazardous Condition" means any situation involving the actual, imminent or probable spillage, leakage, or release of a hazardous substance onto the land, into a water of the state or into the atmosphere which, because of quantity, strength and toxicity of the hazardous substance, its mobility in the environment and its persistence, creates an immediate or potential danger to the public health or safety or to the environment.

"Hazardous Substance" means any substance or mixture of substance that presents a danger to the public health or safety and includes, but is not limited to, a substance that is toxic, corrosive, or flammable, or that is an irritant or that, in confinement, generates pressure through decomposition, heat, or other means. The following are examples of substances which, in sufficient quantity, may be hazardous: acids; alkalis; explosives; fertilizers; heavy metals such as chromium, arsenic, mercury, lead, and cadmium; industrial chemicals; paint thinners; paints; pesticides; petroleum products; poisons; radioactive materials; sludges; and organic solvents. "Hazardous substances" may include any hazardous waste identified or listed by the administrator of the United States Environmental Protection Agency under the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976, or any toxic pollutant listed under Section 307 of the federal Water Pollution Control Act as amended to January 1, 1977, or any hazardous substance designated under Section 311 of the federal Water Pollution Control Act as amended to January 1, 1977, or any hazardous material designated by the secretary of transportation under the Hazardous Materials Transportation Act (49 CFR 172.101)

Key Points

Who is Required to Report Hazardous Conditions. Any person manufacturing, storing, handling, transporting, or disposing of a hazardous substance shall notify the department at (515) 725-8694 and the local police department or the office of the sheriff of the affected county of the occurrence of a hazardous condition as soon as possible but not later than six hours after the onset of the hazardous condition or the discovery of the hazardous condition. A sheriff or police chief who has been notified of a hazardous condition shall immediately notify the department. Reports made pursuant to this rule shall be confirmed in writing as provided in 131.2(2).

Reporting Subsequent Findings. All subsequent finding and laboratory results should be reported and submitted in writing to the department as soon as they become available.

Reminder ~ VERBAL REPORTS ARE REQUIRED WITHIN 6 HOURS OF INCIDENCE OCCURRENCE OR DISCOVERY.

REV. 5/2024

IOWA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL SERVICES DIVISION
FIELD SERVICES & COMPLIANCE BUREAU

Guidelines for Reporting Hazardous Conditions
Verbal Reporting

24 hour number for release reporting
515/725-8694

Report the Condition if:

- ☐ The hazardous substance has the potential to leave the property by run-off, sewers, tile lines, culverts, drains, utility lines, or some other conduit, or,
- ☐ The hazardous substance has the potential to reach a water of the state – either surface water or groundwater or,
- ☐ The hazardous substance can be detected in the air at the boundaries of the facility property by the senses (sight and smell) or by monitoring equipment or,
- ☐ There is a potential threat to the public health and safety or,
- ☐ Local officials (Fire department, law enforcement, Hazmat, public health, and emergency management) respond to the incident or,
- ☐ The release exceeds a Federal Reportable Quantity (RQ).

~ If in Doubt, Report It ~

IDNR REQUIRES VERBAL REPORTS WITHIN 6 HOURS OF INCIDENCE OCCURRENCE OR DISCOVERY

- It is recommended that all spills be cleaned up although a particular spill may not be reportable. A series of small spills over time can result in one big cleanup.
- Department rules stress the immediate or potential danger that a spill may cause.
- A written report of the Hazardous Condition is required within 30 days of the verbal notification.

*In general, Iowa reporting requirements are more stringent than Federal reporting requirements. However, the **time limit** for reporting at the Federal level is more immediate.*

IOWA DNR EMERGENCY RESPONSE UNIT
6200 Park Avenue, Ste 200 / Des Moines, IOWA 50321
515-725-8694 TDD 515-242-5967 www.iowadnr.gov

IOWA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL SERVICES DIVISION
FIELD SERVICES & COMPLIANCE BUREAU

Guidelines for Reporting Hazardous Conditions Written Report Requirements

24 hour number for release reporting
515/725-8694

The Iowa Department of Natural Resources
Requires a written report of any Hazardous Condition.
(VERBAL REPORT REQUIRED WITHIN 6 HOURS)

Written Report. The written report of such a hazardous condition shall be submitted to the department within 30 days and contain the following information:

a. The exact location of the hazardous condition.
b. The time and date of onset or discovery of the hazardous condition.
c. The name of the material, the manufacturer's name, and the volume of each material involved in the hazardous condition in addition to contaminants within the material if they by themselves could cause a hazardous condition.
d. The medium (land, water, or air) in which the hazardous condition occurred or exists.
e. The name, address, and telephone number of the party responsible for the hazardous condition.
f. The time and date of the verbal report to the department of the hazardous condition.
g. The weather conditions at the time of the hazardous condition onset of discovery.
h. The name, mailing address, and telephone number of the person reporting the hazardous condition.
i. The name and telephone of the person closest to the scene of the hazardous condition who can be contacted for further information and action.
j. Any other information, such as the circumstances leading to the hazardous condition, visible effects, and containment measures taken that may assist in the proper evaluation by the department.

The written report should include the IDNR Spill Number (assigned at the time of the verbal report) and be addressed to the duty officer responding to the spill. Reports can be sent via mail, fax, or electronic mail to the addresses listed below.

Mail	Fax	E-Mail
Iowa DNR Field Services Emergency Response 6200 Park Ave. Ste 200 Des Moines, IA 50321	515/725-8201	Emergency_Response@dnr.iowa.gov

Written Report for Hazardous Conditions

The Iowa Department of Natural Resources
Requires a written report of any Hazardous Condition.

(VERBAL REPORT REQUIRED WITHIN 6 HOURS)

Written Report. The written report of a hazardous condition shall be submitted to the department within 30 days and contain the following information (Please complete as much as possible):

DNR Spill Number for hazardous condition: _____

Location of hazardous condition:

Physical Address _____ City _____

Legal Address Lat/Long or Twn/Rng _____ Zip _____

Other description _____

Time and Date of *onset or discovery* of hazardous condition:

Time _____ ☐ AM ☐ PM Date _____

Time and Date of *verbal report* to the department of the hazardous condition:

Time _____ ☐ AM ☐ PM Date _____

Hazardous Condition:

Name of material/substance(s)	Manufacturer	Volume

If more space is needed add additional pages. Attach a Material Safety Data Sheet (MSDS) if possible.

The medium in which the hazardous condition occurred/existed (Check all that apply):

☐ Ground Water ☐ Surface Water ☐ Land ☐ Air

Weather Conditions during the time of the hazardous condition onset or discovery:

Temperature	Wind Direction	Wind Speed	Humidity	Precipitation

Contact Information:

	Name	Company	Mailing Address	Telephone
Person Reporting (if known)				
Party Responsible				
Site Contact				

Cause of the Incident: Write a narrative of the events leading to the incident

Initial Actions Taken: Write a narrative of the initial actions and instructions taken or required.

Written reports should include the DNR spill number and be addressed to the duty officer responding to the spill. Reports can be sent via mail, fax, or electronic mail.

Mail	Fax	Email
DNR Emergency Response 6200 Park Ave Ste 200 Des Moines IA 50321	515-725-8201	Emergency_Response@dnr.iowa.gov

Thank You

Hazardous Substance Designations and Release Notifications

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides for the cleanup of uncontrolled or abandoned hazardous waste sites as well as accidents, spills, and other emergency releases of hazardous substances.

CERCLA defines "hazardous substance" by reference to the following authorities:

- Clean Water Act (CWA) section 311 (“CWA Hazardous Substances”),
- CWA section 307(a) (“CWA Toxic Pollutants”),
- Clean Air Act (CAA) section 112 (“CAA Hazardous Air Pollutants”),
- Resource Conservation and Recovery Act (RCRA) section 3001 (“RCRA Hazardous Wastes”), and
- Toxic Substance Control Act section 7 (currently no substances are designated under this authority).

CERCLA section 102(a) also gives EPA authority to designate additional hazardous substances not listed under the statutory provisions cited above.

There are currently about 800 CERCLA hazardous substances. In addition, there are approximately 1,500 known radionuclides, approximately 760 of which are listed individually. The CERCLA list of hazardous substances can be found at 40 CFR 302.4 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302/section-302.4> in Table 302.4 Hazardous Substances and Reportable Quantities <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302#302.4>.

On this page:

- Definitions
- Reportable Quantities
- Notification Requirements
- FARM Act Amendments to CERCLA
- Continuous Release Reporting Requirements
- Regulations

CERCLA Section 101 – Definitions

CERCLA section 101 [42 U.S.C. section 9601 <https://www.govinfo.gov/app/details/uscode-2021-title42/uscode-2021-title42-chap103-subchapi-sec9601>] provides definitions for terms used throughout CERCLA.

Hazardous Substance: CERCLA section 101(14) defines "hazardous substance" by reference to lists of substances designated under specific authorities. The CERCLA list of hazardous substances (40 CFR part 302.4 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302/section-302.4>) is currently comprised of the following lists:

- **CWA Hazardous Substances** <https://epa.gov/epcra/clean-water-act-cwa-and-cercla-hazardous-substance-lists> per CWA section 311(b)(2) [40 CFR 116.4 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-d/part-116>; 33 U.S.C. 1321(b)(2) <https://www.govinfo.gov/app/details/uscode-2021-title33/uscode-2021-title33-chap26-subchapiii-sec1321>]

- **CWA Toxic Pollutants** <https://epa.gov/eg/toxic-and-priority-pollutants-under-clean-water-act> per CWA section 307(a) [40 CFR 401.15 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-n/part-401/section-401.15>, 40 CFR part 423 Appendix A <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-n/part-423#appendix-a-to-part-423>, and 40 CFR 131.36 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-d/part-131/subpart-d/section-131.36>; 33 U.S.C. 1317(a) <https://www.govinfo.gov/app/details/uscode-2021-title33/uscode-2021-title33-chap26-subchapiii-sec1317>]
- **CAA Hazardous Air Pollutants** <https://epa.gov/haps/initial-list-hazardous-air-pollutants-modifications> per CAA section 112(b) [33 U.S.C. 7412(b) <https://www.govinfo.gov/app/details/uscode-2021-title42/uscode-2021-title42-chap85-subchapi-parta-sec7412>; P.L. 102-187 December 4, 1991 <https://www.congress.gov/102/statute/statute-105/statute-105-pg1285.pdf>; 70 FR 75047 <https://www.govinfo.gov/content/pkg/fr-2005-12-19/pdf/05-24200.pdf>, December 19, 2005; 69 FR 69320 <https://www.govinfo.gov/content/pkg/fr-2004-11-29/pdf/04-26071.pdf>, November 29, 2004; 61 FR 30816 <https://www.govinfo.gov/content/pkg/fr-1996-06-18/pdf/96-15445.pdf>, June 18, 1996; 65 FR 47342 <https://www.govinfo.gov/content/pkg/fr-2000-08-02/pdf/00-19375.pdf>, August 2, 2000, and 87 FR 393 <https://www.govinfo.gov/content/pkg/fr-2022-01-05/pdf/2021-28315.pdf>, January 5, 2022]
- **RCRA Hazardous Wastes** <https://epa.gov/rcra> per RCRA section 3001 [40 CFR part 261 Subpart D – Lists of Hazardous Wastes <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-i/part-261#subpart-d>; 42 U.S.C. 6921 <https://www.govinfo.gov/app/details/uscode-2021-title42/uscode-2021-title42-chap82-subchapiii-sec6921>]

Release: CERCLA section 101(22) defines "release" as any "...spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant) ..."

CERCLA Section 102 - Reportable Quantities

CERCLA Section 102 [42 U.S.C. section 9602 <https://www.govinfo.gov/app/details/uscode-2021-title42/uscode-2021-title42-chap103-subchapi-sec9602>] authorizes the Administrator to revise the substances specified as hazardous under CERCLA Section 102 and designate additional hazardous substances. Furthermore, CERCLA Section 102 assigns a Reportable Quantity of one pound to each hazardous substance and authorizes EPA to promulgate regulations to revise the statutory Reportable Quantity. The Reportable Quantity identifies the quantities of substances that if released require notification and sets forth the notification requirements for releases of these substances.

The CERCLA List of Hazardous Substances and their Reportable Quantities are found in 40 CFR part 302, Table 302.4 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302/section-302.4>.

Note: *For RCRA Hazardous Wastes, the Reportable Quantities apply to the waste itself, not merely to the toxic contaminant. Unlisted hazardous wastes which exhibit toxicity are also covered under this regulation and have been assigned a Reportable Quantity of 100 pounds.*

CERCLA Section 103 - Notification Requirements

CERCLA section 103(a) [42 U.S.C. 9603 <https://www.govinfo.gov/app/details/uscode-2021-title42/uscode-2021-title42-chap103-subchapi-sec9603>] "as amended" requires that the person in charge of a vessel or an offshore or an onshore facility immediately notify the National Response Center <https://epa.gov/emergency-response/national-response-center> whenever a Reportable Quantity or more of a CERCLA hazardous substance

is released in any 24-hour period, unless the release is federally permitted. The purpose of this requirement is to notify officials of potentially dangerous releases so that they can evaluate the need for a response action.

The list of hazardous substances and their reportable quantities are codified in 40 CFR part 302, Table 302.4 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302#302.4>.

The National Response Center <https://epa.gov/emergency-response/national-response-center> can be reached at: 1-800-424-8802; in Washington, D.C.: 202-267-2675.

Reporting Requirements under CERCLA Section 103 and the Emergency Planning and Community Right-to-Know Act Section 304

	CERCLA Section 103	**EPCRA Section 304**
Citation	40 CFR Part 302 42 U.S.C. 9603	40 CFR Part 355, Subpart C 42 U.S.C. 11004

	CERCLA Section 103	EPCRA Section 304
Definition of a Facility	A facility is defined in Section 101(9) of CERCLA as including any building, structure, installation, equipment, pipe or pipeline, well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, or aircraft on any site or area where a hazardous substance has been deposited, stored, disposed of or placed, or otherwise come to be located.	A facility is defined in Section 329(4) of the Emergency Planning and Community Right-to-Know Act (EPCRA) as all buildings, equipment, structures, and other stationary items that are located on a single site or on contiguous or adjacent sites that are owned and controlled by the same person.

	CERCLA Section 103	EPCRA Section 304
Relevant Chemical List	CERCLA hazardous substances (40 CFR 302.4 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302/section-302.4>)	CERCLA hazardous substances (40 CFR 302.4 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302/section-302.4>) and EPCRA Extremely Hazardous Substances (40 CFR 355, Appendices A <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-355#appendix-a-to-part-355> and B <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-355#appendix-b-to-part-355>)
Notification Requirements	National Response Center	State or Tribal Emergency Response Commission (SERC or TERC) and Local or Tribal Emergency Planning Committee (LEPC or TEPC)
Constituents of a Release	Any release of any CERCLA hazardous substance at or above its specified Reportable Quantity into the environment (on-site or off-site)	Any release of a CERCLA hazardous substance or Extremely Hazardous Substance at or above its specified Reportable Quantity with potential exposure to persons off-site

See also:

- CERCLA and EPCRA Release Reporting and Continuous Release Reporting <https://epa.gov/epcra/cercla-and-epcra-continuous-release-reporting>
- EPCRA Section 304 Emergency Release Notification <https://epa.gov/epcra/epcra-emergency-release-notifications>

CERCLA Section 103(e) – FARM Act Amendments to CERCLA

The Fair Agricultural Reporting Method (FARM) Act <https://epa.gov/epcra/cercla-and-epcra-reporting-requirements-air-releases-hazardous-substances-animal-waste-farms> amended CERCLA section 103 to exempt reporting air emissions from animal waste (including decomposing animal waste) at farms.

CERCLA Section 103(f) – Continuous Release Reporting Requirements

Section 103(f)(2) of CERCLA modifies the general notification requirements of section 103(a) for certain releases. Releases may be reported less frequently, if they are "continuous" and "stable in quantity and rate". For more information, see CERCLA and EPCRA Continuous Release Reporting <https://epa.gov/epcra/cercla-and-epcra-continuous-release-reporting> or refer to 40 CFR 302.8 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302#302.8>.

Regulations

- 40 CFR Part 302 – Designation, Reportable Quantities, and Notification <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302>
- 40 CFR Part 302.3 – Definitions <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302#302.3>
- 40 CFR 302.4 – List of Hazardous Substances and their Reportable Quantities <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302#302.4>

- 40 CFR 302.6 – Notification Requirements and Categories of Exempted Releases <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302#302.6>
- 40 CFR 302.8 – Continuous Releases <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-302#302.8>

In addition to release reporting requirements established under CERCLA, EPCRA section 304 <https://epa.gov/epcra/epcra-emergency-release-notifications> [40 CFR part 355 subpart C <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-355#subpart-c>; 42 U.S.C. section 11004 <https://www.govinfo.gov/app/details/uscode-2021-title42/uscode-2021-title42-chap116-subchapi-sec11004>] requires the owner or operator of certain facilities to report releases of extremely hazardous substances and CERCLA hazardous substances to state, tribal and local entities.

Relevant Federal Register Notices

- April 8, 2022 (87 FR 20721-20761 <https://www.govinfo.gov/content/pkg/fr-2022-04-08/pdf/2022-07541.pdf>) – Addition of 1-Bromopropane to the List of CERCLA Hazardous Substances; List of Hazardous Substances; Technical Corrections; Final Rule.
- August 1, 2018 (83 FR 37444 <https://www.govinfo.gov/content/pkg/fr-2018-08-01/pdf/2018-16379.pdf>) – FARM Act Amendments to CERCLA Release Notification Requirements; Final Rule.
- October 4, 2006 (71 FR 58525 <https://www.govinfo.gov/content/pkg/fr-2006-10-04/pdf/e6-16379.pdf>) – Administrative Reporting Exemption for Certain Air Releases of NO_X (NO and NO_2); Final Rule.
- March 19, 1998 (63 FR 13460 <https://www.govinfo.gov/content/pkg/fr-1998-03-19/pdf/fr-1998-03-19.pdf>) – Administrative Reporting Exemptions for Certain Radionuclide Releases; Final Rule.
- July 24, 1990 (55 FR 30166 <https://www.govinfo.gov/content/pkg/fr-1990-07-24/pdf/fr-1990-07-24.pdf>) – Reporting Continuous Releases of Hazardous Substances; Final Rule.
- May 24, 1989 (54 FR 22543 <https://www.govinfo.gov/content/pkg/fr-1989-05-24/pdf/fr-1989-05-24.pdf>) – Reportable Quantity Adjustments; Technical Amendment.

- May 24, 1989 (54 FR 22524 <https://www.govinfo.gov/content/pkg/fr-1989-05-24/pdf/fr-1989-05-24.pdf>) – Reportable Quantity Adjustments for Radionuclides; Final Rule.
- September 29, 1986 (51 FR 34534 <https://www.govinfo.gov/content/pkg/fr-1986-09-29/pdf/fr-1986-09-29.pdf>) – Reportable Quantity Adjustments; Final Rule.
- April 4, 1985 (50 FR 13456 <https://epa.gov/sites/default/files/2017-04/documents/april_4_1985_fr_notice.pdf>) – Notification Requirements; Reportable Quantity Adjustments; Final Rule.

Last updated on August 22, 2025

APPENDIX 7:

GROUNDWATER QUALITY ASSESSMENT PLAN
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

January 15, 2026

CITY OF SPENCER
#1717

GROUNDWATER QUALITY ASSESSMENT MONITORING PLAN

1.0 INTRODUCTION

This document serves the "Appendix 7: Groundwater Quality Assessment Monitoring Plan for the Northern Plains Regional Landfill (NPRL), Palo Alto County, SDP Permit No. 74-SDP-02-76-P" and is a part of the Development and Operational Plan for the facility. This document replaces the previous document # 28914.

This document is required by Iowa Administrative Code 567 - Chapter 113.10. Any updates or revisions to this document shall be submitted with any future SDP permit renewal applications.

2.0 GROUNDWATER QUALITY ASSESSMENT PLAN DIRECTIVE

The landfill operator shall monitor the facility for leachate migration per the HMSP by sampling the monitoring wells and surface waters located at the facility per 113.10(3), 113.10(4) and 113(5).

The IDNR will determine whether additional sampling is warranted if the analysis of sampling data indicates a possible release has occurred (SSI over background). The IDNR may require any additional samples to be split and analyzed to determine if the values obtained outside the control limits were the result of laboratory or sampling error. Any additional analytical results will be submitted to the IDNR within 7 days of receipt. The IDNR will review the information and determine if monitoring or preparation of a groundwater quality assessment monitoring program, in accordance with subrule 113.10(6), is necessary.

3.0 GROUNDWATER ASSESSMENT MONITORING PLAN STUDY - 113.10(6)

If a Groundwater Assessment Monitoring is required, the Landfill Operator shall complete a study to determine the rate of migration and the extent and constituent composition of the leachate release. The program shall include the requirements of 113.10(6).

4.0 ASSESSMENT OF CORRECTIVE MEASURES - 113.10(7)

Within 90 days of finding that any of the constituents listed in Appendix II have been detected at a statistically significant level exceeding the groundwater protection standards defined under paragraph 113.10(6)"h" or 113.10(6)"i," the owner or operator must initiate an assessment of corrective measures in accordance with 113.10(7). Such an assessment must be completed and submitted to the department for review and approval within 180 days of the initial finding unless otherwise authorized or required by the department.

The owner or operator must continue to monitor in accordance with the assessment monitoring program as specified in subrule 113.10(6).

The assessment shall include an analysis of the effectiveness of potential corrective measures in meeting the requirements and objectives of the remedy as described under subrule 113.10(8).

Within 60 days of approval from the department of the assessment of corrective measures, the owner or operator must discuss the results of the corrective measures assessment, prior to the selection of a remedy, in a public meeting with interested and affected parties. The department may establish an alternative schedule for completing the public meeting requirement. Notice of public meeting shall be sent to all owners and occupiers of property adjacent to the permitted boundary of the facility, the department, and the department field office with jurisdiction over the facility. A copy of the minutes of this public meeting and the list of community concerns must be placed in the operating record and submitted to the department.

5.0 SELECTION OF REMEDY - 113.10(8)

Based on the results of the corrective measures assessment conducted under subrule 113.10(7), the owner or operator must select a remedy within 60 days of holding the public meeting that, at a minimum, meets the standards listed in paragraph 113.10(8)“b.” The department may establish an alternative schedule for selecting a remedy after holding the public meeting. The owner or operator must submit a report to the department, within 14 days of selecting a remedy, describing the selected remedy, stating that the report has been placed in the operating record, and explaining how the selected remedy meets the standards in paragraph 113.10(8)“b.”

6.0 PLAN IMPLEMENTATION - 113.10(9)

Based on the schedule established under paragraph 113.10(8)“d” for initiation and completion of remedial activities, the owner or operator must establish and implement a corrective action groundwater monitoring program that meets the requirements of an assessment monitoring program under subrule 113.10(6); indicates the effectiveness of the corrective action remedy in accordance with 113.10(9); and demonstrates compliance with groundwater protection standards pursuant to paragraph 113.10(9)“e”. The landfill shall implement the corrective action remedy selected under subrule 113.10(8) and take any interim measures necessary to ensure the protection of human health and the environment. Interim measures should, to the greatest extent practicable, be consistent with the objectives of and contribute to the performance of any remedy that may be required pursuant to subrule 113.10(8).

Upon completion of the remedy, the owner or operator must notify the department within 14 days that a certification has been placed in the operating record verifying that the remedy has been completed in compliance with the requirements of paragraph 113.10(9)“e.” The certification must be signed by the owner or operator and by a qualified groundwater scientist and approved by the department.

When, upon completion of the certification, the owner or operator determines that the corrective action remedy has been completed in accordance with the requirements under paragraph 113.10(9)“e,” the owner or operator shall be released from the requirements for financial assurance for corrective action pursuant to subrule 113.14(5).

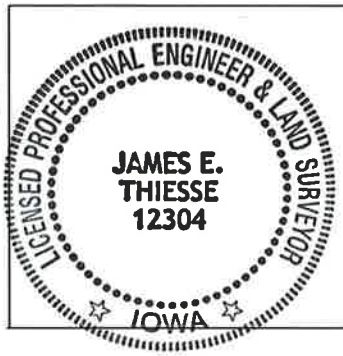
END OF GROUNDWATER QUALITY ASSESSMENT PLAN

APPENDIX 9:

CLOSURE/POST CLOSURE PLAN
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

January 15, 2026

CITY OF SPENCER
#1717



CERTIFICATE:
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.

4/17/2026

James E Thiesse, PE. No. 12304 Date
My license renewal date is December 31, 2027
Pages covered by this seal: All 1-9

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Appendix 9A: Post Closure Semi-Annual Engineer's Inspection Checklist
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1. INTRODUCTION

This document serves the "Closure and Post Closure Plan, Appendix 9: Development and Operational Plan for Northern Plains Regional Landfill, Palo Alto County, SDP Permit No. 74-SDP-02-76-P". This document replaces the Closure Post Closure Plan originally dated December 15, 2004 (#28914) and all updates approved in permit renewal cycles in 2010, 2015 and 2020 (#98741).

This document is required by the Iowa Administrative Code 567 - Chapter 113.12 & 113.13. Any updates or revisions to this document shall be submitted with any future SDP permit renewal applications.

This plan describes the procedures for closing this solid waste facility and ceasing to accept solid waste. In addition, the plan describes the post closure monitoring activities to be implemented for a minimum of 30 years following the closure of the landfill.

This facility was established and operated as the Flannegan Landfill from 1976 until it was purchased by the City of Spencer in January of 2002. This Sanitary Disposal Project (SDP) consists of a multi-cell Sanitary Solid Waste Landfill with clay lined and composite lined solid waste cells, leachate collection system and synthetic lined leachate storage basin. The facility also includes an above ground scale, a combination office/maintenance building, cold storage building and gravel surfaced roads.

The landfill is currently accepting waste from the Emmet County Council of Governments (ECCOG) transfer station located near Estherville, Iowa; the Pocahontas County Transfer Station, located near Pocahontas, Iowa; the Palo Alto County Transfer Station, located near Emmetsburg, Iowa; the city of Whittemore, Iowa in Kossuth County and Bode, Iowa in Humboldt County.

The existing cells constructed and covered under the old Flannegan Landfill permit, Cells 1-12 and 1A-4A were accepted as covered and closed by the IDNR in 2008 (IDNR Docs. #54131 X. Special Provision 8.a and #16134).

Existing cells 5A-15A were constructed under the old Flannegan Landfill permit with a 4' clay liner prior to 2002. Cells 16A-21A were constructed under the City of Spencer's permit using a composite liner. Cells 5A-21A were accepted as covered and closed by the IDNR in 2010. (IDNR Doc. #64563). Note the north 1/2 of Cell 16A is filled, but not capped.

The proposed vertical and horizontal expansion as shown on Drawing 2026-X1 thru 2026-X12 has a projected life expectancy of 20 years resulting in a projected closure date of 2046 for this area. The closure and post closure care shall be in accordance with chapters 113.12 and 113.13 respectively.

It is the current intent of the City of Spencer to operate the landfill until there is no longer a need for landfill disposal of solid waste or until the site can hold no additional waste.

1.1 Post/Closure Primary Contact Information

a. Landfill Owner/ Permit holder:	CITY OF SPENCER, IOWA 418 2nd Avenue West Spencer, Iowa 51301
b. **Responsible Official**:	PUBLIC WORKS DIRECTOR Mark White City of Spencer, Iowa 712-580-7200
c. Facility Engineer:	KRUSE, CATE & NELSON, P.C. James E Thiesse, PE 1801 Highway Blvd. Spencer, Iowa 51301 712-262-3468
d. Agencies Served:	Emmet County Council of Governments (ECCOG) Pocahontas County Solid Waste Commission Palo Alto County Solid Waste Commission City of Spencer, Iowa City of Bode, Iowa City of Whittemore, Iowa

1.2 Facility Location And Legal Description

The legal description of the facility boundary is as follows:

The Northwest Quarter of Section 21, Township 97 North, Range 33 West of the 5th Principal Meridian, Palo Alto County, Iowa, except the northerly 470.00 feet of the easterly 350.00 feet of the Northwest Quarter, all located in Section 21, Township 97 North, Range 33 West of the 5th Principal Meridian, Palo Alto County, Iowa.

The facility is located approximately 2 miles south of Graettinger, Iowa on IA Highway 4.

Address:	3032 420th Avenue Graettinger, IA, 51342

2.0 CLOSURE NOTIFICATION & IMPLEMENTATION REQUIREMENTS

The Owner/operator of the landfill should make all parties using the landfill aware of the intent to close the landfill years ahead of its actual closure date. IAC section 113.12(5) requires as a minimum that not less than 180 days prior to the planned facility closure or suspension of operations, the owner or operator shall:

a. Notify the IDNR Solid Waste division in writing of their intent to close the facility.
b. Post a Notice of intent to close the facility. Said Notice shall include the date of closure and a list of alternative solid waste management facilities.
c. Send a Notice to each entity using the facility under contract. Said Notice shall include the date of closure and a list of alternative solid waste management facilities.
d. Publish a Notice in a locally circulated newspaper. Said Notice shall include the date of closure and a list of alternative solid waste management facilities.

The IAC 113.12(6) requires as a minimum, that in a facility with ongoing operations, not less than one year following the closure of a cell block or suspension of operations within a cell block, the owner or operator shall begin closure activities including:

a. 113.12(7). Complete construction of CPC Plan improvements within 180 days;
b. 113.12(7). Implement the planning & monitoring provisions of the plan within 180 days;
c. 113.12(8) Obtain a certification by an Engineer registered in Iowa that the closure/post closure plan has been implemented in compliance with the rules, the closure/post closure plan and the permit.
d. 113.12(9) Record a notation in the property deed noting in perpetuity that the land has been used as a landfill facility and that its use is restricted under IAC 567 113.13(3)”c”.

To meet these requirements, a multi-phase, long-range approach is anticipated. Earth moving and erosion control operations are weather dependent and the availability of construction equipment and personnel to complete a large scale project within the time frame required needs to be analyzed long before the actual closure date. Proposed phases are shown on Drawing 1717CPC-X1 revised 1/15/2026.

Once closure activities have been completed, the owner/operator shall submit to the IDNR the following documentation:

a. As-built drawings showing all changes from the original closure design plans;
b. Test results indicating compliance with final cover requirements.
c. Waste Removal if applicable;
d. Equipment decontamination certification;
e. A copy of the notation filed with the county recorder;
f. Other documentation required by the IDNR.

All requirements of the closure plan, the closure permit and the rules must be satisfied before the IDNR can approve the closure of the landfill.

2.1 Implementation Schedule

2.1.1 Phase I. The east and south faces of filled cells 1-12 and 1A-4A have been covered, terraced and final vegetation is established. Phase I cells were accepted as covered and closed by the IDNR in 2008 (IDNR Docs. #54131 X. Special Provision 8.a). The existing cover configuration placed prior to 1989 was verified by small diameter probing on a 100 foot by 100 foot grid as shown on the May 5, 1995 CPC Plan for the Hugh J Flannegan Landfill. Some maintenance grading will be required to prevent rainwater runoff from pooling over the old, filled cells. The post closure monitoring period shall commence when all adjacent cells are permanently closed.

2.1.2 Phase II. Cells 5A-21A and the south 1/2 of Cell 16A were permanently closed, certified on April 5, 2011 and approved by the IDNR on April 18, 2011 (#64563).

2.1.3 Phase III. Existing Cells A-E and Future Expansion Cells F-J in the expansion areas will be closed after they are filled. It is anticipated that the approved expansion area will be filled and closed around the year 2046. Cells A-D2, are approximately 95% full (8/2025) with an estimated remaining airspace of 20,000 tons.

Cells E-J, have an estimated remaining net solid waste capacity of 1,770,000 tons.

3.0 CLOSURE DESIGN

The goal of landfill closure under the current rules (IAC section 113.12) is to minimize the negative impact that the solid waste in the landfill has on the environment. The current philosophy is to entomb the waste in an impervious envelope of soil and flexible membrane liner (FML) thus preventing exposure of the solid waste to the environment. Leachate generation and release from the facility is a potential cause of off-site contamination. The primary source of liquid generating landfill leachate is precipitation infiltration. Infiltration is reduced by covering the solid waste with a low permeability final cover soil and FML that is graded to drain without creating erosion. The impervious layer is covered with an organic soil layer designed to support vegetative cover that provides protection from erosion. Drawing 1717CPC-X1 shows the existing and proposed operational cells and final grading of the landfill at the time of closure.

3.1 Final Cover Design

Cells will be covered with a cover not less than 42” in total thickness consisting of an infiltration layer of 18” of compacted clay with a permeability of less than 1×10^{-7} and a flexible membrane liner (FML) and an erosion layer consisting of 24” of earth suitable to establish vegetation.

A heavy clay soil capable of meeting the specified permeability requirements for the infiltration layer shall be excavated from the expansion area or borrow area. Due to the sequence of construction, it will be necessary to stockpile this material prior to constructing the final cover. The topsoil and overburden soil should be saved and stockpiled for use as the erosion layer.

Based on a required depth of 42" the following volume of material is required:

PHASE	COVER AREA	CLAY VOLUME (18")	SOIL VOLUME (24")
III	47 Acres	135,000 CY	180,000 CY

3.2 Final Cover Construction

The final cover for closed cells shall meet the requirements of Chapter 113.12 and the following:

a. Regrade and shape the existing intermediate cover to provide a suitable working subgrade surface. It may be necessary to bench soil to achieve adequate density.
b. To verify the suitability of the soil and the Contractor's methods to produce a Low Permeability Clay layer with a permeability (hydraulic conductivity) equal to or less than 1 X 10-7 cm/sec, the Contractor shall construct a 20' by 80' test pad using this material and his proposed compaction methods.
c. The Contractor shall select representative soil, with the concurrence of the Engineer and Geotechnical Engineer, to be used to construct the test pad.
d. The test pad may be constructed on the prepared subgrade or some other location approved by the Engineer. The Contractor shall notify the Engineer (QCAO)not less than 48 hours in advance of his intent to complete the test pad so that arrangements may be made to observe the construction process and for the Geotechnical Engineer to obtain 5 Shelby Tube samples upon completion of the test pad by the. Samples from the test pad to be used to develop Moisture/Density/Permeability relationship target values required to meet the 1 x 10-7 cm/sec. permeability limit required.
e. Place a minimum of 18**"** of suitable, compacted clay material over the subgrade in 9" lifts and compact to target density. Conduct a minimum of 5 field density tests per lift per acre to verify that the required density and permeability have been met. The infiltration layer over lined cells needs to achieve a permeability of 1×10^{-7} or less.
f. Install a 40 mil LLDPE textured liner over the entire clay surface. Fuse the LLDPE liner to the HDPE floor liner at the intercept. The manufacture, installation and testing of the liner shall be in accordance with the requirements of the Geosynthetic Research Institute (GRI) specifications to form a complete clay envelope surrounding the solid waste .
g. To improve slope stability a 200 mil double-sided 6oz. drainage geocomposite may be required on the side slopes to relieve pore pressure in the cover soil. Calculations shall be performed at the time of closure to determine the need for the geocomposite. If required, the geocomposite shall be placed directly over the LLDPE liner and shall terminate by attachment to drainage pipes or swales.
h. Not less than 24" of earthen material that is capable of sustaining native plant growth shall be placed over the geocomposite.
i. The slope on the top of the completed fill shall have a slope between 5 percent and 25 percent. Steeper slopes may be used if it is demonstrated that a steeper slope is unlikely to adversely affect final cover system integrity.

j. The final end slope shall not be steeper than 4:1. Quality control and assurance will be ensured through staking, inspection and testing of all construction under the supervision of a professional engineer registered in the State of Iowa. (See final contours for the proposed final elevations shown on the site on Drawing 1717CPC-X1).

g. Terraces with letdown pipes may be constructed to reduce erosion.

3.3 Final Cover Vegetation

Final cover vegetation serves as erosion control. The final cover will be seeded as soon as practical upon placement of final cover soils. If seeding cannot be accomplished due to seasonal conditions, temporary erosion control measures such as silt fence shall be installed. Seedbed preparation, seeding, fertilizing and mulching will be performed in accordance with accepted practice at the time of seeding and generally follow IDOT methods. The following seed mixture is proposed:

Brome grass - 12 lbs PLS per acre
Annual Rye - 15 lbs PLS per acre
Orchard grass - 12 lbs PLS per acre

All areas to be seeded will be fertilized in accordance with IDOT methods. The fertilizer shall be 750 lbs per acre of a commercial grade 13-13-13 (NPK) fertilizer worked into the upper 3" of soil by disking. The area shall be rolled following the disking. Immediately following the seeding operation, the seedbed shall be mulched with 1-1/2 tons per acre of dry cereal straw or equivalent. The mulch shall be evenly distributed and mechanically anchored into the soil.

The operator shall maintain the erosion control vegetation in good condition throughout the post closure period and make repairs to eroded areas.

3.4 Ultimate Land Use Proposal

The ultimate land use upon closure of the facility will most likely be as pasture for livestock or as wildlife habitat. The remote rural area precludes other potential uses. Drawing 1717CPC-X1 depicts the final fill elevations, grades, permanent drainage structures and other pertinent improvements.

3.5 Groundwater Monitoring

The landfill operates a complete groundwater monitoring system in accordance with Chapter 113 rules and as described in "APPENDIX 4: HYDROLOGIC MONITORING SYSTEM PLAN". It is anticipated that the HMSP requirements will be updated periodically throughout the life of the landfill. Prior to the time of closure, the groundwater monitoring system is required to be in place and operating in accordance with the rules in effect at the time and as required by the closure permit.

3.6 Leachate Control

The landfill operates a complete leachate control system in accordance with Chapter 113 rules and as described in "APPENDIX 5: LEACHATE CONTROL PLAN". It is anticipated that the LCP requirements will be updated periodically throughout the life of the landfill. Prior to the time of closure, the leachate control system is required to be in place and operating in accordance with the rules in effect at the time and as required by the closure permit.

3.7 Explosive Gas Control

The landfill currently does not generate detectable levels of explosive gases. The landfill operator monitors the facility for methane gas generation each quarter. Detection monitoring consists of taking meter readings in a random pattern using a handheld, explosive-gas detection meter. See "APPENDIX 8: EXPLOSIVE GAS CONTROL PLAN".

3.8 Financial Assurance

The landfill owner is required to maintain an approved financial assurance instrument, adequate to fund the estimated costs of all closure and post closure construction and operating costs as required by the closure plan and the closure permit. See 567—113.14(455B) Municipal solid waste landfill financial assurance.

Each year the City submits a "Municipal Waste Sanitary Landfill Financial Assurance Annual Report" as required. The report consists of an eight-section form developed by the IDNR to satisfy compliance and notification requirements of IAC 567 Chapter 113.14. The most recent annual report is included in Appendix 10.

4.0 POST CLOSURE MONITORING REQUIREMENTS

The landfill owner is required to monitor the landfill site for releases of solid waste constituents into the surrounding environment for a period of 30 years following the closure of the facility. At least 180 days prior to closing the site, the owner shall submit a detailed plan to the IDNR for approval that describes the monitoring program. Generally the post closure monitoring plan will be a continuation of the semi-annual monitoring well testing (as described in the HMSP), explosive gas monitoring and leachate collection system in operation at the time of closure with modifications as required by the closure permit.

The IDNR is to review the landfill's post closure monitoring records at five-year intervals to determine if changes in the monitoring frequencies or test parameters are required. Note that the landfill owner is required to submit semi-annual reports documenting the post closure monitoring during the entire post closure period.

The IDNR may adopt site-specific rules for the landfill identifying additional monitoring requirements based on their review of on-going test results.

5.0 30-YEAR POST CLOSURE OPERATING REQUIREMENTS

The landfill owner is required to maintain the environmental protection improvements implemented at the time of landfill closure for a period of not less than 30 years following the approved closure of the landfill. The specific items that follow need to be maintained during the post closure period.

5.1 Diversion and Drainage

The precipitation runoff drainage and diversion system will be inspected and maintained to prevent run-off and run-on from eroding or otherwise damaging the final cover. Damage to the soil cover shall be repaired by placing compacted fill in the eroded area and reseeding. Steps should be taken to divert runoff from the eroded area by mounding or berming adjacent soil. Areas of concentrated runoff may require a geotextile erosion fabric, staked sod or other special provisions. Let down pipes should be checked for physical damage due to settling or shifting of the solid waste below. Let down pipe entrances and exists should be checked for sediment and cleaned as needed. Low areas adjacent to diversion dikes and the bottoms of swales and terraces should also be kept free of sediment.

5.2 Final Cover Maintenance

The final cover will require periodic maintenance to restore areas damaged by settling, subsistence, and erosion. The cover soil and impervious layer need to be maintained with positive slopes to prevent ponding and the resulting infiltration of precipitation. If the compacted soil impervious layer is damaged, it needs to be restored to the original permeability specifications.

5.3 Final Cover Vegetation

The owner is required to maintain a healthy vegetative cover to prevent soil erosion. In addition, the owner needs to inspect the cover vegetation for weeds, forbs, trees, or other invading vegetation species whose root system could damage the compacted soil layer. Invading vegetation should be removed or destroyed immediately upon discovery.

5.4 Ground Water Monitoring

As described in section 3.5, the owner shall maintain and operate the groundwater monitoring system in accordance with all applicable rules and the closure permit.

5.5 Leachate Control

As described in section 3.6, the owner shall maintain and operate the leachate control system in accordance with all applicable rules and the closure permit.

5.6 Explosive Gas Control

As described in section 3.7, the owner shall maintain and operate the explosive gas control system in accordance with all applicable rules and the closure permit.

5.7 Permanent Survey Monuments

The permanent survey monuments shall be maintained throughout the life of the facility until the end of the post closure period (not less than 30 years).

6.0 POST CLOSURE REPORTING REQUIREMENTS

The post closure reporting is required for any monitoring, testing, or analytical data as required by rules 567—113.12(455B) and 567—113.13(455B). The plan implemented at the time of closure shall include the following reporting information to be submitted to the IDNR at the intervals required by the closure permit at the time of closure:

a. information concerning the general conditions at the site;
b. groundwater monitoring results;
c. leachate generation and treatment volume;
d. explosive gas monitoring and collection;
e. other information as required by the closure permit.

END OF CLOSURE POST CLOSURE PLAN

POST CLOSURE MONTHLY INSPECTION CHECKLIST

Northern Plains Regional Landfill
Palo Alto, County
74-SDP-2076P

Inspector:_____ Date of Inspection:_____

Item		Condition Acceptable	Action Required	Description of Action Required or Comment on Condition
1	Drainage and Diversion System			
	Terraces			
	Letdown pipes			
2	Final Cover Soil Condition			
	Slopes maintained			
3	Vegetative Cover/Erosion Control			
	Invading species present			
4	Groundwater Monitoring System			
	Water levels recorded monthly			
	Well condition/security maintained			
5	Leachate Control System			
	Piezometers Checked Monthly			
	Lift Station Inspected Weekly			
	Volume Records Maintained Monthly			
	Pipes Cleaned as needed			
	Holding Pond Liner Inspected			
	Visible Seeps			
	Surface Pond Condition			
6	Survey Monuments Perpetuated			
7	Entrance Gate			
8	Access Road Condition			
9	Perimeter Fence			
10	Building Security			

Additional Comments or Recommendations: _____

_____

_____

_____

_____
Signature

POST CLOSURE SEMI-ANNUAL ENGINEER'S INSPECTION CHECKLIST

Northern Plains Regional Landfill, Owner: City of Spencer
Palo Alto, County
74-SDP-2076P

Inspector:_____ Date of Inspection:_____

Item	Condition Acceptable	Action Required	Description of Action Required or Comment on Condition
1 Drainage and Diversion System			
Terraces			
Letdown pipes			
2 Final Cover Soil Condition			
Slopes maintained			
3 Vegetative Cover/Erosion Control			
Invading species present			
4 Groundwater Monitoring System			
Water levels recorded monthly			
Testing performed per permit			
Results tabulated, charted & submitted			
Well condition/security maintained			
5 Leachate Control System			
Piezometers Checked Monthly			
Lift Station Inspected Weekly			
Volume Records Maintained Monthly			
Pipes Cleaned as needed			
Holding Pond Liner Inspected			
Visible Seeps			
Surface Pond Condition			
6 Survey Monuments Perpetuated			
7 Entrance Sign			
8 Entrance Gate			
9 Access Road Condition			
10 Perimeter Fence			
11 Building Security			

Additional Comments or Recommendations: _____

_____

_____

_____

_____
Signature

APPENDIX 10:
FINANCIAL ASSURANCE REQUIREMENTS
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

April 17, 2026

CITY OF SPENCER
#1717

1. INTRODUCTION

The purpose of this document is to describe the procedures required to assure compliance with Iowa Code sections 455B.304(8) and 455B.306(9) by establishing financial assurance for closure, postclosure care and corrective action at the "Northern Plains Regional Landfill, Palo Alto County, SDP Permit No. 74-SDP-02-76-P".

Chapter 455B.306(9)(b) of the Code of Iowa requires permit holders of municipal solid waste landfills to maintain separate closure and postclosure care accounts to accumulate resources for the payment of closure and postclosure care costs.

2. REPORTING REQUIREMENTS

2.1 Closure Cost Fund

The City (as Owner and Operator) is required to provide continuous coverage for closure costs until released from this requirement by demonstrating compliance with rule 567—113.12(455B). Proof of compliance pursuant to paragraphs 113.14(3)"a" through 113.14(3)"e" must be submitted by the owner or operator yearly by April 1 and approved by the department.

a. The city is required to submit the current version of department Form 542-8090, Municipal Solid Waste Sanitary Landfill Financial Assurance Report Form, which contains, but is not limited to, the amount of the financial assurance, the annual financial statement required by Iowa Code sections 455B.306(8)"e" and 455B.306(6)"c," and the current balances of the closure and postclosure accounts at the time of submittal as required by Iowa Code section 455B.306(8)"b."
b. The city is required to submit a copy of the financial assurance instruments or the documents establishing the financial assurance instruments in an amount equal to or greater than the amount specified in subrule 113.14(9). Documentation for the mechanism(s) used to demonstrate financial assurance shall contain, at a minimum, the items required to be submitted as specified in paragraphs 113.14(6)"a" to 113.14(6)"i.".
c. The city is required to submit a detailed written estimate, in current dollars, certified by an Iowa-licensed professional engineer, of the cost of hiring a third party to close the MSWLF in accordance with the closure plan as required by paragraph 103.5(1)"i" and rule 567—113.12(455B). Such estimate must be available at any time during the active life of the landfill.
d. The most recent form 542-8090 and supporting documents submitted by the city are included at the back of this Appendix.

2.1 Post Closure Cost Fund

The City (as Owner and Operator) is required to establish financial assurance for the costs of postclosure care in accordance with rule 567—113.13(455B). The city must provide continuous coverage for postclosure care until released from this requirement by demonstrating compliance with the postclosure plan and the closure permit. Proof of compliance pursuant to paragraphs 113.14(4)“a” through 113.14(4)“e” must be submitted by the owner or operator yearly by April 1 and approved by the department.

a. The city shall submit the current version of department Form 542-8090, Municipal Solid Waste Sanitary Landfill Financial Assurance Report Form, which contains, but is not limited to, the amount of the financial assurance, the annual financial statement required by Iowa Code sections 455B.306(8)“e” and 455B.306(6)“c,” and the current balances of the closure and postclosure accounts required by Iowa Code section 455B.306(8)“b.”
b. The city is required to submit a copy of the documents establishing a financial assurance instrument in an amount equal to or greater than the amount specified in subrule 113.14(9). Documentation for the mechanism(s) used to demonstrate financial assurance shall contain, at a minimum, the items required to be submitted as specified in paragraphs 113.14(6)“a” to 113.14(6)“i.”
c. The city is required to submit a detailed a detailed written estimate, in current dollars, certified by an Iowa-licensed professional engineer, of the cost of hiring a third party to conduct postclosure care for the MSWLF in compliance with the postclosure plan developed pursuant to paragraph 113.5(1)“i” and rule 567—113.13(455B). The cost estimate must account for the total cost of conducting postclosure care, as described in the plan, for the entire postclosure care period.
d. The most recent form 542-8090 and supporting documents submitted by the city are included at the back of this Appendix.

3. FINANCIAL ASSURANCE MECHANISM

The City has adopted the dedicated fund financial assurance mechanism allowed under 567 IAC 113.14(6)i *Local government dedicated fund*. The City maintains two separate restricted accounts for these Closure costs and Post Closure Care costs.

a. Each fund is dedicated by local government statute as a reserve fund.
b. Payments into the funds are made annually over a pay-in period of ten years or the permitted life of the landfill, whichever is shorter.
c. Annual deposits to the funds are determined by the following formula:

$$NP = \frac{CE - CB}{Y}$$

NP = next payment (projected deposit)
CE = total required financial assurance CB = current balance of the (Combined) fund
Y = number of years remaining in the pay-in period

$$Y = \frac{RPC}{TR}$$

RPC = remaining permitted capacity
TR = total number of tons disposed in the prior year.

The dedicated fund shall be adjusted annually to correct any deficiency of the fund with respect to the adjusted cost estimates and may be adjusted annually should the balance in the fund exceed the adjusted cost estimate.

Municipal Solid Waste Sanitary Landfill
Financial Assurance Report Form

SECTION 1: FACILITY INFORMATION

(please print or type)

Information Requested

Facility Name: Northern Plains Regional Landfill Permit Number: 74-SDP-02-76P

Permitted Agency/Entity: City of Spencer, Iowa

SECTION 2: CLOSURE/POSTCLOSURE OR CORRECTIVE ACTION COST ESTIMATES

Information Requested	Cost Estimate	Date of Cost Estimate
Updated Closure Cost Estimate	$ $2,448,500	4/1/2026
Updated Postclosure Cost Estimate	$ $3,147,000	4/1/2026
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 113.14(3)"c" for closure and 113.14(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	116,831
Amount of waste disposed of at the facility during the prior fiscal year	96,162

SECTION 4: PROOF OF COMPLIANCE

Publicly Owned Municipal Solid Waste Landfills *(ATTACH AUDIT REPORT)*

Owner's Most Recent Annual Audit Report

Prepared by: Wither Stave & Company, LLP (pending)

For fiscal year ending: 6/30/2025

Privately Owned Municipal Solid Waste Landfills *(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 landfill is in compliance with IAC 567 Chapter 113. 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 113.14(6)"a"		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Surety Bond 567 IAC 113.14(6)"b"		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Letter of Credit 567 IAC 113.14(6)"c"		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Insurance 567 IAC 113.14(6)"d"		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Corporate Financial Test 567 IAC 113.14(6)"e"		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Local Gov't. Financial Test 567 IAC 113.14(6)"f"		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Corporate Guarantee 567 IAC 113.14(6)"g"		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Local Gov't Guarantee 567 IAC 113.14(6)"h"		Closure ☐ Postclosure ☐ Corrective Action ☐	$
Local Gov't. Dedicated Fund 567 IAC 113.14(6)"i"		Closure ☒ Postclosure ☒ Corrective Action ☐	$ $4,725,618.90

*Pursuant to IAC 567 113.14(9), if account(s) are restricted/reserved to pay for closure, postclosure or corrective action costs, then the amount of the financial assurance instrument may be reduced by the sum of the cash balance of the account(s) established to comply with subrule 113.14(8).

SECTION 6: INITIAL PROOF OF ESTABLISHMENT OF ACCOUNTS

Check Which Applies: ☐ New Mechanism ☒ Previously Submitted

Pursuant to IAC 567 Chapter 113.14(8)"f", documentation of the establishment of accounts is to be submitted to the department by April 1, 2003 for currently permitted MSWLFs. Permit holders for MSWLFs permitted after April 1, 2003, shall submit documentation of the establishment of accounts prior to the MSWLF's initial receipt of waste.

Please attach documentation indicating accounts/fund have been established for closure and postclosure care and if the account(s) are restricted/reserved for closure or postclosure care. Examples of documentation include bank statements for closure/postclosure accounts, letter signed by the chief financial officer, letter from certified public accountant, etc.

Accounts established pursuant to paragraph 113.14(6)"a" for trust funds or paragraph 113.14(6)"i" for local government dedicated funds also satisfies the requirements of this subrule, and the permit holder shall not be required to establish additional closure and postclosure accounts.

SECTION 7: CLOSURE AND POSTCLOSURE ACCOUNTS

Completion of the following closure and postclosure account information complies with the annual financial statement requirements of IAC 567 113.14(3)"a" and 113.14(4)"a" by indicating the current balance(s) of the closure/postclosure account(s) or dedicated/trust fund and the projected amount(s) to be deposited in the account(s).

Under "Beginning Balance", please state the account/fund balance 30 days after the start of the previous fiscal year, for "Ending Balance", indicate the account 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
Closure Account Balance *(see formula below)*	$ 1,949,156.04	$ 2,006,570.44	$
Postclosure Account Balance *(see formula below)*	$ 2,641,337.70	$ 2,719,146.46	$
Or			
Dedicated Fund Balance *(see formula below)*	$ 4,590,493.74	$ 4,725,716.90	$ $718,910.00
Trust Fund Balance *(see formula below)*	$	$	$

Formula for Projected Deposits

Closure or Postclosure Account

$$\frac{CE - CB}{RPC} \times TR$$

Where "CE" is the closure or postclosure cost estimate, "CB" is the balance 30 days after close of the previous fiscal year, "RPC" is the remaining permitted capacity in tons, of the landfill from the beginning of the current fiscal year, and "TR" is the total number of tons of solid waste disposed in the prior year.

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 deposits

Closure	Postclosure

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 113.

Name of Official: Mark White Title: Public Works Director

Agency/Entity: Northern Plains Regional Landfill / City of Spencer, Iowa

Address: 101 W 5th Street

City: Spencer State: IA Zip: 51301

Telephone: 712-580-7200 Fax:

Email Address: Mark White <mwhite@spenceriowacity.com>

Signature of Official: Mark White Date: 4/16/2026

Questions? Contact Mary Klemesrud at (515) 802-8835 or Mary.Klemesrud@dnr.iowa.gov

POST CLOSURE COSTS (567-113.14(455B)) FOR:
NORTHERN PLAINS REGIONAL LANDFILL, PALO ALTO CO., IOWA
OWNED BY: CITY OF SPENCER, IOWA
PREPARED BY: KRUSE, CATE & NELSON, P.C.

DATE: 4/14/2026

		CB		CE		CE - CB =
		Ending Balance FY 24	Ending Balance FY 25			
		$ 2,641,337.70	$ 2,719,146.46	$ 3,147,000.00	$	427,853.54
		$ 1,949,156.04	$ 2,006,472.44	$ 2,448,500.00	$	442,027.56
Combined Total		$ 4,590,493.74	**$ 4,725,618.90**		$	869,881.10

		TR 2024	**TR 2025**	**Remaining Cap.**	
Capacity Calculations	Ton	80,526	**96,162**	**116,831**	See attached

116,831
96,162

Years =
1.21

(CE-EB) / Yrs =

	NEXT PAYMENT	
679 Post Close	$	353,597.97
680 Closure	$	365,312.03

Projected Deposit
Next Deposit = **$ 718,910.00**

Combined Estimate	CE =	$ 5,595,500.00
	CE - CB =	$ 869,881.10
	Y =	$ 1.21

Northern Plains Regional Landfill

Airspace re-calculation for FY 2026

JULY 1, 2025

		From ACAD	
Volume Remaining			
Existing Cells A-E1		364,000	Oct-23
Expansion Cells E-J		-	
Gross		364,000	CY
Less 12" Drainage Layer	148500	(5,500)	
Net Volume		358,500	CY
Assumed Density (Very Good Compaction)		0.8	Ton/CY
Gross Airspace Available in Tons		286,800	Ton
Nov 2023-Dec 2023 Solid Waste		(10,515)	Ton
2024 Solid Waste		(102,815)	Ton
1/2025 to 6/2025 Solid Waste		(36,563)	
Intermediate Cover Losses	7%	(20,076)	
GROSS VOLUME (JULY 1 2025)		**116,831**	**Ton**
Annual SW FY 2025		**96,162**	**Ton/Year**
		1.21	Years

Note Cell E2 was permitted in December of 2025 and will increase airspace for FY 2027

Prepared By: James E. Thiesse PE, KRUSE, CATE & NELSON, P.C.

April 15, 2027

I, Barbara Smith, attest that the fund balances are correct to the best of my knowledge as of June 30, 2025.

CITY of SPENCER Spencer, IA

Fund Balance Report

As Of 06/30/2025

Fund	Beginning Balance	Total Revenues	Total Expenses	Ending Balance
679 - LANDFILL POST CLOSURE	2,633,735.94	83,534.12	0.00	2,717,270.06
680 - LANDFILL CLOSURE	1,943,637.73	61,548.04	0.00	2,005,185.77
Report Total:	**4,577,373.67**	**145,082.16**	**0.00**	**4,722,455.83**

Barb Smith

Barb Smith, Finance Director

STATEMENT OF PROBABLE POST CLOSURE COSTS (567-113.14(455B)) FOR:
NORTHERN PLAINS REGIONAL LANDFILL, PALO ALTO CO., IOWA
OWNED BY: CITY OF SPENCER, IOWA
PREPARED BY: KRUSE, CATE & NELSON, P.C.

DATE: 4/1/2026

ITEM	DESCRIPTION	AMOUNT			
1	General Site Facilities	$1,700.00	Used for future cell development		
2	Cap & Cover Maintenance	$9,400.00	$427.27 /acre		
3	Drainage Erosion Control Maintenance	$1,200.00	No special structures		
4	Groundwater to Waste Separation	$1,600.00	Tile Maintenance	=	$16,000.00 / 10
5	Gas Control System maintenance	$1,700.00	Passive system		
6	Gas Control System monitoring/reporting	$1,700.00	Note: Also required to operate existing cells		
7	Groundwater/Surface water system maintenance	$3,200.00			
8	Groundwater/Surface water system monitoring/reporting	$19,100.00	Note: Also required to operate existing cells		
9	Groundwater/Surface water system evaluation/reports	$4,800.00	Note: Also required to operate existing cells		
10	Leachate control systems maintenance	$3,700.00	$18,500.00 /5years		cleaning/pumps
11	Leachate collection, hauling & disposal	$45,900.00	$0.057 /gallon		(800,000gallons)
12	Leachate system evaluation/reports	$2,400.00	Note: Also required to operate existing cells		
13	Facility Inspections & reports	$2,600.00	Note: Also required to operate existing cells		
14	Engineering & Technical services	$0.00	included in line items		
15	Legal, financial & legal services	$2,400.00			
16	Financial Assurance, accounting, audits & reports	$3,500.00	Note: Also required to operate existing cells		
PROBABLE ANNUAL POST CLOSURE COST (2024 FA)		**$104,900.00**	**104.1% Over previous year**		
		30			
	30 YEAR TOTAL	**$ 3,147,000**			

Closure based on **22.0 acres**. Cells A-E1 and the north part of Cells 15A & 16A.

Note most costs are a duplication of costs for items required to maintain operation of active cells in expansion area. Post Closure costs will be adjusted annually based on future life of expansion area.

PREPARED BY: KRUSE, CATE & NELSON, P.C.

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.

4/16/26

By: James E. Thiesse, License No. 12304 Date

My License renewal date is 12/31/2027
Number of Pages covered by this seal: 1 of 1

STATEMENT OF PROBABLE CLOSURE COSTS (567-111.3) FOR:
NORTHERN PLAINS REGIONAL LANDFILL, PALO ALTO CO., IOWA
OWNED BY: CITY OF SPENCER, IOWA
PREPARED BY: KRUSE, CATE & NELSON, P.C.

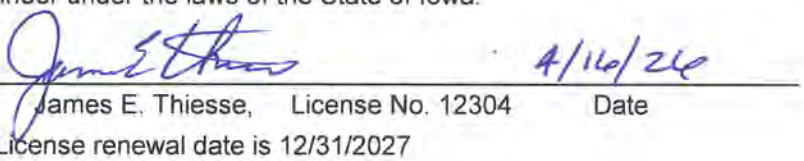
DATE: 4/1/2026

ITEM	DESCRIPTION		AMOUNT
1	Closure and postclosure plan document revisions	$	13,000
2	Site preparation, earthwork and final grading	$	174,700
3	Drainage control culverts, piping and structures	$	32,800
4	Erosion control structures, sediment ponds and terraces	$	32,800
5	Final cap construction	$	1,698,000
6	Cap vegetation soil placement	$	218,400
7	Cap seeding, mulching and fertilizing	$	65,500
8	Monitoring well, piezometer and gas control modifications	$	17,500
9	Leachate system cleanout and extraction well modifications	$	8,200
10	Monitoring well installations and abandonments	$	8,200
11	Facility modifications to effect closed status	$	13,100
12	Engineering and technical services	$	140,100
13	Legal, financial and administrative services	$	10,900
14	Closure compliance certifications and documentation.	$	15,300
	PROBABLE TOTAL CLOSURE COST (2026 FA)	**$**	**2,448,500**
	Cost per Acre =	**$**	**111,093**
	Increase over previous year =		107.5%

Closure based on 22.04 acres. Cells A-E1 and the northernmost parts of Cells 15A & 16A.

PREPARED BY: KRUSE, CATE & NELSON, P.C.

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.



By: James E. Thiesse, License No. 12304 Date

My License renewal date is 12/31/2027

Number of pages covered by this seal: 1 of 1

APPENDIX 11:

COMPREHENSIVE PLAN REQUIREMENTS
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

January 15, 2026

CITY OF SPENCER
#1717

The NPRL Planning Area was an Environmental Management System Participant starting in September 2011 but withdrew from the program in November 2022. The service area of the landfill has changed slightly as described on Form 50.

The last Comp Plan update was dated March 11, 2011.

The 2017 and 2022 Comprehensive Plan updates were waived due to EMS status.

The next update is the 9th round due on May 1, 2027.

APPENDIX 12:

WEIGH SCALE CERTIFICATION
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

January 15, 2026

CITY OF SPENCER
#1717

POST IN CONSPICUOUS PLACE

NONTRANSFERABLE

STATE OF IOWA

DEPARTMENT OF AGRICULTURE & LAND STEWARDSHIP

DES MOINES

SCALE LICENSE

License No. 1619
CITY OF SPENCER
101 W 5TH STREET
SPENCER IA 51301

SCALE LOCATION
NORTHERN PLAINS REGIONAL
3032 420TH AVENUE
GRAETTINGER IA 51342

IS GRANTED THE ABOVE LICENSE PURSUANT TO SECTIONS 214, CODE OF IOWA. THIS LICENSE SHALL REMAIN IN FULL FORCE FROM THE DATE OF ISSUE UNTIL ITS EXPIRATION DATE, UNLESS REVOKED OR SUSPENDED FOR CAUSE BY THE SECRETARY OF AGRICULTURE FOR NONCOMPLIANCE WITH CHAPTER 214, CODE OF IOWA OR RULES ADOPTED PURSUANT THERETO.

DATE OF ISSUE 10/30/2024

EXPIRATION DATE
12/31/2025

This license is non-transferable and non-refundable

Mike Naig

SECRETARY OF AGRICULTURE

TYPE OF DEVICE	--- NUMBER
0 THRU 500 LBS	0
501 THRU 5000 LBS	0
5001 THRU 50000 LBS	0
50001 THRU 120000 LBS	0
OVER 120000 LBS	1
MOISTURE METERS	0
COUNTY	74

APPENDIX 13:

OPERATOR CERTIFICATIONS
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

January 15, 2026

CITY OF SPENCER
#1717

STATE OF IOWA

OPERATOR CERTIFICATION

CERTIFICATE EXPIRES JUNE 30, 2020.

WHEN THIS CERTIFICATE EXPIRES A CURRENT RENEWAL CERTIFICATE MUST BE ATTACHED.

IOWA DEPARTMENT OF NATURAL RESOURCES

RENEWAL CERTIFICATE

EXPIRES JUNE 30, 2026

DAN CHISM
LANDFILL OPERATOR
CERTIFICATE # 31135

DAN CHISM
IS QUALIFIED IN ACCORDANCE WITH STATE LAW AS A LANDFILL OPERATOR.

CERTIFICATE **31135**

GIVEN UNDER THE HANDS OF THE
IOWA DEPARTMENT OF NATURAL RESOURCES
ON APRIL 27, 2020.

FOR THE DIRECTOR:

ED TORMEY, DIVISION ADMINISTRATOR

©GOES 746

LITHO IN U.S.A

STATE OF IOWA

OPERATOR CERTIFICATION

CERTIFICATE EXPIRES JUNE 30, 2012.

WHEN THIS CERTIFICATE EXPIRES A CURRENT RENEWAL CERTIFICATE MUST BE ATTACHED.

IOWA DEPARTMENT OF NATURAL RESOURCES

RENEWAL CERTIFICATE

EXPIRES JUNE 30, 2026

LINDA SCHALLER
LANDFILL OPERATOR
CERTIFICATE # 30897

LINDA SCHALLER

IS QUALIFIED IN ACCORDANCE WITH STATE LAW AS A LANDFILL OPERATOR.

CERTIFICATE # **30897**

GIVEN UNDER THE HANDS OF THE
IOWA DEPARTMENT OF NATURAL RESOURCES
ON JANUARY 27, 2012.

FOR THE DIRECTOR:

WILLIAM A. EHM, DIVISION ADMINISTRATOR

THIS CERTIFICATE REMAINS THE PROPERTY OF THE DEPARTMENT

© GOES 746

LITHO IN U.S.A.

STATE OF IOWA

OPERATOR CERTIFICATION

CERTIFICATE EXPIRES JUNE 30, 2022.

WHEN THIS CERTIFICATE EXPIRES A CURRENT RENEWAL CERTIFICATE MUST BE ATTACHED.

IOWA DEPARTMENT OF NATURAL RESOURCES

RENEWAL CERTIFICATE

EXPIRES JUNE 30, 2026

NATHAN LAWSON
LANDFILL OPERATOR
CERTIFICATE # 31155

NATHAN LAWSON

IS QUALIFIED IN ACCORDANCE WITH STATE LAW AS A LANDFILL OPERATOR.

CERTIFICATE # **31155**

GIVEN UNDER THE HANDS OF THE
IOWA DEPARTMENT OF NATURAL RESOURCES
ON JANUARY 19, 2021.

FOR THE DIRECTOR:

ED TORMEY, DIVISION ADMINISTRATOR

THIS CERTIFICATE REMAINS THE PROPERTY OF THE DEPARTMENT

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LITHO IN U.S.A.

STATE OF IOWA

OPERATOR CERTIFICATION

CERTIFICATE EXPIRES JUNE 30, 2024.

WHEN THIS CERTIFICATE EXPIRES A CURRENT RENEWAL CERTIFICATE MUST BE ATTACHED.

IOWA DEPARTMENT OF NATURAL RESOURCES

RENEWAL CERTIFICATE

EXPIRES JUNE 30, 2026

WADE ALESCH
LANDFILL OPERATOR
CERTIFICATE # 31226

WADE ALESCH

IS QUALIFIED IN ACCORDANCE WITH STATE LAW AS A LANDFILL OPERATOR.

CERTIFICATE # **31226**

GIVEN UNDER THE HANDS OF THE
IOWA DEPARTMENT OF NATURAL RESOURCES
ON DECEMBER 5, 2022.

FOR THE DIRECTOR:

Edmund J Tormey

ED TORMEY, DIVISION ADMINISTRATOR

THIS CERTIFICATE REMAINS THE PROPERTY OF THE DEPARTMENT

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LITHO IN U.S.A.

STATE OF IOWA

OPERATOR CERTIFICATION

CERTIFICATE EXPIRES JUNE 30, 2026.

WHEN THIS CERTIFICATE EXPIRES A CURRENT RENEWAL CERTIFICATE MUST BE ATTACHED.

Iowa Department of Natural Resources

LANDFILL OPERATOR

CERTIFICATE # 31297
Expires June 30th, 2026

CODY HOFFMAN
103 NORTH LINCOLN AVE
GRAETTINGER, IA 51342

CODY HOFFMAN

IS QUALIFIED IN ACCORDANCE WITH STATE LAW AS A LANDFILL OPERATOR.

CERTIFICATE # **31297**

GIVEN UNDER THE HANDS OF THE
IOWA DEPARTMENT OF NATURAL RESOURCES
ON OCTOBER 28, 2024.

FOR THE DIRECTOR:

Edmund J. Tormey

ED TORMEY, DIVISION ADMINISTRATOR

E PROPERTY OF THE DEPARTMENT

©GOES 746

LITHO IN U.S.A.

APPENDIX 14:

HOUSEHOLD HAZARDOUS MATERIALS CERTIFICATE
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

January 15, 2026

CITY OF SPENCER
#1717

The NPRL operates a permitted HHM Regional Collection Center and Storage facility that is in Spencer at the transfer station and operated under the transfer station permit 21-SDP-01-76. The attached License (21-RCC-2011) which expires November 1, 2028, authorizes the operation of this facility. Operators' Certificates for the facility are included in Appendix 14.

Household hazardous materials are prohibited at the Northern Plains Regional Landfill.

21-RCC-2011

License to Operate a Regional Collection Center collecting Household Hazardous Waste and Hazardous Waste from Very Small Quantity Generators in accordance with IAC 567-123.

Northern Plain Regional Landfill
Regional Collection Center
3101 W 18th Street
Spencer, IA 51301

Issued-November 1, 2023 for a period of five years unless amended or renewed before November 1, 2028

Kathleen L. Hennings
Environmental Specialist Sr.
Land Quality Bureau
Household Hazardous Waste Program

Cherokee/Buena Vista Household Hazardous Waste
1805 Linden Street Cherokee, IA 51012

8 Hour Annual HHW Refresher Training

Brad Pitts

Has successfully completed the 8-Hour Annual Health & Safety Course on the management of Household Hazardous Waste (HHW) and Very Small Quantity Generator Wastes in accordance with requirements of Title 29 CFR 1910.1200
This training was conducted and completed on
April 2, 2025.
Level D PPE was used in training.

Brent Kach
Trainer
Certificate #2025 - 10

Cherokee/Buena Vista Household Hazardous Waste
1805 Linden Street Cherokee, IA 51012

8 Hour Annual HHW Refresher Training

Tom Clark

Has successfully completed the 8-Hour Annual Health & Safety Course on the management of Household Hazardous Waste (HHW) and Very Small Quantity Generator Wastes in accordance with requirements of Title 29 CFR 1910.1200
This training was conducted and completed on
April 2, 2025.
Level D PPE was used in training.

Brent Kach
Trainer
Certificate #2025 - 11

Cherokee/Buena Vista Household Hazardous Waste
1805 Linden Street Cherokee, IA 51012

8 Hour Annual HHW Refresher Training

Lance Winther

Has successfully completed the 8-Hour Annual Health & Safety Course on the management of Household Hazardous Waste (HHW) and Very Small Quantity Generator Wastes in accordance with requirements of Title 29 CFR 1910.1200
This training was conducted and completed on
April 2, 2025.
Level D PPE was used in training.

Brent Kach
Trainer
Certificate #2025 - 9

APPENDIX 15:

SITE LEGAL DESCRIPTION AND PROOF OF OWNERSHIP
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

January 15, 2026

CITY OF SPENCER
#1717

Appendix 15: Legal Description and Proof of Ownership.

The title opinion for the original active landfill site found on page 327 of INDR Docs. #28914 and remains valid and is included herein.

The Northwest Quarter of Section 21, Township 97 North, Range 33 West of the 5th Principal Meridian, Palo Alto County, Iowa, except the northerly 470.00 feet of the easterly 350.00 feet of the Northwest Quarter, all located in Section 21, Township 97 North, Range 33 West of the 5th Principal Meridian, Palo Alto County, Iowa.

Since the last permit renewal in 2020, the city has purchased two acreages adjacent to the landfill, removed the buildings and the existing well on the acreage southeast of the landfill. An updated property parcel map surrounding the active landfill site is attached showing the property currently Owned by the City of Spencer. Also included are the deeds to the parcels.

CITY OF SPENCER, IOWA
City Hall
418 2nd Ave W
SPENCER, IOWA 51301

HEMPHILL LAW OFFICE
#02-011
1-22-02 dfz
file copy

From the Office of:

Donald J. Hemphill, City Attorney
215 Grand Avenue
Spencer, Iowa 51301-1475

Phone: (712) 262-6801
Fax: (712) 262-2018

ATTORNEY'S TITLE OPINION

January 22, 2002

Mayor Cleber Meyer
City Manager Dean Torreson
Spencer City Hall
418 1st Avenue West
Spencer, IA 51301

Re: The Northwest Quarter of Section 21, Township 97 North, Range 33 West of the 5th P.M., Palo Alto County, Iowa, except the northerly 470 feet of the easterly 350 feet

Dear Mayor Meyer and City Manager Torreson:

I have been provided and have examined abstracts that, collectively, constitute the abstract to the above described property continued to the date of December 31, 2001, at 8:00 o'clock A.M. as prepared and certified by the Palo Alto County Abstract Company of Emmetsburg, Iowa.

The abstract is in four parts. Part I covers the Southeast Quarter of the Northwest Quarter of Section 21, Township 97 North, Range 33, Palo Alto County, Iowa; consists of 32 entries; and covers the period from the patent from the United States to 5:00 o'clock P.M. on November 9, 1909. Part II also covers the Southeast Quarter of the Northwest Quarter of Section 21, Township 97 North, Range 33, Palo Alto County, Iowa; contains entries numbered 42 through 74; and covers the period from November 9, 1909, at 5:00 o'clock P.M. to March 13, 1995, at 8:00 o'clock A.M. Part III covers the Northeast Quarter of the Northwest Quarter and the West Half of the Northwest Quarter of Section 21, Township 97 North, Range 33 West of the 5th P.M., Palo Alto County, Iowa; contains 102 entries; and covers the period from the patent from the United States to March 13,

1995, at 8:00 o'clock A.M. Part IV covers the entire parcel under examination from March 13, 1995, at 8:00 o'clock A.M. to December 31, 2001, at 8:00 o'clock A M.

A review of the abstracts establishes that the title to the property under examination was held by Hugh J. Flannegan at the date of his death on April 26, 1999. A formal probate of the Estate of Hugh J. Flannegan has been undertaken in Palo Alto County, Iowa, as Estate No. 10275. The surviving spouse of Hugh J. Flannegan, Elizabeth Flannegan, is the duly appointed and acting executor of the estate. As executor, Elizabeth Flannegan is authorized to, and may, convey marketable title to the property under examination to the City of Spencer, subject to the following:

1. HIGHWAY EASEMENT. At Entry #33 of Part III of the abstract is shown a grant of easement by the then titleholder to the State of Iowa. This easement was recorded May 12, 1938, in Deed Record Book 27 at page 613. Pursuant to this easement, the State of Iowa was granted a permanent easement for road purposes and for use as a public highway over the following parcel:

> "Beginning at the northwest corner of Section 21, Township 97 North, Range 33 West of the 5th P.M., Palo Alto County, Iowa; thence East 65.5 feet; thence South 0°6' West 2,635.2 feet; thence West 60.8 feet; thence North 2,635.2 feet to the point of beginning and containing 1.82 acres, more or less . . ."

You are charged with knowledge of the existence of this highway easement.

2. ZONING. The property is subject to the zoning ordinance of Palo Alto County, which was adopted August 9, 1995, and recorded January 11, 2000, in Miscellaneous Book 26 at pages 490 through 600.

3. REAL ESTATE TAXES. The abstracter has noted that the first installment of real estate taxes for the current year and all prior real estate taxes are paid in full. The second installment of current taxes is in the amount of $819, is unpaid, and will become delinquent if not paid by April 1, 2002. The abstracter has also noted that 70 acres of the property under examination are shown as "exempt" for real estate tax purposes.

4. MECHANICS LIENS. Claims of liens for labor or materials furnished for the improvement of the premises need not be filed until 90 days after the completion of the work or until 90 days after the last item of material has been furnished. A lien for recently completed work may not be reflected in the abstract of title upon which this title opinion is based.

Subject to the foregoing, I find that title to the real estate under examination is marketable in accordance with the Title Standards of the Iowa State Bar Association.

Respectfully submitted,

Donald J. Hemphill
Spencer City Attorney

DJH/lo

Beacon™ Palo Alto County, IA

Overview

99-268

Parcel ID: 490021002010

E-541

State of Iowa,
Palo Alto County,
Entered for taxation this 25th day
of January, 2002
Gary J. Leonard, Co. Auditor
by Carmen L Mason Deputy

REAL ESTATE TRANSFER
TAX PAID
157
STAMP #
$2198.40
Lori M. Kliegl
RECORDER
1-25-2002 Palo Alto
DATE COUNTY

Palo Alto County, Iowa No. 183
Filed for Record 1-25-2002 At 10:10 AM
Book 99 Page 268 Fee 5.00/6.00
LORI M. KLIEGL, RECORDER
D. Marie Gilman DEPUTY

Preparer
Information Loren A. Nalean, 724 Story Street, Boone, Iowa 50036-2804, (515) 432-8266

Loren A. Nalean ISBA # 3952

COURT OFFICER DEED

ESTATE OF HUGH J. FLANNEGAN, Deceased,
now pending in the Iowa District Court Probate No. ESPR 010275
in and for Palo Alto County.

Pursuant to the authority and power vested in the undersigned, and in consideration of one and 00/100 (1.00) Dollar(s) and other valuable consideration, the undersigned, in the representative capacity designated below, hereby Convey(s) to City of Spencer, Iowa, an Iowa municipal corporation, the following described real estate in Palo Alto County, Iowa:

Northwest quarter of Section 21, Township 97, Range 33, West of the 5th P.M., Palo Alto County, Iowa, EXCEPT: the northerly 470 feet of the easterly 350 feet of the Northeast quarter of the Northwest quarter of Section 21, Township 97, Range 33, West of the 5th P.M., Palo Alto County, Iowa.

Words and phrases herein, including acknowledgement hereof, shall be construed as in the singular or plural number, and as masculine, feminine or neuter gender, according to the context.

Estate of Hugh J. Flannegan, Deceased

By Elizabeth Flannegan Executor
Elizabeth Flannegan as Executor in the
above-entitled estate or cause.

STATE OF IOWA, COUNTY OF PALO ALTO, ss:

On this JANUARY 25, 2002, before me, the undersigned, a Notary Public in and for said state, personally appeared Elizabeth Flannegan to me known to be the identical person named in and who executed the foregoing instrument, and acknowledged that such person, as such fiduciary, executed the same as the voluntary act and deed of such person and of such fiduciary.

Loren A Nalean
Notary Public in and for said State

NOTARIAL SEAL IOWA
LOREN A. NALEAN
COMMISSION # 128721
MY COMMISSION EXPIRES
JULY 6, 2004

Parcel ID: 490016003041

Document 2022 856

Book 2022 Page 856 Pages 3
Date 5/19/2022 Time 2:47 PM
Rec Amt $17.00 Aud Amt $10.00
Rev Transfer Tax $439.20
DOV# 140

SUE RUPPERT, RECORDER
PALO ALTO COUNTY IOWA

COURT OFFICER DEED
Recorder's Cover Sheet

Preparer Information: Todd R. Buchanan, 111 North Dodge Street, PO Box 617, Algona, IA 50511, Phone: (515) 295-3565

Taxpayer Information: City of Spencer, Iowa, 101 W. 5th Street, Spencer, IA 50301

Return Document To: Todd R. Buchanan, 111 North Dodge Street, PO Box 617, Algona, Iowa 50511

Grantors: Kim Marie Driftmier Estate

Grantees: The City of Spencer, Iowa

Legal Description: See Page 2

Document or instrument number of previously recorded documents:

COURT OFFICER DEED

THE ESTATE OF
KIM MARIE DRITMIER

now pending in the Iowa District Court in and for Palo Alto County. Case No. ESPR012320

Pursuant to the authority and power vested in the undersigned, and in consideration of One Dollar(s) and other valuable consideration, the undersigned, in the representative capacity designated below, hereby Conveys to The City of Spencer, Iowa, the following described real estate in Palo Alto County, Iowa:

The northerly 470 feet of the easterly 350 feet of the Northeast Quarter of the Northwest Quarter (NE¼NW¼), Section Twenty-one (21), Township Ninety-seven (97) North, Range Thirty-three (33) West of the 5th P.M., Palo Alto County, Iowa.
AND
That part of the South Half of the Southwest Quarter (S½SW¼) of Section Sixteen (16), Township Ninety-seven (97) North, Ranger Thirty-three (33) West of the 5th P.M., Palo Alto County, Iowa, described as follows: Beginning at the South one quarter corner of said Section 16; thence North 0°00.0' East 614.52 feet along the East line of said SW¼; thence South 89°33.6' West 217.71 feet; thence South 22°10.4' West 143.98 feet; thence South 89°01.4' West 103.04 feet; thence South 3°33.5' East 217.37 feet; thence South 86°33.0' West 87.92 feet; thence South 2°46.6' East 264.82 to a point on the South line of said SW¼; thence North 88°49.2' East 436.91 feet to the point of beginning, containing 5.298 acres, subject to any existing easements. NOTE: The East line of the SW¼ of said Section 16 is assumed to bear true North and South.

Transfer Tax: $439.20

Words and phrases herein, including acknowledgement hereof, shall be construed as in the singular or plural number, and as masculine, feminine or neutral gender, according to the context.

Dated: May 2, 2022

Michael D. Mammen
As Administrator in the above entitled estate or cause.

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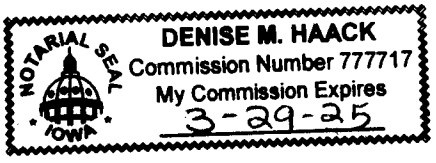
STATE OF IOWA, COUNTY OF PALO ALTO, ss:

This record was acknowledged before me on May 2, 2022, by Michael D. Mammen as Administrator of the Kim Marie Driftmier Estate.

Denise M. Haack
Signature of Notary Public



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Parcel ID: 490016004022

Document 2024 451

Book 2024 Page 451 Pages 3
Date 4/04/2024 Time 1:39 PM
Rec Amt $17.00 Aud Amt $5.00
Rev Transfer Tax $69.60
DOV# 66

SUE RUPPERT, RECORDER
PALO ALTO COUNTY IOWA

Return To: City of Spencer, Iowa, 101 West 5th Street, Spencer, IA 51301
Taxpayer: City of Spencer, Iowa, 101 West 5th Street, Spencer, IA 51301
Preparer: Kevin R. Sander, 108 North 7th Street, Estherville, IA 51334, Phone: 712-362-7215

COURT OFFICER DEED

IN THE MATTER OF
THE ESTATE OF
RICHARD SCHANY, Deceased,

now pending in the Iowa District Court in and for Palo Alto County. Case No. ESPR012382

Pursuant to the authority and power vested in the undersigned, and in consideration of One Dollar and other valuable consideration, the undersigned, in the representative capacity designated below, hereby Convey(s) to **City of Spencer, Iowa**, the following described real estate in Palo Alto County, Iowa:

That part of the Southwest Quarter of the Southeast Quarter of Section 16, Township 97 North, Range 33 West of the Fifth Principal Meridian, Palo Alto County, Iowa, described as follows to wit: Beginning at the southwest corner of the Southeast Quarter of said Section 16, and running from this point of beginning north 00° 00' 00" east (north 00 degree 00 minutes 00 seconds east) along the west line of the Southeast Quarter of said Section 16 a distance of 692.95 feet to a southwesterly corner of the existing parcel described in the deed recorded in Book 2009, Page 1465, Palo Alto County, Iowa Recorder's office; thence south 46° 55' 50" east along a southwesterly line of said parcel a distance of 306.12 feet to a southernly corner of said parcel; thence south 64° 06' 50" east along a southernly line of said parcel a distance of 114.85 feet to a southernly corner of said parcel (also being the northwest corner of the existing parcel described in the deed recorded in Book 65, Page 388, Palo Alto County, Iowa Recorder's office); thence south 02° 45' 34" west a distance of 424.17 feet to the southwest corner of said

parcel (also being the south line of said section 16); thence south 88° 08' 16' west along the south line of said recorded parcel a distance of 307.02 feet to the point of beginning. All bearings stated in this description are based on the assumption that the west line of the Southeast Quarter of said Section 16 has a bearing of north 00° 00' 00" east. The area of the above-described parcel of land is 3.971 acres, which includes 0.332 acres of highway right-of-way, varying in width along the northerly line of the above-described parcel of land, described as Parcel A in Plat of Survey dated 7/17/23

There is no known private burial site, well, solid waste disposal site, underground storage tank, hazardous waste, or private sewage disposal system on the property as described in Iowa Code Section 558.69, and therefore the transaction is exempt from the requirement to submit a groundwater hazard statement.

Words and phrases herein, including acknowledgement hereof, shall be construed as in the singular or plural number, and as masculine, feminine or neutral gender, according to the context.

Dated: 12/6, 2023.

Kelly Schany, Co-Executor

STATE OF NEBRASKA, COUNTY OF Washington, ss:

This record was acknowledged before me on December 6th, 2023, by Kelly Schany as Co-Executor of the Estate of Richard Schany.

GENERAL NOTARY - State of Nebraska
BROOKLYN BRENNEIS
My Comm. Exp. February 14, 2027

Brooklyn Brenneis
Signature of Notary Public

Bruce Schany, Co-Executor

STATE OF IOWA, COUNTY OF Emmet, ss:

This record was acknowledged before me on Dec. 5, 2023, by Bruce Schany as Co-Executor of the Estate of Richard Schany.

KEVIN R. [illegible]
Commission N[illegible]
My Commission [illegible]
September 26, 2024

Signature of Notary Public

Parcel ID: 490020001041

Document 2025 1152

Book 2025 Page 1152 Pages 2
Date 8/06/2025 Time 12:41 PM
Rec Amt $12.00 Aud Amt $5.00
Rev Transfer Tax $239.20
DOV# 196

SUE RUPPERT, RECORDER
PALO ALTO COUNTY IOWA

COURT OFFICER DEED
Recorder's Cover Sheet

Preparer Information:
Sarah K. Haack, 407 Grand Ave., P.O. Box 999, Spencer, IA 51301,
Phone: (712) 262-1630

Taxpayer Information:
City of Spencer, 101 W 5th St., Spencer, IA 51301

Return Document To:
City of Spencer, 101 W 5th St., Spencer, IA 51301

Grantor:
Estate of Todd Alan Friesner

Grantee:
City of Spencer

Legal Description: See Page 2

Document or instrument number of previously recorded documents: N/A

COURT OFFICER DEED

In the Matter of the Estate of Todd Alan Friesner, now pending in the Iowa District Court in and for Palo Alto County. Case No. ESPR012598.

Pursuant to the authority and power vested in the undersigned, and in consideration of One Dollar ($1.00) and other valuable consideration, the undersigned, in the representative capacity designated below, hereby Conveys to the City of Spencer, Iowa, the following described real estate in Palo Alto County, Iowa:

A tract of land located in the Southeast Quarter (SE¼) of the Northeast Quarter (NE¼) of Section Twenty (20), Township Ninety-Seven (97) North, Range Thirty-Three (33) West of the 5th P.M., Palo Alto County, Iowa, described as follows: Beginning at the Southeast corner of the NE¼ of Section 20-97-33, thence North 0 degrees 06½' East 681.9 feet along the east line of said NE¼, thence West 590.2 feet, thence South 0 degrees 52' East 694.4 feet, thence North 88 degrees 46' East 578.6 feet to the point of beginning, containing 9.23 acres, subject to existing highway.

Words and phrases herein, including acknowledgement hereof, shall be construed as in the singular or plural number, and as masculine, feminine, or neutral gender, according to the context.

Dated: July 23, 2025

ESTATE OF TODD ALAN FRIESNER

By: Daniel Lee Friesner
Daniel Lee Friesner, Administrator of the Estate of Todd Alan Friesner

STATE OF IOWA, COUNTY OF CLAY, ss:

This record was acknowledged before me on July 23, 2025, by Daniel Lee Friesner, Administrator of the Estate of Todd Alan Friesner.

Colleen Krebsbach
Signature of Notary Public

NOTARIAL SEAL IOWA
Colleen Krebsbach
COMMISION NO. 773507
MY COMMISSION EXPIRES
06-21-2027

Notarized online using Audio and Video Communications
Electronic Notary Public

APPENDIX 17:

STATE HISTORICAL PRESERVATION OFFICE CLEARANCE
NORTHERN PLAINS REGIONAL LANDFILL
SDP PERMIT NO. 74-SDP-02-76P

January 15, 2026

CITY OF SPENCER
#1717

Appendix 17: State Historical Preservation Office Clearance:

Prior to the construction of expansion Cell E1 a "PHASE I CULTURAL RESOURCES INVESTIGATION FOR A PROPOSED LANDFILL EXPANSION PROJECT IN WALNUT TOWNSHIP, PALO ALTO COUNTY, IOWA" prepared by Bear Creek Archeology, Inc., dated July 2023 was completed. This document was submitted to the IDNR and SHPO on July 10, 2023 and the associated construction permit was issued on July 13, 2023 (107203). We could not find the report in the IDNR record so a copy is included for addition to Appendix 17.

PHASE I CULTURAL RESOURCES INVESTIGATION FOR A PROPOSED LANDFILL EXPANSION PROJECT IN WALNUT TOWNSHIP, PALO ALTO COUNTY, IOWA

Section 21, T97N, R33W

BCA 3318

THIS REPORT MAY CONTAIN SITE LOCATION INFORMATION
NOT FOR PUBLIC DISTRIBUTION

Prepared for
Kruse, Cate & Nelson, P.C.
2303 W 18th Street
Spencer, IA 51301

Prepared by
Haley R. Madden
(Project Archeologist)

Josh Anderson
(Principal Investigator)

Bear Creek Archeology, Inc.
P.O. Box 347
Cresco, Iowa 52136
Derek V. Lee, Director

July 2023

MANAGEMENT SUMMARY

The following report presents the results of a Phase I cultural resources investigation conducted for Kruse, Cate & Nelson, P.C. by Bear Creek Archeology, Inc., Cresco, Iowa, for a proposed landfill expansion project in northwest Palo Alto, Iowa. Located south of Graettinger, Iowa, the 11.1 ha (27.4 ac) project area occupies a portion of the NW¼, Section 21, T97N, R33W, Walnut Township, Palo Alto County, Iowa.

Based on the soil survey and topographic maps, the project area sets on glacial upland landforms. At the time of the survey in June of 2023, the project area was mostly covered by an oat crop offering 70–80% ground surface visibility between rows. The southern end of the project area was covered in grass offering <10% ground surface visibility. Prefield archival research indicated no previously recorded archeological sites, previously conducted cultural resource surveys, or inventoried properties within the project area. An archival review of historic maps and aerial photographs indicated no historic-age resources were located within the project area. The project area has been under continuous cultivation since at least the early 20th century.

The field investigation consisted of a geomorphological evaluation of the project area and an archeological survey based on the results of the geomorphological investigation. The geomorphological investigation involved the extraction of four hand cores, three of which were recorded as formal profiles, and indicated the project area was comprised of disturbed Dows Formation upland landforms. A pedestrian survey was utilized as a site discovery method throughout the oat field portion of the project area. Shovel tests (n = 11) were utilized at the southern end of the project area where visibility was poor. No cultural materials were encountered during the survey. As such, Bear Creek Archeology, Inc. recommends no further cultural resources investigations for the project area.

Information contained in this report relating to the nature and location of archeological sites is considered private and confidential and not for public disclosure in accordance with Section 304 of the National Historic Preservation Act (54 U.S.C. § 307103); 36 CFR Part 800.6(a)(5) of the Advisory Council on Historic Preservation's rules implementing Sections 106 and 110 of the National Historic Preservation Act; Section 9(a) of the Archaeological Resource Protection Act (54 U.S.C. § 100707), and Chapter 22.7, subsection 20 of the Iowa Code.

INTRODUCTION

Bear Creek Archeology, Inc. (BCA) was contracted by Kruse, Cate & Nelson, P.C. to conduct a Phase I survey for a proposed landfill expansion project located south of Graettinger in Palo Alto County, Iowa. This Phase I cultural resources investigation was conducted in accordance with the National Historic Preservation Act (Advisory Council on Historic Preservation 2004, 2016) and the Secretary of the Interior's standards for the identification of historic properties (National Park Service [NPS] 1983), and the investigation meets or exceeds the guidelines for Iowa archeological investigations offered by the Association of Iowa Archaeologists (AIA; 2022). This report details the information gathering process concerning cultural resource properties that may exist in or near the project area, provides descriptions and natural contexts of cultural resources when encountered, and gives recommendations concerning the potential impact of the proposed development on existing cultural resources. This investigation included archival research, landform evaluations, in addition to archeological survey, utilizing pedestrian survey and shovel testing as site identification methods. The fieldwork portion of this investigation was conducted by BCA personnel in June of 2023. The fieldwork, data analyses, and report production were completed by BCA personnel under the supervision of the Principal Investigator. The resulting field notes and other records generated by BCA during this project are housed at BCA's office in Cresco, Iowa.

PROJECT LOCATION

The project area is located in northwest Iowa within the physiographic region known as the Des Moines Lobe (Prior 1991; Figures 1 and 2). The 11.1 ha (27.4 ac) project area occupies a portion of the NW¼, Section 21, T97N, R33W, Walnut Township, Palo Alto County, Iowa (Figure 3). Set south of Graettinger, the project area sits on the east side of 420th Avenue, just south of the intersection with 300th Street and consists of an agricultural field edged by grass positioned along upland landforms (Figure 4). The nearest perennial water source to the project area, an unnamed tributary of the Des Moines River, is located approximately 300 m (984 ft) to the southwest, and the streams converge just over .6 km (.4 mi) to the east (Figure 3).

INVESTIGATION PREMISES

The purpose of this investigation is to document the cultural resources within the project area at the Phase I level of investigation. Phase I surveys are intended to provide basic data on the occurrence, location, and identification of cultural resources within a given area. The goals of the Phase I survey are based on the Secretary of the Interior's Standards and Guidelines for the Identification of Archeological Properties (NPS 1983:44716–44728).

These standards are summarized and annotated within the archeological guidelines for Iowa (AIA 2022).

The survey strategy of this Phase I investigation was based on an analysis of the project area and the landforms that exist within it. Archeological sites are integrated into the environment by natural surficial and formation processes and may be viewed not only as cultural remains, but also as geologic deposits. Geological processes condition a region's geographic and pedologic character, and an awareness of these site formation processes is fundamental to any evaluation of the archeological record. Landform and soil characteristics strongly influence the presence, absence, and distribution of the plant and animal populations utilized by human groups. Geological processes affect not only the patterns of human habitation and environmental exploitation but are also largely responsible for the preservation, destruction, and manipulation of the archeological record. Therefore, archeological sites should be viewed as a product of both cultural and geological processes (Bettis and Green 1991).

This perspective on site location takes into account an area's geological processes and cultural interactions, allowing archeologists to use landform modeling to predict site occurrence and patterned distributions within a given region (Bettis and Benn 1984; Bettis and Thompson 1981). Such an approach also proves useful in investigator recognition of post-settlement alluvium (PSA), made land, plowzones (Ap horizons), and other disturbances that may have modified the area under investigation.

As a tool of cultural resource management, this type of landform modeling is critical to developing and implementing survey strategies. More sensitive strategies toward geomorphological context allow the investigator to focus on those areas where the probabilities of site occurrence are highest. This approach reduces or eliminates the cost of surveying areas where sites should not sensibly occur (e.g., made land, heavily disturbed areas, and landforms consisting entirely of recent alluvium, etc.). Informed survey strategies such as outlined above allow for the determination of the depth and distribution of subsurface tests necessary for detecting buried cultural resource deposits. Additionally, the nature of the proposed impacts can be assessed in terms of the landforms present.

GENERAL INVESTIGATION METHODOLOGY

Prior to beginning the fieldwork, online site and previous survey records at the Office of the State Archaeologist (OSA) in Iowa City were examined to determine if previously reported cultural resources were within or near the project area. To check for potential historic properties and nonextant structures, digital copies of 19th century and early 20th century General Land Office (GLO) maps, historic plat maps, and aerial photographs dated 1939–2021 stored on the BCA server were also consulted.

Preceding the fieldwork, a brief geomorphic review was conducted to assess the general landform context of the survey area. A ¾" hand probe was used to inspect subsurface

deposits and monitor the depth of the plowzone and other modern impacts. Representative soil profiles were recorded for various landscape positions, supplemented by visual assessments of the project area. Field investigations were conducted as needed based on the findings of the archival review and geomorphological evaluation, following the guidelines for archeological investigations in Iowa offered by the AIA (2022).

ENVIRONMENTAL CONTEXT AND LANDFORM MODELS

Physiographic Region

The project area is located in northwestern Iowa within the Des Moines Lobe physiographic region (Prior 1991; Figures 1 and 2). This region was created during the extension of the Wisconsinan Laurentide ice sheet into Iowa approximately 14,000 years ago (Kemmis et al. 1981). Because this area was covered with glacial ice, the thick deposition of loess common in most of Iowa was prevented (Prior 1991). Subsequently, the Late Wisconsinan-age glacier deposited materials commonly referred to as the Dows Formation (Kemmis et al. 1981; Ruhe 1969). Relief on the Des Moines Lobe is generally low. As the region has only been free of glacial ice for 12,000 years, the drainage system is still developing. Glacial till, more resistant to erosion than loess, further slows the process of valley incision.

A large portion of the lobe area is hummocky with distinct ridges and swales marking the limits of the major ice advances. The hummocky areas are comprised of elevational highs such as end moraines, kettles, and knobs. The relatively flat plains are underlain by ground moraine till (Prior 1991). Swales, depressions, and low relief drainages produce a grid across portions of the Des Moines Lobe. These linked drainage-depression systems are glacial features formed during the collapse of stagnant-ice environments rather than moving ice. Evidence for these environments can be found regionally across the lobe (Bettis et al. 1996). Recent work on the glacial and post-glacial deposition and environmental changes on the Des Moines Lobe have further refined sequences from earlier works (Bettis et al. 1996; Kemmis et al. 1981; Ruhe 1969).

Dows Formation. Almost all of the uplands within the Des Moines Lobe are covered with thick, glacially deposited sediments termed the Dows Formation (Kemmis et al. 1981). The formation is subdivided into four different members: Alden, Morgan, Lake Mills, and Pilot Knob, which were deposited by glacial advances between ca. 15,000 and 12,000 B.P. (Bettis et al. 1996). The loamy Alden Member contains till that was deposited beneath the glacial ice. The Morgan Member is comprised of loamy sediments that exhibit a higher density of coarse materials as compared to the Alden Member. These materials are associated with the upper and marginal portions of the glacier. The Morgan Member consists of alternating beds of unsorted and size-sorted sediments. The Lake Mills Member consists of an upper bed of fine-grained sediments and a thinner, lower bed of sands and gravels. This member formed in glacial lakes through the initial transport of larger sediments by glacial meltwater followed by fine-grained deposition consistent with low-

energy lake environments. The Pilot Knob Member contains the coarsest sediments of the Dows Formation. This member consists of sands and gravels associated with subglacial meltwater and streams. The sediment-laden meltwater often resulted in the formation of kames and eskers.

Project Area Soils and Landscape Analysis

According to the Natural Resources Conservation Service and soil survey of Palo Alto County (Jones 1977; Soil Survey Staff 2021, 2023), there are five soil units mapped in the project area (Figure 5): Okoboji silty clay loam, 0–2% slopes (L6); Nicollet clay loam, 1–3% slopes (L55); Webster clay loam, 0–2% slopes (L107); Clarion loam, 2–6% slopes (L138B); and Canisteo clay loam, 0–2% slopes (L507). Okoboji series soils are found on closed depressions on till plains and moraines and formed in alluvium or lacustrine sediments. This series is comprised of very poorly drained soils with a soil sequence of Ap-A1-A2-A3-Bg1-Bg2-Bg3-BCg-Cg. Nicollet soils are formed in calcareous loamy glacial till on plains and moraines. This series is very deep, somewhat poorly drained, and has a soil sequence of Ap-A-Bw-Bg1-Bg2-BCg-BCkg. Webster series soils are found in and along poorly drained upland depressions in wet prairie settings and formed in glacial till or local alluvium from till on uplands. With a soil sequence of Ap-A-BAg-Bg1-Bg2-BCg-Cg, these soils are very deep, poorly drained, and moderately permeable. Clarion series soils are found on uplands and formed in glacial till under tall grass prairies. This series is comprised of very deep, moderately well drained soils with a soil sequence of Ap-A1-A2-Bw1-Bw2-C1-C2. Canisteo series soils are formed in calcareous, loamy till, or in a thin mantle of loamy or silty sediments and the underlying calcareous, loamy till. These soils are found on rims of depressions, and depressions and flats on moraines or till plains. They consist of very deep, poorly and very poorly drained soils with a soil sequence of Ap-A-Bkg1-Bkg2-Cg1-Cg2. Combined with the available soil information, a review of the topographic map and lidar imagery (Figures 3 and 6) indicates that the project area is positioned along uplands associated with a till plain. Elevations within the project area vary from 388.6–393.2 m (1275–1290 ft). Based off of the reviewed soil and elevational data, the project area is interpreted as having moderate overall archeological potential.

ARCHIVAL REVIEW RESULTS

Previous Surveys, Recorded Sites, and Inventoried Properties

Information regarding previous cultural resource surveys, recorded archeological sites, and inventoried properties within or near the project area was obtained from the online resource managed by OSA. A county history was also reviewed (McCarty 1910). No previous cultural resource surveys, previously recorded archeological sites, or inventoried historic properties were identified within or adjacent to the project area.

Widening the search area to a radius of 1.6 km (1 mi) from the project area, one previously recorded historic structure was noted 0.6 km (0.4 mi) south of the project area (Collins

2013). The inventoried structure, a bridge (74-00321) spanning a drainage ditch, was recommended not eligible for the National Register of Historic Places (NRHP). A previous road survey was conducted at the same location in 2013 and yielded negative results.

An additional layer comprised of Historic Indian Location Database (HILD) locations and other Notable Locations was examined and identified no locations of interest in the project area or the search radius.

Historic Maps and Aerial Photographs

A GLO map, a state atlas, and two historic county plat maps were consulted to identify potential historic-age properties within or directly adjacent to the project area (Andreas 1875; Fuller 1919; GLO 1855; Ogle 1908; Figures 7–10). No structures or other cultural features appear in the vicinity of the project area on the 1855 (GLO) map or 1875 (Andreas) state atlas (Figures 7 and 8). The 1855 GLO map depicts the unnamed stream to the south of the project area along with the Des Moines River valley wall escarpment indicated off to the east. The 1908 county plat map indicates a property had been built southeast of the project area (Ogle 1908; Figure 9). This property continues to appear on the 1919 plat map (Fuller; Figure 10).

Aerial photographs dated 1939–2021 were also reviewed to determine if any historic-age buildings or structures were located within the project area and to better understand landscape change and land use practices within the project area since the early twentieth century (Figures 11–13). The earliest aerial photograph, dated 1939, shows the project area set within an agricultural field abutting 420th Avenue (Figure 11). The southeastern portion of the project area overlaps with a tree line connected to a farmstead, though no buildings are within the project area. Plat maps indicated that a farmstead had been present at that location since at least 1908. The project area undergoes continued agricultural use throughout the 20th and 21st centuries, with virtually no changes up to a 2006 image revealing a newly constructed farm drive abutting the southeastern boundary (Figure 12). The adjacent farmstead also appears to have fallen out of use by this time. An additional drive along much of the remaining project area perimeter, likely associated with the neighboring landfill, appears in a recent 2021 aerial photograph (Figure 13).

Archival Review Summary

Based on the review of available archival materials, there are no previously recorded archeological sites, previously conducted cultural resource surveys, or inventoried properties within the project area. No buildings, structures, or other cultural elements appear within the project area on the historic maps or aerial photographs which show the land under continuous cultivation. As such, it is likely that the project area has been negatively impacted by agricultural activities. Additionally, peripheral portions of the project area along the western, northern, and eastern boundaries have likely been impacted by adjacent roadway construction.

SURVEY RESULTS

Geomorphic Evaluation

To begin the field investigation, a geomorphic evaluation was conducted across the project area. The geomorphic evaluation utilized visual assessments of the project area and the extraction of four hand cores, three of which were recorded as representative soil profiles (Figure 4). At the time of the geomorphic evaluation, the project area was found to be almost entirely occupied by an agricultural field of oats (70–80% GSV between rows; Figures 4 and 14–16) while the southernmost extent was in a cover of grass (<10% GSV; Figures 4 and 17). The very gently undulating uplands within the project area offered slopes ranging from nearly 0–5%. Soil Profile (SP) 1, recorded within a swale in the southern portion of the project area, displayed stacked plowzones truncating a poorly drained subsoil. SP 2, extracted from a rise near the center of the project area, revealed a single plowzone truncating a poorly drained subsoil. A similar profile was observed along a rise near the northern project area boundary. SP 3, extracted along an additional northern rise displayed stacked plowzones truncating a better-drained Bw horizon subsoil. Given the observed disturbances, the project area was interpreted to have low potential for intact archeological deposits.

DESIGNATION: SP 1
LANDSCAPE POSITION: upland till plain (swale)
PARENT MATERIAL: glacial till
SLOPE: 0–2%
VEGETATION: agricultural field, 70–80% GSV
METHOD: hand core
DATE DESCRIBED: 06/21/2023
DESCRIBED BY: H. Madden

Depth (cm)	Soil Horizon	Description
0–28	Ap1	Black (10YR 2/1) clay loam; weak, fine subangular blocky structure; friable; abrupt boundary.
28–45	Ap2	Very dark brown (10YR 2/2) clay loam; weak, fine subangular blocky structure; friable; abrupt boundary.
45–53	Ap3	Very dark brown (10YR 2/2) to very dark gray (10YR 3/1) clay loam (stickier); weak, medium subangular blocky structure; friable; clear to abrupt boundary.
53–110	Bg	Very dark gray (10YR 3/1) to dark gray (10YR 4/1) clay loam; weak to moderate, medium subangular blocky structure; friable; common, fine, distinct yellowish brown (10YR 5/6) redoximorphic features; pebbles present; water table reached at 100 cm. End.

DESIGNATION: SP 2
LANDSCAPE POSITION: upland till plain (rise)
PARENT MATERIAL: glacial till
SLOPE: 2–5%
VEGETATION: agricultural field, 70–80% GSV
METHOD: hand core

DATE DESCRIBED: 06/21/2023
DESCRIBED BY: H. Madden

Depth (cm)	Soil Horizon	Description
0–22	Ap	Very dark gray (10YR 3/1) sandy loam; weak, fine subangular blocky structure; friable; clear to abrupt boundary.
22–55	Bg	Olive yellow (2.5Y 6/6) sandy loam; weak to moderate, fine subangular blocky structure; friable. End.

DESIGNATION: SP 3
LANDSCAPE POSITION: upland till plain (rise)
PARENT MATERIAL: glacial till
SLOPE: 2–5%
VEGETATION: agricultural field, 70–80% GSV
METHOD: hand core
DATE DESCRIBED: 06/21/2023
DESCRIBED BY: K. Johansen

Depth (cm)	Soil Horizon	Description
0–21	Ap1	Very dark brown (10YR 2/2) sandy loam; weak, fine subangular blocky structure; friable; abrupt boundary.
21–47	Ap2	Very dark grayish brown (10YR 3/2) sandy loam; weak, fine subangular blocky structure; friable; common, fine, distinct yellowish brown (10YR 5/4) mottles; clear to abrupt boundary.
47–80	Bw	Brown (10YR 5/3) to pale brown (10YR 6/3) silty clay loam; weak, fine subangular blocky structure; common, fine, distinct yellowish red (5YR 5/8) redoximorphic features. End.

Archeological Survey

Based on the results of the geomorphological investigation, the project area was determined to be comprised of disturbed Dows Formation upland landforms. The upland landforms featured surficial soils disturbed by plowing, and archeological materials, if present, should have been readily identifiable on the surface. When paired with sufficient GSV (70–80%; Figure 18) due to cultivation, it was determined that the majority of the project area would be subject to pedestrian survey as a site discovery method. The pedestrian survey was conducted at 5 m (16.4 ft) intervals. No cultural materials were observed during the pedestrian survey. Given the inadequate GSV (<10%) in the southern portion of the project area, eleven shovel tests were excavated across this grass-covered stretch along a single transect at 15 m (49.2 ft) intervals (Figure 17). Subsurface shovel test openings measured 35 cm in diameter and were excavated to depths that extended well into the subsoil. The excavated matrix was removed in 10 cm vertical levels and screened through ¼" hardware mesh before being backfilled. No cultural materials were identified as a result of the shovel testing.

SUMMARY AND RECOMMENDATIONS

This Phase I cultural resources survey was conducted for Kruse, Cate & Nelson, P.C. by BCA for a proposed landfill expansion project. Located south of Graettinger, Iowa, the 11.1 ha (27.4 ac) project area occupies a portion of the NW¼, Section 21, T97N, R33W, Walnut Township, Palo Alto County, Iowa. The fieldwork for this investigation was conducted in June of 2023.

Based on the soil survey and topographic maps, the project area sits on glacially derived upland landforms. At the time of the survey, the project area was mostly within an agricultural field offering 70–80% GSV between rows. A small remaining southern portion was in grass (<10% GSV). Prefield archival research indicated no previously recorded archeological sites, previously conducted cultural resource surveys, or inventoried properties within the project area. An archival review of historic maps and aerial photographs indicated no historic-age buildings or structures within the project area. The project area has been continuously under cultivation since the early 20th century.

The field investigation consisted of a geomorphological evaluation of the project area and subsequent archeological survey based on the results of the geomorphological investigation. The geomorphological investigation involved the extraction of four hand cores, three of which were recorded as formal profiles. The soil cores indicated the project area is comprised of disturbed Dows Formation upland landforms with low potential for intact archeological deposits. The agricultural field portion of the project area was subsequently pedestrian surveyed at 5 m (16.4 ft) intervals. No cultural materials were observed during the pedestrian survey. Shovel tests (n = 11) were utilized as a site discovery method where visibility was poor at the southern end of the project area. No cultural materials were encountered in the shovel tests. Based on the negative results of the pedestrian survey and shovel tests, BCA recommends no further cultural resources investigations for the project area.

No archeological investigation method can guarantee discovery of all sites or cultural resource materials. If any cultural resource materials, not found in the investigation, are encountered during implementation of the proposed construction project, the State Historic Preservation Office should be contacted immediately. It is the responsibility of the developer to protect cultural resources from disturbance until a professional examination can be made or until clearance to proceed is authorized by the State Historic Preservation Office or a designated representative.

Information contained in this report relating to the nature and location of archeological sites is considered private and confidential and not for public disclosure in accordance with Section 304 of the National Historic Preservation Act (54 U.S.C. § 307103); 36 CFR Part 800.6(a)(5) of the Advisory Council on Historic Preservation's rules implementing Sections 106 and 110 of the National Historic Preservation Act; Section 9(a) of the Archaeological Resource Protection Act (54 U.S.C. § 100707), and Chapter 22.7, subsection 20 of the Iowa Code.

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FIGURES

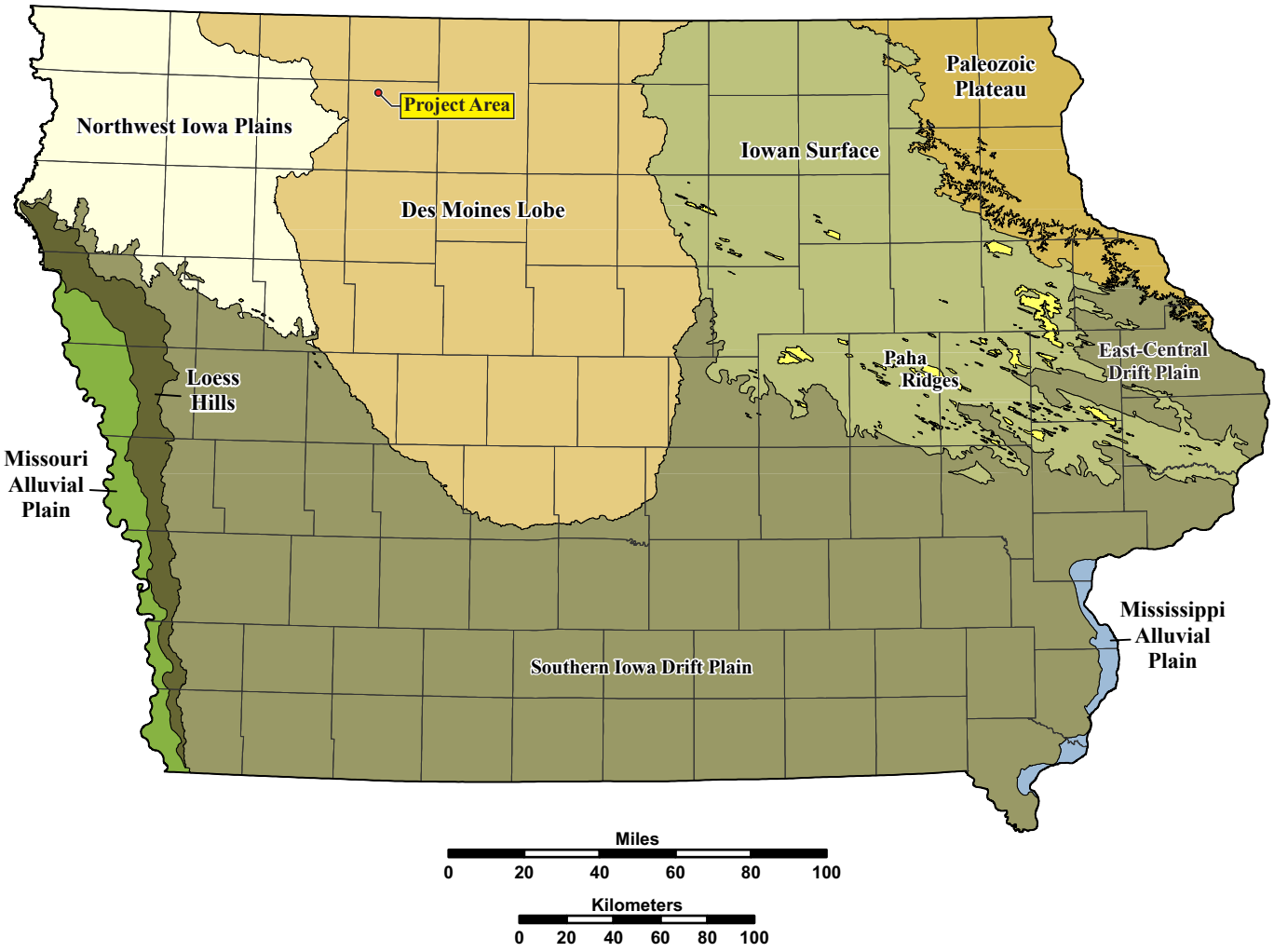

Figure 1. Physiographic location of the project area (adapted from Prior [1991:31]).

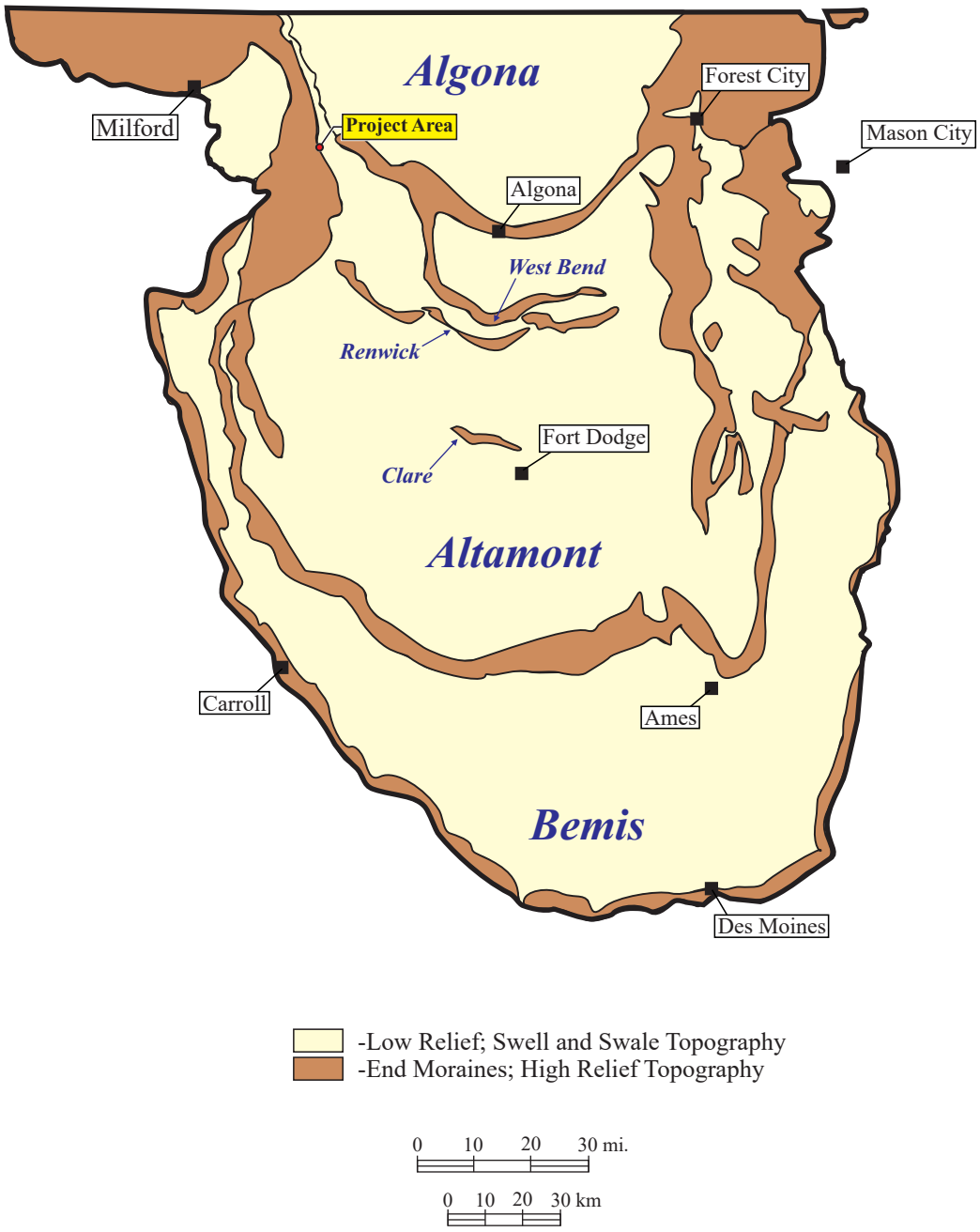

Figure 2. Location of the project area in the Des Moines Lobe (adapted from Prior [1991:35]).

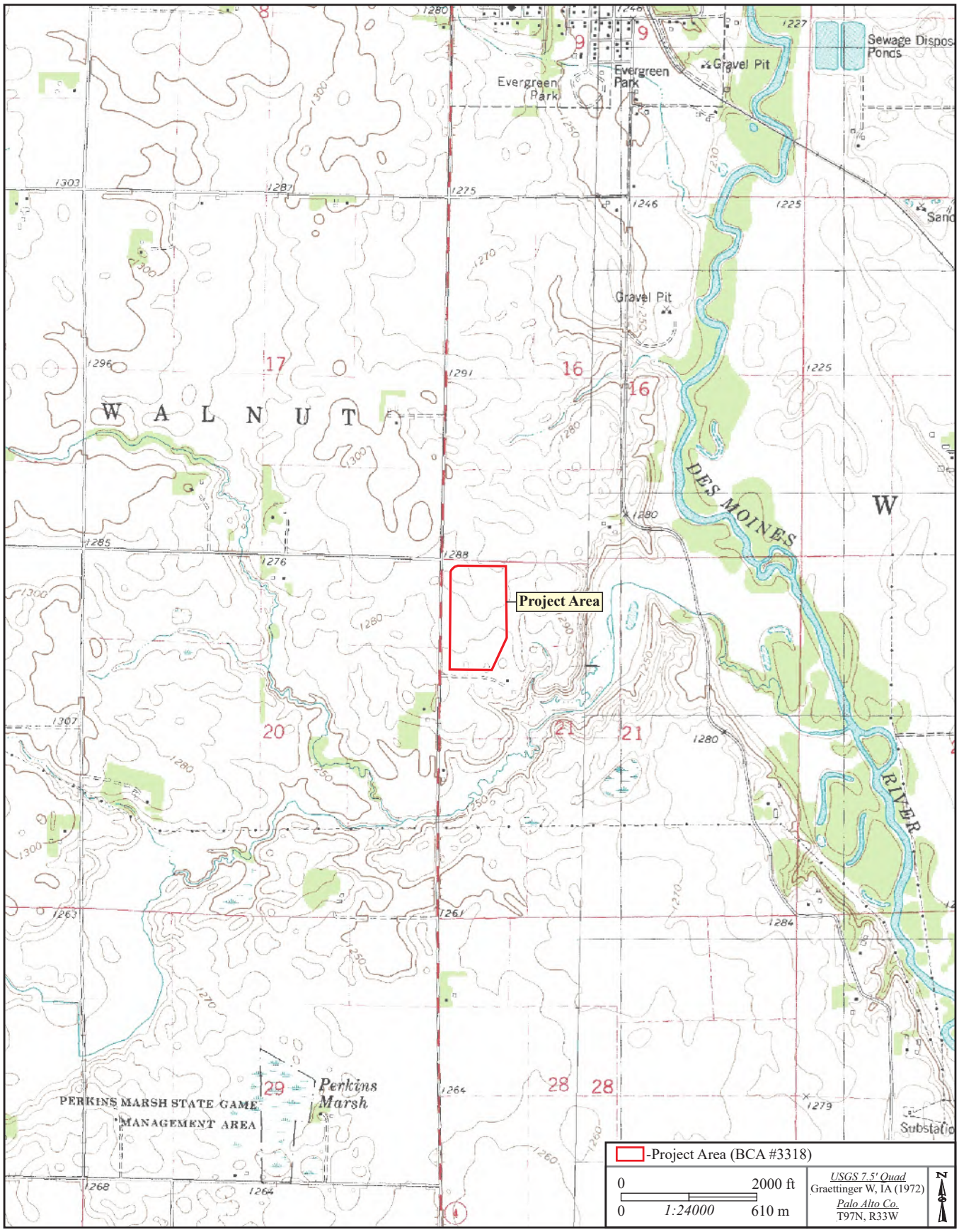

Figure 3. Topographic coverage of the project area.

Figure 4. Scale map of the project area.

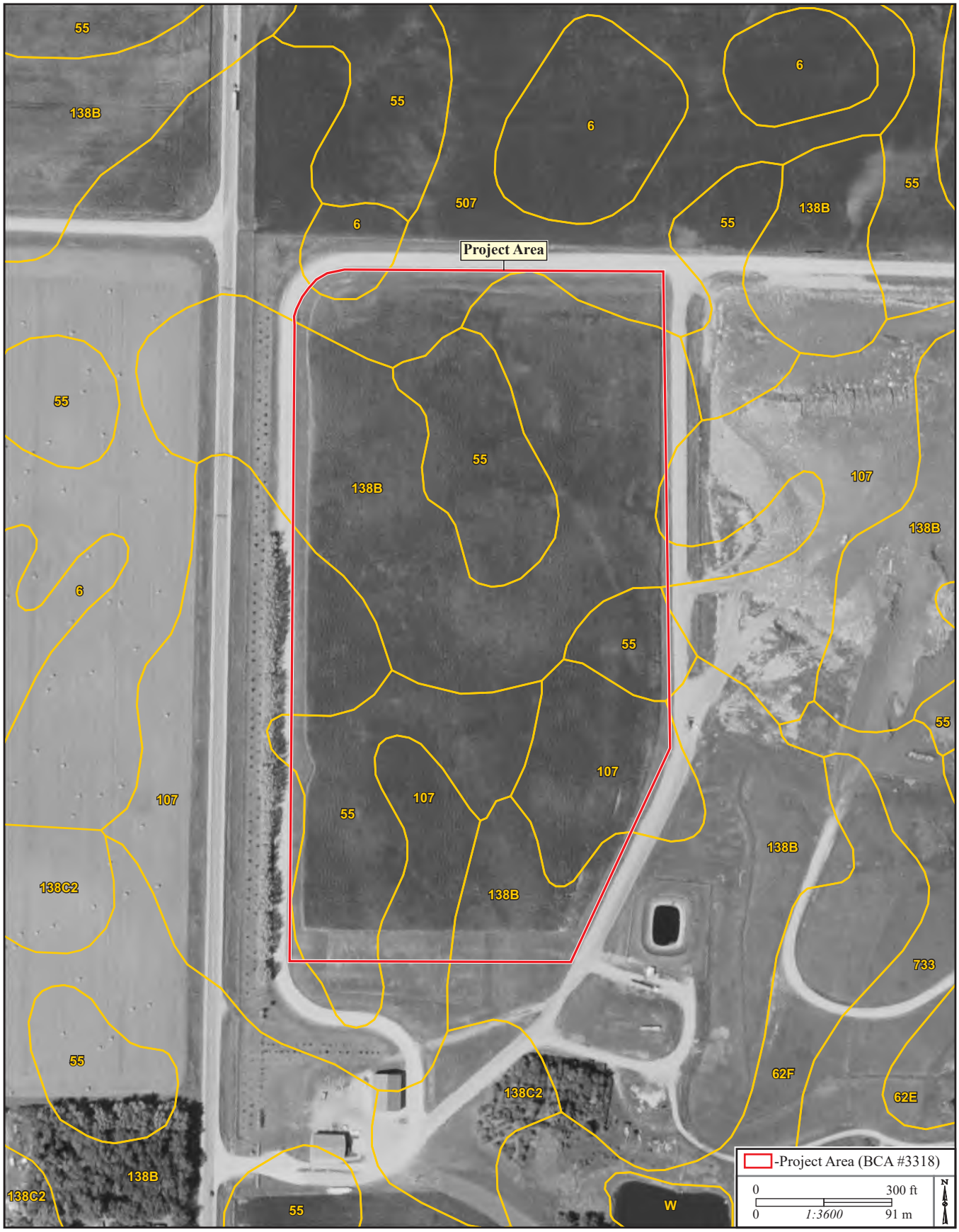

Figure 5. Soil map of the project area (Soil Survey Staff 2021).

Figure 6. Lidar image of the project area.

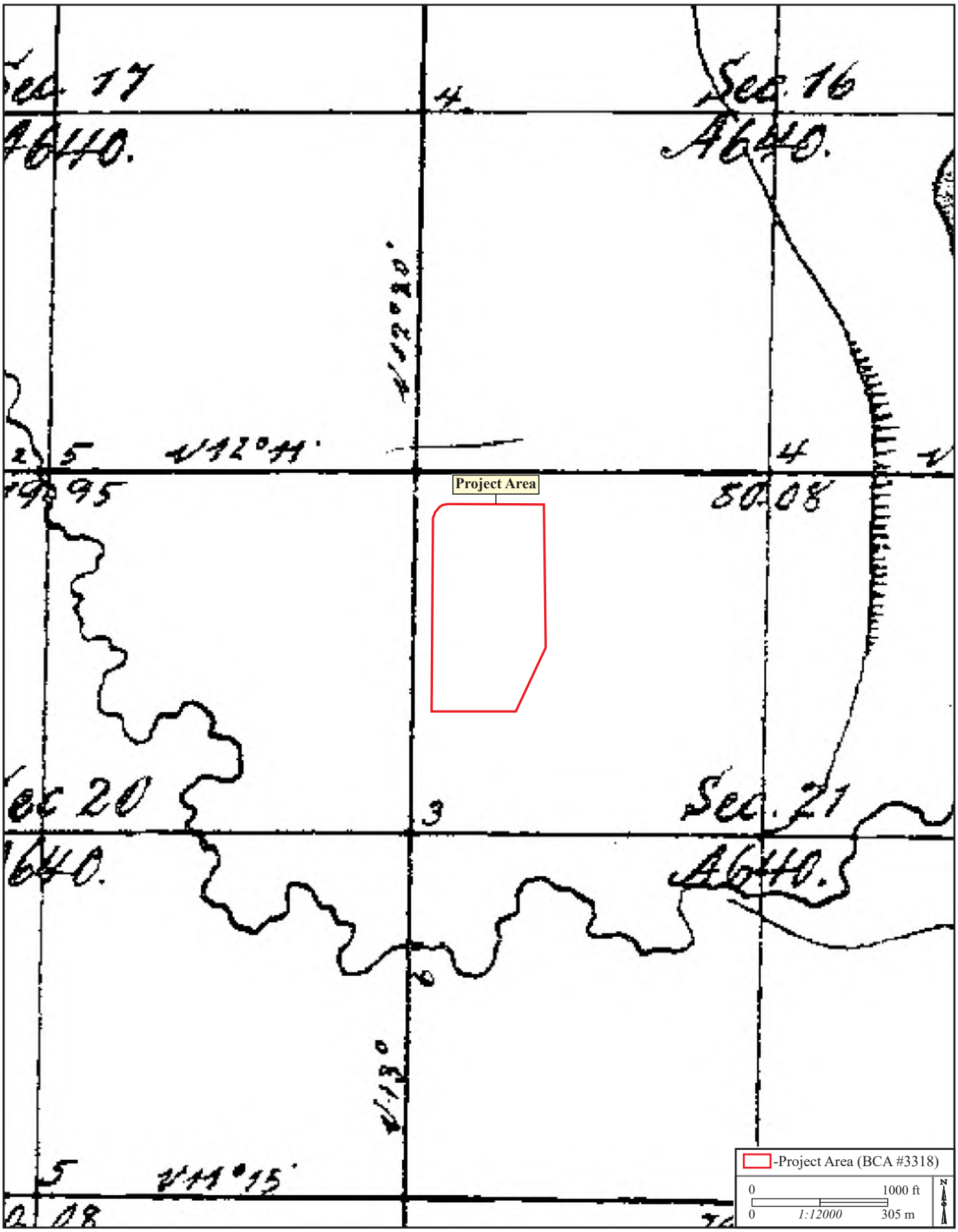

Figure 7. 1855 map of the project area (GLO).

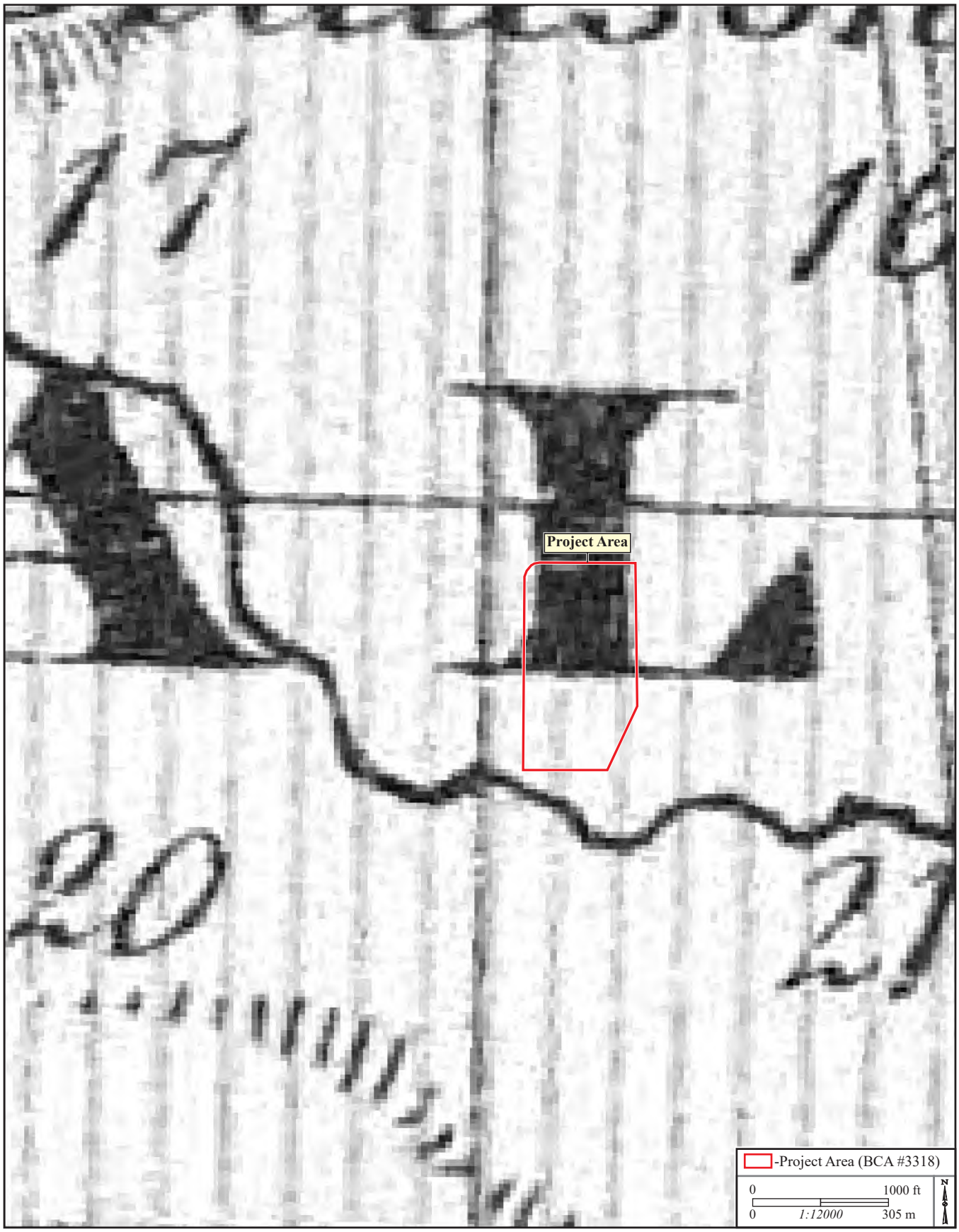

Figure 8. 1875 map of the project area (Andreas).

Figure 9. 1908 map of the project area (Ogle).

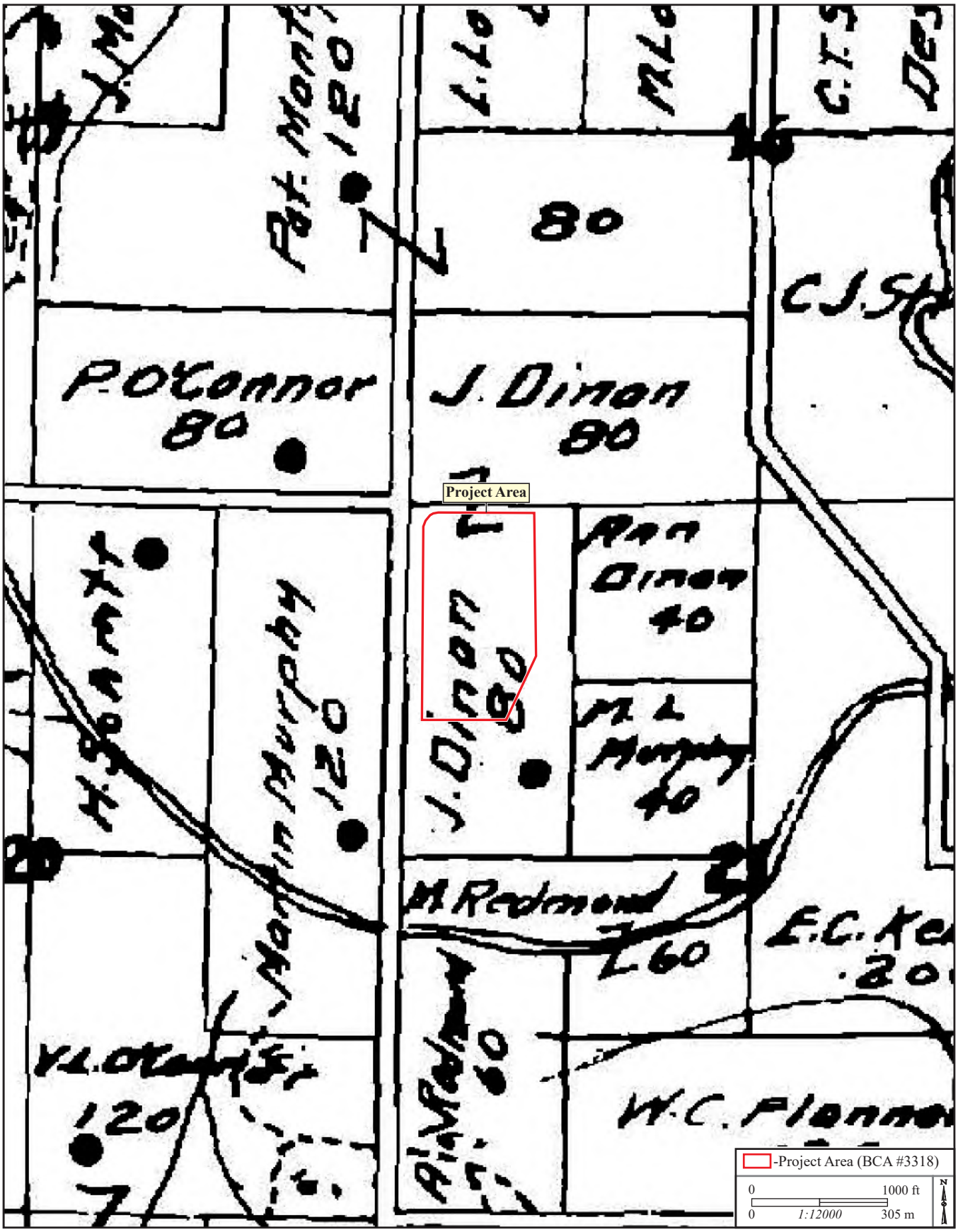

Figure 10. 1919 map of the project area (Fuller).

Figure 11. 1939 aerial photograph of the project area.

Figure 12. 2006 aerial photograph of the project area.

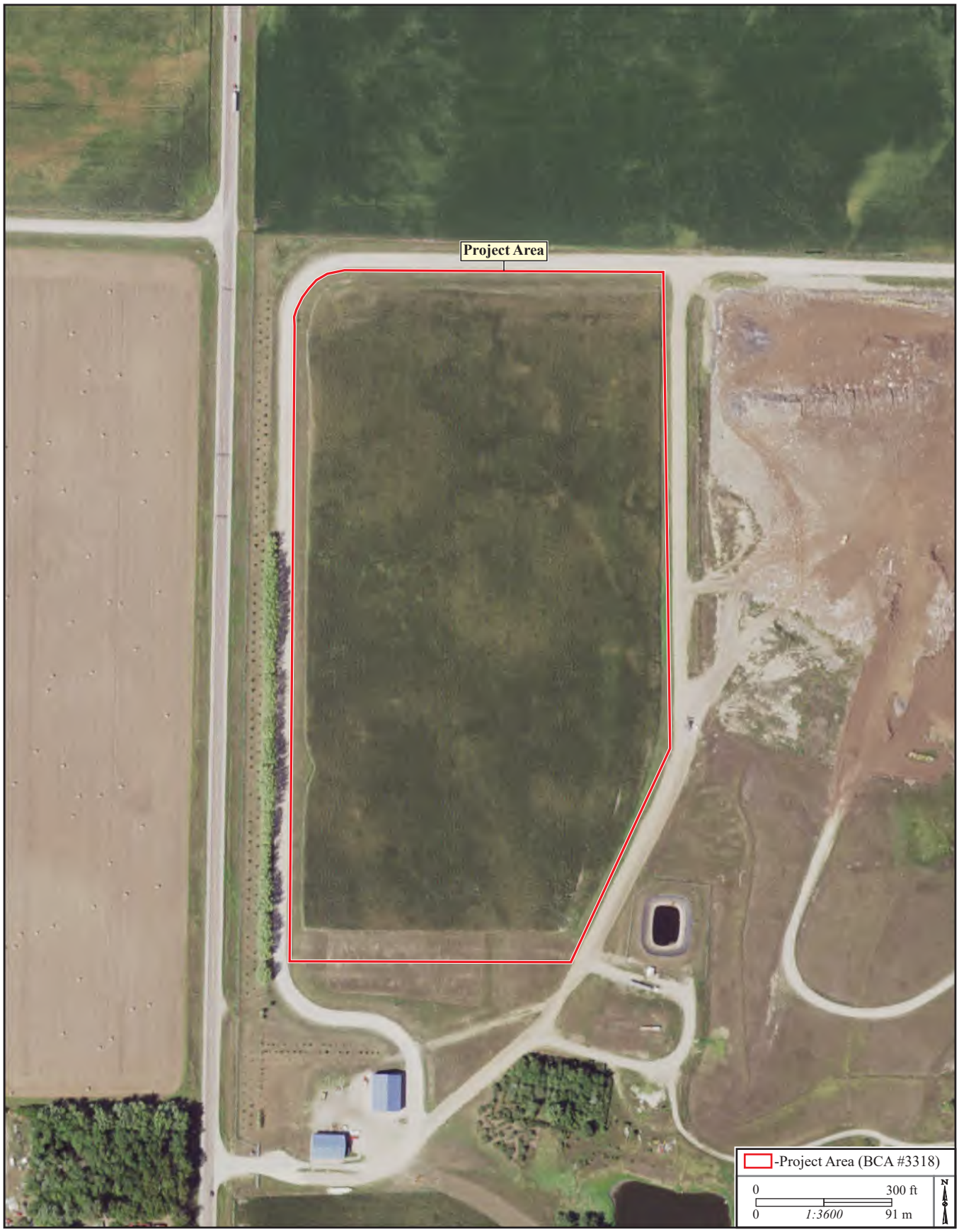

Figure 13. 2021 aerial photograph of the project area.

Figure 14. Overview of the northern half of the project area from the central rise. View to the north (6/20/23).

Figure 15. Overview of the southern half of the project area from the central rise. View to the south (6/20/23).

Figure 16. Northern boundary of the project area. View to the north (6/20/23).

Figure 17. Shovel testing along the southern boundary of the project area. View to the west (6/20/23).

Figure 18. Typical ground surface visibility (70-80%) within the agricultural field (6/20/23).

APPENDIX A
National Archaeological Database Form

Database Doc Number:

NATIONAL ARCHAEOLOGICAL DATABASE – REPORTS; DATA ENTRY FORM

1. R and C #:
2. Authors: Madden, Haley N.

Year of Publication 2023

3. Title Phase I Cultural Resources Investigation for a Landfill Expansion Project in Walnut Township, Palo Alto County, Iowa

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4. Report Title: BCA Reports

Volume #: Report #: 3318 NTIS:
Publisher: Bear Creek Archeology, Inc.
Place: Cresco, Iowa 52136

---

5. Unpublished

Sent From:
Sent To:
Contract #:

---

6. Federal Agency:

---

7. State: Iowa
County: Palo Alto
Town:

---

8. Work Type: 31

9. Keyword:

0 - Types of Resources / Features		1 - Generic terms / Research Questions	
No Resources	[0]		[ ]
Des Moines Lobe	[4]		[ ]
Uplands	[4]		[ ]
Des Moines River	[4]		[ ]
11.1 ha (27.4 ac)	[7]		[ ]
	[ ]		[ ]
	[ ]		[ ]

2 - Taxonomic Names	3 - Artifact Types / Material Classes
4 - Geographic Names / Locations	5 - Time Periods
6 - Project Names / Study Unit	7 - Other Key Words

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10. UTM Zone:

15	Easting:		Northing:	
15	Easting:		Northing:	
15	Easting:		Northing:	
15	Easting:		Northing:	

---

11. Township: 97N
Range: 33W

Other Publication Types:

12. Monographs:
    Name: _____
    Place: _____

---

13. Chapter: In: _____ First: _____ Last: _____

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14. Journal: Volume: _____ Issue: _____ First: _____ Last: _____

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15. Dissertation:
    Degree: Ph.D. LL.D. M.A. M.S. B.A. B.S. Institute _____

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16. Paper: Meeting: _____
    Place: _____ Date: _____

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17. Other:
    Reference Line: _____

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18. Site #: _____ _____ _____ _____ _____ _____

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19. Quad Map: Name Graettinger West, Iowa Date 1972