City Water, Light & Power
FGDS Development Landfill Unit 2
Springfield, Sangamon County, Illinois

Final Closure Plan for FGDS Development Landfill Unit 2

September 2024 – Revised July 2025

Submitted to:
United States Environmental Protection Agency

Prepared for:
City Water, Light & Power
3100 Stevenson Drive
Springfield, Illinois 62703

ANDREWS ENGINEERING

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ILLINOIS | MISSOURI | INDIANA

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ATTACHMENTS

Attachment A:	Construction Quality Assurance Plan
Attachment B:	Phase 1 – Cell 33; Construction Report for the City Water, Light & Power FGDS Landfill
Attachment C:	Construction Quality Assurance Program (Application Log No. 1995-469)
Attachment D:	Test Liner Report (Application Log No. 1995-469)
Attachment E:	Leachate Drainage and Collection System Chemical Compatibility Documentation (Application Log No. 1995-469)
Attachment F:	Leachate Management Plan (Application Log No. 1995-469)
Attachment G:	Final Cover Stability Analysis
Attachment H:	Run-On Run-Off Analysis

1. INTRODUCTION

City Water, Light and Power (CWLP) owns and operates the Flue Gas Desulfurization System (FGDS) Development Landfill Unit 2. The plans and specifications for the installation of the final cover system are contained in this closure plan along with the Construction Quality Assurance Plan provided in Attachment A. This Final Closure Plan has been prepared pursuant to 40 CFR 257.102.

This Final Closure Plan has been revised pursuant to Attachment 4 of the January 14, 2025 Consent Agreement and Final Order (CAFO), RCRA-05-2025-0015, and additional comments (Attachment A) provided in the US EPAs April 10, 2025 letter.

2. FACILITY DESCRIPTION

The CWLP FGDS Development Landfill Unit 2 is located north and east of the former Lakeside Power Generating Station and Dallman Power Generating Station in the Eastern ½ of Section 12, Township 15 North, Range 5 West, in Springfield, Illinois (see Drawing B1-1). The former Lakeside Power Generating Station and Dallman Power Generating Station are situated on the northwestern bank of Lake Springfield in Springfield, Illinois.

CWLP has owned and operated the FGDS Development Landfill since 1988. Prior to 1988, the facility was owned and operated by the private corporation Environmental Site Developers, Inc. The original design for Landfill Unit 2 designated three disposal areas identified as Cells 1, 2, and 3. In September 1993, the Illinois Environmental Protection Agency (“IEPA”) approved an application seeking the separation of the active Cell 1 from the then-undeveloped Cells 2 and 3. This created Landfill Unit 1, which consists solely of the now-closed Cell 1, and Landfill Unit 2, which is comprised of Cells 2 and 3.

CWLP initiated development of Landfill Unit 2 in 1993, and IEPA issued a permit to operate Landfill Unit 2 under 35 Ill. Admin. Code Parts 811–814 on November 9, 1995. Landfill Unit 2 consists of approximately 22.3-acres of permitted disposal area separated into Cells 2 and 3. Cell 2 has not been developed and only approximately 3.0 acres of Cell 3 has been developed. The IEPA operating permit authorizes Landfill Unit 2 to receive flue gas desulfurization (“FGD”) sludge (more commonly known as gypsum), bottom ash, fly ash, lime sludge from the Water Purification Plant, FGD wastewater treatment plant sludge, and Generating Facility wastewater treatment plant sludge.

Unit 2, Cell 3 was constructed in accordance with the approved permit application (Log No. 1995-469).

The construction of the liner and supporting appurtenances, including installation of the leachate collection system, were documented in the September 1993 Phase 1 – Cell 3 Construction Report for the City Water, Light & Power FGDS Landfill. This document is provided in Attachment B. The existing liner system was installed in accordance with the Construction Quality Assurance Program contained in Attachment 22 of application Log No. 1995-469 and is herein provided in Attachment C. Evaluation of the actual constructed liner was conducted by the use of a sealed double-ring infiltrometer. The Test Liner Report was included as Attachment 21 in application Log No. 1995-469 and is provided as Attachment D to this document. The documentation explicitly shows the bottom liner permeability is approximately three orders of magnitude lower than $1x10^{-5}$ cm/sec.

As stated above, details of the installation of the leachate collection system are contained in the September 1993 Phase 1 – Cell 3 Construction Report (Attachment B). As part of application Log No. 1995-469, additional information was provided which included the Leachate Drainage and Collection System Chemical Compatibility Documentation and a Leachate Management Plan. These documents were contained in Attachments 14 and 16, respectively in application Log No. 1995-469 and are provided in this as Attachments E and F, respectively.

The site hydrogeologic conditions in conjunction with the design specifications and liner/leachate collection system construction documentation were evaluated pursuant to 35 Illinois Administrative Code Section 811.317 (Groundwater Impact Assessment). The evaluation included contaminant transport modeling of actual leachate concentrations within the site-specific hydrogeologic framework. The results showed there was no degradation of the groundwater quality above background concentrations at 100 feet from the waste unit for a minimum 100 years after closure of the unit. The Groundwater Impact Assessment was contained in application Log No. 1995-469.

Pursuant to the requirements of 40 CFR § 257.102(d)(1), this Plan demonstrates that the closure of the coal combustion residuals (CCR) unit with CCR left in place will be conducted in a manner that meets the general performance standards.

The closure system incorporates a final cover that meets the requirements of 40 CFR § 257.102(d)(3), which includes an engineered, low-permeability barrier layer designed to significantly reduce infiltration into the CCR. The final cover will consist of (at a minimum):

- A low hydraulic conductivity layer no greater than $1x10^{-5}$ cm/sec,
- A geomembrane barrier layer (e.g., 40-mil LLDPE or equivalent),
- An infiltration layer (minimum 18 inches), and
- A protective soil and/or vegetative layer to control erosion and promote runoff.

The infiltration layer will actually be a minimum 30 inches for the infiltration (protective) layer as required by the Illinois EPA. The design of this system reduces percolation of precipitation into the underlying CCR by draining the seepage with composite drainage layer, thereby minimizing the generation of leachate and the potential migration of contaminants to groundwater or surface water. The final cover system will also be graded to promote surface water runoff, further reducing infiltration potential.

Run-off from the closed unit will be managed by an engineered stormwater control system that directs precipitation away from the unit and into properly designed drainage structures. These controls are designed to minimize the contact of clean stormwater with the closed CCR surface, preventing the formation of contaminated runoff.

Additionally, fugitive dust emissions will be controlled through the use of vegetative or other protective covers, compliance with dust control measures during construction, and long-term stabilization of exposed areas.

Closure will be conducted such that the final topography of the CCR unit is graded and compacted to shed surface water effectively, thereby precluding the potential for future ponding or impoundment of water, sediment, or slurry (see Drawings B1-00 through B1-08). The final surface will maintain positive drainage, with side slopes and contours designed to prevent depressions and promote lateral runoff to designated discharge locations.

No hydraulic or operational features will remain after closure that could result in the collection or impoundment of liquids. Structural modifications to the unit, such as breaching of existing containment berms or grading of impoundment basins, will be completed to eliminate conditions favorable to impoundment.

The final cover system is designed with robust, passive controls to minimize future maintenance. The use of durable, low-permeability materials in the barrier layer, combined with protective and vegetative cover systems, provides long-term resistance to weathering, erosion, and physical degradation.

Stormwater management features are designed for long-term function with minimal maintenance, and inspection procedures will ensure that any required maintenance can be identified and addressed proactively. Stabilized slopes, erosion-resistant channels, and low-maintenance vegetation further minimize the potential for future repairs or interventions.

By incorporating proven engineering design and long-term stability measures, the closure approach ensures that the CCR unit will remain in a stable, protective condition with minimal long-term management needs.

3. FINAL CLOSURE PLAN

The closure for the FGDS Development Landfill Unit 2 will be accomplished by leaving the waste in place and encapsulating the material with a final cover system. The closure plan contains the following elements:

- Final grading and placement of structural fill, if necessary
- Stormwater Management
- Installation and placement of the final cover system

Details of these items are discussed in the following sections. This plan may be revised at any time as allowed under 40 CFR 257.102(b)(3). Amendments to this plan will be required if and when any significant changes occur to the operation of the Landfill Unit 2 that would substantially affect this plan, or unanticipated events necessitate a revision of this plan. This plan must be amended at least 60 days prior to a planned change in operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise this closure plan. Should the written closure plan be revised after closure activities have commenced, this plan will be amended within 30 days of the triggering event.

Design and construction details (Drawings Sheets B1-00 through B1-08) are provided with this plan. CWLP received approval of the FGDS Landfill Final Closure Plan under Illinois EPA authority with the approval of December 29, 1995 permit application (Log No. 1995-496). In addition, a Final Closure Plan and Post-Closure Care Plan for FGDS Development Landfill Unit 2 were prepared and submitted to the USEPA in September 2024. This document hereby revises that plan.

Closure of the FGDS (Flue Gas Desulfurization Sludge) Landfill, with CCR left in place, will be conducted in accordance with the requirements of 40 CFR § 257.102(d)(1) (General Performance Standard) and § 257.102(d)(2) (Drainage and Stabilization). Closure of the landfill will incorporate best engineering practices to ensure long-term protection of human health and the environment.

The FGDS Landfill final cover system is designed to reduce infiltration to the maximum extent feasible, thereby minimizing the potential for leachate generation and release of CCR constituents to the environment. The cover system will comply with the design criteria under 40 CFR § 257.102(d)(3) and includes:

- A low-permeability infiltration barrier;
- A 40-mil texture LLDPE geomembrane
- A 200-mil geocomposite drainage layer
- A protective soil layer is composed of the following:
    - Structure fill (minimum 2.5 feet) to protect the barrier and support vegetation;

- An erosion-resistant vegetative or alternate surface (6 inches) to minimize runoff impacts and promote surface stability.

This engineered cover will sharply reduce vertical infiltration, effectively isolating the underlying CCR and controlling potential migration of contaminants. Surface drainage features will be incorporated to channel precipitation away from the closed unit, preventing contact with the CCR and eliminating the potential for contaminated runoff or atmospheric releases (e.g., fugitive dust).

The closure grading plan for the FGDS Landfill ensures that the final contours promote positive drainage and eliminate any potential for future impoundment of water, sediment, or slurry. Side slopes and surface grades are designed to exceed minimum runoff gradients (e.g., ≥2% on the cover surface) and prevent the formation of ponded areas. Runoff from the closed unit will be managed by an engineered stormwater control system that directs precipitation away from the unit and into properly designed drainage structures. These controls are designed to minimize the contact of clean stormwater with the closed CCR surface, preventing the formation of contaminated runoff. Any internal drainage features, low-lying depressions, or containment berms that may contribute to pooling will be removed or regraded as part of the final grading and stabilization activities.

Additionally, fugitive dust emissions will be controlled through the use of vegetative or other protective covers, compliance with dust control measures during construction, and long-term stabilization of exposed areas.

Closure will be conducted such that the final topography of the CCR unit is graded and compacted to shed surface water effectively, thereby precluding the potential for future ponding or impoundment of water, sediment, or slurry. The final surface will maintain positive drainage, with side slopes and contours designed to prevent depressions and promote lateral runoff to designated discharge locations.

No hydraulic or operational features will remain after closure that could result in the collection or impoundment of liquids. Structural modifications to the unit, such as breaching of existing containment berms or grading of impoundment basins, will be completed to eliminate conditions favorable to impoundment.

The final cover system is designed with robust, passive controls. The use of durable, low-permeability materials in the barrier layer, combined with protective and vegetative cover systems, provides long-term resistance to weathering, erosion, and physical degradation. Long-term performance is achieved through:

- Stable vegetative cover to control erosion and evapotranspiration;
- Engineered slope stabilization to resist movement and erosion;

- Use of durable geomembranes or compacted clay with proven longevity.

Stormwater management features are designed for long-term function with minimal maintenance, and inspection procedures will ensure that any required maintenance can be identified and addressed proactively. Stabilized slopes, erosion-resistant channels, and low-maintenance vegetation further minimize the potential for future repairs or interventions.

By incorporating proven engineering design and long-term stability measures, the closure approach ensures that the CCR unit will remain in a stable, protective condition with minimal long-term management needs.

As required by 40 CFR § 257.102(d)(2), prior to installation of the final cover system, the FGDS Landfill will undergo evaluation and, as needed, pre-closure dewatering and stabilization measures to ensure that free liquids are eliminated. Any areas containing accumulated liquid wastes will be drained, and the liquid removed via decanting, pumping, or dewatering processes. Where necessary, solidification agents may be used to stabilize residual wet CCR to achieve a non-flowable condition, ensuring that the waste mass no longer contains free liquids as defined in 40 CFR § 257.53.

Documented inspections and laboratory testing (such as paint filter liquid tests) will confirm the absence of free liquids prior to cover system installation, in accordance with regulatory requirements and facility-specific closure plans.

Remaining CCR materials within the FGDS Landfill will be stabilized to a degree sufficient to support the final cover system. This will be accomplished through a combination of:

- Controlled compaction of CCR materials to achieve structural stability;
- Moisture content management to enhance bearing capacity;
- Placement of additional stabilizing materials, if necessary, in localized areas with lower shear strength;
- Engineering evaluation of slope stability and settlement potential to verify that the underlying waste will remain stable under the anticipated load of the final cover.

The stabilization process will be verified through geotechnical testing and field evaluations, ensuring that the foundation will support the design loads imposed by the cover system and maintain long-term integrity.

Attachment G of this closure plan includes a final cover stability analysis. All static and seismic slope stability analyses for the final cover system meet or exceed the minimum regulatory factor

of safety requirements established by 40 CFR 257.73. Detailed stability computations and cross-section profiles are included in Appendices A and B of Attachment G of this plan.

3.1 Final Grading Design

Grading design plans have been developed and are provided in the Drawings attachment. The grading design may be amended during the final engineering design to accommodate the final quantity of material stored in Landfill Unit 2. Final top slopes will include a minimum slope of three to five percent to promote surface drainage. Structural fill may be added above the in-place material to provide sufficient slope for the final cover system. Structural fill may consist of earthen materials (clay) that would be compacted and graded to meet the final grading design. A final grading design will be implemented that accommodates the anticipated amount of settling and/or subsidence of the in-place materials, as well as any structural fill placed in Landfill Unit 2.

3.2 Leachate Management

Phase I of Cell 3 was constructed with a liner and leachate collection system in accordance with 35 Ill. Admin. Code Parts 811 through 814. The liner system is comprised of a 5-foot thick compacted earthen/clay liner with hydraulic conductivities at or below $1.0x10^{-7}$ cm/sec when compacted to 95% standard proctor density. A leachate drainage system consisting of a 12-inch-thick sand layer covered by geotextile fabric overlies the compacted clay/earthen liner. A leachate collection system, consisting of six-inch diameter perforated PVC pipes wrapped in geotextile fabric, was installed atop the leachate drainage system. Leachate from Landfill Unit 2 is collected on a sump located on the east side of Phase I of Cell 3. From the sump, leachate is conveyed via a force main to the Clarification Pond for additional polishing before eventual discharge to Sugar Creek in accordance with NPDES permit conditions.

The leachate drainage and collection system are passive systems installed in the floor of Landfill Unit 2. These passive systems require no maintenance during operation, closure or post closure. The leachate pumping system is an active system consisting of an electric pump in the leachate collection manhole designated L303. This active system will require regular inspection to ensure proper function during closure and post-closure.

3.3 Stormwater Management

Post-closure infiltration of liquids into Landfill Unit 2 will be minimized by directing stormwater through a system of drainage ditches. Drainage ditches will be built between the inner slope of the outer berms of Landfill Unit 2 and the outer slope of the final cover. Stormwater will exit the ditches through letdowns built into the outer berms and discharge into the undeveloped area of Landfill Unit 2 where stormwater is currently collected in evaporation ponds. The ponds can be pumped to the adjacent Clarification Pond for eventual discharge to Sugar Creek in accordance

with NPDES permit conditions. Any stormwater which occurs in active construction areas within the waste boundary will be handled by the existing leachate collection system.

Attachment H of this closure plan includes run-on run-off analysis for the stormwater runoff control plan. The stormwater control system for the Unit 2 Landfill is designed to manage peak flow associated with the 1,000-year, 24-hour storm event. The landfill features a 4:1 final cover slope and is equipped with terrace berms and a letdown structure engineered to control surface water runoff.

Based on this analysis, all conveyance structures have sufficient capacity to manage the peak flows generated under both initial and vegetated cover conditions.

3.4 Final Cover Placement

To meet the performance standards of 40 CFR 257.102(d)(3), the final grades of in-place material and structural fill, if used, will be covered by a 40-mil textured LLDPE geosynthetic membrane layer, which will be topped with a geocomposite drainage layer. In terms of hydraulic flux, the compacted final grades of in-place material and structural fill overlain by the geosynthetic membrane will be equivalent or superior to a three-foot layer of soil with a hydraulic conductivity of 1×10^{-7} cm/sec and withstand the normal stresses imposed by the waste stabilization process. Roots, cobbles, debris, organic, and other deleterious material that may cause damage to the geosynthetic membrane will be removed from the in-place waste and/or soil material prior to placement of the geosynthetic membrane layer. The geosynthetic membrane will be installed in accordance with the Construction Quality Assurance Plan.

A 36-inch soil protective layer (infiltration and erosion layers) containing a minimum of 2.5 feet of soil (structural fill) and 6 inches of (topsoil/erosion layer) capable of sustaining plant growth will overlie the low permeable layer. The soil used for the protective layer should not be compacted and should be the best onsite readily available soil for supporting vegetation. Shallow-rooted grasses and legumes should be used to establish a vegetative growth for erosion control. The mixture of grasses and legumes selected must be amenable to the soil quality and thickness, slopes, moisture, and climatological conditions that exist without the need for continued maintenance.

Lime, fertilizer, and any other appropriate soil amendments, may be incorporated into the topsoil/erosion layer at application rates determined from composite soil tests of the area to be seeded. Mulch consisting of straw, yard waste compost, jute, and/or wood excelsior may be used as necessary to hold the seed in place and conserve moisture. A professional knowledgeable in vegetation establishment will be consulted for determining the specific seed mixtures to be sown, suitable soil amendments, and application rates based upon specific seasonal conditions at the time of placement.

The finished surface of the final cover shall be surveyed on a spacing that shall not exceed 100 feet in any ordinate direction. Numerical testing tolerances shall be governed by standard significant digit and rounding as warranted. Acceptable standards for isolated non-conformances shall be the significant digit less 1/10 corrected for decimal place. However, at no time shall the allowable survey tolerances of the low permeability layer and final protective layers (final cover) be such that the final protective layer be less than three-feet thick. This survey and acceptance criteria shall apply to protective layers of the final cover system, with allowance for the minimum three-foot difference between their surfaces. Installation and testing of all final cover components will be performed in accordance with the Construction Quality Assurance Plan.

4. CCR INVENTORY ESTIMATES

Between 1991 and 1996, Illinois EPA granted determinations to CWLP for bottom ash, fly ash, gypsum, and lime sludge to be beneficially reused as coal combustion byproducts materials. As material has been reclaimed for beneficial reuse from Landfill Unit 2 since then, the maximum inventory of material ever on site for the active life of Landfill Unit 2 has not been determined.

Landfill Unit 2 was designed for an in-place net disposal capacity of 1,162,275 cubic yards, excluding any final cover system. However, only approximately 3-acres of Phase I of Cell 3 has been constructed. Currently, approximately 64,657 cubic yards of material is in-place leaving a remaining capacity for the 3-acre cell of approximately 31,626 cubic yards. The in-place volume varies as the material is transported offsite for beneficial use. The estimated maximum inventory of CCR ever on-site over the current active life of the unit is 75,000 cubic yards.

5. FINAL COVER AREA

The entire approximate 3-acre developed cell of Landfill Unit 2 will require closure with a final cover system when operations have ceased.

6. CLOSURE SCHEDULE

Closure of Landfill Unit 2 will commence within 30 days of the unit receiving the last known final receipt of waste or removed the final volume of waste for the purpose of beneficial use. If the final receipt of CCR or non-CCR wastes is not known, then the closure process must still commence if Landfill Unit 2 has not received wastes, or has not had waste material removed from it for a duration of two years, unless it can be demonstrated that the idle unit will resume receiving waste material or waste material shall be removed in the foreseeable future.

CWLP has an Illinois EPA approved closure and post-closure care plan for Landfill Unit 2. As such, no additional applications or permitting are required to initiate or complete closure under Illinois regulations.

The predominant materials placed in Landfill Unit 2 are gypsum, bottom ash and fly ash. These materials are dry in nature when placed in the landfill and area relatively stable and readily compacted. No additional time is anticipated to stabilize the material for final grading and compaction in support of the final cover system.

The nature of the materials do not generate excess leachate through decomposition. Existing leachate is typically generated by precipitation falling on the active area of the landfill. The existing leachate collection system produces less than 1,000 gallons per day and is anticipated to be sufficient for elimination of residual free liquids during the closure process.

The general sequence and timing of closure activities identified below will be applied to the closure of Landfill Unit 2:

Months 1 and 2 – Initiation of the closure process

- Final engineering design
- Remove existing vegetation on slopes as needed
- Initial grading and compaction of in-place materials

Months 3 and 4 – Continuation of the closure process

- Complete grading of in-place materials
- Add and grade structural fill, if necessary
- Begin construction of final cover system

Months 5 and 6 – Completion of closure process

- Complete construction of final cover system, as necessary
- Prepare Construction Acceptance Report
- Prepare Deed notations

CWLP may seek extension of closure timeframes as necessary pursuant to 40 CFR 257.102(f)(2).

7. REPORTS AND NOTICES

7.1 Construction Acceptance Report

In accordance with the prepared Construction Quality Assurance Plan, a Professional Engineer (Engineer) must certify that closure is in accordance with the closure plan. Therefore, the Engineer will be designated at the outset of the closure process so that all aspects of the closure can be overseen. The Engineer will need to spend sufficient time on site to ensure adequate cover quality and thickness as well as proper completion of the other tasks. Furthermore, the Engineer

7.2 Closure Notices

In accordance with 40 CFR 257.102(h) and 102(i) the following closure documentation will be completed and placed in CWLP's operating record and on the publicly accessible 40 CFR 257 CWLP website:

- Notification and Certification of Intent to Close a CCR unit per 40 CFR 257.102(g)
- Notification and Certification of Closure Completion of a CCR unit per 40 CFR 257.102(h)
- Deed notation per 40 CFR 257.102(i)(2)
- Notification stating the Deed notation has been recorded 40 CFR 257.102(i)(3)

7.3 Record Keeping/Internet Posting

Pursuant to 40 CFR 257.107(i)(7)-(9), in addition to being placed in the facility operating record, notices of Intent to Close, Completion of Closure and recording of deeds, shall be placed on the CWLP CCR website (https://www.cwlp.com/CCRCompliance.aspx).

8. STATEMENT

This Final Closure Plan for the FGDS Development Landfill Unit 2 was completed for CWLP by Andrews Engineering, Inc. in accordance with the requirements under 40 CFR 257.102. These requirements have been met.

Signature: Karl W. Finke

Illinois P.E. No: 062.068571

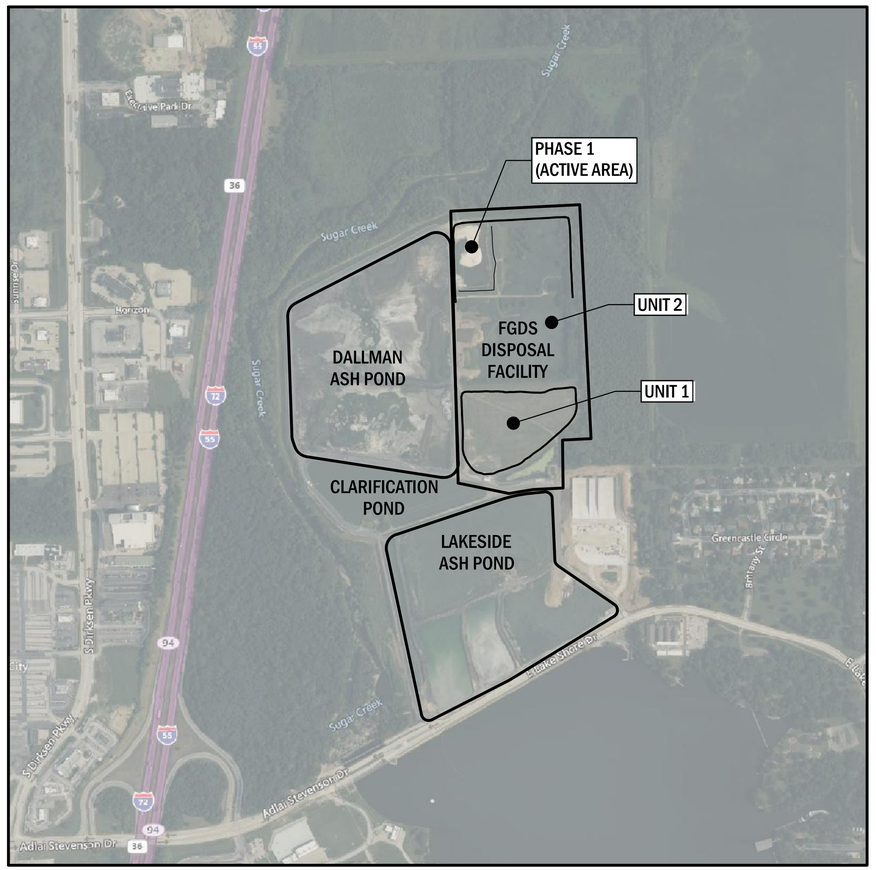
Date: 07/11/25

License Expiration: 11/30/25

DRAWINGS

CITY WATER, LIGHT, AND POWER
FGDS DISPOSAL FACILITY CLOSURE PLANS

SPRINGFIELD, SANGAMON COUNTY, ILLINOIS
JULY 2025



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VICINITY MAP

NOT TO SCALE

INDEX OF SHEETS

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B1-3	SITE PLAN MAP
B1-4	FINAL SITE CONDITIONS
B1-5	CROSS SECTION @ E 2,115
B1-6	CROSS SECTION @ N 5,500
B1-7	CROSS SECTION @ N 5,298
B1-8	DETAILS

PREPARED FOR:

CITY WATER, LIGHT, AND POWER
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PONTIAC, IL • LOMBARD, IL • INDIANAPOLIS, IN • WARRENTON, MO

I HEREBY AFFIRM THAT ALL INFORMATION CONTAINED ON THESE DRAWINGS ARE TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

Karl W. Finke 7/10/25

KARL W. FINKE, P.E. DATE
ILLINOIS LICENSE NO. 062.068571

SEAL: LICENSED PROFESSIONAL ENGINEER — KARL W. FINKE — 062.068571 — STATE OF ILLINOIS

EXPIRATION DATE: 11/30/2025

DATE: JULY 2025

PROJECT ID: 230339/0030

SHEET NUMBER: B1-0

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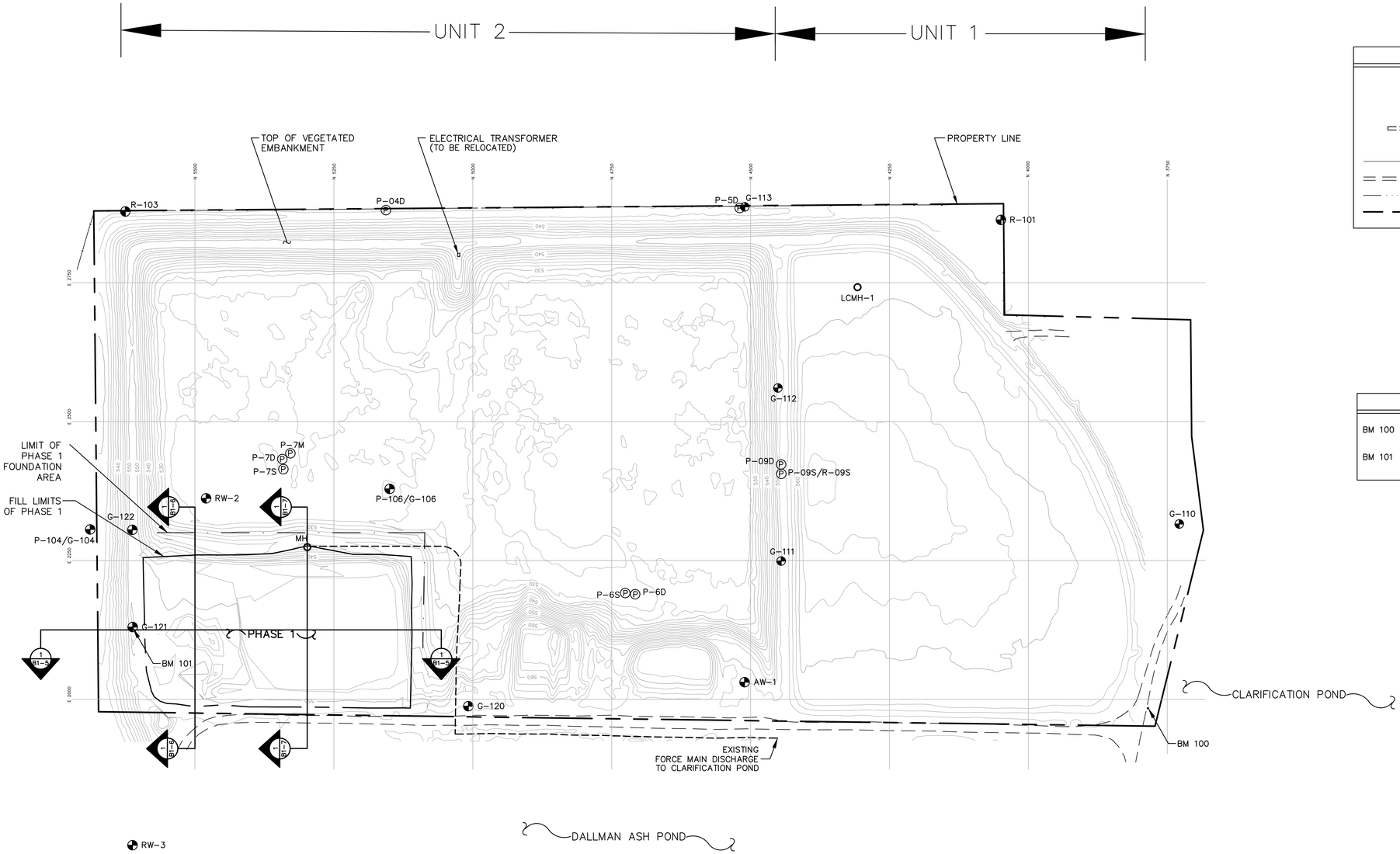
Tab: Layout1 Last Saved: July 10, 2025, by Mike Nguyen Plotted: Thursday, July 10, 2025 5:10:34 PM
C:\Civil 3D Projects\Springfield CWLP\DWG\B4\B1-00.dwg



LEGEND

BM-0	BENCHMARK (SEE DESCRIPTION THIS SHEET)
	GROUNDWATER MONITORING WELL (EXISTING)
P	PIEZOMETER
	CULVERT
	LEACHATE OR STORMWATER MANHOLE
×	FENCE
	ROADWAYS
	STREAM, DITCH OR WATERWAY
	PROPERTY BOUNDARY

BENCHMARK DESCRIPTIONS

BM 100	SET RAILROAD SPIKE IN CUT OFF POWER POLE: POWER PLANT COORDINATES N. 3785.14 E. 1984.37 – ELEVATION 554.731
BM 101	CUT CHISELED SQUARE IN CONCRETE 6 INCHES WEST OF MW G-121: POWER PLANT COORDINATES N. 5612.06 E. 2129.53 – ELEVATION 552.364

NOTES:

1. THE CONTOURS SHOWN FOR THE LANDFILL WERE GENERATED FROM LIDAR DATA PROVIDED BY HANSON PROFESSIONAL SERVICES, INC. DATED MAY 2023 MERGED WITH TOPOGRAPHIC SURVEY PERFORMED BY ANDREWS ENGINEERING, INC. DATED MARCH 11, 2024.
2. THE PROPERTY LINE LOCATION WAS SUPPLIED BY CWLP, BASED UPON SUBSEQUENT FIELD SURVEYING AND THE ORIGINAL LEGAL DESCRIPTION PREPARED BY MOSS, JOHNSON, SANDOVAL AND ASSOC. LTD.
3. FOR CLARITY NOT ALL SITE FEATURES ARE SHOWN.
4. MONITORING WELL(S) OR PIEZOMETER(S) PLUGGING SHALL BE IN ACCORDANCE WITH THE REGULATIONS, REQUIREMENTS AND/OR GUIDELINES OF THE IEPA AND/OR ILLINOIS DEPARTMENT OF PUBLIC HEALTH.
5. DURING THE OPERATION OF THE FACILITY, THE OPERATOR SHALL COMPLY WITH THE SAFETY STANDARDS PURSUANT TO THE FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970, INCLUDING ALL SUBSEQUENT AMENDMENTS.
6. ACCESS TO THE FACILITY WILL BE CONTROLLED BY THE EXISTING TOPOGRAPHY, LOCKABLE GATES AND FENCING, LOCATED ALONG EAST LAKE SHORE DRIVE, ADJACENT TO THE FACILITY.
7. UNIT 1 AND UNIT 2 WERE RECOGNIZED AS TWO INDEPENDENT WASTE DISPOSAL ENTITIES BY SUPPLEMENTAL PERMIT NO. 1993-486-SP DATED JANUARY 7, 1994.
8. WHERE NESTED PIEZOMETERS AND/OR BORINGS ARE LOCATED, THE SYMBOLS HAVE BEEN SEPARATED TO FACILITATE IDENTIFICATION. THEREFORE THE LOCATIONS ARE APPROXIMATE.
9. CWLP OWNS THE SURROUNDING PROPERTY AROUND THE LANDFILL EXCEPT TO THE EAST.
10. THE MIDDLE FORCE MAIN LOCATION IS APPROXIMATE.

N

0 100 200 400

SCALE: IN FEET

NO.	DATE	REVISION DESCRIPTION	BY
3	09/2024	REMOVED BORING LOCATIONS	MPN
2	09/2024	REVISED TITLEBLOCK, DATE, NOTES, AND CONTOURS	MPN
1	06/1995	REVISED DATE	VJM

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DESIGNED BY: DWM | DRAWN BY: MPN | APPROVED BY: KWF

EXISTING SITE CONDITIONS

PLANS PREPARED FOR
CITY WATER, LIGHT, AND POWER
FGDS DISPOSAL FACILITY
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JULY 2025

PROJECT ID: 230339/0030

SHEET NUMBER: B1-1

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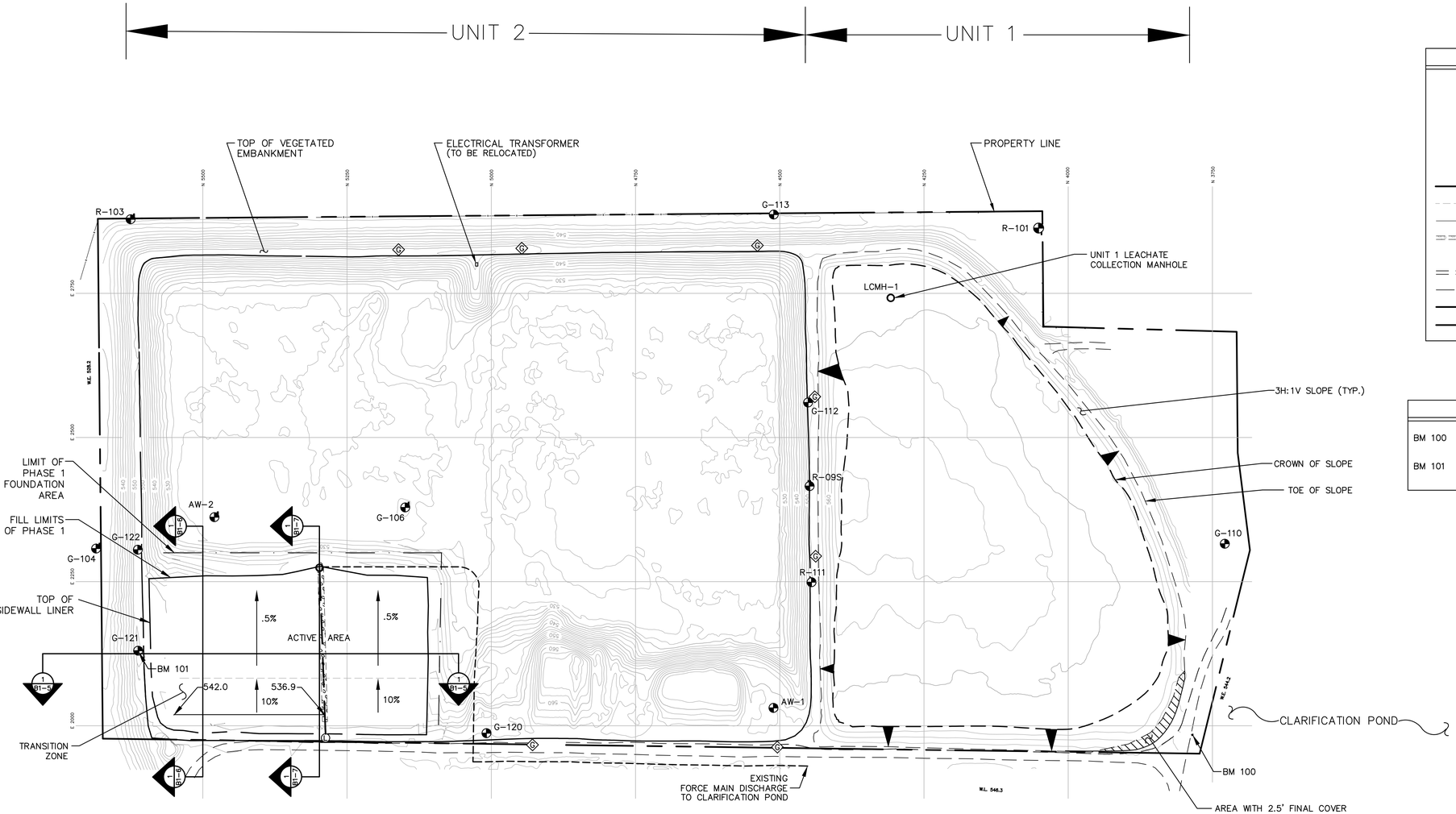

LEGEND

BM-0	BENCHMARK (SEE DESCRIPTION THIS SHEET)
	GROUNDWATER MONITORING WELL (EXISTING)
P	PIEZOMETER (LONG TERM)
	CULVERT
	LEACHATE COLLECTION MANHOLE
L	LEACHATE CLEANOUT RISER
	LEACHATE COLLECTION LINE
	TRENCH INVERT GRADE BREAK POINT
x	FENCE
	FOUNDATION UNDERDRAIN LATERAL
G	FOUNDATION UNDERDRAIN COLLECTION RISER
	ROADWAYS
	STREAM, DITCH OR WATERWAY
	PROPERTY BOUNDARY
	UNIT 2 WASTE BOUNDARY

BENCHMARK DESCRIPTIONS

BM 100	SET RAILROAD SPIKE IN CUT OFF POWER POLE: POWER PLANT COORDINATES N. 3785.14 E. 1984.37 – ELEVATION 554.731
BM 101	CUT CHISELED SQUARE IN CONCRETE 6 INCHES WEST OF MW G-121: POWER PLANT COORDINATES N. 5612.06 E. 2129.53 – ELEVATION 552.364

NOTES:

1. THE CONTOURS SHOWN FOR THE SURROUNDING AREA OF THE LANDFILL WERE GENERATED FROM LIDAR DATA PROVIDED BY HANSON PROFESSIONAL SERVICES, INC. DATED MAY 2023 MERGED WITH TOPOGRAPHIC SURVEY PERFORMED BY ANDREWS ENGINEERING, INC. DATED MARCH 11, 2024.
2. THE PROPERTY LINE LOCATION WAS SUPPLIED BY CWLP, BASED UPON SUBSEQUENT FIELD SURVEYING AND THE ORIGINAL LEGAL DESCRIPTION PREPARED BY MOSS, JOHNSON, SANDOVAL AND ASSOC. LTD.
3. FOR CLARITY NOT ALL SITE FEATURES ARE SHOWN.
4. MONITORING WELL(S) OR PIEZOMETER(S) PLUGGING SHALL BE IN ACCORDANCE WITH THE REGULATIONS, REQUIREMENTS AND/OR GUIDELINES OF THE IEPA AND/OR ILLINOIS DEPARTMENT OF PUBLIC HEALTH.
5. DURING THE OPERATION OF THE FACILITY, THE OPERATOR SHALL COMPLY WITH THE SAFETY STANDARDS PURSUANT TO THE FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970, INCLUDING ALL SUBSEQUENT AMENDMENTS.
6. WHERE THE FOUNDATION UNDERDRAIN SYSTEM DISCHARGES INTO A FORCE MAIN, THE UNDERDRAIN PIPING SHALL BE EQUIPPED WITH AN APPROPRIATE CHECK VALVE TO PREVENT BACKFLOW.
7. UNIT 1 AND UNIT 2 WERE RECOGNIZED AS TWO INDEPENDENT WASTE DISPOSAL ENTITIES BY SUPPLEMENTAL PERMIT NO. 1993-486-SP DATED JANUARY 7, 1994.
8. ACCESS TO THE FACILITY WILL BE CONTROLLED BY THE EXISTING TOPOGRAPHY, LOCKABLE GATES AND FENCING, LOCATED ALONG EAST LAKE SHORE DRIVE, ADJACENT TO THE FACILITY.
9. THE DESIGN SHOWN ON THE DRAWINGS ARE MEANT TO INDICATE A GENERAL DESIGN CONCEPT FOR THE FACILITY. ADJUSTMENTS MAY BE MADE IN THE FIELD BY THE CQAO FOR CONDITIONS ENCOUNTERED. AS APPROPRIATE, ANY ADJUSTMENTS SHALL BE REFLECTED ON THE RECORD DRAWINGS TO BE SUBMITTED TO THE AGENCY FOR OPERATING AUTHORIZATION IN NEWLY DEVELOPED AREAS.
10. WHERE POROUS MATERIALS ARE USED FOR FOUNDATION REPAIR THEY SHALL BE CONNECTED TO THE FOUNDATION UNDERDRAIN SYSTEM, WHERE PRACTICAL, TO FACILITATE ADDITIONAL SUBGRADE DRAINAGE.
11. CWLP OWNS THE SURROUNDING PROPERTY AROUND THE LANDFILL EXCEPT TO THE EAST.

UNIT 1 MONITORING WELL LEGEND
PHASED – 95-469

WELL I.D.	SCREEN MATERIAL	GRADIENT DESCRIPTION
R-101	PVC	UP
G-110	S.S.	UP
R-111	S.S.	UP
G-112	S.S.	UP

UNIT 2 MONITORING WELL LEGEND

WELL I.D.	SCREEN MATERIAL	GRADIENT DESCRIPTION
G-113	PVC	UP
G-120	PVC	UP
G-121	PVC	DOWN
G-122	PVC	DOWN
AW-1	PVC	UP
AW-2	PVC	DOWN
RW-3	PVC	DOWN
G-104	PVC	DOWN
R-103	PVC	DOWN
G-106	PVC	DOWN
R-09S	PVC	DOWN

N

0 100 200 400

SCALE: IN FEET

NO.	DATE	REVISION DESCRIPTION	BY
4	07/2025	REVISED NOTE 2	MPN
3	09/2024	REVISED SITE DEVELOPMENT PLAN, NOTES, AND DATE	MPN
2	12/1995	REVISED MONITORING WELL LABELS	RWH
1	06/1995	REVISED WELL LOCATION AND DATE	VJM

KARL W. FINKE
062.065571
PROFESSIONAL ENGINEER
STATE OF ILLINOIS

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APPROVED BY: KWF | DESIGNED BY: DWM | DRAWN BY: MPN

SITE DEVELOPMENT PLAN

PLANS PREPARED FOR
CITY WATER, LIGHT, AND POWER
FGDS DISPOSAL FACILITY
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JULY 2025

PROJECT ID: 230339/0030

SHEET NUMBER: B1-2

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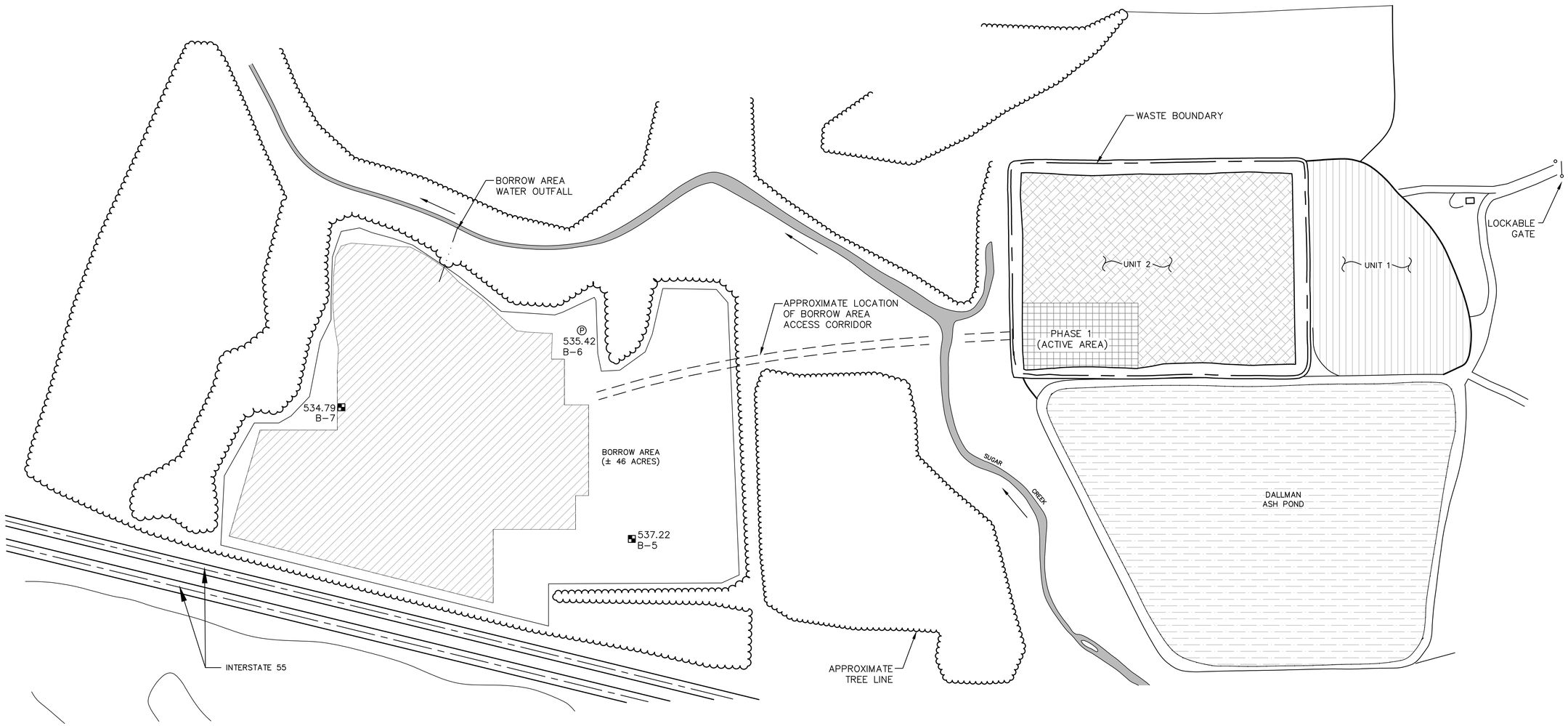

NOTES:

1. THE LANDFILL PHASING DEPICTED IN THIS DRAWING IS BASED ON THE CURRENT PROJECTED CONSTRUCTION AND PAST SLUDGE GENERATION RATES. THE PHASING MAY VARY FROM THAT SHOWN DUE TO SLUDGE RECYCLING, VARYING GENERATION RATES, AND DIFFERING CONSTRUCTION SCHEDULES.
2. THIS DRAWING WAS DIGITIZED INTO AUTOCAD USING AN AERIAL PHOTOGRAPH. FOR A MORE PRECISE REPRESENTATION OF THE WASTE BOUNDARY AND BOUNDARIES OF ALL UNITS IN THE FACILITY, SEE DRAWINGS B1-2 AND B1-4.
3. THE WASTE BOUNDARY SHOWN DEPICTS THE MAXIMUM LATERAL EXTENT TO WHICH WASTE WILL BE PLACED AND CORRESPONDS TO THE INNER EDGE WHERE THE FINAL COVER MEETS THE LINER SIDEWALL.
4. DUE TO THE NATURE OF THE SLUDGE WASTE, NO LITTER CONTROL DEVICES OR FIRE PROTECTION DEVICES ARE NECESSARY. FIRE EXTINGUISHERS WILL BE PRESENT ON LANDFILL EQUIPMENT IN CASE OF EQUIPMENT FIRES.
5. THE BORROW AREA PHASING DELINEATED IN THIS DRAWING IS BASED ON MAINTAINING ACCESS TO THE CURRENT EXCAVATION AS WELL AS ALLOWING FARMING TO CONTINUE ON UNDISTURBED AREAS. BORROW AREA PHASING MAY VARY FROM THAT SHOWN BASED ON ACTUAL SOILS ENCOUNTERED, WATER CONTENT, ETC.
6. A LOCKABLE ACCESS GATE IS PRESENT AT THE ENTRANCE OF THE FACILITY APPROXIMATELY 500' OFF OF EAST LAKE SHORE DRIVE. THE LOCATION SHOWN ON THIS DRAWING IS APPROXIMATE. ACCESS TO THE BORROW AREA IS AVAILABLE FROM ROUTE 29 AND IS SECURED BY LOCKABLE CABLE.
7. THE ONLY ON-SITE UTILITIES NECESSARY WILL BE ELECTRICITY FOR PUMP OPERATION AND WILL BE FURNISHED AS NEEDED BY CITY WATER, LIGHT AND POWER.
8. THIS MAP AND OTHER DRAWINGS PROVIDED SHOW THE ROADS IN AND AROUND THE FACILITY. TEMPORARY ROADS WILL BE CONSTRUCTED FROM THESE ROADS INTO OR ALONGSIDE EACH INDIVIDUAL FILL AREA DEPENDENT UPON ACTUAL FIELD CONDITIONS AND AS NECESSARY TO FACILITATE ACCESS TO THE CURRENT FILL AREA.
9. THIS DRAWING IS INTENDED TO ADDRESS THE REQUIREMENTS OF 35 IAC 812.107. HOWEVER, TO THE EXTENT NECESSARY FOR COMPLIANCE, THIS COMPLETE SET OF DRAWINGS (B1-0 THROUGH B1-8) MAY BE CONSIDERED THE SITE PLAN MAP.

LEGEND

Ⓟ	PIEZOMETER
■	BORING

N

0 200 400 800

SCALE: IN FEET

NO.	DATE	REVISION DESCRIPTION	BY
3	07/2025	REVISED NOTE 9	MPN
2	09/2024	REVISED TITLEBLOCK, DATE, AND PHASING AREAS	MPN
1	06/1995	REVISED DATE	VJM

LICENSED PROFESSIONAL ENGINEER KARL W. FINKE 062.068571 STATE OF ILLINOIS

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APPROVED BY: KWF DESIGNED BY: DWM DRAWN BY: MPN

SITE PLAN MAP

PLANS PREPARED FOR
CITY WATER, LIGHT, AND POWER
FGDS DISPOSAL FACILITY
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JULY 2025

PROJECT ID: 230339/0030

SHEET NUMBER: B1-3

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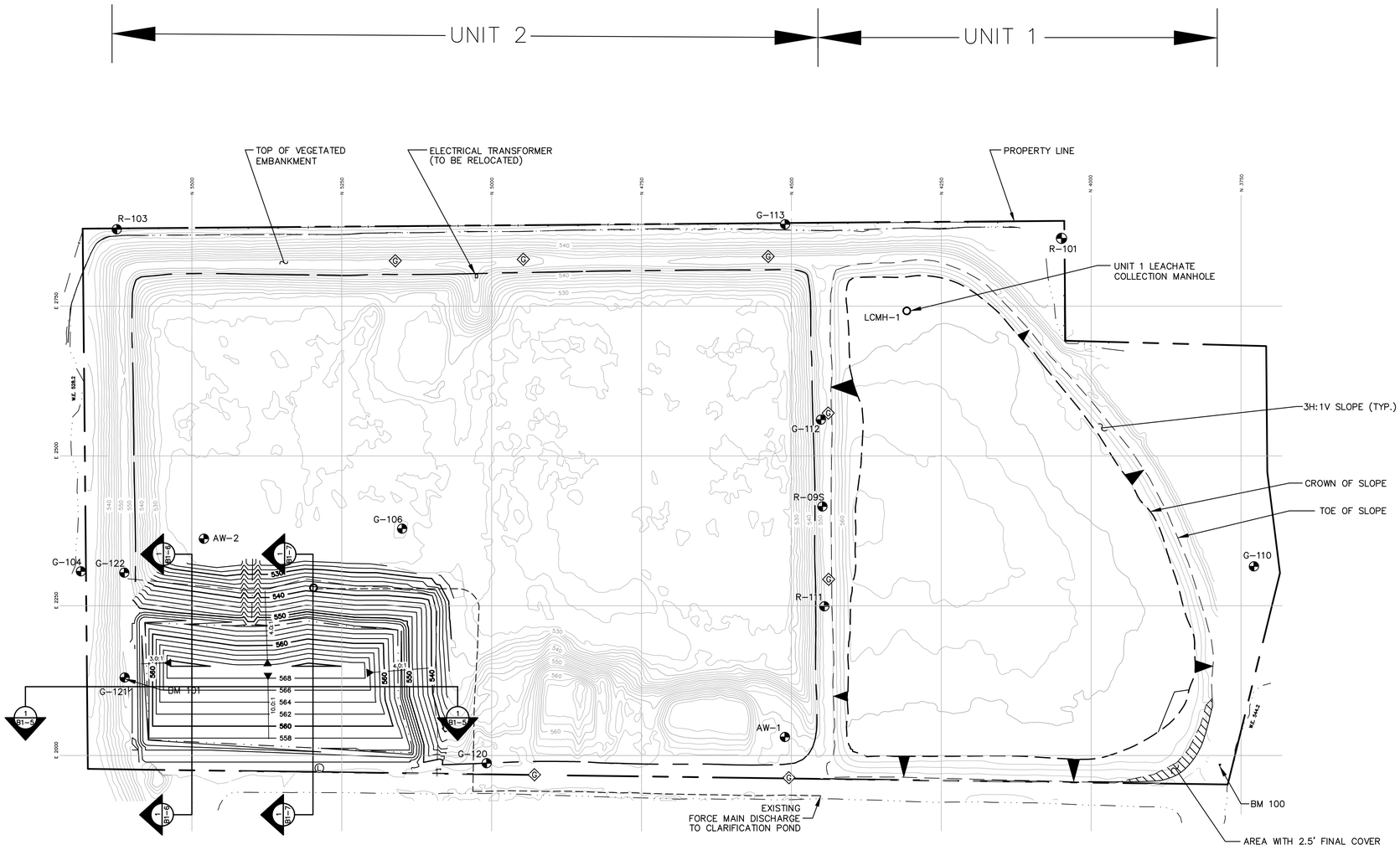

LEGEND

BM-0	BENCHMARK (SEE DESCRIPTION THIS SHEET)
	GROUNDWATER MONITORING WELL (EXISTING)
P	PIEZOMETER (LONG TERM)
	CULVERT
	LEACHATE COLLECTION MANHOLE
L	LEACHATE CLEANOUT RISER
	DRAINAGE DITCH OUTLET
	FENCE
G	FOUNDATION UNDERDRAIN COLLECTION RISER
	ROADWAYS
	STREAM, DITCH OR WATERWAY
	PROPERTY BOUNDARY
	UNIT 2 WASTE BOUNDARY

BENCHMARK DESCRIPTIONS

BM 100	SET RAILROAD SPIKE IN CUT OFF POWER POLE: POWER PLANT COORDINATES N. 3785.14 E. 1984.37 – ELEVATION 554.731
BM 101	CUT CHISELED SQUARE IN CONCRETE 6 INCHES WEST OF MW G-121: POWER PLANT COORDINATES N. 5612.06 E. 2129.53 – ELEVATION 552.364

NOTES:

1. THE CONTOURS SHOWN FOR THE SURROUNDING AREA OF THE LANDFILL WERE GENERATED FROM LIDAR DATA PROVIDED BY HANSON PROFESSIONAL SERVICES, INC. DATED MAY 2023 MERGED WITH TOPOGRAPHIC SURVEY PERFORMED BY ANDREWS ENGINEERING, INC. DATED MARCH 11, 2024.
2. THE PROPERTY LINE LOCATION WAS SUPPLIED BY CWLP, BASED UPON SUBSEQUENT FIELD SURVEYING AND THE ORIGINAL LEGAL DESCRIPTION PREPARED BY MOSS, JOHNSON, SANDOVAL AND ASSOC. LTD.
3. FOR CLARITY NOT ALL SITE FEATURES ARE SHOWN.
4. MONITORING WELL(S) OR PIEZOMETER(S) PLUGGING SHALL BE IN ACCORDANCE WITH THE REGULATIONS, REQUIREMENTS AND/OR GUIDELINES OF THE IEPA AND/OR ILLINOIS DEPARTMENT OF PUBLIC HEALTH.
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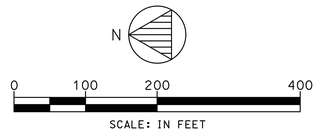
6. WHERE THE FOUNDATION UNDERDRAIN SYSTEM DISCHARGES INTO A FORCE MAIN, THE UNDERDRAIN PIPING SHALL BE EQUIPPED WITH AN APPROPRIATE CHECK VALVE TO PREVENT BACKFLOW.
7. ACCESS TO THE FACILITY WILL BE CONTROLLED BY THE EXISTING TOPOGRAPHY, LOCKABLE GATES AND FENCING, LOCATED ALONG THE EAST LAKE SHORE DRIVE, ADJACENT TO THE FACILITY.
8. THE DESIGN SHOWN ON THE DRAWINGS ARE MEANT TO INDICATE A GENERAL DESIGN CONCEPT FOR THE FACILITY. ADJUSTMENTS MAY BE MADE IN THE FIELD BY THE CQAO FOR CONDITIONS ENCOUNTERED. AS APPROPRIATE, ANY ADJUSTMENTS SHALL BE REFLECTED ON THE RECORD DRAWINGS TO BE SUBMITTED TO THE AGENCY FOR OPERATING AUTHORIZATION IN NEWLY DEVELOPED AREAS.
9. THE SYMBOLS FOR THE VARIOUS APPURTENANCE ARE LARGER THAN THE ITEM SHOWN.
10. UNIT 1 AND UNIT 2 WERE RECOGNIZED AS TWO INDEPENDENT WASTE DISPOSAL ENTITIES BY SUPPLEMENTAL PERMIT NO. 1993-486-SP DATED JANUARY 7, 1994.
11. CWLP OWNS THE SURROUNDING PROPERTY AROUND THE LANDFILL EXCEPT TO THE EAST.
12.. THE FINAL CONTOURS ARE APPLICABLE TO THE AREA UTILIZED FOR DISPOSAL. THE AREA OUTSIDE THE WASTE FOOTPRINT MAY BE UTILIZED FOR OTHER PURPOSES AS LONG AS THE INTEGRITY OF THE LANDFILL IS NOT COMPROMISED.

UNIT 1 MONITORING WELL LEGEND
PHASED – 95-469

WELL I.D.	SCREEN MATERIAL	GRADIENT DESCRIPTION
R-101	PVC	UP
G-110	S.S.	UP
R-111	S.S.	UP
G-112	S.S.	UP

UNIT 2 MONITORING WELL LEGEND

WELL I.D.	SCREEN MATERIAL	GRADIENT DESCRIPTION
G-113	PVC	UP
G-120	PVC	UP
G-121	PVC	DOWN
G-122	PVC	DOWN
AW-1	PVC	UP
AW-2	PVC	DOWN
RW-3	PVC	DOWN
P-07D	PVC	DOWN



NO.	DATE	REVISION DESCRIPTION	BY
2	09/2024	REVISED TITLEBLOCK, DATE, NOTES, AND CONTOURS	MPN
1	06/1995	REVISED WELL LOCATIONS AND DATE	VJM

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APPROVED BY: KWF | DESIGNED BY: DWM | DRAWN BY: MPN

FINAL SITE CONDITIONS

PLANS PREPARED FOR
CITY WATER, LIGHT, AND POWER
FGDS DISPOSAL FACILITY
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JULY 2025

PROJECT ID: 230339/0030

SHEET NUMBER: B1-4

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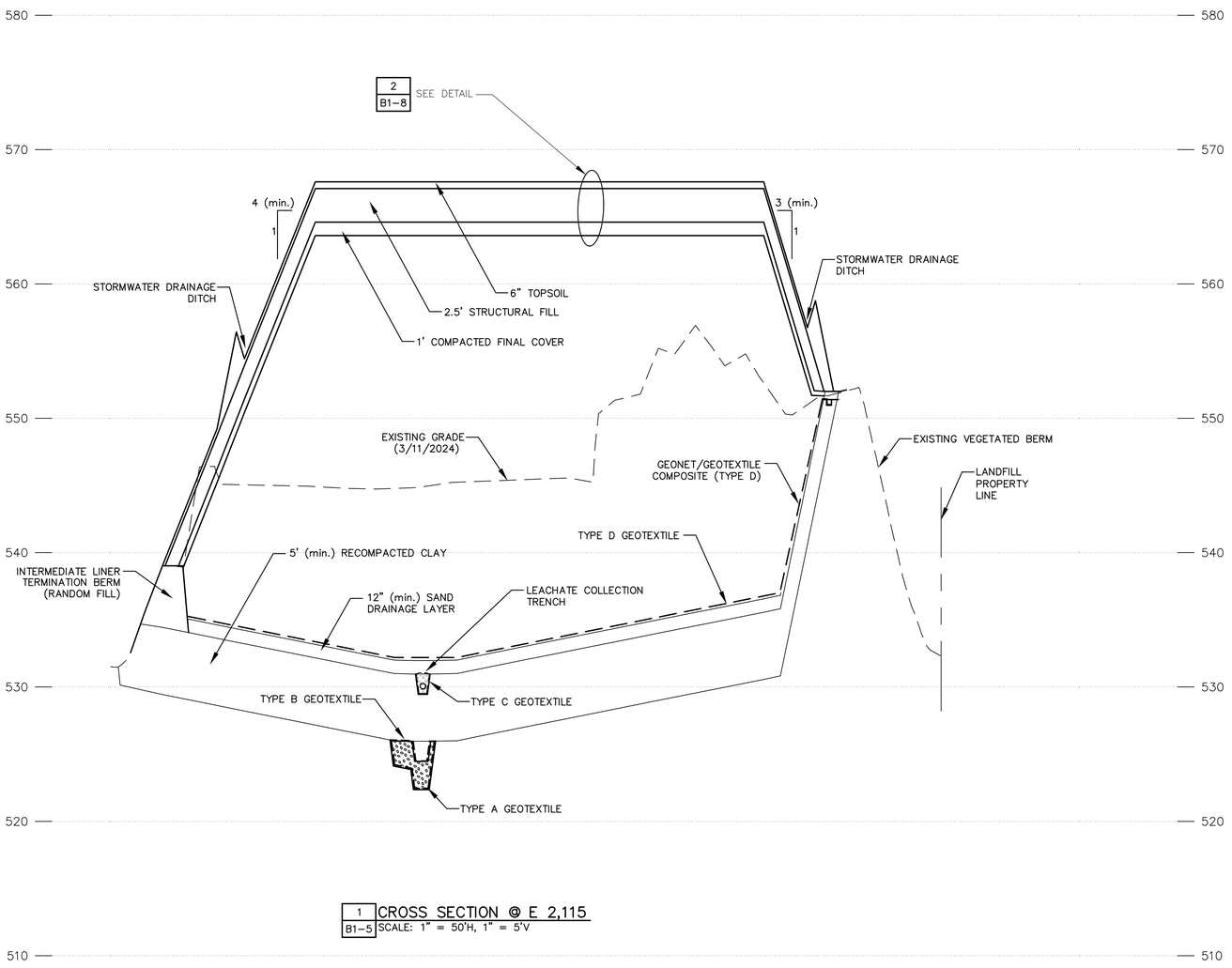
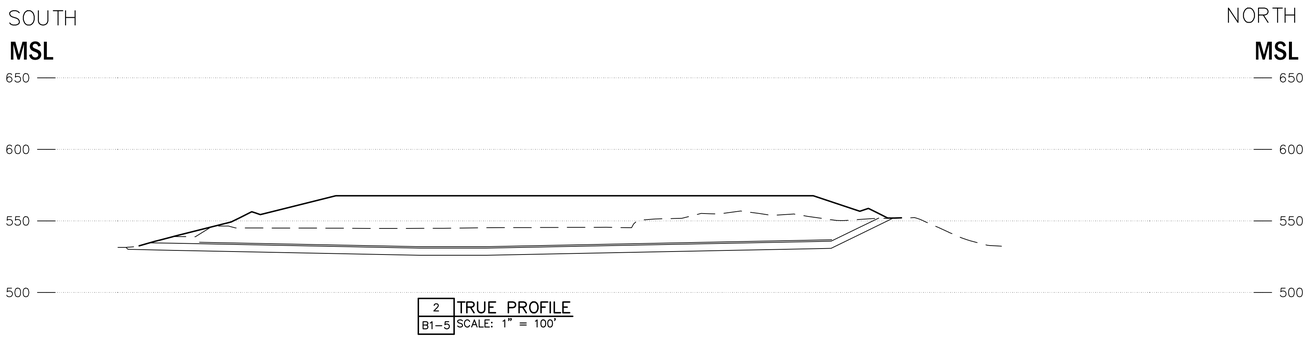


1 B1-5 CROSS SECTION @ E 2,115
SCALE: 1" = 50'H, 1" = 5'V



2 B1-5 TRUE PROFILE
SCALE: 1" = 100'

NOTES:

1. FOR CLARITY IN DEPICTING THE FEATURES OF THE LANDFILL, THE SECTION SHOWN IN DRAWING 1 HAS BEEN DISTORTED BY A FACTOR OF 10 IN THE VERTICAL SCALE. THE TRUE PROFILE OF THE LANDFORM IS 1/10 THAT SHOWN AND IS DEPICTED IN DRAWING 2.
2. FINAL CONTOURS ARE TAKEN THROUGH AREAS OF DIFFERENT SLOPES CAUSING THE THICKNESS OF THE FINAL COVER TO APPEAR TO VARY DUE TO THE VERTICAL EXAGGERATION. ALL LANDFILL SURFACES ARE TO BE COVERED WITH 6-INCHES TOPSOIL, 2.5-FEET OF STRUCTURAL FILL AND 1-FOOT COMPACTED FINAL COVER.
3. THE CROWN SLOPE OF THE LANDFILL APPEARS SMALLER THAN IT IS DUE TO THE LOCATION OF THE SECTION DEPICTED.
4. DEPENDING UPON THE FOUNDATION CONDITIONS ENCOUNTERED, A MANHOLE, PUMP, AND DISCHARGE LINE MAY BE SUBSTITUTED FOR THE PIPING CROSS CONNECTION, GRAVITY DRAIN PIPE, AND CLEANOUT RISER.

NO.	DATE	REVISION DESCRIPTION	BY
3	07/2025	REVISED NOTE 2	MPN
2	09/2024	REVISED TITLEBLOCK, DATE, NOTES, AND PROFILES	MPN
1	06/1995	REVISED DATE	VJM

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DRAWN BY: MPN | DESIGNED BY: DWM | APPROVED BY: KWF

CROSS SECTION @ E 2,115

PLANS PREPARED FOR
CITY WATER, LIGHT, AND POWER
FGDS DISPOSAL FACILITY
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JULY 2025

PROJECT ID: 230339/0030

SHEET NUMBER: B1-5

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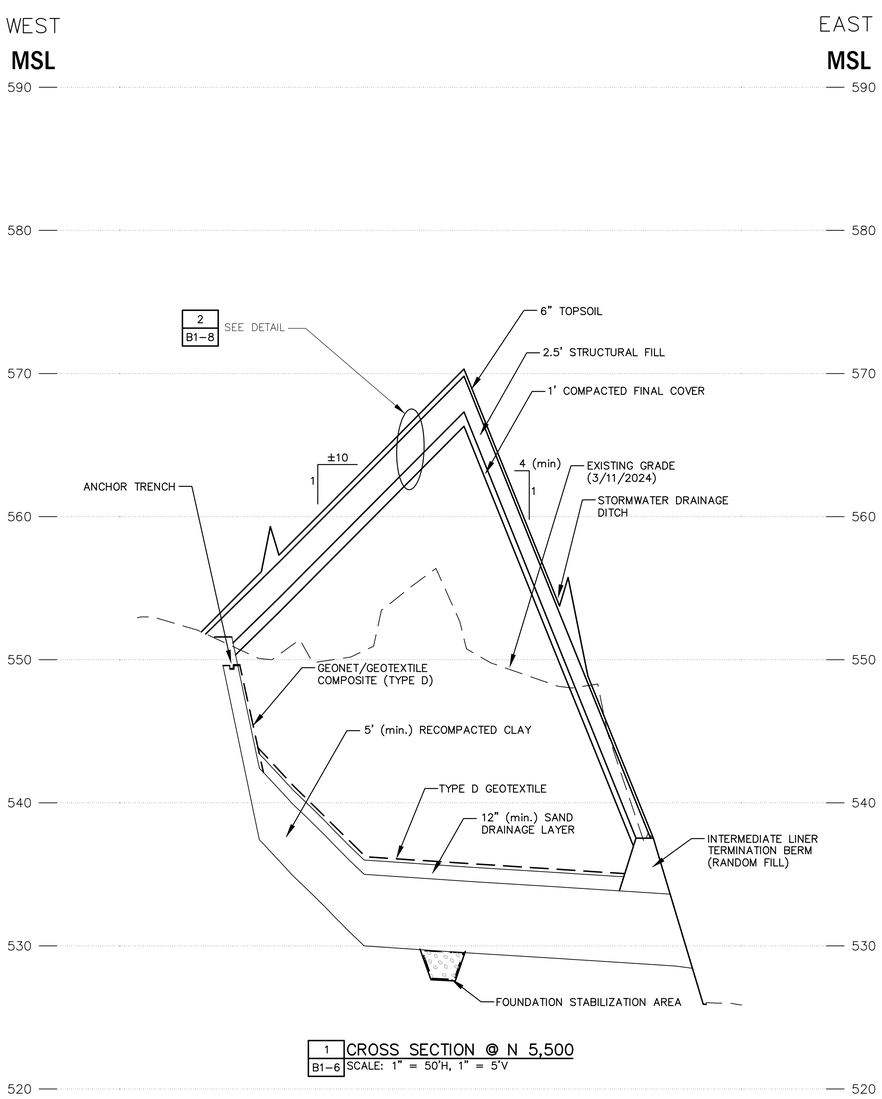
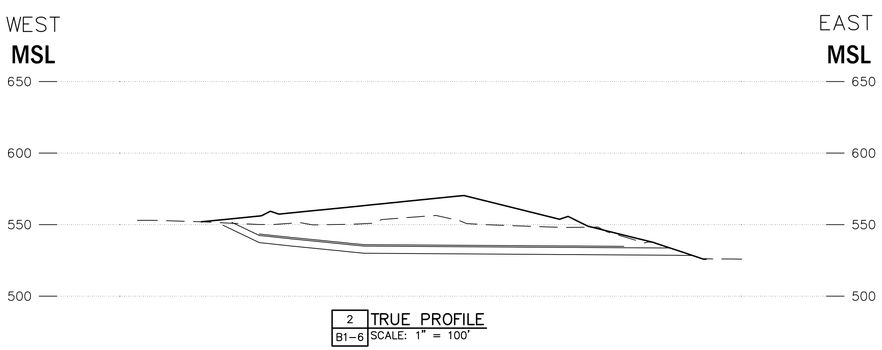


1 B1–6 CROSS SECTION @ N 5,500
SCALE: 1" = 50'H, 1" = 5'V



2 B1–6 TRUE PROFILE
SCALE: 1" = 100'

NOTES:

1. FOR CLARITY IN DEPICTING THE FEATURES OF THE LANDFILL, THE SECTION SHOWN IN DRAWING 1 HAS BEEN DISTORTED BY A FACTOR OF 10 IN THE VERTICAL SCALE. THE TRUE PROFILE OF THE LANDFORM IS 1/10 THAT SHOWN AND IS DEPICTED IN DRAWING 2.
2. FINAL CONTOURS ARE TAKEN THROUGH AREAS OF DIFFERENT SLOPES CAUSING THE THICKNESS OF THE FINAL COVER TO APPEAR TO VARY DUE TO THE VERTICAL EXAGGERATION. ALL LANDFILL SURFACES ARE TO BE COVERED WITH 6–INCHES TOPSOIL, 2.5–FEET OF STRUCTURAL FILL AND 1–FOOT COMPACTED FINAL COVER.

NO.	DATE	REVISION DESCRIPTION	BY
3	07/2025	REVISED NOTE 2	MPN
2	09/2024	REVISED TITLEBLOCK, DATE, NOTES, AND PROFILES	MPN
1	06/1995	REVISED DATE	VJM

PROFESSIONAL ENGINEER
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APPROVED BY: KWF | DESIGNED BY: DWM | DRAWN BY: MPN

CROSS SECTION @ N 5,500

PLANS PREPARED FOR
CITY WATER, LIGHT, AND POWER
FGDS DISPOSAL FACILITY
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JULY 2025

PROJECT ID: 230339/0030

SHEET NUMBER: B1-6

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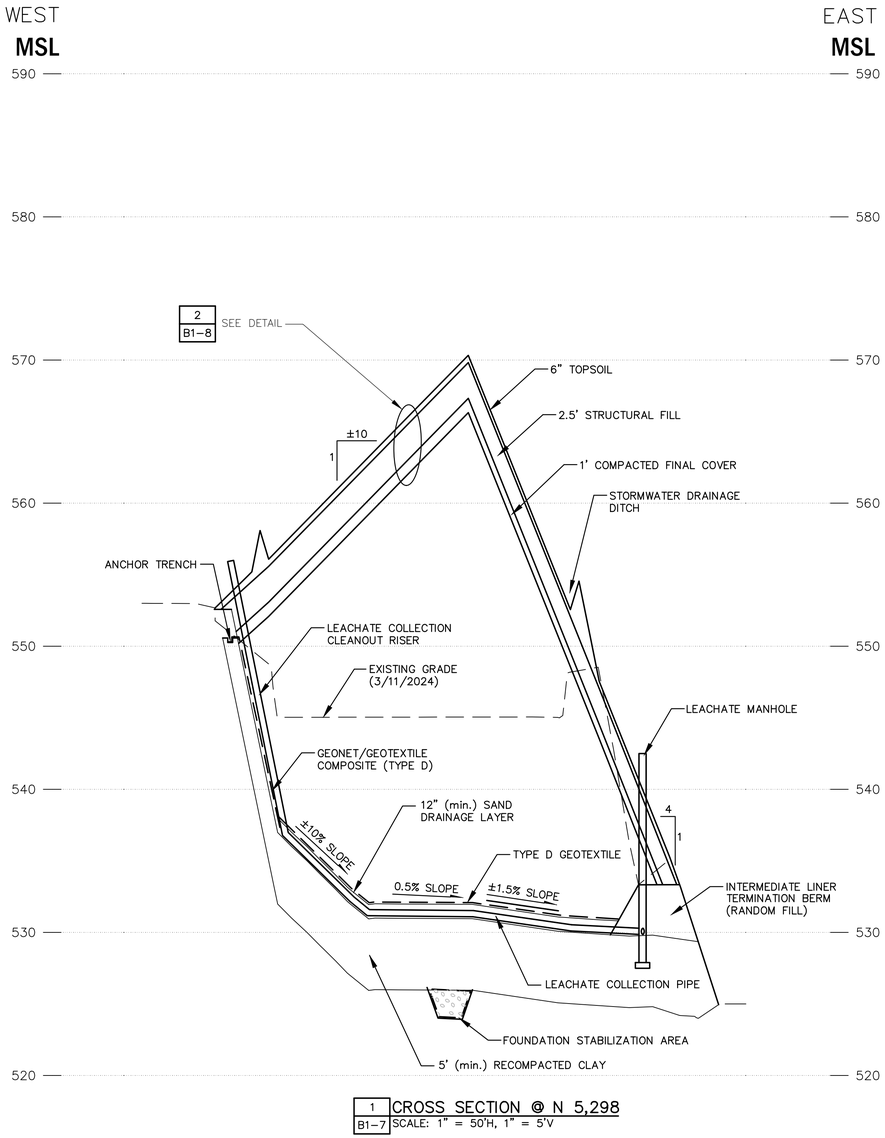
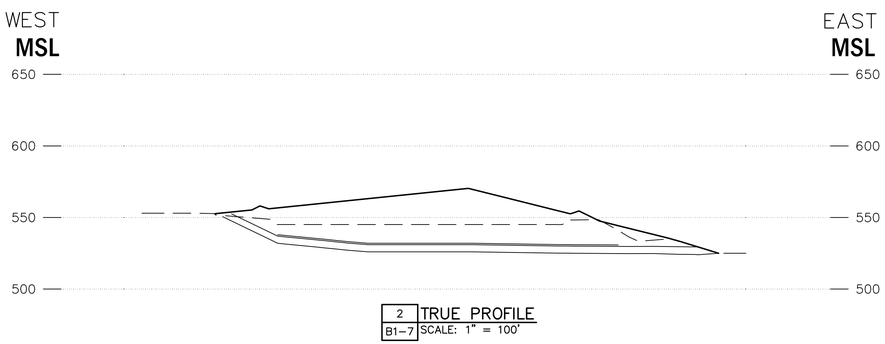


1 B1–7 CROSS SECTION @ N 5,298
SCALE: 1" = 50'H, 1" = 5'V



2 B1–7 TRUE PROFILE
SCALE: 1" = 100'

NOTES:

1. FOR CLARITY IN DEPICTING THE FEATURES OF THE LANDFILL, THE SECTION SHOWN IN DRAWING 1 HAS BEEN DISTORTED BY A FACTOR OF 10 IN THE VERTICAL SCALE. THE TRUE PROFILE OF THE LANDFORM IS 1/10 THAT SHOWN AND IS DEPICTED IN DRAWING 2.
2. FINAL CONTOURS ARE TAKEN THROUGH AREAS OF DIFFERENT SLOPES CAUSING THE THICKNESS OF THE FINAL COVER TO APPEAR TO VARY DUE TO THE VERTICAL EXAGGERATION. ALL LANDFILL SURFACES ARE TO BE COVERED WITH 6–INCHES TOPSOIL, 2.5–FEET OF STRUCTURAL FILL AND 1–FOOT COMPACTED FINAL COVER.
3. DUE TO THE DRAWING SCALE, THE LEACHATE COLLECTION SYSTEM DETAIL HAS BEEN SIMPLIFIED. SEE SHEET B1–8 FOR COMPLETE DETAILS.

NO.	DATE	REVISION DESCRIPTION	BY
3	07/2025	REVISED NOTE 2	MPN
2	09/2024	REVISED TITLEBLOCK, DATE, NOTES, AND PROFILES	MPN
1	06/1995	REVISED DATE	VJM

PROFESSIONAL ENGINEER
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062-065571
STATE OF ILLINOIS

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DESIGNED BY: DWM | DRAWN BY: MPN | APPROVED BY: KWF

CROSS SECTION @ N 5,298

PLANS PREPARED FOR
CITY WATER, LIGHT, AND POWER
FGDS DISPOSAL FACILITY
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JULY 2025

PROJECT ID: 230339/0030

SHEET NUMBER: B1-7

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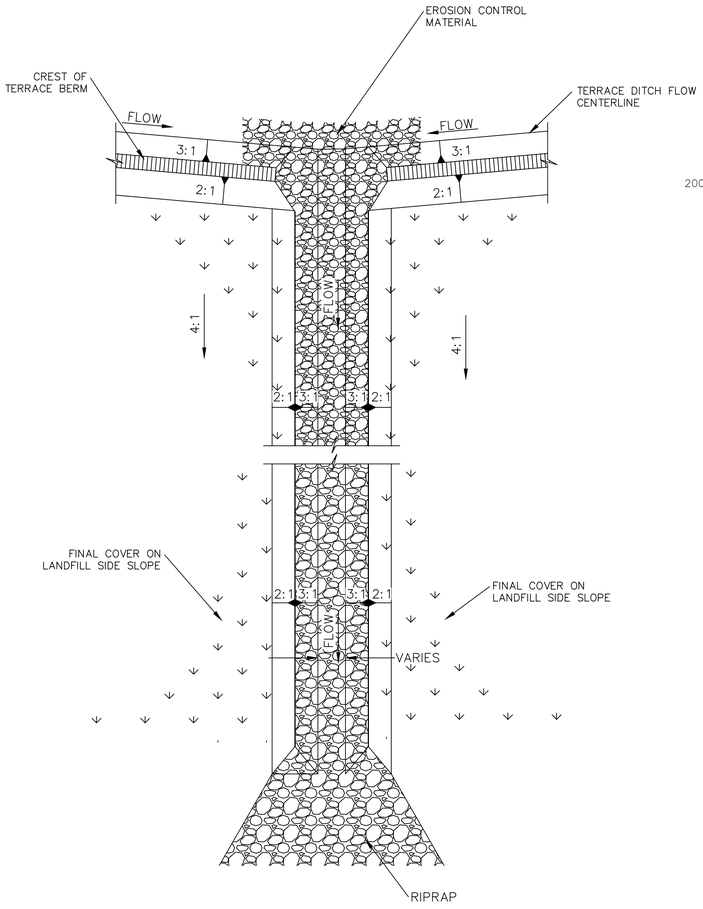
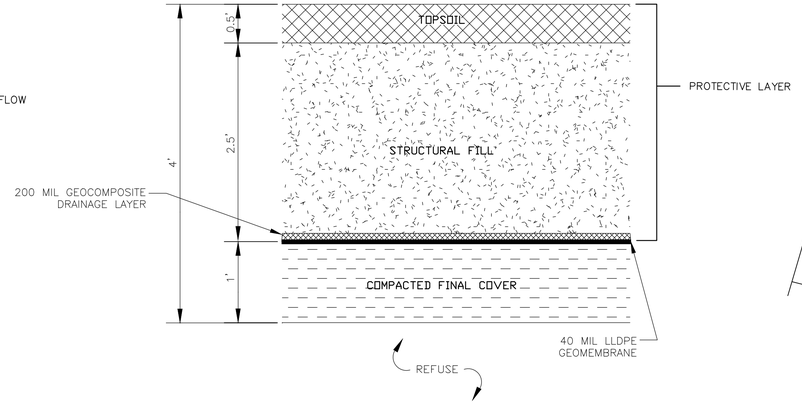
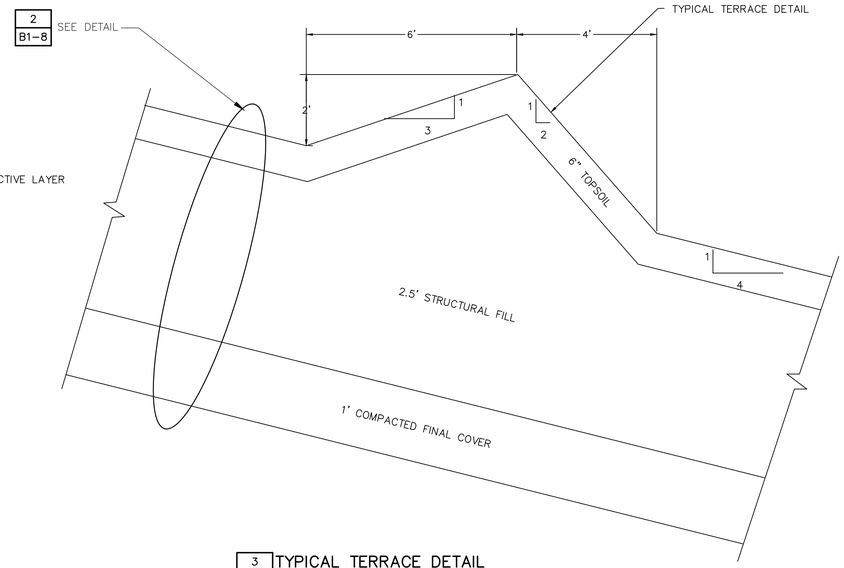


NOTE:
CONSTRUCT DOWN SLOPE CHANNEL USING RAISED SIDEWALLS ON TOP OF FINAL COVER. SIDEWALL TO BE FILLED A MINIMUM OF 1.5' ABOVE EXISTING FINISH GRADE.

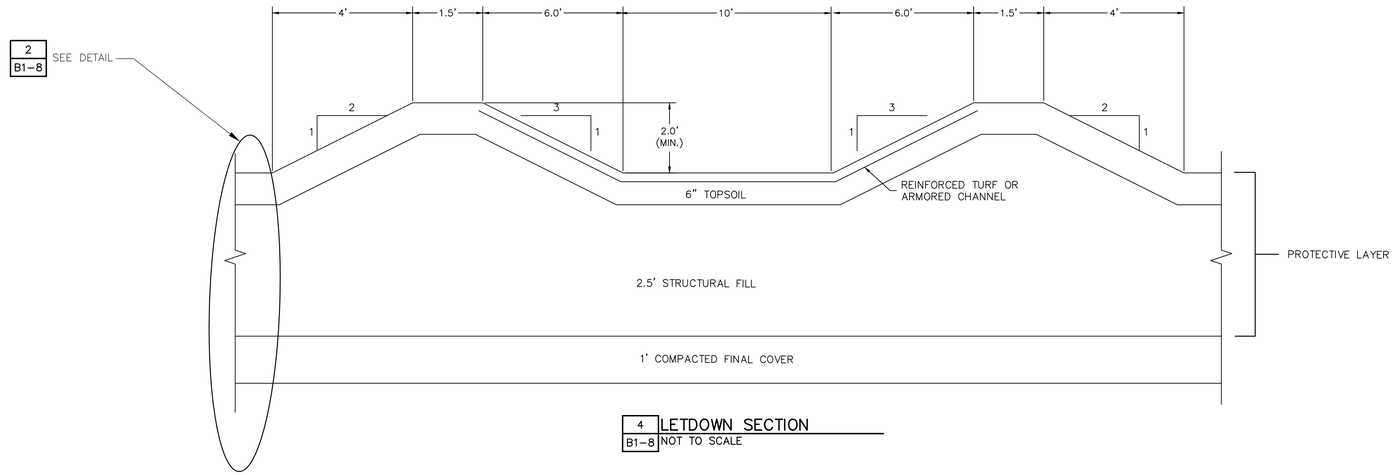
1 / B1-8 TYPICAL LETDOWN DETAIL
NOT TO SCALE



2 / B1-8 FINAL COVER SYSTEM DETAIL
NOT TO SCALE



3 / B1-8 TYPICAL TERRACE DETAIL
NOT TO SCALE



4 / B1-8 LETDOWN SECTION
NOT TO SCALE

NO.	DATE	REVISION DESCRIPTION	BY
3	07/2025	REVISED DETAILS 2, 3 & 4	MPN
2	09/2024	REVISED TITLEBLOCK, DATE, NOTES, AND DETAILS	MPN
1	06/1995	REVISED DATE	VJM

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DETAILS

PLANS PREPARED FOR
CITY WATER, LIGHT, AND POWER
FGDS DISPOSAL FACILITY
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JULY 2025

PROJECT ID: 230339/0030

SHEET NUMBER: B1-8

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Tab: Layout1 Last Saved: July 10, 2025, by Mike Nguyen Plotted: Thursday, July 10, 2025 12:14:08 PM
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ATTACHMENT A:
Construction Quality Assurance Plan

City Water, Light & Power
FGDS Development Landfill Unit 2
Springfield, Sangamon County, Illinois

Construction Quality Assurance Plan

July 2025

Submitted to:
United States Environmental Protection Agency

Prepared for:
City Water, Light & Power
3100 Stevenson Drive
Springfield, Illinois 62703

ANDREWS ENGINEERING

3300 Ginger Creek Drive, Springfield, IL 62711 | 217.787.2334

ILLINOIS | MISSOURI | INDIANA

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1. INTRODUCTION

This Construction Quality Assurance (CQA) Plan is specific to closure by final cover system defined in 40 CFR 257.102(b)(3). All structures necessary to comply with the requirements of 40 CFR 257.102 shall be constructed pursuant to the monitoring and certification activities summarized in this CQA Plan.

The CQA Plan provides an outline of inspection activities and responsibilities to ensure proper performance of the closure components. The Owner or Operator will designate a qualified professional engineer as the CQA Officer. The CQA Officer will supervise, approve, and be responsible for all inspections, testing, and other activities required in this plan. The CQA Officer will be an Illinois Registered Professional Engineer with experience in geosynthetics. In addition, the CQA Officer will be responsible for providing documentation and as-built record drawings of completed construction and maintaining records of the construction sequences throughout the development, operation, and closure of the landfill. The CQA Officer will comply with the requirements of this plan and will accept full responsibility for all inspections performed and reports prepared by the designated CQA Officer-in-Absentia during the absence of the CQA Officer. The CQA Officer may utilize one or more inspectors to assist the CQA Officer with the various inspections and testing to be conducted in the field. Any such inspector will work under the direct supervision of the CQA Officer and will be properly trained and/or experienced, as appropriate.

2. INSPECTION ACTIVITIES

The CQA Officer will be present to provide supervision and assume responsibility for performing all inspections of the following activities:

1. Excavation in Borrow Areas, including topsoil and vegetation stripping.
2. CCR grading of the final cover area and compaction of subgrade.
3. Erosion control, storm water pollution prevention and all required pumping.
4. Construction of Final Cover including geomembrane installation.
5. Seed, fertilize, and mulch Final Cover and borrow pits.
6. Construction of ditches, culverts, and letdowns.

If the CQA Officer is unable to be present, the CQA Officer will designate a person who will exercise professional judgment in carrying out the duties of a CQA Officer as the designated CQA Officer-in-absentia. The CQA Officer should be present at least one day of every week.

3. SAMPLING PLAN

A sampling plan will be implemented as part of the CQA Plan for all construction activities.

The CQA Officer will review all specifications and requirements for the manufactured items used in the construction of those components requiring inspection. (See Inspection Activities section previously presented herein.) The CQA Officer will approve all materials based on satisfaction of their individual specification. Furthermore, the CQA Officer will ensure that proper installation methods are used. Structural fill may not be necessary. However, if needed, loams of the United States Department of Agriculture (USDA) soils classification system or USCS classes CL, ML, CH and CL-ML are all considered suitable protective soils for use as structural fill and would be subject to the specifications provided in Table 1.

Facility Component	**Sample Program Location**
Structural Fill (if needed)	Table 1
Protective/Vegetative Cover Layer	Table 2
Textured Geomembrane Cover Liner (40-mil)	Table 3
Final Cover Drainage Layer	Table 4
Ditches	Table 5

Additional testing and sampling may be required at the discretion of the CQA Officer, if in the CQA Officer's judgment they are necessary to ensure proper materials usage and construction procedures set forth by Federal and State Regulations. Furthermore, the CQA Officer will authorize additional sampling or sampling frequencies as necessary to ensure statistical sampling techniques are employed.

TABLE 1

STRUCTURAL FILL/COMPACTED SUBGRADE CQA SAMPLING PROGRAM

STRUCTURAL FILL CONFORMANCE TESTING

Test/Procedure	Minimum Frequency	Acceptable Values
Grain Size Distribution (ASTM D422)	1 per 10,000 cy	P_{200} > 50%
Atterberg Limits (ASTM D4318)	1 per 10,000 cy (fine-grained soils only)	CL, ML, CH CL-ML
Standard Proctor (ASTM D698)	1 per 10,000 cy or soil change	> 95% Max. Dry Density by ASTM D698

CONSTRUCTION TESTING

Test/Procedure	Minimum Frequency	Acceptable Values
Nuclear Density (ASTM D6938)	5 per Acre-Lift	> 95% Max. Dry Density by ASTM D698
In-Place Moisture Content (ASTM D6938)	5 per Acre-Lift	-3 to +3 % of by ASTM D698
Base Elevation	100-ft grid	≤ As necessary
Top Elevation	100-ft grid	≤ As necessary

Table 2

Protective/Vegetative Cover Layer CQA Sampling Program

Test/Procedure	Minimum Frequency	Acceptable Values
Base Elevation	100-ft grid	≤ Final Permitted Elevation – 36 inches
Top Elevation	100-ft grid	≤ Final Permitted Elevation
Thickness	100-ft grid	≥ 36 inches normal to surface

TABLE 3

TEXTURED GEOMEMBRANE COVER LINER CQA SAMPLING PROGRAM
(40-mil LLDPE Geomembrane)

MANUFACTURER QUALITY CONTROL (MQC) TESTING

Test/Procedure	Minimum Frequency	Acceptable Values
Geosynthetic Research Institute (GRI) GM-17 Testing Standard	Per GRI GM17	Per GRI GM17

CONFORMANCE TESTING

Test/Procedure	Minimum Frequency	Acceptable Values
Thickness (ASTM D5994)	1 per 100,000 ft^2 per lot	38 mil
Asperity Heights (ASTM D7466)	1 per 100,000 ft^2 per lot	$\geq$ 16 mil
Density (ASTM D1505 or ASTM D792)	1 per lot	$\geq$ 0.939
Tensile Strength at Break (ASTM D6693)	1 per 100,000 ft^2 per lot	$\geq$ 60 ppi
Elongation at Break (ASTM D6693)	1 per 100,000 ft^2 per lot	$\geq$ 250%
Tear Resistance (ASTM D1004)	1 per 100,000 ft^2 per lot	$\geq$ 22 lbs
Puncture Resistance (ASTM D4833)	1 per 100,000 ft^2 per lot	$\geq$ 44 lbs
Carbon Black Content (ASTM D4218)	1 per lot	2.0 to 3.0%
Carbon Black Dispersion (ASTM D5596)	1 per lot	9 in 10 Views Cat. 1 Or 2 1 in 10 Views Cat. 3

TABLE 4

FINAL COVER DRAINAGE LAYER CQA SAMPLING PROGRAM

Geocomposite Drainage Layer Configuration (200-mil. Double Sided Geotextile)

MANUFACTURER QUALITY CONTROL (MQC) TESTING

Double-Sided Geocomposite

Test/Procedure	Minimum Frequency	Acceptable Values
Tests and Procedures in accordance with the manufacturer's product specification sheet	Testing Frequency in accordance with manufacturer's product specification sheet	Acceptable Values in accordance with the manufacturer's product specification sheet

MANUFACTURER QUALITY ASSURANCE (MQA) TESTING

Double-Sided Geocomposite

Test/Procedure	Minimum Frequency	Acceptable Values
100-Hour Transmissivity* (ASTM D4716)	1 test per Manufacturer of Double Sided Geocomposite	> 1.0×10^{-4} m^2/sec (min)

*Test to be completed using 200-mil. GSE FabriNet Double Sided Geocomposite (or equivalent) layered between samples of a 40-mil. HPDE geomembrane and the project specific general protective layer material. The sample shall be presoaked for 24 hours, loaded with a 1,000 psf normal load, and run at a flow gradient of 0.1.

Ply Adhesion (ASTM D7005)	1 per 100,000 ft^2 per lot	> 1 ppi

Geonet Core

Test/Procedure	Minimum Frequency	Acceptable Values
Thickness (ASTM D5199)	1 per 100,000 ft^2 per lot	200 mil. avg.
Density (ASTM D1505)	1 per 100,000 ft^2 per lot	> 0.940
Carbon Black Content (ASTM D1603)	1 per 100,000 ft^2 per lot	> 2.0%

TABLE 4 (cont.)
CONFORMANCE TESTING

Geotextile (Prior to Lamination)

Test/Procedure	Minimum Frequency	Acceptable Values
Mass per unit Area (ASTM D5261)	1 per 100,000 ft^2 per lot	6 $oz./yd^2$
Grab Tensile (ASTM D4632)	1 per 100,000 ft^2 per lot	160 lbs.
Puncture Strength (ASTM D4833)	1 per 100,000 ft^2 per lot	90 lbs.
AOS, US Sieve (ASTM D4751)	1 per 540,000 ft^2 per lot	70
Permittivity (ASTM D4491)	1 per 540,000 ft^2 per lot	1.5 sec^{-1}

Table 5

Ditches CQA Sampling Program

MANUFACTURER DATA SHEETS AND QUALITY CONTROL (MQC) TESTING

Channel Lining Material (Armored Channel Lining, Erosion Control Material, Rip Rap)

Test/Procedure	Minimum Frequency	Acceptable Values
Obtain Manufacturer's product specification sheets and MQC testing (if available)	Per Material Order and Product Type	At discretion of CQA Officer per design applicability
Rip Rap Supplier Gradation Certification	Per Material Order and Product Type	At discretion of CQA Officer per design applicability

Ditches

Test/Procedure	Minimum Frequency	Acceptable Values
Survey Centerline Profiles	100-foot intervals or at major breaks in grade	At discretion of CQA Officer
Cross-Sections	200-foot intervals or at major breaks in grade	At discretion of CQA Officer

4. CONSTRUCTION MEETINGS

The CQA Officer may hold meetings prior to, and during, construction to ensure proper construction techniques, understanding of the specifications and plans, the proper handling of deviations from the plans necessitated by site-specific field conditions and to review the appropriate chain-of-command used if unsuitable work is discovered. Meetings shall be held with Owner, all Contractors, and Operator representatives involved with the project to discuss their individual responsibilities.

5. DOCUMENTATION

5.1 Daily Summary Report

A daily summary report will be prepared by the CQA Officer, or under the direct supervision of the CQA Officer, during each day of activity. The report will contain, at a minimum:

1. The date
2. A summary of the weather conditions
3. A summary of locations where construction is occurring
4. Equipment and personnel on the project
5. A summary of any meetings held and attendees
6. A description of all materials used and references or results of testing and documentation
7. The calibration and recalibration (if needed) of test equipment
8. The daily inspection report from each inspector

5.2 Daily Inspection Reports

Each inspector will complete a daily inspection report containing the following information:

1. The location
2. The type of inspection
3. The procedure used
4. Test data
5. Acceptable limits for construction testing analysis
6. In the event of unsuitable materials or construction techniques, documentation regarding corrective action taken and causes for the incongruity
7. Results of the activity
8. Personnel involved in the inspection and sampling activities
9. The signature of the inspector

5.3 Weekly Summary Report

A weekly summary report will be prepared by the CQA Officer, or under the direct supervision of the CQA Officer at the end of each week of construction until the end of construction. The CQA Officer must review and approve the report. The report will contain, at a minimum:

1. The dates of the week
2. Descriptions of the weather
3. Locations where construction occurred during the week
4. Materials used
5. Testing results
6. Inspection reports
7. Procedures used to perform the inspections

5.4 Photographic Records

Photographs may be used as tools to document the progress and acceptability of the work and may be incorporated into a daily summary report, a daily inspection report, and an acceptance report.

5.5 Acceptance Report

Upon completion of the construction of each major phase, the CQA Officer will submit an acceptance report to the Owner and Operator. The acceptance report will be submitted before the structure is placed into service and will contain the following:

1. A certification by the CQA Officer that the construction has been prepared and constructed in accordance with the engineering design
2. As-built record drawings
3. All daily summary, inspection, and work location reports

6. FINAL COVER SYSTEM

6.1 Geomembrane

The CQA Officer will thoroughly inspect the subgrade surface layer on which the geomembrane cover is to be laid prior to proof rolling. The inspector will concentrate on the following and completion of the corrective action required:

1. The subgrade surface layer will be inspected and surveyed ensuring the grades and lines are consistent with those on the design plans.
2. The surface will be examined ensuring that all rocks, litter, construction debris, and/or undesirable objects are not present that could weaken the support of the geomembrane cover or puncture it.

3. All depressions will be filled and raised areas leveled.
4. Any desiccation cracks will be corrected as necessary to ensure proper performance of the subgrade layer.
5. No vegetative growth will be present.
6. All surfaces are firm and have not been wetted excessively in local areas in the preceding period before the geomembrane installation.

It is expected that fine finishing of the final surface will be required, starting from the top and working down. Uniform application of additional moisture to the surface may provide a smoother surface if grading is required. The geomembrane installer will conduct an additional inspection near the time of geomembrane placement, and any necessary repairs to its supporting layer will be made.

Prior to any geomembrane installation, the installer will provide the CQA Officer with a panel layout plan for the specific area included in his construction bid. The installer or manufacturer will also provide assurance that the geomembrane material is compatible with the soils to be contacted, and furthermore, that the liner is believed to have sufficient strength and durability to function at the site for the design period under the maximum expected loadings imposed by heavy equipment and stresses imposed by settlement, temperature, construction, and operation. These assurances will be approved by the CQA Officer. Alternatively, the CQA Officer may perform and/or subcontract performance of tests and/or calculations, as necessary to realize such assurances independent of the installer/manufacturer. The CQA Officer will also ensure that the geomembrane utilized has an adequate angle of friction based upon the actual materials/products that it will have contact with. As necessary, alternative products, materials, and/or thicknesses may be used to meet or exceed the geomembrane specifications, presented in Table 3.

A 40-mil LLDPE geomembrane cover will be installed on top of the subgrade layer in accordance with the drawings, specifications, and manufacturer's instructions by persons experienced in similar cover installation. Furthermore, the geomembrane cover will be installed in accordance with the installer's panel layout plan, and it may be revised with the approval of the CQA Officer to suit field conditions at the time of installation. All field seaming will be in accordance with the manufacturer's specifications. Any necessary revisions during installation will be reflected on the record as-built drawings.

Geomembrane bonding will use fusion welding when possible and extrusion welding as a secondary means. Fusion welding will typically consist of applying dynamic energy and heat between two overlapped panels. This will allow panel-to-panel bonding, providing a homogenous mass along the area of the seam. Extrusion welding will be completed via an extrusion gun equipped with an extrusion head and pre-heat blower to ensure proper pre-heating of the geomembrane seams.

Equipment used to bond the LLDPE geomembrane cover will be equipped with monitors capable of providing instantaneous temperature readings regarding the zone of contact. This will allow the operator to manually or automatically alter the bonding process to ensure integrity based on changes in environment.

The quality control aspects of LLDPE geomembrane cover installation will include, but not necessarily be limited to:

1. Inspection of the procedures and adequacy used for cleaning and/or drying the surfaces of the geomembrane to be seamed.
2. Monitoring of the temperature and speed of welding.
3. Only smooth soled shoes will be allowed on the geomembrane cover.

No vehicles will be allowed directly on the geomembrane cover. Subsequent placement of the final protective layer will be with a LGP dozer or other suitable equipment and the materials advanced in front of the equipment so that operation directly on the cover does not occur.

The quality assurance aspects of LLDPE geomembrane cover installation will include, but not necessarily be limited to:

1. Conformance testing of the geomembrane material meets the minimum requirements of Table 3.
2. Test welds on scrap geomembrane cover materials will be produced by each seamer at least twice daily, in the early morning and afternoon, under the same conditions as production seaming to verify conditions are adequate.
3. All field seams will be pressure or vacuum tested over their full length.
4. Samples of actual field seams will be tested on an average basis of at least once every 500 feet of seam length by sample removal and laboratory testing for bonded seam strength and peel adhesion as recommended in the Geosynthetic Research Institutes' (GRI) GM-19 Technical Guidance. The test results will be considered acceptable if they meet the minimum requirements of the GRI GM-19 standards (Patches will be welded over holes created by sampling.)
5. Inadequate seams will be cut out and rewelded or an additional layer of geomembrane will be welded over the suspect seam.
6. Documentation of the location of each panel, sample point, repaired areas, and the test results.

Using the above-mentioned procedures and others that may be required or deemed appropriate by the CQA Officer, upon completion of the cover installation, the CQA Officer will exercise professional judgment to certify:

1. The bedding material contained no undesirable objects.

2. The placement plan has been followed.
3. The final protective layer was applied to prevent damage to the geomembrane cover.
4. All tears, rips, punctures, and other damages were repaired.
5. The anchor trench and backfill are constructed to prevent damage to the geosynthetic membrane.
6. All geomembrane seams were properly constructed and tested in accordance with the manufacturer's specifications.

6.2 Geocomposite Drainage Layer and Toe Drain

Installation of the geocomposite drainage layer and toe drain shall be made in accordance with the manufacturer's specifications. The geocomposite shall be installed in the direction of the slope and flow unless specified by the design engineer. A toe drain will be installed and care will be used when spreading the protective cover layer over the entire length of the geocomposite. Seams and edges of the geocomposite shall be butted against each other and joined with ties placed no greater than every five feet along the seam. End-to-end seams shall be overlapped by a minimum of 12 inches, shingled in the direction of flow with ties no greater than five feet along the seam. Testing requirements for the geocomposite will be conducted in accordance with Table 4.

6.3 Final Protective Layer

The final protective layer will consist of a minimum 36 inch thickness of soil. A layer of double-sided geocomposite will be placed directly over the geomembrane layer to provide a free-draining element to remove moisture from the final cover system. The soils overlaying the double-sided geocomposite will not be compacted, with the top 6 inches being the best onsite, readily available soil for supporting vegetation. The thickness of the final protective layer will be documented by comparing the finished elevation of the low permeability layer with the final surface. The minimum thickness of the final protective layer will be placed as soon as possible after placement of the geomembrane low permeability layer.

Loams of the United States Department of Agriculture (USDA) soils classification system or USCS classes GM, GC, SM, SC, ML, and CL are all considered suitable protective soils. The final protective layer may include soils from on- and/or offsite sources and compost. Other products that may be considered waste besides compost (such as sewage treatment sludge) may be used as a soil amendment if all necessary permits/authorizations are secured.

The finished surface of the final cover system will be surveyed on a spacing, which will not exceed 100 feet in any ordinate direction. This survey and acceptance criteria will apply to final protective layers of the final cover system, with allowance for the minimum three-foot difference between their surfaces.

In conjunction with the monitoring activities described above, the CQA Officer will implement the sampling program summarized in Table 2.

6.4 Vegetative Cover

Finalized areas will be prepared and seeded as soon as reasonably possible to prevent potential erosion impacts. Composite soil sample testing should be done to determine the amount of lime and/or fertilizer needed. Seed will typically be incorporated into the upper surface of the final protective layer using a disk or harrow, or by using hydroseeding techniques. The seed mixture selected must be amenable to the soil quality/thickness, slopes, and moisture/climatological conditions that exist without the need for continued maintenance and with minimal potential for root penetration into the low permeability layer. Such vegetation will be established by seeding with a dry prairie mix or dry-mesic prairie mix as recommended by the local Soil and Water Conservation Office. Fertilizer, lime, and straw mulch should be used at rates necessary to establish proper growth of the seed.

Landscaping or seeding professionals knowledgeable of Springfield area climatological conditions will be consulted in determining necessary soil amendments and application rates based upon specific seasonal conditions at the time of closure. As a guide, the design procedures and specifications presented in the handbook *Procedures and Standards for Urban Soil Erosion and Sediment Control in Illinois* may be utilized. Mulch consisting of straw, jute, and/or wood excelsior will be used as necessary to hold the seed in place and conserve moisture. The CQA Officer should record the amount of amendments and seed, and the boundaries of the completed areas on the as-built record drawings.

6.5 Drainage Control Structures

The CQA Officer shall inspect the final cover ditches, berms, and related drainage features to ensure proper construction of these structures as indicated by the drawings. Deviations from the plans shall be noted on the as-built record drawings with the appropriate erosion control covering as soon as reasonably possible. Repairs as warranted should be done prior to applying the coverings.

7. ROADWAYS

The CQA Officer will inspect the location of the roadways in relation to the transportation plan. The CQA Officer's primary responsibility will be to ensure proper grading of the roadway surfaces enabling runoff water to enter the stormwater runoff collection ditching as appropriate.

8. SURFACE WATER CONTROL

The CQA Officer will inspect the ditches to ensure proper construction of these structures as indicated by the drawings. Deviations from the plans will be noted on the as-built record drawings with the appropriate calculations showing that the hydraulic carrying capacity remains sufficient. All ditches will be completed with the appropriate erosion control coverings as soon as practicable. Repairs, as warranted, should be done prior to applying the coverings.

In conjunction with the monitoring activities described above, the CQA Officer will implement the sampling program summarized in Table 5.

9. EXCEPTIONS

The CQA Officer shall have the authority to modify the design shown on the plans based upon unexpected conditions encountered in the field. Small changes or modifications are historically required on any construction job of this size. Accordingly, the changes or modifications should be incorporated into the Acceptance Report and/or record drawings. Calculations, supporting discussion, etc. shall also be included to authenticate the adequacy of the changes in relation to the original design.

ATTACHMENT B:

Phase 1 - Cell 3 Construction Report for the City Water, Light & Power FGDS Landfill

ANDREWS ENVIRONMENTAL ENGINEERING INC. 3535 Mayflower Blvd., Springfield, Illinois 62707/(217) 787-2334

September 15, 1993

Mr. John Richardson
Field Operations Section
Illinois Environmental Protection Agency
Division of Land Pollution Control
4500 South Sixth Street
Springfield, IL 62706

re: City Water, Light & Power
Construction Report

Dear John:

The attached Report was prepared prior to the precipitation events which occurred recently. As such, the Report was written based upon completion of the project. Currently, we have the following tasks to accomplish:

- Seaming and placement of a small amount of geotextile.
- Repair of various geotextile holes.
- Installation of the leachate removal pump.

These items can be easily accomplished and should involve less than two days of work.

Based upon the immediate need to begin placing material in the Cell, we are proposing to place material around the areas not completely done. We will supply documentation regarding completion of these remaining items when they have been completed.

If you have any questions, please do not hesitate to contact me.

Sincerely,

R. Michael McDermont, P.E.
Project Engineer
Division of Solid Waste Management

CC: Brian Wood - Sangamon County Health Department
Ed Riordan - CWLP
Sue Corcoran - CWLP

Enclosures

RMM:njm

PHASE 1 - CELL 3

CONSTRUCTION REPORT

FOR THE

CITY WATER, LIGHT & POWER

FGDS LANDFILL

Submitted To:

Illinois Environmental Protection Agency
Division of Field Operations Section

September 1993

Prepared By:

ANDREWS ENVIRONMENTAL ENGINEERING INC.
3535 Mayflower Boulevard, Springfield, Illinois 62707/(217) 787-2334

ANDREWS ENVIRONMENTAL ENGINEERING INC. 3535 Mayflower Blvd., Springfield, Illinois 62707/(217) 787-2334

September 13, 1993

John Richardson
Field Operations Section
Illinois Environmental Protection Agency
Division of Land Pollution Control
4500 South Sixth Street
Springfield, Illinois 62706

re: City Water, Light & Power
Construction Report

Dear John:

Enclosed is the Phase 1 Construction Report for Cell 3 of the City Water, Light & Power FGDS Landfill. Construction was done in general conformance with Supplemental Permit 1992-161 issued September 15, 1992.

The client is anxious to begin filling the area, therefore an expeditious review of the materials presented herein would be appreciated. If you have any questions, please do not hesitate to contact me.

Sincerely,

R Michael McDermont

R. Michael McDermont, P.E.
Project Engineer
Division of Solid Waste Management

MMC:pll
enclosures
cc: Brian Wood, Sangamon County Health Department
Ed Riordan
Sue Corcoran

CITY WATER, LIGHT & POWER

CONSTRUCTION REPORT

Foundation

The entire Phase 1 area of Cell 3 was stripped of vegetation and upper topsoil. This material was removed and used in the Cell 1 vegetative layer. After removal of the vegetation, the floor area of Phase 1 was proof-rolled with a loaded tandem axle dump truck. Visual observation was made of the subgrade response under load and problem areas were identified. Additional grading was performed and the liner design elevations modified to more closely match the subgrade elevations.

Two areas of organic matter were identified on the floor. These areas are identified as Areas G and E. The organic matter was excavated and used in the vegetative layer of Cell 1. Area G was partially filled with CA-7 rock where softer foundation areas were encountered. The remainder of the excavation was filled with compacted soil. Area E was filled with rock due to the small area of excavation. Area F was filled with rock only, due to a job-site shortage of reinforcement geotextile.

The remainder of the repair areas were filled with compacted CA-7 rock underlain by a woven reinforcement geotextile. Rock depth typically varied between 18 - 24 inches. Based upon the previous location of an existing drainage ditch at approximate N 5300, the leachate collection pipe and manhole foundation were placed in the centerline of this ditch. This resulted in a small southwesterly skew of the leachate line from the manhole. The subgrade under the leachate collection system was stabilized with woven reinforcement geotextile and 24" of compacted CA-7 stone.

Prior to placement of liner material, the remainder of the floor east of E 2082.5 was disked to remove potential excessive moisture and rolled with a sheepsfoot roller. This resulted in a firm subgrade surface. The area west of E 2082.5 was used as a haul road during much of the construction and no subgrade attention was required.

Earthen Liner

Brown silty clay was obtained from the borrow area north of the project site. Additional soil was obtained from the Cell 2/3 division berm to construct the sidewall liners and a portion of the floor liner. This material was generally spread in thin lifts and compacted to 95% Standard Proctor at or above optimum moisture content. Water was added to increase moisture content when needed or disking/working the soil was done to lower excessive moisture contents.

Typically, a Raygo or Caterpillar 815 B were used to compact the soil. In specialized areas, such as the initial placement of the recompacted liner under the leachate collection system, the backhoe bucket or Tampo vibratory roller were used. In these specialized areas, bentonite was added to the soil to further reduce hydraulic conductivity.

Where the surface had dried from previous activities the soil was moistened with City water prior to placing additional soil. When the surface was sealed or bladed to reduce precipitation infiltration, the surface was scarified prior to placing additional soil.

Typically, four passes of the compactor was used to densify, kneed and mold the soil. This number was based upon a test performed at the onset of the project where a density/roller pass comparison was made. Additional roller passes were performed for scarification, when excessive soil moisture was encountered or when perpendicular rolling and blading was needed to smooth the liner surface to a more uniform level, normal for any earthen liner construction project.

Random Fill

At the onset of the project, the north Cell 3 berm was breeched to shallow the slope between the creek crossing and Dallman Ash Pond berm road. Some of this material was pushed into the northwest corner of Cell 3. This fill became part of the haul road. The inside slope of this random fill was trimmed to match the west sidewall slope and the sidewall liner placed adjacent to it.

Freeze Damage

Since the project was suspended in late December, 1992 the floor received an insulating layer of approximately 12" of soil. One portion of the floor was protected by a sand stockpile. In May of 1993, shelby tube samples were collected of various elevations of the floor liner and analyzed for permeability. At the toe of the sand stockpile, no soil was placed and one sample was collected from this area. The resulting permeability was found to be acceptable. Three other samples were collected and all of the results are provided below:

Identification	Permeability	Depth Cover Soil	Depth Below Final Grade
PT 1	6.03×10^{-9}	0	0
PT 2	5.68×10^{-9}	2.5'	1.6'
PT 3	3.52×10^{-9}	2.1'	1.3'
PT 4	8.75×10^{-9}	1.6'	.8'

As a precautionary measure, the insulating layer and six inches minimum was removed from the previously constructed liner. The exposed subgrade was then scarified and redensified with the soil compactor prior to placing the remaining liner material.

Excessive soil was trimmed from the interior sidewall liner and redensified with a sheepsfoot roller, tow behind roller or dozer tracks depending upon location. The horizontal portion of the sidewall liner was excavated 12" minimum and rerolled.

Diversion Berms

Approximately 6' high random fill berms were placed on the south and east side to contain the scrubber residue and stormwater runoff. The eastern berm was moved west from the original location and the previously placed liner material outside of the new location was used to construct a portion of it. This material was placed in approximately 12" lifts and compacted with the vibratory sheepsfoot roller, equipment tracks or the backhoe bucket in limited areas.

Leachate Collection System

The leachate collection system includes a sand drainage layer on the floor, a drainage net/geotextile composite on the sidewalls, a leachate collection pipe and storage/removal manhole. The sand drainage layer was placed directly on top of the clay liner surface after it was rolled with a smooth drum roller. Sand was placed to a depth of 12" minimum and was compacted by precipitation events and a dozer. A geotextile was then placed over the sand.

The sidewall drainage net/geotextile composite was placed on the sidewall liner. The top of the composite was placed in a shallow 12" anchor trench which was backfilled with compacted soil. An additional 24" of compacted liner material was then placed above the anchor trench.

The drainage net/geotextile composite consists of a drainage net between two pieces of non-woven geotextile. Subsequent pieces were joined by overlapping. The bottom geotextiles overlapped each other. The drainage net itself was overlapped and tied with nylon ties.

The overlaps of the upper geotextile and geotextile placed over the floor's sand drainage layer were fused together by the addition of heat. This will prevent any separation of the geotextiles during initial filling. Repairs of holes were made by placement of an additional piece of geotextile on top of the damaged area.

The leachate collection pipe was placed in a trench excavation surrounded by geotextile and a compacted gravel envelope. The leachate collection pipe consisted of perforated 6" diameter SCH 80 PVC pipe. The pipe and floor itself were placed at an approximate .5% slope to enable conveyance of the leachate to the manhole through the sand drainage layer, gravel envelope and leachate collector pipe.

A 4' diameter concrete manhole was placed at the termination point of the Phase 1 collector pipe. This manhole will be equipped with a submersible pump activated by float switches. A 2" diameter force main was installed to remove leachate to a new 4" diameter force main located around the perimeter of Cell 3. Leachate will be pumped to the Dallman Ash Pond for treatment.

The western point of the leachate collector point was equipped with a 6" diameter sidewall riser cleanout pipe. This pipe was placed on top of the sidewall drainage net and extends to the top of the sidewall liner. This pipe is solid and is equipped with an end cap.

Floor Repair

A general corridor from the northwest corner to the southeast corner was used by the earthmoving equipment in December 1992 when placing the sidewall liners on the west and north. Based upon the temperature and the previous precipitation, the clay liner became rutted from vehicular traffic. Upon resuming constructions in 1993, two feet of previously placed liner material was removed. The subgrade was rolled with the sheepsfoot roller and tested before placing additional liner in the repair area.

Clay Thickness

The contour lines shown on Drawing Numbers D-1 and D-2 were constructed based upon surveying the contour lines on approximate 50' spacing. Corrections were made to the grade as warranted. Sidewall liner thickness was controlled by surveying the existing grade prior to constructing the sidewall liner and again after placement of the sidewall liner. This was completed on approximately 50' centers. Based upon this work, 5' of compacted clay liner exists on the sidewalls and floor.

QA/QC Testing

All work was generally supervised by an experienced soil technician and/or professional engineer. Testing data regarding density and moisture content, unconfined compressive strength, grain size, Atterberg limits, permeability, laboratory density and laboratory moisture were obtained at varying frequencies. Data regarding these tests are provided in the following attachments.

Certification

This report has been prepared based upon our observations through the construction of Phase 1 of Cell 3. The information is true and representative of the accomplished tasks.

Michael P. McConnell
Technician

R. Michael McDermont, P.E.
Project Engineer

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ATTACHMENT 3	Moisture Density Relationship
ATTACHMENT 4	Liner Permeability Analysis
ATTACHMENT 5	Sand Thickness Data
ATTACHMENT 6	Leachate Collection System Components
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ATTACHMENT 1

Report of Compaction Testing

- REPORT OF SOIL COMPACTION TESTING -

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

PROJECT: Cell #3 Clay Liner
REPORT NUMBER: 89-118A-1

DATE: September/October 1992
CLIENT: City Water, Light & Power

JOB NUMBER: 89-118A
CONTRACTOR: Siciliano, Inc.

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
1	9-29-92	N 5114.15 E 2229.92	527.77	100.9	106.2	19.7	19.7	95.0
2	9-29-92	N 5112.98 E 2151.79	528.68	101.1	106.2	22.6	19.7	95.2
3	9-29-92	N 5133.65 E 2097.54	529.26	102.1	106.2	19.9	19.7	96.2
4	9-29-92	N 5176.48 E 2094.32	528.16	101.9	106.2	19.5	19.7	96.0
5	9-29-92	N 5160.04 E 2137.55	528.05	100.3	106.2	20.9	19.7	94.6
6	9-29-92	N 5155.07 E 2246.22	527.01	106.3	106.2	19.7	19.7	100.1
7	9-30-92	N 5142.78 E 2235.31	527.69	101.0	106.2	22.3	19.7	95.1
8	9-30-92	N 5106.12 E 2228.74	528.09	102.9	106.2	21.9	19.7	96.9
9	9-30-92	N 5120.43 E 2156.26	528.86	101.3	106.2	21.3	19.7	95.4
10	9-30-92	N 5152.98 E 2180.91	527.90	101.0	106.2	21.5	19.7	95.1
11	9-30-92	N 5157.53 E 2133.83	528.54	102.0	106.2	20.1	19.7	96.0
12	9-30-92	N 5124.69 E 2107.50	529.56	103.1	106.2	21.3	19.7	97.0
13	10-01-92	N 5174.19 E 2133.88	528.15	101.0	106.2	20.2	19.7	95.1
14	10-01-92	N 5172.81 E 2186.19	527.71	102.8	106.2	20.8	19.7	96.8

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
15	10-01-92	N 5170.82 E 2252.77	526.96	102.0	106.2	21.7	19.7	96.0
16	10-01-92	N 5207.66 E 2223.15	526.71	104.8	106.2	19.7	19.7	98.7
17	10-01-92	N 5185.87 E 2086.82	528.23	101.1	106.2	20.0	19.7	95.1
18	10-01-92	N 5245.37 E 2237.23	526.65	101.6	106.2	21.2	19.7	95.7
19	10-01-92	N 5255.44 E 2289.62	526.64	102.1	106.2	20.4	19.7	96.2
20	10-01-92	N 5211.31 E 2161.55	527.11	105.3	106.2	20.7	19.7	99.1
21	10-01-92	N 5145.55 E 2265.93	527.30	102.8	106.2	20.3	19.7	96.8
22	10-01-92	N 5154.13 E 2152.93	528.31	104.3	106.2	21.3	19.7	98.2
23	10-01-92	N 5162.75 E 2095.22	528.61	104.4	106.2	20.2	19.7	98.3
24	10-01-92	N 5195.13 E 2100.18	528.38	103.2	106.2	20.9	19.7	97.2
25	10-01-92	N 5189.98 E 2205.79	527.25	101.3	106.2	20.9	19.7	95.4
26	10-01-92	N 5175.04 E 2257.86	527.07	102.2	106.2	19.9	19.7	96.3
27	10-01-92	N 5249.85 E 2269.01	527.12	101.5	106.2	22.2	19.7	95.5
28	10-01-92	N 5213.97 E 2214.45	527.20	100.8	106.2	20.3	19.7	94.9
29	10-01-92	N 5214.92 E 2151.12	527.27	100.8	106.2	22.3	19.7	94.9
30	10-02-92	N 5157.80 E 2157.80	528.51	101.3	106.2	20.3	19.7	95.4
31	10-02-92	N 5139.85 E 2264.66	527.38	105.2	106.2	19.7	19.7	99.1
32	10-02-92	N 5202.13 E 2261.26	527.10	105.9	106.2	20.8	19.7	99.7
33	10-02-92	N 5171.67 E 2219.80	527.97	105.2	106.2	20.5	19.7	99.1

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
34	10-02-92	N 5104.13 E 2204.52	528.41	105.2	106.2	20.5	19.7	99.1
35	10-02-92	N 5231.69 E 2199.00	527.53	105.0	106.2	21.8	19.7	98.8
36	10-02-92	N 5239.84 E 2277.80	527.29	103.5	106.2	19.8	19.7	97.4
37	10-05-92	N 5183.92 E 2122.32	529.04	103.2	106.2	20.6	19.7	97.2
38	10-05-92	N 5174.42 E 2217.41	528.41	104.7	106.2	19.9	19.7	98.6
39	10-05-92	N 5162.46 E 2260.03	528.10	105.4	106.2	19.8	19.7	99.2
40	10-05-92	N 5117.14 E 2274.78	528.01	101.2	106.2	22.7	19.7	95.2
41	10-05-92	N 5133.94 E 2213.50	528.58	102.9	106.2	20.5	19.7	96.9
42	10-05-02	N 5121.56 E 2143.11	529.57	102.6	106.2	19.7	19.7	96.6
43	10-06-92	N 5128.52 E 2134.73	529.59	103.8	106.2	19.8	19.7	97.7
44	10-06-92	N 5125.22 E 2221.62	528.43	102.2	106.2	21.1	19.7	96.3
45	10-06-92	N 5158.46 E 2242.67	528.28	104.0	106.2	20.8	19.7	98.0
46	10-06-92	N 5166.41 E 2179.25	529.16	104.4	106.2	20.6	19.7	98.3
47	10-06-92	N 5192.15 E 2108.54	529.48	104.6	106.2	20.3	19.7	98.5
48	10-06-92	N 5542.67 E 2107.89	527.92	101.7	106.2	21.2	19.7	95.8
49	10-06-92	N 5219.48 E 2174.95	528.28	105.2	106.2	20.7	19.7	99.1
50	10-06-92	N 5227.98 E 2256.77	527.96	103.5	106.2	20.8	19.7	97.3
51	10-06-92	N 5150± E 2260±	528.5±	102.5	106.2	20.0	19.7	96.5
52	10-06-92	N 5130± E 2120±	530.0±	103.8	106.2	20.8	19.7	97.8

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
53	10-06-92	N 5140± E 2200±	528.9	102.4	106.2	20.8	19.7	96.4
54	10-07-92	N 5201.27 E 2114.42	529.07	101.9	106.2	21.8	19.7	96.0
55	10-07-92	N 5190.71 E 2192.72	528.53	105.5	106.2	19.7	19.7	99.3
56	10-07-92	N 5193.06 E 2258.74	527.91	101.1	106.2	23.0	19.7	95.2
57	10-07-92	N 5151.89 E 2256.87	528.67	104.0	106.2	19.8	19.7	98.0
58	10-07-92	N 5166.31 E 2154.86	529.63	103.8	106.2	19.8	19.7	97.7
59	10-07-92	N 5135.72 E 2126.66	530.5	102.4	106.2	20.5	19.7	96.4
60	10-07-92	N 5114.95 E 2192.75	530.0	101.5	106.2	22.3	19.7	95.5
61	10-07-92	N 5130.51 E 2251.79	529.27	105.2	106.2	20.5	19.7	99.0
62	10-07-92	N 5163.96 E 2247.54	529.21	103.4	106.2	20.6	19.7	97.3
63	10-07-92	N 5166.17 E 2170.00	529.92	103.4	106.2	21.0	19.7	97.3
64	10-07-92	N 5184.93 E 2100.89	529.85	100.9	106.2	21.5	19.7	95.0
65	10-07-92	N 5197.26 E 2202.26	528.69	103.8	106.2	20.7	19.7	97.8
66	10-07-92	N 5200.40 E 2264.37	528.12	103.1	106.2	20.3	19.7	97.1
67	10-07-92	N 5231.96 E 2224.36	528.37	102.0	106.2	21.6	19.7	95.9
68	10-07-92	N 5258.97 E 2141.34	527.58	103.8	106.2	20.7	19.7	97.8
69	10-08-92	N 5543.52 E 2236.12	527.12	102.5	106.2	21.2	19.7	96.5
70	10-08-92	N 5533.41 E 2292.86	526.54	103.7	106.2	19.9	19.7	97.7
71	10-08-92	N 5531.67 E 2197.76	528.33	103.3	106.2	21.5	19.7	97.3

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
72	10-08-92	N 5530.73 E 2160.27	529.02	102.2	106.2	20.1	19.7	96.2
73	10-08-92	N 5536.81 E 2120.78	529.63	102.6	106.2	21.4	19.7	96.6
74	10-09-92	N 5501.85 E 2135.43	529.13	101.1	106.2	21.7	19.7	95.2
75	10-09-92	N 5465.18 E 2127.15	528.90	101.4	106.2	22.8	19.7	95.5
76	10-09-92	N 5484.17 E 2223.34	528.29	100.8	106.2	21.6	19.7	95.0
77	10-09-92	N 5465.74 E 2210.17	528.07	101.4	106.2	21.0	19.7	95.5
78	10-09-92	N 5550± E 2200±	528.1	101.5	106.2	21.9	19.7	95.6
79	10-09-92	N 5550± E 2280±	527.8	104.4	106.2	21.3	19.7	98.3
80	10-09-92	N 5530± E 2185±	528.1±	103.4	106.2	20.4	19.7	97.3
81	10-09-92	N 5505± E 2190±	528.1±	102.8	106.2	21.3	19.7	96.8
82	10-09-92	N 5480± E 2140±	529±	104.3	106.2	20.7	19.7	98.2
83	10-09-92	N 5420± E 2085±	527.5±	101.8	106.2	22.9	19.7	95.8
84	10-12-92	N 5265.12 E 2120.83	528.2±	101.2	106.2	21.6	19.7	95.3
85	10-12-92	N 5260.50 E 2205.35	528.6	102.4	106.2	21.0	19.7	96.4
86	10-12-92	N 5250.45 E 2275.38	528.5	101.9	106.2	20.9	19.7	95.9
87	10-12-92	N 5127.56 E 2264.06	529.71	101.3	106.2	21.8	19.7	95.4
88	10-12-92	N 5118.97 E 2193.29	530.9	106.2	106.2	19.7	19.7	100.0
89	10-12-92	N 5126.56 E 2111.17	531.5	105.2	106.2	20.0	19.7	99.1
90	10-12-92	N 5171.69 E 2221.70	529.78	104.0	106.2	21.3	19.7	97.9

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
91	10-12-92	N 5173.56 E 2146.12	530.29	102.7	106.2	19.8	19.7	96.7
92	10-12-92	N 5171.46 E 2104.17	530.27	105.0	106.2	20.3	19.7	99.0
93	10-12-92	N 5535.45 E 2098.27	531.03	103.6	106.2	20.0	19.7	97.6
94	10-12-92	N 5528.70 E 2166.64	529.65	103.9	106.2	20.8	19.7	97.8
95	10-12-92	N 5547.05 E 2244.69	528.88	105.2	106.2	20.3	19.7	99.0
96	10-12-92	N 5489.42 E 2260.07	528.04	100.8	106.2	21.4	19.7	94.8
97	10-12-92	N 5501.52 E 2186.61	529.28	104.1	106.2	19.9	19.7	98.0
98	10-12-92	N 5489.90 E 2106.71	530.01	104.2	106.2	20.7	19.7	98.2
99	10-14-92	N 5432.50 E 2287.50	528.0	104.8	106.6	19.1	18.8	98.3
100	10-14-92	N 5428.77 E 2213.07	528.03	101.5	106.6	21.9	18.8	95.2
101	10-14-92	N 5430.38 E 2153.53	528.32	105.7	106.6	18.9	18.8	99.2
102	10-14-92	N 5434.32 E 2100.87	528.95	105.7	106.6	19.0	18.8	99.1
103	10-14-92	N 5410.84 E 2256.47	527.76	101.3	106.6	20.9	18.8	95.0
104	10-14-92	N 5525.61 E 2073.58	531.86	105.2	106.6	18.8	18.8	98.7
105	10-14-92	N 5538.49 E 2195.40	530.21	103.1	106.6	20.2	18.8	96.7
106	10-14-02	N 5529.02 E 2284.60	530.2	103.0	106.6	20.3	18.8	96.5
107	10-14-92	N 5502.17 E 2214.48	529.61	103.6	106.6	19.0	18.8	97.2
108	10-14-92	N 5497.54 E 2161.53	529.61	105.6	106.6	18.8	18.8	99.0
109	10-14-92	N 5497.97 E 2092.82	531.15	105.9	106.6	18.9	18.8	99.3

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
110	10-14-92	N 5452.14 E 2097.76	530.08	103.0	106.6	19.4	18.8	96.6
111	10-14-92	N 5460.18 E 2156.79	529.65	103.2	106.6	18.8	18.8	96.8
112	10-14-92	N 5465.75 E 2239.46	529.24	103.5	106.6	18.9	18.8	97.1
113	10-14-92	N 5437.65 E 2264.66	528.64	100.9	106.6	19.9	18.8	94.7
114	10-14-92	N 5423.66 E 2147.12	528.88	102.6	106.6	21.4	18.8	96.2
115	10-14-92	N 5382.31 E 2131.42	527.96	101.6	106.6	20.0	18.8	95.3
116	10-14-92	N 5373.46 E 2238.52	527.77	104.1	106.6	19.2	18.8	97.7
117	10-14-92	N 5217.49 E 2100.96	529.97	100.6	106.6	20.3	18.8	94.7
118	10-14-92	N 5209.06 E 2164.26	529.90	103.6	106.6	20.0	18.8	97.5
119	10-14-92	N 5221.51 E 2237.76	529.31	100.8	106.6	19.8	18.8	95.0
120	10-14-92	N 5180.46 E 2263.56	529.84	101.5	106.6	20.6	18.8	95.5
121	10-14-92	N 5175.87 E 2158.53	530.92	101.1	106.6	21.7	18.8	95.2
122	10-14-92	N 5169.66 E 2098.38	530.98	103.2	106.6	21.2	18.8	97.2
123	10-14-92	N 5134.52 E 2105.72	531.97	102.5	106.6	19.8	18.8	96.6
124	10-14-92	N 5139.90 E 2163.73	531.40	104.2	106.6	21.1	18.8	98.1
125	10-14-92	N 5128.09 E 2234.06	531.34	101.3	106.6	22.8	18.8	95.4
126	10-14-92	N 5093.60 E 2083.31	531.47	103.2	106.6	21.1	18.8	95.9
127	10-14-92	N 5089.41 E 2152.60	531.10	102.0	106.6	20.3	18.8	95.6
128	10-14-92	N 5086.42 E 2229.84	529.89	106.5	106.6	19.1	18.8	99.9

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
129	10-14-92	N 5117.06 E 2273.77	530.25	105.8	106.6	20.1	18.8	99.2
130	10-14-92	N 5111.89 E 2207.28	531.89	104.9	106.6	19.8	18.8	98.4
131	10-14-92	N 5121.17 E 2112.66	532.49	102.4	106.6	21.0	18.8	96.0
132	10-14-92	N 5295± E 2270±	521±	102.7	106.6	21.2	18.8	96.3
133	10-14-92	N 5305± E 2280±	521±	104.2	106.6	18.9	18.8	97.8
134	10-14-92	N 5305± E 2270±	521.5±	100.8	106.6	20.6	18.8	94.7
135	10-14-92	N 5300± E 2280±	521.5±	103.7	106.6	19.7	18.8	97.3
136	10-14-92	N 5300± E 2270±	522.1±	105.7	106.6	19.8	18.8	99.1
137	10-14-92	N 5300± E 2270±	523.1±	101.6	106.6	19.5	18.8	95.3
138	10-15-92	N 5305± E 2160±	525.3±	102.5	106.6	20.4	18.8	96.1
139	10-15-92	N 5300± E 2120±	525.5±	105.9	106.6	19.8	18.8	99.3
140	10-15-92	N 5300± E 2220±	525.25±	102.4	106.6	20.8	18.8	96.0
141	10-15-92	N 5105.57 E 2088.69	531.97	105.2	106.6	18.8	18.8	98.7
142	10-15-92	N 5110.37 E 2145.67	532.41	104.3	106.6	19.6	18.8	97.8
143	10-15-92	N 5110.56 E 2221.09	531.82	103.9	106.6	19.4	18.8	97.4
144	10-15-92	N 5153.00 E 2235.32	530.91	105.1	106.6	19.7	18.8	98.6
145	10-15-92	N 5145.88 E 2186.93	531.53	103.3	106.6	20.9	18.8	96.9
146	10-15-92	N 5154.32 E 2097.24	531.53	104.3	106.6	20.9	18.8	97.9
147	10-15-92	N 5538.37 E 2294.64	530.68	102.7	106.6	21.2	18.8	96.4

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
148	10-15-92	N 5534.34 E 2203.43	530.74	103.9	106.6	20.0	18.8	97.4
149	10-15-92	N 5531.05 E 2113.29	530.86	103.8	106.6	20.3	18.8	97.4
150	10-15-92	N 5484.36 E 2109.13	530.3	104.4	106.6	19.3	18.8	97.9
151	10-15-92	N 5479.63 E 2196.56	530.24	102.4	106.6	20.0	18.8	96.0
152	10-15-92	N 5481.32 E 2276.76	530.17	101.3	106.6	22.0	18.8	95.0
153	10-15-92	N 5401.16 E 2178.93	528.63	103.8	106.6	19.6	18.8	97.3
154	10-15-92	N 5352.76 E 2092.3	528.01	102.1	106.6	23.5	18.8	95.8
155	10-15-92	N 5335.03 E 2203.09	527.59	104.5	106.6	20.0	18.8	98.1
156	10-19-92	N 5241.40 E 2146.35	530.57	106.1	106.6	19.8	18.8	99.6
157	10-19-92	N 5202.61 E 2127.46	529.37	106.7	106.6	19.0	18.8	100.1
158	10-19-92	N 5107.6 E 2096.3	532.57	101.9	106.6	19.4	18.8	95.6
159	10-19-92	N 5109.6 E 2238.2	531.9	105.0	106.6	18.9	18.8	98.5
160	10-19-92	N 5175.9 E 2226.9	530.9	101.7	106.6	20.3	18.8	95.4
161	10-19-92	N 5177.6 E 2079.7	531.8	102.7	106.6	20.6	18.8	96.2
162	10-19-92	N 5315.3 E 2136.5	524.5	101.6	106.6	21.3	18.8	95.4
163	10-19-92	N 5305.2 E 2192.5	524.4	101.7	106.6	19.0	18.8	95.4
164	10-20-92	N 5523.75 E 2104.3	532.0	101.2	106.6	21.0	18.8	95.0
165	10-20-92	N 5515.2 E 2170.2	531.0	104.5	106.6	19.2	18.8	98.0
166	10-20-92	N 5520.7 E 2264.8	529.8	102.0	106.6	20.2	18.8	95.7

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
167	10-20-92	N 5485.1 E 2243.1	530.8	102.4	106.6	21.4	18.8	96.1
168	10-20-92	N 5483.1 E 2150.9	530.8	105.0	106.6	19.0	18.8	98.5
169	10-20-92	N 5464.8 E 2080.5	531.2	102.3	106.6	21.7	18.8	96.0
170	10-20-92	N 5521.5 E 2085.4	533.0	102.0	106.6	19.8	18.8	95.7
171	10-20-92	N 5519.9 E 2236.8	531.2	101.4	106.6	21.7	18.8	95.1
172	10-20-92	N 5480.5 E 2105.4	531.8	103.5	106.6	20.9	18.8	97.1
173	10-20-92	N 5481.71 E 2217.2	530.9	102.8	106.6	20.8	18.8	96.4
174	10-20-92	N 5446.35 E 2231.82	530.46	103.9	106.6	19.3	18.8	97.4
175	10-20-92	N 5443.39 E 2109.94	530.81	102.5	106.6	20.4	18.8	96.2
176	10-21-92	N 5531.70 E 2113.00	533.3	101.4	106.6	22.7	18.8	95.7
177	10-21-92	N 5630.1 E 2233.5	531.3	103.4	106.6	19.7	18.8	97.0
178	10-21-92	N 5484.2 E 2235.4	531.0	101.8	106.6	21.1	18.8	95.5
179	10-21-92	N 5483.1 E 2155.2	531.8	102.3	106.6	20.1	18.8	95.9
180	10-21-92	N 5432.1 E 2110.7	530.8	102.9	106.6	20.4	18.8	96.5
181	10-21-92	N 5435.6 E 2275.5	530.1	101.6	106.6	21.5	18.8	95.3
182	10-21-92	N 5273.6 E 2136.4	527.1	103.5	106.6	19.6	18.8	97.1
183	10-21-92	N 5296.7 E 2181.6	525.5	102.3	106.6	19.6	18.8	95.9
184	10-21-92	N 5310.1 E 2231.9	525.7	101.8	106.6	20.2	18.8	95.5
185	10-22-92	N 5288.3 E 2144.1	524.8	101.5	106.6	18.9	18.8	95.2

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
186	10-22-92	N 5279.9 E 2187.2	525.4	103.3	106.6	19.0	18.8	96.9
187	10-22-92	N 5308.3 E 2236.7	524.6	102.2	106.6	21.5	18.8	95.9
188	10-22-92	N 5293.6 E 2142.6	524.9	104.0	106.6	18.9	18.8	97.5
189	10-22-92	N 5310.1 E 2188.8	525.5	102.2	106.6	19.5	18.8	95.9
190	10-22-92	N 5291.8 E 2234.5	524.9	106.9	106.6	18.8	18.8	100.2
191	10-22-92	N 5316.0 E 2234.2	526.2	104.0	106.6	20.6	18.8	97.6
192	10-22-92	N 5298.3 E 2192.9	526.5	105.3	106.6	19.6	18.8	98.8
193	10-22-92	N 5283.0 E 2144.0	526.5	103.3	106.6	19.9	18.8	96.9
194	10-22-92	N 5101.1 E 2074.4	530.3	101.1	106.6	22.0	18.8	95.0
195	10-22-92	N 5148.7 E 2047.1	531.56	103.9	106.6	20.2	18.8	97.5
196	10-22-92	N 5228.5 E 2058.3	528.5	103.5	106.6	18.9	18.8	97.1
197	10-23-92	N 5527.2 E 2137.4	532.99	101.6	106.6	20.4	18.8	95.4
198	10-23-92	N 5535.1 E 2221.2	531.8	101.3	106.6	20.5	18.8	95.0
199	10-23-92	N 5487.1 E 2128.7	532.5	102.6	106.6	20.7	18.8	96.3
200	10-23-92	N 5488.4 E 2253.2	531.4	103.0	106.6	19.3	18.8	96.6
201	10-23-92	N 5460.0 E 2108.5	532.1	102.4	106.6	20.7	18.8	96.1
202	10-23-92	N 5450.9 E 2248.4	531.2	104.0	106.6	20.6	18.8	97.6
203	10-23-92	N 5402.6 E 2251.0	529.4	102.2	106.6	20.9	18.8	95.9
204	10-23-92	N 5406.3 E 2127.4	529.8	103.8	106.6	19.4	18.8	97.4

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
205	10-23-92	N 5184.6 E 2057.1	531.2	102.0	106.6	21.2	18.8	95.7
206	10-23-92	N 5134.8 E 2068.4	531.0	103.2	106.6	20.7	18.8	96.8
207	10-23-92	N 5135.9 E 2035.3	534.5	103.1	106.6	22.0	18.8	96.7
208	10-23-92	N 5163.6 E 2073.8	530.3	102.2	106.6	20.7	18.8	95.9
209	10-23-92	N 5189.2 E 2064.2	532.14	101.5	106.6	20.5	18.8	95.2
210	10-23-92	N 5273.9 E 2150.1	526.7	104.0	106.6	20.5	18.8	97.5
211	10-23-92	N 5292.4 E 2179.1	525.7	102.4	106.6	21.6	18.8	96.1
212	10-23-92	N 5316.0 E 2214.7	525.5	101.4	106.6	21.2	18.8	95.1
213	10-23-92	N 5303.5 E 2130.3	527.2	102.6	106.6	19.0	18.8	96.3
214	10-23-92	N 5310.3 E 2182.3	526.0	102.9	106.6	21.4	18.8	96.6
215	10-23-92	N 5291.2 E 2213.1	526.1	103.0	106.6	20.3	18.8	96.7
216	10-23-92	N 5513.5 E 2195.4	526.5	101.3	106.6	21.0	18.8	95.0
217	10-23-92	N 5300.9 E 2172.34	527.2	101.9	106.6	20.6	18.8	95.6
218	10-23-92	N 5270.9 E 2152.3	528.5	102.3	106.6	22.4	18.8	95.9
219	10-23-92	N 5122.2 E 2134.5	533.8	106.8	106.6	19.4	18.8	100.2
220	10-23-92	N 5117.0 E 2229.2	532.8	101.6	106.6	20.9	18.8	95.3
221	10-23-92	N 5177.6 E 2224.6	531.4	103.0	106.6	20.8	18.8	96.6
222	10-23-92	N 5185.3 E 2132.2	532.2	101.7	106.6	21.2	18.8	95.4
223	10-23-92	N 5214.9 E 2139.3	531.3	102.2	106.6	19.1	18.8	95.9

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
224	10-23-92	N 5216.5 E 2228.1	530.8	101.5	106.6	21.3	18.8	95.2
225	10-26-92	N 5506.5 E 2113.0	533.3	104.8	109.1	20.7	17.9	96.0
226	10-26-92	N 5504.77 E 2240.00	531.81	105.9	109.1	20.3	17.9	97.0
227	10-26-92	N 5461.5 E 2106.3	532.34	104.0	109.1	19.3	17.9	95.4
228	10-26-92	N 5453.5 E 2269.1	531.32	104.0	109.1	20.2	17.9	95.4
229	10-26-92	N 5397.5 E 2278.7	529.38	105.1	109.1	20.1	17.9	96.3
230	10-26-92	N 5404.7 E 2105.9	530.2	103.8	109.1	20.0	17.9	95.2
231	10-26-92	N 5345.0 E 2117.7	528.8	103.5	109.1	20.1	17.9	94.9
232	10-26-92	N 5377.0 E 2234.0	529.10	104.2	109.1	19.5	17.9	95.5
233	10-26-92	N 5327.3 E 2195.5	527.82	105.8	109.1	19.2	17.9	97.0
234	10-26-92	N 5278.7 E 2208.5	528.8	104.7	109.1	19.4	17.9	95.9
235	10-26-92	N 5301.9 E 2162.4	527.7	106.5	109.1	18.9	17.9	97.6
236	10-26-92	N 5221.9 E 2036.4	533.0	105.8	109.1	20.1	17.9	97.0
237	10-26-92	N 5162.3 E 2043.6	534.0	104.3	109.1	18.2	17.9	95.6
238	10-26-92	N 5125.66 E 2065.4	532.9	107.2	109.1	18.0	17.9	98.3
239	10-26-92	N 5255± E 2255±	528±	105.5	109.1	19.8	17.9	96.7
240	10-27-92	N 5534.1 E 2119.6	534.2	107.1	109.1	18.3	17.9	98.2
241	10-27-92	N 5524.6 E 2228.2	532.8	105.5	109.1	19.6	17.9	96.7
242	10-27-92	N 5473.63 E 2257.1	532.34	104.0	109.1	18.4	17.9	95.4

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
243	10-27-92	N 5467.1 E 2180.6	533.0	105.1	109.1	18.8	17.9	96.3
244	10-27-92	N 5448.1 E 2109.6	532.5	105.6	109.1	20.4	17.9	96.8
245	10-27-92	N 5423.6 E 2195.7	531.3	104.8	109.1	20.2	17.9	96.6
246	10-27-92	N 5371.5 E 2256.9	529.5	105.1	109.1	18.1	17.9	96.3
247	10-27-92	N 5374.9 E 2162.5	529.8	103.6	109.1	20.9	17.9	95.0
248	10-27-92	N 5290.9 E 2181.2	528.5	103.6	109.1	20.4	17.9	95.0
249	10-27-92	N 5313.2 E 2224.1	528.31	103.5	109.1	19.5	17.9	94.9
250	10-27-92	N 5276.7 E 2140.1	528.8	103.3	109.1	19.4	17.9	94.7
251	10-27-92	N 5179.1 E 2154.2	532.17	107.1	109.1	19.2	17.9	98.1
252	10-27-92	N 5207.6 E 2026.4	534.0	108.4	109.1	18.4	17.9	99.4
253	10-27-92	N 5167.3 E 2074.5	531.5	104.1	109.1	19.0	17.9	95.4
254	10-27-92	N 5143.9 E 2033.8	535.0	104.3	109.1	18.0	17.9	95.6
255	10-28-92	N 5520.0 E 2179.7	533.7	103.6	109.1	18.5	17.9	95.0
256	10-28-92	N 5454.9 E 2261.0	532.26	103.6	109.1	18.4	17.9	94.9
257	10-28-92	N 5450.5 E 2176.1	532.4	105.2	109.1	18.8	17.9	96.5
258	10-28-92	N 5398.0 E 2167.1	530.9	104.7	109.1	19.0	17.9	96.0
259	10-28-92	N 5396.6 E 2249.7	530.4	104.1	109.1	19.8	17.9	95.5
260	10-29-92	N 5331.31 E 2173.73	528.96	105.2	109.1	18.8	17.9	96.4
261	10-29-92	N 5305.2 E 2212.6	528.73	103.4	109.1	20.1	17.9	94.8

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION (APPROXIMATE)	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
262	10-29-92	N 5278.8 E 2177.88	528.65	106.6	109.1	18.5	17.9	97.7
263	10-29-92	N 5432.1 E 2060.3	531.1	107.6	109.1	18.9	17.9	98.6
264	10-29-92	N 5448.18 E 2049.81	532.5	108.7	109.1	17.9	17.9	99.6
265	10-29-92	N 5493.7 E 2065.89	531.33	103.4	109.1	20.4	17.9	95.0
266	10-29-92	N 5476.75 E 2066.34	531.48	105.1	109.1	18.9	17.9	96.3
267	10-29-92	N 5411.68 E 2061.20	531.02	106.4	109.1	18.9	17.9	97.5
268	10-29-92	N 5339.2 E 2057.5	529.69	106.2	109.1	20.0	17.9	97.3
269	10-29-92	N 5121.38 E 2136.1	534.5	106.0	109.1	20.2	17.9	97.2
270	10-29-92	N 5124.9 E 2051.7	534.9	106.3	109.1	18.1	17.9	97.4
271	10-29-92	N 5180.1 E 2064.2	532.8	106.7	109.1	18.8	17.9	97.8
272	10-29-92	N 5206.28 E 2042.3	534.3	104.5	109.1	19.7	17.9	95.8
273	10-29-92	N 5336.93 E 2238.3	531.1	105.8	109.1	19.9	17.9	97.0
274	10-29-92	N 5227.1 E 2134.9	531.6	109.5	109.1	17.9	17.9	100.3
275	10-29-92	N 5422.3 E 2059.1	531.7	108.6	109.1	18.1	17.9	99.5
276	10-29-92	N 5493.8 E 2064.4	531.97	103.9	109.1	20.3	17.9	95.9

NOTE: The permit requires compaction to at least 95 percent of the maximum laboratory dry density at or above optimum moisture using ASTM D698 Standard Proctor.

Failed tests were not reported, however, all areas were corrected as warranted based upon the test results.

Michael P. McConnell
Technician

- REPORT OF SOIL COMPACTION TESTING -

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

PROJECT: Cell 3 - Clay Liner
REPORT NUMBER: 89-118A-3

DATE: June, 1993
CLIENT: City Water, Light & Power

JOB NUMBER: 89-118A
CONTRACTOR: Siciliano, Inc.

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
277	12-04-92	N 5515.7 E 2163.2	534.7	105.2	109.1	19.7	17.9	96.5
278	12-04-92	N 5507.6 E 2206.9	534.7	103.5	109.1	22.7	17.9	94.9
279	12-04-92	N 5485.4 E 2172.8	534.2	103.3	109.1	20.6	17.9	94.7
280	12-04-92	N 5444.1 E 2241.9	532.7	104.2	109.1	20.6	17.9	95.6
281	12-04-92	N 5305.6 E 2070.6	527.8	108.3	112.2	17.8	13.8	96.5
282	12-04-92	N 5307.8 E 2037.6	528.5	111.3	112.2	16.9	13.8	99.2
283	12-04-92	N 5303.6 E 2066.5	529.1	109.3	112.2	16.3	13.8	97.4
284	12-04-92	N 5300.1 E 2052.5	529.6	112.7	112.2	15.0	13.8	100.5
285	12-04-92	N 5401.6 E 2080.5	530.9	111.9	112.2	15.9	13.8	99.8
286	12-04-92	N 5443.7 E 2062.8	532.2	109.9	112.2	17.2	13.8	98.0
287	12-04-92	N 5287.2 E 2056.4	529.8	113.7	112.2	14.1	13.8	101.3
288	12-04-92	N 5292.3 E 2092.7	529.1	107.2	112.2	16.8	13.8	95.5
289	12-04-92	N 5574.3 E 2277.2	536.2	107.8	112.2	18.2	13.8	96.1
290	12-04-92	N 5570.3 E 2118.8	537.9	112.5	112.2	15.5	13.8	100.3
291	12-04-92	N 5510.5 E 2011.0	537.8	110.0	112.2	16.6	13.8	98.0
292	12-04-92	N 5433.1 E 2011.7	535.9	110.8	112.2	16.1	13.8	98.8

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
293	12-04-92	N 5213.3 E 2006.5	538.3	112.0	112.2	17.6	13.8	99.8
294	12-04-92	N 5109.6 E 2000.7	540.7	110.9	112.2	17.5	13.8	98.8
295	12-04-92	N 5319.6 E 2018.9	534.1	109.6	112.2	17.4	13.8	97.7
296	12-05-92	N 5465.2 E 2028.9	534.1	108.6	112.2	17.1	13.8	96.8
297	12-05-92	± N 5450.0 E 2150.0	± 534.5	109.9	112.2	16.7	13.8	98.0
298	12-05-92	N 5343.8 E 2030.6	532.5	109.9	112.2	15.6	13.8	98.0
299	12-05-92	± N 5300.0 E 2150.0	± 533.0	107.3	112.2	17.6	13.8	95.6
300	12-05-92	± N 5225.0 E 2200.0	± 533.0	108.9	112.2	17.8	13.8	97.0
301	12-05-92	N 5227.9 E 2036.4	534.3	110.4	112.2	15.6	13.8	98.4
302	12-05-92	± N 5150.0 E 2275.0	± 535.0	114.6	112.2	15.9	13.8	102.1
303	12-05-92	± N 5300.0 E 2275.0	± 528.0	113.2	112.2	16.0	13.8	100.9
304	12-05-92	N 5568.7 E 2234.0	536.6	110.1	112.2	16.2	13.8	98.2
305	12-05-92	N 5464.5 E 2043.0	533.1	106.9	112.2	17.7	13.8	95.3
306	12-05-92	N 5442.4 E 2013.8	535.0	111.2	112.2	17.4	13.8	99.4
307	12-05-92	N 5299.5 E 2076.3	530.1	108.1	112.2	18.2	13.8	96.4
308	12-05-92	N 5280.0 E 2022.0	533.1	111.5	112.2	16.6	13.8	99.4
309	12-05-92	N 5570.3 E 2106.5	538.0	108.0	112.2	19.1	13.8	96.3
310	12-05-92	N 5569.6 E 2152.6	538.4	110.6	112.2	18.0	13.8	98.6
311	12-05-92	N 5569.0 E 2252.5	536.8	111.7	112.2	16.9	13.8	99.6
312	12-05-92	N 5422.2 E 2030.2	533.6	114.2	112.2	15.1	13.8	101.8
313	12-05-92	N 5329.2 E 2028.9	533.0	111.2	112.2	16.9	13.8	99.1

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
314	12-05-92	N 5253.9 E 2024.7	533.97	111.3	112.2	16.6	13.8	99.2
315	12-05-92	N 5230.7 E 2062.2	532.3	111.7	112.2	15.8	13.8	99.6
316	12-05-92	N 5289.9 E 2059.8	531.4	110.5	112.2	17.5	13.8	98.5
317	12-05-92	N 5355.1 E 2057.6	531.4	111.7	112.2	16.5	13.8	99.6
318	12-05-92	N 5424.1 E 2056.3	532.8	109.9	112.2	17.6	13.8	97.9
319	12-05-92	N 5117.8 E 2087.4	534.0	111.3	112.2	15.9	13.8	99.2
320	12-05-92	N 5183.2 E 2086.6	532.5	107.1	112.2	17.1	13.8	95.4
321	12-05-92	N 5261.2 E 2088.8	531.2	111.3	112.2	17.0	13.8	99.2
322	12-05-92	N 5281.0 E 2114.3	530.8	109.5	112.2	17.9	13.8	97.6
323	12-05-92	N 5327.8 E 2092.7	530.8	109.8	112.2	17.4	13.8	97.9
324	12-05-92	N 5384.5 E 2123.1	531.5	110.9	112.2	16.6	13.8	98.8
325	12-05-92	N 5429.6 E 2093.4	532.8	113.3	112.2	16.0	13.8	100.9
326	12-05-92	N 5508.2 E 2075.0	534.3	109.6	112.2	16.7	13.8	97.7
327	12-07-92	N 5422.5 E 2070.6	533.3	106.2	112.2	17.8	13.8	94.7
328	12-07-92	N 5565.1 E 2083.1	537.4	112.5	112.2	17.2	13.8	100.3
329	12-07-92	N 5571.4 E 2160.6	538.3	112.2	112.2	16.1	13.8	100.0
330	12-07-92	N 5569.6 E 2245.4	536.5	113.0	112.2	15.9	13.8	100.7
331	12-07-92	N 5245.5 E 2009.6	536.2	112.5	112.2	15.1	13.8	100.3
332	12-07-92	N 5304.8 E 2012.1	535.7	109.9	112.2	17.7	13.8	98.0
333	12-07-92	N 5316.7 E 2013.3	534.8	110.9	112.2	15.6	13.8	98.9
334	12-07-92	N 5400.9 E 2014.4	534.7	108.5	112.2	17.3	13.8	96.7

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
335	12-07-92	N 5568.5 E 2132.5	538.5	111.1	112.2	16.9	13.8	99.0
336	12-07-92	N 5572.1 E 2177.5	538.9	110.8	112.2	16.5	13.8	98.8
337	12-07-92	N 5572.6 E 2248.3	538.1	107.0	112.2	17.9	13.8	95.4
338	12-07-92	N 5465.6 E 2129.0	533.8	112.2	112.2	16.5	13.8	100.7
339	12-07-92	N 5357.1 E 2127.1	530.9	111.1	112.2	16.9	13.8	99.0
340	12-07-92	N 5272.5 E 2129.4	530.3	110.3	112.2	16.3	13.8	98.3
341	12-07-92	N 5248.2 E 2107.7	531.5	112.1	112.2	16.1	13.8	99.9
342	12-07-92	N 5337.6 E 2106.8	530.7	114.0	112.2	16.5	13.8	101.6
343	12-07-92	N 5427.7 E 2106.1	531.6	111.0	112.2	16.2	13.8	98.9
344	12-07-92	N 5495.7 E 2080.8	534.1	112.2	112.2	16.9	13.8	100.0
345	12-07-92	N 5390.5 E 2084.5	531.8	111.1	112.2	16.9	13.8	99.0
346	12-07-92	N 5290.8 E 2079.2	531.0	107.3	112.2	18.0	13.8	95.6
347	12-07-92	± N 5150.0 E 2005.0	538.0	107.8	112.2	17.6	13.8	96.0
348	12-07-92	± N 5300.0 E 2000.0	± 538.0	110.3	112.2	16.8	13.8	98.3
349	12-07-92	± N 5400.0 E 2000.0	± 538.0	110.5	112.2	16.2	13.8	98.5
350	12-07-92	N 5572.18 E 2156.1	539.1	111.4	112.2	16.6	13.8	99.3
351	12-07-92	N 5577.1 E 2197.2	539.9	109.0	112.2	17.8	13.8	97.2
352	12-07-92	N 5574.9 E 2252.9	539.2	109.4	112.2	17.2	13.8	97.5
353	12-08-92	N 5380.8 E 2009.9	538.4	113.1	112.2	15.6	13.8	100.8
354	12-08-92	N 5320.2 E 2008.1	539.0	110.8	112.2	16.5	13.8	98.7
355	12-08-92	N 5242.9 E 2004.6	538.7	106.7	112.2	19.5	13.8	95.1

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
356	12-08-92	N 5321.5 E 2101.3	531.0	110.5	112.2	16.7	13.8	98.5
357	12-08-92	N 5250.0 E 2103.0	531.6	109.3	112.2	16.0	13.8	97.4
358	12-08-92	N 5191.8 E 2105.6	532.8	110.7	112.2	15.4	13.8	98.7
359	12-08-92	N 5410.8 E 2113.5	532.5	108.1	112.2	16.4	13.8	96.4
360	12-08-92	N 5221.2 E 2143.3	532.0	107.9	112.2	17.9	13.8	96.2
361	12-08-92	N 5279.7 E 2148.9	530.6	110.6	112.2	16.4	13.8	98.6
362	12-08-92	N 5348.7 E 2153.9	530.9	106.9	112.2	15.6	13.8	95.3
363	12-08-92	N 5424.3 E 2157.4	532.5	109.5	112.2	16.6	13.8	97.5
364	12-09-92	N 5297.9 E 2274.2	525.9	107.8	112.2	16.9	13.8	96.0
365	12-09-92	N 5302.6 E 2277.8	526.4	108.7	112.2	16.3	13.8	96.9
366	12-09-92	N 5301.9 E 2272.6	527.0	108.9	112.2	17.6	13.8	97.0
367	12-09-92	N 5302.9 E 2270.9	527.9	106.2	112.2	20.1	13.8	94.6
368	12-09-92	N 5305.6 E 2262.9	528.0	107.3	112.2	18.6	13.8	95.6
369	12-09-92	N 5148.8 E 1997.4	542.0	106.1	112.2	16.0	13.8	94.5
370	12-09-92	N 5228.9 E 2000.6	541.8	108.9	112.2	17.8	13.8	97.0
371	12-09-92	N 5329.6 E 2004.6	540.5	107.8	112.2	18.1	13.8	96.1
372	12-09-92	N 5176.3 E 1998.3	542.6	109.9	112.2	17.3	13.8	97.9
373	12-09-92	N 5243.6 E 2000.7	542.2	108.8	112.2	17.9	13.8	96.9
374	12-09-92	N 5314.6 E 2002.8	541.2	109.3	112.2	16.7	13.8	97.4
375	12-09-92	N 5162.3 E 1996.9	543.8	109.2	112.2	17.2	13.8	97.3
376	12-09-92	N 5225.8 E 1998.6	542.9	109.6	112.2	17.6	13.8	97.6

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
377	12-09-92	N 5318.2 E 2001.9	541.4	107.3	112.2	18.3	13.8	95.6
378	12-09-92	N 5325.9 E 2000.9	542.0	109.8	112.2	17.1	13.8	97.8
379	12-09-92	N 5264.8 E 1997.6	543.6	110.0	112.2	17.4	13.8	98.0
380	12-09-92	N 5172.4 E 1998.4	544.7	109.3	112.2	16.7	13.8	97.4
381	12-12-92	± N 5300.0 E 2285.0	± 526.0	107.6	112.2	16.9	13.8	94.9
382	12-12-92	± N 5290.0 E 2275.0	± 526.5	108.4	112.2	14.6	13.8	95.7
383	12-12-92	± N 5295.0 E 2270.0	± 527.0	107.8	112.2	17.9	13.8	95.1
384	12-12-92	± N 5300.0 E 2270.0	± 527.5	109.5	112.2	16.9	13.8	96.6
385	12-12-92	± N 5290.0 E 2285.0	± 528.0	107.9	112.2	16.0	13.8	95.2
386	12-12-92	± N 5255.0 E 1995.0	± 543.0	109.2	112.2	16.9	13.8	96.4
387	12-12-92	± N 5415.0 E 1995.0	± 541.0	111.6	112.2	16.4	13.8	98.5
388	12-12-92	± N 5475.0 E 1995.0	± 542.0	107.5	112.2	18.9	13.8	94.8
389	12-12-92	± N 5185.0 E 1995.0	± 543.5	108.6	112.2	17.0	13.8	95.9
390	12-12-92	± N 5275.0 E 1995.0	± 543.5	107.5	112.2	17.3	13.8	94.8
391	12-12-92	± N 5410.0 E 1995.0	542.6	108.0	112.2	17.4	13.8	95.3
392	12-13-92	± N 5570.0 E 2100.0	± 542.0	114.4	112.2	15.1	13.8	100.9
393	12-13-92	± N 5570.0 E 2250.0	± 542.0	107.7	112.2	16.2	13.8	95.0
394	12-13-92	± N 5250.0 E 1995.0	± 545.0	108.2	112.2	18.5	13.8	95.5
395	12-13-92	± N 5400.0 E 1995.0	± 545.0	108.0	112.2	17.6	13.8	95.3
396	12-13-92	± N 5550.0 E 1995.0	± 544.0	109.9	112.2	15.3	13.8	97.0
397	12-13-92	± N 5100.0 E 1990.0	± 545.5	109.5	112.2	16.8	13.8	96.6

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
398	12-13-92	± N 5250.0 E 1990.0	± 545.5	107.3	112.2	18.2	13.8	94.7
399	12-13-92	± N 5300.0 E 2265.0	± 530.0	107.6	112.2	17.5	13.8	94.9
400	12-13-92	± N 5285.0 E 2270.0	± 530.0	111.9	112.2	15.4	13.8	98.7
401	12-13-92	± N 5300.0 E 2280.0	± 530.5	113.3	112.2	15.3	13.8	99.8
402	12-13-92	± N 5310.0 E 2270.0	± 530.5	112.1	112.2	15.2	13.8	98.9
403	12-14-92	± N 5250.0 E 1995.0	± 546.0	108.0	112.2	17.2	13.8	95.3
404	12-14-92	± N 5355.0 E 1995.0	± 546.0	107.9	112.2	18.2	13.8	95.3
405	12-14-92	± N 5425.0 E 1995.0	± 546.0	109.2	112.2	17.8	13.8	96.4
406	12-14-92	± N 5575.0 E 2200.0	± 543.0	109.6	112.2	17.1	13.8	96.7
407	12-14-92	± N 5575.0 E 2100.0	± 543.0	107.5	112.2	18.0	13.8	94.9
408	06-23-93	N 5579.0 E 2183.1	542.5	106.8	112.2	17.6	13.8	95.2
409	06-23-93	N 5575.9 E 2072.9	543.2	109.6	112.2	17.7	13.8	97.7
410	06-23-93	N 5535.5 E 1997.4	544.9	109.6	112.2	17.3	13.8	97.7
411	06-23-93	N 5316.5 E 1995.2	545.8	108.5	112.2	19.1	13.8	96.7
412	06-23-93	N 5125.5 E 1990.0	545.9	108.2	112.2	18.4	13.8	96.4
413	06-23-93	N 5145.2 E 1991.0	546.2	109.6	112.2	18.0	13.8	97.7
414	06-23-93	N 5287.6 E 1992.7	546.6	107.5	112.2	18.4	13.8	95.8
415	06-23-93	N 5472.2 E 1996.2	545.9	107.3	112.2	19.0	13.8	95.6
416	06-23-93	N 5576.2 E 2110.2	543.4	110.1	112.2	15.4	13.8	98.1
417	06-23-93	N 5578.9 E 2205.1	543.1	107.4	112.2	17.1	13.8	95.7
418	06-23-93	N 5426.2 E 2103.7	531.3	108.6	112.2	19.3	13.8	96.8

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
419	06-23-93	N 5375.0 E 2139.8	529.9	107.1	112.2	18.6	13.8	95.5
420	06-23-93	N 5318.9 E 2177.4	528.4	108.3	112.2	18.4	13.8	96.5
421	06-23-93	N 5249.6 E 2221.3	528.7	106.4	112.2	19.9	13.8	95.0
422	06-23-93	N 5191.4 E 2252.4	529.5	106.7	112.2	19.9	13.8	95.1
423	06-23-93	N 5232.5 E 2233.6	529.9	107.3	112.2	16.8	13.8	95.7
424	06-23-93	N 5317.9 E 2178.1	529.6	106.3	112.2	16.0	13.8	94.8
425	06-23-93	N 5400.0 E 2122.2	531.3	108.6	112.2	15.6	13.8	96.8
426	06-23-93	N 5371.0 E 2142.0	530.6	112.2	112.2	15.5	13.8	100.0
427	06-23-93	N 5194.6 E 2246.8	530.5	109.6	112.2	15.6	13.8	97.7
428	06-23-93	N 5584.9 E 2204.9	545.0	109.5	112.2	17.2	13.8	97.6
429	06-23-93	N 5581.9 E 2125.2	545.1	108.9	112.2	17.3	13.8	97.1
430	06-23-93	N 5575.3 E 2014.0	545.9	109.3	112.2	15.8	13.8	97.4
431	06-23-93	N 5538.0 E 1995.6	546.1	110.9	112.2	16.5	13.8	98.8
432	06-23-93	N 5386.5 E 1996.1	546.8	111.4	112.2	15.8	13.8	99.3
433	06-23-93	N 5227.3 E 1994.8	548.1	111.5	112.2	15.4	13.8	99.3
434	06-23-93	N 5117.2 E 1990.0	548.0	111.9	112.2	16.1	13.8	99.7
435	06-24-93	N 5348.7 E 2069.2	531.3	111.6	112.2	16.9	13.8	99.4
436	06-24-93	N 5428.0 E 2069.9	532.9	112.0	112.2	16.1	13.8	99.8
437	06-24-93	N 5392.4 E 2051.3	532.3	111.8	112.2	17.1	13.8	99.6
438	06-24-93	N 5487.5 E 2053.1	532.5	112.8	112.2	15.4	13.8	100.5
439	06-24-93	N 5362.9 E 2035.8	532.8	112.6	112.2	16.0	13.8	100.4

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
440	06-24-93	N 5533.0 E 2063.1	535.0	112.2	112.2	16.8	13.8	100.0
441	06-28-93	N 5369.0 E 2041.5	533.1	111.6	112.2	15.6	13.8	99.4
442	06-28-93	N 5391.0 E 2069.5	532.6	112.5	112.2	17.2	13.8	100.2
443	06-28-93	N 5468.0 E 2070.8	533.3	111.5	112.2	17.0	13.8	99.4
444	06-28-93	N 5490.0 E 2037.2	534.2	111.7	112.2	15.4	13.8	99.6

NOTE: The permit requires compaction to at least 95 percent of the maximum laboratory dry density at or above optimum moisture using ASTM D698 Standard Proctor.

Failed tests were not reported, however, all areas were corrected as warranted based upon the test results.

Mike McConnell
Technician

- REPORT OF SOIL COMPACTION TESTING -

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

PROJECT: Cell 3 - Clay Liner
REPORT NUMBER: 93-119-1

DATE: September, 1993
CLIENT: City Water, Light & Power

JOB NUMBER: 93-119
CONTRACTOR: Siciliano, Inc.

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
1	07-06-93	N 5388.3 E 2057.0	535.5	106.4	112.2	17.0	13.8	95.0
2	07-06-93	N 5428.7 E 2062.1	533.7	108.9	112.2	16.0	13.8	97.1
3	07-06-93	N 5484.5 E 2049.2	534.7	109.6	112.2	17.3	13.8	97.7
4	07-06-93	N 5311.8 E 2065.9	531.5	112.1	112.2	16.5	13.8	99.9
5	07-06-93	N 5241.9 E 2074.3	531.4	110.8	112.2	16.8	13.8	98.7
6	07-06-93	N 5157.1 E 2069.2	533.8	108.8	112.2	18.3	13.8	97.0
7	07-06-93	N 5254.8 E 2044.7	533.3	108.9	112.2	18.1	13.8	97.1
8	07-06-93	N 5199.2 E 2044.7	534.2	112.7	112.2	17.7	13.8	100.4
9	07-06-93	N 5302.6 E 2034.6	534.0	107.4	112.2	17.7	13.8	95.7
10	07-06-93	N 5361.2 E 2064.1	533.0	111.3	112.2	16.5	13.8	99.2
11	07-06-93	N 5406.2 E 2060.6	533.9	111.4	112.2	15.5	13.8	99.3
12	07-06-93	N 5462.4 E 2055.6	534.4	111.7	112.2	16.7	13.8	99.6
13	07-06-93	N 5158.4 E 2044.1	535.1	111.3	112.2	15.4	13.8	99.2
14	07-06-93	N 5225.2 E 2039.6	534.7	113.1	112.2	15.5	13.8	100.8
15	07-06-93	N 5295.2 E 2044.2	533.4	111.0	112.2	16.2	13.8	98.9
16	07-06-93	N 5584.2 E 2218.5	545.0	109.1	112.2	18.1	13.8	97.2
17	07-06-93	N 5582.9 E 2159.8	545.9	111.5	112.2	15.2	13.8	99.4
18	07-06-93	N 5583.2 E 2057.1	546.1	113.0	112.2	15.8	13.8	100.7
19	07-06-93	N 5506.4 E 1993.4	546.7	110.8	112.2	18.1	13.8	98.7

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
20	07-06-93	N 5372.7 E 1991.1	547.0	109.6	112.2	17.2	13.8	97.7
21	07-06-93	N 5281.8 E 1988.6	548.3	111.0	112.2	17.8	13.8	98.9
22	07-06-93	N 5474.0 E 1991.5	547.2	109.8	112.2	16.1	13.8	97.9
23	07-06-93	N 5301.2 E 1989.8	548.5	109.5	112.2	15.3	13.8	97.6
24	07-06-93	N 5142.7 E 1986.6	549.5	111.1	112.2	15.5	13.8	99.0
25	07-06-93	N 5583.5 E 2028.8	546.5	110.8	112.2	16.3	13.8	98.8
26	07-06-93	N 5584.3 E 2094.2	546.4	111.2	112.2	16.5	13.8	99.1
27	07-06-93	N 5585.4 E 2184.6	546.2	108.3	112.2	16.8	13.8	96.5
28	07-09-93	N 5220.7 E 1986.1	549.8	108.5	112.2	17.7	13.8	96.7
29	07-09-93	N 5322.3 E 1991.9	549.0	109.1	112.2	16.9	13.8	97.2
30	07-09-93	N 5479.9 E 1992.3	547.4	110.2	112.2	16.5	13.8	98.2
31	07-09-93	N 5584.3 E 2117.5	547.2	107.6	112.2	17.6	13.8	95.9
32	07-09-93	N 5583.2 E 2225.4	545.4	107.7	112.2	19.2	13.8	96.0
33	07-09-93	N 5175.1 E 1985.1	550.1	112.4	112.2	16.5	13.8	100.1
34	07-09-93	N 5256.7 E 1992.0	549.3	109.5	112.2	16.7	13.8	97.6
35	07-09-93	N 5494.6 E 2042.0	536.4	107.3	112.2	18.1	13.8	95.7
36	07-09-93	N 5426.1 E 2034.2	536.0	111.2	112.2	16.6	13.8	99.1
37	07-09-93	N 5317.3 E 2035.2	535.0	109.1	112.2	17.9	13.8	97.2
38	07-09-93	N 5179.8 E 2038.7	535.7	107.7	112.2	17.6	13.8	96.0
39	07-13-93	N 5133.2 E 1982.5	550.1	107.4	112.2	16.2	13.8	95.7
40	07-13-93	N 5216.4 E 1984.3	550.4	106.9	112.2	17.2	13.8	95.3
41	07-13-93	N 5329.3 E 1988.4	549.8	106.9	112.2	17.9	13.8	95.3

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
42	07-13-93	N 5565.8 E 1990.5	547.6	107.2	112.2	19.2	13.8	95.6
43	07-13-93	N 5586.2 E 2046.2	548.2	111.3	112.2	17.0	13.8	99.2
44	07-13-93	N 5585.2 E 2149.4	547.7	111.5	112.2	17.3	13.8	99.3
45	07-13-93	N 5290.8 E 2061.9	533.4	108.6	112.2	18.4	13.8	96.8
46	07-13-93	N 5179.9 E 2062.3	534.1	107.3	112.2	18.7	13.8	95.6
47	07-13-93	N 5385.3 E 2047.6	535.1	108.2	112.2	17.7	13.8	96.5
48	07-13-93	N 5432.2 E 2060.6	534.6	108.9	112.2	18.3	13.8	97.1
49	07-20-93	N 5521.8 E 2058.0	536.4	106.3	112.0	19.1	15.7	94.9
50	07-20-93	N 5497.1 E 2033.1	536.8	108.5	112.0	17.1	15.7	96.9
51	07-20-93	N 5453.2 E 2054.0	535.9	108.8	112.0	17.2	15.7	97.2
52	07-20-93	N 5425.9 E 2028.6	537.0	106.9	112.0	17.6	15.7	95.5
53	07-20-93	N 5455.5 E 2092.3	532.7	108.8	112.0	17.3	15.7	97.1
54	07-20-93	N 5404.9 E 2110.8	531.7	113.5	112.0	16.7	15.7	101.3
55	07-20-93	N 5355.4 E 2091.6	531.2	111.7	112.0	18.0	15.7	99.7
56	07-20-93	N 5313.7 E 2119.6	530.4	112.2	112.0	16.4	15.7	100.2
57	07-20-93	N 5263.0 E 2096.2	530.6	110.1	112.0	18.4	15.7	98.3
58	07-20-93	N 5227.9 E 2120.1	530.8	109.8	112.0	18.3	15.7	98.0
59	07-21-93	N 5376.4 E 2219.3	530.8	108.0	112.0	19.4	15.7	96.4
60	07-21-93	N 5468.0 E 2212.7	532.6	108.9	112.0	18.7	15.7	97.2

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
61	07-21-93	N 5493.7 E 2181.8	533.1	107.8	112.0	19.9	15.7	96.2
62	07-21-93	N 5414.8 E 2134.2	531.9	108.0	112.0	17.2	15.7	96.0
63	07-21-93	N 5229.8 E 2139.4	530.4	108.9	112.0	19.6	15.7	96.0
64	07-21-93	N 5176.7 E 2110.3	532.0	107.8	112.0	16.8	15.7	98.3
65	07-28-93	N 5587.6 E 2207.5	547.6	107.9	112.0	16.9	15.7	96.3
66	07-28-93	N 5585.9 E 2081.8	548.5	107.0	112.0	18.0	15.7	95.6
67	07-28-93	N 5544.2 E 1989.2	548.0	106.4	112.0	18.7	15.7	95.0
68	07-28-93	N 5464.7 E 1987.3	548.9	106.7	112.0	18.1	15.7	95.3
69	07-28-93	N 5364.3 E 1987.3	549.5	106.7	112.0	18.2	15.7	95.3
70	07-28-93	N 5265.5 E 1987.2	550.4	106.7	112.0	18.4	15.7	95.3
71	07-29-93	N 5513.1 E 2031.1	538.9	108.1	107.6	17.1	17.5	100.5
72	07-29-93	N 5481.8 E 2026.1	539.0	101.4	107.6	22.0	17.5	95.2
73	07-30-93	N 5339.9 E 2212.5	531.6	107.1	109.1	19.4	17.9	98.2
74	07-30-93	N 5420.5 E 2216.8	532.6	107.7	109.1	18.8	17.9	98.7
75	07-30-93	N 5484.9 E 2219.2	534.5	105.4	109.1	19.2	17.9	96.6
76	07-30-93	N 5436.2 E 2125.2	533.8	108.0	109.1	19.4	17.9	99.0
77	07-30-93	N 5332.6 E 2122.8	531.7	108.2	109.1	19.0	17.9	99.2
78	07-30-93	N 5385.9 E 2120.2	532.7	107.7	109.1	19.1	17.9	98.7
79	07-30-93	N 5134.6 E 2200.0	532.1	104.7	109.1	21.6	17.9	96.0

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
80	07-30-93	N 5154.2 E 2190.3	532.1	108.4	109.1	19.2	17.9	99.4
81	07-30-93	N 5142.3 E 2169.2	533.2	105.4	109.1	19.8	17.9	96.6
82	07-30-93	N 5139.1 E 2223.0	532.3	105.3	109.1	19.5	17.9	96.5
83	07-30-93	N 5138.8 E 2137.7	529.9	110.2	109.1	18.4	17.9	101.0
84	07-30-93	N 5133.9 E 2192.0	530.0	107.7	109.1	18.0	17.9	98.7
85	07-30-93	N 5141.4 E 2219.3	533.2	107.5	109.1	18.0	17.9	98.5
86	07-31-93	N 5251.9 E 2100.1	531.6	106.8	109.1	18.3	17.9	97.9
87	07-31-93	N 5202.2 E 2103.1	532.6	108.8	109.1	19.5	17.9	99.7
88	07-31-93	N 5173.2 E 2178.7	532.8	107.2	109.1	19.2	17.9	98.3
89	07-31-93	N 5134.8 E 2150.2	534.0	109.7	109.1	19.2	17.9	100.5
90	07-31-93	N 5125.8 E 2176.7	533.2	104.7	109.1	19.1	17.9	96.0
91	08-06-93	N 5181.2 E 1980.6	551.3	108.9	109.1	18.7	17.9	99.8
92	08-06-93	N 5300.9 E 1985.1	551.3	107.8	109.1	19.4	17.9	98.8
93	08-06-93	N 5469.9 E 1986.5	549.8	106.7	109.1	18.5	17.9	97.8
94	08-06-93	N 5172.4 E 2039.1	536.3	112.9	112.0	17.9	15.7	100.8
95	08-09-93	N 5480.0 E 1985.9	549.9	109.4	112.0	18.1	15.7	97.7
96	08-09-93	N 5589.6 E 2070.1	549.3	109.3	112.0	17.3	15.7	97.6
97	08-09-93	N 5592.4 E 2193.8	549.1	111.4	112.0	18.1	15.7	99.5

				DRY DENSITY-LBS./CU.FT.		MOISTURE CONTENT - %		
TEST NO.	TEST DATE	TEST LOCATION	TEST ELEVATION	FIELD	MAXIMUM	FIELD	OPTIMUM	PERCENT COMPACTION
98	09-13-93	N 5599.4 E 2191.7	553.3	103.3	109.1	19.1	17.9	94.7
99	09-13-93	N 5588.7 E 2002.7	553.7	104.0	109.1	20.5	17.9	95.4
100	09-13-93	N 5365.6 E 1980.5	553.0	104.1	109.1	19.4	17.9	95.5
101	09-13-93	N 5154.9 E 1977.4	553.3	103.6	109.1	20.6	17.9	95.1

NOTE: The permit requires compaction to at least 95 percent of the maximum laboratory dry density at or above optimum moisture using ASTM D698 Standard Proctor.

Failed tests were not reported, however, all areas were corrected as warranted based upon the test results.

Mike McConnell
Technician

CITY WATER, LIGHT & POWER

FIELD/LABORATORY COMPARISON

SAMPLE LOCATION	% H_2O	WET DENSITY	DRY DENSITY	COMPARISON
N 5493.7	23.45	127.96	103.65	Lab
E 2181.8	19.9	129.2	107.8	Field
N 5229.8	23.45	130.25	105.51	Lab
E 2139.4	19.6	128.6	107.5	Field
N 5141.4	21.6	132.91	109.3	Lab
E 2219.3	18.0	126.9	107.5	Field
	19.68			Bag Moisture
	19.92			Bag Moisture

ATTACHMENT 2

Report of Pocket Penetrometer Readings

CITY WATER, LIGHT AND POWER - CELL #3

CLAY LINER

SUMMARY OF POCKET PENETROMETER TESTS

The following Report is a summation of the unconfined compressive strength taken by pocket penetrometer. The test numbers reflect the test numbers of the nuclear density/moisture tests and the associated location.

CITY WATER, LIGHT AND POWER - CELL #3

CLAY LINER

SUMMARY OF POCKET PENETROMETER TESTS

DATE	TEST NUMBER*	READING TONS/FT²
September 29, 1992	1	3.0
September 29, 1992	2	2.5
September 29, 1992	3	3.0
September 29, 1992	4	3.5
September 29, 1992	5	3.0
September 29, 1992	6	4.0
September 30, 1992	7	2.5
September 30, 1992	8	2.5
September 30, 1992	9	3.0
September 30, 1992	10	2.5
September 30, 1992	11	3.0
September 30, 1992	12	2.75
October 1, 1992	13	3.0
October 1, 1992	14	3.5
October 1, 1992	15	3.0
October 1, 1992	16	3.75
October 1, 1992	17	4.0
October 1, 1992	18	4.0
October 1, 1992	19	3.75
October 1, 1992	20	4.0
October 2, 1992	30	3.5
October 2, 1992	31	3.75
October 2, 1992	32	3.5
October 2, 1992	33	3.5
October 2, 1992	34	3.25
October 2, 1992	35	3.5
October 2, 1992	36	3.75
October 5, 1992	37	2.5
October 5, 1992	38	3.5
October 5, 1992	39	3.75
October 5, 1992	40	2.5

* From Report of Soil Compaction Testing -- Report Number 89-118A-1

DATE	TEST NUMBER*	READING TONS/FT²
October 5, 1992	41	3.0
October 5, 1992	42	3.5
October 6, 1992	43	3.5
October 6, 1992	44	3.0
October 6, 1992	45	3.0
October 6, 1992	46	3.25
October 6, 1992	47	3.25
October 6, 1992	48	3.0
October 6, 1992	49	3.5
October 6, 1992	50	3.5
October 6, 1992	51	3.5
October 6, 1992	52	3.25
October 6, 1992	53	3.5
October 7, 1992	54	3.0
October 7, 1992	55	3.5
October 7, 1992	56	2.5
October 7, 1992	57	3.5
October 7, 1992	58	3.75
October 7, 1992	59	3.5
October 7, 1992	60	3.0
October 7, 1992	61	3.5
October 7, 1992	62	3.5
October 7, 1992	63	3.25
October 7, 1992	64	3.0
October 7, 1992	65	3.5
October 7, 1992	66	3.25
October 7, 1992	67	3.0
October 7, 1992	68	3.25
October 9, 1992	74	2.5
October 9, 1992	75	2.0
October 9, 1992	76	2.25
October 9, 1992	77	3.0
October 12, 1992	84	3.0
October 12, 1992	85	3.25

* From Report of Soil Compaction Testing -- Report Number 89-118A-1

DATE	TEST NUMBER*	READING TONS/FT²
October 12, 1992	86	3.25
October 12, 1992	87	3.5
October 12, 1992	88	4.0
October 12, 1992	89	4.0
October 12, 1992	90	3.5
October 12, 1992	91	4.0
October 12, 1992	92	4.5 +
October 12, 1992	93	3.0
October 12, 1992	94	3.0
October 12, 1992	95	3.5
October 12, 1992	96	2.5
October 12, 1992	97	3.5
October 12, 1992	98	3.0
October 14, 1992	99	3.5
October 14, 1992	100	4.0
October 14, 1992	101	4.0
October 14, 1992	102	3.5
October 14, 1992	103	3.5
October 14, 1992	104	3.5
October 14, 1992	105	3.5
October 14, 1992	106	3.75
October 14, 1992	107	3.5
October 14, 1992	108	3.5
October 14, 1992	109	3.5
October 14, 1992	110	3.5
October 14, 1992	111	3.25
October 14, 1992	112	4.0
October 14, 1992	113	2.75
October 14, 1992	114	3.5
October 14, 1992	115	3.25
October 14, 1992	116	3.0
October 14, 1992	117	3.5
October 14, 1992	118	3.0

* From Report of Soil Compaction Testing -- Report Number 89-118A-1

DATE	TEST NUMBER*	READING TONS/FT²
October 14, 1992	119	3.75
October 14, 1992	120	3.5
October 14, 1992	121	3.0
October 14, 1992	122	3.25
October 14, 1992	123	3.75
October 14, 1992	124	3.0
October 14, 1992	125	3.0
October 14, 1992	126	3.5
October 14, 1992	127	3.0
October 14, 1992	128	4.0
October 14, 1992	129	4.0
October 14, 1992	130	4.0
October 15, 1992	141	3.5
October 15, 1992	142	3.5
October 15, 1992	143	3.75
October 15, 1992	144	3.75
October 15, 1992	145	3.5
October 15, 1992	146	3.5
October 15, 1992	147	4.5 +
October 15, 1992	148	2.5
October 15, 1992	149	2.0
October 15, 1992	150	2.0
October 15, 1992	151	2.0
October 15, 1992	152	2.0
October 15, 1992	153	2.75
October 15, 1992	154	2.0
October 15, 1992	155	2.0
October 19, 1992	156	3.5
October 19, 1992	157	3.5
October 19, 1992	158	3.0
October 19, 1992	159	3.5
October 19, 1992	160	3.25
October 19, 1992	161	3.25

* From Report of Soil Compaction Testing -- Report Number 89-118A-1

DATE	TEST NUMBER*	READING TONS/FT²
October 19, 1992	162	2.5
October 19, 1992	163	3.5
October 20, 1992	164	2.5
October 20, 1992	165	2.5
October 20, 1992	166	2.5
October 20, 1992	167	2.25
October 20, 1992	168	2.5
October 20, 1992	169	2.5
October 20, 1992	170	3.5
October 20, 1992	171	3.5
October 20, 1992	172	3.5
October 20, 1992	173	3.5
October 20, 1992	174	3.5
October 20, 1992	175	3.5
October 21, 1992	176	2.5
October 21, 1992	177	3.0
October 21, 1992	178	2.75
October 21, 1992	179	3.5
October 21, 1992	180	3.25
October 21, 1992	181	3.0
October 21, 1992	182	3.75
October 21, 1992	183	3.75
October 21, 1992	184	2.5
October 22, 1992	185	4.0
October 22, 1992	186	4.0
October 22, 1992	187	3.5
October 22, 1992	188	3.5
October 22, 1992	189	3.5
October 22, 1992	190	4.0
October 22, 1992	191	3.5
October 22, 1992	192	4.0
October 22, 1992	193	3.5
October 22, 1992	194	3.0
October 22, 1992	195	3.5

* From Report of Soil Compaction Testing -- Report Number 89-118A-1

DATE	TEST NUMBER*	READING TONS/FT²
October 22, 1992	196	4.0
October 22, 1992	197	2.5
October 22, 1992	198	3.0
October 22, 1992	199	3.0
October 22, 1992	200	4.0
October 22, 1992	201	3.25
October 22, 1992	202	3.5
October 22, 1992	203	3.5
October 22, 1992	204	4.0
October 22, 1992	205	4.0
October 22, 1992	206	4.5
October 22, 1992	207	3.0
October 22, 1992	208	3.5
October 22, 1992	209	3.0
October 22, 1992	210	2.75
October 22, 1992	211	3.0
October 22, 1992	212	2.5
October 22, 1992	213	3.75
October 22, 1992	214	3.0
October 22, 1992	215	3.5
October 22, 1992	216	3.0
October 22, 1992	217	3.5
October 22, 1992	218	2.5
October 22, 1992	219	4.0
October 22, 1992	220	3.5
October 22, 1992	221	3.5
October 22, 1992	222	3.25
October 22, 1992	223	4.0
October 22, 1992	224	3.0
October 26, 1992	225	3.5
October 26, 1992	226	3.5
October 26, 1992	227	3.0
October 26, 1992	228	3.0
October 26, 1992	229	3.5
October 26, 1992	230	3.5

* From Report of Soil Compaction Testing -- Report Number 89-118A-1

DATE	TEST NUMBER*	READING TONS/FT²
October 26, 1992	231	3.0
October 26, 1992	232	3.5
October 26, 1992	233	3.0
October 26, 1992	234	3.5
October 26, 1992	235	3.5
October 26, 1992	236	3.0
October 26, 1992	237	4.0
October 26, 1992	238	4.5
October 26, 1992	239	4.5
October 27, 1992	240	4.25
October 27, 1992	241	3.5
October 27, 1992	242	3.25
October 27, 1992	243	4.0
October 27, 1992	244	3.25
October 27, 1992	245	3.25
October 27, 1992	246	4.0
October 27, 1992	247	3.0
October 27, 1992	248	3.0
October 27, 1992	249	3.25
October 27, 1992	250	3.0
October 27, 1992	251	3.75
October 27, 1992	252	4.25
October 27, 1992	253	3.5
October 27, 1992	254	4.0
October 28, 1992	255	4.0
October 28, 1992	256	3.0
October 28, 1992	257	4.0
October 28, 1992	258	3.5
October 28, 1992	259	3.5
October 29, 1992	260	3.75
October 29, 1992	261	3.5
October 29, 1992	262	4.0
October 29, 1992	263	4.5
October 29, 1992	264	3.75

* From Report of Soil Compaction Testing -- Report Number 89-118A-1

DATE	TEST NUMBER*	READING TONS/FT²
October 29, 1992	265	4.0
October 29, 1992	266	4.0
October 29, 1992	267	4.25
October 29, 1992	268	3.5
October 29, 1992	269	3.5
October 29, 1992	270	4.0
October 29, 1992	271	3.75
October 29, 1992	272	3.5
October 29, 1992	273	3.75
October 29, 1992	274	4.5 +
October 29, 1992	275	4.5
October 29, 1992	276	3.5

* From Report of Soil Compaction Testing -- Report Number 89-118A-1

CITY WATER, LIGHT AND POWER - CELL #3

CLAY LINER

SUMMARY OF POCKET PENETROMETER TESTS

DATE	TEST NUMBER*	READING TONS/FT²
June 23, 1993	408	4.0
June 23, 1993	409	4.0
June 23, 1993	410	4.0
June 23, 1993	411	2.75
June 23, 1993	412	4.0
June 23, 1993	413	4.0
June 23, 1993	414	3.5
June 23, 1993	415	3.0
June 23, 1993	416	4.25
June 23, 1993	417	4.25
June 24, 1993	435	3.75
June 24, 1993	436	4.0
June 24, 1993	437	3.75
June 24, 1993	438	4.0
July 24, 1993	439	4.0
June 24, 1993	440	3.75

* From Report of Soil Compaction Testing -- Report Number 89-118A-3

CITY WATER, LIGHT AND POWER - CELL #3

CLAY LINER

SUMMARY OF POCKET PENETROMETER TESTS

DATE	TEST NUMBER*	READING TONS/FT²
July 6, 1993	1	3.75
July 6, 1993	2	4.0
July 6, 1993	3	4.0
July 6, 1993	4	4.0
July 6, 1993	5	3.75
July 6, 1993	6	3.0
July 6, 1993	7	3.0
July 6, 1993	8	3.25
July 6, 1993	9	3.5
July 6, 1993	10	4.25
July 6, 1993	11	4.5 +
July 6, 1993	12	4.0
July 6, 1993	13	4.5
July 6, 1993	14	4.5
July 6, 1993	15	3.75
July 6, 1993	16	2.5
July 6, 1993	17	4.5 +
July 6, 1993	18	4.0
July 6, 1993	19	3.0
July 6, 1993	20	3.5
July 6, 1993	21	3.75
July 6, 1993	22	3.75
July 6, 1993	23	4.0
July 6, 1993	24	4.25
July 6, 1993	25	4.0
July 6, 1993	26	4.0
July 6, 1993	27	4.0
July 9, 1993	28	3.5
July 9, 1993	29	4.0
July 9, 1993	30	4.0
July 9, 1993	31	3.75

* From Report of Soil Compaction Testing -- Report Number 93-119-1

DATE	TEST NUMBER*	READING TONS/FT²
July 9, 1993	32	2.5
July 9, 1993	33	4.5
July 9, 1993	34	4.0
July 9, 1993	35	3.0
July 9, 1993	36	4.0
July 9, 1993	37	3.75
July 9, 1993	38	3.75
July 13, 1993	39	4.0
July 13, 1993	40	3.5
July 13, 1993	41	2.75
July 13, 1993	42	2.5
July 13, 1993	43	2.75
July 13, 1993	44	3.0
July 13, 1993	45	3.0
July 13, 1993	46	3.5
July 13, 1993	47	2.25
July 13, 1993	48	2.5
July 20, 1993	49	3.25
July 20, 1993	50	3.75
July 20, 1993	51	3.75
July 20, 1993	52	3.5
July 20, 1993	53	3.75
July 20, 1993	54	4.5
July 20, 1993	55	3.5
July 20, 1993	56	4.5
July 20, 1993	57	3.5
July 20, 1993	58	3.5
July 21, 1993	59	2.5
July 21, 1993	60	3.5
July 21, 1993	61	3.25
July 21, 1993	62	4.0
July 21, 1993	63	3.5
July 21, 1993	64	4.0
July 28, 1993	65	2.75

* From Report of Soil Compaction Testing -- Report Number 93-119-1

DATE	TEST NUMBER*	READING TONS/FT²
July 28, 1993	66	2.5
July 28, 1993	67	3.0
July 28, 1993	68	3.0
July 28, 1993	69	3.0
July 28, 1993	70	2.75
July 29, 1993	71	3.75
July 29, 1993	72	4.0
July 30, 1993	73	2.5
July 30, 1993	74	2.5
July 30, 1993	75	2.25
July 30, 1993	76	3.0
July 30, 1993	77	3.25
July 30, 1993	78	3.5
July 30, 1993	79	2.5
July 30, 1993	80	4.5
July 30, 1993	81	3.0
July 30, 1993	82	3.0
July 30, 1993	83	3.0
July 30, 1993	84	3.0
July 30, 1993	85	3.0
July 31, 1993	86	3.0
July 31, 1993	87	3.5
July 31, 1993	88	4.0
July 31, 1993	89	3.5
July 31, 1993	90	3.5
August 6, 1993	91	3.0
August 6, 1993	92	2.5
August 6, 1993	93	3.5
August 6, 1993	94	3.0
August 9, 1993	95	3.0
August 9, 1993	96	3.75
August 9, 1993	97	3.5
September 13, 1993	98	2.75
September 13, 1993	99	2.5

* From Report of Soil Compaction Testing -- Report Number 93-119-1

DATE	TEST NUMBER*	READING TONS/FT²
September 13, 1993	100	3.0
September 13, 1993	101	2.5

* From Report of Soil Compaction Testing -- Report Number 93-119-1

ATTACHMENT 3

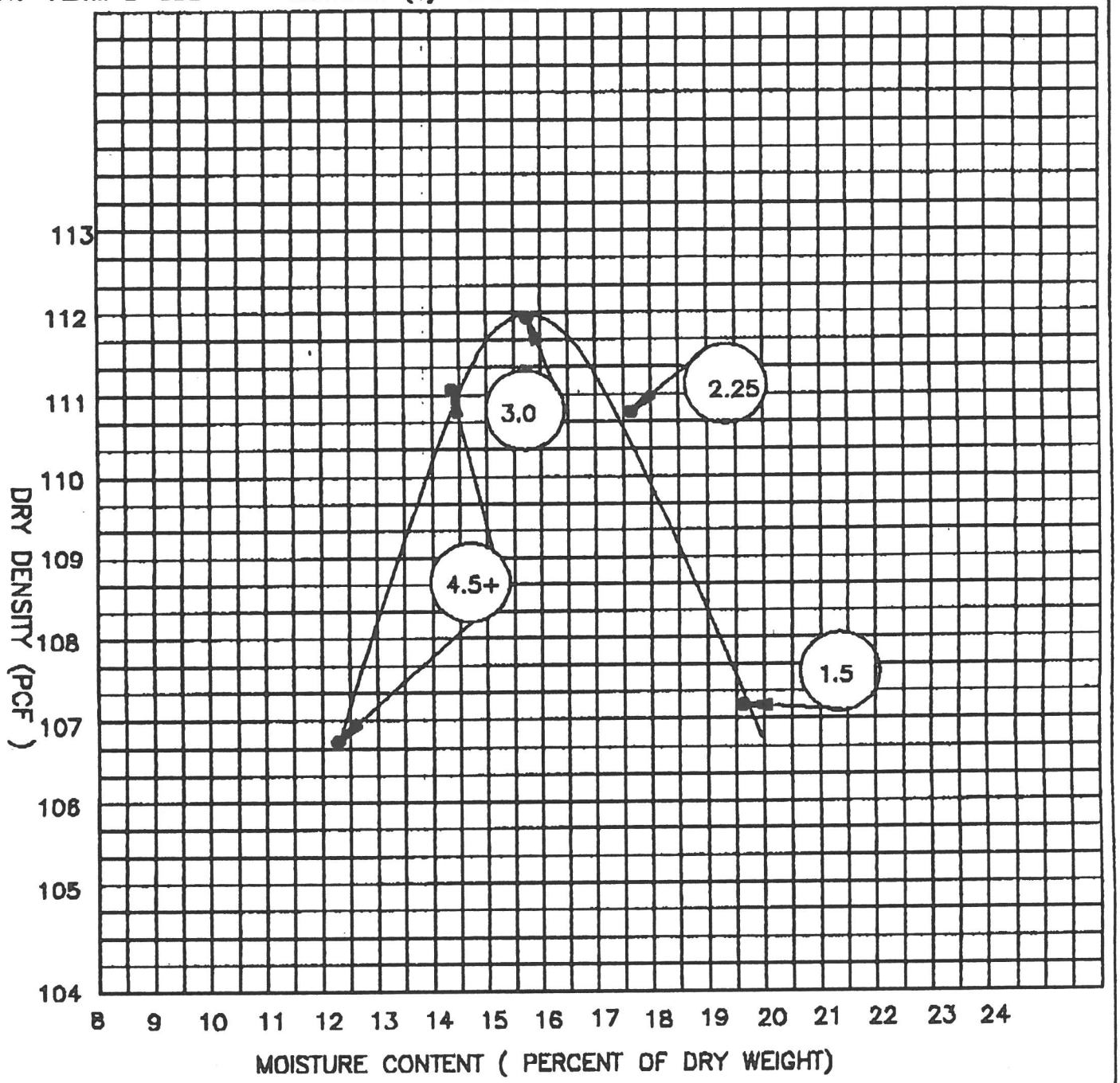
Moisture Density Relationship

Source: Cell 2/3 Division Berm

PROJECT NO.:

MOISTURE DENSITY RELATIONSHIPS

TEST: ASTM D-698 METHOD: (A) DATE: 6-18-92



MAXIMUM DRY DENSITY (LBS. / CU. FT.) 112.0 TYPE OF MATERIAL

OPTIMUM MOISTURE CONTENT (%) 15.7 SAMPLE NO. 3

FOR: ANDREWS ENVIRONMENTAL ENG.

SUBJECT: CWLP

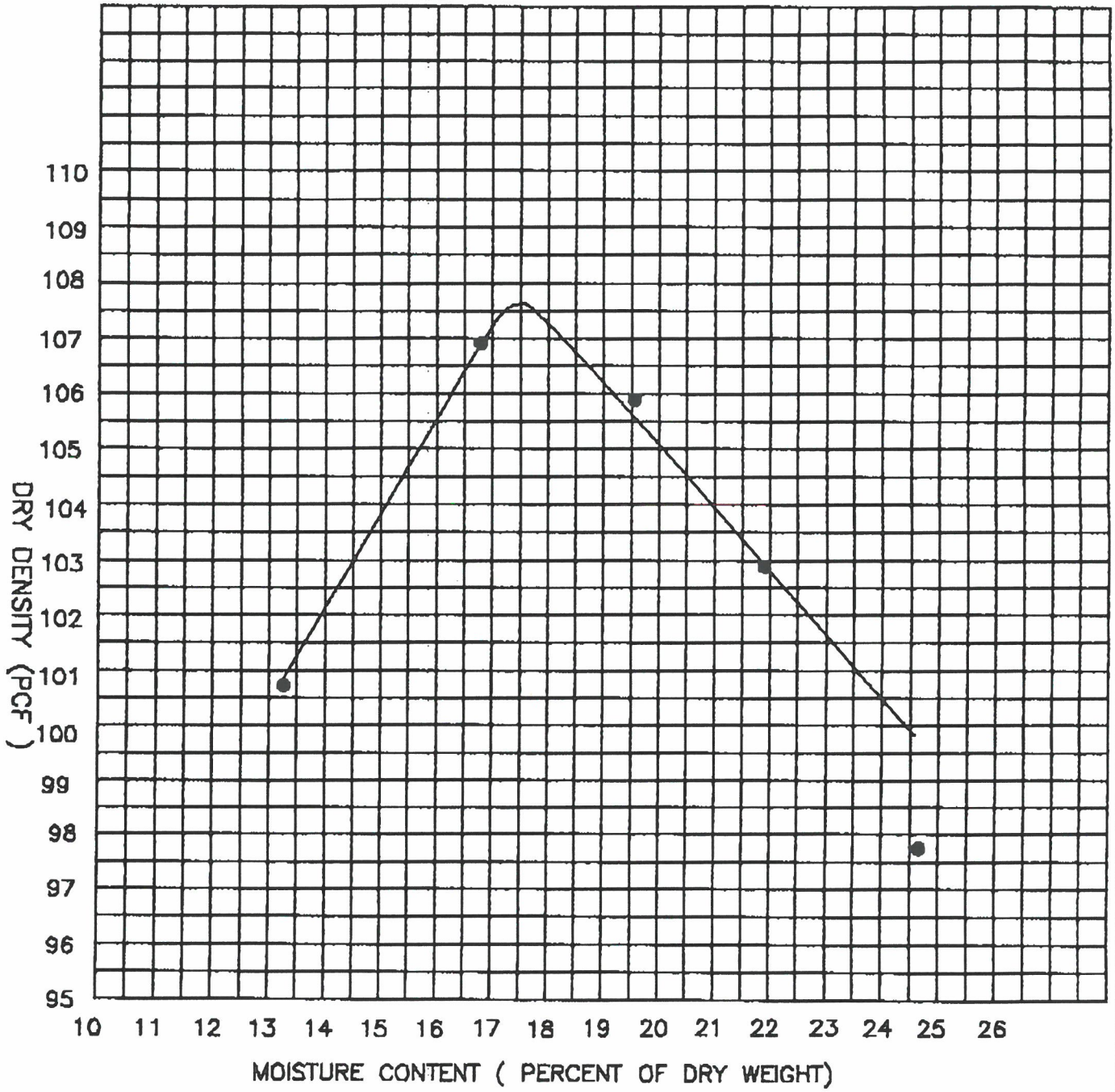
AE EXPLORATION CORPORATION
2813 NORTH DIRKSEN PARKWAY
SPRINGFIELD, ILLINIOS 62702
(217) 525-6023 FAX: (217) 525-6025

Source: Cell 3 Stockpile from Borrow Area

PROJECT NO.:

MOISTURE DENSITY RELATIONSHIPS

TEST: ASTM D-698 METHOD: (A) DATE: 6-18-92



MAXIMUM DRY DENSITY (LBS. / CU. FT.) 107.6 TYPE OF MATERIAL

OPTIMUM MOISTURE CONTENT (%) 17.5 SAMPLE NO. 2

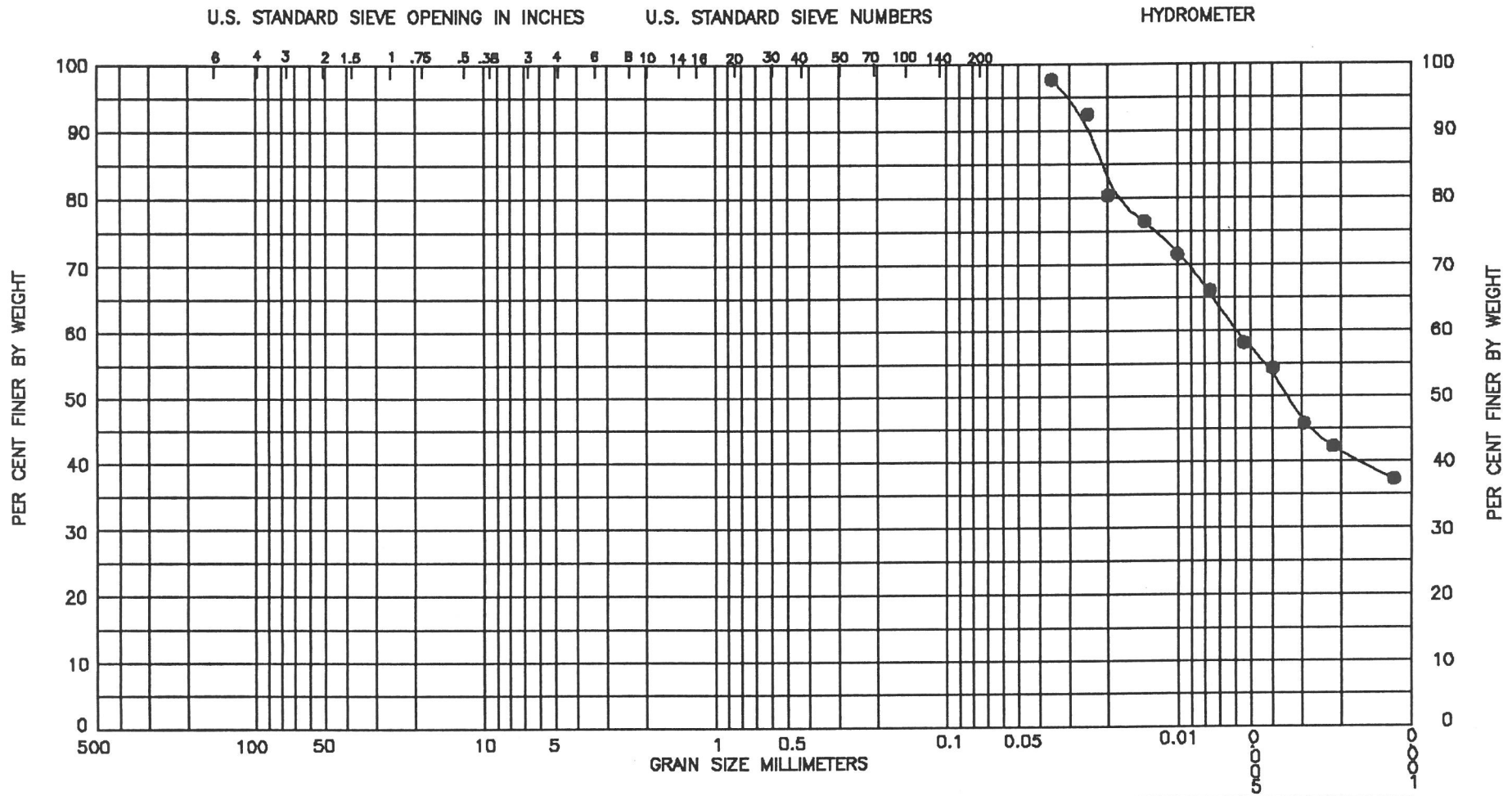
FOR: ANDREWS ENVIRONMENTAL ENG.

SUBJECT: CWLP

AE EXPLORATION CORPORATION
2813 NORTH DIRKSEN PARKWAY
SPRINGFIELD, ILLINIOS 62702
(217) 525-6023 FAX: (217) 525-6025

GRAIN SIZE DISTRIBUTION

DATE: 7-15-93



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COURSE	FINE	COURSE	MEDIUM	FINE	

BORING NO.	SAMPLE NO.	ELEV./ DEPTH	USC	DECRIPTION	NAT. W%	LL	PL	PI
CELL 3	NO. 2		CL	BROWN SILTY CLAY, TRACE SAND		42.5	18.1	24.4
AEX NO.	19-3184-2							

% GRAVEL	
% SAND	3.15
% SILT	54.25
% CLAY	42.60

PROJECT: CWLP

SPECIAL REMARKS

0.002 mm DIVISION BETWEEN SILT & CLAY PARTICLES

AE EXPLORATION CORPORATION
2813 NORTH DIRKSEN PARKWAY
SPRINGFIELD, ILLINOIS 62702
(217) 525-6023 FAX: (217) 525-6025

Professional Service Industries, Inc.

REPORT OF MOISTURE DENSITY RELATIONSHIP OF SOIL

TESTED FOR: Andrews Environmental Engineering
3535 Mayflower Boulevard
Springfield, Illinois 62707

Attn: Mr. Mike McDermont

PROJECT: City, Water, Light & Power

DATE: December 4, 1992

OUR REPORT NO.: 020-20039-05

TEST DATA SOIL I.D. # 4

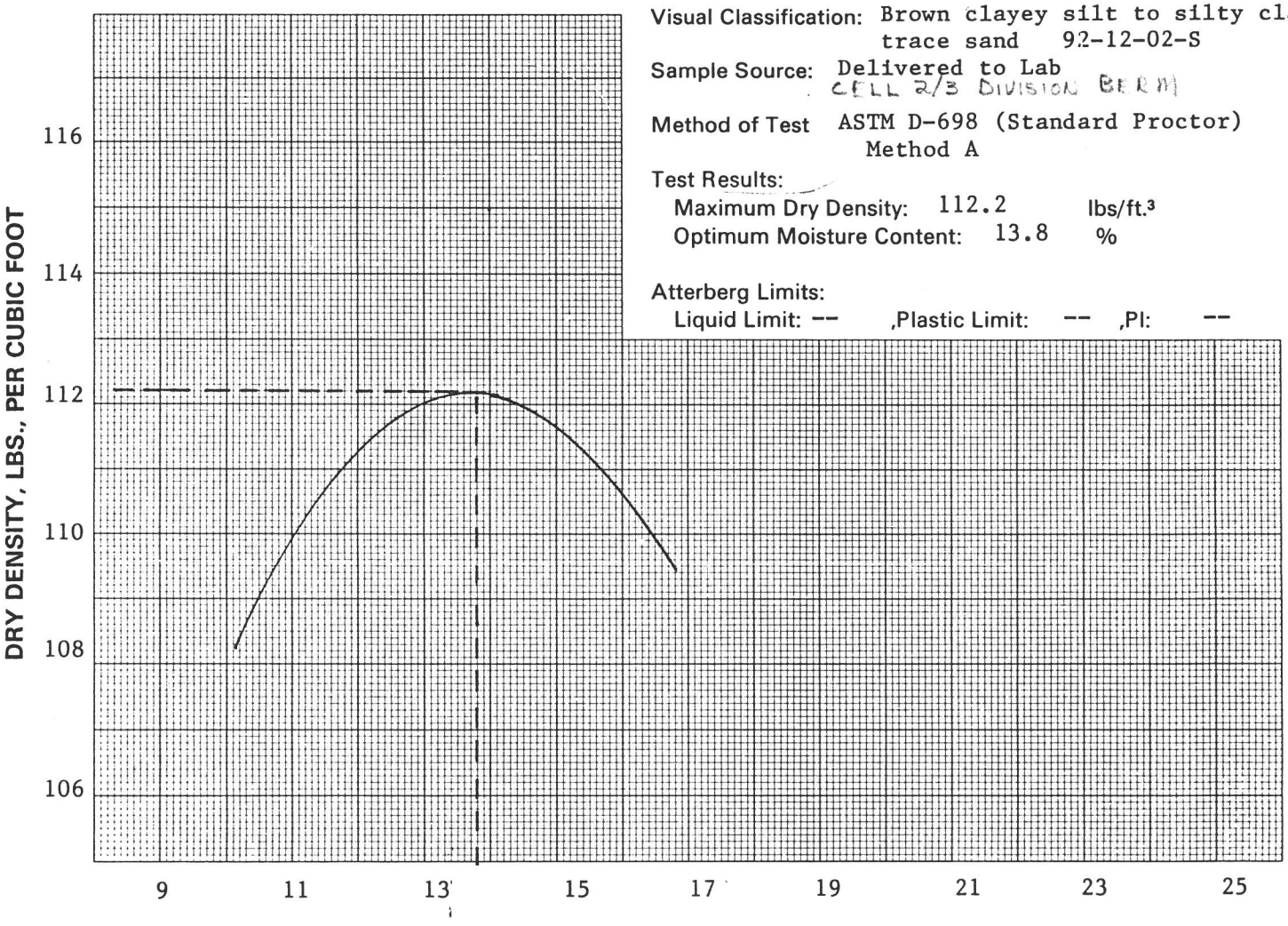
Visual Classification: Brown clayey silt to silty clay, trace sand 92-12-02-S

Sample Source: Delivered to Lab CELL 2/3 DIVISION BERM

Method of Test ASTM D-698 (Standard Proctor) Method A

Test Results:
Maximum Dry Density: 112.2 lbs/ft.³
Optimum Moisture Content: 13.8 %

Atterberg Limits:
Liquid Limit: -- ,Plastic Limit: -- ,PI: --



Respectfully submitted,
Professional Service Industries, Inc.

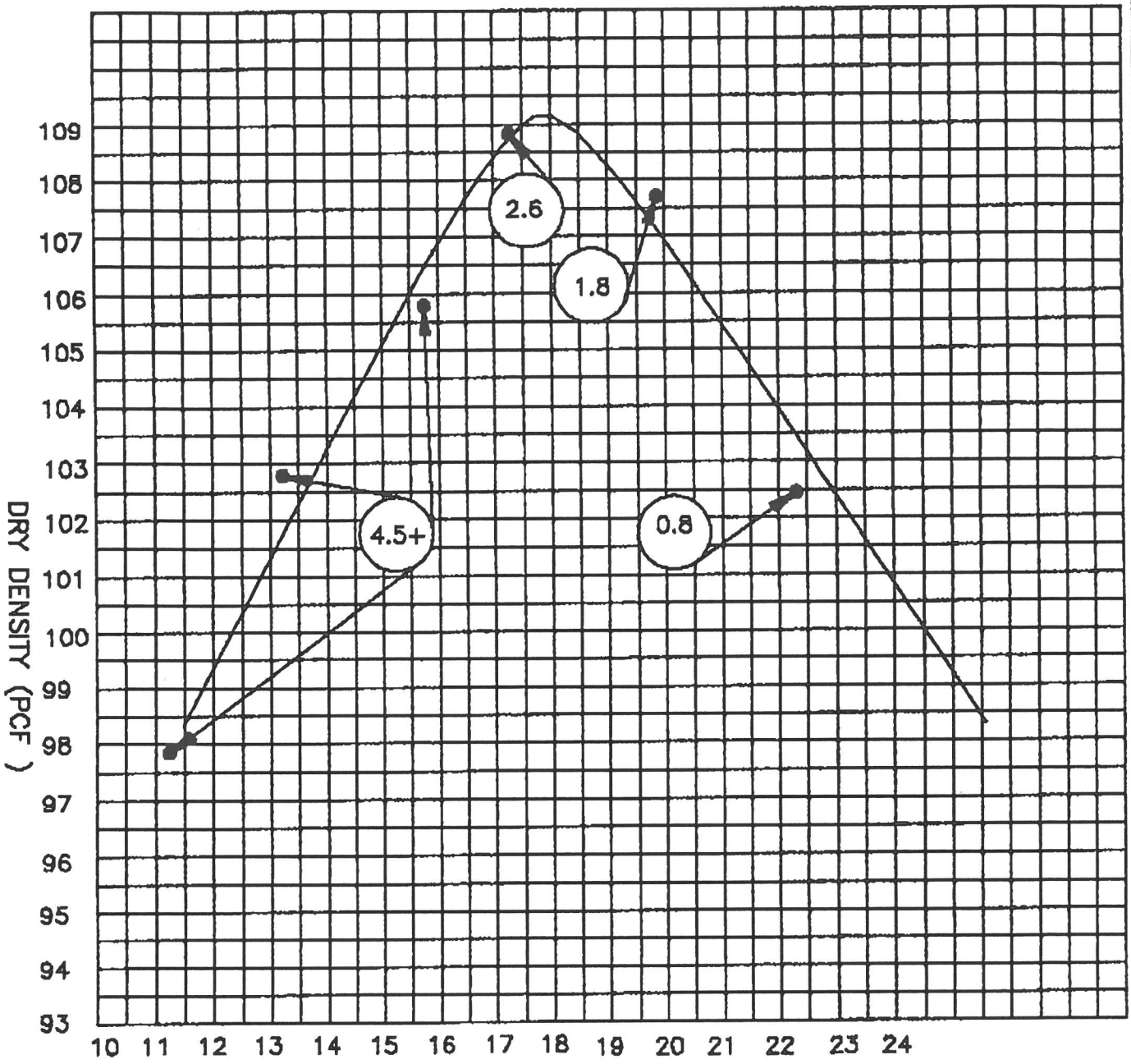
308 North Street • Springfield, IL 62704 • Phone: 217/544-6663 • Fax: 217/544-6148

SOURCE: BORROW PIT

PROJECT NO.: 19-2141-2

MOISTURE DENSITY RELATIONSHIPS

TEST METHOD: ASTM D-698



NAT. MOISTURE 25.98%

MOISTURE CONTENT (PERCENT OF DRY WEIGHT)

MAXIMUM DRY DENSITY (LBS. / CU. FT.) 109.1

OPTIMUM MOISTURE CONTENT (%) 17.9

TYPE OF MATERIAL MOTTLED BROWN SILTY CLAY, TRACE FINE SAND.

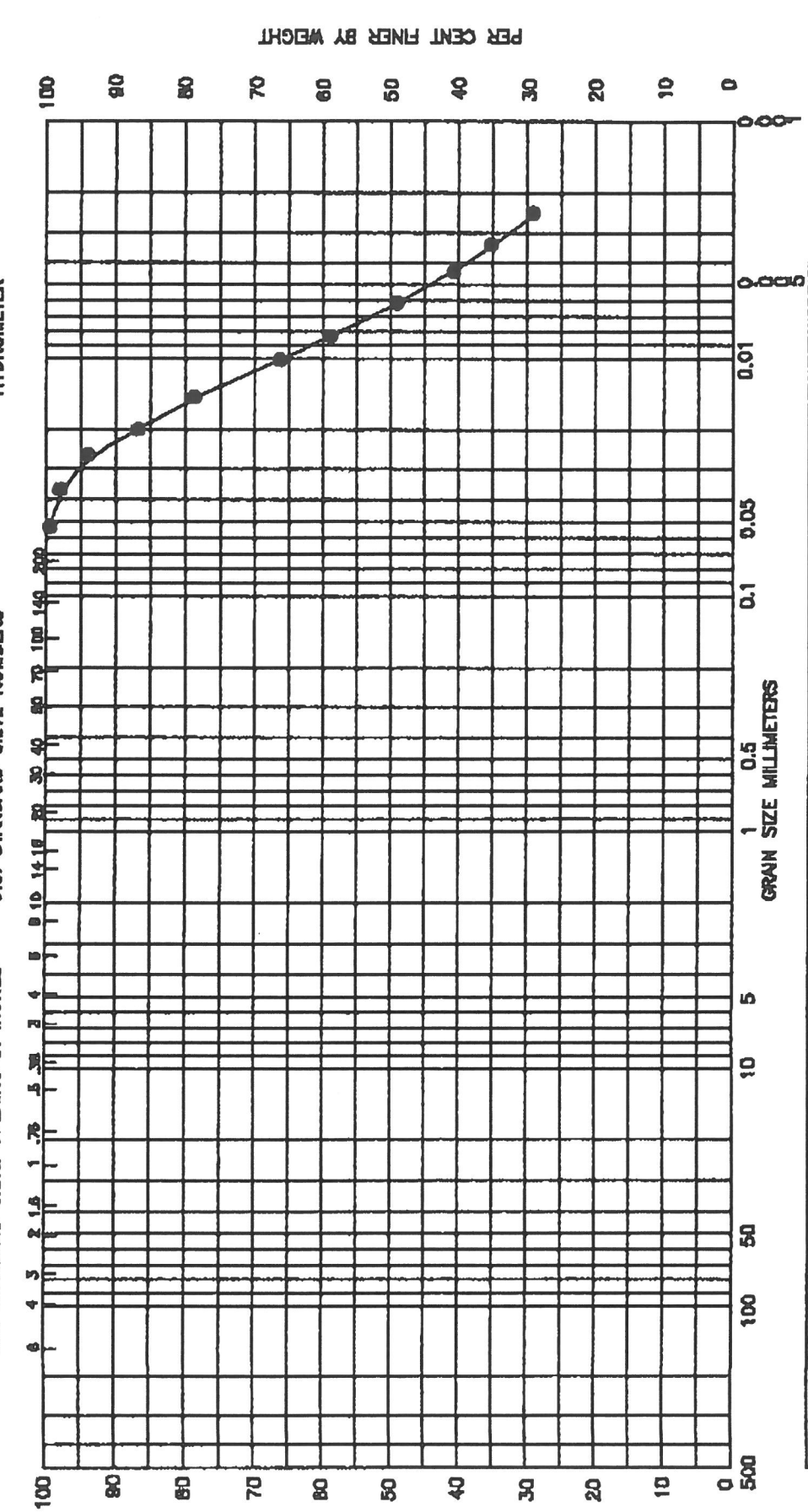
SAMPLE NO. 3

FOR: ANDREWS ENVIRONMENTAL ENG.

SUBJECT: CWLP

AE EXPLORATION CORPORATION
2813 NORTH DIRKSEN PARKWAY
SPRINGFIELD, ILLINOIS 62702
(217) 525-6023 FAX: (217) 525-6025

GRAIN SIZE DISTRIBUTION



BORING NO.	SAMPLE NO.	ELEV./ DEPTH	USC	DESCRIPTION	NAT. W%	LL	PL	PI
	3		CL	MOTTLED BROWN SILTY CLAY, TRACE FINE SAND.		37.2	18.0	19.2
AEX NO.								
A-2141-2								

% GRAVEL	
% SAND	1.7
% SILT	53.0
% CLAY	45.3

PROJECT NAME: CWLP

SPECIAL REMARKS

ASTM D-422

AE EXPLORATION CORPORATION
2813 NORTH DRIESEN PARKWAY
BROOKFIELD, ILLINOIS 61702
(217) 525-6023 FAX: (217) 525-6025

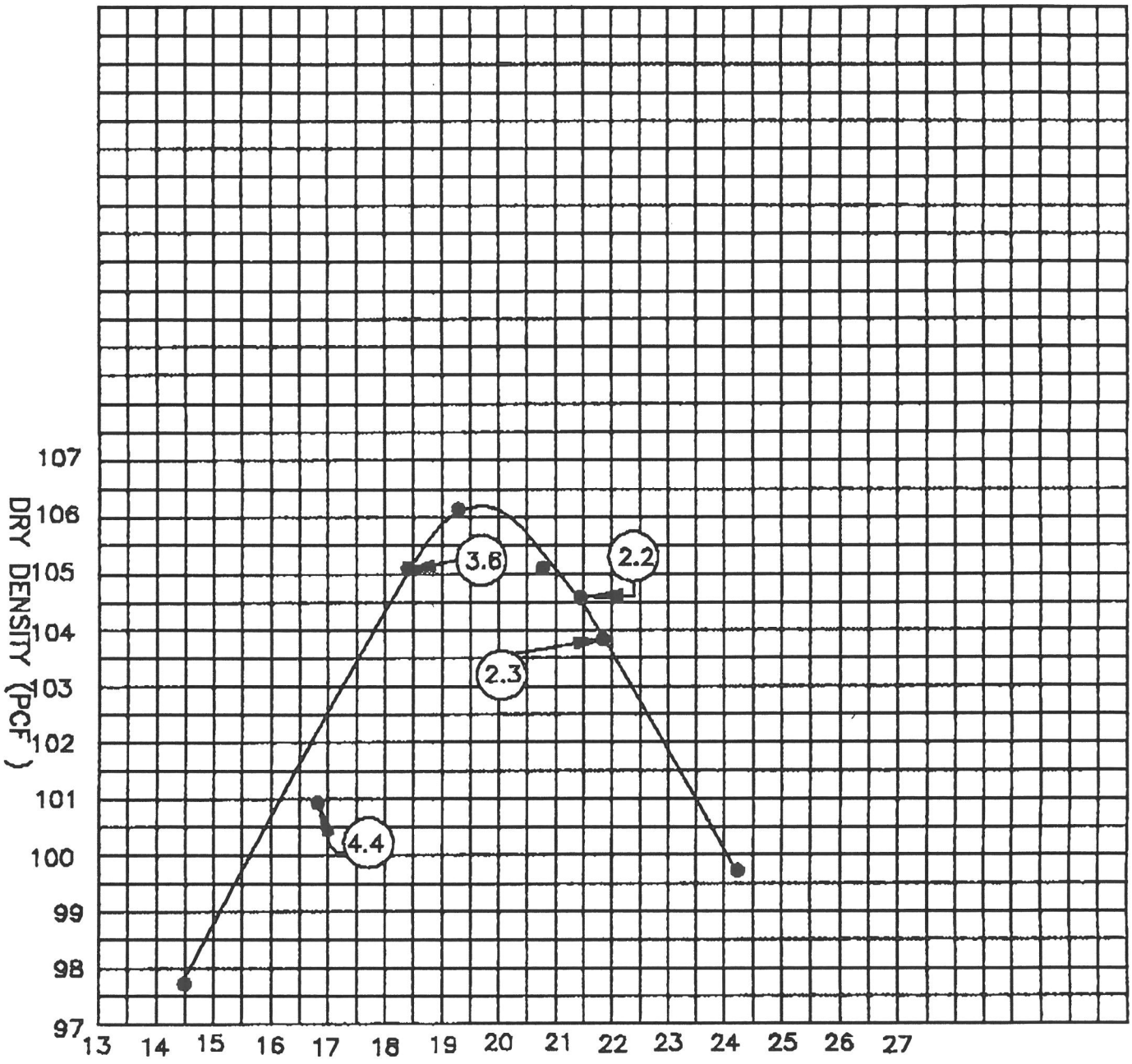
SOURCE: BORROW PIT

Sample #1

PROJECT NO.: 19-2141-2

MOISTURE DENSITY RELATIONSHIPS

TEST METHOD: ASTM D-698



MOISTURE CONTENT (PERCENT OF DRY WEIGHT)

MAXIMUM DRY DENSITY (LBS. / CU. FT.) 106.2

OPTIMUM MOISTURE CONTENT (%) 19.7

TYPE OF MATERIAL: MOTTLED BROWN SILTY CLAY, TRACE FINE TO COARSE SAND.

(NO.) = PPR READING IN T.S.F..

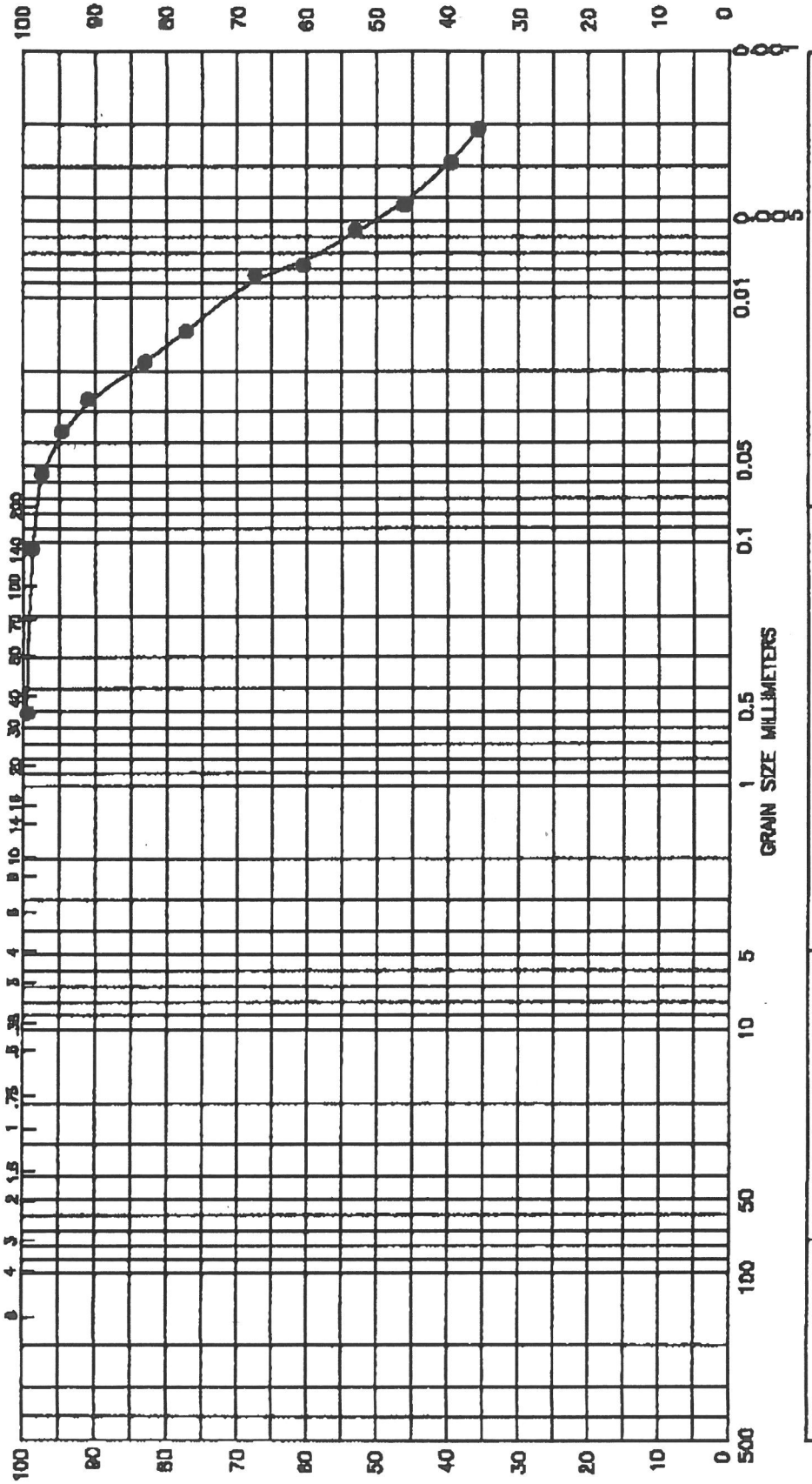
FOR: ANDREWS ENVIRONMENTAL ENG.

SUBJECT: C.W.L.P. BORROW AREA.

AE EXPLORATION CORPORATION
2813 NORTH DIRKSEN PARKWAY
SPRINGFIELD, ILLINIOS 62702
(217) 525-6023 FAX: (217) 525-6025

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE OPENING IN INCHES U.S. STANDARD SIEVE NUMBERS HYDROMETER



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COURSE	FINE	COURSE	MEDIUM	FINE	

BORING NO.	SAMPLE NO.	ELEV./ DEPTH	USC	DESCRIPTION	NAT. W%	LL	PL	PI
			CL	MOTTLED BROWN SILTY CLAY, TRACE FINE TO COARSE SAND.		40.1	18.3	21.8

% GRAVEL	
% SAND	1.5
% SILT	51.0
% CLAY	49.5

SPECIAL REMARKS

IN ACCORDANCE WITH A.S.T.M. D-422

AE EXPLORATION CORPORATION
2813 NORTH DIRKSEN PARKWAY
SPRINGFIELD, ILLINOIS 62702
(217) 525-6023 FAX: (217) 525-6025

Professional Service Industries, Inc.

REPORT OF MOISTURE DENSITY RELATIONSHIP OF SOIL

TESTED FOR: Andrews Environmental Engineering, Inc.
3535 Mayflower Boulevard
Springfield, Illinois 62707

Attn: Mr. Mike McDermont

PROJECT: City, Water, Light & Power

DATE: October 14, 1992

OUR REPORT NO.: 020-20039-03 (Page 1 of 2)

TEST DATA Soil I.D. #2

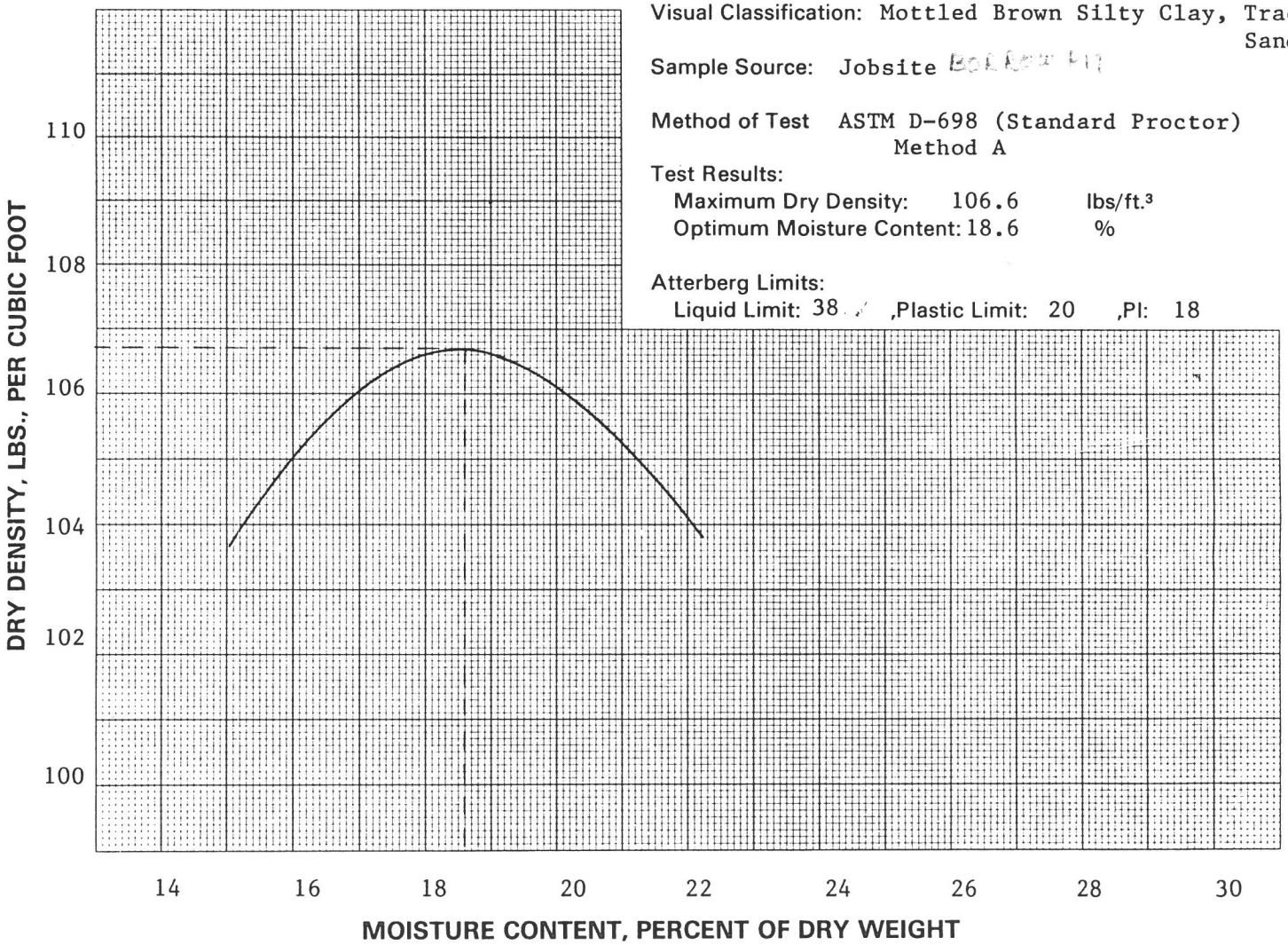
Visual Classification: Mottled Brown Silty Clay, Trace Sand

Sample Source: Jobsite Boring #17

Method of Test ASTM D-698 (Standard Proctor) Method A

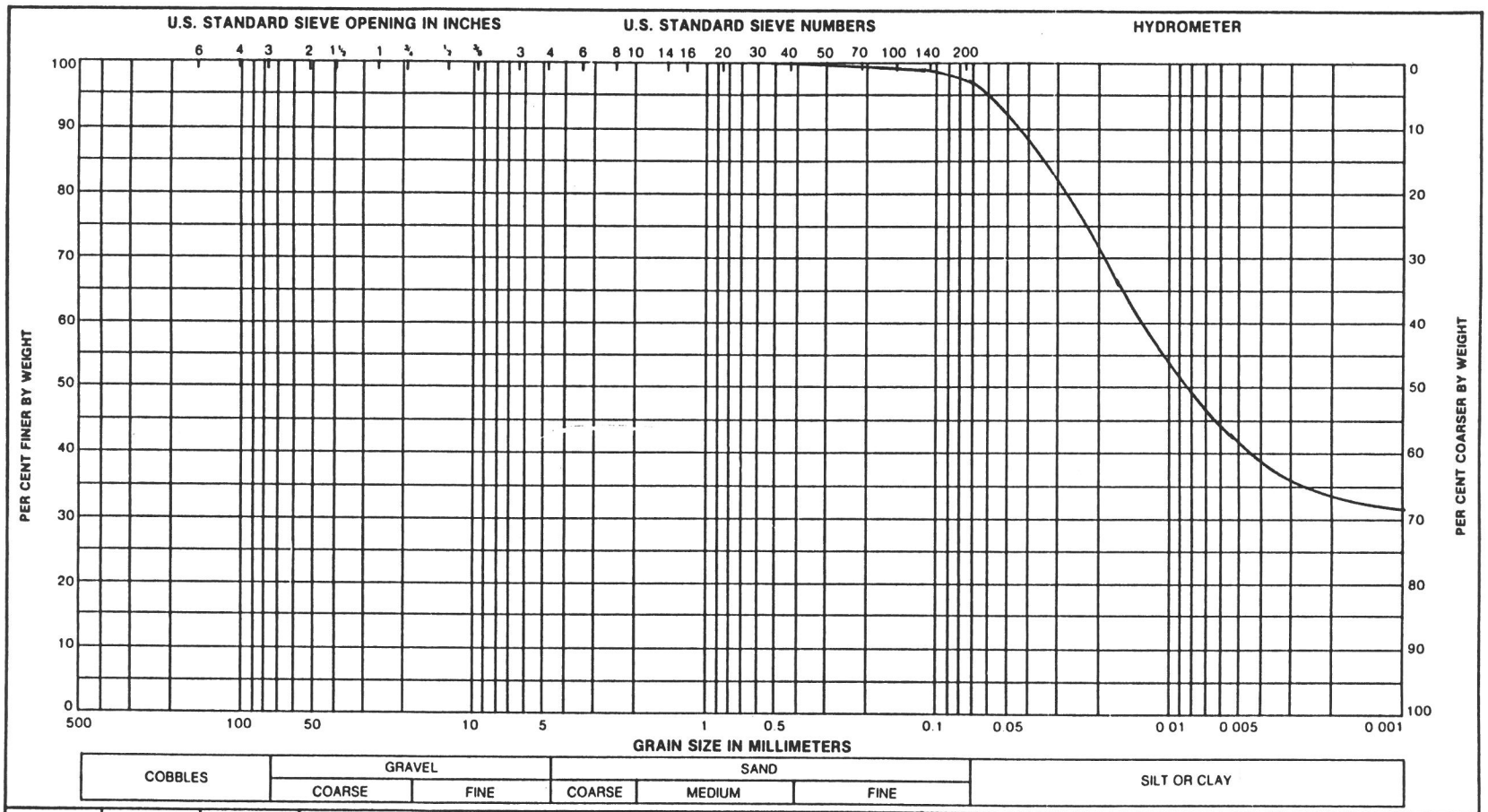
Test Results:
Maximum Dry Density: 106.6 lbs/ft.³
Optimum Moisture Content: 18.6 %

Atterberg Limits:
Liquid Limit: 38 ,Plastic Limit: 20 ,PI: 18



Respectfully submitted,
Professional Service Industries, Inc.

308 North Street • Springfield, IL 62704 • Phone: 217/544-6663 • Fax: 217/544-6148



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI	Project
--	Soil	--	Silty Clay, Trace Sand,	--	38	20	18	Cell #3
	I.D.#2		Fine, Mottled Brown					City Water, Light & Power
								Springfield, Illinois
								(Andrews Enviro. Engineering, Inc.)

REPORT OF SOIL ANALYSIS

File No. 020-20039-03 (Page 2 of 2)

Professional Service Industries, Inc.

REPORT OF MOISTURE DENSITY RELATIONSHIP OF SOIL

TESTED FOR: Andrews Environmental Engineering, Inc.
3535 Mayflower Boulevard
Springfield, Illinois 62707

Attn: Mr. Mike McDermont

PROJECT: City Water, Light & Power

DATE: June 9, 1992

OUR REPORT NO.: 020-20039-01

TEST DATA #1

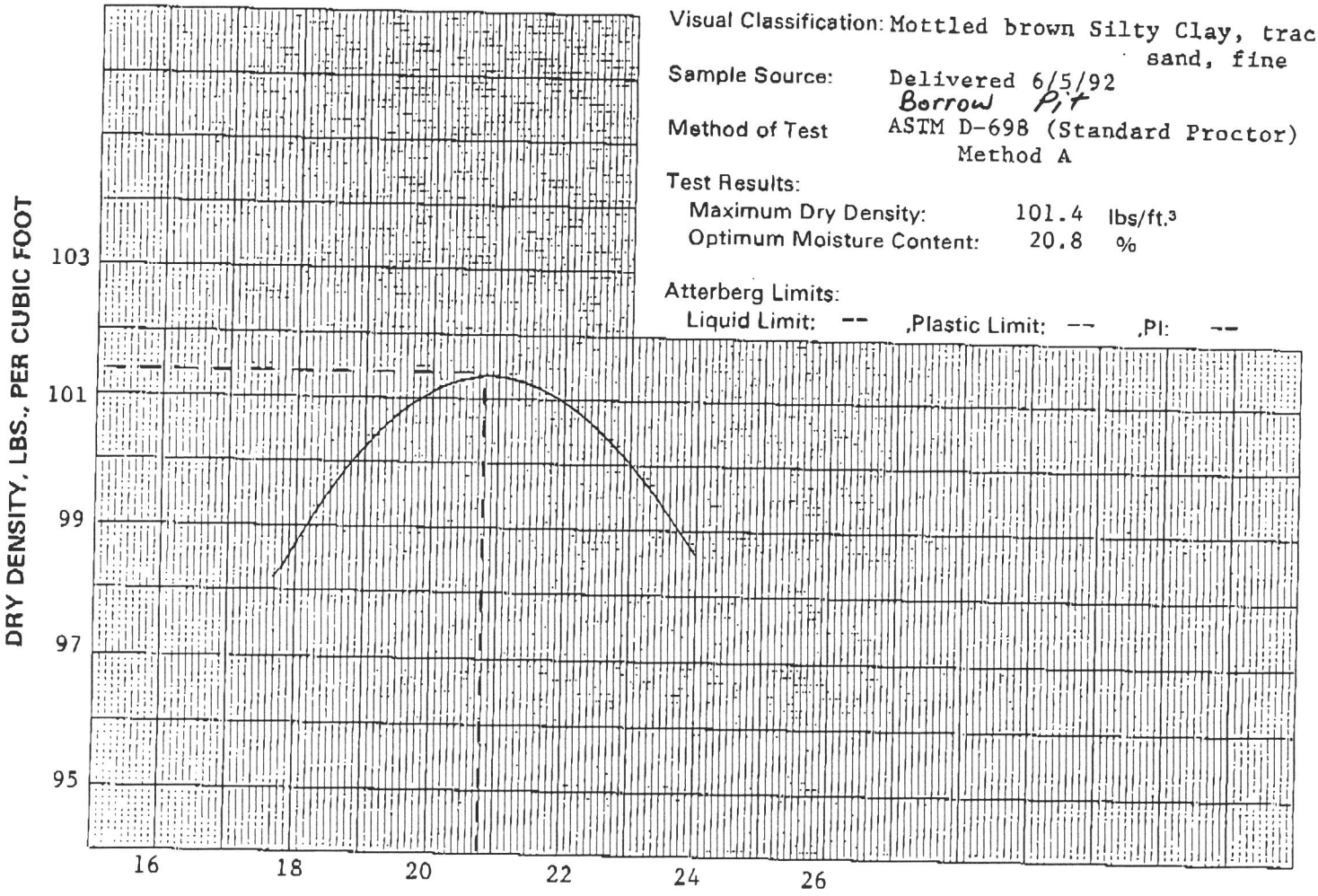
Visual Classification: Mottled brown Silty Clay, trace sand, fine

Sample Source: Delivered 6/5/92 Borrow Pit

Method of Test: ASTM D-698 (Standard Proctor) Method A

Test Results:
- Maximum Dry Density: 101.4 lbs/ft.³
- Optimum Moisture Content: 20.8 %

Atterberg Limits:
Liquid Limit: -- ,Plastic Limit: -- ,PI: --



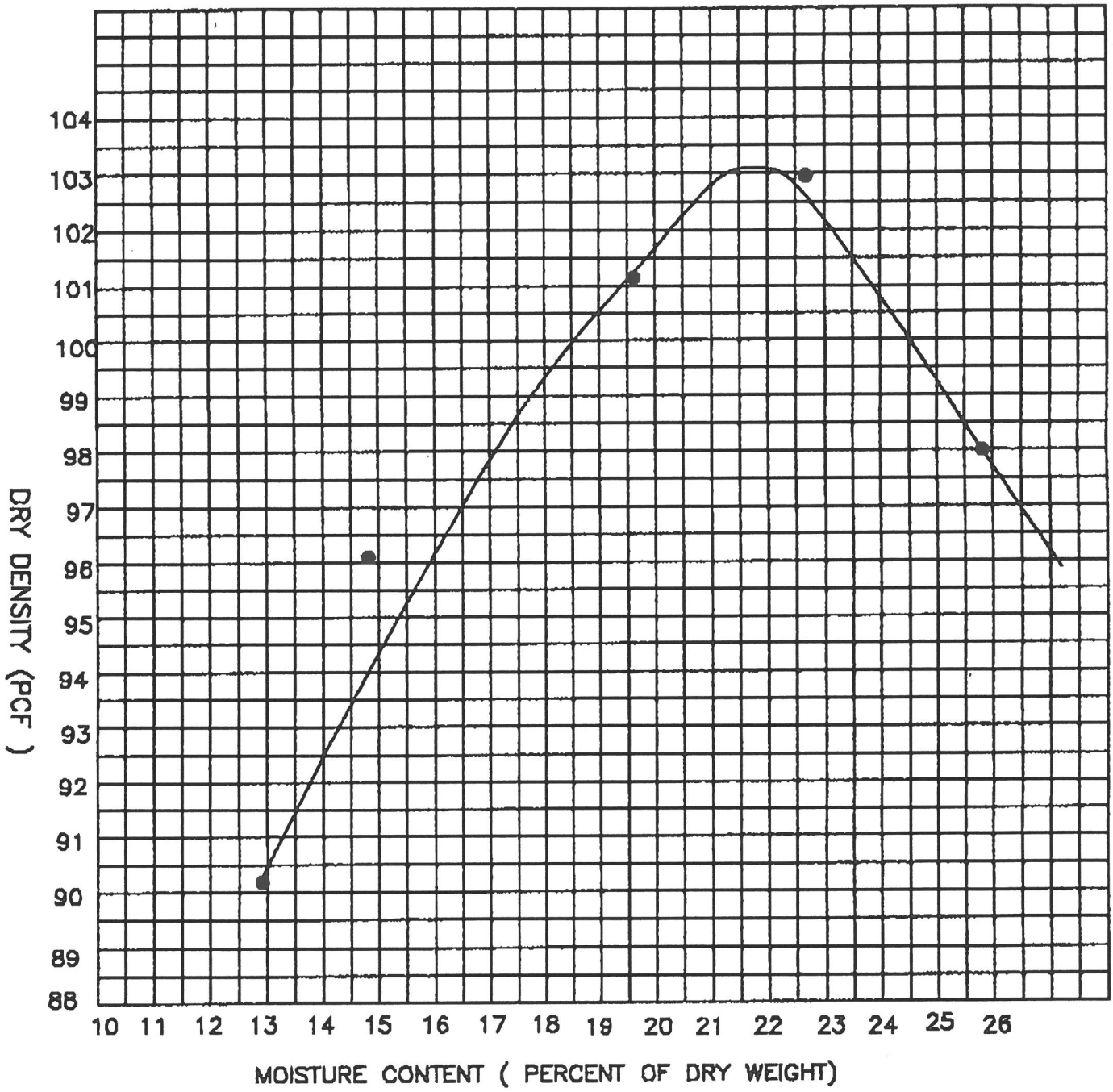
Respectfully submitted,
Professional Service Industries, Inc.

Source: Borrow Pit

PROJECT NO.: 19-2141-2

MOISTURE DENSITY RELATIONSHIPS

TEST METHOD: ASTM D-698



MAXIMUM DRY DENSITY (LBS. / CU. FT.) 103.10

OPTIMUM MOISTURE CONTENT (%) 21.6

TYPE OF MATERIAL MOTTLED GRAY AND BROWN SILTY CLAY, TRACE SAND, TRACE GRAVEL.

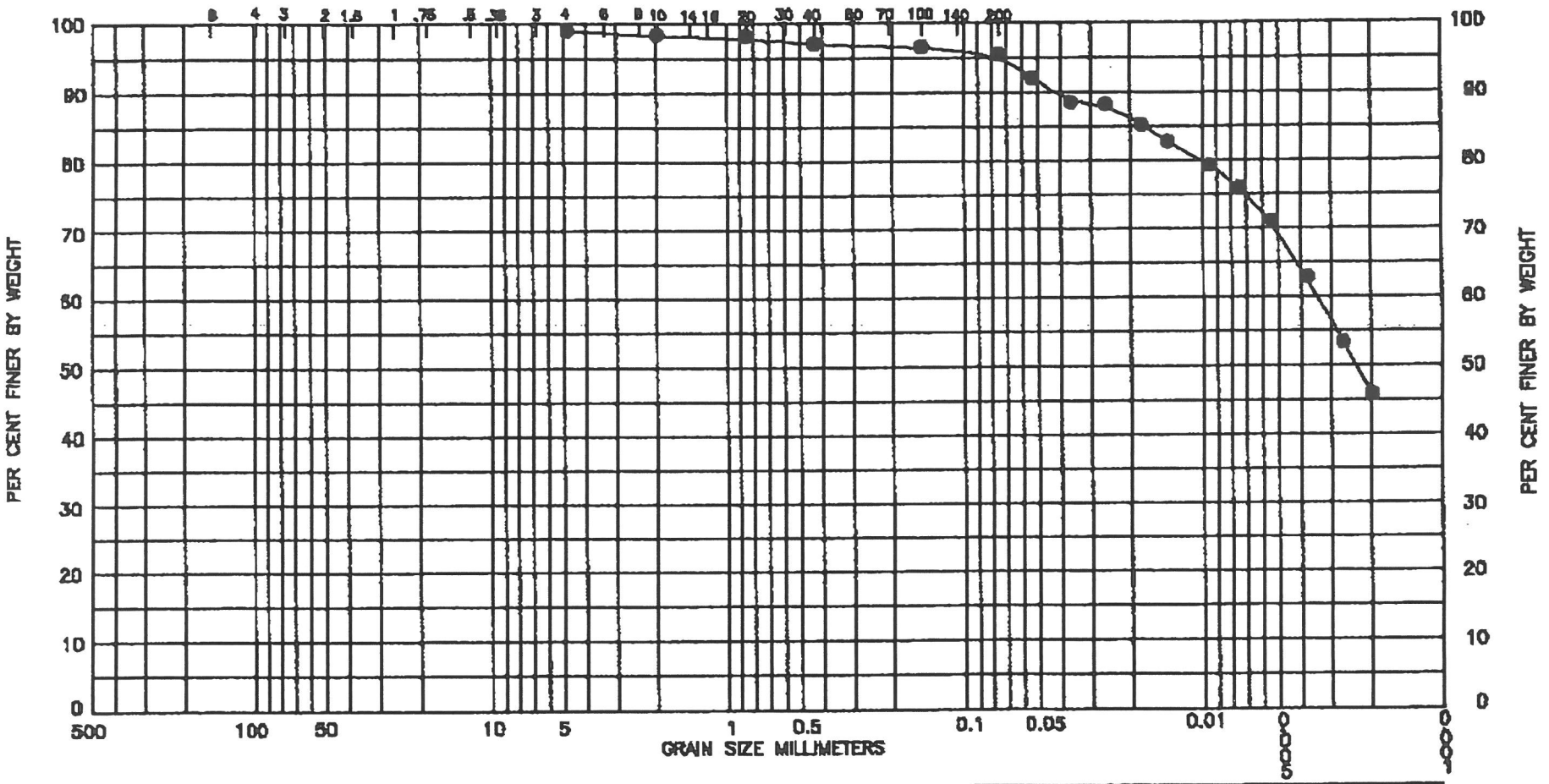
SAMPLE NO. 2

FOR: ANDREWS ENVIRONMENTAL ENG.

SUBJECT: C.W.L.P.

AE EXPLORATION CORPORATION
2813 NORTH DIRKSEN PARKWAY
SPRINGFIELD, ILLINOIS 62702
(217) 525-6023 FAX: (217) 525-6025

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COURSE	FINE	COURSE	MEDIUM	FINE	

BORING NO.	SAMPLE NO.	ELEV./ DEPTH	USC	DECRIPTION	NAT. W%	LL	PL	PI
	2		CL/CH	MOTTLED GRAY & BROWN SILTY CLAY, TRACE SAND, TRACE GRAVEL		53.8	21.9	31.9

% GRAVEL	1.1
% SAND	3.2
% SILT	25.8
% CLAY	70.1

SPECIAL REMARKS

ASTM D-422

AE EXPLORATION CORPORATION
2815 NORTH DIRKSEN PARKWAY
SPRINGFIELD, ILLINOIS 62702
(217) 525-8023 FAX: (217) 525-8025

NOV 04 '92 14:22 AE_EXPLORATION 217-525-6025 P.7/7

Professional Service Industries, Inc.

REPORT OF MOISTURE DENSITY RELATIONSHIP OF SOIL

TESTED FOR: Andrews Environmental Engineering
3535 Mayflower Boulevard
Springfield, Illinois 62707

Attn: Mr. Mike McDermont

PROJECT: City, Water, Light & Power

DATE: December 9, 1992
December 15, 1992

OUR REPORT NO.: 020-20039-06 (Revised)

TEST DATA SOIL I.D. # 5

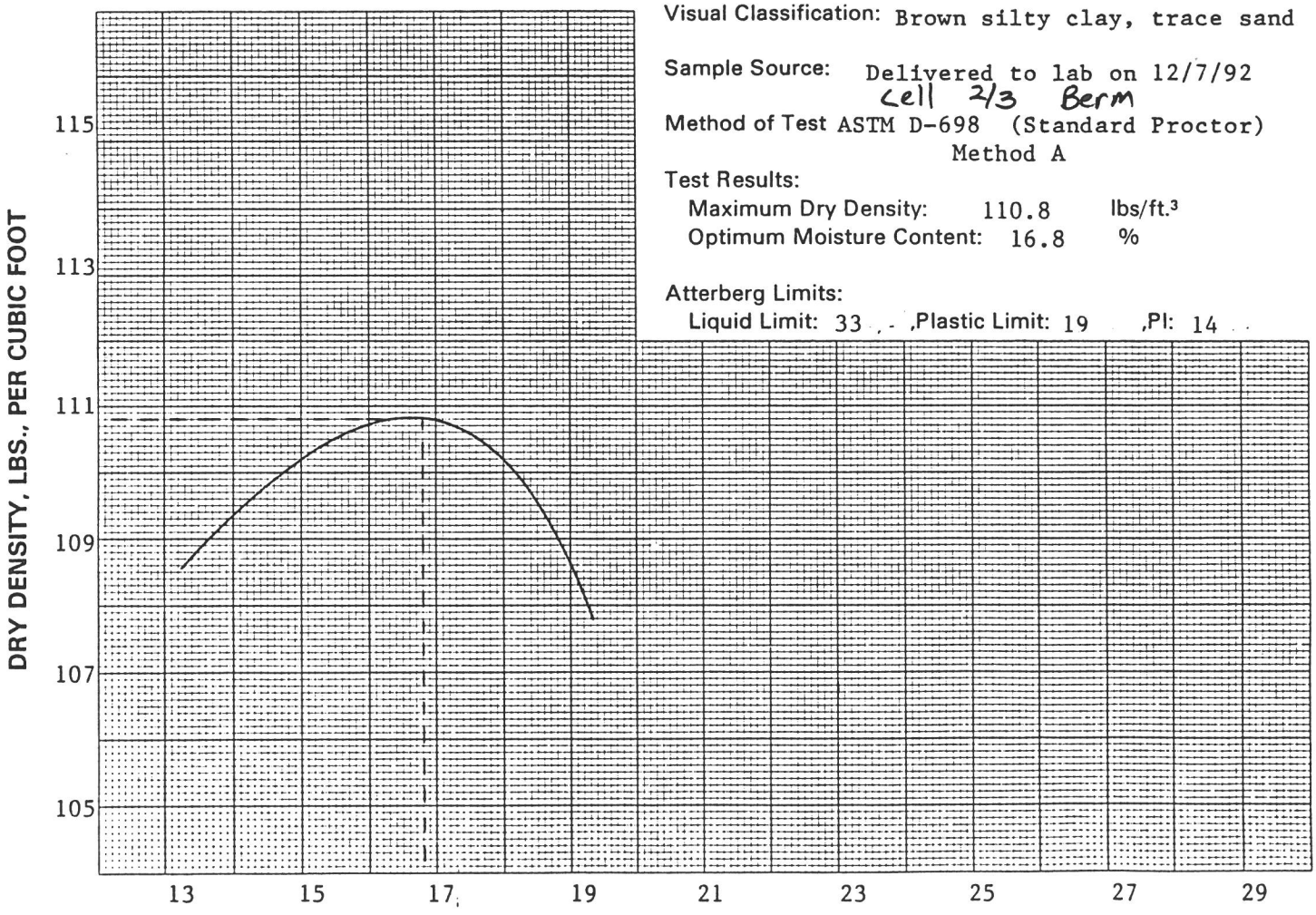
Visual Classification: Brown silty clay, trace sand

Sample Source: Delivered to lab on 12/7/92
Cell 2/3 Berm

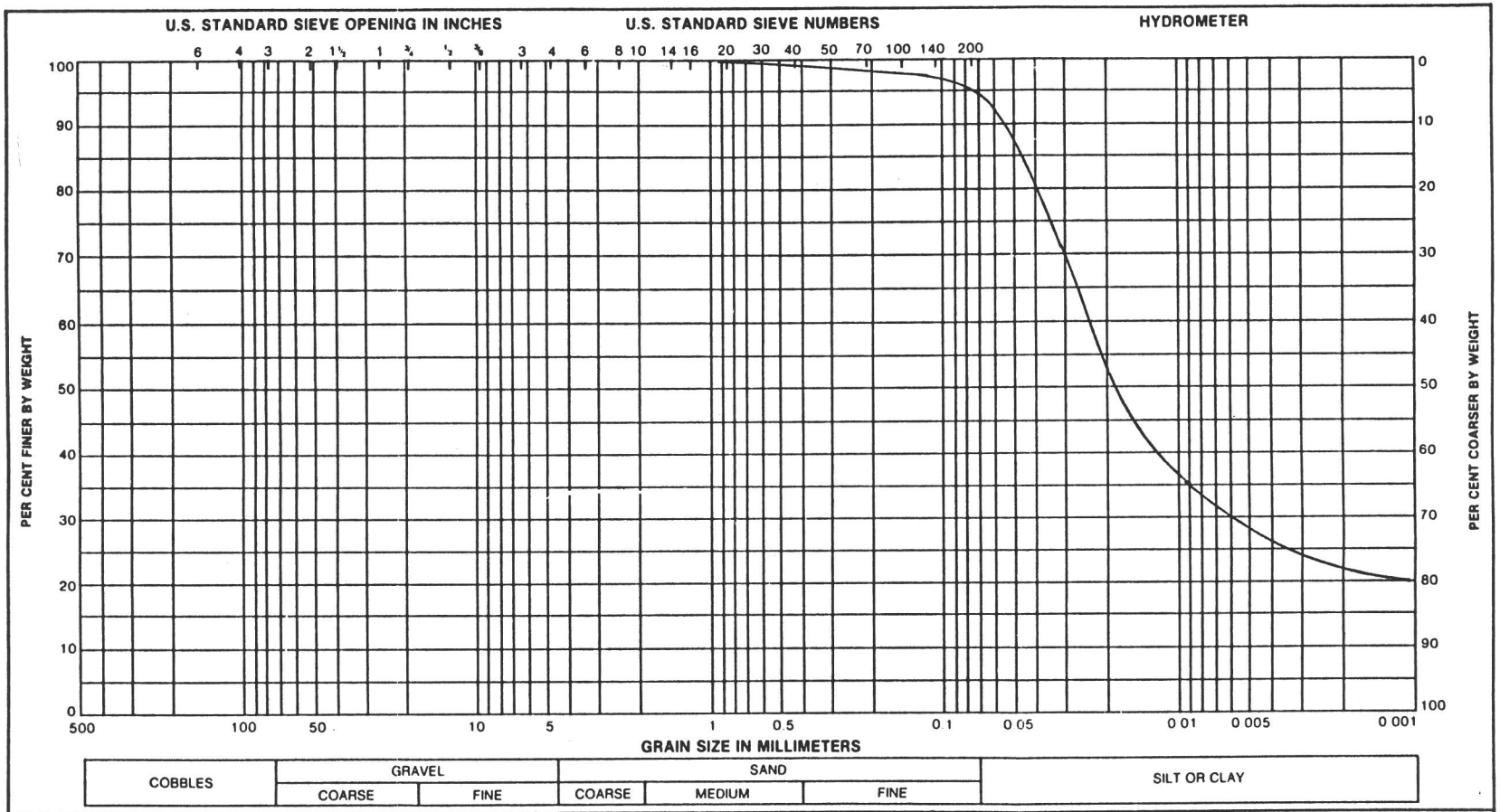
Method of Test ASTM D-698 (Standard Proctor)
Method A

Test Results:
Maximum Dry Density: 110.8 lbs/ft.³
Optimum Moisture Content: 16.8 %

Atterberg Limits:
Liquid Limit: 33 ,Plastic Limit: 19 ,PI: 14



Respectfully submitted,
Professional Service Industries, Inc.



Boring No.	Sample No.	Elev. or Depth	Classification	Nat w %	LL	PL	PI	Project
		--	Silty clay, trace sand,	--	38	20	18	City, Water, Light & Power
			Mottled brown					

REPORT OF SOIL ANALYSIS

File No. 020-20039-06 (Page 2 of 2)

Professional Service Industries, Inc.

REPORT OF MOISTURE DENSITY RELATIONSHIP OF SOIL

TESTED FOR: Andrews Environmental Engineering
3535 Mayflower Boulevard
Springfield, Illinois 62707

Attn: Mr. Mike McDermont

PROJECT: City, Water, Light & Power

DATE: December 4, 1992

OUR REPORT NO.: 020-20039-04

TEST DATA SOIL I.D. # 3

Visual Classification: Brown Clayey silt to silty clay, trace sand 92-12-02-C

Sample Source: Delivered to Lab

Method of Test ASTM D-698 (Standard Proctor) Method A

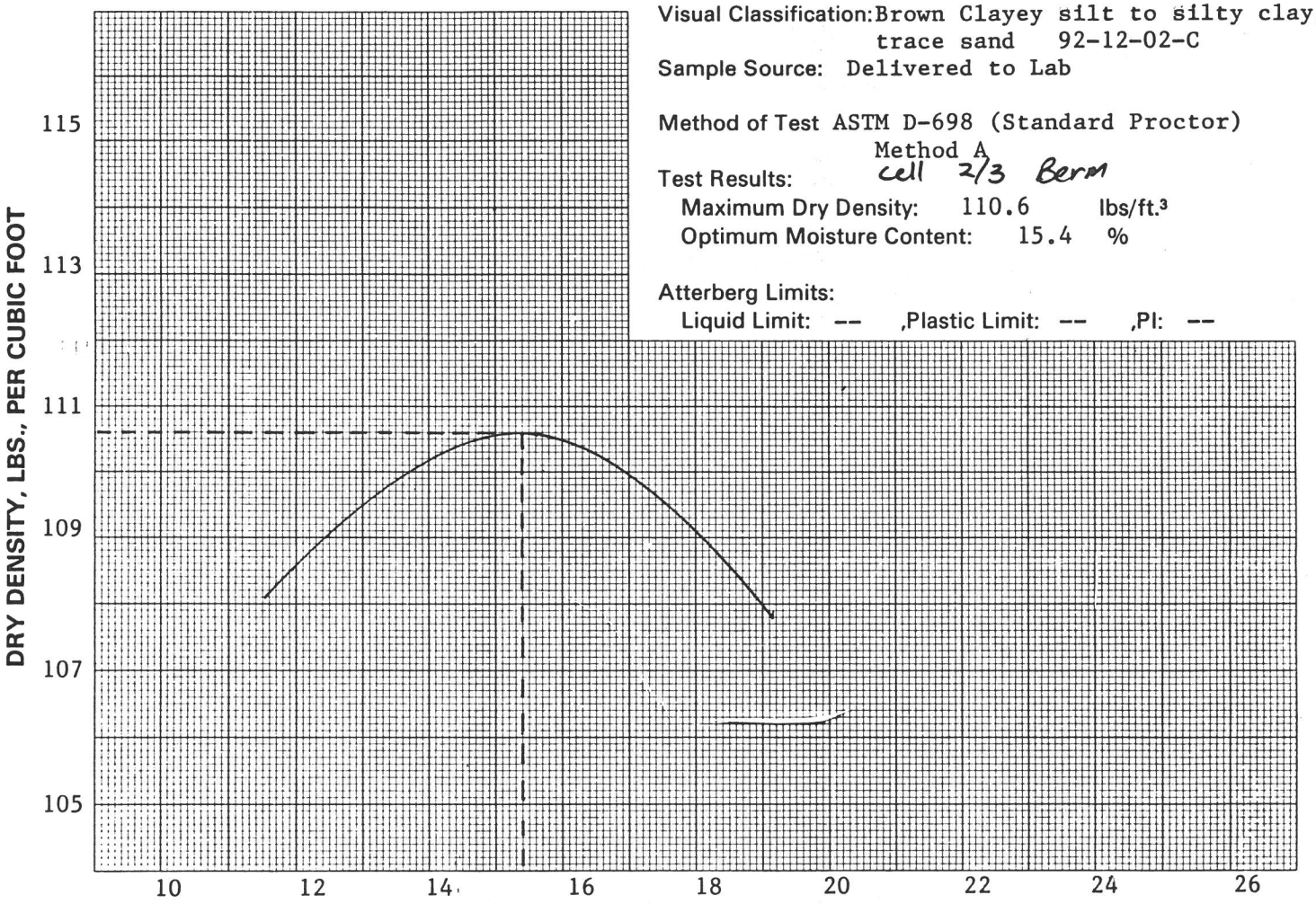
Test Results: cell 2/3 Berm

Maximum Dry Density: 110.6 lbs/ft.³

Optimum Moisture Content: 15.4 %

Atterberg Limits:

Liquid Limit: -- ,Plastic Limit: -- ,PI: --



Respectfully submitted,
Professional Service Industries, Inc.

308 North Street • Springfield, IL 62704 • Phone: 217/544-6663 • Fax: 217/544-6148

ATTACHMENT 4

Liner Permeability Analysis

SHAFFER KRIMMEL SILVER
AND ASSOCIATES, INC. • 2900 N. MARTIN LUTHER KING, JR. DRIVE, DECATUR, ILLINOIS 62526 • 217-877-2100 • FAX 217-877-4816

CONSULTING ENGINEERS
• CIVIL ENGINEERING • GEOTECHNICAL ENGINEERING • STRUCTURAL ENGINEERING • LAND SURVEYING • SOILS / MATERIALS TESTING
• SUBSURFACE INVESTIGATIONS • ENVIRONMENTAL INVESTIGATIONS • CONSTRUCTION QUALITY CONTROL

Client: Andrews Environmental Engineering, Inc.
3535 Mayflower Boulevard
Springfield, Illinois 62707

Attn: Mr. Mike McDermont

Subject: Soil Laboratory Test Results
Scrubber Landfill
City Water, Light & Power
City of Springfield, IL

Date: November 13, 1992

Project No.: I9-24932-6s

Report No.: 24932-3

Sheet 1 of 6

Enclosed are copies of the results of assigned laboratory soil testing for the subject project.

We trust that this submittal is adequate for your present need; however, please call if you have any questions regarding it. We have appreciated performing this work for you.

Very truly yours,

SHAFFER, KRIMMEL, SILVER & ASSOCIATES, INC.

BY: Van A. Silver
Van A. Silver, P.E.

VAS/vy

Enclosures: Test Boring Logs of Shelby Tube Samples (1 sheet)
Permeability & Classification Test Results (2 sheets)
Gradation Curves w/Atterberg Limits' Results (2 sheets)

SKS shaffer • krimmel • silver
AND ASSOCIATES, INC. CONSULTING ENGINEERS
2900 N. Martin Luther King, Jr. Drive • P.O. Box 2233 • Decatur, IL 62526 • 217/877-2100

TEST BORING LOGS Cell #3

PROJECT City Water Light & Power
PROJECT NO. 24932
FOR Andrews Environmental Engineering
DATE October 20, 1992
WEATHER _____
DEPTH TO WATER _____ @ _____ HRS.
DEPTH TO WATER _____ @ _____ HRS.
DRILLER _____ HELPER _____

BORING NO. _____
LOCATION N 5085 E 2125
SURFACE ELEV. _____

S	DEPTH; FT. FROM	DEPTH; FT. TO	SAMPLE DESCRIPTION RECOVERY 14.5
ST-1	532.30		Mottled brown, moist, medium to high plasticity SILTY CLAY,
		531.09	trace sand

DATE October 20, 1992
WEATHER _____
DEPTH TO WATER _____ @ _____ HRS.
DEPTH TO WATER _____ @ _____ HRS.
DRILLER _____ HELPER _____

BORING NO. _____
LOCATION N 5162.5 E 2192.9
SURFACE ELEV. _____

S	DEPTH; FT. FROM	DEPTH; FT. TO	SAMPLE DESCRIPTION RECOVERY 21.0
ST-2	531.81		Mottled brown, moist, medium plasticity, SILTY CLAY, trace sand
		530.06	

SHAFFER KRIMMEL SILVER
AND ASSOCIATES, INC. • 2900 N. MARTIN LUTHER KING, JR. DRIVE, DECATUR, ILLINOIS 62526 • 217-877-2100 • FAX 217-877-4816

CONSULTING ENGINEERS • CIVIL ENGINEERING • GEOTECHNICAL ENGINEERING • STRUCTURAL ENGINEERING • LAND SURVEYING • SOILS / MATERIALS TESTING • SUBSURFACE INVESTIGATIONS • ENVIRONMENTAL INVESTIGATIONS • CONSTRUCTION QUALITY CONTROL

PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CITY, WATER, LIGHT AND POWER; CELL 3
DATE: November 12, 1992
PROJECT NO.: I9-24932-6s.
CLIENT: ANDREWS ENVIRONMENTAL ENGINEERING INC.
REPORT NO: 24932-4

SAMPLE IDENTIFICATION: ST-1; N 5085/ E 2125 DEPTH/ELEV: 532.3

CLASSIFICATION; USCS: CL-CH USDA:

DESCRIPTION: Mottled Brown, Moist, Medium-High Plasticity, SILTY CLAY, Trace Sand

SOIL PARTICLE SIZES
GRAVEL %: 0.0 SAND %: 1.0 SILT %: 54.0 CLAY %: 45.0 *

NATURAL MOISTURE %: 21.7 DENSITY;lb/ft3 NATURAL: 106.5
LIQUID LIMIT : 49.0 MAX. DRY;lb/ft3: REMOLDED: 0.0
PLASTICITY INDEX : 26.0 PROCTOR;DEG OF COMPACTION ( ):
PERMEABILITY (k), cm/sec: 1.12E-9 **

PERMEABILITY TEST DETAILS

SAMPLES OBTAINED BY: CLIENT TYPE OF SAMPLE: Undisturbed

SPECIMEN DATA
DIAMETER;cm: 7.239 INITIAL WEIGHT;pcf: 129.5
LENGTH;cm: 7.201 DRY UNIT WEIGHT;pcf: 106.5
AREA;cm2: 41.16 INITIAL % H2O: 21.7
VOLUME;cm3: 296.4 FINAL % H2O: 25.6
VOID RATIO: 0.6068 FLOW ORIENTATION: V
TEST APPARATUS: GEOTEST

TEST PRESSURES
CELL/CONFINING; psi: 85.0 HEADWATER;cm:
SAMPLE BACK PRESSURE;psi: 62.0 TAILWATER;cm:
HYDRAULIC; GRADIENT: 29.3 DRIVING: 3.00 psi 210.9 cm H2O
PERMEANT LIQUID: 0.005 N CaSO4

TIME OF TEST; SATURATION: 137.6 Hrs PERMEABILITY: 48.0 Hrs
FLOW THRU SPECIMEN; TOTAL: 5.60 ml PERMEABILITY TEST: 0.25 ml
TEMPERATURE CORRECTION; TEMPERATURE: 22.4 C FACTOR: 0.944

REMARKS: Three inch thin-wall Shelby tube sample obtained and delivered by client. See informational sheets on hydraulic conductivity/permeability test procedures.

* Percentage of silt and clay fractions is based on 0.002mm as the division between the fractions (Unified Soil Classification System)

** E-8 equals 10 to the minus 8 (exponent); cm3 equals cubic centimeters; the 2 in H2O is a subscript.

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PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CITY, WATER, LIGHT AND POWER; CELL 3
DATE: November 12, 1992
PROJECT NO.: I9-24932-6s.
CLIENT: ANDREWS ENVIRONMENTAL ENGINEERING INC.
REPORT NO: 24932-4

SAMPLE IDENTIFICATION: ST-2; N 5162.5/E 2192.5 DEPTH/ELEV: 531.81

CLASSIFICATION; USCS: CL-m USDA:

DESCRIPTION: Mottled Brown, Moist, Medium Plasticity, SILTY CLAY, Trace Sand

SOIL PARTICLE SIZES
GRAVEL %: 0.0 SAND %: 1.0 SILT %: 66.0 CLAY %: 33.0 *

NATURAL MOISTURE %: 21.6 DENSITY;lb/ft3 NATURAL: 108.3
LIQUID LIMIT : 42.0 MAX. DRY;lb/ft3: REMOLDED: 0.0
PLASTICITY INDEX : 20.0 PROCTOR;DEG OF COMPACTION ( ):
PERMEABILITY (k), cm/sec: 2.84E-9 **

PERMEABILITY TEST DETAILS

SAMPLES OBTAINED BY: CLIENT TYPE OF SAMPLE: Undisturbed

SPECIMEN DATA
DIAMETER;cm: 7.188 INITIAL WEIGHT;pcf: 131.7
LENGTH;cm: 7.252 DRY UNIT WEIGHT;pcf: 108.3
AREA;cm2: 40.58 INITIAL % H2O: 21.6
VOLUME;cm3: 294.3 FINAL % H2O: 21.7
VOID RATIO: 0.5680 FLOW ORIENTATION: V
TEST APPARATUS: GEOTEST

TEST PRESSURES
CELL/CONFINING; psi: 85.0 HEADWATER;cm:
SAMPLE BACK PRESSURE;psi: 57.0 TAILWATER;cm:
HYDRAULIC; GRADIENT: 29.1 DRIVING: 3.00 psi 210.9 cm H2O
PERMEANT LIQUID: 0.005 N CaSO4

TIME OF TEST; SATURATION: 115.9 Hrs PERMEABILITY: 98.0 Hrs
FLOW THRU SPECIMEN; TOTAL: 6.52 ml PERMEABILITY TEST: 1.24 ml
TEMPERATURE CORRECTION; TEMPERATURE: 22.1 C FACTOR: 0.952

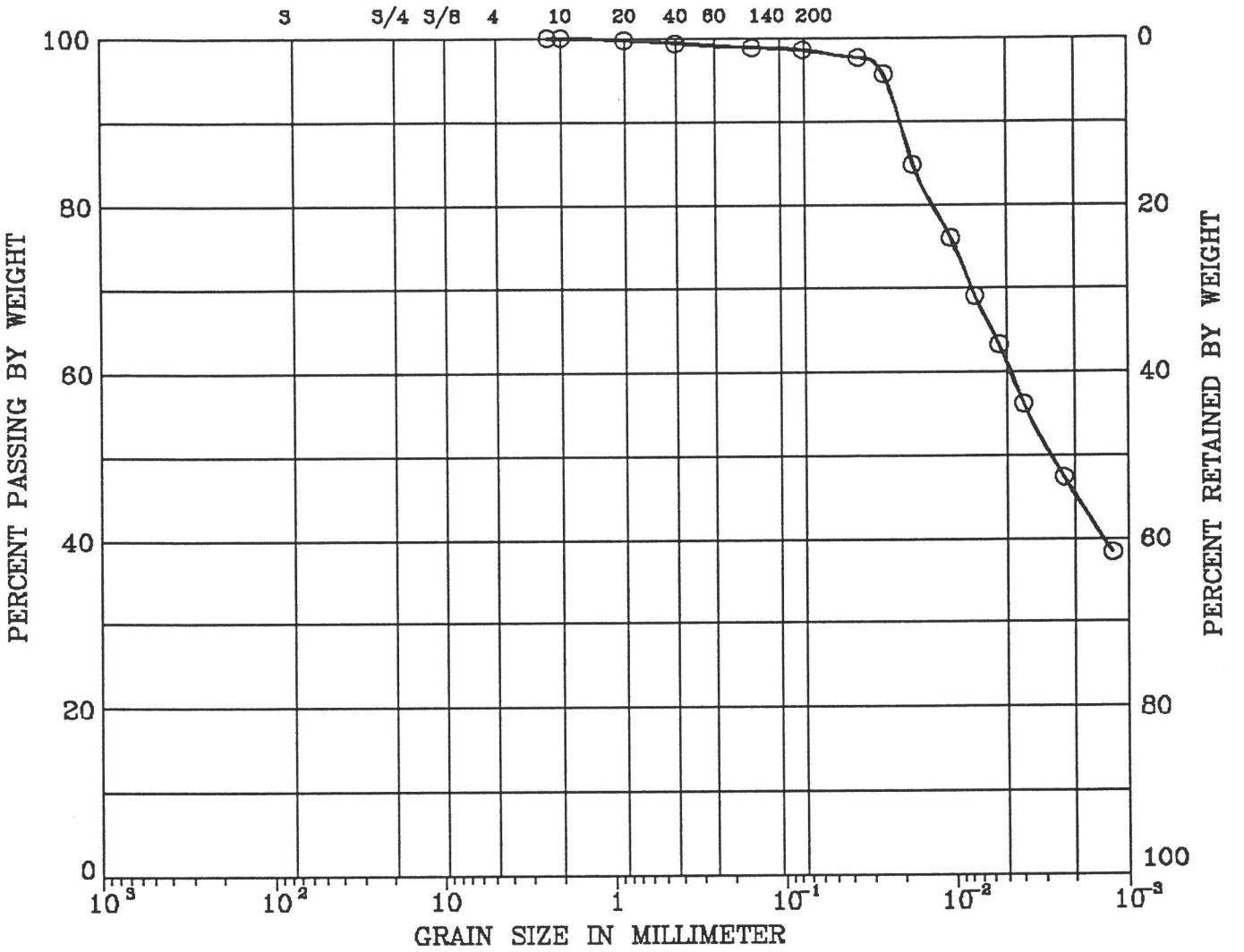
REMARKS: Three inch thin-wall Shelby tube sample obtained and delivered by client. See informational sheets on hydraulic conductivity/permeability test procedures.

* Percentage of silt and clay fractions is based on 0.002mm as the division between the fractions (Unified Soil Classification System)

** E-8 equals 10 to the minus 8 (exponent); cm3 equals cubic centimeters; the 2 in H2O is a subscript.

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



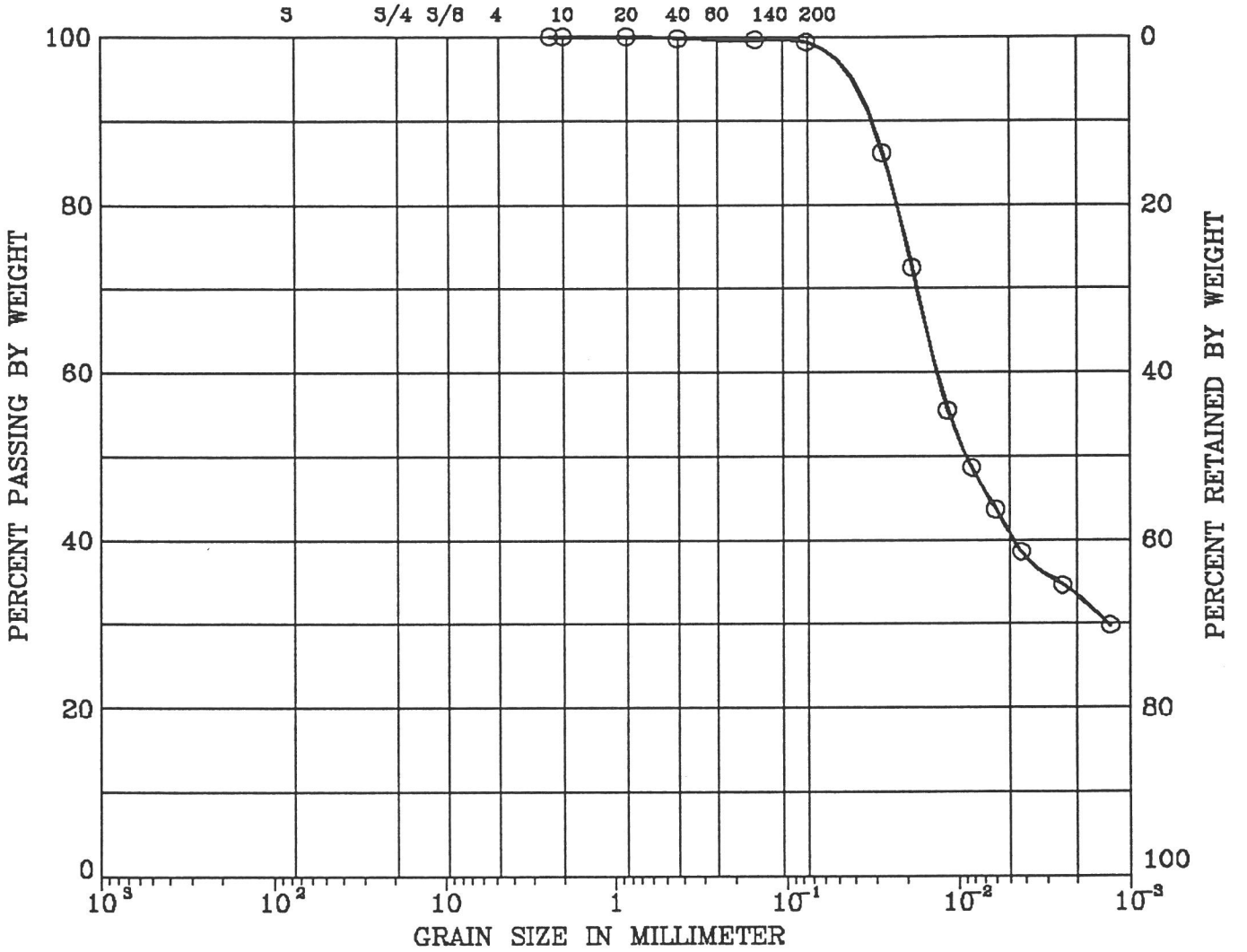
SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
O	ST-1	532.3	49	26	Mottled Brown, Med.-High Pl., SILTY CLAY, Tr. Sand

Remark : N 5085/ E 2125

24932	CITY WATER, LIGHT AND POWER; CELL 3
Shaffer, Krimmel Silver & Associates, Inc	GRAIN SIZE DISTRIBUTION

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
O	ST-2	531.81	42	20	Mottled Brown, Med. Pl., SILTY CLAY, Trace Sand

Remark : N 5162.5/ E 2192.9

24932	CITY WATER, LIGHT AND POWER; CELL 3
Shaffer, Krimmel Silver & Associates, Inc	GRAIN SIZE DISTRIBUTION

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• SUBSURFACE INVESTIGATIONS • ENVIRONMENTAL INVESTIGATIONS • CONSTRUCTION QUALITY CONTROL

Client: Andrews Environmental Engineering, Inc.
3535 Mayflower Boulevard
Springfield, Illinois 62707

Attn: Mr. Mike McDermont

Subject: Soil Laboratory Test Results
Scrubber Landfill
City Water, Light & Power
City of Springfield, IL

Date: December 30, 1992

Project No.: I9-24932-6s

Report No.: 24932-4

Sheet 1 of 7

Enclosed are copies of the results of assigned laboratory soil testing for the subject project. Please note that Shelby tube #3 (N 5571.19; E 2205.98) was insufficient/unsuitable for testing. We were advised by your office that this sample would be replaced, but we have never received the replacement sample.

We trust that this submittal is adequate for your present need; however, please call if you have any questions regarding it. We have appreciated performing this work for you.

SHAFFER, KRIMMEL, SILVER & ASSOCIATES, INC.

BY: Van A. Silver
Van A. Silver, P.E.

VAS/vy

Enclosures: Test Boring Logs of Shelby Tube Samples (2 sheets)
Permeability & Classification Test Results (2 sheets)
Gradation Curves w/Atterberg Limits' Results (2 sheets)

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TEST BORING LOGS

PROJECT City Water, Light & Power
PROJECT NO. I9-24932-6s
FOR Andrews Environmental Engineering
DATE 12/11/92
WEATHER _____
DEPTH TO WATER _____ @ _____ HRS.
DEPTH TO WATER _____ @ _____ HRS.
DRILLER _____ HELPER _____

BORING NO. ST-1
LOCATION N 5215.68 E 2040.24
SURFACE ELEV. 534.07

S	DEPTH; FT. FROM	TO	1627 SAMPLE DESCRIPTION RECOVERY 14.5
ST-1	534.07		Mottled brown/gray, very moist, medium to high plasticity, SILTY
		532.86	CLAY, trace sand
			LL=45; PL=23; PI=22
			Gravel - 0%; Sand - 1%; Silt - 50%; Clay - 49%; Fines - 99%

DATE 12/11/92
WEATHER _____
DEPTH TO WATER _____ @ _____ HRS.
DEPTH TO WATER _____ @ _____ HRS.
DRILLER _____ HELPER _____

BORING NO. ST-2
LOCATION N 5224.87 E 2001.93
SURFACE ELEV. 542.20

S	DEPTH; FT. FROM	TO	1628 SAMPLE DESCRIPTION RECOVERY 14.5
ST-2	542.20		Mottled dark brown, very moist, medium plasticity SILTY CLAY,
		540.99	trace sand
			LL=40; PL=20; PI=20
			Gravel - 0%; Sand - 6%; Silt - 68%; Clay - 26%; Fines - 94%

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TEST BORING LOGS

PROJECT City Water, Light & Power
PROJECT NO. I9-24932-6s
FOR Andrews Environmental Engineering
DATE 12/11/92
WEATHER _____
DEPTH TO WATER _____ @ _____ HRS.
DEPTH TO WATER _____ @ _____ HRS.
DRILLER _____ HELPER _____

BORING NO. ST-3
LOCATION N 5571.19 E 2205.98
SURFACE ELEV. 540.43

S	DEPTH; FT. FROM	TO	1629 SAMPLE DESCRIPTION RECOVERY 5.5
ST-3	540.43		Mottled dark brown, very moist, medium plasticity SILTY CLAY,
		539.97	trace sand
			Note: There was insufficient undisturbed material in the tube
			for testing purposes.

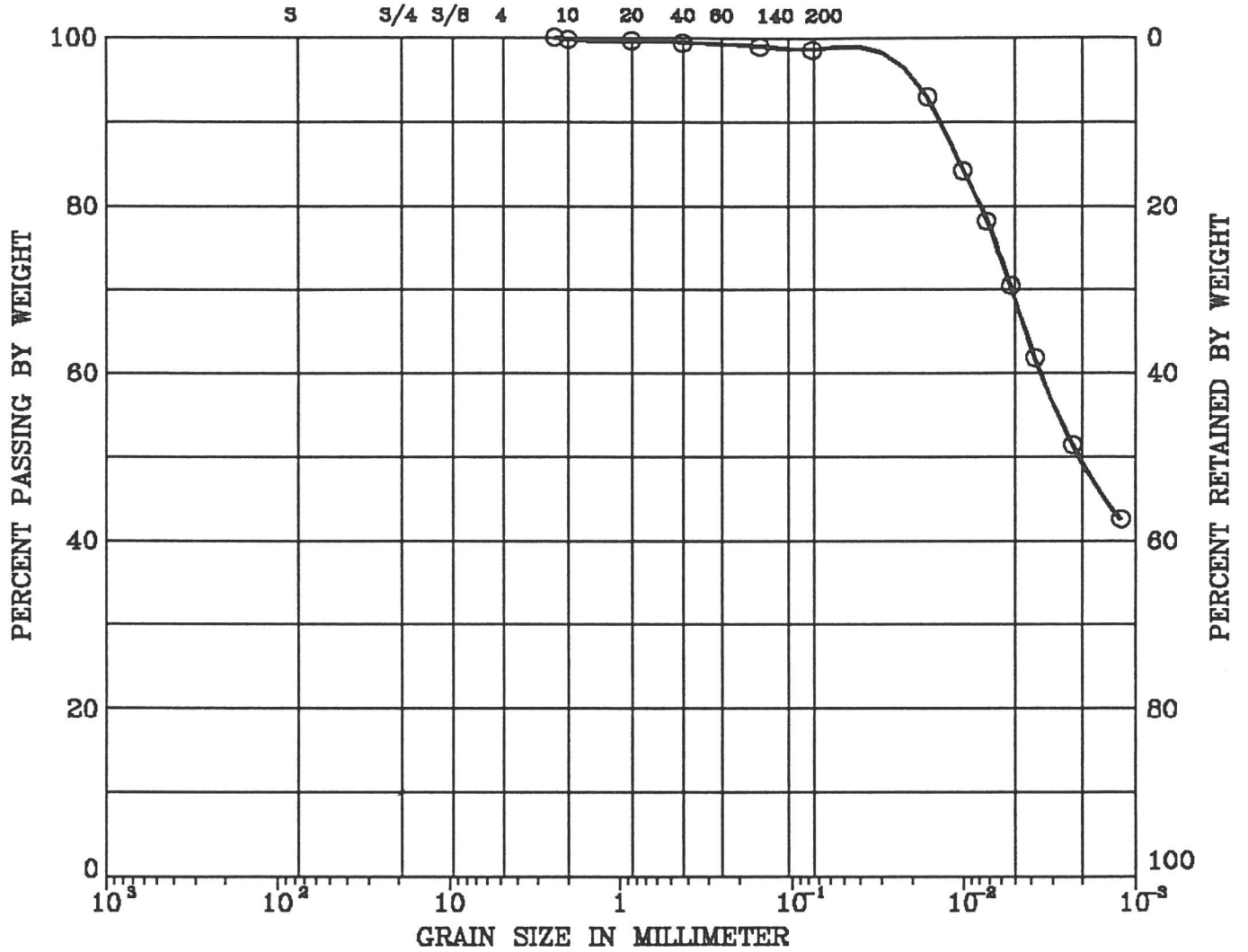
DATE _____
WEATHER _____
DEPTH TO WATER _____ @ _____ HRS.
DEPTH TO WATER _____ @ _____ HRS.
DRILLER _____ HELPER _____

BORING NO. _____
LOCATION _____
SURFACE ELEV. _____

S	DEPTH; FT. FROM	TO	SAMPLE DESCRIPTION

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



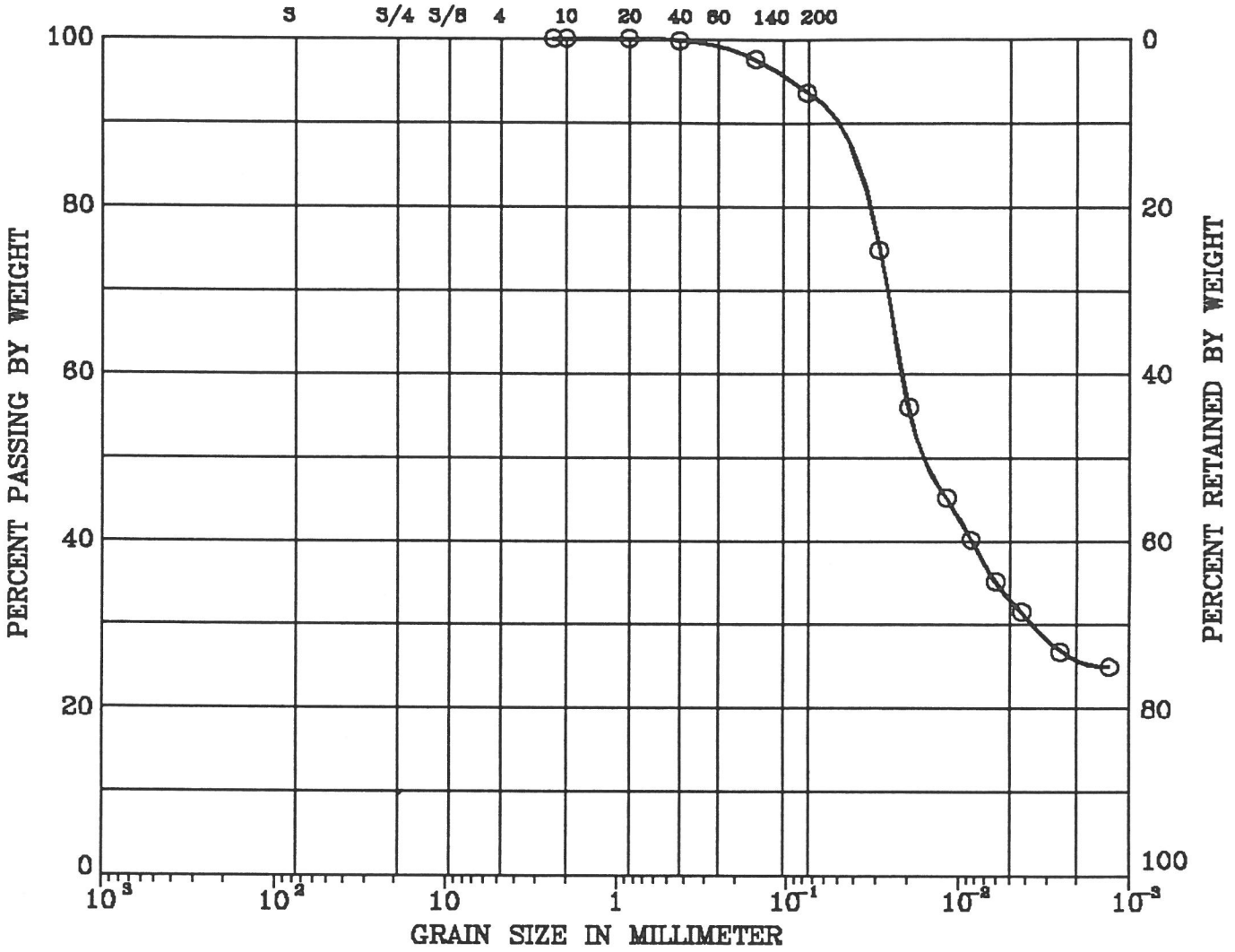
SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
O	ST-1	534.07	45	22	Mott. Br./Gr., Med.-H. Pl., SILTY CLAY, Trace Sand

Remark : N 5215.98/ E 2040.24

24932	CITY WATER, LIGHT AND POWER
Shaffer, Krimmel Silver & Associates, Inc	GRAIN SIZE DISTRIBUTION

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
O	ST-2	542.0	40	20	Mott. Dark Brown, Med. Pl., SILTY CLAY, Trace Sand

Remark : N 5224.87/ E 2001.93

24932	CITY WATER, LIGHT AND POWER
Shaffer, Krimmel Silver & Associates, Inc	GRAIN SIZE DISTRIBUTION

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PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CITY, WATER, LIGHT AND POWER
DATE: December 30, 1992
PROJECT NO.: I9-24932-6s.
CLIENT: ANDREWS ENVIRONMENTAL ENGINEERING INC.
REPORT NO: 24932-5
Sheet 1 of 3

SAMPLE IDENTIFICATION: ST-1; N5215.68/E2040.24 DEPTH/ELEV: 534.07

CLASSIFICATION; USCS: CL-CH USDA:

DESCRIPTION: Mottled Brown/Gray, Very Moist, Medium-High Plasticity, SILTY CLAY, Trace Sand

SOIL PARTICLE SIZES
GRAVEL %: 0.0 SAND %: 1.0 SILT %: 50.0 CLAY %: 49.0 *

NATURAL MOISTURE %: 22.3 DENSITY;lb/ft3 NATURAL: 107.5
LIQUID LIMIT : 45.0 MAX. DRY;lb/ft3: REMOLDED: 0.0
PLASTICITY INDEX : 22.0 PROCTOR;DEG OF COMPACTION ( ):
PERMEABILITY (k), cm/sec: 4.02E-9 **

PERMEABILITY TEST DETAILS

SAMPLES OBTAINED BY: CLIENT TYPE OF SAMPLE: Undisturbed

SPECIMEN DATA
DIAMETER;cm: 7.137 INITIAL WEIGHT;pcf: 131.5
LENGTH;cm: 7.023 DRY UNIT WEIGHT;pcf: 107.5
AREA;cm2: 40.01 , INITIAL % H2O: 22.3
VOLUME;cm3: 281.0 FINAL % H2O: 22.8
VOID RATIO: 0.5909 FLOW ORIENTATION: V
TEST APPARATUS: GEOTEST

TEST PRESSURES
CELL/CONFINING; psi: 85.0 HEADWATER;cm:
SAMPLE BACK PRESSURE;psi: 65.0 TAILWATER;cm:
HYDRAULIC; GRADIENT: 30.0 DRIVING: 3.00 psi 210.9 cm H2O
PERMEANT LIQUID: 0.005 N CaSO4

TIME OF TEST; SATURATION: 99.1 Hrs PERMEABILITY: 112.0 Hrs
FLOW THRU SPECIMEN; TOTAL: 4.14 ml PERMEABILITY TEST: 1.95 ml
TEMPERATURE CORRECTION; TEMPERATURE: 20.2 C FACTOR: 0.996

REMARKS: Three inch thin-wall Shelby tube sample obtained and delivered by client. See informational sheets on hydraulic conductivity/permeability test procedures.

* Percentage of silt and clay fractions is based on 0.002mm as the division between the fractions (Unified Soil Classification System)

** E-8 equals 10 to the minus 8 (exponent); cm3 equals cubic centimeters; the 2 in H2O is a subscript.

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• SUBSURFACE INVESTIGATIONS • ENVIRONMENTAL INVESTIGATIONS • CONSTRUCTION QUALITY CONTROL

PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CITY, WATER, LIGHT AND POWER
DATE: December 30, 1992
PROJECT NO.: I9-24932-6s.
CLIENT: ANDREWS ENVIRONMENTAL ENGINEERING INC.
REPORT NO: 24932-5

SAMPLE IDENTIFICATION: ST-2; N5224.87/E2001.93 DEPTH/ELEV: 542.0

CLASSIFICATION; USCS: CL-m USDA:

DESCRIPTION: Mottled Dark Brown, Very Moist, Medium Plasticity, SILTY CLAY, Trace Sand

SOIL PARTICLE SIZES
GRAVEL %: 0.0 SAND %: 6.0 SILT %: 68.0 CLAY %: 26.0 *

NATURAL MOISTURE %: 19.6 DENSITY;lb/ft3 NATURAL: 112.2
LIQUID LIMIT : 40.0 MAX. DRY;lb/ft3: REMOLDED: 0.0
PLASTICITY INDEX : 20.0 PROCTOR;DEG OF COMPACTION ( ):
PERMEABILITY (k), cm/sec: 1.5E-9 **

PERMEABILITY TEST DETAILS

SAMPLES OBTAINED BY: CLIENT TYPE OF SAMPLE: Undisturbed

SPECIMEN DATA
DIAMETER;cm: 7.188 INITIAL WEIGHT;pcf: 134.2
LENGTH;cm: 7.277 DRY UNIT WEIGHT;pcf: 112.2
AREA;cm2: 40.58 INITIAL % H2O: 19.6
VOLUME;cm3: 295.3 FINAL % H2O: 19.9
VOID RATIO: 0.5128 FLOW ORIENTATION: V
TEST APPARATUS: GEOTEST

TEST PRESSURES
CELL/CONFINING; psi: 85.0 HEADWATER;cm:
SAMPLE BACK PRESSURE;psi: 72.0 TAILWATER;cm:
HYDRAULIC; GRADIENT: 58.0 DRIVING: 6.00 psi 421.9 cm H2O
PERMEANT LIQUID: 0.005 N CaSO4

TIME OF TEST; SATURATION: 188.8 Hrs PERMEABILITY: 30.0 Hrs
FLOW THRU SPECIMEN; TOTAL: 6.69 ml PERMEABILITY TEST: 0.39 ml
TEMPERATURE CORRECTION; TEMPERATURE: 21.3 C FACTOR: 0.968

REMARKS: Three inch thin-wall Shelby tube sample obtained and delivered by client. See informational sheets on hydraulic conductivity/permeability test procedures.

* Percentage of silt and clay fractions is based on 0.002mm as the division between the fractions (Unified Soil Classification System)

** E-8 equals 10 to the minus 8 (exponent); cm3 equals cubic centimeters; the 2 in H2O is a subscript.

FREEZE DAMAGE EVALUATION

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Client: Andrews Environmental Engineering, Inc.
3535 Mayflower Boulevard
Springfield, Illinois 62707

Attn: Mr. Mike McDermont

Subject: Soil Laboratory Test Results
City, Water, Light & Power

Date: June 16, 1993

Project No.: I9-35297-6s

Report No.: 35297-1

Sheet 1 of 6

Enclosed are copies of the results of assigned laboratory soil testing for the subject project.

We trust that this submittal is adequate for your present need; however, please call if you have any questions regarding it. We have appreciated performing this work for you.

Very truly yours,

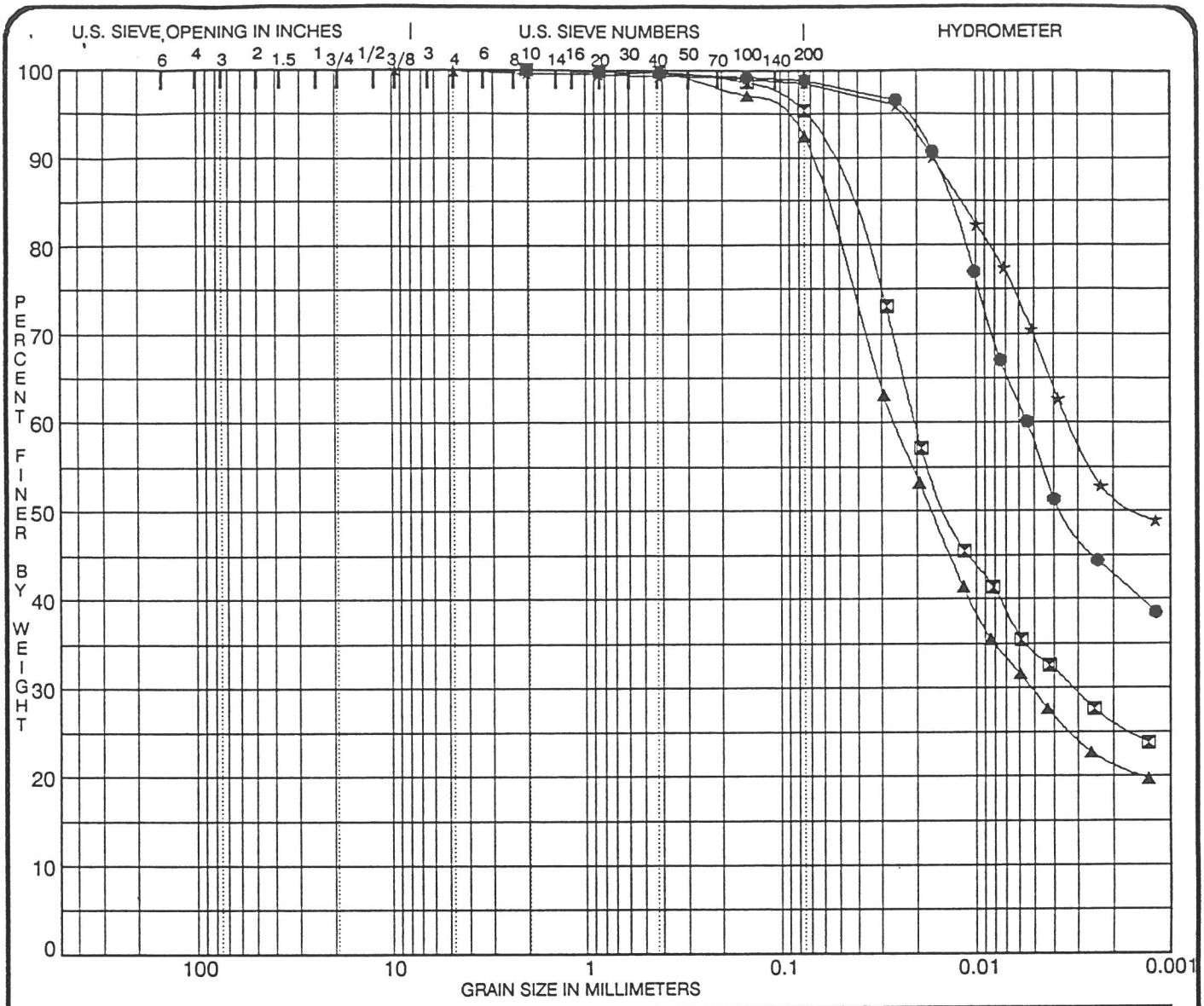
Very truly yours,

SKS ENGINEERS, INC.

BY: Brian E. Smith vy
Brian E. Smith, P.E.

BES/vy

Enclosures: Permeability & Classification Test Results (4 sheets)
Grain Size Distribution w/Atterberg Limits' (1 sheet)



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	MC%	LL	PL	PI	Cc	Cu
●	PT-1	530.8	LEAN CLAY CL		43	20	23		
⊠	PT-2	529.3	LEAN CLAY CL		38	20	18		
▲	PT-3	529.7	LEAN CLAY CL		35	19	16		
★	PT-4	531.4	FAT CLAY CH		51	23	28		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	PT-1	530.8	2.00	0.01			0.0	1.1	41.4	57.5
⊠	PT-2	529.3	2.00	0.02	0.003		0.0	4.7	61.3	34.0
▲	PT-3	529.7	0.85	0.03	0.005		0.0	7.6	63.0	29.4
★	PT-4	531.4	9.52	0.00			0.1	1.4	29.1	69.4

NOTE: % Silt and % Clay based on ASTM Classification (0.005mm)

PROJECT CITY WATER,LIGHT AND POWER - SPRINGFIELD, ILLINOIS

JOB NO. I9-35297-6s

DATE 6/1/93

GRADATION CURVES

SKS ENGINEERS, INC.

Decatur, Illinois

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PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CITY WATER, LIGHT AND POWER
DATE: June 15, 1993
PROJECT NO.: I9-35297-6s.
CLIENT: ANDREWS ENVIRONMENTAL ENGINEERING, INC.
REPORT NO: 35297-1

SAMPLE IDENTIFICATION: Pt.1 ; N5230/ E2170 DEPTH/ELEV: 531.3

CLASSIFICATION; USCS: CL-m USDA:

DESCRIPTION: Mottled brown/gray, moist, medium plasticity, SILTY CLAY, trace sand

SOIL PARTICLE SIZES
GRAVEL %: 0.0 SAND %: 1.0 SILT %: 56.0 CLAY %: 43.0 *

NATURAL MOISTURE %: 24.6 DENSITY;lb/ft3 NATURAL: 104.5
LIQUID LIMIT : 43.0 MAX. DRY;lb/ft3: REMOLDED: 0.0
PLASTICITY INDEX : 23.0 PROCTOR;DEG OF COMPACTION ( ):
PERMEABILITY (k), cm/sec: 6.03E-9 **

PERMEABILITY TEST DETAILS

SAMPLES OBTAINED BY: CLIENT TYPE OF SAMPLE: Undisturbed

SPECIMEN DATA
DIAMETER;cm: 7.190 INITIAL WEIGHT;pcf: 130.2
LENGTH;cm: 3.645 DRY UNIT WEIGHT;pcf: 104.5
AREA;cm2: 40.60 INITIAL % H2O: 24.6
VOLUME;cm3: 148.0 FINAL % H2O:
VOID RATIO: 0.6250 FLOW ORIENTATION: V
TEST APPARATUS: GEOTEST

TEST PRESSURES
CELL/CONFINING; psi: 10.0 HEADWATER;cm:
SAMPLE BACK PRESSURE;psi: 5.0 TAILWATER;cm:
HYDRAULIC; GRADIENT: 19.3 DRIVING: 1.00 psi 70.3 cm H2O
PERMEANT LIQUID: 0.005 N CaSO4

TIME OF TEST; SATURATION: 67.3 Hrs PERMEABILITY: 51.0 Hrs
FLOW THRU SPECIMEN; TOTAL: 2.39 ml PERMEABILITY TEST: 0.94 ml
TEMPERATURE CORRECTION; TEMPERATURE: 23.4 C FACTOR: 0.922

REMARKS:

* Percentage of silt and clay fractions is based on 0.002mm as the division between the fractions (Unified Soil Classification System)

** Hydraulic conductivity test conducted in accordance with ASTM D 5084-90 unless noted otherwise. E-8 equals 10 to the minus 8 (exponent); cm3 equals cubic centimeters; The 2 in H2O is a subscript.

SKS ENGINEERS, INC.

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PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CITY WATER, LIGHT AND POWER
DATE: June 15, 1993
PROJECT NO.: I9-35297-6s.
CLIENT: ANDREWS ENVIRONMENTAL ENGINEERING, INC.
REPORT NO: 35297-1

SAMPLE IDENTIFICATION: Pt.2; N5293.4/ E2251.6 DEPTH/ELEV: 528.3

CLASSIFICATION; USCS: CL-m USDA:

DESCRIPTION: Mottled brown/gray, moist, medium plasticity, SILTY CLAY, trace sand

SOIL PARTICLE SIZES
GRAVEL %: 0.0 SAND %: 5.0 SILT %: 69.0 CLAY %: 26.0 *

NATURAL MOISTURE %: 19.4 DENSITY;lb/ft3 NATURAL: 111.0
LIQUID LIMIT : 38.0 MAX. DRY;lb/ft3: REMOLDED: 0.0
PLASTICITY INDEX : 18.0 PROCTOR;DEG OF COMPACTION ( ):
PERMEABILITY (k), cm/sec: 5.68E-9 **

PERMEABILITY TEST DETAILS

SAMPLES OBTAINED BY: CLIENT TYPE OF SAMPLE: Undisturbed

SPECIMEN DATA
DIAMETER;cm: 7.112 INITIAL WEIGHT;pcf: 132.5
LENGTH;cm: 3.683 DRY UNIT WEIGHT;pcf: 111.0
AREA;cm2: 39.73 INITIAL % H2O: 19.4
VOLUME;cm3: 146.3 FINAL % H2O: 18.6
VOID RATIO: 0.5301 FLOW ORIENTATION: V
TEST APPARATUS: GEOTEST

TEST PRESSURES
CELL/CONFINING; psi: 10.0 HEADWATER;cm:
SAMPLE BACK PRESSURE;psi: 5.0 TAILWATER;cm:
HYDRAULIC; GRADIENT: 19.1 DRIVING: 1.00 psi 70.3 cm H2O
PERMEANT LIQUID: 0.005 N CaSO4

TIME OF TEST; SATURATION: 117.0 Hrs PERMEABILITY: 74.0 Hrs
FLOW THRU SPECIMEN; TOTAL: 5.01 ml PERMEABILITY TEST: 1.29 ml
TEMPERATURE CORRECTION; TEMPERATURE: 24.9 C FACTOR: 0.891

REMARKS:

* Percentage of silt and clay fractions is based on 0.002mm as the division between the fractions (Unified Soil Classification System)

** Hydraulic conductivity test conducted in accordance with ASTM D 5084-90 unless noted otherwise. E-8 equals 10 to the minus 8 (exponent); cm3 equals cubic centimeters; The 2 in H2O is a subscript.

SKS ENGINEERS, INC.

CONSULTING ENGINEERS

2900 N. MARTIN LUTHER KING, JR. DRIVE • DECATUR, ILLINOIS 62526 • 217-877-2100 • FAX 217-877-4816

PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CITY WATER, LIGHT AND POWER
DATE: June 15, 1993
PROJECT NO.: I9-35297-6s.
CLIENT: ANDREWS ENVIRONMENTAL ENGINEERING, INC.
REPORT NO: 35297-1

SAMPLE IDENTIFICATION: Pt.3; N5301/ E2103 DEPTH/ELEV: 529.7

CLASSIFICATION; USCS: CL-m USDA:

DESCRIPTION: Mottled brown/gray, moist, medium plasticity, SILTY CLAY, trace sand

SOIL PARTICLE SIZES
GRAVEL %: 0.0 SAND %: 8.0 SILT %: 71.0 CLAY %: 21.0 *

NATURAL MOISTURE %: 16.3 DENSITY;lb/ft3 NATURAL: 114.5
LIQUID LIMIT : 35.0 MAX. DRY;lb/ft3: REMOLDED: 0.0
PLASTICITY INDEX : 16.0 PROCTOR;DEG OF COMPACTION ( ):
PERMEABILITY (k), cm/sec: 3.52E-9 **

PERMEABILITY TEST DETAILS

SAMPLES OBTAINED BY: CLIENT TYPE OF SAMPLE: Undisturbed

SPECIMEN DATA

DIAMETER;cm:	7.175	INITIAL WEIGHT;pcf:	133.2
LENGTH;cm:	3.861	DRY UNIT WEIGHT;pcf:	114.5
AREA;cm2:	40.44	INITIAL % H2O:	16.3
VOLUME;cm3:	156.1	FINAL % H2O:	16.1
VOID RATIO:	0.4826	FLOW ORIENTATION:	V

TEST APPARATUS: GEOTEST

TEST PRESSURES
CELL/CONFINING; psi: 10.0 HEADWATER;cm:
SAMPLE BACK PRESSURE;psi: 5.0 TAILWATER;cm:
HYDRAULIC; GRADIENT: 18.2 DRIVING: 1.00 psi 70.3 cm H2O
PERMEANT LIQUID: 0.005 N CaSO4

TIME OF TEST; SATURATION: 24.0 Hrs PERMEABILITY: 167.0 Hrs
FLOW THRU SPECIMEN; TOTAL: 2.38 ml PERMEABILITY TEST: 1.73 ml
TEMPERATURE CORRECTION; TEMPERATURE: 24.5 C FACTOR: 0.9

REMARKS:

* Percentage of silt and clay fractions is based on 0.002mm as the division between the fractions (Unified Soil Classification System)

** Hydraulic conductivity test conducted in accordance with ASTM D 5084-90 unless noted otherwise. E-8 equals 10 to the minus 8 (exponent); cm3 equals cubic centimeters; The 2 in H2O is a subscript.

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CONSULTING ENGINEERS
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PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CITY WATER, LIGHT AND POWER
DATE: June 15, 1993
PROJECT NO.: I9-35297-6s.
CLIENT: ANDREWS ENVIRONMENTAL ENGINEERING, INC.
REPORT NO: 35297-1
Sheet 4 of 4

SAMPLE IDENTIFICATION: Pt.4; N5418.2/ E2225.8 DEPTH/ELEV: 531.4

CLASSIFICATION; USCS: CL-CH USDA:

DESCRIPTION: Mott. brown/gray, moist, medium-high plasticity, SILTY CLAY, tr. sand, tr. grvl.

SOIL PARTICLE SIZES
GRAVEL %: 1.0 SAND %: 1.0 SILT %: 46.0 CLAY %: 52.0 *

NATURAL MOISTURE %: 24.7 DENSITY;lb/ft3 NATURAL: 100.9
LIQUID LIMIT : 51.0 MAX. DRY;lb/ft3: REMOLDED: 0.0
PLASTICITY INDEX : 28.0 PROCTOR;DEG OF COMPACTION ( ):
PERMEABILITY (k), cm/sec: 8.75E-9 **

PERMEABILITY TEST DETAILS

SAMPLES OBTAINED BY: CLIENT TYPE OF SAMPLE: Undisturbed

SPECIMEN DATA

DIAMETER;cm:	7.099	INITIAL WEIGHT;pcf:	125.8
LENGTH;cm:	4.001	DRY UNIT WEIGHT;pcf:	100.9
AREA;cm2:	39.58	INITIAL % H2O:	24.7
VOLUME;cm3:	158.4	FINAL % H2O:	23.9
VOID RATIO:	0.6959	FLOW ORIENTATION:	V

TEST APPARATUS: GEOTEST

TEST PRESSURES
CELL/CONFINING; psi: 10.0 HEADWATER;cm:
SAMPLE BACK PRESSURE;psi: 5.0 TAILWATER;cm:
HYDRAULIC; GRADIENT: 17.6 DRIVING: 1.00 psi 70.3 cm H2O
PERMEANT LIQUID: 0.005 N CaSO4

TIME OF TEST; SATURATION: 26.5 Hrs PERMEABILITY: 135.0 Hrs
FLOW THRU SPECIMEN; TOTAL: 3.85 ml PERMEABILITY TEST: 3.37 ml
TEMPERATURE CORRECTION; TEMPERATURE: 25.5 C FACTOR: 0.878

REMARKS:

* Percentage of silt and clay fractions is based on 0.002mm as the division between the fractions (Unified Soil Classification System)

** Hydraulic conductivity test conducted in accordance with ASTM D 5084-90 unless noted otherwise. E-8 equals 10 to the minus 8 (exponent); cm3 equals cubic centimeters; The 2 in H2O is a subscript.

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CLIENT: Andrews Environmental Engineering
3535 Mayflower Blvd.
Springfield, IL 62707

DATE: August 3, 1993

PROJECT NO.: I9-35297-6s

ATTN: Mr. Mike McDermont

REPORT NO.: 35297-2

SUBJECT: Soil Laboratory Test Results
City, Water, Light & Power

Enclosed are copies of the results of assigned laboratory soil testing for the subject project.

We trust that this submittal is adequate for your present need; however, please call if you have any questions regarding it. We have appreciated performing this work for you.

SKS ENGINEERS, INC.

BY: Brian E. Smith
Brian E. Smith, P.E.

BES/vy

Enc.: Permeability & Classification Test Results (1 sheet)
Grain Size Distribution w/Atterberg Limits' (1 sheet)

SKS ENGINEERS, INC.

CONSULTING ENGINEERS

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PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CITY WATER, LIGHT AND POWER
DATE: August 2, 1993
PROJECT NO.: I9-35297-6s.
CLIENT: ANDREWS ENVIRONMENTAL ENGINEERING, INC.
REPORT NO: 35297-2
Sheet 1 of 1

SAMPLE IDENTIFICATION: CELL 3;N5305.08/E2040.7 DEPTH/ELEV: 535.67

CLASSIFICATION; USCS: CL-m USDA:

DESCRIPTION: Brown, moist, medium plasticity, SILTY CLAY, trace sand

SOIL PARTICLE SIZES
GRAVEL %: 0.0 SAND %: 3.0 SILT %: 59.0 CLAY %: 38.0 *

NATURAL MOISTURE %: 19.4 DENSITY;lb/ft3 NATURAL: 109.6
LIQUID LIMIT : 44.0 MAX. DRY;lb/ft3: REMOLDED: 0.0
PLASTICITY INDEX : 24.0 PROCTOR;DEG OF COMPACTION ( ):
PERMEABILITY (k), cm/sec: 3.37E-9 **

= = = = = = = = = = = PERMEABILITY TEST DETAILS = = = = = = = = = = =

SAMPLES OBTAINED BY: CLIENT TYPE OF SAMPLE: Undisturbed

SPECIMEN DATA
DIAMETER;cm: 7.302 INITIAL WEIGHT;pcf: 130.9
LENGTH;cm: 3.581 DRY UNIT WEIGHT;pcf: 109.6
AREA;cm2: 41.88 INITIAL % H2O: 19.4
VOLUME;cm3: 150.0 FINAL % H2O: 21.4
VOID RATIO: 0.5489 FLOW ORIENTATION: V
TEST APPARATUS: GEOTEST

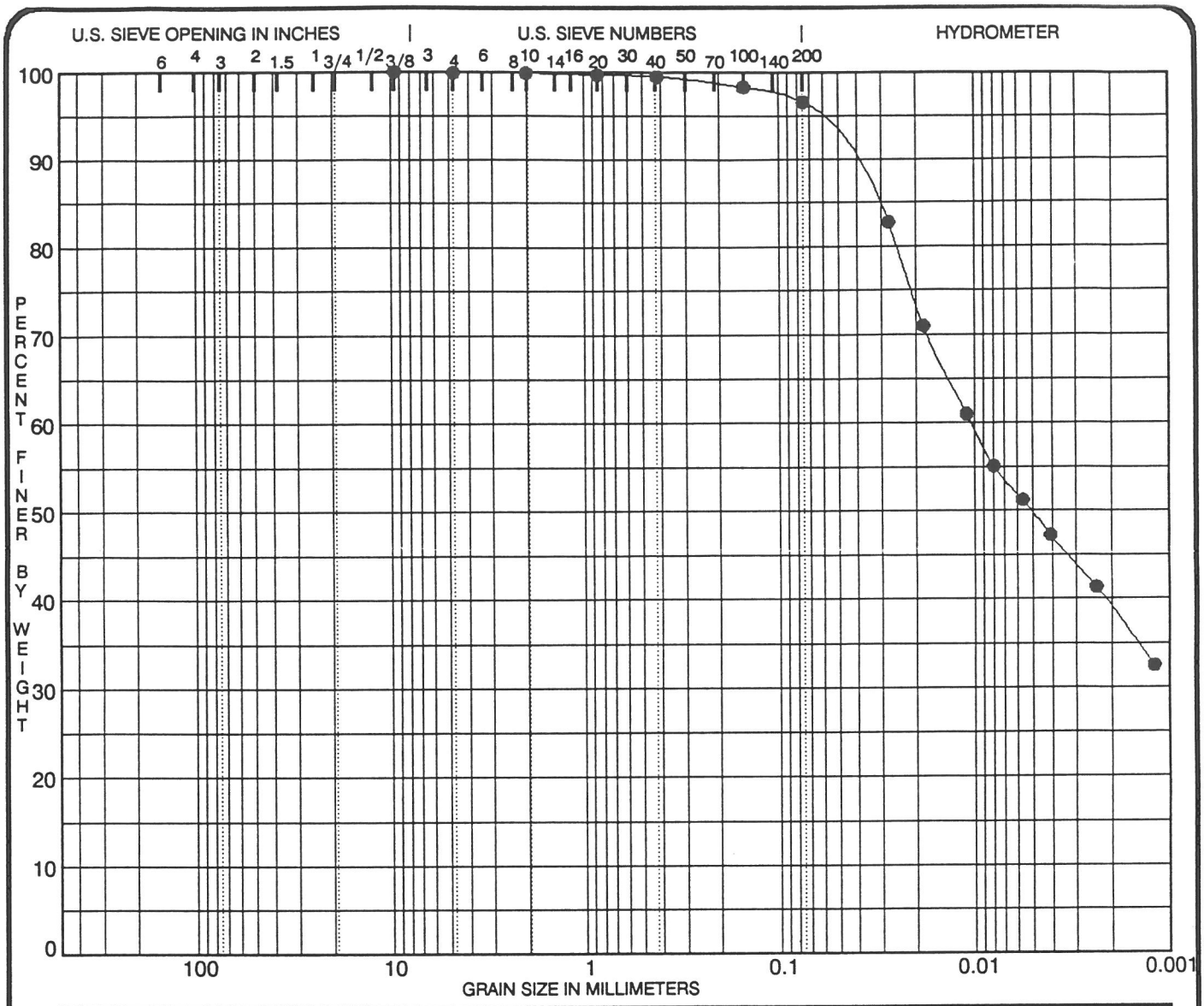
TEST PRESSURES
CELL/CONFINING; psi: 10.0 HEADWATER;cm:
SAMPLE BACK PRESSURE;psi: 5.0 TAILWATER;cm:
HYDRAULIC; GRADIENT: 19.6 DRIVING: 1.00 psi 70.3 cm H2O
PERMEANT LIQUID: 0.005 N CaSO4

TIME OF TEST; SATURATION: 23.8 Hrs PERMEABILITY: 166.7 Hrs
FLOW THRU SPECIMEN; TOTAL: 3.10 ml PERMEABILITY TEST: 1.87 ml
TEMPERATURE CORRECTION; TEMPERATURE: 24.9 C FACTOR: 0.891

REMARKS:

* Percentage of silt and clay fractions is based on 0.002mm as the division between the fractions (Unified Soil Classification System)

** Hydraulic conductivity test conducted in accordance with ASTM D 5084-90 unless noted otherwise. E-8 equals 10 to the minus 8 (exponent); cm3 equals cubic centimeters; The 2 in H2O is a subscript.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	ST-1	535.7	LEAN CLAY CL		44	20	24		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	ST-1	535.7	9.52	0.01			0.1	3.3	47.0	49.6

NOTE: % Silt and % Clay based on ASTM Classification (0.005mm)

PROJECT CITY WATER,LIGHT AND POWER - SPRINGFIELD, ILLINOIS

JOB NO. I9-35297-6s

DATE

GRADATION CURVES

SKS ENGINEERS, INC.

Decatur, Illinois

ATTACHMENT 5

Sand Thickness Data

CITY WATER, LIGHT AND POWER - CELL 3

SAND THICKNESS DATA

N	E	THICKNESS (in feet)
5297.4	2261.8	1.3
5296.2	2234.4	1.2
5294.8	2208.0	1.4
5293.0	2168.0	1.1
5292.0	2136.8	1.3
5289.8	2098.1	1.0
5288.4	2054.2	1.0
5287.8	2041.9	1.1
5216.6	2234.0	1.4
5227.9	2181.3	1.2
5199.0	2090.2	1.3
5148.0	2100.6	1.5
5136.9	2150.0	1.2
5179.0	2175.5	1.0
5242.0	2127.0	1.4
5250.1	2090.0	1.2
5335.7	2121.3	1.1
5386.9	2119.2	1.1
5434.1	2119.0	1.2
5493.3	2128.7	1.1
5506.8	2173.1	1.1
5453.5	2171.5	1.0
5405.5	2178.1	1.1
5357.5	2175.0	1.1
5423.5	2225.2	1.1
5469.2	2219.5	1.0

CITY WATER, LIGHT AND POWER - CELL 3

SAND THICKNESS DATA - PAGE TWO

N	E	THICKNESS (In feet)
5349.5	2019.0	1.0
5400.7	2016.7	1.2
5450.0	2012.0	1.3
5552.0	2250.2	1.6
5325.7	2060.8	1.6
5324.9	2039.4	1.3
5374.9	2039.6	1.3
5425.3	2032.3	1.1
5425.3	2050.0	1.2
5425.2	2071.1	1.4
5475.0	2061.8	1.1
5474.6	2041.9	1.5
5474.8	2020.9	1.0
5524.6	2024.0	1.1
5525.0	2042.0	1.0
5525.0	2062.3	1.3
5252.7	2039.9	1.0
5252.4	2060.7	1.1
5202.3	2071.6	1.2
5202.8	2049.6	1.0
5152.4	2059.4	1.1
5152.5	2028.3	1.1
5494.3	2260.1	1.0
5448.7	2259.8	1.0
5405.2	2260.4	1.1
5361.6	2262.5	1.1

CITY WATER, LIGHT AND POWER - CELL 3

SAND THICKNESS DATA - PAGE THREE

N	E	THICKNESS (In feet)
5337.1	2267.5	1.0
5215.4	2261.1	1.0
5166.0	2261.0	1.0
5117.3	2257.6	1.0
5550.0	2067.8	1.0
5550.0	2057.7	1.1
5550.0	2047.4	1.2
5550.0	2037.0	1.0
5550.0	2030.0	1.0
5550.0	2020.0	1.0
5111.1	2080.0	1.1
5111.1	2066.0	1.0
5111.1	2036.0	1.0
5111.1	2169.2	1.1
5111.1	2118.5	1.3
5112.9	2207.0	1.2
5111.5	2017.8	1.3
		1.3 AVERAGE

ATTACHMENT 6

Leachate Collection System Components

CITY WATER, LIGHT & POWER

LEACHATE COLLECTION SYSTEM COMPONENTS

Sand for the leachate drainage blanket came from two sources: Buckhart Sand and Gravel and Builder's Sand. An additional sample was obtained from Builder's Sand, but it was found to be slightly less permeable than the required value of $K = 5 \times 10^{-3}$ cm/sec (min.). This material was not used, however, the grain size curve was used as a comparison to assure that the sand delivered had the required permeability.

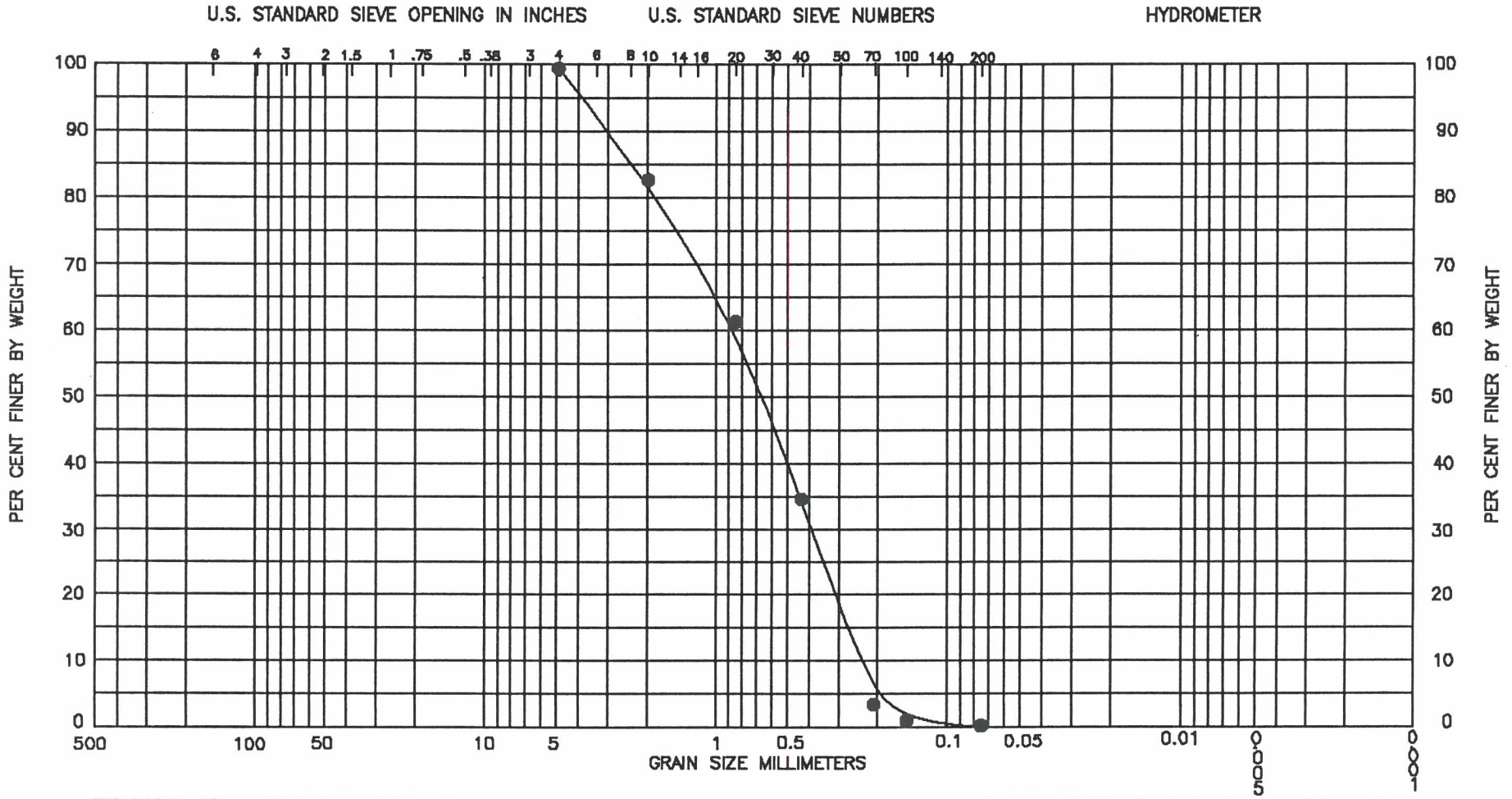
Two sources of gravel for the gravel envelope were tested. The sample identified as large, coarse aggregate was used. The smaller aggregate was not used because of the relationship of the 1/2" diameter holes in the collection pipe and the larger corresponding percentage of stone smaller than 1/2".

Soundness testing of the sand drainage blanket material was done on the Buckhart Sand and Gravel sand sample. However, the laboratory reported it was not possible to run a permeability test of the treated sand. Based upon the results of the permeability sample from Builder's Sand of 1.08×10^{-2} cm/sec in comparison with the minimum required value of 5×10^{-3} cm/sec, no problems are expected.

Certification of the manhole design by a licensed structural engineer is also enclosed within this Attachment.

GRAIN SIZE DISTRIBUTION

DATE: 7-11-93



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COURSE	FINE	COURSE	MEDIUM	FINE	

BORING NO.	SAMPLE NO.	ELEV./ DEPTH	USC	DECRIPTION	NAT. W%	LL	PL	PI
	LCS		SW	BROWN SAND				
AEX NO.	19-3184-2			Builders SAND				

% GRAVEL	0.66
% SAND	98.95
% SILT	0.39
% CLAY	

PROJECT: BUILDERS SAND (CWLP)

SPECIAL REMARKS

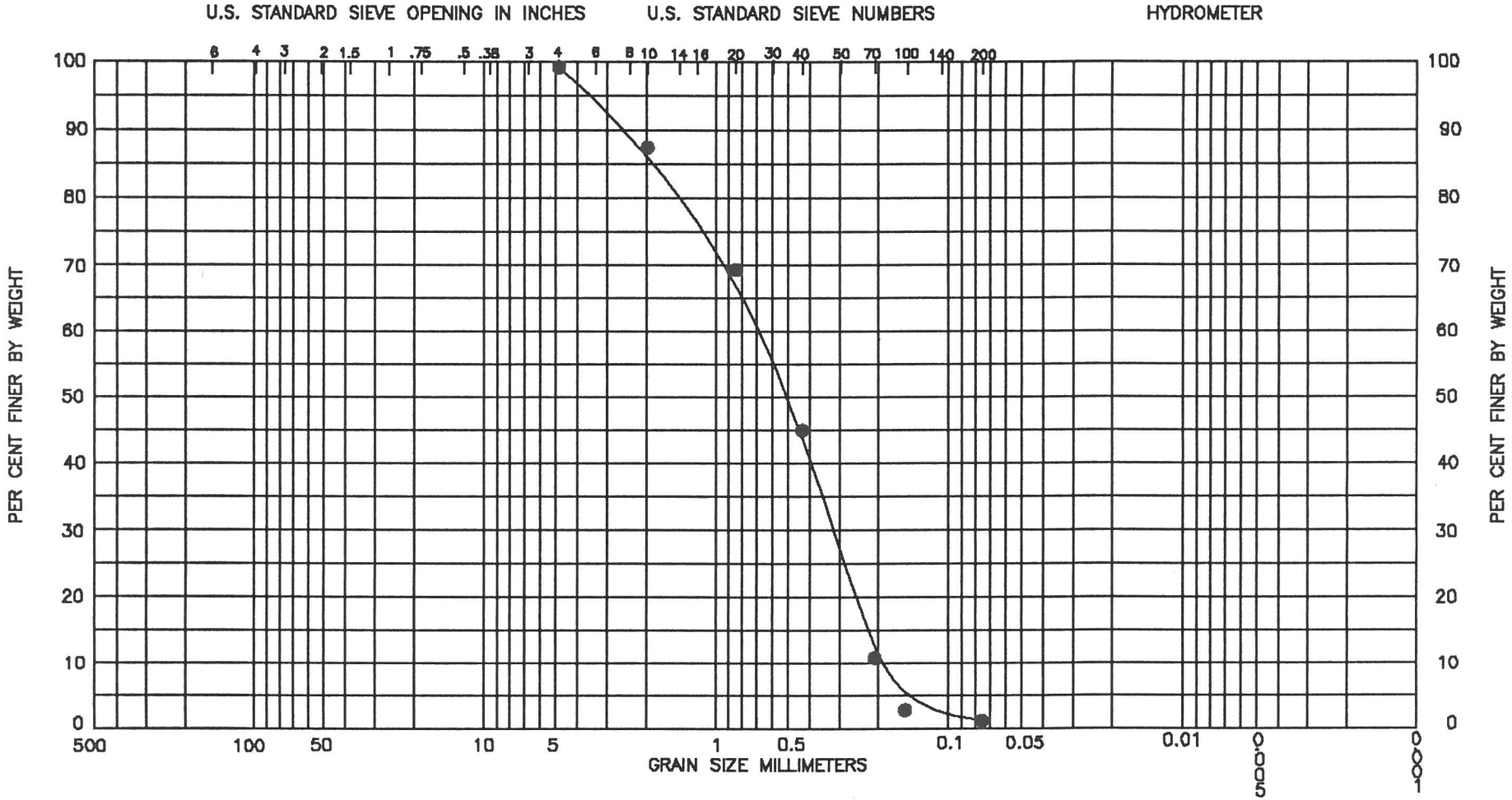
0.002 mm DIVISION BETWEEN SILT & CLAY PARTICLES

$k = 1.08 \times 10^{-2}$

AE EXPLORATION CORPORATION
2813 NORTH DIRKSEN PARKWAY
SPRINGFIELD, ILLINOIS 62702
(217) 525-6023 FAX: (217) 525-6025

GRAIN SIZE DISTRIBUTION

DATE: 8-30-93



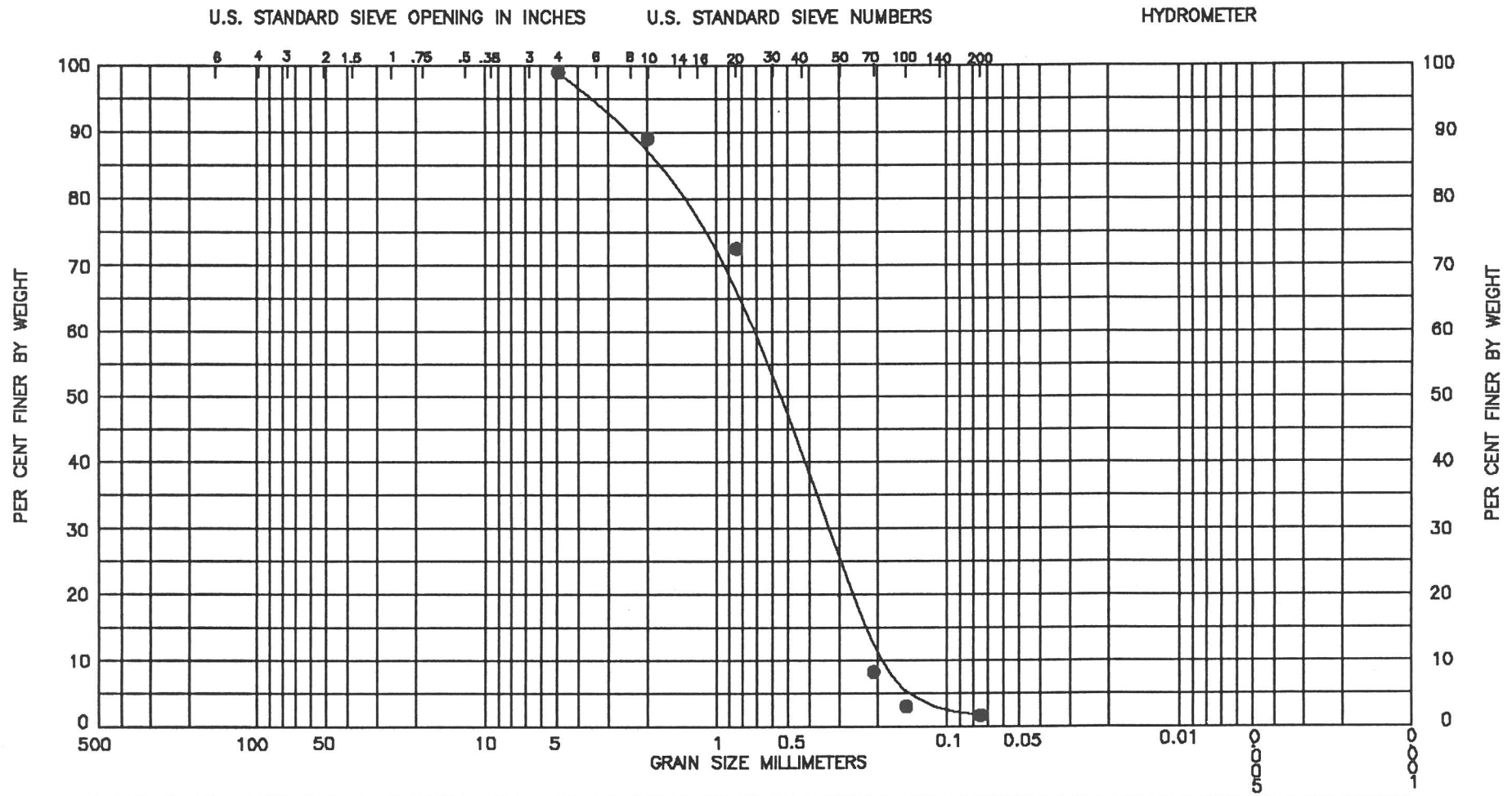
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COURSE	FINE	COURSE	MEDIUM	FINE	

BORING NO.	SAMPLE NO.	ELEV./ DEPTH	USC	DECRIPTION	NAT. W%	LL	PL	PI
# 1	Cell # 3	N5199 E2090		BROWN SAND, TRACE GRAVEL, TRACE FINES				
AEX NO.	19-3184-2			Builder's Sand				

% GRAVEL 0.33	PROJECT: CWLP	AE EXPLORATION CORPORATION
% SAND 98.17	SPECIAL REMARKS	2813 NORTH DIRKSEN PARKWAY
% SILT / % CLAY 1.50	0.002 mm DIVISION BETWEEN SILT & CLAY PARTICLES	SPRINGFIELD, ILLINIOS 62702 (217) 525-6023 FAX: (217) 525-6025

GRAIN SIZE DISTRIBUTION

DATE: 8-30-93



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COURSE	FINE	COURSE	MEDIUM	FINE	

BORING NO.	SAMPLE NO.	ELEV./ DEPTH	USC	DECRIPTION	NAT. W%	LL	PL	PI
#2	Cell # 3	N5405.5 E2178.1		BROWN SAND, TRACE GRAVEL, TRACE FINES				
AEX NO.	19-3184-2			Builder's SAND				

% GRAVEL	0.39	PROJECT: CWLP
% SAND	98.78	SPECIAL REMARKS
% SILT	1.2	0.002 mm DIVISION BETWEEN SILT & CLAY PARTICLES
% CLAY		

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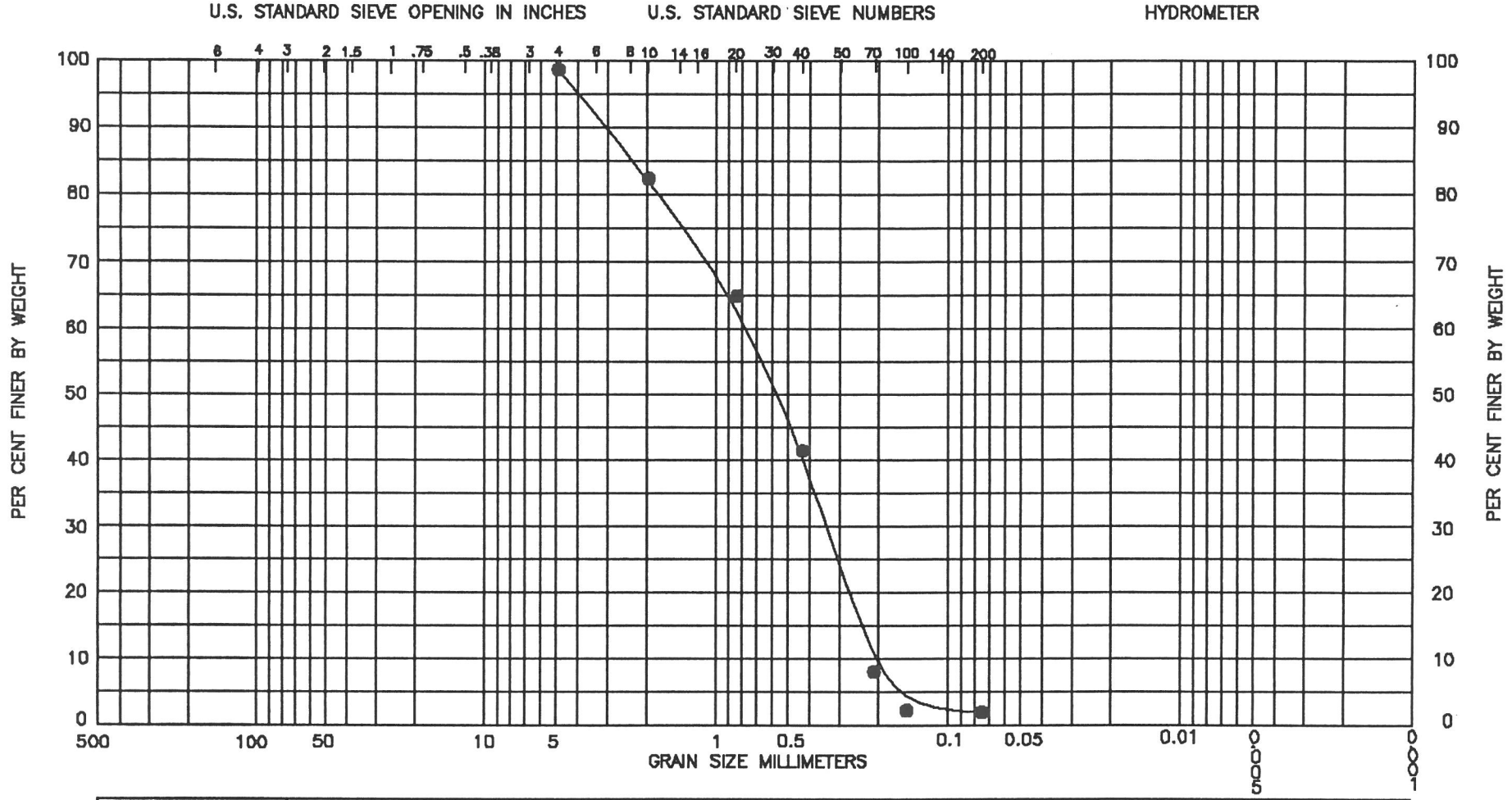
(217) 525-6023 FAX: (217) 525-6025

GRAIN SIZE DISTRIBUTION

DATE: 8-30-93



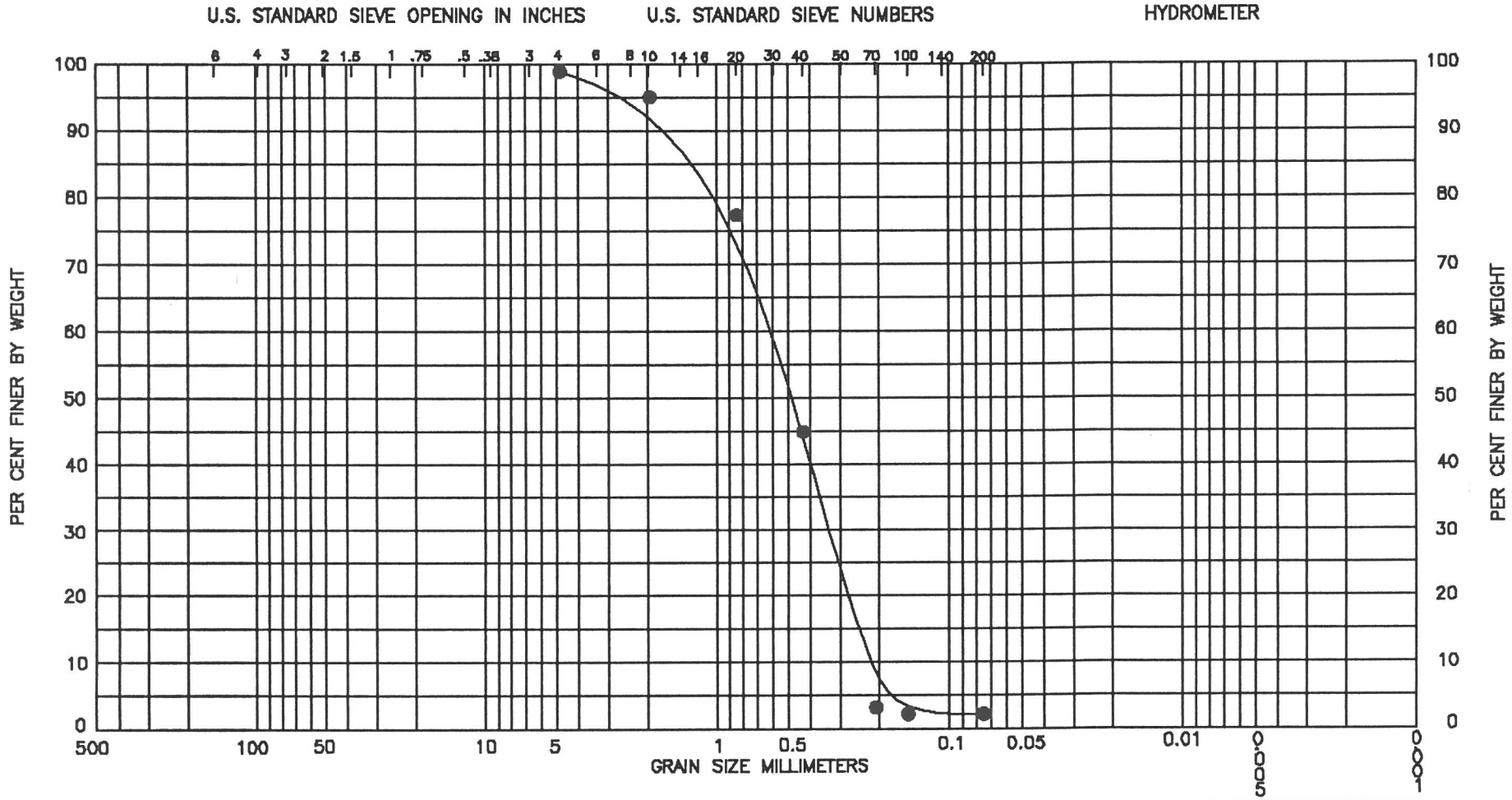
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COURSE	FINE	COURSE	MEDIUM	FINE	

BORING NO.	SAMPLE NO.	ELEV./ DEPTH	USC	DECRIPTION	NAT. W%	LL	PL	PI
#3	Coll # 3	N5242 E2127		BROWN SAND, TRACE GRAVEL, TRACE FINES				
AEX NO.	19-3184-2			Builder's SAND				

% GRAVEL 1.75	PROJECT: CWLP	AE EXPLORATION CORPORATION
% SAND 95.25	SPECIAL REMARKS	2813 NORTH DIRKSEN PARKWAY SPRINGFIELD, ILLINOIS 62702 (217) 525-6023 FAX: (217) 525-6025
% SILT / % CLAY 3.00	0.002 mm DIVISION BETWEEN SILT & CLAY PARTICLES	

GRAIN SIZE DISTRIBUTION

DATE: 8-30-93



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COURSE	FINE	COURSE	MEDIUM	FINE	

BORING NO.	SAMPLE NO.	ELEV./ DEPTH	USC	DECRIPTION	NAT. W%	LL	PL	PI
#4	Cell # 3	N5523.5 E2224.66		BROWN SAND, TRACE GRAVEL, TRACE FINES				
AEX NO.	19-3184-2			Builder's SAND				

% GRAVEL	0.44
% SAND	97.36
% SILT	2.20
% CLAY	

PROJECT: CWLP

SPECIAL REMARKS

0.002 mm DIVISION BETWEEN SILT & CLAY PARTICLES

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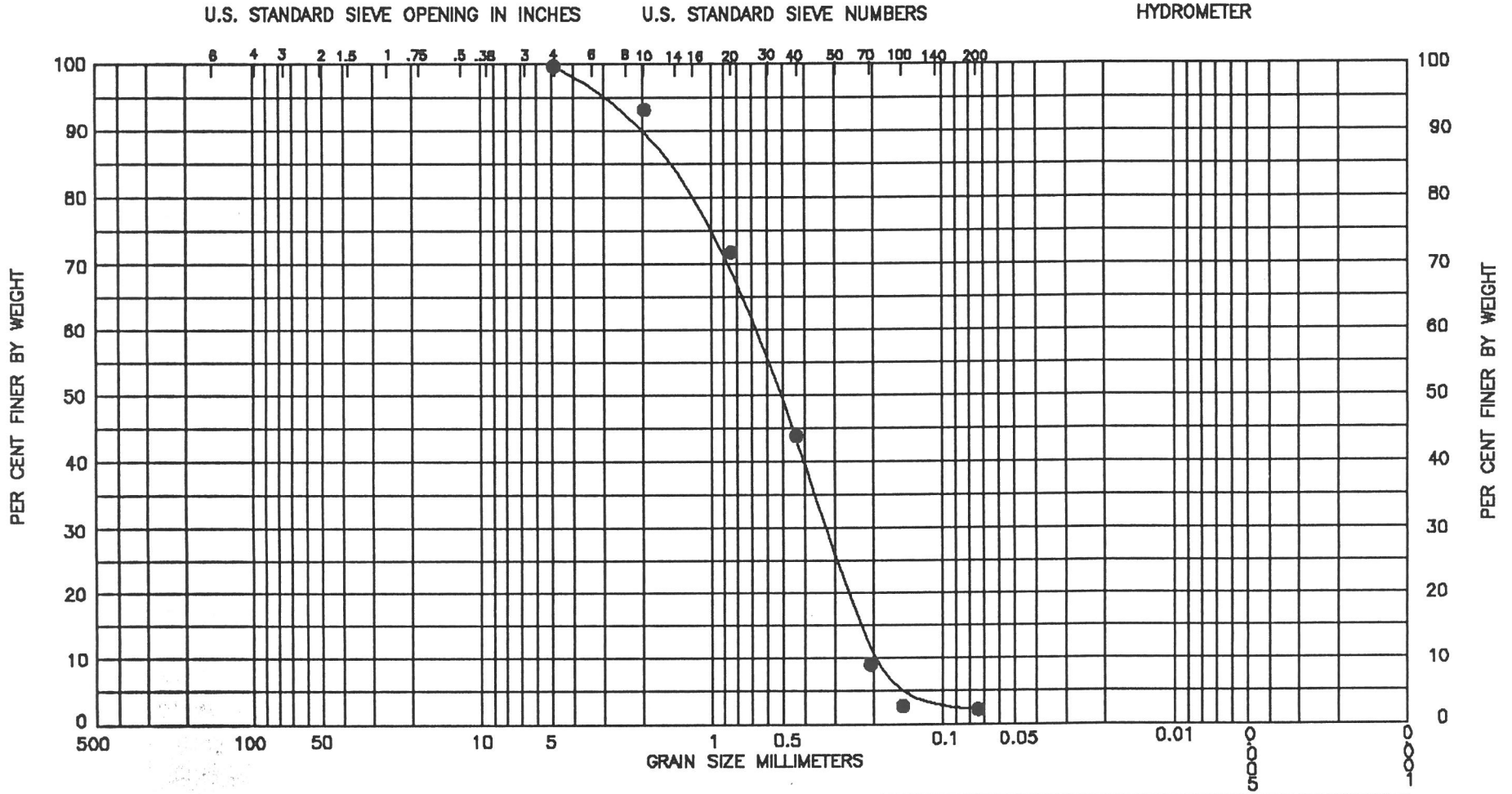
2813 NORTH DIRKSEN PARKWAY
SPRINGFIELD, ILLINOIS 62702
(217) 525-6023 FAX: (217) 525-6025

GRAIN SIZE DISTRIBUTION

DATE: 8-30-93



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COURSE	FINE	COURSE	MEDIUM	FINE	

BORING NO.	SAMPLE NO.	ELEV./ DEPTH	USC	DECRIPTION	NAT. W%	LL	PL	PI
#5	Cell # 3	N5335.7 E2121.3		BROWN SAND, TRACE GRAVEL, TRACE FINES				
AEX NO.	19-3184-2			Builder's Sand				

% GRAVEL	0.54
% SAND	97.23
% SILT	
% CLAY	2.23

PROJECT: CWLP

SPECIAL REMARKS

0.002 mm DIVISION BETWEEN SILT & CLAY PARTICLES

AE EXPLORATION CORPORATION
2813 NORTH DIRKSEN PARKWAY
SPRINGFIELD, ILLINIOS 62702
(217) 525-6023 FAX: (217) 525-6025

SHAFFER
KRIMMEL
SILVER
AND ASSOCIATES, INC. • 2900 N. MARTIN LUTHER KING, JR. DRIVE, DECATUR, ILLINOIS 62526 • 217-877-2100 • FAX 217-877-4816

CONSULTING ENGINEERS • CIVIL ENGINEERING • GEOTECHNICAL ENGINEERING • STRUCTURAL ENGINEERING • LAND SURVEYING • SOILS / MATERIALS TESTING • SUBSURFACE INVESTIGATIONS • ENVIRONMENTAL INVESTIGATIONS • CONSTRUCTION QUALITY CONTROL

Client: Andrews Environmental Engineering
3535 Mayflower Blvd.
Springfield, IL 62707

Attn: Mr. Mike McConnell

Date: November 23, 1992

Project No.: I9-25165-6

Report No.: 25165-1

Sheet 1 of 4

REPORT OF DRAINAGE MEDIA ANALYSIS

Three samples of filter media proposed for utilization at the CWLP in Springfield, Illinois were submitted to our laboratory on November 10, 1992 by personnel of Andrews Environmental Engineering.

Laboratory tests conducted on the three samples consisted of permeability, grain size analysis and five cycle sodium sulfate soundness.

The laboratory test results are presented in this report.

If you have any questions, or if we can be of further assistance, please call.

Very truly yours,

SHAFFER, KRIMMEL, SILVER & ASSOCIATES, INC.

BY: Jerrel L. Shaffer, P.E.

RAW/JLS/vy

Buckhart

PERMEABILITY TEST RESULTS		
Fine Aggregate	Small Coarse Aggregate*	Large Coarse Aggregate
K=0.030 cm/sec	K=0.42 cm/sec	K=0.22 cm/sec

Note: Permeability tests performed in general accordance with ASTM D 2434.

* not used

SkS

DATE: November 23, 1992
PROJECT: CWLP

REPORT NO.: 25165-1

GRAIN SIZE for FA	
SIEVE SIZE	PERCENT PASSING
3/8"	100
No. 4	99.4
No. 8	91.3
No. 10	88.7
No. 16	80.2
No. 30	62.3
No. 40	41.4
No. 50	23.4
No. 80	4.7
No. 100	2.1
No. 200 (wash)	0.6

SOUNDNESS TEST OF FINE AGGREGATE				
SIEVE SIZE	ORIGINAL SAMPLE GRADATION (%)	WT. OF TEST FRACTION BEFORE TEST (g)	% PASSING DESIGNATED SIEVE	WEIGHTED % LOSS
Minus No. 100	4.4			
No. 50 to No. 100	36.8			
No. 30 to No. 50	38.8	100.0	5.6	2.2
No. 16 to No. 30	8.6	100.0	11.4	2.0
No. 8 to No. 16	10.7	100.0	5.8	0.50
No. 4 to No. 8	0.7	100.0	0.2	0.02
3/8" to No. 4	0.0			
TOTALS	100.0			4.72

NOTE: Fractions smaller than No. 50 sieve and those containing less than 5% of the sample gradation are not subject to the soundness test per ASTM C 88.

All tests were conducted in accordance with applicable ASTM Standard (ASTM C 136 and C 88). If there are any questions concerning the data presented, please do not hesitate to contact us.

SKS

DATE: November 23, 1992 PAGE 3 of 4
PROJECT: CWLP REPORT NO.: 25165-1

GRAIN SIZE for CA-S	
SIEVE SIZE	PERCENT PASSING
1"	100
3/4"	89.0
1/2"	42.0
3/8"	11.3
No. 4	0.4

SOUNDNESS TEST OF SMALL COARSE AGGREGATE				
SIEVE SIZE	ORIGINAL SAMPLE GRADATION (%)	WT. OF TEST FRACTION BEFORE TEST (g)	% PASSING DESIGNATED SIEVE	WEIGHTED % LOSS
3/8" - No. 4	10.9	300.3	2.5	0.3
1/2" - 3/8"	30.8	330.0	4.1	1.3
3/4" - 1/2"	47.5	667.7	1.6	0.8
1" - 3/4"	10.8	510.3	2.8	0.3
TOTALS	100.0			2.7

QUALITATIVE EXAMINATION OF SMALL COARSE AGGREGATE						
Retained on Sieve Size	No. of Particles	Splitting	Crumbling	Cracking	Flaking	Total No. of Particles
3/4"	No. of Particles	1	0	1	3	32
	% of total particles	3.1	0	3.1	9.4	
1/2"	No. of Particles	4	0	0	11	106
	% of total particles	3.8	0	0	10.4	
3/8"	No. of Particles	4	0	0	20	190
	% of total particles	2.1	0	0	10.5	
No. 4	No. of Particles	3	0	0	18	151
	% of total particles	2.0	0	0	11.9	

SkS

DATE: November 23, 1992
PROJECT: CWLP

REPORT NO.: 25165-1

GRAIN SIZE for CA-L	
SIEVE SIZE	PERCENT PASSING
2"	100
1 1/2"	100
1"	38.8
3/4"	2.7
1/2"	0.8
3/8"	0.6

SOUNDNESS TEST OF LARGE COARSE AGGREGATE				
SIEVE SIZE	ORIGINAL SAMPLE GRADATION (%)	WT. OF TEST FRACTION BEFORE TEST (g)	% PASSING DESIGNATED SIEVE	WEIGHTED % LOSS
3/8" - No. 4	0.6			
1/2" - 3/8"	0.2			
3/4" - 1/2"	1.9			
1" - 3/4"	36.1	499.5	0.56	0.4
1 1/2" TO 1"	61.2	101.0	1.24	0.8
TOTALS	100.0			1.2

QUALITATIVE EXAMINATION OF LARGE COARSE AGGREGATE						
Retained on Sieve Size	No. of Particles	Splitting	Crumbling	Cracking	Flaking	Total No. of Particles
1"	No. of Particles	1	0	5	1	21
	% of total particles	4.76	0	23.8	4.76	
3/4"	No. of Particles	0	0	6	0	21
	% of total particles	0	0	28.6	0	

Note: This material not used.

SHAFFER KRIMMEL SILVER
AND ASSOCIATES, INC. • 2900 N. MARTIN LUTHER KING, JR. DRIVE, DECATUR, ILLINOIS 62526 • 217-877-2100 • FAX 217-877-4816

CONSULTING ENGINEERS • CIVIL ENGINEERING • GEOTECHNICAL ENGINEERING • STRUCTURAL ENGINEERING • LAND SURVEYING • SOILS / MATERIALS TESTING • SUBSURFACE INVESTIGATIONS • ENVIRONMENTAL INVESTIGATIONS • CONSTRUCTION QUALITY CONTROL

Client: Andrews Environmental Engineering, Inc.
3535 Mayflower Boulevard
Springfield, Illinois 62707

Attn: Mr. Mike McDermont

Subject: Soil Laboratory Test Results
City Water Light and Power

Date: February 16, 1993

Project No.: I9-25165.1-6s

Report No.: 25165.1-1

Enclosed are copies of the results of assigned laboratory soil testing for the subject project.

We trust that this submittal is adequate for your present need; however, please call if you have any questions regarding it. We have appreciated performing this work for you.

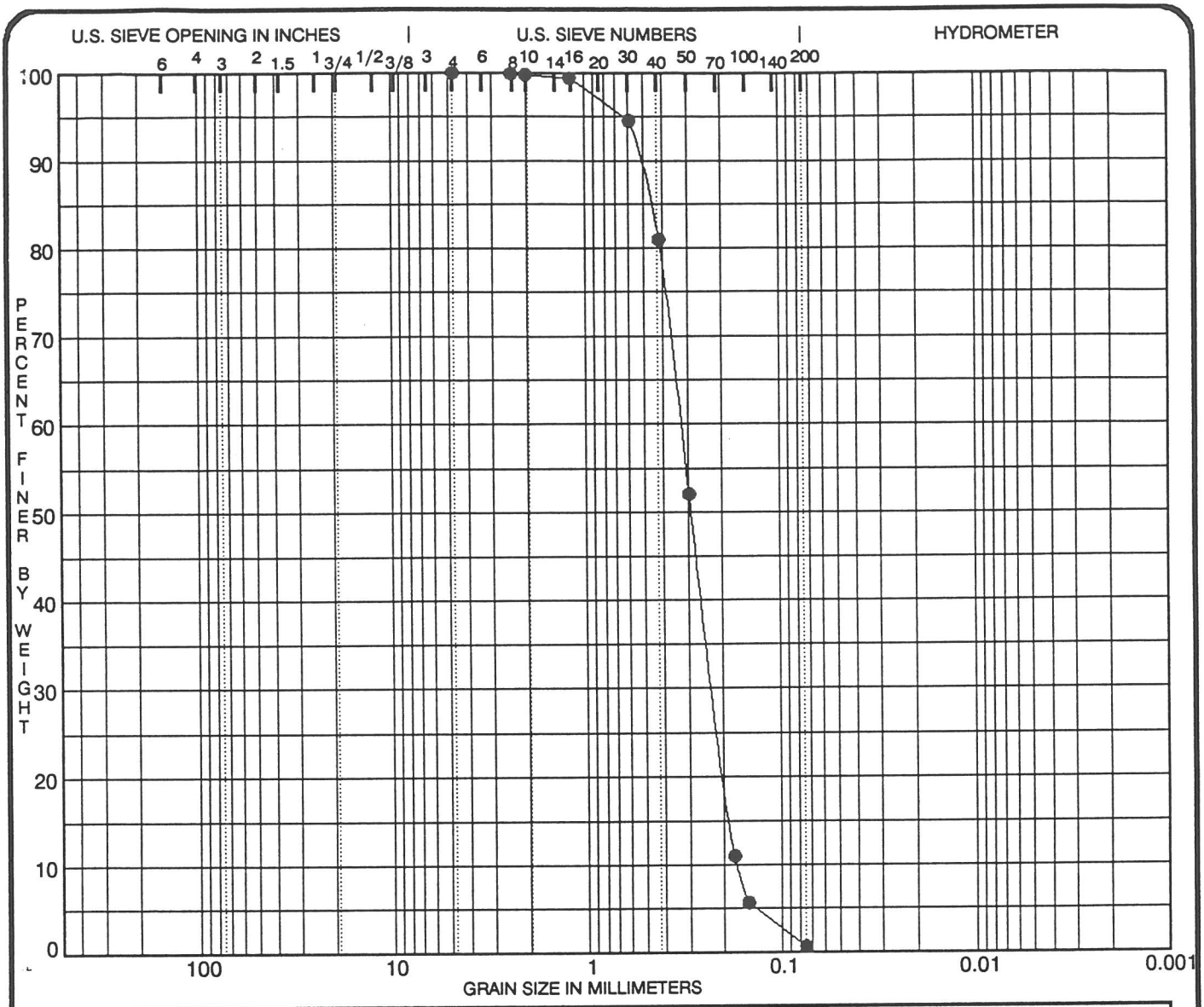
Very truly yours,

SHAFFER, KRIMMEL, SILVER & ASSOCIATES, INC.

BY: Van A. Silver
Van A. Silver, P.E.

VAS/vy

Enclosures: Permeability & Classification Test Results
Gradation Curves



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	SAND	1.0						0.90	1.9

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SAND	1.0	4.75	0.33	0.225	0.1716	0.0	99.3	0.7	

NOTE: % Silt and % Clay based on ASTM Classification (0.005mm)

PROJECT City Water Light & Power

JOB NO. 25165.1

DATE 02/15/93

GRADATION CURVES

SHAFFER KRIMMEL SILVER & ASSOCIATES

Decatur, Illinois

SHAFFER
KRIMMEL
SILVER
AND ASSOCIATES, INC. • 2900 N. MARTIN LUTHER KING, JR. DRIVE, DECATUR, ILLINOIS 62526 • 217-877-2100 • FAX 217-877-4816

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PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CITY WATER LIGHT AND POWER DATE: February 15, 1993

PROJECT NO.: I9-25165.1-6S

CLIENT: ANDREWS ENVIRONMENTAL ENGINEERING INC. REPORT NO: 25165-2

Sheet 1 of 1

SAMPLE IDENTIFICATION: BUILDERS SAND DEPTH/ELEV:

CLASSIFICATION; USCS: SP USDA:

DESCRIPTION: FINE SAND

SOIL PARTICLE SIZES

GRAVEL %: SAND %: SILT %: CLAY %: *

NATURAL MOISTURE %: DENSITY;lb/ft3 NATURAL: 0.0

LIQUID LIMIT : MAX. DRY;lb/ft3: REMOLDED: 0.0

PLASTICITY INDEX : PROCTOR;DEG OF COMPACTION (D698):

PERMEABILITY (k), cm/sec: 0.00497

PERMEABILITY TEST DETAILS

SAMPLES OBTAINED BY: CLIENT TYPE OF SAMPLE:

SPECIMEN DATA

DIAMETER;cm:	0.000	INITIAL WEIGHT;pcf:	0.0
LENGTH;cm:	0.000	DRY UNIT WEIGHT;pcf:	0.0
AREA;cm2:	0.00	INITIAL % H2O:	
VOLUME;cm3:	0.0	FINAL % H2O:	
VOID RATIO:		FLOW ORIENTATION:	

TEST APPARATUS:

TEST PRESSURES

CELL/CONFINING; psi: HEADWATER;cm:

SAMPLE BACK PRESSURE;psi: TAILWATER;cm:

HYDRAULIC; GRADIENT: DRIVING: 0.00 psi 0.0 cm H2O

PERMEANT LIQUID: TAP WATER

TIME OF TEST; SATURATION: Hrs PERMEABILITY: Hrs

FLOW THRU SPECIMEN; TOTAL: ml PERMEABILITY TEST: ml

TEMPERATURE CORRECTION; TEMPERATURE: 22. C FACTOR: 0.953

REMARKS:

* Percentage of silt and clay fractions is based on 0.002mm as the division between the fractions (Unified Soil Classification System)

Michael J. Welsh, P.E., S.E.
Consulting Structural Engineer
300 West Pershing • Morton, Illinois 61550 • (309) 266-5461

October 2, 1992

Mr. Russ Waller
Andrews Environmental Engineering, Inc.
3535 Mayflower Blvd.
Springfield, IL 62707

Re: Temporary Leachate Collection Manhole
Flue Gas Desulfurization Disposal Facility
City Water, Light & Power
Springfield, Illinois

Dear Mr. Waller:

This letter will certify that I have reviewed the structural specifications for the installation of a 4' diameter temporary leachate collection manhole for the referenced project. The specifications reviewed include Section 5.04 of the Specification Document and an elevational cross section of the installation.

I certify that installation of the temporary manhole as specified will provide adequate structural strength and safety against failure for its intended use and service life.

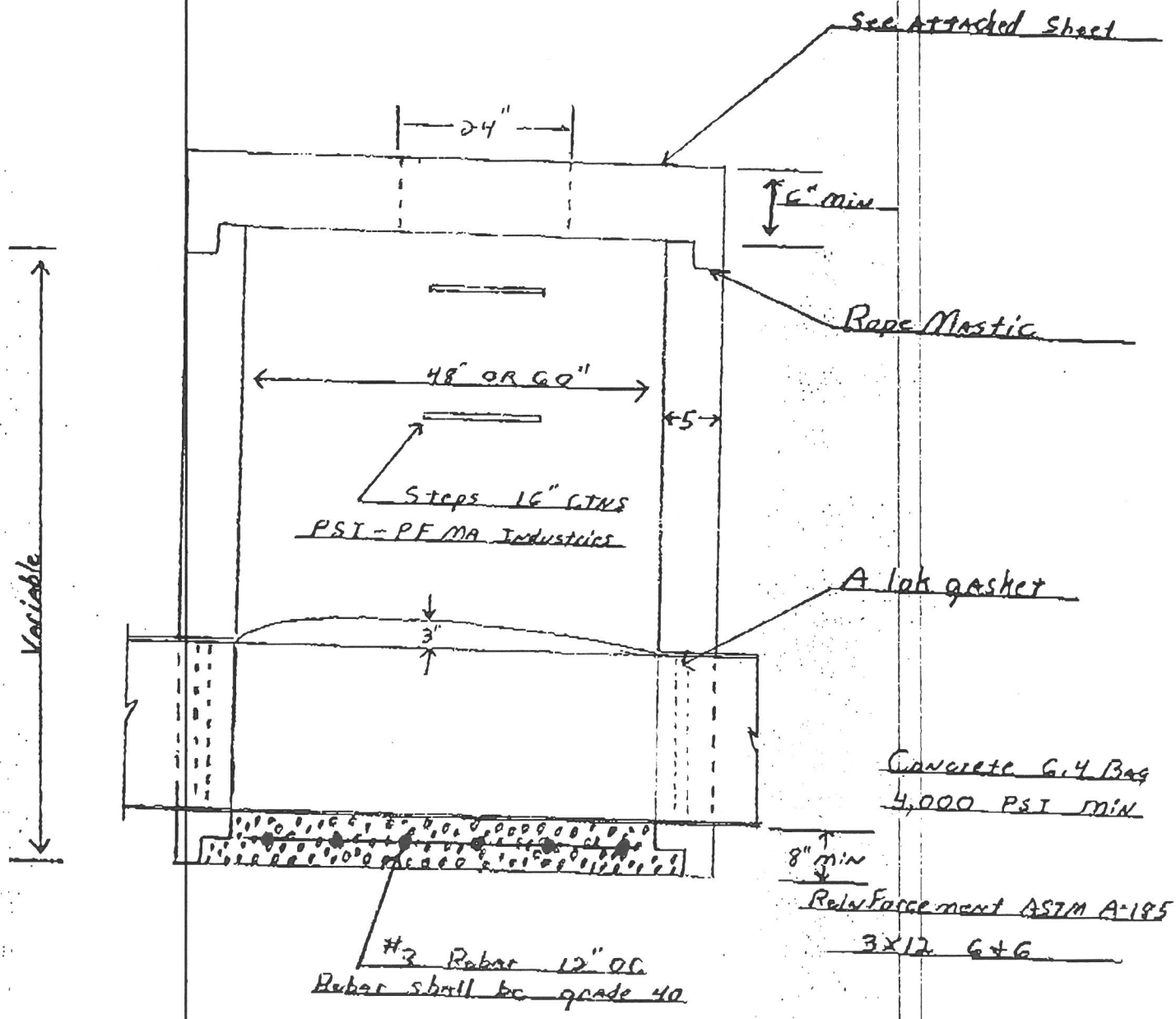
Michael J. Welsh, S.E
Dated 10/2/92
License No. 4656
License Expires 11/94

MJW:jw

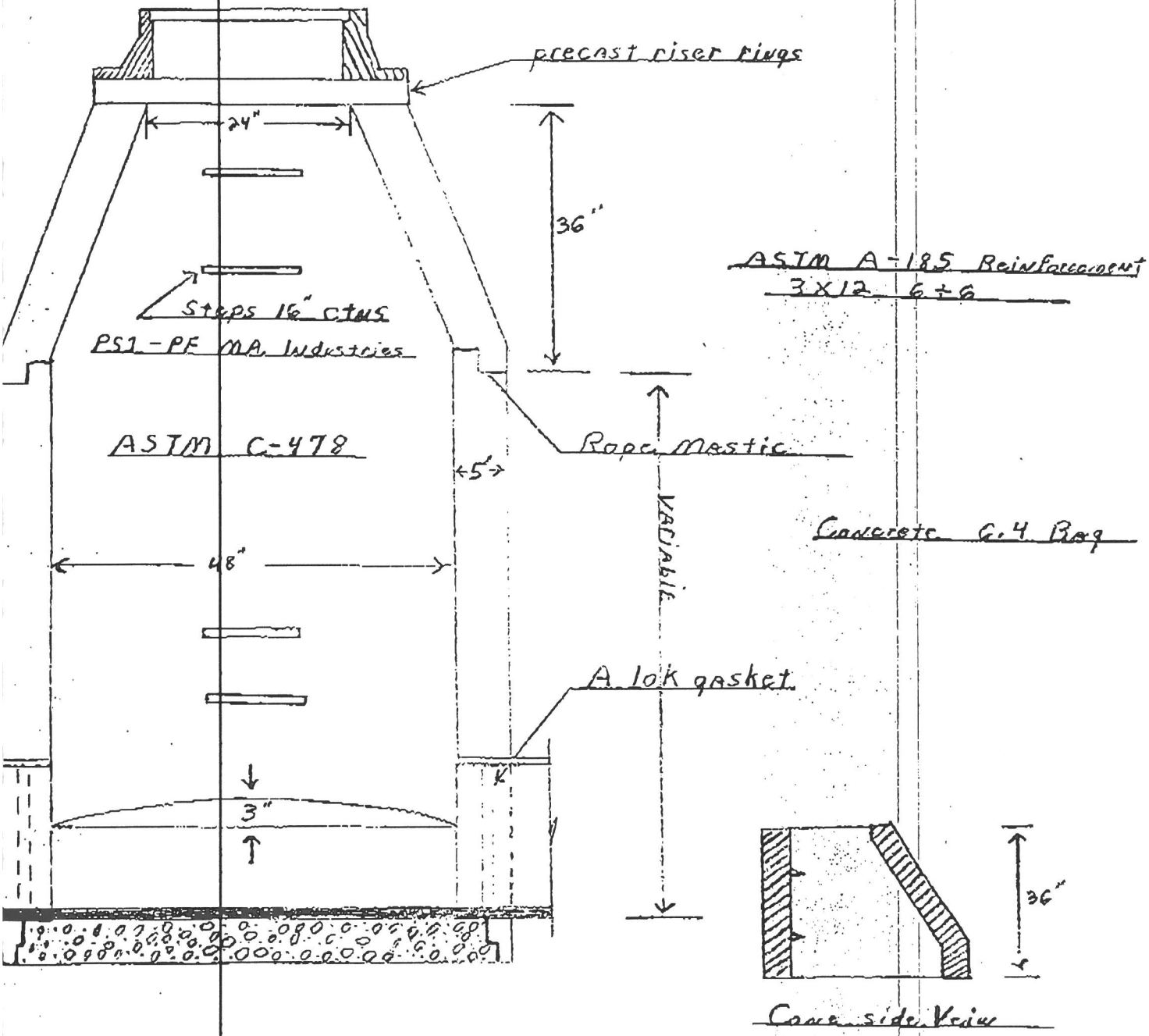
COADY CO.
1301 ALUTO AVENUE, P.O. BOX 9526 • SPRINGFIELD, ILLINOIS 62791 • (217) 522-9598 • (217) 522-1311 • FAX #: (217) 528-3710

Type C Manhole

ASTM C-478



JFC
J. F. COADY CO.
INCORPORATED
1301 PLUTO AVENUE • SPRINGFIELD, ILLINOIS 62702 • 217/522-9598 217-/522-1311



ATTACHMENT 7

Daily Summary Reports

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: September 28, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	8:00 AM	8:30 AM	8:00 AM
TIME OF DEPARTURE:	7:00 PM	7:00 PM	7:00 PM

WEATHER: Sunny and Cool
TEMPERATURE: 65°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 1-6

LOCATION AND TYPE WORK PERFORMED:
Topsoil removal northeast corner, cell floor compaction of lift south 1/2, placement of lift south 1/2

PERSONNEL:
4 Operators

TYPE INSPECTION:
Visual Observation and Nuclear Density Testing

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan and Mark Shea (CWLP) and Frank Siciliano

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Placement of lift south 1/2. After placement of the first lift of compacted clay liner it was decided that a true test of the first 6" could not be achieved. A second 6" loose lift was placed and after 4 passes of the sheepsfoot roller testing did not meet requirements. New Criteria: First 6" loose lift will be placed and rolled 4 passes, second lift will be placed and rolled 8 passes and tested. Compaction was achieved with this method. Topsoil excavation continued in the northeast corner. Undercuts in north 1/2 of cell continued today.

Michael P. McConnell
Technician

R M McDermott
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: September 29, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	8:00 AM	8:30 AM - 11:00 AM	8:00 AM
TIME OF DEPARTURE:	7:00 PM	9:30 AM - 7:00 PM	7:00 PM

WEATHER:
TEMPERATURE: 65°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 1-6

LOCATION AND TYPE WORK PERFORMED:
Topsoil removal northeast corner, compaction of lift south 1/2, undercut north 1/2, and placement of lift south 1/2

PERSONNEL:
6 Operators

TYPE INSPECTION:
Nuclear Density/Moisture Testing, and Visually Observed Roller passes to insure a minimum of four

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan and Mark Shea (CWLP) and Frank Siciliano

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge

REMARKS:

Michael P. McConnell
Technician

RMM Dennat
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: September 30, 1992

	TECHNICIAN	ENGINEER (AAR)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	8:00 AM	4:45 PM	8:00 AM
TIME OF DEPARTURE:	6:00 PM	5:45 PM	NOON

WEATHER: Sunny and Mild
TEMPERATURE: 73°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 7-12

LOCATION AND TYPE WORK PERFORMED:
Compaction of clay liner south 1/2

PERSONNEL:
4 Operators

TYPE INSPECTION:
Visual Observation and Nuclear Density Testing

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Compaction of lift south 1/2 was halted as the Raygo Ram-60 Sheepsfoot Roller had mechanical difficulties today. Compaction testing met or exceeded the required.

Michael P. McConnell
Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 1, 1992

	TECHNICIAN	ENGINEER (AAR)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	8:00 AM	3:45 PM	8:00 AM
TIME OF DEPARTURE:	6:30 PM	4:15 PM	NOON

WEATHER: Sunny and Mild
TEMPERATURE: 75°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 13-29

LOCATION AND TYPE WORK PERFORMED:
Compaction of lift placed September 30, 1992 on south 1/2 placement of 1 lift south 1/2

PERSONNEL:
4 Operators

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing, and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Siciliano brought in a Caterpillar 815-B Sheepsfoot Roller today. The lift placed yesterday was rolled and tested meeting requirements. Another lift was placed but not yet compacted. Informed Curt Siciliano that prior to placement of lift that the surface should be roughed up and moist to insure bond between lifts.

Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 2, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	8:00 AM	8:30 AM - NOON	8:00 AM
TIME OF DEPARTURE:	5:30 PM	3:30 - 4:30 PM	5:30 PM

WEATHER: Sunny and Mild
TEMPERATURE: 78°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 30-36

LOCATION AND TYPE WORK PERFORMED:
Placement of fabric in unsuitable ground north and south 1/2's. Placement and compaction of clay liner south 1/2

PERSONNEL:
4 Operators

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing, and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea and Sue Corcoran (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Fabric arrived and was placed in area N 5285 to N 5258 and E 2220 to E 2115 also placed was N 5362 to N 5400 and E 2140 to E 2190. Checked to insure 2' lap. Excavation of topsoil resumed today at north side. It would appear that this excavation will be quite large.

Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 3, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	8:30 AM	7:00 AM
TIME OF DEPARTURE:	5:30 PM	4:30 PM	5:30 PM

WEATHER: Sunny and Mild
TEMPERATURE: 82°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):

LOCATION AND TYPE WORK PERFORMED:
Placement of stone in undercuts and placement of clay liner south 1/2

PERSONNEL:
4 Operators

TYPE INSPECTION:
Visual Observation and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Total Station

REMARKS:
Continued to excavate topsoil in north 1/2. Shot rock grade with Mike McDermont in undercuts previously backfilled with CA-7 stone. Placed 1 lift on south 1/2 however Siciliano did not roll it.

Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 5, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	8:30 AM	7:00 AM
TIME OF DEPARTURE:	5:30 PM	NOON	5:30 PM

WEATHER: Sunny and Mild
TEMPERATURE: 80°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 37-42

LOCATION AND TYPE WORK PERFORMED:
Compaction of lift placed October 2, 1992, stone grading in undercuts and base grading of north 1/2

PERSONNEL:
4 Operators

TYPE INSPECTION:
Survey Base Grades, Nuclear Density Testing, and Visual Observation

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan (CWLP) and Vince Madonia (AEEI)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Compacted clay lift placed October 2, 1992. Graded and surveyed stone grades in undercuts. Staked and surveyed base grades at north 1/2. Base grades still high at days end. Siciliano will cut early AM and will re-survey.

Michael P. McConnell
Technician

R M McDermott
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 6, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	4:30 PM	7:00 AM
TIME OF DEPARTURE:	6:00 PM	5:30 PM	6:00 PM

WEATHER: Sunny and Mild
TEMPERATURE: 74°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 43-53

LOCATION AND TYPE WORK PERFORMED:
Fabric placement and stone in undercuts adjacent ditch north and south sides, clay placement and compaction north and south 1/2, cutting base grades in north 1/2

PERSONNEL:
4 Operators

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing, and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea (CWLP) and Frank Siciliano

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Surveyed base grades north 1/2 after cutting. Checked compaction of clay placement in north and south 1/2. Base grade pumped up through first lift of clay placed N 5310 to N 5385 and E 2190 to E 2260. Area was then undercut, fabric was placed, and filled with stone.

Technician

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 7, 1992

	TECHNICIAN	ENGINEER (AAR)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	1:30 PM	7:00 AM
TIME OF DEPARTURE:	6:00 PM	2:30 PM	6:00 PM

WEATHER: Windy and Mild
TEMPERATURE: 76°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 54-68

LOCATION AND TYPE WORK PERFORMED:
Backfill of topsoil undercut north 1/2 and placement and compaction of lift south 1/2

PERSONNEL:
4 Operators

TYPE INSPECTION:
Surveying, Nuclear Density Testing, and Visual Observation

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Undercut at north side of ditch was excavated today, however, no fabric was available. Excavation was left open. Surveyed limits of topsoil excavation and began backfill with clay and compaction.

Michael P. McConnell
Technician

RM McDermott
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 8, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	8:30 AM	7:00 AM
TIME OF DEPARTURE:	5:30 PM	9:45 AM	5:30 PM

WEATHER: Windy Falling Temperatures
TEMPERATURE: 65°
SKY: Mostly Cloudy
PRECIPITATION: Shower AM

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 69-73

LOCATION AND TYPE WORK PERFORMED:
Clay placement and compaction north 1/2

PERSONNEL:
4 Operators

TYPE INSPECTION:
Visual Observation and Nuclear Density Testing

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
After AM rain, areas of wet clay were removed, replaced with new lift and compacted. Not much time or equipment was devoted to Cell #3 today.

Michael P. McConnell
Technician

R M McDermott
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 9, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	8:30 AM	7:00 AM
TIME OF DEPARTURE:	5:00 PM	NOON	5:00 PM

WEATHER:
TEMPERATURE: 60°
SKY: AM Cloudy - PM Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 74-83

LOCATION AND TYPE WORK PERFORMED:
Placement of clay and compaction in north 1/2 and south 1/2 undercut backfill and fabric placement

PERSONNEL:
5 Operators

TYPE INSPECTION:
Visual Observation and Nuclear Density Testing

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan and Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Placement of clay liner in cell floor in north 1/2 of Cell 3 and placement of lift on south 1/2. Placement of liner on south 1/2 was stopped due to previous lift being dry. Area was moistened and lift was continued. Placement of fabric in undercuts took place today. Observed to ensure a 2' minimum lap was being used.

Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 10, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	10:00 AM	
TIME OF DEPARTURE:	2:30 PM	3:00 PM	

WEATHER:
TEMPERATURE: 78°
SKY: Partly Cloudy
PRECIPITATION: None

TEST RESULTS (SUMMARY):
None

LOCATION AND TYPE WORK PERFORMED:
No construction in Cell today

PERSONNEL:

TYPE INSPECTION:
Survey of ditch

EQUIPMENT (CONSTRUCTION):

VISITORS:

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Total Station

REMARKS:
Surveyed ditch cross-sections in Cell #3. Toured site and formed a list of things to do for Siciliano.

Michael P. McConnell
Technician

R M McDermott
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 12, 1992

	TECHNICIAN	ENGINEER (AAR)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	1:15 PM	7:00 AM
TIME OF DEPARTURE:	5:30 PM	2:00 PM	5:30 PM

WEATHER: Sunny and Pleasant
TEMPERATURE: 65°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 84-98

LOCATION AND TYPE WORK PERFORMED:
Placement and compaction of clay liner in north 1/2 and south 1/2. Grading of stone in undercuts north 1/2, and grading of drainage ditch base

PERSONNEL:
8 Operating Engineers
3 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan and Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Placed 2 lifts south 1/2 of clay liner and compacted to meet requirements. Prior to placement-area was scarified, moistened and rerolled. Grading of ditch base clay took place but was not completed. Mentioned to Siciliano that equipment should not run in the same path as this could fail clay liner previously placed.

Michael P. McConnell
Technician

R M McDermott
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 13, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	10:00 AM	7:00 AM
TIME OF DEPARTURE:	5:30 PM	5:30 PM	5:30 PM

WEATHER: Sunny and Mild
TEMPERATURE: 75°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):

LOCATION AND TYPE WORK PERFORMED:
Placement and compaction of clay liner in north 1/2 and south 1/2. Final grading of clay at ditch and placement of foundation for leachate collection manhole

PERSONNEL:
8 Operating Engineers
3 Teamsters

TYPE INSPECTION:
Visual Observation and Nuclear Density Testing, and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Problems encountered with compaction today. No compaction tests performed today met requirements. Proctor sample was sent to PSI. Final grading of ditch was completed today. Placement of foundation for leachate collection manhole was also performed today. Areas of non-compliance compaction in Cell floor will be rerolled and retested on October 14, 1992.

Michael P. McConnell
Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 14, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	8:30 AM	7:00 AM
TIME OF DEPARTURE:	7:00 PM	7:00 PM	7:00 PM

WEATHER: Warm and Windy
TEMPERATURE: 86°
SKY: Mostly Sunny
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 99-137

LOCATION AND TYPE WORK PERFORMED:
Rework and reroll areas not meeting requirements and foundation stone and clay work at leachate collection manhole

PERSONNEL:
8 Operating Engineers
3 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan and Sue Corcoran (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge, Total Station, and Auto Level

REMARKS:
North 1/2 of Cell floor was rerolled and areas not meeting requirements from yesterday were retested and met or exceeded requirements after which another lift of clay was placed. The south 1/2 was finish rolled and checked with results meeting or exceeding requirements. Work on foundation stone and clay of leachate collection manhole. A new Proctor Value from PSI 106.6 PCF at 18.8%.

Michael P. McConnell
Technician

RMMcDermott
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 15, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	8:00 AM	7:00 AM
TIME OF DEPARTURE:	5:30 PM	5:30 PM	5:30 PM

WEATHER: Hot and Humid
TEMPERATURE: 85°
SKY: Partly Cloudy
PRECIPITATION: .1" late last night

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 138-155

LOCATION AND TYPE WORK PERFORMED:
Clean up of water and wet clay in Cell floor, recompacted clay liner, placement of CA-7 stone in ditch foundation and placement of clay in ditch bottom

PERSONNEL:
8 Operating Engineers
3 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge, Total Station and Auto Level

REMARKS:
Arrived at site to observe clean up and drying operations as .1" rain was received late last night and early this morning. Areas were "de-mucked" and churned up with dozer blades. Areas were then recompacted and checked for moisture-density meeting requirements. Material was stockpiled east of E 2300. All day clay was placed in ditch bottom over CA-7 stone from E 2100 to E 2165. Compaction was checked and met or exceeded requirements. Job site was back-dragged due to prediction of rain. This was done with dozer blades at days end.

Michael P. McConnell
Technician

RM McDermott
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 16, 1992

	TECHNICIAN	ENGINEER	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM		
TIME OF DEPARTURE:	7:30 PM		

WEATHER:
TEMPERATURE: 65°
SKY: Cloudy
PRECIPITATION: .3" rain overnight

TEST RESULTS (SUMMARY):

LOCATION AND TYPE WORK PERFORMED:
No work today due to rain

PERSONNEL:

TYPE INSPECTION:

EQUIPMENT (CONSTRUCTION):

VISITORS:

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):

REMARKS:
Job shut down due to rain.

Michael P. McConnell
Technician

RMMcDermott
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 19, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	7:30 AM	7:00 AM
TIME OF DEPARTURE:	6:30 PM	5:30 PM	6:00 PM

WEATHER:
TEMPERATURE: 55°
SKY: Partly Cloudy
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 156-163

LOCATION AND TYPE WORK PERFORMED:
Remix and recompact Cell floor. Placement and compaction of clay south 1/2. Stone placement over fabric in ditch. Placement and compaction of clay in ditch.

PERSONNEL:
7 Operating Engineers
3 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing, and Topo of north and west sideslopes

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan and Mark Shea (CWLP), Rick Lawrence (Siciliano), and Vince Madonia (AEEI)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge

REMARKS:
Checked compaction of north 1/2 after remix and recompact finding high moisture and low density. Recommended a soil disk be used to dry materials. Retested 2 areas in south 1/2 that were low in moisture and found acceptable conditions. A lift was placed on this area. Vince Madonia came out to the site and assisted with topo of north and west sideslopes. Also checked rock grades in ditch foundation after which clay was placed in lifts and compaction. Stone was also placed over fabric lapped 2' in ditch foundation from E 2285 to E 2310, however, stone is not to grade at this time.

Michael P. McConnell
Technician

R M McDermott
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 20, 1992

	TECHNICIAN	ENGINEER (AAR)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	1:30 PM	7:00 AM
TIME OF DEPARTURE:	6:00 PM	2:30 PM	6:00 PM

WEATHER:
TEMPERATURE: 62°
SKY: Partly Cloudy and Windy
PRECIPITATION: Showers late last night

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 164-175

LOCATION AND TYPE WORK PERFORMED:
Drying side down north 1/2. Compaction and placement at north 1/2. Cut to Base Grade SW 1/4 (i.e. N 5085 to N 5250 and E 2082.5 to E 2040 approximately)

PERSONNEL:
7 Operating Engineers
3 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing, and Surveying of Base Grade SW 1/4

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan (CWLP) and Vince Madonia (AEEI)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Due to last night's rain, site was windrowed to promote drying after which compaction occurred and after testing another lift placed. Staked our cuts for Base Grades SW 1/4 and excavation began. Pushed 2/3" shelby tubes for permeability testing.

Michael P. McConnell
Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 21, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	8:00 AM	7:00 AM
TIME OF DEPARTURE:	6:00 PM	9:00 AM	6:00 PM

WEATHER:
TEMPERATURE: 66°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 176-184

LOCATION AND TYPE WORK PERFORMED:
Placement of lift north 1/2 and south 1/2. Disking of lift to dry material down, and compaction after drying

PERSONNEL:
7 Operating Engineers
2 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing, and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan and Vince Madonia (AEEI)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Siciliano placed lift north 1/2 and south 1/2 material coming in from borrow pit was wet and did not meet compaction. Disking was suggested and implemented. Material was stockpiled from 10:30 AM to 3:30 PM east of E 2300. Hauling was stopped at 3:30 PM.

Michael P. McConnell
Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 22, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	8:00 AM	7:00 AM
TIME OF DEPARTURE:	6:30 PM	9:00 AM	6:30 PM

WEATHER:
TEMPERATURE: 78°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 185-196

LOCATION AND TYPE WORK PERFORMED:
Finished Base Grades in SW 1/4, proofrolled SW 1/4, placement of clay and compaction in adjacent ditch and SW 1/4, and placement and disking in north 1/2

PERSONNEL:
7 Operating Engineers
2 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing, and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan and Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Siciliano finished Base Grade excavation of SW 1/4. After excavation elevation was checked and area proofrolled. A total of 3 lifts were placed in SW 1/4 and 1 lift placed on south 1/2. Prior to placement of lift at south 1/2 dry material was removed at surface exposing moist material and area received 2 passes with the Caterpillar 815-B Sheepsfoot Roller. A lift was placed at north 1/2, however, material was wet coming from the borrow pit. Area was disked and will be compacted on October 23, 1992.

Michael P. McConnell
Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 23, 1992

	TECHNICIAN	ENGINEER (AAR)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	11:00 AM	7:00 AM
TIME OF DEPARTURE:	5:30 PM	NOON	5:30 PM

WEATHER:
TEMPERATURE: 78°
SKY: Partly Cloudy
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 197-224

LOCATION AND TYPE WORK PERFORMED:
Disked north 1/2 and compaction. Placement and compaction of ditch south 1/2 and SW 1/4 today

PERSONNEL:
7 Operating Engineers
2 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing, and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
North 1/2 of Cell floor was disked twice prior to being compacted. Compaction tests met or exceeded requirements. The lift at south 1/2 started yesterday was finished today and compacted. Another lift was started but not finished. Area in and adjacent to ditch and SW 1/4 received 3 lifts today. In checking the survey of stone grades from the previous days' work, it was found that the stone grade, outside of the SW corner of foundation for the leachate collection manhole, was left high by 0.6'. Siciliano was informed and said he will fix at a later date.

Michael P. McConnell
Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 24, 1992

	TECHNICIAN	ENGINEER (AAR)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	8:00 AM	7:00 AM
TIME OF DEPARTURE:	2:00 PM	9:30 AM	NOON

WEATHER: Cooler
TEMPERATURE: 72°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
None

LOCATION AND TYPE WORK PERFORMED:
Rerolled SW corner and north 1/2, placed lift near ditch area, and finished placement of lift in south 1/2. Stripped topsoil in borrow pit

PERSONNEL:
7 Operating Engineers
2 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing, and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Siciliano rerolled SW corner, tests met or exceeded requirements. However, pumping was evident under the Caterpillar 815-B Sheepsfoot Roller. North 1/2 was rerolled with pumping evident. A lift was placed on either side and through ditch area with pumping evident in new layer. The lift placed yesterday on south 1/2 was finished. It was decided by Siciliano to disk the entire area of floor and leave open until Monday, October 26, 1992. Majority of work suspended at Noon today.

Michael P. McConnell
Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 26, 1992

	TECHNICIAN	ENGINEER (AAR)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	1:30 PM	7:00 AM
TIME OF DEPARTURE:	5:30 PM	3:30 PM	5:30 PM

WEATHER:
TEMPERATURE: 72° and Falling
SKY: AM Clear - PM Cloudy
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 225-239

LOCATION AND TYPE WORK PERFORMED:
Redisked entire Cell floor and compacted, lift placed over north 1/2 and ditch. SW 1/4 disked and compacted

PERSONNEL:
6 Operating Engineers
2 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan and Mark Shea (CWLP)
Frank Siciliano

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
The entire floor of the Cell was redisked early morning and compacted. Compaction met requirements and was stable. A new Proctor Value of 109.1 PCF at 17.9% was received today. Observed a great deal of "pumping" of soils placed today. A test pit was excavated to observe for moisture in Cell floor as a cause of deflection. Soils in test pit were observed to be same conditions as upper layer. No conclusion-area will be disked on October 27, 1992.

Michael P. McConnell
Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 27, 1992

	TECHNICIAN	ENGINEER (AAR)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	8:45 AM	7:00 AM
TIME OF DEPARTURE:	5:30 PM	10:30 AM	5:30 PM

WEATHER: Cool
TEMPERATURE: 72°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 240-254

LOCATION AND TYPE WORK PERFORMED:
Mixing dry material with material which was too wet, area was disked to mix and compact. Placement and disking of a lift north 1/2 and SW 1/4

PERSONNEL:
6 Operating Engineers
2 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing, and Observation for Pumping Material

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan and Mark Shea (CWLP)
Frank Siciliano

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Meter and Total Station

REMARKS:
Lift in place from N 5300 to N 5550 was wet. A thin lift of dry material from bottom of borrow pit was mixed in with wet material by disking. After which area was compacted with the Caterpillar 815B Sheepsfoot Roller and testing showed passing results with no stability problems. Went to borrow pit and checked moisture of material finding 24% to 27% moisture content in north west area and 22% in central west area. Siciliano selected this material for borrow. A lift was placed N 5300 to N 5550 and E 2082.5 to E 2300 and N 5080 to N 5300 and E 2082.5 to E 2015, however drying time was short after placement and not enough disking occurred. Areas will be disked and compacted on October 28, 1992.

Michael P. McConnell
Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 28, 1992

	TECHNICIAN	ENGINEER (AAR)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	10:00 AM	7:00 AM
TIME OF DEPARTURE:	5:00 PM	11:00 AM	5:00 PM

WEATHER:
TEMPERATURE: 65°
SKY: Partly Sunny
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 255-258

LOCATION AND TYPE WORK PERFORMED:
Disking of north 1/2 of Cell floor. Removal of material in NW corner at 10% slope. Placement and compaction of clay in 10% slope area

PERSONNEL:
6 Operating Engineers
2 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan (CWLP), Frank Siciliano, and Vince Madonia (AEEI)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Vince Madonia and I staked out the cuts for Base Grades from E 2082.5 west and N 5550 to N 5300. Siciliano cut to grade and proofrolled with a Caterpillar 815B Sheepsfoot Roller. No pumping or rutting of base soils were observed. Area was also visually checked for organics, finding none. Two 6" lifts of clay were placed over base soils and compacted to a minimum 95% of a Standard Proctor Value. Area from N 5550 to N 5275 and E 2082.5 to E 2300 was disked three times today as moisture from yesterday was high and compaction low.

Michael P. McConnell
Technician

Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 29, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	8:30 AM	7:00 AM
TIME OF DEPARTURE:	5:30 PM	1:30 PM	5:30 PM

WEATHER: Cool
TEMPERATURE: 50°
SKY: Cloudy
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 260-276

LOCATION AND TYPE WORK PERFORMED:
Excavation of trench E 2082.5 to E 2010.
Placement of clay liner in Cell floor.
Placement of 1 lift in trench E 2082.5 to E 2010

PERSONNEL:
6 Operating Engineers
2 Teamsters

TYPE INSPECTION:
Visual Observation, Nuclear Density Testing, and Surveying

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Ed Riordan and Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge and Total Station

REMARKS:
Finished excavation of trench from E 2082.5 to E 2010. Fabric and stone placed after which area was surveyed. One lift of clay was placed in trench floor. At day's end, compaction testing performed did not meet requirements. Siciliano wheelrolled entire floor area closed due to prediction of rain.

Michael P. McConnell
Technician

R M McDermott
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: October 30, 1992

	TECHNICIAN	ENGINEER	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM		
TIME OF DEPARTURE:	7:30 AM		

WEATHER: Cool
TEMPERATURE: 52°
SKY: Cloudy
PRECIPITATION: Showers

TEST RESULTS (SUMMARY):

LOCATION AND TYPE WORK PERFORMED:
No work today due to rain

PERSONNEL:

TYPE INSPECTION:

EQUIPMENT (CONSTRUCTION):

VISITORS:
Ed Riordan (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):

REMARKS:
Arrived at site at 7:00 AM. Rain in progress. Job shut down.

Michael P. McConnell
Technician

RMM Dennard
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME:	City Water Light & Power	JOB NUMBER:	93-119
LOCATION:	Cell 3 - Phase 1	DATE:	**SEE NOTE**
MONITOR:	Michael P. McConnell		

NOTE:

Job was terminated from October 30, 1992 to December 2, 1992 due to excessive precipitation.

Michael P. McConnell
Technician

R M McDermott
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: December 2, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	8:00 AM	11:00 AM	8:00 AM
TIME OF DEPARTURE:	5:00 PM	NOON	5:00 PM

WEATHER: Windy
TEMPERATURE: 30°
SKY: Cloudy
PRECIPITATION: None

TEST RESULTS (SUMMARY):
None

LOCATION AND TYPE WORK PERFORMED:
Disking floor of Cell 3. Excavation of new force main. Stripping topsoil from Cell 2/3 division berm

PERSONNEL:
6 Operating Engineers

TYPE INSPECTION:
Visual Observation

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
None

REMARKS:
Siciliano stripped topsoil from Cell 2/3 division berm and hauled to Cell 1. A stockpile of organic material was also created south of liner for frost protection layer. Excavation and piping of new force main began today. Two proctor samples obtained from random areas in Cell 2/3 division berm were taken to PSI today.

Michael P. McConnell
Technician

RMM Dennat
Engineer

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: December 3, 1992

	TECHNICIAN	ENGINEER	CONSTRUCTION HOURS
TIME OF ARRIVAL:	8:00 AM		8:00 AM
TIME OF DEPARTURE:	4:30 PM		5:00 PM

WEATHER: Windy and Cool
TEMPERATURE: 40°
SKY: Cloudy
PRECIPITATION: None

TEST RESULTS (SUMMARY):
None

LOCATION AND TYPE WORK PERFORMED:
Disking of in-place clay liner in Cell floor

PERSONNEL:
6 Operating Engineers

TYPE INSPECTION:
Visual Observation

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
None

REMARKS:
Siciliano continued disking operations in Cell floor. Also stripped topsoil from Cell 2/3 division berm.

Michael P. McConnell
Technician

R M McDermott
Engineer

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DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: December 4, 1992

	TECHNICIAN	ENGINEER	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:30 AM		7:30 AM
TIME OF DEPARTURE:	3:30 PM		5:00 PM

WEATHER: Windy and Cold
TEMPERATURE: 34° and Falling
SKY: Mostly Cloudy
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 277-295

LOCATION AND TYPE WORK PERFORMED:
Installation of force main. Removal of frost material in NW corner at 10% slope. Placement of clay in ditch excavation. Placement of clay liner in floor and compaction of Cell floor. Force main piping

PERSONNEL:
9 Operating Engineers
1 Laborer

TYPE INSPECTION:
Visual Observation and Nuclear Density Testing

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge, Thermometer, and Total Station

REMARKS:
Area of ditch from E 2010 to E 2082.5 was cleaned up and fill was placed in 6" loose lifts. Area was compacted to 95% of a Standard Proctor Value. Force main piping was completed today and tied into existing manhole. Material (clay) was being borrowed from Cell 2/3 division berm.

Michael P. McConnell
Technician

RMMcDermott
Engineer

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DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Kent L. Lovellette

JOB NUMBER: 93-119
DATE: December 5, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	12:45 PM	7:00 AM	7:00 AM
TIME OF DEPARTURE:	4:45 PM	1:00 PM	4:30 PM

WEATHER: Windy
TEMPERATURE: 32°
SKY: Sunny
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 296-326

LOCATION AND TYPE WORK PERFORMED:
Removal of frost, compaction and recompaction of sideslopes, north and west. Frost protection layer was placed at end of day

PERSONNEL:
9 Operating Engineers

TYPE INSPECTION:
Nuclear Density Testing and Observation for frost or frozen material

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge

REMARKS:
Mike McDermont was present in the morning. He said frost was removed from the liner and stockpiled to the east. Material was placed and recompacted with a Caterpillar 815B Sheepsfoot Roller, 5 passes seemed to be required to obtain the 95% compaction of Standard Proctor Value. At the day's end, a loose (lightly compacted layer) was placed for frost protection.

Kent L. Lovellette
Technician

R M McDermont
Engineer

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DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: December 7, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:30 AM	8:00 AM	7:00 AM
TIME OF DEPARTURE:	5:30 PM	NOON	5:30 PM

WEATHER:
TEMPERATURE: 35°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 327-352

LOCATION AND TYPE WORK PERFORMED:
Frost removal, placement of clay liner in floor and sideslopes, and installation of outlet pipe in borrow area

PERSONNEL:
9 Operating Engineers
1 Laborer

TYPE INSPECTION:
Visual Observation with temperature for frost, and Nuclear Density Testing

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge, Thermometer, and Total Station

REMARKS:
Outlet pipe was installed from borrow pit to Sugar Creek.

Michael P. McConnell
Technician

RMMcDermat
Engineer

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DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Kent L. Lovellette

JOB NUMBER: 93-119
DATE: December 7, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	NOON	8:30 AM	8:30 AM
TIME OF DEPARTURE:	5:30 PM	NOON	5:30 PM

WEATHER: Cool
TEMPERATURE: 35°
SKY: Overcast
PRECIPITATION: None

TEST RESULTS (SUMMARY):
None

LOCATION AND TYPE WORK PERFORMED:
Placed new drain pipe from borrow area to Sugar Creek. Checked with orange die to see if old drain tile was flowing

PERSONNEL:
1 Backhoe Operator
1 Laborer

TYPE INSPECTION:
Check Location and Grade of Drain Pipe

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Auto Level and Tape Measure

REMARKS:
Set the drainage pipe from the borrow area to Sugar Creek. Checked the old drain tile with orange die to see if still worked. The die never came through--considered to be non-operational.

Kent L. Lovellette
Technician

RMMcDermott
Engineer

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DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: December 8, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	7:30 - 8:00 AM	7:00 AM
TIME OF DEPARTURE:	5:00 PM	9:45 - NOON 1:00 - 4:00 PM	5:00 PM

WEATHER: Cool
TEMPERATURE: 35°
SKY: Clear
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 353-363

LOCATION AND TYPE WORK PERFORMED:
Frost removal and placement of compacted clay in sideslopes of liner, and stockpiled sand

PERSONNEL:
9 Operating Engineers
2 Teamsters

TYPE INSPECTION:
Temperature and visual for frost in soils. Compaction testing, surveyed grades, final at floor and base at northwest corner

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea and Ed Riordan (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge, Thermometer and Total Station

REMARKS:
Staked out for final grade in floor of Cell #3 today marking fills. Siciliano brought in 4 loads of sand and stockpiled. Researched stockpile east of E 2300 for moisture content as an alternative borrow source. Material is being brought from Cells 2 and 3 division berm for sideslope fills.

Michael P. McConnell
Technician

R M McDermott
Engineer

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DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: December 9, 1992

	TECHNICIAN	ENGINEER	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM		7:00 AM
TIME OF DEPARTURE:	2:00 PM		1:00 PM

WEATHER: Cool
TEMPERATURE: 28°
SKY: Cloudy
PRECIPITATION: Freezing Rain Noon

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 364-380
New Proctor Received 113.1 PCF at
15.2 Optimum Moisture

LOCATION AND TYPE WORK PERFORMED:
Frost removal, placement of clay at north and west sideslopes, and stockpile of FA-2 sand began today

PERSONNEL:
9 Operating Engineers
2 Teamsters

TYPE INSPECTION:
Temperature and visual for frost, Nuclear Moisture/Density, 3 Hydraulic Conductivity Samples Pushed

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge, 3 (3" Shelby Tubes) and Total Station

REMARKS:
Frank Siciliano kept jumping from one thing to the next today. Started to stake east berm 3 times. Job was shut down at 1 PM due to freezing rain. Hauling equipment was no longer able to make it to load from Cells 2 and 3 division berm. Three 3" shelby tube samples were pushed into clay liner. After removal of tube, holes were backfilled with Ben-Seal.

Michael P. McConnell
Technician

R M McDermott
Engineer

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DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: December 12, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	7:00 AM	7:00 AM
TIME OF DEPARTURE:	6:30 PM	6:30 PM	6:15 PM

WEATHER: Cool
TEMPERATURE: 42°
SKY: Partly Cloudy
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 381-391

LOCATION AND TYPE WORK PERFORMED:
Frost removal of area in and around leachate collection manhole, north and west sideslope berms, and east perimeter. Placement of clay in all areas mentioned.

PERSONNEL:
9 Operating Engineers

TYPE INSPECTION:
Density-Moisture, Visual Observation for frost, Frozen Material and Horizontal width of north and west sideslope liner berms

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge

REMARKS:
Removal of frost in sub-grade of manhole area and in north and west sideslopes. Material placed in lifts from Cells 2 and 3 division berm tests met or exceeded requirements. Rutting of existing clay is taking place today as the equipment was run in the same path all day. East berm was staked out today and placement of material took place today.

Michael P. McConnell
Technician

R M McDermott
Engineer

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DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: December 13, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	7:00 AM	7:00 AM
TIME OF DEPARTURE:	4:30 PM	4:00 PM	4:30 PM

WEATHER: Cool
TEMPERATURE: 42°
SKY: Partly Sunny
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 392-402

LOCATION AND TYPE WORK PERFORMED:
Removal of frost, placement and compaction of clay liner in north and west berms and in and around leachate collection manhole area

PERSONNEL:
9 Operating Engineers

TYPE INSPECTION:
Density-Moisture, Visual Observation for frost, Frozen Material and Horizontal width of north and west sideslope liner berms

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge

REMARKS:
Siciliano removed frost and frozen material from area adjacent leachate collection manhole and north and west sideslopes. Material was placed to grade in and around the area of the leachate collection manhole. Compaction testing met or exceeded the required 95% of a Standard Proctor Value. Also placed today were lifts of clay liner in north and west sideslopes. Horizontal width was checked. Compaction testing was also performed finding the minimum 95% compaction at optimum moisture content.

Michael P. McConnell
Technician

MMcDermott
Engineer

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DAILY SUMMARY REPORT

SITE NAME: City Water Light & Power
LOCATION: Cell 3 - Phase 1
MONITOR: Michael P. McConnell

JOB NUMBER: 93-119
DATE: December 14, 1992

	TECHNICIAN	ENGINEER (MMc)	CONSTRUCTION HOURS
TIME OF ARRIVAL:	7:00 AM	7:00 AM	7:00 AM
TIME OF DEPARTURE:	5:00 PM	5:00 PM	4:30 PM

WEATHER: Windy
TEMPERATURE: 38°
SKY: Partly Sunny
PRECIPITATION: None

TEST RESULTS (SUMMARY):
Nuclear Density Test Numbers 403-407

LOCATION AND TYPE WORK PERFORMED:
Removal of frost, compaction and recompaction of north and west sideslopes, removal of wet material in 10% slope area and attempted to place 1 lift of clay

PERSONNEL:
9 Operating Engineers

TYPE INSPECTION:
Density-Moisture, Visual Observation for frost, Frozen Material and Horizontal width of north and west sideslope liner berms

EQUIPMENT (CONSTRUCTION):
See Inventory Dated October 1, 1992

VISITORS:
Mark Shea (CWLP)

TESTING EQUIPMENT AND CALIBRATION EQUIPMENT (TEST):
Nuclear Density Gauge

REMARKS:
Siciliano started the day out by removing frost and frozen materials after which the Caterpillar 815-B Sheepsfoot Roller recompacted material in place and several passes before obtaining the required 95% compaction of a standard proctor value. Another lift was placed, however, compaction did not meet requirements at days end. The 10% slope area was excavated to dry unfrozen material and 1 lift of clay was placed compacted, and tested however test results did not meet requirements. Staked area for grade finding that the area is still in need of fill to bring area up to the required 5' of compacted clay liner.

Technician

Engineer

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** June 22, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM		7:00 AM
Time of Departure:	5:00 PM		5:30 PM
Weather: Sunny and Hot	**Temperature:** 88°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Cut north and west berms to last year's elevation. Placed 2 lifts on north and west berms. Cut Repair Area out.			
Type Inspection: Visual Observation, Survey topo of north and west berms, Nuclear Density Testing, and Survey Repair Area			
Personnel: 6 Operators		**Visitors:** None	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R. M. McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** June 23, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM		7:00 AM
Time of Departure:	7:00 PM		6:00 PM
Weather: Hot and Humid	**Temperature:** 90°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Cut out repair area, backfilled, and berms rolled.			
Type Inspection: Visual Observation, survey and stake repair area, and survey sideslopes			
Personnel: 6 Operators		**Visitors:** None	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		RM McDermont R. Michael McDermont, Engineer	

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Springfield, Illinois 62707
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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** June 24, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	6:30 AM & 10:00 AM		6:30 AM
Time of Departure:	9:30 AM & 2:30 PM		2:30 PM
Weather: Windy, Warm and Humid	**Temperature:** 88°	**Sky:** AM - Partly Cloudy PM - Cloudy	**Precipitation:** Rain at 2:30 PM
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Cut apron north to last year's grade. Attempted to place lift but rain stopped work.			
Type Inspection: Visual Observation, Nuclear Density Testing, and survey and stake cut grades			
Personnel: 5 Operators		**Visitors:** Ed Riordan and Mark Shea (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** June 28, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:30 AM		7:30 AM
Time of Departure:	5:30 PM		5:30 PM
Weather: Partly Sunny, Hot and Humid	**Temperature:** 85°	**Sky:** Partly Sunny	**Precipitation:** Light shower at Noon
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Dry material on top of north and west berms. Attempted wetting NW 1/4. Placement of 1 lift on north and west berm tops.			
Type Inspection: Visual Observation, Nuclear Density Testing, stake out on 50' centers in floor, and survey sideslopes			
Personnel: 6 Operators		**Visitors:** Ed Riordan and Mark Shea (CWLP) and Matt Reichert (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks: Removed dry material from berm tops north and west. One lift was placed on north and west berm tops, however, mositure was low. Berms will be reworked. No work took place from June 29, 1993 through July 5, 1993 due to rain.			
Michael P. McConnell Michael McConnell, Technician		R. M. McDermont R. Michael McDermont, Engineer	

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Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** July 6, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:30 AM		7:30 AM
Time of Departure:	3:30 PM		3:30 PM
Weather: Partly Cloudy with Rain in PM	**Temperature:** 75°	**Sky:** Partly Cloudy	**Precipitation:** Rain in the PM
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Berms and apron disked, moistened, and recompacted. Cutting to -.5' from contour. Placement of liner north and west berms.			
Type Inspection: Visual Observation, Nuclear Density Testing, staking for cuts to fills, and Surveying			
Personnel: 6 Operators		**Visitors:** Ed Riordan and Mark Shea (CWLP) and Matt Reichert (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks: Floor area was cut down to -0.5' below contours for frost damage remediation. This material was carried to tops of north and west berms.			
Michael P. McConnell Michael McConnell, Technician		R. Michael McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** July 9, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM	10:00 AM	7:00 AM
Time of Departure:	5:00 PM	NOON	5:00 PM
Weather: Sunny and Mild	**Temperature:** 82°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Clay liner placement north and west berms and apron area.			
Type Inspection: Visual Observation, Nuclear Density Testing, and Surveying			
Personnel: 6 Operators		**Visitors:** Ed Riordan and Mark Shea (CWLP) and Matt Reichert (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** July 13, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM		7:00 AM
Time of Departure:	5:00 PM		4:30 PM
Weather: Sunny, Hot and Humid	**Temperature:** 85°	**Sky:** Mostly Clear	**Precipitation:** None
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Dried floor and berms by disking and recompacting.			
Type Inspection: Visual Observation, Nuclear Density Testing, Survey slopes, and Check grades apron			
Personnel: 6 Operators		**Visitors:** Ed Riordan and Mark Shea (CWLP) and Matt Reichert (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks: Much of the day was spent drying in-place materials down. D-6 Dozer was down all day.			
Michael P. McConnell Michael McConnell, Technician		R. Michael McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** July 20, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM & 3:30 PM	8:00 AM	7:00 AM
Time of Departure:	2:30 PM & 6:00 PM	5:00 PM	6:00 PM
Weather: Partly Cloudy and Mild	**Temperature:** 83°	**Sky:** Partly Cloudy	**Precipitation:** Light Rain in the PM
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Placed liner, 1 lift in floor, and 2 lifts in apron.			
Type Inspection: Visual Observation, Nuclear Density Testing, and Surveying			
Personnel: 6 Operators		**Visitors:** Ed Riordan and Mark Shea (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test):			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** July 21, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM		7:00 AM
Time of Departure:	6:30 PM		6:30 PM
Weather: Partly Sunny and Mild	**Temperature:** 80°	**Sky:** Partly Sunny	**Precipitation:** None
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Watering and rolling of in-place liner. Placement of liner north 1/2 not rolled.			
Type Inspection: Visual Observation, Nuclear Density Testing, Surveying, and Pushed 3" shelby tube			
Personnel: 6 Operators		**Visitors:** Ed Riordan and Mark Shea (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** July 22, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	6:30 AM		6:30 AM
Time of Departure:	8:00 AM		7:00 AM
Weather: Rain and Cool	**Temperature:** 68°	**Sky:** Cloudy	**Precipitation:**
Test Results (Summary):			
Location and Type Work Performed: No work today, due to rain starting at 7:00 AM.			
Type Inspection: Visual Observation			
Personnel:		**Visitors:**	
Equipment (Construction):			
Testing Equipment and Calibration Equipment (Test):			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R. M. McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** July 27, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM	8:00 AM & 4:30 PM	7:00 AM
Time of Departure:	6:30 PM	10:00 AM & 5:30 PM	6:30 PM
Weather: Sunny, Hot, and Humid	**Temperature:** 90°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: AM - Disked entire floor of Cell. PM - Placed clay liner.			
Type Inspection: Visual Observation, Nuclear Density Testing, and Surveying			
Personnel: 6 Operators		**Visitors:** Ed Riordan and Mark Shea (CWLP) and Frank Siciliano	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test):			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R.M.McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** July 28, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	6:00 AM		6:30 AM
Time of Departure:	6:30 PM		6:30 PM
Weather: Sunny and Warm	**Temperature:** 88°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Clay liner placed in floor and apron.			
Type Inspection: Visual Observation, Nuclear Density Testing, and Survey and stake contours in floor and apron			
Personnel: 6 Operators		**Visitors:** Ed Riordan and Mark Shea (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		RMMcDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** July 29, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	6:30 AM	8:00 AM & 4:00 PM	6:30 AM
Time of Departure:	5:30 PM	8:30 AM & 5:30 PM	5:30 PM
Weather: Sunny, Windy, and Mild	**Temperature:** 82°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Placement of clay and cutting to grade north 1/2. Disked to dry tops of north and west berms.			
Type Inspection: Visual Observation, Nuclear Density Testing, and Surveying grades north 1/2			
Personnel: 6 Operators		**Visitors:** Ed Riordan and Mark Shea (CWLP), Frank Siciliano, and Matt Reichert (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks: Frank Siciliano was on site today and drove the Kenworth Haul Truck on liner and placed liner material with it, mechanical problems caused this. It appears that the stockpile in Cell 3 has been exhausted today. Material for the remainder will have to come from Cell 2/3 division berm.			
Michael P. McConnell Michael McConnell, Technician		R. M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** July 31, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	6:30 AM	7:30 AM	6:30 AM
Time of Departure:	4:30 PM	9:00 AM	4:30 PM
Weather: Humid	**Temperature:** 82°	**Sky:** Mostly Cloudy	**Precipitation:** None
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Compacted and graded liner in south side of site.			
Type Inspection: Visual Observation, Nuclear Density Testing, and Surveying			
Personnel: 6 Operators		**Visitors:** None	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 2, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	6:30 AM		6:30 AM
Time of Departure:	5:30 PM		5:30 PM
Weather: Mild	**Temperature:** 85°	**Sky:** Partly Cloudy	**Precipitation:** None
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Sand continued to be stockpiled in south 1/2 of Cell. Clay was placed in NW corner.			
Type Inspection: Visual Observation, Nuclear Density Testing, and Surveying			
Personnel: 6 Operators		**Visitors:** Ed Riordan and Mark Shea (CWLP) and Matt Reichert (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 5, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM & 11:00 AM	8:30 AM & 5:00 PM	7:00 AM
Time of Departure:	10:00 AM & 6:30 PM	2:30 PM & 6:30 PM	6:30 PM
Weather: Partly Cloudy and Mild	**Temperature:** 82°	**Sky:** Partly Cloudy	**Precipitation:** Light rain late afternoon
Test Results (Summary): None			
Location and Type Work Performed: Excavated and placed manhole. Excavated and placed leachate line.			
Type Inspection: Visual Observation, Surveyed elevations of manhole, gravel and leachate piping for record drawings			
Personnel: 5 Operators 1 Laborer		**Visitors:** Ed Riordan and Mark Shea (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test):			

Remarks: The leachate collection system was excavated today. Manhole arrived and the base was 6' diameter. Specification called for 6' x 6' square base. Manhole was not asphalt coated. Manhole was set on Ben-Seal enriched soil. Collection trench was excavated, gravel was compacted in, and pipe was placed from manhole to approximately E 2082.5 today. Some gravel was compacted around and above piping.

Mike McDermont brought it to Kurt Siciliano's attention that the replacement berm north of recompacted berm should be compacted.

Michael P. McConnell	R. M. McDermont
Michael McConnell, Technician	R. Michael McDermont, Engineer

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 6, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM	8:30 AM	7:00 AM
Time of Departure:	5:00 PM	11:00 AM	5:00 PM
Weather: Sunny and Cool	**Temperature:** 75°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Gravel and piping of leachate line. Berm construction at temporary south and east berms. Final grading SW apron. Placement and compaction SW apron. Liner placement at north and west berms. Placement of sand in floor.			
Type Inspection: Visual Observation, Surveyed, Nuclear Density Testing, Observed compaction of gravel and clay, and Observed placement of leachate line			
Personnel: 5 Operators 1 Laborer		**Visitors:** Ed Riordan and Mark Shea (CWLP) and Matt Reichert (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks: Rock was compacted below, around, and above leachate piping. Fabric was folded over and sand was placed over fabric. Problems with material being placed on north and west berms were solved as a vain of brown and gray silty clay was found very similar to material from original borrow pit today at Cell 2/3 division berm.			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 9, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	8:00 AM	8:30 AM	8:00 AM
Time of Departure:	5:00 PM	9:30 AM	5:00 PM
Weather: Sunny and Warm	**Temperature:** 87°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): None			
Location and Type Work Performed: Finished west end of leachate line. Graded sand in floor.			
Type Inspection: Visual Observation and Surveyed			
Personnel: 3 Operators		**Visitors:** Ed Riordan and Mark Shea (CWLP) and Matt Reichert (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks: Siciliano finished west end of leachate line. Riser was bent at toe of slope and one length of pipe was run up slope. Stone was compacted in and fabric folded over. Sand was then pushed over the top of the fabric over leachate and gravel. Surveyed and staked Center Line of Anchor Trench for composite Geo Net along west slope. Topo of west slope was surveyed.			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 10, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	2:00 PM		2:00 PM
Time of Departure:	5:00 PM		5:00 PM
Weather: Hot and Humid	**Temperature:** 90°	**Sky:** Clear	**Precipitation:** Rain Overnight
Test Results (Summary): None			
Location and Type Work Performed: Excavation of Anchor Trench on west sideslope.			
Type Inspection: Visual Observation and Surveyed Center Line			
Personnel: 2 Operators		**Visitors:** Ed Riordan (CWLP) and Matt Reichert (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 11, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	8:00 AM		8:00 AM
Time of Departure:	5:00 PM		5:00 PM
Weather: Hot and Humid	**Temperature:** 88°	**Sky:** Clear	**Precipitation:**
Test Results (Summary): None			
Location and Type Work Performed: Placement of composite fabric/net at west sideslope.			
Type Inspection: Visual Observation, Observed placement of sideslope net/fabric, and Surveyed sand grades			
Personnel: 4 Operators 4 Laborers Several Teamsters		**Visitors:** Ed Riordan (CWLP), Frank Siciliano, and Matt Reichert (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test):			
Remarks: Placed composite fabric/Geo Net at west sideslope. Laps are pre-engineered into fabric, net is tie-wrapped together. Anchor Trench was partially backfilled and fabric weighted down with sand bags.			
Michael P. McConnell Michael McConnell, Technician		R. M. McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 13, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:15 AM		
Time of Departure:	8:15 AM		
Weather: Rain Overnight	**Temperature:** 85°	**Sky:** Clear	**Precipitation:** Rain Overnight
Test Results (Summary):			
Location and Type Work Performed: No work today.			
Type Inspection: Visual Observation			
Personnel:		**Visitors:**	
Equipment (Construction):			
Testing Equipment and Calibration Equipment (Test):			
Remarks:			
Michael McConnell, Technician		R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 16, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM		
Time of Departure:	8:00 AM		
Weather: Partly Sunny	**Temperature:** 90°	**Sky:**	**Precipitation:** Rain Overnight
Test Results (Summary):			
Location and Type Work Performed: No work today, too wet.			
Type Inspection: Visual Observation			
Personnel:		**Visitors:**	
Equipment (Construction):			
Testing Equipment and Calibration Equipment (Test):			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 17, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	7:30 AM	9:00 AM	7:30 AM
Time of Departure:	4:30 PM	10:30 AM	4:30 PM
Weather:	**Temperature:**	**Sky:**	**Precipitation:**
Test Results (Summary): None			
Location and Type Work Performed: Excavation of Anchor Trench along north berm. Fabric placement. Sand placement on floor.			
Type Inspection: Visual Observation, and Lapping of composite fabric			
Personnel: 2 Operators 2 Laborers Several Teamsters		**Visitors:** Ed Riordan (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks: Anchor Trench excavated north berm to elevation 550±. Fabric was overlapped on bottom layer. Net was tie-wrapped and top folded over. Sand bags were utilized to hold the fabric down.			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 18, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	8:00 AM		8:00 AM
Time of Departure:	11:30 AM		11:30 AM
Weather: Mostly Cloudy, Late AM - Thunderstorms	**Temperature:** 85°	**Sky:** Mostly Cloudy	**Precipitation:** Late AM - Thunderstorms
Test Results (Summary): None			
Location and Type Work Performed: Grading of sand.			
Type Inspection: Visual Observation, Excavated test pits by hand, and Measured sand thickness			
Personnel: 2 Operators 1 Mechanic		**Visitors:** Ed Riordan (CWLP) and Matt Reichert (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test):			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 19, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	8:00 AM		
Time of Departure:	8:30 AM		
Weather: Sunny and Hot	**Temperature:** 90°	**Sky:** Clear	**Precipitation:** Rain Overnight
Test Results (Summary):			
Location and Type Work Performed: No work today due to rain last night.			
Type Inspection: Visual Observation			
Personnel:		**Visitors:**	
Equipment (Construction):			
Testing Equipment and Calibration Equipment (Test):			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		RMMDer R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 20, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	8:00 AM	8:30 AM	8:00 AM
Time of Departure:	5:00 PM	9:30 AM	5:00 PM
Weather: Sunny and Mild	**Temperature:** 83°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): None			
Location and Type Work Performed: Grading of sand at floor.			
Type Inspection: Visual Observation, Surveyed sand thickness, and Checked grades of berms south and east			
Personnel: 1 Operator 1 Laborer		**Visitors:** Ed Riordan (CWLP) and Dennis Wittmer (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks: Checked sand grades using last shots from clay grades and adding 1'. Test pits were also excavated by shovel and sand measured to insure 1' thickness.			
Michael P. McConnell Michael McConnell, Technician		R. M. McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 23, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:30 AM		7:30 AM
Time of Departure:	6:00 PM		5:30 PM
Weather: Sunny, Hot, and Humid	**Temperature:** 90°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): None			
Location and Type Work Performed: Seamed sideslope fabric. Graded sand NW and SW. Sand was trucked to site.			
Type Inspection: Visual Observation, Survey of sand grades, and Observed for burns in sideslope fabric			
Personnel: 1 Operator 2 Laborers Several Teamsters		**Visitors:** Ed Riordan (CWLP), Frank Siciliano, and Vince Madonia (AEEI)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks: Seamed fabric on side walls with torch today. Any areas burned were patched with like fabric. Vince came out to assist with sand grades and recheck of the clay grading.			
Michael P. McConnell Michael McConnell, Technician		RM McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 24, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM		7:00 AM
Time of Departure:	5:00 PM		5:00 PM
Weather: Sunny and Hot	**Temperature:** 88°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): None			
Location and Type Work Performed: Fabric placement in floor of NE corner. Partial seaming. Sand grading floor.			
Type Inspection: Visual Observation, Surveying, Measurement of laps, and Checking of grades on sand			
Personnel: 1 Operator 4 Laborers		**Visitors:** Ed Riordan (CWLP) and Frank Siciliano	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks: Placement of fabric in floor began today. Some laps were heat-seamed today. Sand bags were utilized to weigh fabric down. Manufacturer's recommendation for laps is 6" when being heat-seamed with a torch. Ed Riordan wants fabric to extend 4' up on all slopes.			
Michael McConnell, Technician		R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 25, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM & 2:00 PM	2:30 PM	7:00 AM
Time of Departure:	8:00 AM & 3:30 PM	3:30 PM	3:30 PM
Weather:	**Temperature:**	**Sky:**	**Precipitation:**
Test Results (Summary): None			
Location and Type Work Performed: Placement of fabric and seaming N 5550 to N 5200 approximately (floor).			
Type Inspection: Visual Observation, and Measurement of laps			
Personnel: 1 Operator 7 Laborers		**Visitors:** Ed Riordan (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 26, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM		7:00 AM
Time of Departure:	4:30 PM		4:30 PM
Weather: Hot and Humid	**Temperature:** 94°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): None			
Location and Type Work Performed: Fabric placement, seaming and patching. Sand placement. Leachate discharge piping.			
Type Inspection: Visual Observation, and Measurement of overlaps, etc.			
Personnel: 1 Operator 5 Laborers 1 Teamster		**Visitors:** Ed Riordan (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks: One tandem-axle dump truck ran all day to sand pit. Siciliano is having difficulty getting sand. Placement of leachate discharge piping began today from manhole to crown of north slope.			
Michael P. McConnell Michael McConnell, Technician		R. M. McDermont R. Michael McDermont, Engineer	

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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 27, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	8:00 AM & 3:30 PM		8:00 AM
Time of Departure:	2:30 PM & 5:30 PM		5:30 PM
Weather: Hot and Humid	**Temperature:** 93°	**Sky:** Clear	**Precipitation:**
Test Results (Summary): None			
Location and Type Work Performed: Clay placement at north and west berms. Seaming of fabric placed on August 26, 1993.			
Type Inspection: Visual Observation			
Personnel: 4 Operators 2 Laborers 1 Teamster		**Visitors:** Ed Riordan (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks: Mechanical problems with all three (3) Scrapers. E270 had a blown engine.			
Michael P. McConnell Michael McConnell, Technician		R. Michael McDermont R. Michael McDermont, Engineer	

ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 28, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM		7:00 AM
Time of Departure:	11:00 AM		11:00 AM
Weather: Hot and Humid	**Temperature:** 85°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): None			
Location and Type Work Performed: Sand placement at south and east perimeters. Stockpiled material north and west for berms over fabric.			
Type Inspection: Visual Observation			
Personnel: 4 Operators 4 Teamsters		**Visitors:** None	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks:			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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Springfield, Illinois 62707
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DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 30, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM	10:00 AM	7:00 AM
Time of Departure:	5:00 PM	11:00 AM	5:00 PM
Weather: Hot and Humid	**Temperature:** 91°	**Sky:** Hazy	**Precipitation:** None
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Grading of clay at slot in east berm, east of M.H. Placement of lift on north and west berms.			
Type Inspection: Visual Observation			
Personnel: 2 Operators 1 Laborer		**Visitors:** Ed Riordan (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Meter			
Remarks: A lift was placed on north and west berms from material stockpiled Saturday. Mechanical problems occurred with JD 990 and Raygo Ram - 60.			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** August 31, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM & 3:00 PM		7:00 AM
Time of Departure:	1:00 PM & 3:30 PM		3:30 PM
Weather: Intermediate Showers and Cool	**Temperature:** 70°	**Sky:** Cloudy	**Precipitation:** Intermediate Showers
Test Results (Summary): None			
Location and Type Work Performed: Grading of sand south and east. Placed fabric on east side.			
Type Inspection: Visual Observation, and Surveying			
Personnel: 2 Operators 1 Laborer		**Visitors:** Ed Riordan (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks: Mechanical problems and showers prevented much from being accomplished today.			
Michael McConnell, Technician		R. Michael McDermont, Engineer	

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Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** September 1, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	7:00 AM	1:30 PM	7:00 AM
Time of Departure:	5:00 PM	3:30 PM	5:00 PM
Weather: Mild	**Temperature:** 80°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): None			
Location and Type Work Performed: Excavation and placement of leachate discharge line and valves. Completion of east and south berms. Placement of clay on north and west berms. Grading of sand south and east. Placement of fabric in south and east.			
Type Inspection: Visual Observation, and Surveying			
Personnel: 2 Operators 2 Laborers 1 Truck Driver		**Visitors:** IEPA, and Ed Riordan and Sue Corcoran (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks: During placement of piping and backflow valves, slip joint in 4" leaked water. The 4" backflow was taken apart and joint-glued from inside.			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** September 2, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	7:30 AM		
Time of Departure:	8:30 AM		
Weather: Cloudy and Cool	**Temperature:** 70°	**Sky:** Cloudy	**Precipitation:** Overnight
Test Results (Summary): None			
Location and Type Work Performed: No work today due to rain.			
Type Inspection: Visual Observation			
Personnel:		**Visitors:**	
Equipment (Construction):			
Testing Equipment and Calibration Equipment (Test): None			
Remarks: Placed rubber valve back in 4" backflow valve and reassembled.			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** September 7, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	8:00 AM		8:00 AM
Time of Departure:	8:30 AM		9:00 AM
Weather: Cool	**Temperature:** 72°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): None			
Location and Type Work Performed: Pumping leachate collection manhole down.			
Type Inspection: Visual Observation			
Personnel:		**Visitors:**	
Equipment (Construction):			
Testing Equipment and Calibration Equipment (Test): None			
Remarks: Siciliano was pumping leachate collection manhole down upon arrival, approximately 2' of water is standing over sand and fabric around manhole.			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** September 9, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER**	**CONSTRUCTION HOURS**
Time of Arrival:	8:00 AM		8:00 AM
Time of Departure:	5:30 PM		5:00 PM
Weather: Windy	**Temperature:** 75°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): None			
Location and Type Work Performed: Placement of clay at tops of north and west			
Type Inspection: Visual Observation, and Surveyed berms, etc., for record drawings			
Personnel:		**Visitors:** Ed Riordan and Mark Shea (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): None			
Remarks: Numerous equipment problems encountered--slowed progress.			
Michael P. McConnell Michael McConnell, Technician		R M McDermont R. Michael McDermont, Engineer	

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3535 Mayflower Boulevard
Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** September 10, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	7:30 AM	9:00 AM	8:00 AM
Time of Departure:	2:30 PM	10:00 AM	4:00 PM
Weather: Sunny and Cool	**Temperature:** 72°	**Sky:** Clear	**Precipitation:** None
Test Results (Summary): None			
Location and Type Work Performed: Placement of clay at north and west berms			
Type Inspection: Visual Observation, and Surveyed berm tops north and west			
Personnel: 3 Operators 1 Laborer 1 Teamster		**Visitors:** Ed Riordan (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Total Station			
Remarks: Continued placement of liner north and west berms over sidewall fabric. Areas were brought to a minimum of elevation 553.			
Michael P. McConnell Michael McConnell, Technician		R. M McDermont R. Michael McDermont, Engineer	

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Springfield, Illinois 62707
(217) 787-2334

DAILY SUMMARY REPORT

Site Name: City Water, Light & Power		**Job Number:** 93-119	
Location: Cell 3 - Phase 1		**Date:** September 13, 1993	
Monitor: Michael P. McConnell, Technician			
	TECHNICIAN	**ENGINEER (MMc)**	**CONSTRUCTION HOURS**
Time of Arrival:	8:00 AM	9:00 AM	8:00 AM
Time of Departure:	5:00 PM	10:00 AM	5:00 PM
Weather: Intermediate Showers and Windy	**Temperature:** 75°	**Sky:** Cloudy	**Precipitation:**
Test Results (Summary): See Nuclear Density Test Report			
Location and Type Work Performed: Compacted tops of north and west berms, installed leachate clean-out, and placed fabric around manhole.			
Type Inspection: Visual Observation, Surveyed, and Nuclear Density Testing			
Personnel: 2 Operators 1 Laborer		**Visitors:** Ed Riordan, Mark Shea, and Sue Corcoran (CWLP)	
Equipment (Construction): See Inventory Dated October 1, 1992			
Testing Equipment and Calibration Equipment (Test): Nuclear Density Gauge and Total Station			
Remarks: Siciliano rolled tops of north and west berms. Performed compaction testing. Siciliano repaired clean-out riser on force main, installed clean-out riser on leachate line, placed fabric around manhole and tied in existing fabric, and placed fabric on sidewalls south and east.			
Michael P. McConnell Michael McConnell, Technician		R. Michael McDermont R. Michael McDermont, Engineer	

ATTACHMENT 8

Equipment Inventory (Siciliano, Inc.)

CITY WATER, LIGHT & POWER - CELL #3

EQUIPMENT INVENTORY

Siciliano, Inc.

(1) Wabco Scraper

(1) Terex Scraper

(1) International E270 Scraper

(1) International Haul Truck

(1) Kenworth Tandem Axle Haul Truck

(1) Caterpillar D 6D Dozer

(1) Caterpillar D 3B Dozer

(1) Caterpillar 815-B Sheepsfoot Roller

(1) John Deere 892 Backhoe

(1) John Deere Kress Haul Truck

(1) Link Belt 4300 Backhoe

(1) Diamond T 2000 Gallon Water Truck with Fan Sprayer

(1) Soil Disk

(1) Tampo Vibratory Sheepsfoot Roller

(1) John Deere 510 Combination Backhoe

(1) John Deere 850 B LGP Dozer (Temporary)

1993

(1) Raygo Ram 60 Sheepsfoot Roller - Replaced Caterpillar 815-B Sheepsfoot Roller

(1) Volvo A-25 6 x 6 Haul Truck - Replaced John Deere Kress Haul Truck (Temporary)

(1) John Deere 990 Backhoe - Replaced Link Belt 4300 Backhoe

Numerous Tandem Axle Dump Trucks Utilized as Needed and Additional Sand Delivery Vehicles Were Used When Sand Delivered.

NOTE: Not all equipment on-site everyday or if on-site may not have been utilized each day.

ATTACHMENT 9

Photographic Records

ORIGINAL CONDITIONS

ORIGINAL CONDITIONS

ORIGINAL CONDITIONS

ORIGINAL CONDITIONS

FOUNDATION STABILIZATION

FOUNDATION STABILIZATION

FOUNDATION STABILIZATION

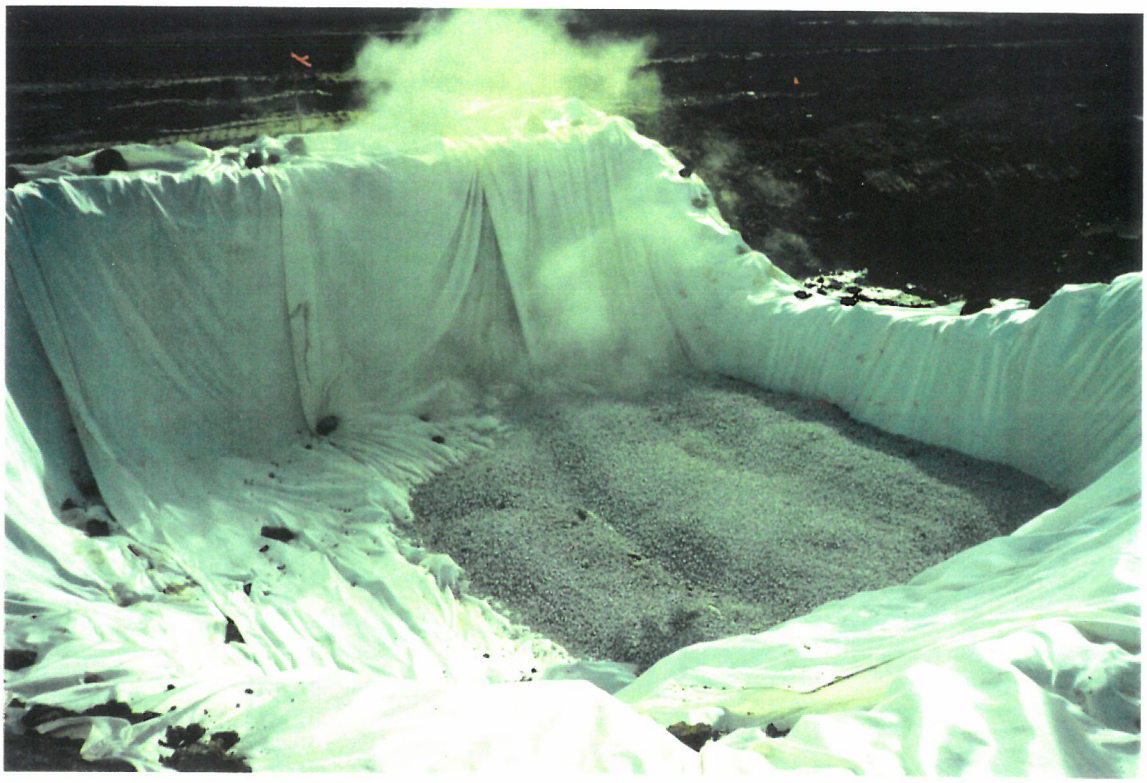
FOUNDATION STABILIZATION

TOPSOIL REMOVAL AREA

FOUNDATION STABILIZATION

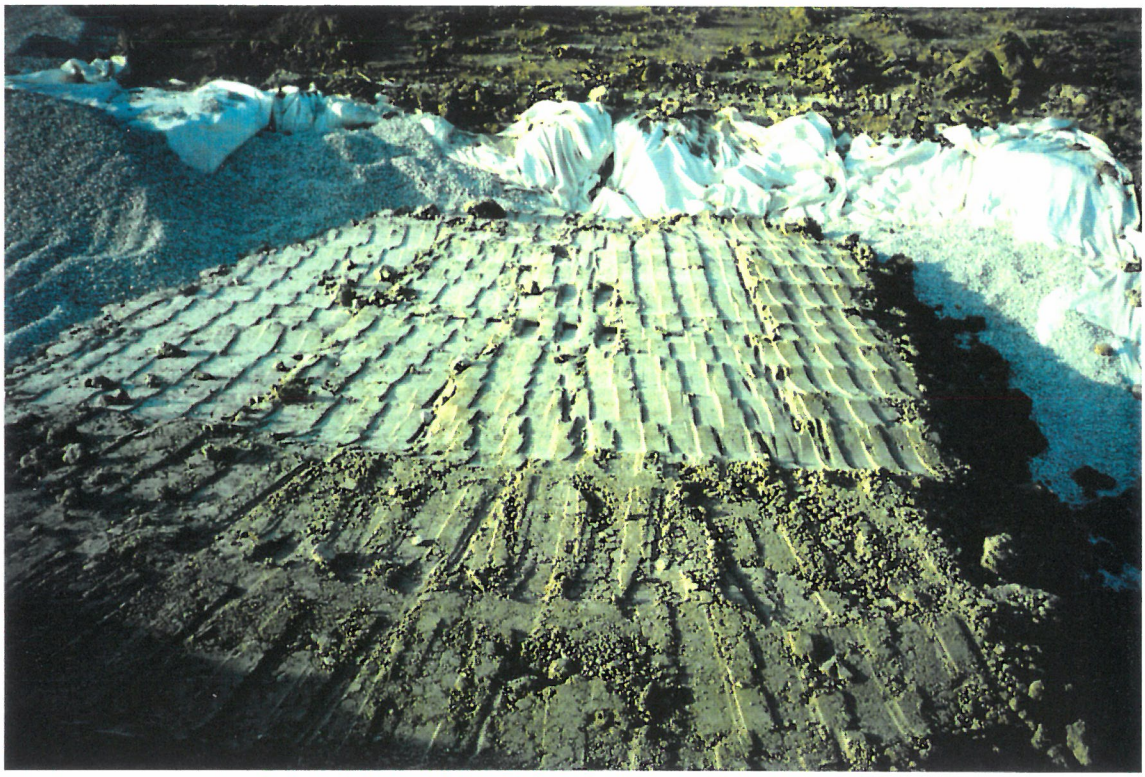
LEACHATE COLLECTOR PIPE FOUNDATION

LEACHATE COLLECTOR PIPE FOUNDATION

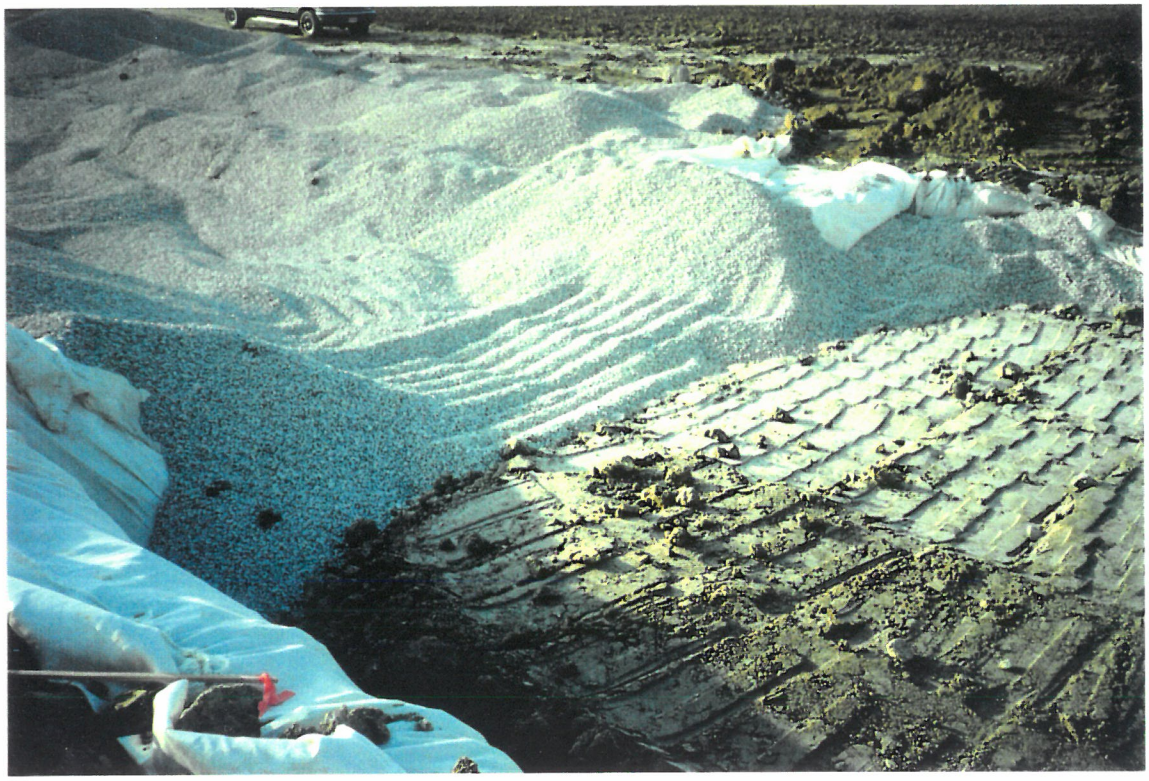


LEACHATE COLLECTION MANHOLE FOUNDATION

LEACHATE COLLECTION MANHOLE FOUNDATION



LEACHATE COLLECTION MANHOLE CLAY LINER



LEACHATE COLLECTION MANHOLE CLAY LINER

CLAY LINER PROGRESSION

CLAY LINER PROGRESSION

SOIL COMPACTOR

CLAY LINER PROGRESSION

CLAY LINER PROGRESSION

CLAY LINER PROGRESSION

CLAY LINER PROGRESSION

CLAY LINER PROGRESSION

CLAY LINER PROGRESSION

SMOOTH DRUM ROLLING PRIOR TO SAND PLACEMENT

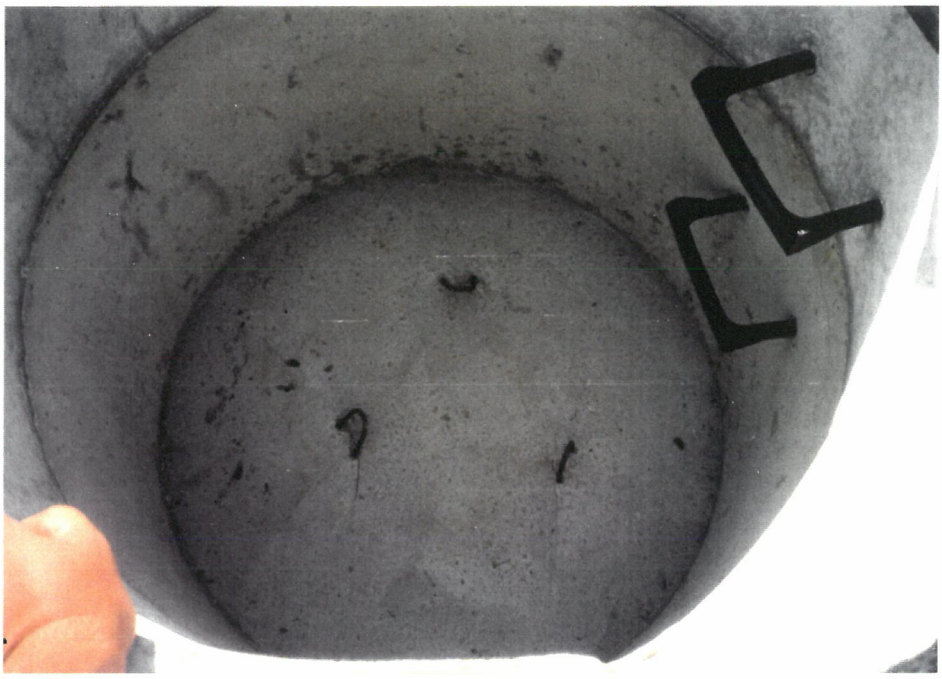
SAND PLACEMENT

SAND PLACEMENT

SAND PLACEMENT

SIDEWALL LINER

LEACHATE COLLECTION MANHOLE



LEACHATE COLLECTION MANHOLE

LEACHATE COLLECTOR PIPE PLACEMENT

LEACHATE COLLECTOR PIPE PLACEMENT

WEST SIDEWALL LINER

WEST SIDEWALL LINER

NORTH SIDEWALL LINER

CELL FLOOR

EAST DRAINAGE DIVERSION BERM

CENTER LINE LEACHATE COLLECTION LINE

FUTURE SDRI TEST LOCATION

FOUNDATION STABILIZATION OUTLET DRAIN

ATTACHMENT 10

Record Drawings

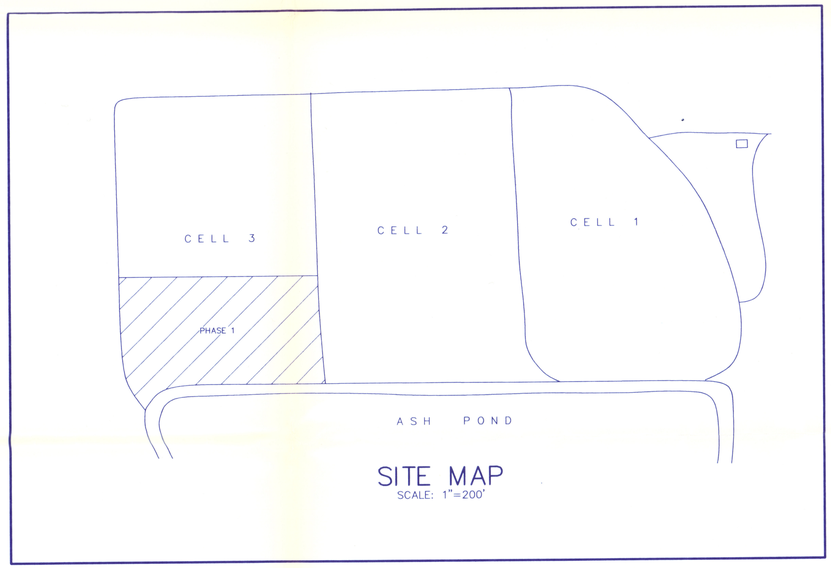
PLANS PREPARED FOR

CITY WATER, LIGHT AND POWER

SPRINGFIELD, ILLINOIS

CELL 3 - PHASE 1
RECORD DRAWINGS

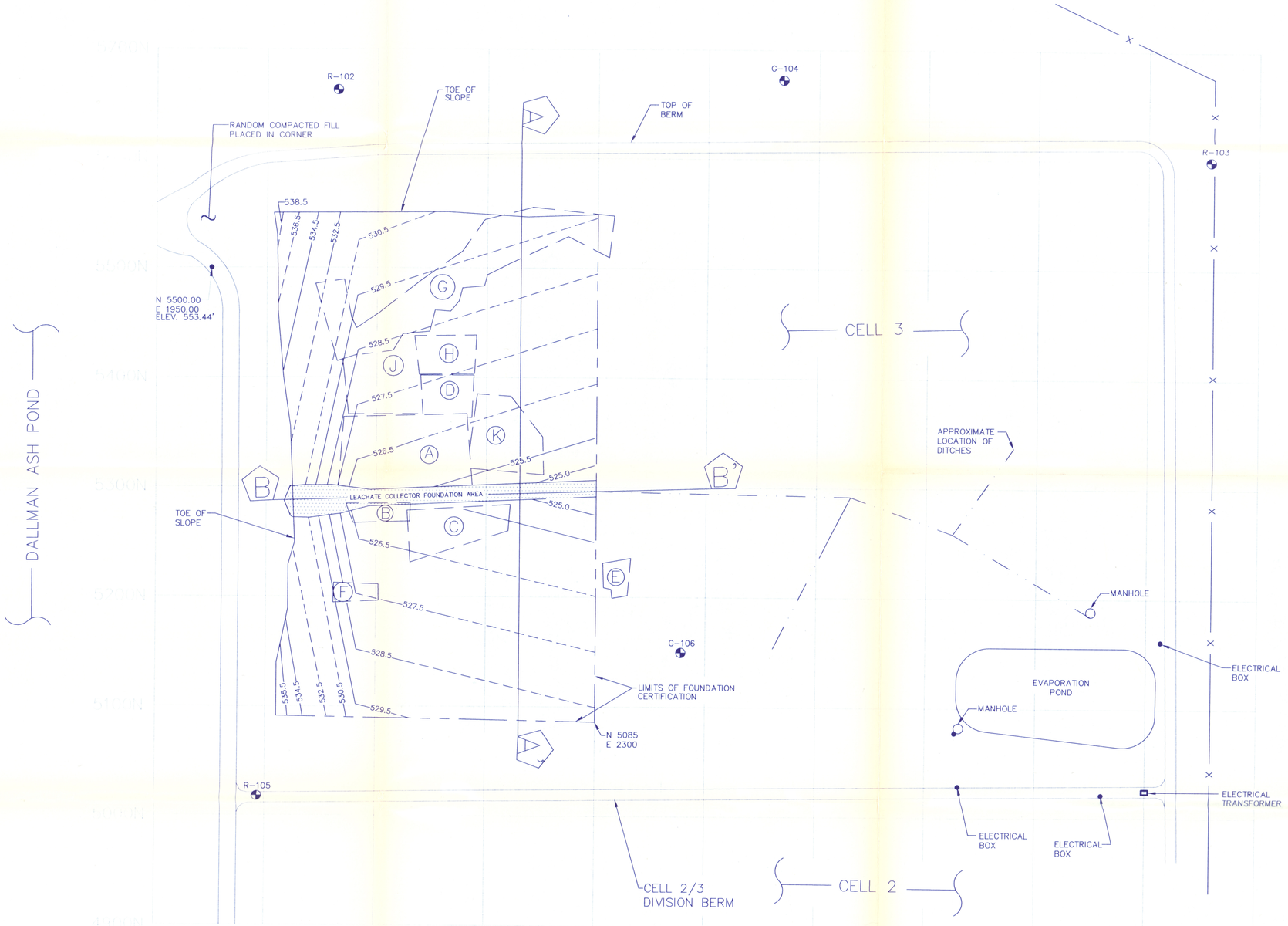
SITE LOCATION



SITE MAP
SCALE: 1"=200'

LIST OF DRAWINGS

D-0	TITLE SHEET
D-1	INVERT CONDITIONS
D-2	FINAL CONDITIONS
D-3	CROSS SECTIONS
D-4	MISCELLANEOUS DETAILS



NOTES:

1. TOPOGRAPHY INFORMATION BASED UPON ELEVATION SHOTS DETERMINED BY VARYING GRID.
2. SOME ANCILLARY FEATURES ARE SHOWN FOR CLARITY, HOWEVER LOCATIONS ARE ESTIMATED.
3. EXCAVATIONS; A, B, C, D, F, H, J, & K WERE FILLED WITH CA-7 STONE. AREAS REMOVED FOR STABILITY RECEIVED GEOTEXTILE STABILIZATION FABRIC PRIOR TO PLACEMENT OF ROCK.
4. FOUNDATION GRADE FOR THE LEACHATE COLLECTOR PIPE AND MANHOLE IS NOT SHOWN ON THIS DRAWING.

FOUNDATION EXCAVATION TABLE

EXCAVATION ID	REASON
A	UNSUITABLE
B	UNSUITABLE
C	UNSUITABLE
D	UNSUITABLE
E	ORGANIC
F	UNSUITABLE
G	ORGANIC
H	UNSUITABLE
J	UNSUITABLE
K	UNSUITABLE

N

APPROXIMATE SCALE (ft.)

0 25 50 100

LEGEND

- MONITORING WELL
- ELECTRICAL BOX
- MANHOLE
- X—X FENCE
- (X) EXCAVATION IDENTIFICATION
- AREAS BELOW GRADE
- AREAS AT GRADE

— TOPOGRAPHY PRIOR TO LINER PLACEMENT

REVISIONS

NO.	DATE	DESCRIPTION	BY

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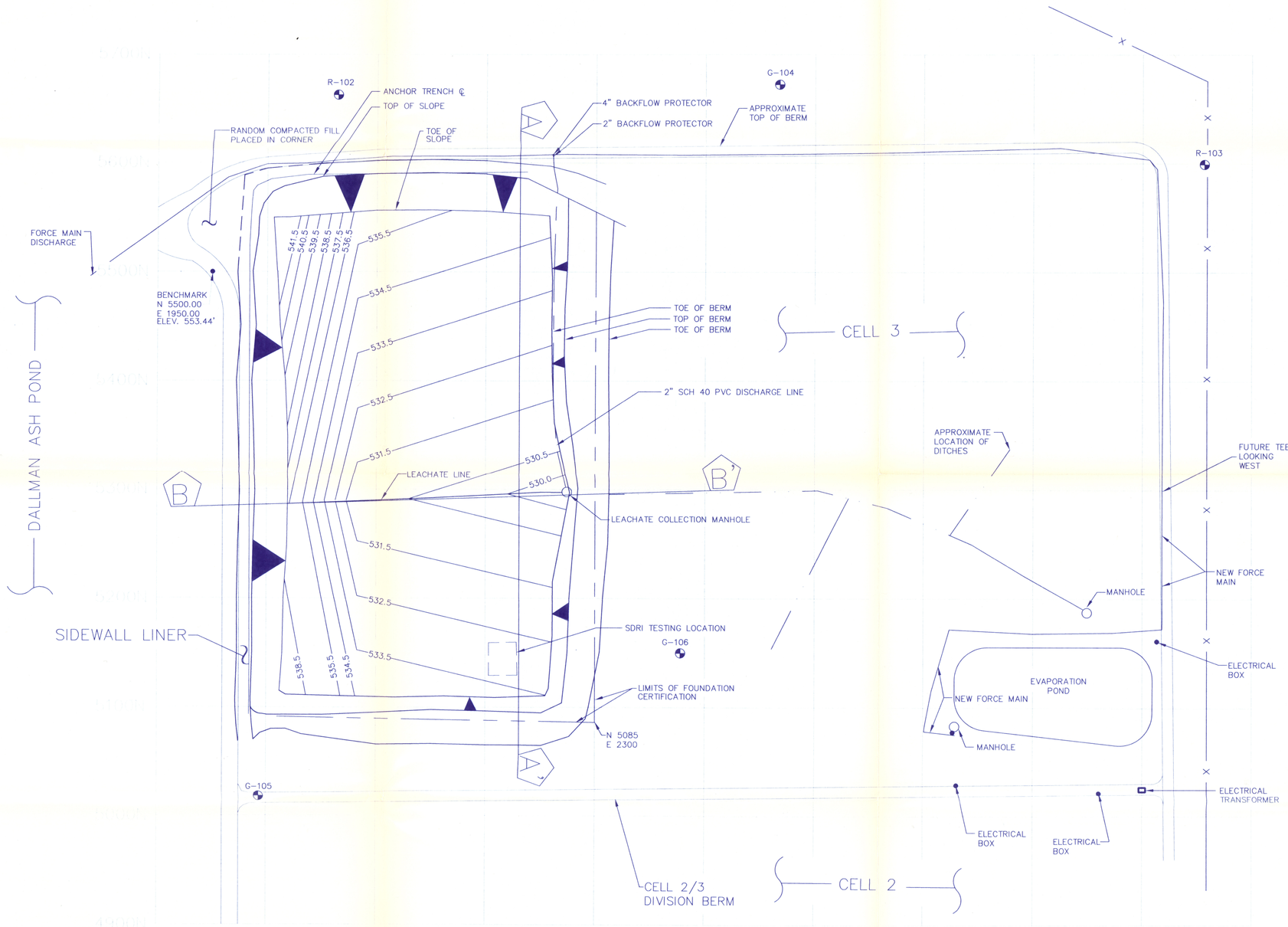
3535 MAYFLOWER BOULEVARD
SPRINGFIELD, ILLINOIS 62707
(217)787-2334 FAX (217)787-9495

PLANS PREPARED FOR
CITY WATER, LIGHT AND POWER
SPRINGFIELD, ILLINOIS

RECORD DRAWINGS FOR CELL 3 - PHASE 1
INVERT CONDITIONS

DRAWN BY: MMcC	DATE: 9-93	SHEET NUMBER
DESIGNED BY: AAR	PROJECT # 93-119	D-1
APPROVED BY: MMcD	FILE #\D\D-1a	



NOTES:

1. TOPOGRAPHY INFORMATION BASED UPON ELEVATION SHOTS DETERMINED BY VARYING GRID.
2. SOME ANCILLARY FEATURES ARE SHOWN FOR CLARITY, HOWEVER LOCATIONS ARE ESTIMATED.
3. THE ELEVATIONS SHOWN REPRESENT THE ELEVATION NEEDED FOR 5' OF RECOMPACTED EARTH LINER AND DOES NOT INCLUDE THE 12" SAND LAYER PLACED ON THE FLOOR.
4. DISCHARGE PIPE TIES INTO FORCE MAIN BY USE OF A WYE CONNECTION. CHECK VALVES ARE LOCATED INSIDE A BELOW GRADE BOX.
5. THE END OF THE ANCHOR TRENCH ON THE NORTH SIDEWALL LINER IS LOCATED AT N 5591.6 E 2237.0. THE END OF THE ANCHOR TRENCH ON THE WEST SIDEWALL LINER IS LOCATED AT N 5118 E 1984.25.

N

APPROXIMATE SCALE (ft.)

0 25 50 100

LEGEND

- MONITORING WELL
- ELECTRICAL BOX
- MANHOLE
- X—X FENCE

REVISIONS			
NO.	DATE	DESCRIPTION	BY

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3535 MAYFLOWER BOULEVARD
SPRINGFIELD, ILLINOIS 62707
(217)787-2334 FAX (217)787-9495

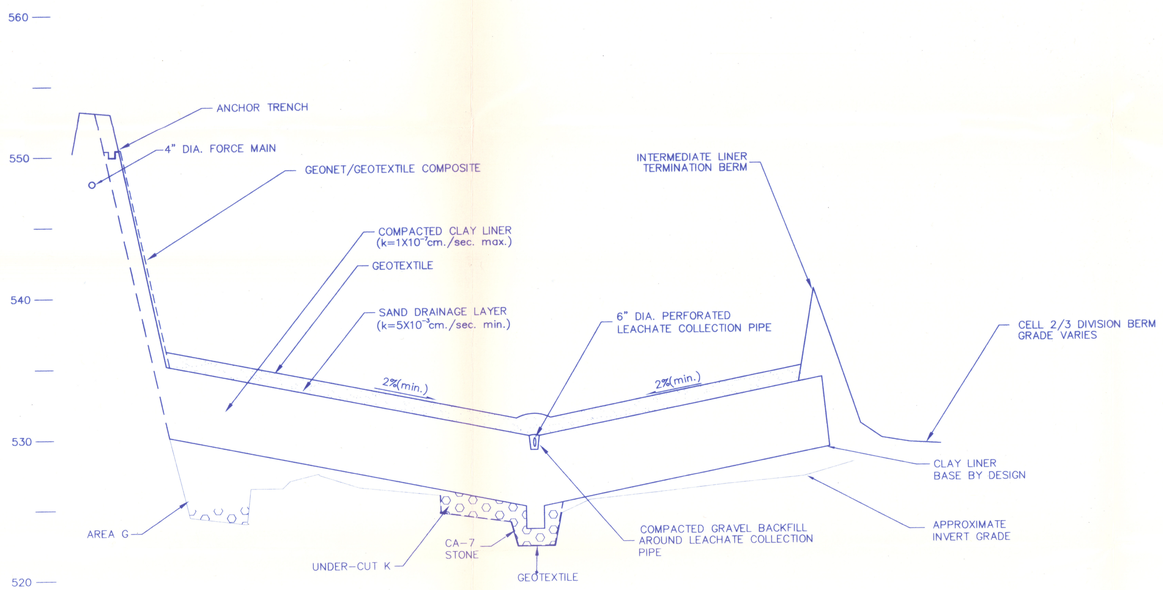
PLANS PREPARED FOR
CITY WATER, LIGHT AND POWER
SPRINGFIELD, ILLINOIS

RECORD DRAWINGS FOR CELL 3 – PHASE 1
FINAL CONDITIONS

DRAWN BY: MMcC	DATE: 9-93	SHEET NUMBER
DESIGNED BY: AAR	PROJECT # 93-119	D-2
APPROVED BY: MMcD	FILE #\D\D-2	

NORTH

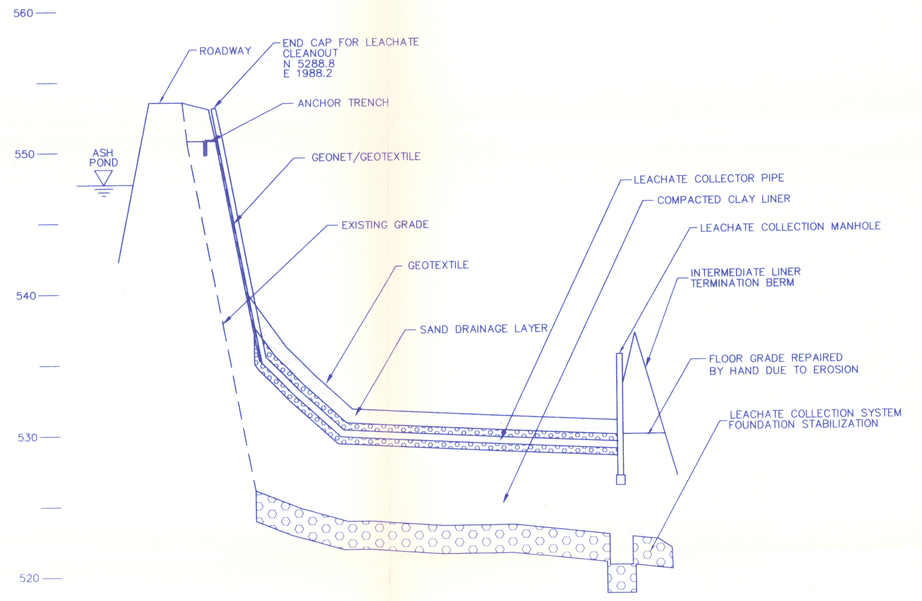
SOUTH



SECTION A–A'
E 2230

WEST

EAST



SECTION B–B'
THROUGH LEACHATE LINE

NOTE:
FOR CLARITY IN DEPICTING THE FEATURES OF THE LANDFILL, SECTIONS A–A' AND B–B' HAVE BEEN DISTORTED BY A FACTOR OF 10 IN THE VERTICAL SCALE. THE TRUE PROFILE OF THE LANDFORM IS 1/10 THE PROFILE SHOWN IN THE VERTICAL DIMENSION.

VERTICAL SCALE:
1"=5'

HORIZONTAL SCALE:
1"=50'

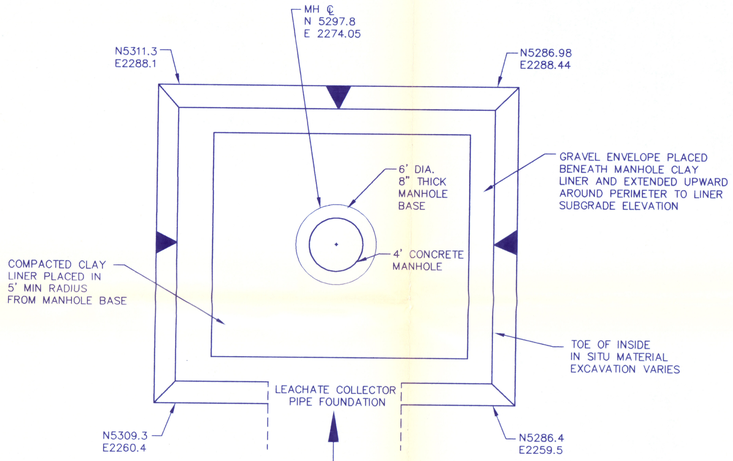
REVISIONS			
NO.	DATE	DESCRIPTION	BY
1.	9-93	EDITING	VJM

ANDREWS ENVIRONMENTAL ENGINEERING INC.
3535 MAYFLOWER BOULEVARD
SPRINGFIELD, ILLINOIS 62707
(217)787-2334 FAX (217)787-9495

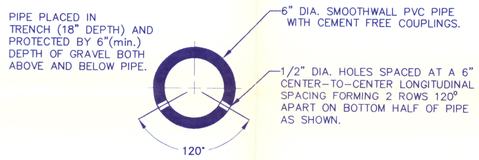
PLANS PREPARED FOR
CITY WATER, LIGHT AND POWER
SPRINGFIELD, ILLINOIS

RECORD DRAWINGS FOR CELL 3 – PHASE 1
CROSS SECTIONS

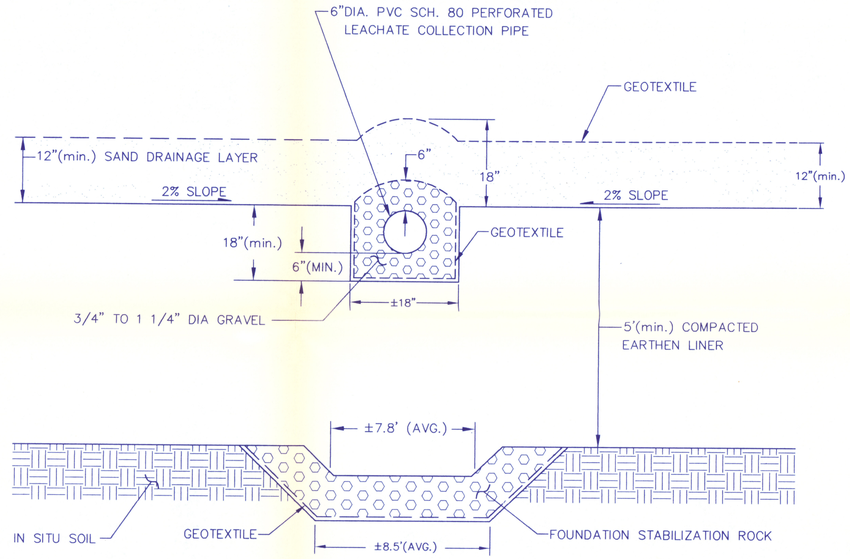
DRAWN BY: MMcC	DATE: 9-93	SHEET NUMBER
DESIGNED BY: AAR	PROJECT #93-119	D-3
APPROVED BY: MMcD	FILE #\D\D-3A	



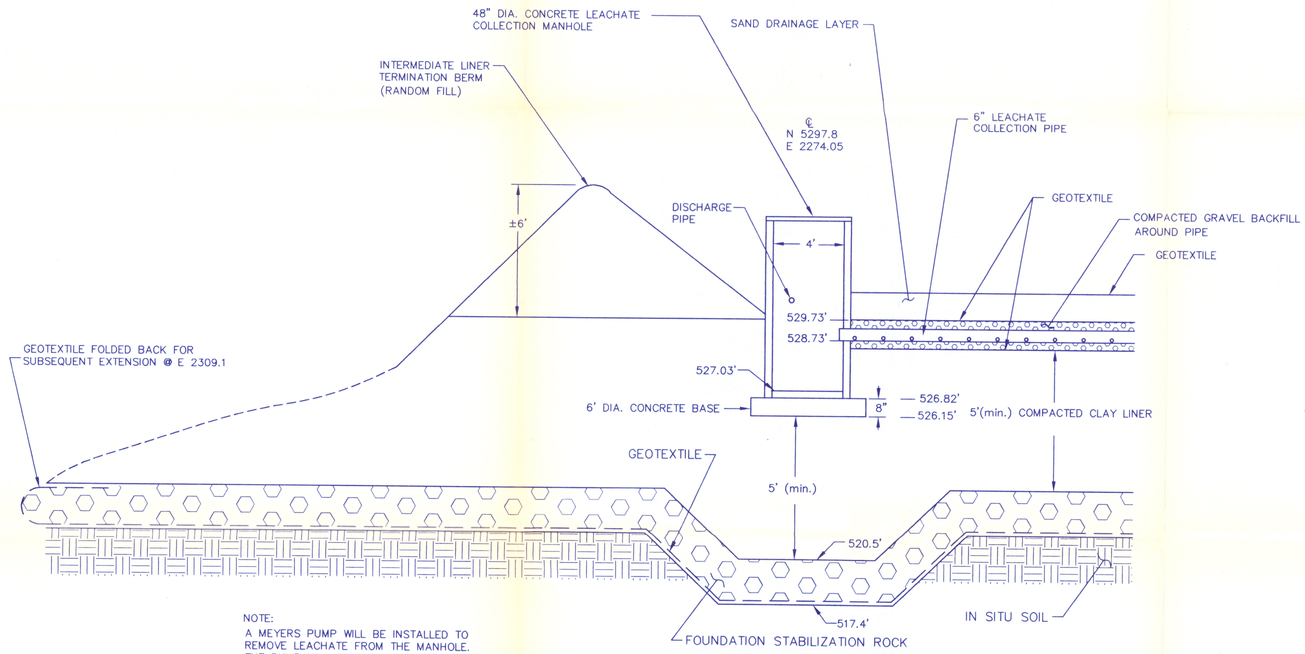
LEACHATE COLLECTION MANHOLE EXCAVATION DETAIL



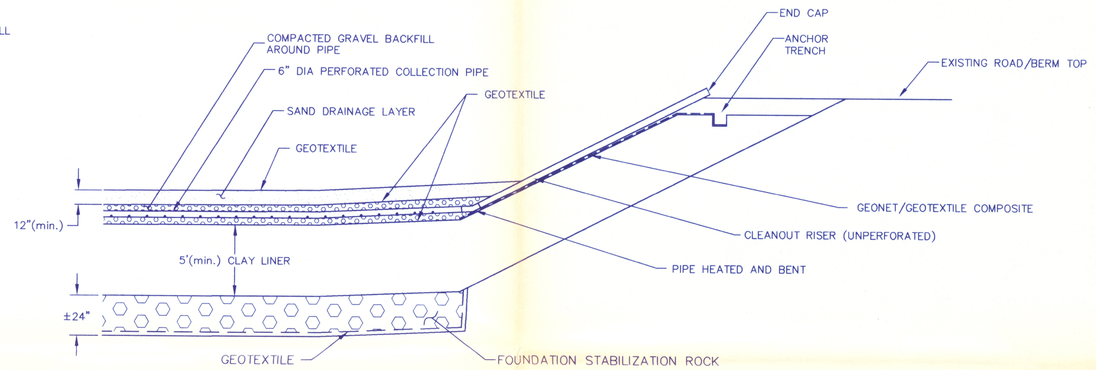
LEACHATE COLLECTION PIPE DETAIL



LEACHATE COLLECTION DETAIL



TEMPORARY LEACHATE COLLECTION MANHOLE/INTERMEDIATE
LINER TERMINATION BERM DETAIL



LEACHATE COLLECTION LINE DETAIL

REVISIONS			
NO.	DATE	DESCRIPTION	BY

ANDREWS ENVIRONMENTAL ENGINEERING INC.
3535 MAYFLOWER BOULEVARD
SPRINGFIELD, ILLINOIS 62707
(217)787-2334 FAX (217)787-9495

RECORD DRAWINGS PREPARED FOR
CITY WATER, LIGHT AND POWER
SPRINGFIELD, ILLINOIS

CELL 3 - PHASE 1
MISCELLANEOUS DETAILS

DRAWN BY: MMcC	DATE: 9-93	SHEET NUMBER
DESIGNED BY: AAR	PROJECT # 93-119	D-4
APPROVED BY: MMcD	FILE #\D\D-4	

ATTACHMENT C:

Construction Quality Assurance Program (Application Log No. 1995-469)

ATTACHMENT 22

CONSTRUCTION QUALITY ASSURANCE PROGRAM

CONSTRUCTION QUALITY ASSURANCE PROGRAM

Introduction

This attachment provides an outline of inspection activities and responsibilities to ensure proper performance of the landfill components. An independent Construction Quality Assurance Officer (CQAO), shall be designated by the Operator to supervise, approve, and be responsible for all inspections, testing, and other activities required in this attachment. In addition, the CQAO will be responsible for providing documentation, record drawings of completed construction and maintain records of the construction sequences throughout the development, operation and closure of the facility. The CQAO shall be an Illinois Registered Professional Engineer. The CQAO may utilize one or more inspectors to assist him with the various inspections and testing to be conducted in the field. Any such inspector shall work under the direct supervision of the CQAO and shall be properly trained and/or experienced as appropriate. Therefore, this Plan should be used as a guide and the CQAO may exercise discretion in the field as necessary from the Plan. Discretions should be noted in the Construction Report, shall not be contrary to regulations or permit conditions, and shall be in accordance with proper engineering principle.

Inspection Activities

A. The CQAO shall be present to provide supervision and assume responsibility for performing all inspections as provided in Table 2 of the following activities:

1. Inspection, compaction and repair of subgrade, and foundation as necessary to design parameters;

2. Installation of the compacted earthen liners;

3. Installation of slurry trenches, or cutoff walls;

4. Installation of the leachate drainage and collection system;

5. Application of final cover;

6. Installation of gas control facilities; and

7. Construction of ponds, ditches and berms.

B. If the CQAO is unable to be present to perform, as required by subsection (A), then the CQAO shall designate a person who shall exercise professional judgement in carrying out the duties of a CQAO as the designated CQAO-in-absentia and a signed statement that the CQAO assumes full personal responsibility for all inspections performed and reports prepared by the designated CQAO-in-absentia during the absence of the CQAO.

Sampling Program

A sampling program shall be implemented as part of the Construction Quality Assurance Program for all construction activities.

The CQAO shall review all specifications and requirements for the manufactured items used in the construction of those components requiring inspection. He shall approve all materials based on satisfaction of their individual specification. Furthermore, he shall ensure that proper installation methods are used.

Table 1 provided herewith summarizes the basic testing requirements, frequencies and specifications for acceptance. Additional testing and sampling may be required at the discretion of the CQAO as in his judgement is necessary to ensure proper materials usage and construction operations. Furthermore, he shall authorize additional sampling or sampling frequencies as necessary to ensure statistical sampling techniques are employed.

Construction Meetings

The CQAO shall hold meetings prior, and during, construction to ensure proper construction techniques, understanding of the specifications and plans, the proper handling of deviations from the plans necessitated by site specific field conditions and to review the appropriate chain-of-command used if unsuitable work is discovered. Meetings shall be held with all Contractors and Owner representatives involved with the project to discuss their individual responsibilities.

Documentation

A. Daily Summary Report

A daily summary report shall be prepared by the CQAO, or under the direct supervision of the CQAO, during each day of activity. The report shall contain, at a minimum:

1. The date;

2. A summary of the weather conditions;

3. A summary of locations where construction is occurring;

4. Changes in equipment and personnel on the project (after completion of an initial listing);

5. A summary of any formal meetings held and attendees held specifically for correction of landfill component deficiencies;

6. A description of all materials used and references or results of testing and documentation;

7. The calibration and recalibration of test equipment; and

8. The daily inspection report from each inspector.

B. Daily Inspection Reports

Each inspector shall complete a daily inspection report containing the following information:

1. The location;

2. The type of inspection;

3. The procedure used;

4. Test data;

5. Acceptable limits for construction testing analysis;

6. In the event of unsuitable materials or construction techniques-documentation regarding corrective action taken and causes for the incongruity;

7. Results of the activity;

8. Personnel involved in the inspection and sampling activities; and

9. The signature of the inspector.

C. Photographic Records

Photographs may be used as tools to document the progress and acceptability of the work and may be incorporated into the daily summary report, daily inspection report, and an acceptance report. Each photo shall be identified with the following information:

1. The date, time, and location of photograph;

2. The name of photographer; and

3. The signature of photographer.

Photographs may be submitted which do not list the above items if they are intended to solely complement the written report of the CQAO.

D. Acceptance Reports

Upon completion of the construction of each major phase, the CQAO shall submit an acceptance report to the Agency and Operator. The acceptance report shall

be submitted before the structure is placed into service and shall contain the following:

1. A certification by the CQAO that the construction has been prepared and constructed in accordance with the engineering design;

2. Record drawings; and

3. All daily summary reports.

Foundation and Subgrade

The CQAO shall inspect the sub-base of the earthen liner and the sidewall slopes. All unsuitable material of high compressibility or which may undergo deterioration shall be removed and replaced with suitable material, and/or other corrective actions taken, as recommended by future site specific geotechnical investigations/reports.

Piezometric surface maps shall be created and reviewed prior to, during and after construction based upon groundwater monitoring points present at the facility. The groundwater elevations should be compared against the subgrade elevation. Based upon subgrade conditions and the difference in elevation the need for additional dewatering devices may become evident.

Prior to stripping the vegetation, the CQAO shall inspect the existing conditions. During his inspection he shall note evidence of sidewall sloughing, wet areas, vegetation changes including type and color, location of trees, etc. After stripping of all vegetation and removal of the soil/vegetation mixture outside of the construction area an inspection of the earthen subgrade should be done. Darker soil conditions on sidewalls and bottom subgrade may indicate the potential for groundwater migration pathways. Furthermore, visual inspection of the subgrade should be made to ascertain the presence of small rivulets of water and/or drainage channels including the formation of small minute deltas of very fine sand and silt at the toe of the slope. As needed these areas should be field located for future corrective action as warranted.

With the exception of the sideslope surface, the entire floor subgrade shall be proof-rolled with a loaded scraper, legally-loaded tandem dump truck or other suitable equipment. Ruts or subgrade depression (pumping) occurring on in situ firm material in excess of approximately 3.5" will require foundation repair. Areas of water seepage will also require repair. When such conditions appear, the unstable soils should be excavated to soils of sufficient stability so that subsequent compaction can be obtained, and the resulting excavation backfilled with essentially horizontal lifts of suitable material spread not more than eight inches thick and compacted to an in-place dry density not less than 90 percent of the maximum laboratory dry density as determined in accordance with ASTM D 698, more commonly known as the standard Proctor density.

Isolated pockets, lenses or layers of soft, compressible nonorganic to organic silts (ML, OL), clayey silts (CL-ML), silty clays (CL), or clays (CL-CH, CH, OH), at or slightly below final subgrade elevations, and which will be detrimental to achieving the required compaction at subgrade, are

expected to be located primarily by proof-rolling. Non-odorous, slightly organic soils are considered acceptable if they meet proof-rolling criteria. The color of non-organic soils generally will be tan to brown; organic-based soils generally are dark grey to black.

Materials to be used for foundation repairs may be any inorganic soil material which is essentially free of vegetation (including roots) and other deleterious material. The moisture content of material used for subgrade repair should be generally adjusted, by either wetting or drying as required, to a value not more than three percent less than the optimum or two percent greater than optimum moisture content (as determined by the above referenced standard) for the soil employed. Alternately, the repair area may be filled with soil material equal to the material to be placed above it. For example, the subgrade beneath the earthen liner may be filled with earthen liner soil allowing the liner to be thicker in this general area. Such repairs will be monitored by an inspector, who will document compliance of the repairs in accordance with this Construction Quality Assurance Program.

In the event that excessive moisture seeps are present or the material underneath the unstable areas is of insufficient stability the bottom liner foundation may be repaired with CA-7 stone, 18-24 inches in depth, placed between a Type A and B geotextile. Repair areas with excessive moisture infiltration shall be graded, sloped and/or connected to provide drainage to the foundation underdrain system. If excessive moisture seeps are detected then the landfill liner subgrade elevation and/or stone thickness may be increased by the CQAO. The foundation underdrain stone shall be compacted as necessary based upon field visual observations.

If excessive moisture seeps are encountered in the sidewall adjacent to the Dallman Ash Pond the interface between the sidewall liner and perimeter may be equipped with a non-woven geotextile or drainage net composite to remove seepage to the foundation underdrain system.

The CQAO shall observe the subgrade for joints, fractures and depressions. All joints, fractures and depressions shall be filled as necessary to prevent deterioration of the component constructed above it. Local and unconsolidated sand pockets shall also be removed.

The use of drying agents shall be limited to the subgrade only as approved by the CQAO. If drying agents are required for liner construction, then a test liner shall be constructed to document the effect of these agents on the soil liner.

The finished subgrade/foundation surface below the landfill liner shall be surveyed on a spacing which shall not exceed 100 feet in any ordinate direction. Surface grades shall be considered acceptable if, when compared to the planned liner grades, will yield the specified minimum 5-foot liner thickness in all locations. The subgrade for the base liner will also essentially be the base for the sidewall liner. The existing perimeter berm will be surveyed after vegetation stripping. The slope of the excavation face shall be calculated and the shallowest slope may again be excavated or the sidewall liner horizontal width calculated assuming a 5' depth perpendicular to the shallowest slope. See Figure 1.

Foundation preparation measures should be monitored full time by the CQA Officer or his designated representative, who should document compliance of the repairs with the Construction Quality Assurance Program. All areas of repair and the methods used for repair shall be

documented and included in the daily summary report. Locations shall be recorded on the record drawings.

Prior to placement of the earthen liner the entire bottom subgrade shall be rolled with a soil compactor to densify and aid in compaction of the initial lifts of the earthen liner. If excessive differential moisture contents exist between the sub-grade and earthen liner soil then correction-disking or wetting should be done.

Test Liner

As previously discussed within this application a portion of the earthen liner of Phase 1 has been selected for a test liner and a Sealed Double-Ring Infiltrometer (SDRI) installed. A formal report on the SDRI is provided in Attachment 21. Please refer to the Phase 1 - Cell 3 Construction Report dated September 13, 1993 for additional details.

Foundation Underdrain System

The dewatering system shall be installed ahead of the excavation of the lower materials and subsequent earthen liner placement. As such it will be installed and its adequacy evaluated prior to initiating full scale construction activities. During actual construction the CQAO will have opportunity to visually inspect the desired performance of the system. The CQAO shall:

1. Prepare record drawings of all sump components and underdrains;

2. Inspect all of the dewatering system components on a routine basis for proper operation;

3. Periodically document piezometric surface levels and record flow volumes;

4. Compare values to the historical values previously established for the system to ascertain the system's continued effectiveness. In addition, the CQAO shall confer with the dewatering system's design engineer on a routine basis; and

5. Inspect the excavation for excessive seepage and sloughing. If unsatisfactory conditions are encountered, then modification to the dewatering system will be necessary. These modifications include but are not limited to increasing the withdrawal rates, installation of additional dewatering points, decreasing the elevation of the water withdrawal points and/or installation of additional dewatering points.

Since the foundation underdrain system may also remove surface water depending upon the phase being constructed, the underdrain system and surface water removal system may be commingled allowing water removal by gasoline or electrical submersible pumps not specified but typically of a higher flow capacity than the foundation underdrain pumps.

The acceptance report shall contain a summary of the dewatering observations made during construction and the effectiveness of the corrective action employed. The acceptance report will also detail the long term requirements of the dewatering system for the newly constructed phase sufficient to balance the groundwater's hydrostatic pressure.

Compacted Earthen Liners

The CQAO shall be present during all phases of the compacted earthen liner construction in accordance with 35 IAC 811 Subpart E. This section shall apply to the floor liner as well as the sidewall liners. During construction of the compacted earthen liner, the CQAO shall ensure the following:

1. Use of the same compaction equipment or equivalent as used in test fill;

2. Use of the same compaction procedures, such as number of passes (minimum) and speed;

3. Uniformity of coverage by compaction equipment;

4. Achievement of soil consistency, water content and the elimination of oversized clods by sufficiently working the soil;

5. Use of appropriate methods to bond successive lifts together;

6. Achievement of liner strength on sidewalls;

7. Placement of protective covering to prevent drying, desiccation and freezing as warranted. As needed, wetting, rework and testing of the affected areas not sufficiently protected;

8. Prevention of the placement of frozen material or the placement of material on frozen ground;

9. Prevention of damage to completed liner sections; and

10. That construction proceeds only during favorable climatic conditions.

The material will be placed in thin lifts (8" loose maximum), worked to ensure proper lift binding and homogeneous moisture and soil consistency and then thoroughly compacted with the same soil compaction equipment or equivalent used for the test liner. Roots, cobbles, debris, and other deleterious material shall be removed from the soil prior to compaction and the soil shall not be used for construction when frozen or placed on frozen ground. The soil compactor to be used shall have fully-penetrating feet (i.e. feet sufficiently long to penetrate the full thickness of the loosely-placed lift and knead it into the previously compacted lift). The moisture content of the materials when placed is specified to be 0 - 6% above optimum. However, based upon actual field conditions and observations, the acceptable moisture range may be adjusted as necessary and/or appropriate as approved by the CQAO. As necessary for moisture addition, pump(s), hose and/or water truck(s) may be used for water conveyance and application. The water to be used for moisture addition may be tap water, well water and/or uncontaminated surface waters.

Each lift is to receive a minimum of four complete passes of the soil compactor prior to placing additional material. However, the number of passes shall be increased as necessary to achieve the specific liner density requirements. The actual lift thicknesses, number of equipment passes and equipment speeds used to meet the liner density requirements shall be recorded. Alternative

compaction equipment, procedures, etc...may be employed as appropriate based upon acceptable results from additional test fills or determinations of equivalency or superiority, as may be allowed by the regulations.

The perimeter berm and sidewall liner shall be constructed essentially the same as the base liner, in thin, approximately horizontal lifts. However, excessive material may be left in place, as necessary, for desiccation control, precipitation events and/or insulating properties to prevent freezing.

All liners shall be protected from freezing and desiccation during and after construction. This may be achieved by applying a random soil layer of sufficient thickness to provide protection. Additional moisture may also be added. Plastic sheeting or other appropriate coverings may also be used in lieu of, or in addition to, the above methods as necessary to protect against desiccation.

If moisture is added to the soil to increase water content, then water shall be uniformly applied to the soil. The soil shall be allowed to absorb the water throughout the particles before being compacted. Double handling may be necessary or water added to the material source prior to excavation.

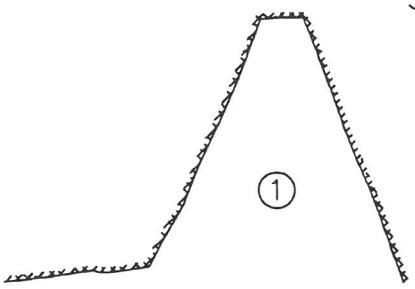
Minimum testing of the liner shall be according to the sampling program schedule presented in Table 1. Test results shall meet the limits shown or the deficiency corrected. All samples selected for testing shall be accompanied by a specific description, the required analysis and the specific location (i.e. Coordinates and Elevation). Samples taken of the compacted earthen liner

resulting in small areas of liner destruction shall be repaired with bentonite and soil as appropriate. Nuclear density testing shall be performed at the shallowest depth possible which provides representative data for density determination. These 1/2" diameter holes should seal when additional compactive energy is applied. Typically, a comparison of the elevations of the top of the liner foundation and the finished liner surface shall be used to verify the thickness of the base liner. Measurement of lateral width will be used to verify perimeter berm and sidewall liner thickness.

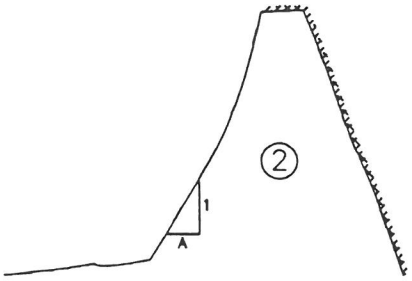
The compacted earthen base liner finished surface shall be surveyed on a spacing which shall not exceed 100 feet in any ordinate direction. The surface grades shall be considered acceptable if the grades when compared to the foundation surface grades yields a base liner thickness equal to or greater than 5 feet and visual observation indicates the top of the liner has been uniformly graded to the proper slope. The compacted earthen sidewall liner thickness shall be measured at a spacing not exceeding 100 feet in the horizontal dimension nor 10 feet in the vertical dimension. A thickness equal to or greater than 5 feet normal to the surface will be considered acceptable. Alternately, the horizontal width of the sidewall liner shall be measured during construction at a frequency of every 3 vertical feet or less. This practice shall be done where benching or excessive traffic disturbs the sidewall liner/perimeter berm excavation interface. Measurement of the horizontal width shall be equal or exceed that required. See Figure 1.

In addition to the laboratory testing, it will be equally important to continually perform visual inspections of the liner and borrow source during construction. The inspections should ensure:

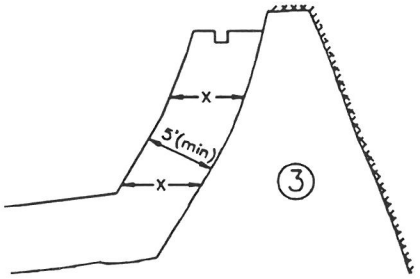
PROCEDURE FOR ENSURING 5' (min.) SIDEWALL THICKNESS



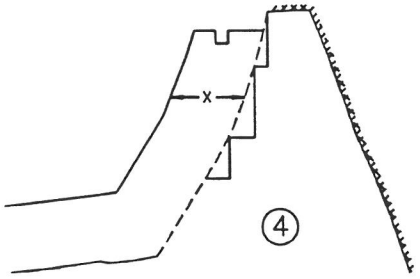
CONDITIONS BEFORE VEGETATIVE STRIPPING



CONDITIONS AFTER VEGETATIVE STRIPPING



CONDITIONS AFTER VEGETATIVE STRIPPING WITH SIDEWALL LINER IN PLACE



ALTERNATIVE SIDEWALL CONSTRUCTION DETAIL

1.) STRIP VEGETATION FROM EXISTING SIDEWALL BERMS.

2.) SURVEY SIDEWALL AND DETERMINE THE SHALLOWEST SLOPE, A:1.

3.) CALCULATE MINIMUM THICKNESS OF CLAY, X, REQUIRED TO ENSURE 5' (min.) PERPENDICULAR TO SIDEWALL AT THE SHALLOWEST SLOPE:

$$X = \frac{5'}{\sin(\tan^{-1}(1/A))}$$

THIS HORIZONTAL DISTANCE, X, ENSURES THAT THERE IS A MINIMUM 5' CLAY THICKNESS IN PLACE AT ALL POINTS ON THE SIDEWALL.

4.) WHERE BENCHING OR TRAFFIC DISTURBS THE PERIMETER BERM FACE, THE HORIZONTAL DISTANCE SHALL BE MEASURED AND THE MINIMUM HORIZONTAL DISTANCE X MAINTAINED. DUE TO THE 2:1 SLOPES, FINISHED GRADING OF THE INTERIOR SIDEWALL LINER WOULD BE DIFFICULT AND TRIMMING MAY POTENTIALLY DISTURB THE CLAY LINER MATRIX. THEREFORE, THIS IS THE PREFERRED METHOD FOR DOCUMENTING SIDEWALL LINER THICKNESS.

NOTE: THE SURFACE OF THE SIDEWALL LINER SHALL BE BACKDRAGGED WITH A DOZER FROM TOP TO BOTTOM PRIOR TO PLACEMENT OF THE DRAINAGE LAYER.

FIGURE 1

1. The thickness of each lift - 8 inch maximum loose;

2. The adequacy of the binding between lifts;

3. That compaction is occurring uniformally across the lift;

4. That the finished grade conforms to the permitted grades and lines unless otherwise modified by the CQAO and shown on the record drawings;

5. That all inappropriate materials such as cobbles $\geq$3" in diameter, sand, silt, organic material, roots $\geq$ 2" in diameter, frozen soil or large clods $\geq$3" in diameter are removed prior to compaction; and

6. That the earthen material is homogeneous in nature and representative of the material selected for Proctor testing and similar to the material used for the test liner.

If the inspection reveals a deficiency, then the Contractor/Operator shall be promptly notified and the corrective action taken. In addition, the deficiency location and corrective action taken shall be noted on the construction report. If additional testing is warranted in the area of nonconformity then it shall be completed and/or the suspect soil recompacted, or removed and replaced as appropriate to acceptable limits.

All liner placement activities shall be conducted to promote drainage to the extent possible. Protection of the compacted earth liner from erosion due to runon and runoff shall be maintained at all times, as practicable.

Leachate Drainage and Collection System

The leachate drainage and collection system consists of sand drainage layer, geotextiles, gravel envelope, collector pipe, collection manhole, and necessary appurtenances. All materials to be used shall be approved by the CQAO, prior to installation.

Sand Drainage Layer

Sand drainage layers shall be provided for the leachate drainage system. The source of the sand drainage layer shall be sampled under the supervision of the CQAO before use for the parameters listed in Table 1. Additional sampling shall be done as the material is received, ensuring continued satisfaction of the specifications.

The sand drainage layer shall be placed (not dropped) using a low ground pressure crawler endloader or dozer. A uniform 12 inches (minimum) thickness of sand shall be placed for the leachate collection layer. An appropriate setback shall be maintained from the area of the leachate collectors and manholes until these structures have been constructed. Operation of equipment on the sand drainage layer shall be kept to a minimum.

A comparison of elevations of the finished compacted earthen top liner surface and top of sand shall be used to verify the thickness of the drainage layer. Alternately the sand may be probed or hand excavated in limited areas and measured for depth. The thickness shall be 12 inches (minimum) normal to the liner surface. Care should be taken to avoid contamination of the sand with soil during stockpiling operations.

Geonet/Geotextile Composite

The geonet shall be made of polyethylene materials and a geotextile (filter fabric) adhered to each of its sides to facilitate improved slope stability and separation from overlying materials. The installer or manufacturer shall provide assurance that the geonet/geotextile composite is compatible with the leachate expected to be generated. Furthermore, that it is believed to have sufficient strength and durability to function at the site for the design period under the maximum expected loadings imposed by the waste, equipment, and stresses imposed by settlement, temperature, construction and operation. Alternatively, the CQAO may perform and/or subcontract performance of tests, calculations, etc... as necessary to realize such assurances independent of the installer/manufacturer. Testing and installation shall be in accordance with standard practice and the recommendations of the manufacturer as approved by the CQAO.

Leachate Collector

The leachate collector trench shall be cleaned of sand prior to laying the base layer of gravel. The gravel shall be a washed, weathered stone free of fines. The individual pieces of gravel shall be no smaller than the perforation hole size in the collector piping

and at least 85% of the gravel shall be greater than the hole size based on sieve analysis. The 4" minimum base layer shall be placed (not dropped) upon the appropriate geotextile. The elevations of the gravel shall be checked as necessary to ensure the minimum thickness, absence of high or low areas and proper grade. Adjustments shall be made as warranted. The gravel shall then be thoroughly compacted by vibratory plate.

The leachate collector pipe shall be placed with the perforations in the appropriate position and additional gravel placed to the springline and compacted. Additional gravel shall be placed and compacted to the top of the pipe and above the pipe to the final depth shown on the plans. The gravel shall be compacted with a hand operated compactor i.e. jumping jack vibrator or tamper as necessary to ensure no damage will occur to the underlying geotextile or piping. The ends of the geotextile shall be brought over the gravel mound and additional gravel or sand placed to hold it in place.

The structural integrity of the collector pipe requires the use of a narrow trench and gravel backfill for strength. The gravel backfill must be compacted thoroughly to minimize future settlement. Enough passes of the vibrating compacting equipment across the gravel shall be done so that the finished density of the gravel is as high as possible without incurring damage to the pipe. A visual inspection shall be performed with each increment of compactive effort until no settlement of material is observed.

The collector pipe will be 6 inch nominal diameter, SDR 21 (minimum), high density smoothed-walled polyethylene (HDPE) containing no fillers or extenders. Carbon black 1.5 - 3.0 percent shall be added to the resin. The pipe manufacturer shall provide

assurance the pipe material is chemically resistant to the leachate from general refuse. Manufacture of the collector pipe shall be done so as to be free from blisters, undispersed raw materials or any sign of contamination by foreign matter. Holes shall be generally drilled into the collector pipe on the lower 120° with 6" center to center longitudinal spacing. Drilling burrs shall be removed to prevent pump plugging. The holes shall be one half inch in diameter. Each linear foot of piping will contain .005 square feet of opening.

The leachate collector pipe shall be installed so as to minimize joints, couplers and abrupt changes in the interior flow area of the pipe. The collector pipe shall be joined using a butt-fusing welder in accordance with the pipe manufacturer's approved installation methods consistent with ASTM D 2657. Each pipe joint shall be free from burrs, irregular edges and foreign impurities. The CQAO shall inspect all joints for uniformity.

Leachate Collection Manhole

Each of the leachate collection manholes shall be placed as shown on the facility plans. The manholes will be constructed of 48" dia (min) HPDE pipe with an 8" minimum concrete reinforced base. The specific requirements for concrete strength, rebar diameter, rebar spacing, and base thickness will be designed by a registered Illinois Professional or Structural Engineer prior to installation. The manhole concrete base shall be sealed with a coating to minimize potential sulfate erosion. A compacted clay with bentonite and/or concrete backfill will be placed around the manhole base to provide stability, seal the base, and achieve finished liner grades. Record drawings of the manhole shall be made and included in the acceptance report.

The leachate collector pipe shall be joined with the manhole after expansion or contraction of the pipe has reached equilibrium, or a slip or expansion joint used at the pipe's intersection with the manhole as appropriate and as approved by the CQAO. The depth of the completed manhole shall be measured to ensure proper pump reinstallation when necessary. The remaining gravel, sand drainage layer and geotextile shall be placed after the cleanout access and manhole have been extended above their levels. The manhole shall be completed with an appropriate cover.

Geotextiles

The geotextiles specified for use at the facility shall be evaluated by the CQAO for apparent opening size and puncture resistance based on the specific materials chosen for the sand drainage layer and gravel backfill. The CQAO shall also take appropriate precautions ensuring that the geotextiles are kept covered to prevent sunlight degradation. All geotextile seams shall be inspected assuring that seaming or fusing is done properly and no areas are omitted. As approved by the CQAO and if consistent with the manufacturer's recommendations, seaming may not be required if the geotextile is sufficiently/appropriately overlapped and secured-down to preclude dislocation and the intrusion of fines. Geotextiles used in geonet composites shall be subject to the same requirements.

Alternately deployment of the geotextile may post-poned if ultraviolet degradation is found to be a problem during the review of the Acceptance Report (90 days). If this option is utilized the permit reviewer and Field Office will be contacted and deployment made prior to the field inspection and issuance of the Acceptance Report approval.

Leachate Management System

The leachate management system consists of pumps, piping and necessary appurtenances. All materials to be used shall be approved by the CQAO, prior to installation. All materials shall be installed in accordance with the manufacturer's recommendations. The CQAO shall verify that the equipment and its installation is consistent with the permitted plans and specifications.

Pumps

By observation/measurement in the field and review of the manufacturer's literature the CQAO shall verify pump capacity, corrosion resistance, its explosion-proof or instrisically safe design, and proper level-actuated on/off switch position. Pump capacities shall be at least the minimum specified with zero tolerance for insufficient capacity. Zero tolerance will also apply to materials of construction which are not corrosion resistant and designs which are not explosion-proof or intrinsically safe. The pump "on" level-actuated switch in leachate collection manholes shall be $\pm$ 0.1 feet of the lowest inlet leachate collection piping invert.

Piping

By field observation/measurement and review of the manufacturer's literature, the CQAO shall verify the piping diameters, materials of construction, the tightness of joints without leaks and the piping system's freeze protection. No tolerance from the specifications are anticipated, however any modifications must be approved by the CQAO.

Surface Water Control

The CQAO shall inspect the ditches, culverts, and sediment control devices to ensure proper construction of these structures as indicated by the facility drawings. Deviations from the plans shall be noted on the record drawings with the appropriate calculations showing that the hydraulic carrying capacity remains sufficient. All ditches shall be completed with the appropriate erosion control coverings as soon as practicable. Repairs as warranted should be done prior to applying the coverings.

Roadways

The CQAO shall inspect the location of the roadways in relation to the transportation plan. His primary responsibility shall be to ensure proper grading of the roadway surfaces enabling runoff water to enter the stormwater runoff collection ditching as appropriate.

Final Cover

The CQAO shall oversee placement of the final cover system. The existing daily or intermediate cover should be surveyed for elevation prior to placement of additional compacted cover. Credit may be given for existing in-place soil if sufficient verification of its thickness is done and the material is suitable for final cover material. A total thickness of 36" of compacted low permeability cover shall be achieved. This final cover shall be constructed using borrow soil from adjacent CWLP property, placed in thin lifts (8" loose maximum) and compacted with a soil compactor or other suitable equipment to produce a homogeneous mass. The hydraulic conductivity shall be

equal to or less than $K=1x10^{-6}$ cm/sec. The final surface of compacted cover shall be surveyed to ensure the minimum thickness of 36". Testing requirements are contained in Table 1.

Soils used for final cover compacted clay shall be Unified Soils Classification System types ML, CL or CH. It should be noted, this includes all soils within the ML-CL-CH classification range.

Adjustments to the surface contours shall be done as necessary to provide drainage and conformity to the lines and grades shown on the facility plans. These adjustments may be made with additional soil or adjusting the underlying waste.

Protective Layer

The upper surface of the compacted cover shall be dimpled with a soil compactor or some other appropriate means used, as approved by the CQAO, to achieve binding with the overlying protective final cover layer. The protective layer shall also consist of a minimum 36" thickness of soil. The lower 24" of soil should be slightly compacted as necessary to hold the soil in place and resist erosion. The remaining 12" should not be compacted and should be the best on-site readily available soil for supporting vegetation. The thickness of the protective layer should be documented by comparing the finished elevation of the compacted clay with the final surface. If excessive compacted clay was placed, the excess may be considered to be a portion of the protective layer. The minimum thickness of protective soil shall be placed as soon as possible after placement of the low permeability layer.

Loams of the USDA soils classification system or Unified Soils Classification System types GM, GC, SM, SC, ML, and CL are all considered suitable protective soils. The protective (vegetative) soil layer may include soils from on-site and/or off-site sources and compost. Other products which may be considered waste besides compost (such as sewage treatment sludge) may be used as a soil's amendment if all necessary permits/authorization are secured.

The finished surface of the final cover shall be surveyed on a spacing which shall not exceed 100 feet in any ordinate direction. There shall be zero tolerance for deviation below the minimum layer thickness. This survey and acceptance criteria shall apply to both the low-permeability and protective soil layers of the final cover system, with allowance for the minimum 3-foot difference between their surfaces.

Vegetative Cover

Finalized areas shall be prepared and seeded as soon as practicable to prevent deterioration. Composite soil sample testing should be done to determine the amount of lime and/or fertilizer needed. Seed will typically be incorporated into the upper surface of the protective soil layer using a disk, harrow, or by using hydroseeding techniques. The seed mixture selected must be amenable to the soil quality/thickness, slopes and moisture/climatological conditions that exist without the need for continued maintenance and with minimal potential for root penetration into the compacted final cover. It shall also be consistent with the "open space" post closure land use. Fertilizer, lime and mulch should be used at rates necessary to establish proper growth of the seed.

Landscaping or seeding professionals knowledgeable of Sangamon County's climatological conditions may be consulted in determining necessary soil amendments and application rates based upon specific seasonal conditions at the time of closure. As a guide, the design procedures and specifications presented in the handbook "Procedures and Standards for Urban Soil Erosion and Sediment Control in Illinois" may be utilized. Mulch consisting of straw, jute, wood excelsior, etc... shall be used as necessary to hold the seed in place and conserve moisture. The CQAO should record the amount of amendments, seed and the appropriate boundaries of the completed final cover areas on the record drawings.

For additional information concerning the final cover and vegetative cover (to be addressed in the following section) see the accompanying Construction Plan and Closure Plan for this unit.

Slurry Trenches or Cutoff Walls

At this time, no slurry trenches or cutoff walls are proposed or anticipated for installation. Should such type barriers be proposed in the future, details regarding construction and quality assurance for these items will be provided in a future permit application.

Tolerances

The values listed herein referring to numerical dimensions shall be taken to mean the minimum values. Acceptable standards for isolated occurrences shall be the significant digit less 1/10 corrected for decimal place. Thus, for example the minimum values for slope, liner thickness and final cover thickness would be .49% (.5%), 4.9' (5') and 2.9' (3') with the typical value also shown

in parenthesis. This small incongruity will not affect component performance and is in the range of acceptable survey tolerances for the items in question.

Testing tolerances of numerical proportion shall be governed by standard significant digit discussion and rounding as warranted.

Exceptions

The CQAO shall have the authority to modify the design shown on the plans based upon unexpected conditions encountered in the field. Small changes or modifications are historically required on any construction job of this size. Accordingly, the changes or modifications should be incorporated into the Acceptance Report and/or record drawings. Calculations, supporting discussion, etc. shall also be included to authenticate the adequacy of the changes in relation to the original design.

- TABLE 1 -

.em	Testing Parameters	Min.Testing Frequency	Specification
Structural Fill (Soil Only)	Nuclear Density (ASTM D 2922)	1,000 yds^3	$\geq$ 90% Standard Proctor
	Moisture Content (ASTM D 3017)	1,000 yds^3	-3 to +2 of opt.
	Atterberg Limits (ASTM D 4318)	10,000 yds^3	LL $\leq$ 60% PI > 8
	Proctor Density (ASTM D 698)	10,000 yds^3	Max. Dry. Density $\geq$ 100 psf
	Unconfined Strength (Penetrometer)	2,500 ft^2	$\geq$ 2 $tons/ft^2$ (Final Surface)
Compacted Earth Liners	Nuclear Density (ASTM D 2922)	1,000 yds^3	$\geq$ 95% Standard Proctor
	Moisture Content (ASTM D 3017)	1,000 yds^3	0-6% above opt.
	Atterberg Limits (ASTM D 4318) ****	10,000 yds^3	LL - 35-50 PI - 18-30
	Grain Size Distribution (ASTM D 422) ****	10,000 yds^3	80% < 200 Sieve
	Proctor Density (ASTM D 698)	10,000 yds^3	***
	Triaxial Laboratory Permeability (thin walled sample)	10,000 yds^3	$K \leq 8x10^{-9}$ cm/sec
	Thickness	100' grid	$\geq$ 5' normal to surface
Granular Drainage Blanket	Sieve Analysis (ASTM C 136)	1,000 yds^3	*
	Hydraulic Conductivity (rigid wall)	8,000 yds^3	$K \geq 6.5 \times 10^{-3}$ cm/sec
	Thickness (Drainage Blanket)	100' grid to surface	$\geq$ 12" normal
Gravel Envelope	Visual Density	continuous	maximum practical

- TABLE 1 -

Continued

Item	Testing Parameters	Min.Testing Frequency	Specification
HDPE Pipe	Visual Inspection of sliced joint (ASTM D 2657)	250 linear feet	no voids in bonding
	Dimensions (ASTM D 2122)	end sections of pipe and fittings	SDR -21 & 6" min.
	Physical Properties	each lot	equal to manufacturer's data
Compacted Final Cover	Same as for Compacted Earthen Liners except where listed below		
	Triaxial Laboratory Permeability (thin walled sample)	10,000 yd^3	$\leq 1 \times 10^{-8}$ cm/sec
	Nuclear Density (ASTM D 2922)	1,000 yd^3	$\geq$ 90% Std. Proc.
	Thickness**	100' grid	$\geq$ 36" normal to surface
Protective Layer	Thickness**	100' grid	$\geq$ 36" normal to surface

NOTES:

* Representative samples shall undergo sieve analysis. The resulting material shall then be analyzed for hydraulic conductivity when compacted to 95% Standard Proctor where appropriate or to the maximum density achievable in the laboratory. Periodic sieve analysis shall be done to confirm that the material quality remains consistent with previous testing.

** Thickness of final cover may be tested by advancing probe holes or topographic survey before and after placement. The thickness of the protective layer may be less than 36 inches if the total final cover thickness is equal to or greater than 6 feet.

*** Proctor Density testing for Compacted Earth Liners and Compacted Final Cover shall be performed to facilitate compliance verification of the specified minimum nuclear density percentages (i.e., 95% and 90% Standard Proctor, respectively). A particular specification value for the Proctor Density test results is not intended.

**** If soil properties vary to a lesser quality soil than used in test liner, then a new test liner will require construction.

Additional testing shall be done with all changes in materials. Frequency are intended to be based upon the average volume of material used in construction of each new area.

- TABLE 2 -

INSPECTION LEVEL

The CQAO shall be an independent licensed professional engineer. The CQAO shall inspect the construction on at least a weekly basis unless stated differently below. However, if should be noted that occasional schedule conflicts, partial work weeks, inclement weather, etc. may occasionally interfere with this schedule.

Activity	Inspection Frequency/Responsibilities CQAO	CQAO-in-absentia
Existing Conditions Inspection	Prior to Initiation of Work	As Necessary
Excavation	As Necessary	As Necessary
Slurry Trenches/Cut Off Walls	N/A	N/A
Subgrade Inspection		
Achievement of Elevation	Check Data	Collect Data
Visual Inspection	Complete Majority	As Needed
Proof Rolling	Weekly	Full-Time
Subgrade Repair	Weekly	Full-Time
Compacted Earthen Liners	Weekly	Full-Time
Geomembrane	N/A	N/A
Leachate Collection System		
Manhole and Collector	Initiation of Work and Weekly Thereafter	Full-Time
Forcemain(s)	As Necessary	As Necessary
Granular Drainage Layer	As Necessary	As Necessary
Geotextiles	As Necessary	As Necessary
Geotextile/Drainage Net Composite	Weekly	Full-Time
Pump and Controllers	Completion of Job	As Needed

Activity	Inspection Frequency/Responsibilities CQAO	CQAO-in-absentia
Foundation Drainage System	Weekly	Full-Time
Final Cover		
Low Permeability Layer	Weekly	Full-Time
Protective Layer	As Necessary	As Necessary
Final Grading	Inspect prior to Completion	Inspect prior to Completion As Necessary
Vegetation	As Necessary	As Necessary
Drainage		
Structures	Weekly	Full-Time
Ditches	As Necessary	Initiation of Work
Final Grading	Inspect prior to Completion	As Necessary
Gas Control Facilities		
Structures	Weekly	Full-Time
Miscellaneous	As Necessary	As Necessary

ATTACHMENT D:

Test Liner Report (Application Log No. 1995-469)

ATTACHMENT 21
TEST LINER REPORT

INTRODUCTION

To comply with 35 Illinois Administrative Code (IAC) 811.507(a), a portion of Phase 1 of Unit 2's recompacted earthen liner was designated to be tested with a Sealed Double Ring Infiltrometer (SDRI). The Construction Report for Phase 1 was submitted to the Agency in September 1993.

TEST LINER CONSTRUCTION

A density versus number of pass study was completed and the minimum number of passes used on the earthen liner was four (4). Additional passes were performed as required for densification, scarification, etc. as typically performed on liner construction. The soil was obtained from the borrow pit north of the landfill as discussed elsewhere in this Application. The three acre size of the earthen liner constructed in Phase 1 allowed the minimum size and the soil quality requirements for test liners to be fulfilled.

Thin lifts of soil were placed to the approximate height of the penetrating pad length on the sheepsfoot. Lifts were spread with a dozer or with the blade of the soil compactor. Drying and wetting of the soil was done on a limited basis as necessary to obtain compaction to $\geq$95 percent of Standard Proctor Density with a moisture content at or above the optimum moisture.

Soil compactor speed was generally 200 feet/minute with the machine operated in second gear. The soil compactor had an approximate weight of 44,174 pounds without operator. As such, acceptable equipment for future liner construction will be governed by the down pressure calculated as:

Equipment Weight ÷ Number of Pads Per Row ÷ Number of Wheels ÷ Pad Area

44,174 lbs. ÷ 2 Rows ÷ 4 Wheels ÷ (6" x 3") = 306.8 lbs/in^2 of Pad Area

During construction of the liner, samples were collected and laboratory tests were performed for:

Standard Proctor
Optimum Moisture
Atterberg Limit
Grain Size
Permeability

Nuclear Density Testing was performed typically on each lift. In the interest of minimization of this Application's size, we have elected not to repeat the Nuclear Density Test Results or Daily Monitoring Reports herein. These reports were previously provided to the Agency in the Phase 1 Construction Report. The soil testing results of the Phase 1 earthen liner are provided in Appendix G.

On October 31, 1993, installation of a Sealed Double Ring Infiltrometer (SDRI) was completed to determine the field permeability of the earthen liner. Measurements were taken from the SDRI for a period of approximately three (3) months.

The amount of water infiltrating through the inner ring continued to decline with time and as such the permeability is believed to be lower than the last result of 8.40×10^{-9} cm/sec. After the SDRI was disassembled, six (6) additional shelby tube samples were collected and analyzed from the area of the inner ring. These results are provided in Appendix I. Two (2) additional shelby tube samples were collected from the inner ring area and were analyzed for moisture content and unconfined strength with a pocket penetrometer. These results are provided in Appendix J.

The laboratory testing of the permeability samples from the inner ring was controlled to select samples from the upper portion of the tube ($\leq$6") in the area of the theoretical wetting front. Cell pressures were minimized to simulate the effective pressure of the water level in the SDRI and the percent saturation of the samples was evaluated. The analysis indicated that we were testing samples generally saturated.

The samples collected for moisture content evaluation were extruded and dissected in thin wavers (1" - 2" lengths) shortly after collection. The wavers were then tested on three sides and their top with a pocket penetrometer to establish a trend regarding the unconfined strength which is dependent upon moisture content. The moisture contents and bearing capacity results were then correlated to predict the depth of the wetting front. Graphs of the data are included in Appendix J.

STATISTICAL TESTING

Once field and laboratory tests were conducted, 35 IAC 811.507(a)(5) requires that the tests be evaluated to determine if there is a statistical correlation. Since the regulations did not indicate a specific level of statistical significance, we solved for this value. To determine whether or not there is a statistical difference between field permeabilities and the laboratory permeabilities, a confidence interval procedure was used as follows:

The Student's t Test was used to determine if there is any statistical differences between the laboratory measurements and the field measurement. The Student's t Value is used for populations whose size is less than 30 samples. The test uses a Confidence Interval to determine significance. The Confidence Interval is given by the following equation:

$$\textit{Confidence Interval} = \bar{x} \pm \left(T_{\frac{\alpha}{2}} \times S \sqrt{1 + \frac{1}{n}}\right)$$

If the field measurement lies outside the limits of the Confidence Interval, then the field measurement is considered to be statistically different than the laboratory measurements. If the field measurement lies within the limits, the field measurement is considered to have no significant difference compared to the laboratory measurements. The calculations are as follows:

SDRI measured Hydraulic Conductivity = 8.40×10^{-9} cm/sec

Lab measurements of Hydraulic Conductivity:

SDRI - K_1	Surrounding Construction - K_2	
4.66×10^{-9} cm/sec	4.02×10^{-9} cm/sec	6.03×10^{-9} cm/sec
5.93×10^{-9} cm/sec	1.5×10^{-9} cm/sec	5.68×10^{-9} cm/sec
3.97×10^{-9} cm/sec	1.12×10^{-9} cm/sec	3.52×10^{-9} cm/sec
4.61×10^{-9} cm/sec	2.84×10^{-9} cm/sec	8.75×10^{-9} cm/sec
4.66×10^{-9} cm/sec	3.37×10^{-9} cm/sec	
7.43×10^{-9} cm/sec		

	K_1	$K_1 + K_2$
Number of Samples	$n_1 = 6$	$n_2 = 15$
Degrees of Freedom	$df_1 = 5$	$df_2 = 14$
Mean	$x_1 = 5.21 \times 10^{-9}$	$x_2 = 4.53 \times 10^{-9}$
Standard Deviation	$s_1 = 1.26 \times 10^{-9}$	$s_1 = 2.04 \times 10^{-9}$

Based upon trial and error:

$$98.5\%\ \textit{Confidence Interval} = x \pm \left(S \times T_{\frac{\alpha}{2}} \times \sqrt{1 + \frac{1}{n}}\right)$$

For inner ring laboratory results (K_1):

$$98.5\%\ \textit{Confidence Interval} = x_1 \pm \left(T_1 \times S_1 \times \sqrt{1 + \frac{1}{n_1}}\right)$$

$$98.5\%\ \textit{Confidence Interval} = 5.21 \times 10^{-9} \pm \left(3.003 \times 1.26 \times 10^{-9} \times \sqrt{1 + \frac{1}{6}}\right)$$

$$98.5\%\ \textit{Confidence Interval} = 5.21 \times 10^{-9} \pm \left(4.087 \times 10^{-9}\right)$$

$$98.5\%\ \textit{Confidence Interval} = 1.123 \times 10^{-9}\ \textit{to}\ 9.3 \times 10^{-9}\ \textit{cm/sec}$$

The SDRI Value of 8.40×10^{-9} meets this Confidence Interval.

For All Phase 1 Laboratory Results ($K_1 + K_2$):

$$98.5\%\ \textit{Confidence Interval} = x_2 \pm \left(T_2 \times S_2 \times \sqrt{1 + \frac{1}{n_2}}\right)$$

$$98.5\%\ \textit{Confidence Interval} = 4.54 \times 10^{-9} \pm \left(2.415 \times 2.04 \times 10^{-9} \sqrt{1 + \frac{1}{15}}\right)$$

$$98.5\%\ \textit{Confidence Interval} = 4.54 \times 10^{-9} \pm 5.09 \times 10^{-9}$$

$$98.5\%\ \textit{Confidence Interval} = 5.5 \times 10^{-10}\ \textit{to}\ 9.62\ 10^{-9}\ \textit{cm/sec}$$

The SDRI Value of 8.40 x 10^{-9} meets this Confidence Interval.

CONCLUSION

Based upon a 98.5 percent Confidence Interval, the field measurement generally lies between the statistical limits of the lab measurements. Based upon the declining values of infiltration and hydraulic conductivity of the field testing device, continued testing time would likely improve the statistical correlation between laboratory and field measurements.

ATTACHMENT E:

Leachate Drainage and Collection System Chemical Compatibility Documentation (Application Log No. 1995-469)

ATTACHMENT 14
LEACHATE DRAINAGE AND COLLECTION SYSTEM CHEMICAL COMPATIBILITY DOCUMENTATION

PB89-139670

Lining of Waste Containment and Other Impoundment Facilities

Matrecon, Inc., Alameda, CA

Prepared for

Environmental Protection Agency, Cincinnati, OH

Sep 88

U.S. Department of Commerce
National Technical Information Service
NTIS

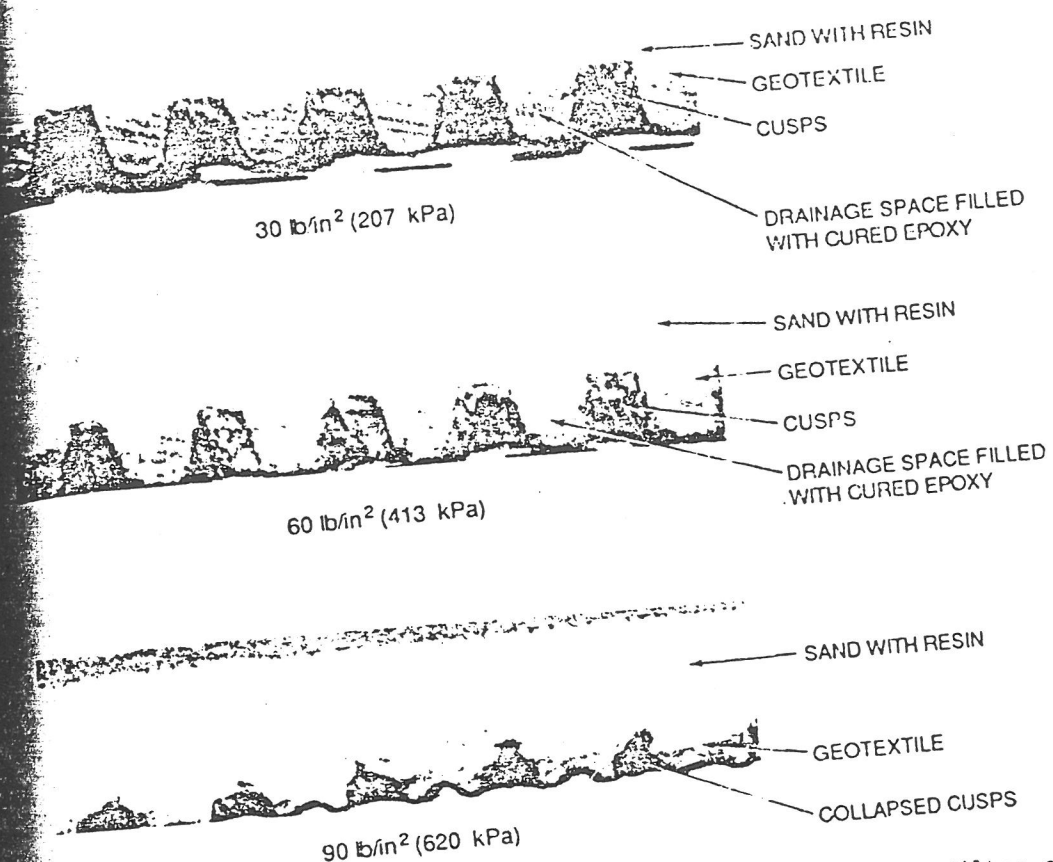


Figure 4-64. Sequence of photographs showing the intrusion of a filter geotextile into drainage core flow space of a drainage composite with extruded cuspations when under various loads for short periods of time. Photographs were taken of the cross sections of a series of test assemblies after the setting of an epoxy resin which had been introduced in assembly after it had been under the indicated load for a few minutes. Note that the cusps had collapsed under 90 psi load with almost complete loss of drainage space.

Thermoplastic pipe materials, such as PVC and HDPE, are preferred over nonplastic pipe materials for leachate collection and drainage above a liner because of the wide range of chemical resistance of the thermoplastics, particularly to inorganic chemicals. Typically, for use beneath the liner, design engineers have specified a wider range of materials (E. C. Jordan Co., 1984). Polymeric pipe materials that may be appropriate for use in below liner leachate collection systems and their properties are presented in Table 4-36. The structural properties of pipes range considerably. Flexible and semiflexible pipes derive structural stability from bedding materials, while rigid pipes require less structural support.

Designing with Geosynthetics

Second Edition

Robert M. Koerner, Ph. D., P. E.

Bowman Professor of Civil Engineering
Director, Geosynthetic Research Institute
Drexel University

PRENTICE HALL, Englewood Cliffs, N.J. 07632

TABLE 2.11 TYPICAL RANGE OF CURRENTLY AVAILABLE GEOTEXTILE PROPERTIES

	English units	SI units
Physical properties		
specific gravity	0.9 to 1.4	
mass per unit area	4–20 oz./yd.^{2}	130–700 g/m^2
thickness	10–300 mils	0.25–7.5 mm
stiffness	nil-22 lb.-mils	nil-25,000 mg-cm
Mechanical properties		
compressibility	nil to high	
tensile strength (wide width)	50–1000 lb./in.	9–180 kN/m
confined tensile strength	100–1000 lb./in.	18–180 kN/m
seam strength	50–100% of tensile	
fatigue strength	50–100% of tensile	
burst strength	50–750 lb./in.^{2}	350–5200 kPa
tear strength	20–300 lb.	90–1300 N
impact strength	10–150 ft.-lb.	14–200 J
puncture strength	10–100 lb.	45–450 N
friction behavior	50–100% of soil friction	
pullout behavior	50–100% of fabric strength	
Hydraulic properties		
porosity (nonwovens)	50–95%	
percent open area (wovens)	1–36%	
apparent opening size (sieve size)	#10–#200	
permittivity	0.02–2.2 s^{-1}	
permittivity under load	0.01–3.0 s^{-1}	
transmissivity	0.1 to 20 $\times 10^{-3}$ ft.^{3}/min.-ft.	0.01 to 2.0 $\times 10^{-3}$ m^3/min.-m
soil retention: turbidity curtains	m.b.e.[a]	
soil retention: silt fences	m.b.e.	
Endurance properties		
creep response	g.n.p[b] if < 40% strength is being used	
confined creep response	g.n.p. if < 50% strength is being used	
abrasion	50–100% of fabric strength	
long term clogging	m.b.e. for critical conditions	
gradient ratio clogging	m.b.e. for critical conditions	
Degradation properties		
installation damage	0–70% of fabric strength	
temperature degradation	g.n.p.	
chemical degradation	g.n.p. unless aggressive chemicals	
hydrolysis degradation	g.n.p. unless pH < 2 or pH > 11	
biological degradation	g.n.p.	
sunlight degradation	major problem unless stabilized	
other degradation processes	g.n.p.	
polymeric aging	g.n.p.	

(a) m.b.e.: must be evaluated

(b) g.n.p.: generally no problem

PHILLIPS DRISCOPIPE, INC.
A SUBSIDIARY OF PHILLIPS PETROLEUM COMPANY

2929 NORTH CENTRAL EXPRESSWAY, SUITE 300
P. O. BOX 83-3866
RICHARDSON, TEXAS 75083 • 214/783-2666

January 13, 1994

Mr. J. W. Bossert
Andres Environmental Engineering, Inc.
3535 Mayflower Blvd.
Springfield, Illinois 62707

RE: CWLP - City of Springfield; #496B

Dear Mr. Bossert:

Phillips Driscopipe, Inc. is pleased to provide information about the use of our pipe products in leachate collection service. We have fully reviewed the attached list of leachate constituent chemicals.

The consensus of opinion is this: Phillips Driscopipe PE 3408 pipe material is chemically compatible with a significant number of the chemicals listed, such as the elements and the organics. Some of the other chemicals, such as the aromatics and chlorinated compounds, are known to produce a slight tensile strength reduction (about 10%) in HDPE pipe when exposed in a 100% concentration for a long time. However, Driscopipe HDPE pipe has an acceptable tolerance for the PPM exposure level described for those aromatic and chlorinated chemicals listed.

In summary, Phillips Driscopipe does have chemical compatibility testing on most of the chemicals listed, but not all. For those other untested chemicals recognized as having a potential affect on polyethylene materials, the preponderance of our experience and knowledge suggests the level of exposure to these chemicals, is <u>so low</u> as to be within an acceptable tolerance limit for HDPE such that there will be little or no effect on the pipe by this contaminated groundwater.

In our cumulative judgement, there should be no reason why our HDPE pipe should not perform its structural or pressure function in contact with this leachate.

Best regards,

Harvey Svetlik

Harvey Svetlik,
Sr. Marketing Technical Rep.

HS:sa(072)
cc: T.D. Roberts
R.H. Heck
att.

ANDREWS ENVIRONMENTAL ENGINEERING INC. 3535 Mayflower Blvd., Springfield, Illinois 62707/(217) 787-2334

December 16, 1993

Mr. Harvey Svetlik
Philips Driscopipe, Inc.
2929 North Central Expressway
Richardson, TX 75083

re: Chemical Compatibility of HDPE Pipe

Dear Mr. Svetlik:

Enclosed are results of analytical testing of a scrubber sludge filter cake sample and leachate generated from a scrubber sludge filter cake landfill. Please comment on the suitability and chemical compatibility of using Driscopipe HDPE piping materials for the conveyance of leachate with these characteristics. If the concentration of particular constituents is not compatible, please specify the limit of concentration.

If you have any comments or questions, please call. Thank you.

Sincerely,

John W. Bossert
Environmental Engineer I
Division of Solid Waste Management

JWB:pll
enclosure

RESULTS OF BULK SAMPLE ANALYSIS

Sludge

Substance	CWLP-1 (1) (percent)	CWLP-2 (2) (percent)	CWLP-3 (3) (percent)
Arsenic	0.010	0.010	<0.005
Barium	0.030	0.030	<0.005
Cadmium	<0.005	<0.005	<0.005
Chromium	0.007	0.008	<0.005
Calcium	4.90	5.20	25.0
Copper	<0.005	<0.005	<0.005
Lead	<0.005	<0.005	<0.005
Magnesium	0.42	0.38	0.14
Mercury	<0.001	<0.001	<0.001
Nickel	0.008	0.006	<0.005
Selenium	<0.005	<0.005	<0.005
Silver	<0.005	<0.005	<0.005
Vanadium	0.020	0.019	<0.005
Zinc	0.010	0.010	<0.005
Sulfur	0.030	0.080	19.6
Crystalline Silica	57.7	58.7	1.61
pH of 10% Slurry	9.26	9.09	8.39
Total Carbonate	-	-	15.3
Total Sulfates	-	-	59.7

NOTES: - Samples were dried in a vacuum desiccator prior to preparing for analysis.
- Analytical Methods: Metals, SW-846, 3050, 6010, 7471; Crystalline Silica, Standard Methods of Chemical Analysis, Sixth Edition, p. 975, and Carbonate, p. 298.

(1) Sample CWLP-1: 31, 32, 33 Bottom Ash Composite; sampled 3/4/93.
(2) Sample CWLP-2: Fly Ash/Bottom Ash Composite (from pond); sampled 3/3/93.
(3) Sample CWLP-3: Scrubber Sludge Filter Cake; sampled 2/19/93.

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
Bartlett , IL 60103
Tel: (708) 289-3100
Fax: (708) 289-5445

ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

12/08/1992

NET Job Number: 92.49393

Enclosed are the Analytical Results for the following samples submitted to NET, Inc. Bartlett Division for analysis:

Project Description: CWLP-City of Springfield; #496B

Sample Number	Sample Description	Date Taken	Date Received
182883	LP1-Leachate Sample	10/05/1992	10/06/1992

Sample analysis in support of the project referenced above has been completed and results are presented on the following pages. Please refer to the enclosed "Key to Abbreviations" for definition of terms. Should you have questions regarding procedures or results, please do not hesitate to call. NET has been pleased to provide these analytical services for you.

Approved By:

Darla Kalicki
Project Manager

OCEAN GROUP

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
Bartlett , IL 60103
Tel: (708) 289-3100
Fax: (708) 289-5445

ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

12/08/1992

Sample No. : 182883

NET Job No.: 92.49393

Sample Description: LP1-Leachate Sample
CWLP-City of Springfield; #496B

Date Taken: 10/05/1992
Time Taken: 15:00
IEPA Cert. No. 100221

Date Received: 10/06/1992
Time Received: 09:24
WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
Gross Alpha	<7.3*	pCi/L	12/07/1992	
Radium, Total	2.8 +/- 0.9	pCi/L	12/07/1992	
Tritium	<100.	pCi/L	12/07/1992	

*Elevated LLD due to high solids content.

OCEAN GROUP

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
Bartlett , IL 60103
Tel: (708) 289-3100
Fax: (708) 289-5445

ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

10/23/1992

Sample No. : 182852

NET Job No.: 92.49391

Sample Description: LP1-Leachate Sample
CWLP-City of Springfield; #496B

Date Taken: 10/05/1992
Time Taken: 15:00
IEPA Cert. No. 100221

Date Received: 10/06/1992
Time Received: 09:24
WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
BOD, Five Day	42.	mg/L	10/07/1992	405.1(3) 5210B(4)
Chloride	2750.	mg/L	10/12/1992	4500Cl(4) 325.3(3)
COD, Total	341.	mg/L	10/13/1992	410.4(3) 5220(4)
Cyanide, total	<0.002	mg/L	10/12/1992	335.2(3) 4500CN(4)
Fluoride	3.25	mg/L	10/07/1992	4500F(4) 340.2(3)
N-Ammonia	0.93	mg/L	10/16/1992	4500(4) 350.2(3)
N-Nitrate	2.1	mg/L	10/07/1992	4500NO3(4)
FOG, Hexane Soluble	31.	mg/L	10/13/1992	5520B(4) 413.1(3)
pH	8.3	units		150.1(3) 9040(1)
Phenols, colorimetric	0.006	mg/L	10/13/1992	9065(1) 420.1(3)
Solids, Total Dissolved	64.	mg/L	10/09/1992	160.1(3) 2540D(4)
Sulfate	1400.	mg/L	10/07/1992	9038(1) 375.4(3)
Total Organic Carbon	12.6	mg/L	10/14/1992	415.1(3) 5310(4)
Aluminum, ICP	8.18	mg/L	10/21/1992	6010(1) 200.7(3)
Antimony, ICP	<0.50	mg/L	10/15/1992	6010(1) 200.7(3)
Arsenic, AA	<0.0050	mg/L	10/16/1992	7061(1) 206.3(3)
Barium, ICP	0.102	mg/L	10/15/1992	6010(1) 200.7(3)
Beryllium, ICP	<0.0050	mg/L	10/15/1992	6010(1) 200.7(3)
Boron,ICP	98.9	mg/L	10/16/1992	6010(1) 200.7(3)
Cadmium, ICP	<0.010	mg/L	10/15/1992	6010(1) 200.7(3)
Calcium, AA	2300.	mg/L	10/19/1992	7140(1) 215.1(3)
Chromium, ICP	<0.040	mg/L	10/15/1992	6010(1) 200.7(3)
Cobalt, ICP	<0.10	mg/L	10/16/1992	6010(1) 200.7(3)
Copper, ICP	0.018	mg/L	10/15/1992	6010(1) 200.7(3)
Iron, ICP	11.3	mg/L	10/16/1992	6010(1) 200.7(3)
Lead, ICP	<0.080	mg/L	10/15/1992	6010(1) 200.7(3)
Magnesium, AA	210.	mg/L	10/19/1992	6010(1) 200.7(3)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

OCEAN GROUP

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
Bartlett , IL 60103
Tel: (708) 289-3100
Fax: (708) 289-5445

ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

10/23/1992

Sample No. : 182852

NET Job No.: 92.49391

Sample Description: LP1-Leachate Sample
CWLP-City of Springfield; #496B

Date Taken: 10/05/1992
Time Taken: 15:00
IEPA Cert. No. 100221

Date Received: 10/06/1992
Time Received: 09:24
WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
Manganese, ICP	0.712	mg/L	10/16/1992	6010(1) 200.7(3)
Mercury, CVAA	0.0006	mg/L	10/14/1992	7470(1) 245.1(3)
Nickel, ICP	<0.050	mg/L	10/15/1992	6010(1) 200.7(3)
Potassium, AA	7.0	mg/L	10/19/1992	6010(1) 200.7(3)
Selenium, AA	<0.0050	mg/L	10/15/1992	7741(1) 270.3(3)
Silver, AA	0.051	mg/L	10/14/1992	7760(1) 272.1(3)
Sodium, AA	77.	mg/L	10/19/1992	7770(1) 273.1(3)
Strontium, ICP	3.84	mg/L	10/16/1992	6010(1) 200.7(3)
Thallium, ICP	<0.20	mg/L	10/15/1992	6010(1) 200.7(3)
Tin, ICP	<2.0	mg/L	10/16/1992	6010(1) 200.7(3)
Vanadium, ICP	0.012	mg/L	10/16/1992	6010(1) 200.7(3)
Zinc, ICP	0.104	mg/L	10/15/1992	6010(1) 200.7(3)
PESTICIDES/PCB - 8080 AQUEOUS				
Aldrin	<0.05	ug/L	10/16/1992	8080 (1)
alpha-BHC	<0.05	ug/L	10/16/1992	8080 (1)
beta-BHC	<0.05	ug/L	10/16/1992	8080 (1)
delta-BHC	<0.05	ug/L	10/16/1992	8080 (1)
gamma-BHC (Lindane)	<0.05	ug/L	10/16/1992	8080 (1)
Chlordane	<0.5	ug/L	10/16/1992	8080 (1)
4,4'-DDD	<0.1	ug/L	10/16/1992	8080 (1)
4,4'-DDE	<0.1	ug/L	10/16/1992	8080 (1)
4,4'-DDT	<0.1	ug/L	10/16/1992	8080 (1)
Dieldrin	<0.1	ug/L	10/16/1992	8080 (1)
Endosulfan I	<0.05	ug/L	10/16/1992	8080 (1)
Endosulfan II	<0.1	ug/L	10/16/1992	8080 (1)
Endosulfan sulfate	<0.1	ug/L	10/16/1992	8080 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

OCEAN GROUP

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
Bartlett , IL 60103
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Fax: (708) 289-5445

ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

10/23/1992

Sample No. : 182852

NET Job No.: 92.49391

Sample Description: LP1-Leachate Sample
CWLP-City of Springfield; #496B

Date Taken: 10/05/1992
Time Taken: 15:00
IEPA Cert. No. 100221

Date Received: 10/06/1992
Time Received: 09:24
WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
Endrin	<0.1	ug/L	10/16/1992	8080 (1)
Endrin aldehyde	<0.1	ug/L	10/16/1992	8080 (1)
Heptachlor	<0.05	ug/L	10/16/1992	8080 (1)
Heptachlor epoxide	<0.05	ug/L	10/16/1992	8080 (1)
Methoxychlor	<0.5	ug/L	10/16/1992	8080 (1)
Toxaphene	<0.5	ug/L	10/16/1992	8080 (1)
PCB-1016	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1221	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1232	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1242	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1248	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1254	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1260	<1.0	ug/L	10/16/1992	8080 (1)
HERBICIDES - AQUEOUS				
2,4-D	<2.0	ug/L	10/16/1992	8150 (1)
2,4,5-TP (Silvex)	<2.0	ug/L	10/16/1992	8150 (1)
Parathion	<10.	mg/L	10/16/1992	
TCL VOLATILES - AQUEOUS				
Chloromethane	<10.0	ug/L	10/16/1992	8240 (1)
Vinyl chloride	<10.0	ug/L	10/16/1992	8240 (1)
Bromomethane	<10.0	ug/L	10/16/1992	8240 (1)
Chloroethane	<10.0	ug/L	10/16/1992	8240 (1)
1,1-Dichloroethene	<1.0	ug/L	10/16/1992	8240 (1)
Carbon disulfide	<100.	ug/L	10/16/1992	8240 (1)
Acetone	<100.	ug/L	10/16/1992	8240 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

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NATIONAL ENVIRONMENTAL TESTING, INC.

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ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

10/23/1992

Sample No. : 182852

NET Job No.: 92.49391

Sample Description: LP1-Leachate Sample
CWLP-City of Springfield; #496B

Date Taken: 10/05/1992
Time Taken: 15:00
IEPA Cert. No. 100221

Date Received: 10/06/1992
Time Received: 09:24
WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
Methylene chloride	<5.0	ug/L	10/16/1992	8240 (1)
trans-1,2-Dichloroethene	<1.0	ug/L	10/16/1992	8240 (1)
1,1-Dichloroethane	<1.0	ug/L	10/16/1992	8240 (1)
Vinyl acetate	<50.0	ug/L	10/16/1992	8240 (1)
2-Butanone	<100.	ug/L	10/16/1992	8240 (1)
cis-1,2-Dichloroethene	<1.0	ug/L	10/16/1992	8240 (1)
Chloroform	<1.0	ug/L	10/16/1992	8240 (1)
1,1,1-Trichloroethane	<1.0	ug/L	10/16/1992	8240 (1)
1,2-Dichloroethane	<1.0	ug/L	10/16/1992	8240 (1)
Benzene	<1.0	ug/L	10/16/1992	8240 (1)
Carbon tetrachloride	<1.0	ug/L	10/16/1992	8240 (1)
1,2-Dichloropropane	<1.0	ug/L	10/16/1992	8240 (1)
Trichloroethene	<1.0	ug/L	10/16/1992	8240 (1)
Bromodichloromethane	<1.0	ug/L	10/16/1992	8240 (1)
2-Chloroethylvinyl ether	<10.0	ug/L	10/16/1992	8240 (1)
trans-1,3-Dichloropropene	<1.0	ug/L	10/16/1992	8240 (1)
4-Methyl-2-pentanone	<50.0	ug/L	10/16/1992	8240 (1)
Toluene	<1.0	ug/L	10/16/1992	8240 (1)
cis-1,3-Dichloropropene	<1.0	ug/L	10/16/1992	8240 (1)
1,1,2-Trichloroethane	<1.0	ug/L	10/16/1992	8240 (1)
Dibromochloromethane	<1.0	ug/L	10/16/1992	8240 (1)
2-Hexanone	<50.0	ug/L	10/16/1992	8240 (1)
Tetrachloroethene	<1.0	ug/L	10/16/1992	8240 (1)
Chlorobenzene	<1.0	ug/L	10/16/1992	8240 (1)
Ethylbenzene	<1.0	ug/L	10/16/1992	8240 (1)
meta & para-Xylene	<1.0	ug/L	10/16/1992	8240 (1)
Bromoform	<1.0	ug/L	10/16/1992	8240 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

OCEAN GROUP

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
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ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

10/23/1992

Sample No. : 182852

NET Job No.: 92.49391

Sample Description: LP1-Leachate Sample
CWLP-City of Springfield; #496B

Date Taken: 10/05/1992
Time Taken: 15:00
IEPA Cert. No. 100221

Date Received: 10/06/1992
Time Received: 09:24
WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
Styrene	<1.0	ug/L	10/16/1992	8240 (1)
ortho-Xylene	<1.0	ug/L	10/16/1992	8240 (1)
1,1,2,2-Tetrachloroethane	<1.0	ug/L	10/16/1992	8240 (1)
1,3-Dichlorobenzene	<1.0	ug/L	10/16/1992	8240 (1)
1,4-Dichlorobenzene	<1.0	ug/L	10/16/1992	8240 (1)
1,2-Dichlorobenzene	<1.0	ug/L	10/16/1992	8240 (1)
TCL BASE NEUTRALS - AQUEOUS				
Aniline	<10.	ug/L	10/13/1992	8270 (1)
Bis(2-chloroethyl) ether	<10.	ug/L	10/13/1992	8270 (1)
1,3-Dichlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
1,4-Dichlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
1,2-Dichlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
Benzyl alcohol	<10.	ug/L	10/13/1992	8270 (1)
Hexachloroethane	<10.	ug/L	10/13/1992	8270 (1)
N-Nitrosodi-n-propylamine	<10.	ug/L	10/13/1992	8270 (1)
Bis(2-chloroisopropyl)ether	<10.	ug/L	10/13/1992	8270 (1)
Nitrobenzene	<10.	ug/L	10/13/1992	8270 (1)
N-Nitrosodimethylamine	<10.	ug/L	10/13/1992	8270 (1)
Isophorone	<10.	ug/L	10/13/1992	8270 (1)
Bis(2-chloroethoxy)methane	<10.	ug/L	10/13/1992	8270 (1)
1,2,4-Trichlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
Naphthalene	<10.	ug/L	10/13/1992	8270 (1)
4-Chloroaniline	<10.	ug/L	10/13/1992	8270 (1)
Hexachlorobutadiene	<10.	ug/L	10/13/1992	8270 (1)
2-Methylnaphthalene	<10.	ug/L	10/13/1992	8270 (1)
2-Chloronaphthalene	<10.	ug/L	10/13/1992	8270 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

OCEAN GROUP

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
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ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

10/23/1992

Sample No. : 182852

NET Job No.: 92.49391

Sample Description: LP1-Leachate Sample
CWLP-City of Springfield; #496B

Date Taken: 10/05/1992
Time Taken: 15:00
IEPA Cert. No. 100221

Date Received: 10/06/1992
Time Received: 09:24
WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
3-Nitroaniline	<50.	ug/L	10/13/1992	8270 (1)
2-Nitroaniline	<50.	ug/L	10/13/1992	8270 (1)
4-Nitroaniline	<50.	ug/L	10/13/1992	8270 (1)
Acenaphthylene	<10.	ug/L	10/13/1992	8270 (1)
Dimethyl phthalate	<10.	ug/L	10/13/1992	8270 (1)
Acenaphthene	<10.	ug/L	10/13/1992	8270 (1)
Fluorene	<10.	ug/L	10/13/1992	8270 (1)
4-Chlorophenylphenyl ether	<10.	ug/L	10/13/1992	8270 (1)
Dibenzofuran	<10.	ug/L	10/13/1992	8270 (1)
Diethyl phthalate	<10.	ug/L	10/13/1992	8270 (1)
N-Nitrosodiphenylamine	<10.	ug/L	10/13/1992	8270 (1)
Hexachlorocyclopentadiene	<10.	ug/L	10/13/1992	8270 (1)
2,6-Dinitrotoluene	<10.	ug/L	10/13/1992	8270 (1)
2,4-Dinitrotoluene	<10.	ug/L	10/13/1992	8270 (1)
4-Bromophenyl phenyl ether	<10.	ug/L	10/13/1992	8270 (1)
Hexachlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
Phenanthrene	<10.	ug/L	10/13/1992	8270 (1)
Anthracene	<10.	ug/L	10/13/1992	8270 (1)
Di-n-butylphthalate	<10.	ug/L	10/13/1992	8270 (1)
Fluoranthene	<10.	ug/L	10/13/1992	8270 (1)
Pyrene	<10.	ug/L	10/13/1992	8270 (1)
Benzo(a)anthracene	<10.	ug/L	10/13/1992	8270 (1)
Chrysene	<10.	ug/L	10/13/1992	8270 (1)
Benzidine	<50.	ug/L	10/13/1992	8270 (1)
3,3'-Dichlorobenzidine	<20.	ug/L	10/13/1992	8270 (1)
Butyl benzyl phthalate	<10.	ug/L	10/13/1992	8270 (1)
Bis(2-ethylhexyl)phthalate	<10.	ug/L	10/13/1992	8270 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

OCEAN GROUP

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
Bartlett , IL 60103
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ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

10/23/1992

Sample No. : 182852

NET Job No.: 92.49391

Sample Description: LP1-Leachate Sample
CWLP-City of Springfield; #496B

Date Taken: 10/05/1992
Time Taken: 15:00
IEPA Cert. No. 100221

Date Received: 10/06/1992
Time Received: 09:24
WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
Benzo(b)fluoranthene	<10.	ug/L	10/13/1992	8270 (1)
Benzo(k)fluoranthene	<10.	ug/L	10/13/1992	8270 (1)
Benzo(a)pyrene	<10.	ug/L	10/13/1992	8270 (1)
Indeno(1,2,3-cd)pyrene	<10.	ug/L	10/13/1992	8270 (1)
Dibenzo (a,h) anthracene	<10.	ug/L	10/13/1992	8270 (1)
Benzo(ghi)perylene	<10.	ug/L	10/13/1992	8270 (1)
Di-n-octylphthalate	<10.	ug/L	10/13/1992	8270 (1)
TCL ACIDS - AQUEOUS				
2-Chlorophenol	<10.	ug/L	10/13/1992	8270 (1)
Phenol	<10.	ug/L	10/13/1992	8270 (1)
2-Methylphenol (o-cresol)	<10.	ug/L	10/13/1992	8270 (1)
4-Methylphenol (p-cresol)	<10.	ug/L	10/13/1992	8270 (1)
Benzoic Acid	<50.	ug/L	10/13/1992	8270 (1)
2-Nitrophenol	<50.	ug/L	10/13/1992	8270 (1)
2,4-Dimethylphenol	<10.	ug/L	10/13/1992	8270 (1)
2,4-Dichlorophenol	<10.	ug/L	10/13/1992	8270 (1)
4-Chloro-3-methylphenol	<10.	ug/L	10/13/1992	8270 (1)
2,4,6-Trichlorophenol	<10.	ug/L	10/13/1992	8270 (1)
2,4,5-Trichlorophenol	<50.	ug/L	10/13/1992	8270 (1)
2,4-Dinitrophenol	<50.	ug/L	10/13/1992	8270 (1)
4-Nitrophenol	<50.	ug/L	10/13/1992	8270 (1)
2-Methyl-4,6-dinitrophenol	<50.	ug/L	10/13/1992	8270 (1)
Pentachlorophenol	<50.	ug/L	10/13/1992	8270 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

OCEAN GROUP

Gundle Lining Systems Inc

Gundle®

19103 Gundle Road
Houston, Texas 77073-3598
U.S.A.

Phone: (713) 443-8564
Toll Free: (800) 435-2008
Telex: 166657 GUNDLE HOU
FAX: (713) 875-6010

February 3, 1994

Mr. John W. Bossert
Andrews Environmental Engineering Inc.
3535 Mayflower Blvd.
Springfield, IL 62707

Re: City Water, Light & Power Landfill
Springfield, Illinois

Dear Mr. Bossert:

In response to your inquiry regarding the chemical compatibility of Gundline® HD high density polyethylene geomembrane, we certify that Gundline HD is resistant to the sludge and leachate associated with the Light and Power Landfill in Springfield, Illinois. We base this certification on the analysis sent to us December 17, 1993, and attached this letter. The components of the sludge and leachate and their concentrations are compatible with Gundline HD high density polyethylene liner. Our standard material warranty would apply for this application and we recommend the use of our liner in this application.

Sincerely,

Mark Cadwallader

Mark Cadwallader
Director of Research
and Technical Development

MC:ams

attachment

cc: Ronnie Ruffeno

CITY WATER, LIGHT AND POWER
APRIL 29, 1993

RESULTS OF BULK SAMPLE ANALYSIS

Sludge

Substance	CWLP-1 (1) (percent)	CWLP-2 (2) (percent)	CWLP-3 (3) (percent)
Arsenic	0.010	0.010	<0.005
Barium	0.030	0.030	<0.005
Cadmium	<0.005	<0.005	<0.005
Chromium	0.007	0.008	<0.005
Calcium	4.90	5.20	25.0
Copper	<0.005	<0.005	<0.005
Lead	<0.005	<0.005	<0.005
Magnesium	0.42	0.38	0.14
Mercury	<0.001	<0.001	<0.001
Nickel	0.008	0.006	<0.005
Selenium	<0.005	<0.005	<0.005
Silver	<0.005	<0.005	<0.005
Vanadium	0.020	0.019	<0.005
Zinc	0.010	0.010	<0.005
Sulfur	0.030	0.080	19.6
Crystalline Silica	57.7	58.7	1.61
pH of 10% Slurry	9.26	9.09	8.39
Total Carbonate	-	-	15.3
Total Sulfates	-	-	59.7

NOTES: - Samples were dried in a vacuum desiccator prior to preparing for analysis.
- Analytical Methods: Metals, SW-846, 3050, 6010, 7471; Crystalline Silica, Standard Methods of Chemical Analysis, Sixth Edition, p. 975, and Carbonate, p. 298.

(1) Sample CWLP-1: 31, 32, 33 Bottom Ash Composite; sampled 3/4/93.
(2) Sample CWLP-2: Fly Ash/Bottom Ash Composite (from pond); sampled 3/3/93.
(3) Sample CWLP-3: Scrubber Sludge Filter Cake; sampled 2/19/93.

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
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ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

12/08/1992

NET Job Number: 92.49393

Enclosed are the Analytical Results for the following samples submitted to NET, Inc. Bartlett Division for analysis:

Project Description: CWLP-City of Springfield; #496B

Sample Number	Sample Description	Date Taken	Date Received
182883	LP1-Leachate Sample	10/05/1992	10/06/1992

Sample analysis in support of the project referenced above has been completed and results are presented on the following pages. Please refer to the enclosed "Key to Abbreviations" for definition of terms. Should you have questions regarding procedures or results, please do not hesitate to call. NET has been pleased to provide these analytical services for you.

Approved By:

Darla Kalicki
Project Manager

OCEAN GROUP

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
Bartlett , IL 60103
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ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

12/08/1992

Sample No. : 182883

NET Job No.: 92.49393

Sample Description: LP1-Leachate Sample
CWLP-City of Springfield; #496B

Date Taken: 10/05/1992
Time Taken: 15:00
IEPA Cert. No. 100221

Date Received: 10/06/1992
Time Received: 09:24
WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
Gross Alpha	<7.3*	pCi/L	12/07/1992	
Radium, Total	2.8 +/- 0.9	pCi/L	12/07/1992	
Tritium	<100.	pCi/L	12/07/1992	

*Elevated LLD due to high solids content.

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NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
Bartlett , IL 60103
Tel: (708) 289-3100
Fax: (708) 289-5445

ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

10/23/1992

Sample No. : 182852

NET Job No.: 92.49391

Sample Description: LP1-Leachate Sample
CWLP-City of Springfield; #496B

Date Taken: 10/05/1992
Time Taken: 15:00
IEPA Cert. No. 100221

Date Received: 10/06/1992
Time Received: 09:24
WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
BOD, Five Day	42.	mg/L	10/07/1992	405.1(3) 5210B(4)
Chloride	2750.	mg/L	10/12/1992	4500Cl(4) 325.3(3)
COD, Total	341.	mg/L	10/13/1992	410.4(3) 5220(4)
Cyanide, total	<0.002	mg/L	10/12/1992	335.2(3) 4500CN(4)
Fluoride	3.25	mg/L	10/07/1992	4500F(4) 340.2(3)
N-Ammonia	0.93	mg/L	10/16/1992	4500(4) 350.2(3)
N-Nitrate	2.1	mg/L	10/07/1992	4500NO3(4)
FOG, Hexane Soluble	31.	mg/L	10/13/1992	5520B(4) 413.1(3)
pH	8.3	units		150.1(3) 9040(1)
Phenols, colorimetric	0.006	mg/L	10/13/1992	9065(1) 420.1(3)
Solids, Total Dissolved	64.	mg/L	10/09/1992	160.1(3) 2540D(4)
Sulfate	1400.	mg/L	10/07/1992	9038(1) 375.4(3)
Total Organic Carbon	12.6	mg/L	10/14/1992	415.1(3) 5310(4)
Aluminum, ICP	8.18	mg/L	10/21/1992	6010(1) 200.7(3)
Antimony, ICP	<0.50	mg/L	10/15/1992	6010(1) 200.7(3)
Arsenic, AA	<0.0050	mg/L	10/16/1992	7061(1) 206.3(3)
Barium, ICP	0.102	mg/L	10/15/1992	6010(1) 200.7(3)
Beryllium, ICP	<0.0050	mg/L	10/15/1992	6010(1) 200.7(3)
Boron,ICP	98.9	mg/L	10/16/1992	6010(1) 200.7(3)
Cadmium, ICP	<0.010	mg/L	10/15/1992	6010(1) 200.7(3)
Calcium, AA	2300.	mg/L	10/19/1992	7140(1) 215.1(3)
Chromium, ICP	<0.040	mg/L	10/15/1992	6010(1) 200.7(3)
Cobalt, ICP	<0.10	mg/L	10/16/1992	6010(1) 200.7(3)
Copper, ICP	0.018	mg/L	10/15/1992	6010(1) 200.7(3)
Iron, ICP	11.3	mg/L	10/16/1992	6010(1) 200.7(3)
Lead, ICP	<0.080	mg/L	10/15/1992	6010(1) 200.7(3)
Magnesium, AA	210.	mg/L	10/19/1992	6010(1) 200.7(3)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

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Parameter	Results	Units	Date of Analysis	Analytical Method
Manganese, ICP	0.712	mg/L	10/16/1992	6010(1) 200.7(3)
Mercury, CVAA	0.0006	mg/L	10/14/1992	7470(1) 245.1(3)
Nickel, ICP	<0.050	mg/L	10/15/1992	6010(1) 200.7(3)
Potassium, AA	7.0	mg/L	10/19/1992	6010(1) 200.7(3)
Selenium, AA	<0.0050	mg/L	10/15/1992	7741(1) 270.3(3)
Silver, AA	0.051	mg/L	10/14/1992	7760(1) 272.1(3)
Sodium, AA	77.	mg/L	10/19/1992	7770(1) 273.1(3)
Strontium, ICP	3.84	mg/L	10/16/1992	6010(1) 200.7(3)
Thallium, ICP	<0.20	mg/L	10/15/1992	6010(1) 200.7(3)
Tin, ICP	<2.0	mg/L	10/16/1992	6010(1) 200.7(3)
Vanadium, ICP	0.012	mg/L	10/16/1992	6010(1) 200.7(3)
Zinc, ICP	0.104	mg/L	10/15/1992	6010(1) 200.7(3)
PESTICIDES/PCB - 8080 AQUEOUS				
Aldrin	<0.05	ug/L	10/16/1992	8080 (1)
alpha-BHC	<0.05	ug/L	10/16/1992	8080 (1)
beta-BHC	<0.05	ug/L	10/16/1992	8080 (1)
delta-BHC	<0.05	ug/L	10/16/1992	8080 (1)
gamma-BHC (Lindane)	<0.05	ug/L	10/16/1992	8080 (1)
Chlordane	<0.5	ug/L	10/16/1992	8080 (1)
4,4'-DDD	<0.1	ug/L	10/16/1992	8080 (1)
4,4'-DDE	<0.1	ug/L	10/16/1992	8080 (1)
4,4'-DDT	<0.1	ug/L	10/16/1992	8080 (1)
Dieldrin	<0.1	ug/L	10/16/1992	8080 (1)
Endosulfan I	<0.05	ug/L	10/16/1992	8080 (1)
Endosulfan II	<0.1	ug/L	10/16/1992	8080 (1)
Endosulfan sulfate	<0.1	ug/L	10/16/1992	8080 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

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PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

10/23/1992

Sample No. : 182852

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CWLP-City of Springfield; #496B

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Parameter	Results	Units	Date of Analysis	Analytical Method
Endrin	<0.1	ug/L	10/16/1992	8080 (1)
Endrin aldehyde	<0.1	ug/L	10/16/1992	8080 (1)
Heptachlor	<0.05	ug/L	10/16/1992	8080 (1)
Heptachlor epoxide	<0.05	ug/L	10/16/1992	8080 (1)
Methoxychlor	<0.5	ug/L	10/16/1992	8080 (1)
Toxaphene	<0.5	ug/L	10/16/1992	8080 (1)
PCB-1016	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1221	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1232	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1242	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1248	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1254	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1260	<1.0	ug/L	10/16/1992	8080 (1)
HERBICIDES - AQUEOUS				
2,4-D	<2.0	ug/L	10/16/1992	8150 (1)
2,4,5-TP (Silvex)	<2.0	ug/L	10/16/1992	8150 (1)
Parathion	<10.	mg/L	10/16/1992	
TCL VOLATILES - AQUEOUS				
Chloromethane	<10.0	ug/L	10/16/1992	8240 (1)
Vinyl chloride	<10.0	ug/L	10/16/1992	8240 (1)
Bromomethane	<10.0	ug/L	10/16/1992	8240 (1)
Chloroethane	<10.0	ug/L	10/16/1992	8240 (1)
1,1-Dichloroethene	<1.0	ug/L	10/16/1992	8240 (1)
Carbon disulfide	<100.	ug/L	10/16/1992	8240 (1)
Acetone	<100.	ug/L	10/16/1992	8240 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

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WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
Methylene chloride	<5.0	ug/L	10/16/1992	8240 (1)
trans-1,2-Dichloroethene	<1.0	ug/L	10/16/1992	8240 (1)
1,1-Dichloroethane	<1.0	ug/L	10/16/1992	8240 (1)
Vinyl acetate	<50.0	ug/L	10/16/1992	8240 (1)
2-Butanone	<100.	ug/L	10/16/1992	8240 (1)
cis-1,2-Dichloroethene	<1.0	ug/L	10/16/1992	8240 (1)
Chloroform	<1.0	ug/L	10/16/1992	8240 (1)
1,1,1-Trichloroethane	<1.0	ug/L	10/16/1992	8240 (1)
1,2-Dichloroethane	<1.0	ug/L	10/16/1992	8240 (1)
Benzene	<1.0	ug/L	10/16/1992	8240 (1)
Carbon tetrachloride	<1.0	ug/L	10/16/1992	8240 (1)
1,2-Dichloropropane	<1.0	ug/L	10/16/1992	8240 (1)
Trichloroethene	<1.0	ug/L	10/16/1992	8240 (1)
Bromodichloromethane	<1.0	ug/L	10/16/1992	8240 (1)
2-Chloroethylvinyl ether	<10.0	ug/L	10/16/1992	8240 (1)
trans-1,3-Dichloropropene	<1.0	ug/L	10/16/1992	8240 (1)
4-Methyl-2-pentanone	<50.0	ug/L	10/16/1992	8240 (1)
Toluene	<1.0	ug/L	10/16/1992	8240 (1)
cis-1,3-Dichloropropene	<1.0	ug/L	10/16/1992	8240 (1)
1,1,2-Trichloroethane	<1.0	ug/L	10/16/1992	8240 (1)
Dibromochloromethane	<1.0	ug/L	10/16/1992	8240 (1)
2-Hexanone	<50.0	ug/L	10/16/1992	8240 (1)
Tetrachloroethene	<1.0	ug/L	10/16/1992	8240 (1)
Chlorobenzene	<1.0	ug/L	10/16/1992	8240 (1)
Ethylbenzene	<1.0	ug/L	10/16/1992	8240 (1)
meta & para-Xylene	<1.0	ug/L	10/16/1992	8240 (1)
Bromoform	<1.0	ug/L	10/16/1992	8240 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

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Parameter	Results	Units	Date of Analysis	Analytical Method
Styrene	<1.0	ug/L	10/16/1992	8240 (1)
ortho-Xylene	<1.0	ug/L	10/16/1992	8240 (1)
1,1,2,2-Tetrachloroethane	<1.0	ug/L	10/16/1992	8240 (1)
1,3-Dichlorobenzene	<1.0	ug/L	10/16/1992	8240 (1)
1,4-Dichlorobenzene	<1.0	ug/L	10/16/1992	8240 (1)
1,2-Dichlorobenzene	<1.0	ug/L	10/16/1992	8240 (1)
TCL BASE NEUTRALS - AQUEOUS				
Aniline	<10.	ug/L	10/13/1992	8270 (1)
Bis(2-chloroethyl) ether	<10.	ug/L	10/13/1992	8270 (1)
1,3-Dichlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
1,4-Dichlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
1,2-Dichlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
Benzyl alcohol	<10.	ug/L	10/13/1992	8270 (1)
Hexachloroethane	<10.	ug/L	10/13/1992	8270 (1)
N-Nitrosodi-n-propylamine	<10.	ug/L	10/13/1992	8270 (1)
Bis(2-chloroisopropyl)ether	<10.	ug/L	10/13/1992	8270 (1)
Nitrobenzene	<10.	ug/L	10/13/1992	8270 (1)
N-Nitrosodimethylamine	<10.	ug/L	10/13/1992	8270 (1)
Isophorone	<10.	ug/L	10/13/1992	8270 (1)
Bis(2-chloroethoxy)methane	<10.	ug/L	10/13/1992	8270 (1)
1,2,4-Trichlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
Naphthalene	<10.	ug/L	10/13/1992	8270 (1)
4-Chloroaniline	<10.	ug/L	10/13/1992	8270 (1)
Hexachlorobutadiene	<10.	ug/L	10/13/1992	8270 (1)
2-Methylnaphthalene	<10.	ug/L	10/13/1992	8270 (1)
2-Chloronaphthalene	<10.	ug/L	10/13/1992	8270 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

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Parameter	Results	Units	Date of Analysis	Analytical Method
3-Nitroaniline	<50.	ug/L	10/13/1992	8270 (1)
2-Nitroaniline	<50.	ug/L	10/13/1992	8270 (1)
4-Nitroaniline	<50.	ug/L	10/13/1992	8270 (1)
Acenaphthylene	<10.	ug/L	10/13/1992	8270 (1)
Dimethyl phthalate	<10.	ug/L	10/13/1992	8270 (1)
Acenaphthene	<10.	ug/L	10/13/1992	8270 (1)
Fluorene	<10.	ug/L	10/13/1992	8270 (1)
4-Chlorophenylphenyl ether	<10.	ug/L	10/13/1992	8270 (1)
Dibenzofuran	<10.	ug/L	10/13/1992	8270 (1)
Diethyl phthalate	<10.	ug/L	10/13/1992	8270 (1)
N-Nitrosodiphenylamine	<10.	ug/L	10/13/1992	8270 (1)
Hexachlorocyclopentadiene	<10.	ug/L	10/13/1992	8270 (1)
2,6-Dinitrotoluene	<10.	ug/L	10/13/1992	8270 (1)
2,4-Dinitrotoluene	<10.	ug/L	10/13/1992	8270 (1)
4-Bromophenyl phenyl ether	<10.	ug/L	10/13/1992	8270 (1)
Hexachlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
Phenanthrene	<10.	ug/L	10/13/1992	8270 (1)
Anthracene	<10.	ug/L	10/13/1992	8270 (1)
Di-n-butylphthalate	<10.	ug/L	10/13/1992	8270 (1)
Fluoranthene	<10.	ug/L	10/13/1992	8270 (1)
Pyrene	<10.	ug/L	10/13/1992	8270 (1)
Benzo(a)anthracene	<10.	ug/L	10/13/1992	8270 (1)
Chrysene	<10.	ug/L	10/13/1992	8270 (1)
Benzidine	<50.	ug/L	10/13/1992	8270 (1)
3,3'-Dichlorobenzidine	<20.	ug/L	10/13/1992	8270 (1)
Butyl benzyl phthalate	<10.	ug/L	10/13/1992	8270 (1)
Bis(2-ethylhexyl)phthalate	<10.	ug/L	10/13/1992	8270 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

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Date Received: 10/06/1992
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Parameter	Results	Units	Date of Analysis	Analytical Method
Benzo(b)fluoranthene	<10.	ug/L	10/13/1992	8270 (1)
Benzo(k)fluoranthene	<10.	ug/L	10/13/1992	8270 (1)
Benzo(a)pyrene	<10.	ug/L	10/13/1992	8270 (1)
Indeno(1,2,3-cd)pyrene	<10.	ug/L	10/13/1992	8270 (1)
Dibenzo (a,h) anthracene	<10.	ug/L	10/13/1992	8270 (1)
Benzo(ghi)perylene	<10.	ug/L	10/13/1992	8270 (1)
Di-n-octylphthalate	<10.	ug/L	10/13/1992	8270 (1)
TCL ACIDS - AQUEOUS				
2-Chlorophenol	<10.	ug/L	10/13/1992	8270 (1)
Phenol	<10.	ug/L	10/13/1992	8270 (1)
2-Methylphenol (o-cresol)	<10.	ug/L	10/13/1992	8270 (1)
4-Methylphenol (p-cresol)	<10.	ug/L	10/13/1992	8270 (1)
Benzoic Acid	<50.	ug/L	10/13/1992	8270 (1)
2-Nitrophenol	<50.	ug/L	10/13/1992	8270 (1)
2,4-Dimethylphenol	<10.	ug/L	10/13/1992	8270 (1)
2,4-Dichlorophenol	<10.	ug/L	10/13/1992	8270 (1)
4-Chloro-3-methylphenol	<10.	ug/L	10/13/1992	8270 (1)
2,4,6-Trichlorophenol	<10.	ug/L	10/13/1992	8270 (1)
2,4,5-Trichlorophenol	<50.	ug/L	10/13/1992	8270 (1)
2,4-Dinitrophenol	<50.	ug/L	10/13/1992	8270 (1)
4-Nitrophenol	<50.	ug/L	10/13/1992	8270 (1)
2-Methyl-4,6-dinitrophenol	<50.	ug/L	10/13/1992	8270 (1)
Pentachlorophenol	<50.	ug/L	10/13/1992	8270 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

OCEAN GROUP

ANDREWS ENVIRONMENTAL ENGINEERING INC. 3535 Mayflower Blvd., Springfield, Illinois 62707/(217) 787-2334

December 17, 1993

Ronnie Ruffeno
Gundle Lining Systems, Inc.
19103 Gundle Road
Houston, Texas 77073

re: City Water, Light and Power Landfill
Springfield, Illinois

Dear Ronnie:

We are in the process of modifying the permit for the subject facility which accepts scrubber sludge filter cake. For your information, the results of analytical testing of sludge and leachate samples from the facility's existing disposal unit are attached. Please comment on the chemical compatibility of the High Density Polyethylelene (HDPE) and polypropylene geonet composite materials with sludge and leachate with these characteristics.

Also, please comment on the HDPE and polypropylene material's chemical compatibility with the clay soils which would serve as the supporting soils in the liner system we are proposing to use. This material will consist of mainly brown to dark brown silty clays and clayey silts, mostly of flood plain type deposits. This also may include loess deposits and some fine grain sand. We do not know of any extreme chemical property, such as pH, which would adversely affect soil/HDPE liner chemical compatibility.

Should you have any comments or questions, please call. Thank you.

Sincerely,

John W. Bossert,
Environmental Engineer I
Division of Solid Waste Management

JWB:pll
enclosure

ATTACHMENT F:

Leachate Management Plan (Application Log No. 1995-469)

ATTACHMENT 16
LEACHATE MANAGEMENT PLAN

LEACHATE MANAGEMENT PLAN

INTRODUCTION

This Leachate Management Plan will supplement the accompanying Permit Application, Design and Construction Plan and Operating Plan for this facility.

As described in the Design and Construction Plan, a compacted earthen liner system is to be utilized in this unit. A leachate drainage system will be situated immediately above the liner system and will be tributary to a leachate collection system. The collection system will be comprised of perforated 6-inch collection piping with cleanouts at the upstream ends and collection manholes at the downstream ends. Leachate will be discharged to the ash pond on-site.

This plan addresses generation, routine operation, disposal, monitoring, time of operation, inspection and maintenance of the leachate control systems.

GENERATION

In order to minimize leachate generation, various means will be employed to minimize the entry of uncontaminated waters into the leachate collection system. These various control techniques may include, but are not limited, to the following practices:

1). The liner/leachate drainage and collection systems will be constructed in small increments. This will minimize the size of advance construction which would

unnecessarily increase the non-operational drainage area tributary to the collection system. However, the construction increments will be sufficient to accommodate landfilling between construction seasons;

2). Use of sacrificial carbon black stabilized plastic sheeting, or other appropriate materials, to temporarily cover the leachate drainage layer prior to waste placement;

3). Use of temporary drainage diversion berms;

4). Postponement of connection to the existing system leachate collection piping serving a newly constructed incremental fill area addition until just prior to its actual use for waste disposal; and

5). Discharge of water which may accumulate in the leachate collection system during construction and/or without waste contact into the site's surface drainage system.

The Army Corps of Engineers' Hydrologic Evaluation of Landfill Performance (HELP version 2.05) computer program was used to simulate the performance of the leachate collection system. The output from this program summarizes the simulation parameters and the performance of the liner/leachate collection systems. For the closed and covered facility, the simulated peak daily leachate flow rate was 1067.2 ft^3/day at 10.4 inches of head. Groundwater infiltration will contribute approximately 59.7 ft^3/day of leachate for a total of 1126.9 ft^3/day. For a newly developed incremental fill area the size of the middle cell (the largest) with five feet of waste

placed and assuming drainage sand with a hydraulic conductivity of 6.5 x 10^{-3} cm/sec., the peak simulated leachate flow rate is 800.7 ft^3/day. Groundwater infiltration will add about 20.3 ft^3/day for a total of 821 ft^3/day (4.3 gpm). This latter simulation was performed to estimate the maximum anticipated flow rate through an individual leachate collection pipe during the unit's active life. The moisture content of the as-received waste is typically below its field capacity. Therefore, during the active life of the unit, much of the moisture infiltration into the landfill should be absorbed by the waste. Copies of the HELP model simulations are provided in Appendix C.

See Appendix D for calculations concerning the effect of groundwater infiltration on leachate generation and other design aspects of the leachate drainage and collection systems.

ROUTINE OPERATION

Routine operation of the leachate collection system will consist of using a 10 gpm (minimum) submersible pump or ejector with appropriate discharge hosing/piping/fittings as necessary to transfer leachate accumulations from the collection manholes to the on-site ash pond. Operation of the pump(s) shall be level-actuated with the high-level "on" elevation no higher than the invert elevation of the influent leachate collection piping. The low-level "shut-off" elevation shall be as recommended by the pump manufacturer as necessary to provide minimum impeller submergence.

The ash pond has sufficient capacity for storage of at least five days worth of accumulated leachate at the generation rate used in designing the leachate drainage system in accordance with 35 IAC 811.309. Based upon the "HELP" model simulations, this equals a minimum of 5,602 ft^3 (41,903 gallons) or $\pm$ 1/8 acre·ft.

During transfer operations care shall be exercised to prevent spillage. Also all fittings shall be maintained in a tight condition to minimize drippage. During winter operation all exposed hoses, piping etc. shall be drained when not in use and/or buried, heat-traced, insulated, etc. to prevent freezing. Should a spill occur outside the waste boundary, sorbent materials shall be used to soakup the spill and the spent sorbent shall be removed and landfilled.

DISPOSAL

At this time, the primary method planned for treatment and disposal of leachate generated by this unit will be by pumping to the ash pond on-site. The discharge from the ash pond is currently permitted under the requirements of 35 IAC 309. A copy of the NPDES permit is included in Attachment 19. The pond's operation is overseen by an operator certified under the requirements of 35 IAC 312, and the leachate constitutes much less than 50 percent of the pond's influent flow of approximately 3 to 5 million gallons per day.

At this time, construction of additional on-site leachate treatment facilities or facilities to recycle leachate are not proposed. Should it become desirable to employ these or other alternative disposal options in the future, appropriate permits and/or permit modifications will be secured at that time.

MONITORING

1. A representative sample of leachate shall be collected from the unit and tested in accordance with item (2) below at a frequency of one per quarter while the leachate management system is in operation. This leachate sample will be acquired from one of

the two leachate collection manholes. There should be no variability in the quality of the leachate generated in the unit. The frequency of testing may be changed to once per year for any monitored constituent, if it is not detected in the leachate. However, if such a constituent is detected in the leachate, the testing frequency shall return to a quarterly schedule.

2. Discharge of leachate from the unit shall be tested for the following constituents prior to treatment or pretreatment:

a). pH;

b). Total Dissolved Solids;

c). Any other constituents listed in the operator's NPDES discharge permit, pursuant to 35 Ill. Adm. Code 304, or required by a publicly or privately owned treatment works, pursuant to 35 Ill. Adm. Code 310. Based upon the current NPDES Permit this includes TSS, Oil and Grease, Boron; and

d). All of the routine indicator constituents chose in accordance with 35 Ill. Adm. Code 811.319(a)(2)(B) and used by the operator for groundwater monitoring.

A comprehensive analysis was conducted on a leachate sample collected from the existing Unit 1. The results of this analysis are provided in Appendix E. The quality of the leachate from the existing unit is considered to be a representative of that which might be expected in Unit 2.

Leachate sampling will be performed by an employee of CWLP and/or a private independent consultant. Results from the leachate monitoring will be submitted to the IEPA as required.

TIME OF OPERATION

The operator shall collect and dispose of leachate for a minimum of five years after closure and thereafter until treatment is no longer necessary. Treatment is no longer necessary if the leachate constituents do not exceed the wastewater effluent standards in 35 Ill. Adm. Code 304.124, 304.125, 304.126 and do not contain a BOD_5 concentration greater than 30 mg/l for six consecutive months.

For the purpose of ensuring compliance with 35 IAC 811.320(a)(1), it was assumed leachate collection/treatment will continue for 100 years past closure. The resultant predicted maximum leachate head is 10.4 inches above the base liner. Using this predicted head and assuming constant source concentrations, the Groundwater Impact Assessment (Attachment 29) shows no violation of the site's groundwater standards will occur.

SYSTEM INSPECTION AND MAINTENANCE

On at least a quarterly basis, all installed leachate collection manholes and cleanouts shall be inspected for physical damage and deficiencies. As reasonable and appropriate, observed damage/deficiencies shall be repaired/corrected as soon as practical after detection.

Equipment and appurtenances utilized in conjunction with the leachate collection system shall be inspected and maintained in accordance with the manufacturer's recommendations. Equipment/appurtenances shall be repaired or replaced as soon as practical after being found to be faulty or worn out.

Within 18 months after the initial leachate collection system piping is put into service, it shall be cleaned. Based upon the amount of debris evident and the apparent need for this initial cleaning, a routine frequency for future cleanings will be established. However, at least annually, the system shall be inspected for evidence of clogging. See Appendix F for documentation that the collection pipes are of a cross-sectional area that allows cleaning.

APPENDIX C

Leachate Generation Simulations

NOTE:

The following Leachate Generation Simulations were made using the Corps of Engineers, Version 2.05 "HELP" Model and use of its synthetically generated St. Louis, Missouri Climatological data. Default soils data were used based upon matching the physical soil properties and classifications actually measured or to be permitted for the unit with those identified in the users manual. Actual testing results were used for the sludge. The long-term average values of the mean monthly temperature and precipitation as well as the average length of the growing season for Springfield were obtained from the Illinois State Water Survey and used in the HELP analysis for greater accuracy.

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 CWLP FGDS Landfill
 100 year post-closure, l = 266
 9/1/94

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********************************************************************************

                              LAYER  1
                              --------

                      VERTICAL PERCOLATION LAYER
   THICKNESS                          =     36.00 INCHES
   POROSITY                           =       .5010 VOL/VOL
   FIELD CAPACITY                     =       .2837 VOL/VOL
   WILTING POINT                      =       .1353 VOL/VOL
   INITIAL SOIL WATER CONTENT         =       .2837 VOL/VOL
   SATURATED HYDRAULIC CONDUCTIVITY   =       .000570000000 CM/SEC


                              LAYER  2
                              --------

                         BARRIER SOIL LINER
   THICKNESS                          =     36.00 INCHES
   POROSITY                           =       .4300 VOL/VOL
   FIELD CAPACITY                     =       .3663 VOL/VOL
   WILTING POINT                      =       .2802 VOL/VOL
   INITIAL SOIL WATER CONTENT         =       .4300 VOL/VOL
   SATURATED HYDRAULIC CONDUCTIVITY   =       .000000010000 CM/SEC


                              LAYER  3
                              --------

                      VERTICAL PERCOLATION LAYER
   THICKNESS                          =    408.00 INCHES
   POROSITY                           =       .5379 VOL/VOL
   FIELD CAPACITY                     =       .4649 VOL/VOL
   WILTING POINT                      =       .1550 VOL/VOL
   INITIAL SOIL WATER CONTENT         =       .3350 VOL/VOL
   SATURATED HYDRAULIC CONDUCTIVITY   =       .000040000000 CM/SEC


                              LAYER  4
                              --------

                        LATERAL DRAINAGE LAYER
   THICKNESS                          =     12.00 INCHES
   POROSITY                           =       .4370 VOL/VOL
   FIELD CAPACITY                     =       .0624 VOL/VOL
   WILTING POINT                      =       .0245 VOL/VOL
   INITIAL SOIL WATER CONTENT         =       .3875 VOL/VOL
   SATURATED HYDRAULIC CONDUCTIVITY   =       .006500000000 CM/SEC
   SLOPE                              =      2.00 PERCENT
   DRAINAGE LENGTH                    =    266.0 FEET
```

LAYER 5

BARRIER SOIL LINER

THICKNESS	=	60.00 INCHES
POROSITY	=	.4300 VOL/VOL
FIELD CAPACITY	=	.3663 VOL/VOL
WILTING POINT	=	.2802 VOL/VOL
INITIAL SOIL WATER CONTENT	=	.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	.000000008000 CM/SEC

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER	=	81.48
TOTAL AREA OF COVER	=	927828. SQ FT
EVAPORATIVE ZONE DEPTH	=	20.00 INCHES
UPPER LIMIT VEG. STORAGE	=	10.0200 INCHES
INITIAL VEG. STORAGE	=	5.6740 INCHES
INITIAL SNOW WATER CONTENT	=	.0000 INCHES
INITIAL TOTAL WATER STORAGE IN SOIL AND WASTE LAYERS	=	192.8232 INCHES

SOIL WATER CONTENT INITIALIZED BY USER.

CLIMATOLOGICAL DATA

SYNTHETIC RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR ST. LOUIS MISSOURI

MAXIMUM LEAF AREA INDEX	= 2.00
START OF GROWING SEASON (JULIAN DATE)	= 105
END OF GROWING SEASON (JULIAN DATE)	= 288

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
24.20	28.70	40.80	53.20	63.50	72.90
76.50	73.70	67.30	55.60	42.90	29.70

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.38	1.85	3.27	3.63	3.45	3.39
	3.46	3.25	3.29	2.56	2.41	2.63
STD. DEVIATIONS	.88	1.08	1.53	1.53	1.75	1.84
	1.65	1.90	1.88	1.68	1.26	1.43
RUNOFF						
TOTALS	.153	.269	.438	.277	.200	.130
	.062	.061	.045	.053	.075	.128
STD. DEVIATIONS	.423	.698	.674	.656	.436	.308
	.160	.126	.107	.199	.310	.466

EVAPOTRANSPIRATION

TOTALS	.805	1.298	2.719	3.445	3.847	5.559
	4.811	3.190	2.694	1.908	1.310	.851
STD. DEVIATIONS	.216	.334	.511	.855	1.344	1.268
	1.734	1.725	1.350	.690	.372	.212

PERCOLATION FROM LAYER 2

TOTALS	.0175	.0166	.0186	.0180	.0185	.0169
	.0156	.0152	.0147	.0155	.0154	.0165
STD. DEVIATIONS	.0022	.0021	.0020	.0017	.0016	.0013
	.0007	.0004	.0004	.0009	.0014	.0018

LATERAL DRAINAGE FROM LAYER 4

TOTALS	.0434	.0393	.0428	.0411	.0421	.0404
	.0414	.0410	.0394	.0403	.0387	.0397
STD. DEVIATIONS	.0682	.0613	.0667	.0636	.0647	.0617
	.0627	.0616	.0586	.0596	.0567	.0575

PERCOLATION FROM LAYER 5

TOTALS	.0085	.0078	.0085	.0083	.0085	.0083
	.0085	.0085	.0083	.0085	.0083	.0085
STD. DEVIATIONS	.0002	.0002	.0002	.0002	.0002	.0002
	.0002	.0002	.0002	.0002	.0002	.0002

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)	PERCENT
PRECIPITATION	34.58 (5.618)	2673908.	100.00
RUNOFF	1.891 (1.959)	146194.	5.47
EVAPOTRANSPIRATION	32.437 (4.326)	2507960.	93.79
PERCOLATION FROM LAYER 2	.1990 (.0125)	15386.	.58
LATERAL DRAINAGE FROM LAYER 4	.4896 (.7429)	37856.	1.42
PERCOLATION FROM LAYER 5	.1006 (.0026)	7780.	.29
CHANGE IN WATER STORAGE	-.335 (2.930)	-25884.	-.97

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	4.32	334018.1
RUNOFF	2.796	216174.3
PERCOLATION FROM LAYER 2	.0007	52.8
HEAD ON LAYER 2	36.4	
LATERAL DRAINAGE FROM LAYER 4	.0138	1067.2
PERCOLATION FROM LAYER 5	.0003	24.7
HEAD ON LAYER 5	10.4	
SNOW WATER	3.56	275200.3
MAXIMUM VEG. SOIL WATER (VOL/VOL)	.5010	
MINIMUM VEG. SOIL WATER (VOL/VOL)	.1346	

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	15.86	.4406
2	15.48	.4300
3	101.41	.2486
4	.80	.0664
5	25.80	.4300
SNOW WATER	.00	

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CWLP FGDS Landfill
Pump Sizing
9/1/94

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LAYER 1

VERTICAL PERCOLATION LAYER

THICKNESS	=	60.00 INCHES
POROSITY	=	.5379 VOL/VOL
FIELD CAPACITY	=	.4649 VOL/VOL
WILTING POINT	=	.1550 VOL/VOL
INITIAL SOIL WATER CONTENT	=	.4649 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	.000040000000 CM/SEC

LAYER 2

LATERAL DRAINAGE LAYER

THICKNESS	=	12.00 INCHES
POROSITY	=	.4370 VOL/VOL
FIELD CAPACITY	=	.0624 VOL/VOL
WILTING POINT	=	.0245 VOL/VOL
INITIAL SOIL WATER CONTENT	=	.0624 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	.006500000000 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	232.0 FEET

LAYER 3

BARRIER SOIL LINER

THICKNESS	=	30.00 INCHES
POROSITY	=	.4300 VOL/VOL
FIELD CAPACITY	=	.3663 VOL/VOL
WILTING POINT	=	.2802 VOL/VOL
INITIAL SOIL WATER CONTENT	=	.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	.000000008000 CM/SEC

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER	=	90.00
TOTAL AREA OF COVER	=	315800. SQ FT
EVAPORATIVE ZONE DEPTH	=	20.00 INCHES
POTENTIAL RUNOFF FRACTION	=	.000000
UPPER LIMIT VEG. STORAGE	=	10.7580 INCHES
INITIAL VEG. STORAGE	=	7.4313 INCHES
INITIAL SNOW WATER CONTENT	=	.0000 INCHES
INITIAL TOTAL WATER STORAGE IN SOIL AND WASTE LAYERS	=	41.5428 INCHES

SOIL WATER CONTENT INITIALIZED BY PROGRAM.

CLIMATOLOGICAL DATA

SYNTHETIC RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR ST. LOUIS MISSOURI

MAXIMUM LEAF AREA INDEX = 2.00
START OF GROWING SEASON (JULIAN DATE) = 105
END OF GROWING SEASON (JULIAN DATE) = 288

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
24.20	28.70	40.80	53.20	63.50	72.90
76.50	73.70	67.30	55.60	42.90	29.70

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 25

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.08	1.74	3.27	3.76	3.70	3.46
	3.66	3.20	3.49	2.51	2.63	2.70
STD. DEVIATIONS	.72	1.01	1.49	1.42	1.41	2.07
	1.45	1.68	2.16	1.40	1.42	1.29
RUNOFF						
TOTALS	.000	.000	.000	.000	.000	.000
	.000	.000	.000	.000	.000	.000
STD. DEVIATIONS	.000	.000	.000	.000	.000	.000
	.000	.000	.000	.000	.000	.000
EVAPOTRANSPIRATION						
TOTALS	.856	1.278	2.674	3.554	4.064	4.374
	3.672	2.972	2.843	1.985	1.383	.850
STD. DEVIATIONS	.241	.304	.480	.869	.876	1.820
	1.621	1.634	1.333	.735	.348	.208
LATERAL DRAINAGE FROM LAYER 2						
TOTALS	.3627	.3396	.3903	.3886	.4094	.3960
	.4039	.3943	.3699	.3698	.3498	.3551
STD. DEVIATIONS	.1573	.1505	.1915	.1841	.1759	.1542
	.1506	.1489	.1444	.1496	.1460	.1539
PERCOLATION FROM LAYER 3						
TOTALS	.0106	.0098	.0111	.0108	.0111	.0106
	.0109	.0108	.0103	.0106	.0102	.0105
STD. DEVIATIONS	.0011	.0011	.0021	.0021	.0018	.0013
	.0010	.0008	.0008	.0009	.0008	.0009

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 25

	(INCHES)	(CU. FT.)	PERCENT
PRECIPITATION	35.20 (5.589)	926231.	100.00
RUNOFF	.000 (.000)	0.	.00
EVAPOTRANSPIRATION	30.506 (3.472)	802805.	86.67
LATERAL DRAINAGE FROM LAYER 2	4.5293 (1.7753)	119197.	12.87
PERCOLATION FROM LAYER 3	.1274 (.0134)	3351.	.36
CHANGE IN WATER STORAGE	.033 (2.959)	877.	.09

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 25

	(INCHES)	(CU. FT.)
PRECIPITATION	3.26	85792.3
RUNOFF	.000	.0
LATERAL DRAINAGE FROM LAYER 2	.0304	800.7
PERCOLATION FROM LAYER 3	.0006	17.1
HEAD ON LAYER 3	41.5	
SNOW WATER	2.34	61487.1
MAXIMUM VEG. SOIL WATER (VOL/VOL)	.4999	
MINIMUM VEG. SOIL WATER (VOL/VOL)	.1539	

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FINAL WATER STORAGE AT END OF YEAR 25

LAYER	(INCHES)	(VOL/VOL)
1	20.99	.3499
2	2.81	.2344
3	12.90	.4300
SNOW WATER	.96	

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****

Water Content Data Conversion and Porosity Calculation

Given:

1. Gravimetric water content information and bulk density information for flue gas desulfurization sludge (FGDS).

2.

$$\Theta = \frac{\rho_b}{\rho_w} x\ W$$

$\odot$ = Volumetric water content, %

W = Gravimetric water content, %

ρ_b = bulk density of FGDS, g/cc

ρ_w = density of water = 1 g/cc

Calculate:

Average FGDS bulk density, ρ_b = 1.291 g/cc

Average gravimetric field capacity water content, W_{fc} = 36.01%

Average gravimetric wilting point water content, W_{wp} = 12.01%

Average volumetric field capacity water content, $\odot_{fc}$ =

$$\Theta_{fc} = \frac{1.291}{1} x\ 36.01 = 46.49\%$$

Average volumetric wilting point water content, $\odot_{wp}$ =

$$\Theta_{wp} = \frac{1.291}{1} x\ 12.01 = 15.50\%$$

Given:

1. Average bulk density information from above.

2.

$$n = 1 - \left(\frac{\rho_b}{\rho_p}\right) x\ 100$$

n = porosity, %

ρ_b = bulk density of FGDS = 1.291 g/cc

ρ_p = particle density of FGDS = 2.794 g/cc

Calculate:

Porosity, n =

$$n = 1 - \frac{1.291}{2.794} x\ 100 = 53.79\ \%$$

-

AE EXPLORATION CORPORATION
2813 N. Dirksen Parkway
Springfield, IL 62702

PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CWLP DATE: 8-18-93

CLIENT: Andrews Environmental Engineering, Inc. PROJECT NO: I9-3184-2
REPORT NO: 2

SAMPLE IDENTIFICATION: LP3 DEPTH/ELEV: 33-35'

CLASSIFICATION: Scrubber sludge USDA:

DESCRIPTION: White silt, trace clay, trace sand

SOIL PARTICLE SIZES: DIVISION BETWEEN SILT & CLAY FRACTIONS IS 0.002 mm.
GRAVEL% SAND% 3.96 SILT% 86.34 CLAY% 9.7

NATURAL MOISTURE%: DENSITY: NATURAL:
LIQUID LIMIT: MAX. DRY: REMOLDED:
PLASTICITY INDEX: PROCTOR:
PERMEABILITY (k), CM/SEC: 4.42×10^{-5}

PERMEABILITY TEST DETAILS

TYPE OF SAMPLE:
SPECIMEN DATA
DIAMETER; cm: 5.08
LENGTH; cm: 6.8453
AREA; cm2: 20.2683
VOLUME; cm3: 138.74
VOID RATIO: 0.96416
TEST APPARATUS: GEOTEST (cell #1)

INITIAL WEIGHT; pcf: 111.53
DRY UNIT WEIGHT; pfc: 82.60
INITIAL % H_20: 35.02
FINAL % H_2O:
FLOW ORIENTATION: V

TEST PRESSURES

SATURATION:
CELL PRESSURE; psi: 30
BACK PRESSURE; psi: 36
TIME/HRS.: 14

CONSOLIDATION:
CELL PRESSURE; 30
BACK PRESSURE; 36
TIME/HRS.: 12

PERMEABILTY:
HYDRAULIC GRADIENT: 10.27 DRIVING PSI: 1 CM H_20 70.29
PERMEANT LIQUID: 0.005 N CaS04
FLOW THRU SPECIMEN: 18.215 ml
TEMPERATURE CORRECTION: TEMPERATURE 24 FACTOR .910
TIME/HRS: .5

AE EXPLORATION CORPORATION
2813 N. Dirksen Parkway
Springfield, IL 62702

PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CWLP DATE: 8-18-93

CLIENT: Andrews Environmental Engineering, Inc. PROJECT NO: I9-3184-2
REPORT NO: 1

SAMPLE IDENTIFICATION: LP3 DEPTH/ELEV: 33-35'

CLASSIFICATION: Scrubber sludge USDA:

DESCRIPTION: White silt, trace clay, trace sand

SOIL PARTICLE SIZES: DIVISION BETWEEN SILT & CLAY FRACTIONS IS 0.002 mm.
GRAVEL% SAND% 3.96 SILT% 86.34 CLAY% 9.7

NATURAL MOISTURE%: DENSITY: NATURAL: 82.60
LIQUID LIMIT: MAX. DRY: REMOLDED:
PLASTICITY INDEX: PROCTOR:
PERMEABILITY (k), CM/SEC: 3.37×10^{-5}

PERMEABILITY TEST DETAILS

TYPE OF SAMPLE:
SPECIMEN DATA

DIAMETER; cm:	5.080	INITIAL WEIGHT; pcf:	111.53
LENGTH; cm:	6.8453	DRY UNIT WEIGHT; pfc:	82.60
AREA; cm2:	20.2683	INITIAL % H_20:	35.02
VOLUME; cm3:	138.74	FINAL % H_2O:	
VOID RATIO:	0.96416	FLOW ORIENTATION:	V

TEST APPARATUS: BRAINARD KILMAN (cell #5)

TEST PRESSURES

SATURATION:	CONSOLIDATION:
CELL PRESSURE; psi: 35	CELL PRESSURE; 95
BACK PRESSURE; psi: 30	BACK PRESSURE; 30
TIME/HRS.: 40	TIME/HRS.: 32

PERMEABILTY:
HYDRAULIC GRADIENT: 51.34 DRIVING PSI: 5 CM H_20 351.45
PERMEANT LIQUID: 0.005 N CaS04
FLOW THRU SPECIMEN: 8.05 ml
TEMPERATURE CORRECTION: TEMPERATURE 26.0 FACTOR 0.869
TIME/HRS: 0.05

NOTE: All pressures were set according to client's specification.

AE EXPLORATION CORP. 2813 North Dirksen Pkwy., Springfield, Illinois 62702 / (217) 525-6023
FAX: (217) 525-6025

MEMO

To: Mike McDermont

From: Kim Pagliai

Date: Monday, August 29, 1994

Subject: CWLP (Scrubber Sludge)

Very light brown silt.

Specific gravity = 2.794

Andrew Environmental Engineering, Springfield, IL
Core Data, 7-29-93, FWS

BULK DENSITY (POROSITY)

ID, Depth (ft)	Sample Depth,ft	Core Lgth,cm	Volume cm3	MC	Dry wt,g	Db g/cc
CWLP, LP-3, 17.7-19.7	18.50	7.62	407.83	55.05	563.10	1.25
CWLP, LP-3, 19.7-21.7	20.50	8.26	441.82	53.84	654.50	1.36
CWLP, LP-3, 21.7-29.7	26.50	8.26	441.82	53.65	595.40	1.23

GRAVIMETRIC MOISTURE (FIELD MOISTURE)

ID, Depth (ft)	Sample Depth,ft	MC	Wet wt,g	Dry wt,g	% Moist	Avg % Moist
CWLP, LP-3, 17.7-19.7	18	37.87	102.88	88.72	27.85	27.84
		37.96	114.67	97.97	27.83	
		38.53	121.88	103.73	27.84	
CWLP, LP-3, 19.7-21.7	20	37.94	134.17	107.93	37.49	35.69
		37.94	128.93	105.19	35.30	
		38.22	104.77	87.78	34.28	
CWLP, LP-3, 21.7-29.7	28	37.73	132.86	101.26	49.74	50.32
		37.99	131.98	100.69	49.90	
		38.62	139.13	105.04	51.32	

1/3 BAR ATMOSPHERE (FIELD CAPACITY)

ID, Depth (ft)	Depth,ft	MC	Wet wt,g	Dry wt,g	% Moist	Avg % Moist
CWLP, LP-3, 17.7-19.7	18	37.87	75.36	64.13	42.76	42.45
		37.96	65.37	57.41	40.93	
		38.53	79.36	66.95	43.67	
CWLP, LP-3, 19.7-21.7	20	37.94	74.86	65.61	33.43	32.18
		37.94	67.80	60.49	32.42	
		38.22	72.15	64.18	30.70	
CWLP, LP-3, 21.7-29.7	25.5	37.73	77.42	67.27	34.36	33.39
		37.99	84.22	73.30	30.93	
		38.62	72.60	63.81	34.89	

15.0 BAR ATMOSPHERE (WILTING POINT)

ID, Depth (ft)	Depth,ft	MC	Wet wt,g	Dry wt,g	% Moist	Avg % Moist
CWLP, LP-3, 17.7-19.7	18	37.87	59.52	57.90	8.09	7.94
		37.96	67.12	64.98	7.92	
		38.53	69.12	66.90	7.83	
CWLP, LP-3, 19.7-21.7	20	37.94	79.76	75.67	10.84	13.50
		37.94	70.82	67.20	12.37	
		38.22	66.12	62.01	17.28	
CWLP, LP-3, 21.7-29.7	25.5	37.73	80.69	74.98	15.33	14.60
		37.99	79.88	74.86	13.62	
		38.62	73.04	68.59	14.85	

WATER RETENTION

ID, Depth (ft)	% Moist @ 1/3 B	% Moist @ 15 B	Wat Ret % Moist
CWLP, LP-3, 17.7-19.7	42.45	7.94	34.51
CWLP, LP-3, 19.7-21.7	32.18	13.50	18.69
CWLP, LP-3, 21.7-29.7	33.39	14.60	18.80

APPENDIX D

Leachate Drainage and Collection System Calculations

Groundwater Infiltration Through Liner

Since the floor liner and part of the sidewalls will potentially be located within the zone of saturation, an estimate of the groundwater infiltration rate into the landfill was calculated.

Given:

1. The floor liner area is approximately 772,570 ft^2. The length of sidewall liner is approximately 3,830 ft. (1112 ft. on the west side).

2. Based upon the liner top elevations shown on the Developmental Drawings and the groundwater elevations reported in the Report of Hydrogeological Investigation, the top of the floor liner is an average of about 1.0 foot lower than the seasonal high groundwater level.

3. The compacted earth liner is a minimum 5 feet thick. The sidewall liner is a minimum of 5 feet thick.

4. The maximum hydraulic conductivity allowable for liner construction is 1 x 10^{-7} cm/sec.

For infiltration through floor liner:

Assume:

1. A 5-foot thick compacted earthen liner with a hydraulic conductivity of 1 x 10^{-7} cm/sec (2.83 x 10^{-4} ft/day).

Solution:

$$Q_{floor} = A\ K \frac{dh}{dl}$$

Where:

Q	= Flow through floor liner, ft^3/day
A	= Area, ft^2
K	= Hydraulic Conductivity, ft/day
$\frac{dh}{dl}$	= Hydraulic Gradient, ft/ft

$$Q = (772{,}570)\ (2.83 \times 10^{-4})\ \frac{(1.0)}{5}$$

$$= 43.7\ ft^3/day = 15{,}950.5\ ft^3/yr$$

For infiltration through sidewall liner (except west side):

Assume:

1. A 2H:1V 5-foot thick compacted earthen liner with a hydraulic conductivity of 1 x 10^{-7} cm/sec (2.83 x 10^{-4} ft/day).
2. The average inward hydraulic pressure is used to calculate the hydraulic gradient. The average hydraulic gradient is one-half the maximum hydraulic gradient.

Solution:

$$Q_{sidewall} = AK\ \frac{dh}{dl}$$

$$Q = (2718)\ (1.0)\ (\sqrt{5})\ (2.83 \times 10^{-4})\ \frac{1}{2}\ \frac{1}{5}$$

$$= 0.17\ ft^3/day = 62.8\ ft^3/yr$$

For infiltration through west sidewall liner:

Assume:

1. A 2H:1V 5-foot thick compacted earthen liner with a hydraulic conductivity of 1 x 10^{-7} cm/sec (2.83 x 10^{-4} ft/day).
2. The average inward hydraulic pressure is used to calculate the hydraulic gradient. The average hydraulic gradient is two thirds the maximum hydraulic gradient. Due to the ash pond, the water level on the west is about 15 feet above the average top of the bottom liner elevation.

Solution:

$$Q_{west} = AK \frac{dh}{dl}$$

$$Q = (1112)\ (\sqrt{5})\ (15)\ (2.83 \times 10^{-4})\ \frac{1}{2}\ \frac{(15)}{5}$$

$$= 15.8\ ft^3/day = 5779.0\ ft^3/yr$$

$$Q = Q_{floor} + Q_{sidewall} + Q_{west} = 59.7\ ft^3/day = 21779.5\ ft^3/yr$$

These values are in comparison to 1067.2 ft^3/day and 37,856 ft^3/yr predicted by the "HELP" Model. Therefore, the contribution of groundwater infiltration to leachate generation is significant. The total leachate generation rate will be assumed to be the rate predicted by HELP plus the calculated groundwater infiltration rate, 1126.9 ft^3/day, and 59,635 ft^3/year.

Laminar Flow Determination for Sand Drainage Layer

GIVEN:

1. Definition of Reynolds Number, **R**:

   $\mathbf{R} = \rho v d/\mu$ (1)

   ρ = fluid density (g/cm^3)

   d = mean grain diameter (cm)

   μ = absolute viscosity (g/(cm-sec))

   v = specific discharge (cm/sec) = K (dh/dl) (2)

   K = hydraulic conductivity (cm/sec)

   dh/dl = hydraulic gradient (drainage slope, dimensionless)

   Combining Equations 1 and 2 gives

   $\mathbf{R} = \rho [K(dh/dl)] d/\mu$

   For $\mathbf{R} < 1$, flow is laminar

2. dh/dl for Transverse flow = 2% = 0.02

Assumptions:

1. Darcy's Law is valid. This assumption will be correct if flow is laminar.

2. Sand used will have a hydraulic conductivity, $K = 6.5 \times 10^{-3}$ cm/sec or greater. However, assume a value of 1.0×10^{-2} cm/sec for K to be conservative.

3. Let d = 4 mm (0.4 cm)

4. Leachate possesses the same density and viscosity values as water. These values will change with temperature. With this assumption and choosing an arbitrary temperature range of 40°F to 100°F (leachate temperature will be assumed to fall in this range):

at 40°F (4° C): $\rho = 1.000\ g/cm^3$, $\mu = 1.568 \times 10^{-2}\ g/(cm\text{-}sec)$

at 100°F (38° C): $\rho = 0.993\ g/cm^3$, $\mu = 6.791 \times 10^{-3}\ g/(cm\text{-}sec)$

(From Unit Operations and Processes in Environmental Engineering)

Calculations:

$K = 1 \times 10^{-2}$ cm/sec

$dh/dl = .02$

$\rho = 1.000\ g/cm^3$ at 40°F and $0.993\ g/cm^3$ at 100°F

$\mu = 1.568 \times 10^{-2}\ g/(cm\text{-}sec)$ at 40°F and $6.791 \times 10^{-3}\ g/(cm\text{-}sec)$ at 100°F

$d = 0.4$ cm

Plugging above values into the Reynolds Number Equation:

$\mathbf{R} = \rho[K(dh/dl)]\ d/\mu$

For Transverse Flow

At 40°F, $\mathbf{R} = (1.000)\ [(1 \times 10^{-2})\ (0.02)](0.4)/(1.568 \times 10^{-2})$

$\mathbf{R} = .005$ at 40°F

At 100°F, $\mathbf{R} = (0.993)[(1 \times 10^{-2})(0.02)](0.4)/(6.791 \times 10^{-3})$

$\mathbf{R} = .012$ at 100°F

Since all values are less than 1, Darcy's Law is valid and flow is laminar for the assumed temperature range. Thus, flow in the drainage layer to the leachate collection pipes is laminar.

References

Freeze, R. Allan and Cherry, John A., Groundwater. Prentice Hall, Englewood Cliffs, 6N.J., 1979, pp. 70-74.

Reynolds, Tom D., Unit Operations and Processes in Environmental Engineering. PWS, Belmont, CA, 1982, p. 545.

Laminar Flow Determination for Geonet Drainage Layer

GIVEN:

1. Definition of Reynolds Number, **R**:

   $\mathbf{R} = \rho v d/\mu$

   ρ = fluid density (g/cm^3)

   d = characteristic length (cm)

   μ = absolute viscosity (g/(cm-sec))

   v = characteristic velocity (cm/sec)

2. The HELP analysis for pump sizing located in Appendix 1 of this Attachment

3. The longest horizontal projection of the landfill sidewall from the top of the sidewall liner to the toe of the sidewall is 50.3 ft.

4. One layer of geonet is composed of two layers of flow channels. Each channel measures approximately 0.80 cm wide by 0.25 cm deep.

Assumptions:

1. Flow through a geonet channel can be considered to be open channel flow. Open channel flow is laminar if $\mathbf{R} < 500$.

2. The geonet is installed such that one layer of channels is aligned directly up and down the sideslope.

3. The landfill is uncovered with only five feet of waste placed on the geonet.

4. The leachate flow into the geonet is equal to the average annual total precipitation minus the average annual total evapotranspiration.

5. Leachate possesses the same density and viscosity values as water. These values will change with temperature. With this assumption and choosing an arbitrary temperature range of 40°F to 100°F (leachate temperature will be assumed to fall in this range):

   at 40°F (4° C): $\rho = 1.000\ g/cm^3$, $\mu = 1.568 \times 10^{-2}\ g/(cm\text{-}sec)$
   at 100°F (38° C): $\rho = 0.993\ g/cm^3$, $\mu = 6.791 \times 10^{-3}\ g/(cm\text{-}sec)$
   (From Unit Operations and Processes in Environmental Engineering)

Calculations:

The maximum horizontally projected area of one geonet channel, $A_{channel}$ will be 50.3 ft by 0.80 cm.

$A_{channel} = (50.3\ ft)\ (0.80\ cm)\ (3.28\ ft/100\ cm) = 1.32\ ft^2$

The average annual leachate flow for the largest uncovered Cell (315,800 ft^2) equals precipitation minus evaportranspiration (from the HELP analysis):

$Q_{Cell} = P\text{-}ET$

$Q_{Cell} = 926{,}231\ ft^3/yr - 802{,}805\ ft^3/yr = 123{,}426\ ft^3/yr$

The average annual leachate flow to one geonet channel:

$Q_{geo} = Q_{Cell}\ (A_{channel}/A_{Cell})$

$Q_{geo} = 123{,}426\ ft^3/yr\ (1.32\ ft^2/315{,}800\ ft^2) = 0.52\ ft^3/yr$

The velocity of leachate flow through a geonet channel equals:

$v_{geo} = Q_{geo}/A_{geo}$

Where

A_{geo} = cross sectional area of one geonet channel

$A_{geo} = 0.80\ cm \times 0.25\ cm = 2.15 \times 10^{-4}\ ft^2$

$v_{geo} = (0.52\ ft^3/yr/2.15 \times 10^{-4}\ ft^2) = 2{,}419\ ft/yr = 2.34 \times 10^{-3}\ cm/sec$

Calculate Reynolds Number, **R**:

$\mathbf{R} = \rho v_{geo} d/\mu$

Where $d = 4R$

At 100°F, $\mathbf{R} = (0.993)\ (2.34 \times 10^{-3})\ (0.62) / 6.791 \times 10^{-3} = 0.212$

At 40°F, $\mathbf{R} = (1.000)\ (2.34 \times 10^{-3})\ (0.62) / 1.568 \times 10^{-2} = 0.093$

Since both values are much less than 500, flow is laminar for the assumed temperature range. Thus, flow in the geonet drainage layer is laminar.

References

"Drainage Products", Geotechnical Fabrics Report, December 1992, p. 163.

Koerner, Robert M., Designing with Geosynthetics, 2nd ed., Prentice Hall, Englewood Cliffs, N.J., 1990, p. 339.

Reynolds, Tom D., Unit Operations and Processes in Environmental Engineering, PWS, Belmont, C.A., 1982, p. 545.

Streeter, Victor L, Fluid Mechanics 8th ed., Mc Graw-Hill, New York, N.Y., 1985, pp. 186-187.

Laminar Flow Determination for Geotextile Drainage Layer

GIVEN:

1. Definition of Reynolds Number, **R**:

   $\mathbf{R} = \rho v d/\mu$ (1)

   ρ = fluid density (g/cm^3)

   d = mean grain diameter (cm)

   μ = absolute viscosity (g/(cm-sec))

   v = specific discharge (cm/sec) = K (dh/dl) (2)

   K = hydraulic conductivity (cm/sec) = T/b (3)

   dh/dl = hydraulic gradient (drainage slope, dimensionless)

   T = transmissivity (cm^2/sec)

   b = thickness of geotextile layer under load (cm)

   Combining Equations 1, 2, and 3 gives

   $\mathbf{R} = \rho [T(dh/dl)] d/\mu b$

2. dh/dl for 2.1H:1V sidewall flow = 0.476 (worst case assumed).

Assumptions:

1. Darcy's Law is valid. This assumption will be correct if flow is laminar. In porous media, flow is laminar if $\mathbf{R} < 1$.

2. Per a conversation with an employee of Gundle Lining Systems, Inc., the recommended geotextile weight for this application is 6 or 8 oz. Since lighter weight geotextiles are more transmissive, a laminar flow determination will be conservative for 8 oz geotextile if parameters for 6 oz geotextile are used. The transmissivity and thickness of a 6 oz. geotextile under load are approximately 0.123 cm^2/sec and 0.08 cm, respectively.

3. The average geotextile filament diameter is analogous to the mean grain diameter. Per a conversation with a member of the Technical Division of Polyfelt Americas, a geotextile manufacturer, an average geotextile filament diameter, d, is 0.003 cm.

4. Leachate possesses the same density and viscosity values as water. These values will change with temperature. With this assumption and choosing an arbitrary temperature range of 40°F to 100°F (leachate temperature will be assumed to fall in this range):

   at 40°F (4° C): $\rho = 1.000$ g/cm^3, $\mu = 1.568 \times 10^{-2}$ g/(cm-sec)
   at 100°F (38° C): $\rho = 0.993$ g/cm^3, $\mu = 6.791 \times 10^{-3}$ g/(cm-sec)
   (From Unit Operations and Processes in Environmental Engineering)

Calculations:

$T = 0.123$ cm^2/sec
$b = 0.08$
$dh/dl = 0.476$
$\rho = 1.000$ g/cm^3 at 40°F and 0.993 g/cm^3 at 100°F
$\mu = 1.568 \times 10^{-2}$ g/(cm-sec) at 40°F and 6.791×10^{-3} g/(cm-sec) at 100°F
$d = 0.003$ cm

Plugging above values into the Reynolds Number Equation:

$\mathbf{R} = \rho[T(dh/dl)]\, d/\mu\, b$
At 40°F, $\mathbf{R} = (1.000)\,[(0.123)\,(0.476)](0.003)/(1.568 \times 10^{-2})(0.08)$
$\mathbf{R} = 0.140$ at 40°F

At 100°F, $\mathbf{R} = (0.993)[(0.123)(0.476)](0.003)/(6.791 \times 10^{-3})(0.08)$
$\mathbf{R} = 0.321$ at 100°F

Since all values are less than 1, Darcy's Law is valid and flow is laminar for the assumed temperature range. Thus, flow in the geotextile layer is laminar.

References

Freeze, R. Allan and Cherry, John A., Groundwater. Prentice Hall, Englewood Cliffs, 6N.J., 1979, pp. 59, 70-74.

Reynolds, Tom D., Unit Operations and Processes in Environmental Engineering. PWS, Belmont, CA, 1982, p. 545.

Personal Conversations with members of the Technical Division of Polyfelt Americas - a geotextiles manufacturer.

Personal Conversations with employees of Gundle Lining Systems, Inc. - geotextile/geonet composite manufacturer.

Leachate Collection Piping Capacity Calculations

Given:

1. The collection system piping will be constructed of smooth walled HDPE Standard Dimension Ratio (SDR) 21 - 6 inch diameter pipe or equivalent.

2. The minimum slope the piping will be placed is 0.5%

3. Manning's Equation for flow in pipe is:

$$Q = \frac{1.49}{n} AR_h^{2/3} S^{1/2}$$

Where = Q = flow (cfs)
A = area of flow (ft^2)
R_h = hydraulic radius (ft)
S = slope (ft/ft)
n = Manning's roughness coefficient

4. Typical value of Manning's coefficient for smooth walled plastic pipes is 0.015.

Assume:

The maximum amount of flow will use only the area of the pipe below the collection holes. The geometry will be a circular segment with x = 120° (the angle betwen holes) and d = 5.995 inches (average inside diameter of pipe). The resulting area and wetted perimeter are:

A = 0.038 ft^2
Wp = 0.523 ft

Calculations:

R_h = A/Wp = 0.038 ft^2/0.523 ft = 0.073 ft
S = 0.005
n = 0.015

$$Q = \frac{1.49}{0.015} (0.038) (0.073)^{⅔} (0.005)^{½}$$

$$= .046 \text{ cfs}$$

Q = 4,027.67 ft^3/d = 30,127 gpd

(vs the design peak leachate generation rate of 1126.9 ft^3/d = 8,429.2 gpd for the uncovered cell)

Leachate Collection System Piping Strength Calculations

Given:

1. Driscopipe System Design manual

2. The collection system piping will be constructed of smooth walled HDPE, SDR 21, 6 inch diameter pipe or equivalent.

3. The 3 design criteria of buried HDPE are:

   a). Wall crushing
   b). Wall buckling
   c). Ring deflection

Assume:

1. The depth of burden over the HDPE pipe is 76.5 feet. This is the maximum depth of refuse and soil that exists .

Calculations:

1. Calculate Total External Pressure, P_T

$$P_T = P_s + P_L$$

Where:

P_s = Total "static load" pressure from overburden

P_L = Total "live load" pressure due to equipment

a). Total Static Load Pressure Determination

The static pressure is the density of the material times the depth of material.

$$P_s = \gamma_{veg} H_{veg} + \gamma_{clay} H_{clay} + \gamma_{refuse} H_{refuse} + \gamma_{sand} H_{sand} + \gamma_{gravel} H_{gravel}$$

Where:

γ = Density of material (lb/ft^3)
H = Height (Z direction) of material

The following densities and heights were used:

Vegetative layer	:	γ = 115 lb/ft^3	H = 3ft
Clay cap	:	γ = 126 lb/ft^3	H = 3ft
Refuse	:	γ = 111.6 lb/ft^3	H = 69ft
Sand drainage layer	:	γ = 115 lb/ft^3	H = 1.0ft
Gravel on top of pipe	:	γ = 130 lb/ft^3	H = 0.5ft

Therefore, the total static pressure, P_s = (115) (3) + (126) (3) + (111.6) (69) + (115) (1.0) + (130) (0.5) = 8,603 lb/ft^2

= 59.75 psi

P_s = 59.75 psi

b). Determine Live Load Pressure

Live load pressure can be calculated by the equation:

$$P_L = \frac{3\,WZ^3}{2\pi R^5}$$

Where:

W = 1.5 times the superimposed live load, pounds.

Z = Vertical distance from the point of load to the top of the pipe, feet.

R = Straight line distance from point of load to the top of the pipe, feet.

R = $(X^2 + Y^2 + Z^2)^{0.5}$

X, Y = Horizontal distances at 90° to each other from point of load to the top of the pipe, feet.

To calculate the live load, the weight of a Caterpillar 825C compactor is assumed. It's weight is 71,430 pounds.

W = (71,430) (1.5) = 107,145 lbs
Z = 76.5 ft
R = 76.5 ft (Assume X = Y = 0, for worst case scenario)

$$P_L = \frac{3\,(107{,}145\text{ lb})\,(76.5\text{ ft})^3}{2\pi\,(76.5\text{ ft})^5}\,\frac{(1\text{ ft}^2)}{(144\text{ in}^2)} = .06\text{ psi}$$

Therefore, $P_T = P_s + P_L$ = 59.75 psi + .06 psi = 59.8 psi

Steps to Design by Wall Buckling

1. Calculate or estimate the total external soil pressure, P_T, at the top of the pipe.

2. Calculate the stress "S_A" in the pipe wall according to the formula:

$$S_A = \frac{(SDR-1)\ P_T}{2}$$

3. Based upon the stress "S_A" and the estimated time duration of non-pressurization, use Chart 25 on page 37 of the Driscopipe manual to find the value of the pipe's modulus of elasticity, E, in psi.

For a use time of 50 years and S_A = 598.0 psi
E = 17,000 psi

4. Based upon the pipe SDR and the value of the polyethylene modulus of elasticity, E, calculate the pipe's hydrostatic, critical-collapse differential pressure, P_C:

$$P_C = \frac{2.32\ (17{,}000\ psi)}{(21)^3} = 4.26\ psi$$

5. Using a coarse-grain bedding material with a 70% relative density (95% Proctor), the Soil Modulus, E', is 3000 psi (Table on P. 36).

6. Calculate the critical buckling pressure at the top of the pipe by the formula: $P_{CB} = (.8)\ [(E')\ (P_C)]^{0.5}$

$$P_{CB} = (0.8)\ [(3{,}000\ psi)\ (4.26\ psi)]^{0.5}$$
$$P_{CB} = 90.4\ psi$$

7. Calculate the Factor of Safety: $F.S. = P_{CB}/P_T$

In burial applications, a safety factor of 1.0 may be considered a minimum because of the margin of safety provided by the arching action of the soil.

$$F.S. = P_{CB}/P_T = \frac{90.4}{59.8} = 1.51 > 1.0$$ **OK**

Design by Ring Deflection

1. Examine wall buckling of the pipe-soil system. By assuming the critical -buckling pressure, P_{CB}, equals the pressure at the top of the pipe, P_T and by using the critical pressure, P_C, the basic soil modulus, E', required to resist buckling can be calculated by rearranging the equation in #6 above:

$$E' = \frac{(P_{CB})^2}{(.64)\ (P_C)}$$

If the thickness of the combined gravel, sand, and refuse totalled only 5 feet, the live load (14.2 psi) would dominate over the static load (0.8 psi). Since this combined total (15.0 psi) is less than the loads that exist at final conditions (59.8 psi), this load that exists after all filling is completed will be used.

Design by Wall Crushing:

Calculate the actual compressive stress on the pipe from the equation:

$$S_A = \frac{(SDR-1)\ P_T}{2}$$

Where:

S_A = Actual Compressive Stress, psi
SDR = Standard Dimension Ratio
P_T = External Pressure, psi

P_T = 59.8 psi
SDR = 21

$$S_A = \frac{(21-1)\ (59.8\ psi)}{2} = 598.0\ psi$$

Calculate the Factor of Safety

$$F.S. = \frac{1500\ psi^*}{S_A} = \frac{1500\ psi}{598.0\ psi} = 2.5 > 2$$ **OK**

* 1500 psi is the Compressive Yield Strength of Driscopipe

Design by Wall Buckling:

Note: Wall buckling can occur if the total external pressure, P_T, is allowed to exceed the pipe - soil system's critical buckling pressure, P_{CB}

$$P_{CB} = (0.8)\ [(E')\ (P_C)]^{0.5}$$

Where:

E' = Soil modulus in psi calculated as the ratio of the vertical soil pressure to vertical soil strain at a specified density

P_C = Hydrostatic, critical - collapse differential pressure, psi

$$P_C = \frac{2.32\ (E)}{(SDR)^3}$$ (for Driscopipe)

E = Stress and time dependent tensile modulus of elasticity of the pipe, psi

Using the values as before:

$P_{CB} = P_T = 59.8$ psi
$P_C = 4.26$ psi
$E' = \frac{(59.8 \text{ psi})^2}{.64\ (4.26 \text{ psi})} = 1311.6$ psi

2. To safeguard against wall buckling, multiply E' by a reasonable factor of safety (F.S.) equal to or greater than 2.0.

$E'_{min} = (E')\ (F.S.)$
$E'_{min} = (1311.6 \text{ psi})\ (2.0) = 2{,}623$ psi

However, E' (from table on p. 36) > E'_{min} since 3000 psi > 2,623 psi, thus, we use the actual E' of the gravel.

3. Calculate pipe deflection based upon the principle that its deflection will be the same as the backfill surrounding the pipe under the influence of the overburden pressure at the top of the pipe:

$$\% \text{ Soil Strain} = s = \frac{P_T}{E'} \times 100$$

$$\% \text{ Soil Strain} = \frac{59.8 \text{ psi}}{3000 \text{ psi}} \times 100 = 1.99\%$$

Hence, Ring Deflection = 1.99%

4. Examine allowable Ring Deflection for the specific SDR under consideration to insure the pipe deflection is less than the allowable deflection for that SDR. (See Chart 27).

From Chart 27 of the Driscopipe Systems Manual (p 38) the allowable ring deflection is 5.2%.

Therefore, the SDR 21 is okay, since 1.99% < 5.2%

Since the Wall Crushing, Wall Buckling, and Ring Deflection criteria have all been met, pipe with an SDR of 21 or equivalent will be used.

Leachate Collection Manhole Strength Calculations

High density polyethylene manholes must be designed to support axial loads encountered due to the settlement of waste materials and radial loads due to active earth pressures. The following methodology comes from a draft copy of a proposed ASTM standard for the design of HDPE manholes. Calculations are performed for SDR 21, 48 in. diameter solid HDPE pipe.

Assumptions:

1. The manhole will be subject to the loads created by a fill depth of approximately 76.5 ft with an average density (including cover materials) of 112.8 pcf.

2. The following physical characteristics are typical for HDPE:

Allowable Strain:	0.05
Stress Relaxation Modulus:	35,000 psi
Poisson's Ratio:	0.45

3. The internal angle of friction for scrubber sludge is 34°.

4. The coefficient of friction between scrubber sludge and HDPE is 0.4. The draft ASTM standard suggests a coefficient of friction of 0.4 for a granular soil, and since the scrubber sludge is a cohesionless material, this assumption is conservative.

5. The following dimensions are associated with 48 in. diameter SDR 21 HDPE pipe:

Inside Diameter:	42.744 in.	3.56 ft
Outside Diameter:	47.244 in.	3.94 ft
Wall Thickness:	2.250 in.	0.188 ft
Weight:		135.42 lb/ft

Calculations:

1. Calculate the radial pressure (P_{R2}) at the base of the manhole and the Downdrag (P_D) due to the weight of fill material.

   Radial Pressure:

$$P_{R2} = (1.21)\ K_A \cdot \gamma \cdot H$$

where:

K_A	=	Active Earth Pressure Coefficient
γ	=	Soil Unit Weight
H	=	Height of Fill

and:

$$K_A = \tan^2 (45 - \frac{\phi}{2})$$

where: ϕ = Angle of Internal Friction.

Therefore:

$$K_A = \tan^2 (45 - 34/2) = 0.283$$

and:

$$P_{R2} = (1.21)(0.283)(76.5 \text{ ft})(112.8 \text{ lb/ft}^3)$$

$$= 2960 \text{ lb/ft}^2$$

Downdrag:

$$P_D = \pi \cdot \tau_A \cdot D_M \cdot H$$

where:
τ_A = Average Shear Stress
D_M = Mean Diameter of Manhole
H = Height of Fill

and:

$$\tau_A = \mu \cdot \left[\frac{(P_{R1} + P_{R2})}{2}\right]$$

where:
μ = Coefficient of Friction
P_{R1} = Radial Pressure at Top of Manhole
P_{R2} = Radial Pressure at Bottom of Manhole.

Therefore:

$$\tau_A = (0.4)(2960/2) = 592 \text{ lb/ft}^2$$

and

$$P_D = \pi (592 \text{ lb/ft}^2)(3.75 \text{ ft})(76.5 \text{ ft})$$

$$= 533{,}540 \text{ lb}$$

2. Design the manhole with respect to radial pressure by calculating the total compressive strain which is the sum of the strains due to ring compression (ϵ_T) and ring bending (ϵ_B). The combined strain (ϵ_C) should be less than 0.05, the allowable strain for HDPE.

Ring Compressive Strain:

$$\epsilon_T = \left[\frac{N_T}{(E \cdot A_S)}\right]$$

where:
- N_T = Ring Thrust
- E = Stress Relaxation Modulus
- A_S = Wall Thickness

and:

$$N_T = P_R \cdot R_M$$

where:
- P_R = Radial Pressure
- R_M = Mean Radius of Manhole.

Therefore:

$$N_T = (2960 \text{ lb/ft}^2)(1.88 \text{ ft}) = 5565 \text{ lb/ft}$$

and:

$$\epsilon_T = (5565 \text{ lb/ft}) \; / \; (35{,}000 \text{ psi} \cdot 144 \text{ in}^2/\text{ft}^2 \cdot 0.188 \text{ ft})$$

$$= 0.0059$$

Ring Bending Strain:

$$\epsilon_B = \left[\frac{M_E}{(E \cdot S_X)}\right]$$

where:
- M_E = Bending Moment
- E = Stress Relaxation Modulus
- S_X = Section Modulus (I/c)
- I = Moment of Inertia of pipe cross section
  = $\pi d^3 t/8 = 3.89 \text{ ft}^4$
- c = Location of Centroid
  = $d/2 = 1.97$ ft

and:

$$M_E = e \cdot N_T \cdot (0.5)$$

where: e = Eccentricity Factor
N_T = Ring Thrust

and:

$$e = \mu \cdot (\frac{D_M}{2})$$

where: μ = Ovality Correction Factor (0.02)
D_M = Mean Diameter of Manhole.

Therefore:

$e = (0.02) \cdot (3.75 \text{ ft} / 2) = 0.0375 \text{ ft}$

$M_E = (0.0375 \text{ ft}) (5565 \text{ lb/ft}) (0.5) = 104.3 \text{ lb•ft/ft}$

$\epsilon_B = (104.3 \text{ lb•ft/ft}) / (35{,}000 \text{ psi} \cdot 144 \text{ in}^2/\text{ft}^2 \cdot 1.97 \text{ ft})$

$= 0.000011$

Combined Strain:

When compared with the ring compressive strain, the ring bending strain is negligible. Therefore, the combined strained is equal the ring compressive strain.

$$\epsilon_C = \epsilon_T + \epsilon_B$$

$$\epsilon_C = 0.0059 + 0.000011 = 0.0059$$

The allowable strain for driscopipe (0.05) divided by the combined strain yields the safety factor (S.F.).

S.F. = (0.05)/(0.0059) = 8.5 **OK**

3. Design the manhole with respect to radial pressure in terms of ring buckling by comparing the critical ring thrust (N_{CR}) to the ring thrust (N_T) calculated in Step 2. The ring thrust should be less than or one-half of the critical ring thrust.

Critical Ring Thrust:

$$N_{CR} = 1.2\phi \cdot R_H \cdot (E\,I)^{(2/3)} \cdot (E_S^*)^{(2/3)}$$

where:

ϕ	=	Calibration Factor (0.55)
RH	=	Geometry Factor (1.0)
E	=	Stress Relaxation Modulus
I	=	Moment of Inertia of Manhole Wall
E^*_S	=	$E_S/(1-\upsilon)$, (conservatively 1000)
E_S	=	Young's Modulus of the Soil
υ	=	Poisson's Ratio of the Soil.

Therefore:

$$N_{CR} = (1.22)(0.55)(1.0)(35{,}000 \cdot 144 \cdot 3.89)^{2/3}(1{,}000)^{2/3}$$

$$= 4{,}880{,}000 \text{ lb/ft}$$

Since the calculated ring thrust (5565 lb/ft) is much less than the critical ring thrust (4,880,000 lb/ft), ring buckling should not be encountered.

4. Design the manhole with respect to axial loading by calculating the axial strain (ε_A) in the manhole shaft. The calculated axial strain should be less than 0.05, the allowable strain for HDPE.

Axial Strain:

$$\varepsilon_A = \left[\frac{P_D + P_L + P_W}{E\,\pi\,D_M t_n}\right]$$

where:

P_D	=	Downdrag Force
P_L	=	Live Load
P_W	=	Dead Load
E	=	Stress Relaxation Modulus
D_M	=	Mean Diameter of Manhole
t_n	=	Net Wall Thickness.

Dead load on the manhole will be its weight of approximately 10,400 lb. No live loading is anticipated.

Therefore:

$$\varepsilon_A = (535{,}630 + 10{,}400) \,/\, (35{,}000 \cdot 144 \cdot \pi \cdot 3.75 \cdot 0.188)$$

$$= 0.049$$

The allowable strain for driscopipe (0.05) divided by the combined strain yields the safety factor (S.F.).

$$\text{S.F.} = (0.05)/(0.049) = 1.02 \qquad \textbf{OK}$$

5. Design the manhole in terms of axial loading in terms of localized buckling by calculating the critical axial strain which should be less than 0.05, the allowable strain for HDPE.

Axial Buckling:

$$\varepsilon_{CR} = \frac{2S_E}{D_M\sqrt{3(1-\mu^2)}}$$

where: D_M = Mean Diameter of Manhole
μ = Poisson's Ratio of HDPE
S_E = Equivalent Solid Wall Thickness

and:

$$S_E = \sqrt[3]{12I}$$

where: I = Moment of Inertia of wall cross section
= $bh^3/12 = 4.57 \times 10^{-5}$ ft^4/ft

Therefore:

$$S_E = (12 \cdot 4.57 \times 10^{-5})^{1/3} = 0.082$$

and:

$$\varepsilon_{CR} = (2)(0.082) \,/\, (3.75)(3 \cdot [1-(0.45)^2])^{1/2} = 0.028$$

The allowable strain for driscopipe (0.05) divided by the combined strain yields the safety factor (S.F.).

$$\text{S.F.} = (0.05)/(0.028) = 1.78 \qquad \textbf{OK}$$

GEOTEXTILE DESIGN CALCULATIONS

The design procedure used in this report is taken from the Geotextile Filter Design Manual prepared by Geosyntec Consultants for the Nicolon Corporation, and based on principles outlined by Giroud (1988).

APPLICATIONS

Geotextile A was designed for reinforcement and separation. Geotextiles B, C, and D were designed for filtration.

BOUNDARY CONDITIONS

Flow conditions are steady-state, uni-directional.
Confining stress is high, at least 8000 psf.

SOIL RETENTION REQUIREMENTS

Soil Retention Requirements were obtained using particle size analyses, Atterberg Limits, and soil density conditions. The soil density conditions were estimated between 35% and 65% for the waste and sand drainage layers, and greater than 65% for the clay layer (Figure 1, Geotextile Filter Design Manual). Double Hydrometer Ratio tests were not available so fine grained soils were assumed to be non-dispersive. Apparent Opening Size (AOS) was calculated according to the equations in Chart 1 of the Geotextile Filter Design Manual.

GEOTEXTILE PERMEABILITY REQUIREMENTS

Minimum Flow Rate through the geotextiles was calculated using the hydraulic conductivity of the drainage layers and a hydraulic gradient of 1.5 (conservative). Permeability should not be a limiting design factor due to the low hydraulic conductivity of the soils involved and the absence of lateral flow requirements through the geotextiles.

LONG-TERM EFFECTIVENESS REQUIREMENTS

The ability of the soil to resist clogging was evaluated based on the particle size analysis and plasticity index. Long-term flow tests were suggested for some of the geotextiles.

SURVIVABILITY REQUIREMENTS

Survivability requirements were determined from Figure 4 in the Geotextile Filter Design Manual. All geotextiles were assumed to be subject to moderate installation conditions and high contact stresses.

DURABILITY REQUIREMENTS

Exposure to UV radiation should not pose a problem if the geotextiles are covered soon after installation. Even so, geotextiles should be specified to retain at least 70% of their strength after 150 hours of exposure to sunlight. Contractors should be informed that geotextiles will degrade if they are exposed to sunlight for considerable periods of time.

TABLE 1. Required geotextile specifications.

	A	B	C	D
AOS (maximum) Sieve No. mm	 70 0.21	 70 0.21	 10 2.00	 100 0.15
Unit Weight (oz/yd^2)	NA	NA	NA	12.0
Flow Rate (minimum) $l/m^2 \cdot min$	NA	2.6×10^{-6}	4.5	4.0×10^{-2}
Porosity (nonwovens) Percent Open Area (wovens)	 NA	>30%	 >4%	>30%
Grab Strength (lb)	>180	>180	>180	>180
Sewn Seam Strength (lb)	>160	>160	>160	>160
Puncture Strength (lb)	>80	>80	>80	>80
Burst Strength (psi)	>290	>290	>290	>290
Trapezoid Tear Strength (lb)	>50	>50	>50	>50
UV Resistance (%)	>70	>70	>70	>70

REFERENCES

Geotextile Filter Design Manual. 1991. Nicolon Corporation. Norcross, GA.

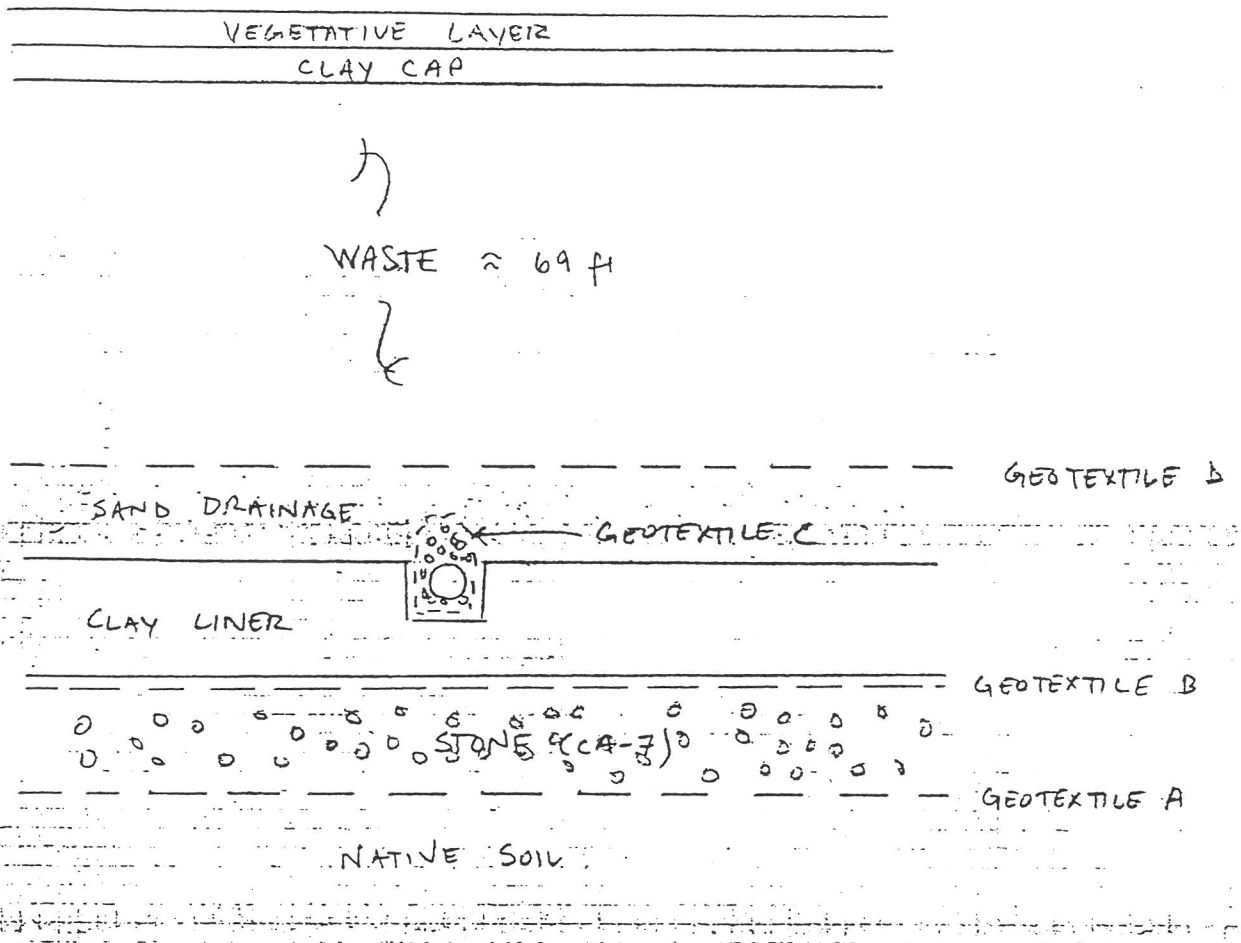
Giroud, J.P. 1988. Review of Geotextile Filter Design Criteria. Proceedings of the First Indian Conference on Reinforced Soil and Geotextiles, Calcutta, India. pp. 1-6.

Koerner, R.M. 1990. Designing with Geosynthetics. Prentice-Hall, Inc. Englewood Cliffs, NJ.

1994 Specifiers Guide. Geotechnical Fabrics Report, Dec. 1993. Industrial Fabrics Association International. St. Paul, MN.

CWLP GEOTEXTILE DESIGN

SCHEMATIC DIAGRAM



NOTES:

1. GEOTEXTILES B, C, & D ARE DESIGNED FOR FILTRATION PURPOSES
2. GEOTEXTILE A IS DESIGNED FOR REINFORCEMENT PURPOSES.
3. CONFINING STRESS FOR ALL GEOTEXTILES WILL BE HIGH, AT LEAST 8000 psf
4. ALL FLOW CONDITIONS WILL BE STEADY STATE, UNI-DIRECTIONAL.

GEOTEXTILE D

Drainage Medium: Scrubber Sludge

SOIL RETENTION REQUIREMENTS

Particle Size Distribution

Sand: 4% Silt: 86% Clay: 10%

Plasticity Index: Low

Coefficient of Uniformity:

$$C_u = d_{60}/d_{10} = .029/.009 = 3.2$$

Coefficient of Curvature:

$$C_c = d_{30}^2/(d_{60} \cdot d_{10}) = (.019)^2/(0.029 \cdot 0.009) = 1.4$$

Linear Coefficient of Curvature:

$$C'_u = \sqrt{(d'_{100}/d'_0)} = \sqrt{(0.049/0.013)} = 2.0$$

Apparent Opening Size (optimal):

$$O_{95} < 1.5C'_u \cdot d'_{50} = (1.5)(2.0)(0.025) = \underline{0.08 \text{ mm}}$$

NOTE: The calculated AOS for Geotextile D is smaller than that of any commercially available geotextile. As per the manufacturer's suggestion, a geotextile with a U.S. Sieve #100 should be used. Due to its fine grain size and low plasticity, some of the material may move through the geotextile, and a long-term flow test may be required to determine the geotextile's effectiveness (Koerner, 1990).

GEOTEXTILE PERMEABILITY REQUIREMENTS

Soil Hydraulic Conductivity: 4.42×10^{-5} cm/sec

Maximum Hydraulic Gradient: 1.5

Minimum Allowable Geotextile Permeability:

$$k_g > i_s \cdot k_s = (1.5)(4.42 \times 10^{-5}) = 6.6 \times 10^{-5} \text{ cm/sec}$$

equivalent flux $= 4.0 \times 10^{-2}$ l/m^2·min

LONG-TERM EFFECTIVENESS REQUIREMENTS

Geotextile porosity > 30%

Long-term flow test may be required.

SURVIVABILITY REQUIREMENTS

Grab Strength:	180 lb.
Sewn Seam Strength:	160 lb.
Puncture Strength:	80 lb.
Burst Strength:	290 psi
Trapezoid Tear Strength:	50 lb.

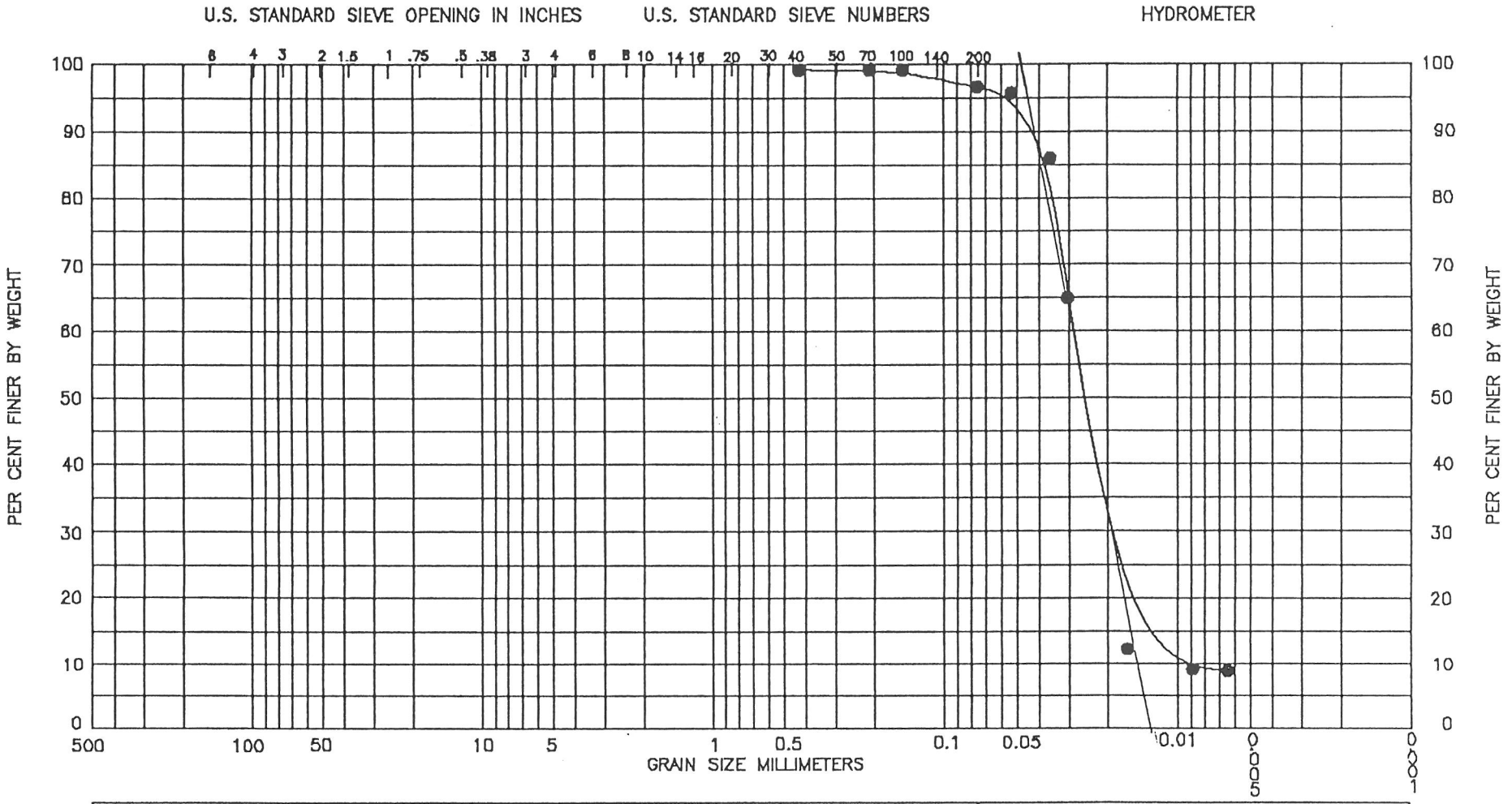
SUGGESTED PRODUCTS

Nicolon S1200 (12 oz. Nonwoven)
Amoco 4512 (12 oz. Nonwoven)
Mirafi 1160N (16 oz. Nonwoven)
Trevira 011/550 (16 oz. Nonwoven)

NOTE: As per manufacturer's suggestion, heavier geotextiles, at least 12 oz/yd^2, should be used in this application to aid in retention of the scrubber sludge. Since this extra weight is not needed for strength requirements, a lighter geotextile could be used if long-term flow tests showed that the geotextile adequately retained the scrubber sludge.

GRAIN SIZE DISTRIBUTION

DATE: 8-10-93



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COURSE	FINE	COURSE	MEDIUM	FINE	

BORING NO.	SAMPLE NO.	ELEV./ DEPTH	USC	DECRIPTION	NAT. W%	LL	PL	PI
	LP3	33-35'		SCRUBBER SLUDGE				
AEX NO.	19-3184-2			(WHITE SILT, TRACE CLAY, TRACE SAND)				

% GRAVEL	PROJECT: CWLP	AE EXPLORATION CORPORATION
% SAND 3.96	SPECIAL REMARKS	2813 NORTH DIRKSEN PARKWAY
% SILT 86.34	0.002 mm DIVISION BETWEEN SILT & CLAY PARTICLES	SPRINGFIELD, ILLINIOS 62702
% CLAY 9.70		(217) 525-8023 FAX: (217) 525-8025

GEOTEXTILE C

Drainage Medium: Sand (Widely Graded)

SOIL RETENTION REQUIREMENTS

Particle Size Distribution

Gravel: 1% Sand: 97% Silt & Clay: 2%

Plasticity Index: 0

Coefficient of Uniformity:

$$C_u = d_{60}/d_{10} = .70/.20 = 3.5$$

Coefficient of Curvature:

$$C_c = d_{30}^2/(d_{60} \cdot d_{10}) = (.33)^2/(0.70 \cdot 0.20) = 0.9$$

Linear Coefficient of Curvature:

$$C'_u = \sqrt{(d'_{100}/d'_0)} = \sqrt{(1.90/0.15)} = 3.5$$

Apparent Opening Size (optimal):

$$O_{95} < (13.5/C'_u) \cdot d'_{50} = (13.5/3.5)(0.54) = \underline{2.10 \text{ mm}}$$

NOTE: The calculated AOS for Geotextile C is much larger than that of any commercially available geotextile. This is because the sand used as a filter media is fairly coarse and widely graded, and therefore may be unstable. Manufacturer's recommendations were to use a woven filtration geotextile with a relatively large opening, at least comparable to U.S. sieve no. 40. Another alternative would be to use a finer sand that is more uniformly graded and redesign the geotextile.

GEOTEXTILE PERMEABILITY REQUIREMENTS

Soil Hydraulic Conductivity: 5.0×10^{-3} cm/sec

Maximum Hydraulic Gradient: 1.5

Minimum Allowable Geotextile Permeability:

$$k_g > i_s \cdot k_s = (1.5)(5.0 \times 10^{-3}) = 7.5 \times 10^{-3} \text{ cm/sec}$$

equivalent flux = 4.5 $l/m^2 \cdot min$

LONG-TERM EFFECTIVENESS REQUIREMENTS

Geotextile porosity > 30%

Long-term flow test may be required

SURVIVABILITY REQUIREMENTS

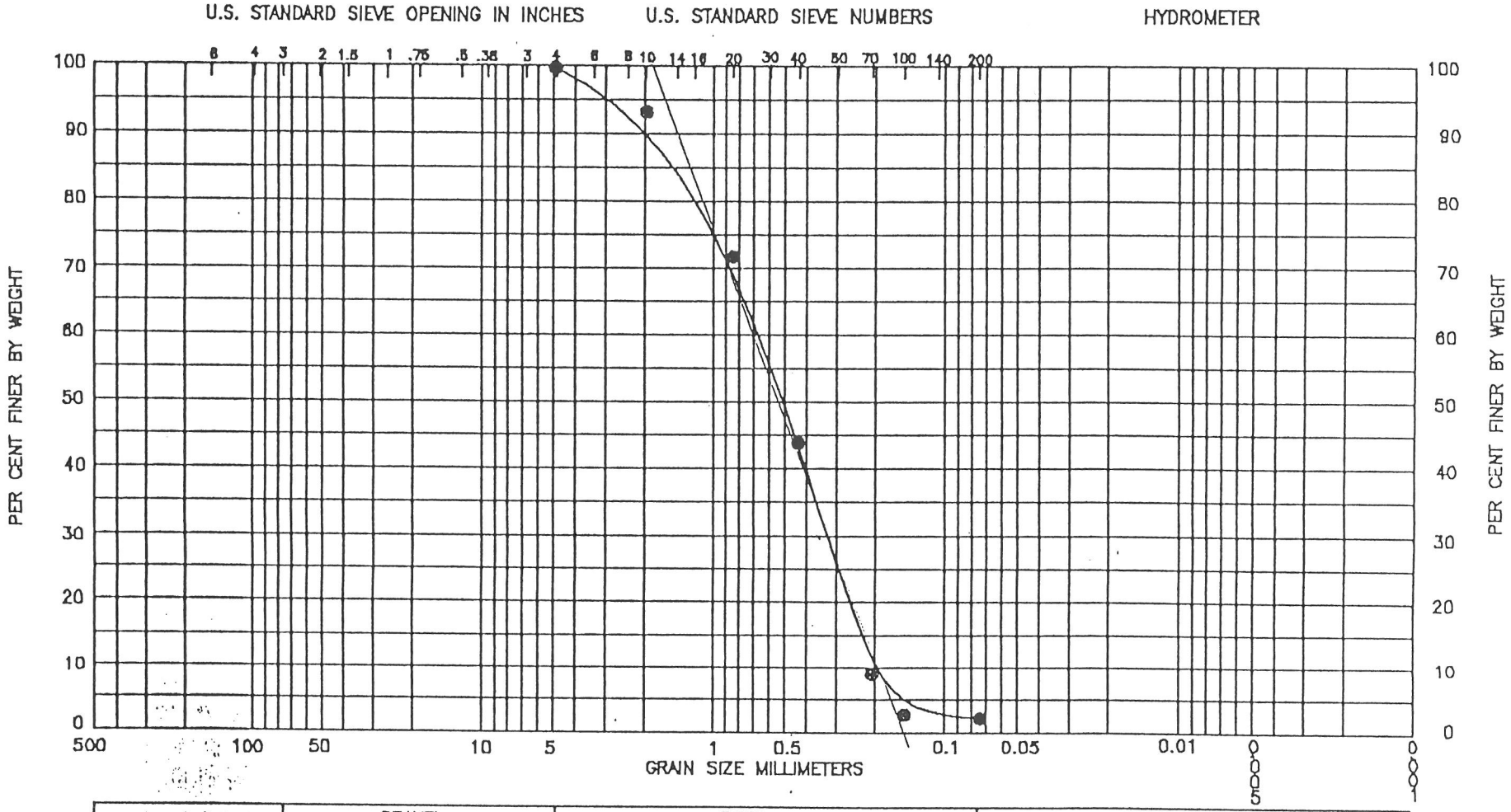
Grab Strength:	180 lb.
Sewn Seam Strength:	160 lb.
Puncture Strength:	80 lb.
Burst Strength:	290 psi
Trapezoid Tear Strength:	50 lb.

SUGGESTED PRODUCTS

Nicolon Filterweave 40/30A (Woven)

GRAIN SIZE DISTRIBUTION

DATE: 8-30-93



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COURSE	FINE	COURSE	MEDIUM	FINE	

BORING NO.	SAMPLE NO.	ELEV./ DEPTH	USC	DECRIPTION	NAT. W%	LL	PL	PI
#5	Coll # 3	N5335.7 E2121.3		BROWN SAND, TRACE GRAVEL, TRACE FINES				
AEX NO.	19-3184-2			Builder's Sand				

% GRAVEL	0.54	PROJECT: CWLP
% SAND	97.23	SPECIAL REMARKS
% SILT	2.23	0.002 mm DIVISION BETWEEN SILT & CLAY PARTICLES
% CLAY		

AE EXPLORATION CORPORATION
2813 NORTH DIRKSEN PARKWAY
SPRINGFIELD, ILLINOIS 62702
(217) 525-6023 FAX: (217) 525-6025

SHAFFER
KRIMMEL
SILVER
AND ASSOCIATES, INC. • 2900 N. MARTIN LUTHER KING, JR. DRIVE, DECATUR, ILLINOIS 62526 • 217-877-2100 • FAX 217-877-4816

CONSULTING ENGINEERS • CIVIL ENGINEERING • GEOTECHNICAL ENGINEERING • STRUCTURAL ENGINEERING • LAND SURVEYING • SOILS / MATERIALS TESTING • SUBSURFACE INVESTIGATIONS • ENVIRONMENTAL INVESTIGATIONS • CONSTRUCTION QUALITY CONTROL

PERMEABILITY & CLASSIFICATION TEST RESULTS

PROJECT: CITY, WATER, LIGHT AND POWER; CELL 3
DATE: November 12, 1992
PROJECT NO.: I9-24932-6s.
CLIENT: ANDREWS ENVIRONMENTAL ENGINEERING INC.
REPORT NO: 24932-4

SAMPLE IDENTIFICATION: ST-2; N 5162.5/E 2192.5 DEPTH/ELEV: 531.81

CLASSIFICATION; USCS: CL-m USDA:

DESCRIPTION: Mottled Brown, Moist, Medium Plasticity, SILTY CLAY, Trace Sand

SOIL PARTICLE SIZES
GRAVEL %: 0.0 SAND %: 1.0 SILT %: 66.0 CLAY %: 33.0 *

NATURAL MOISTURE %: 21.6 DENSITY;lb/ft3 NATURAL: 108.3
LIQUID LIMIT : 42.0 MAX. DRY;lb/ft3: REMOLDED: 0.0
PLASTICITY INDEX : 20.0 PROCTOR;DEG OF COMPACTION ( ):
PERMEABILITY (k), cm/sec: 2.84E-9 **

PERMEABILITY TEST DETAILS

SAMPLES OBTAINED BY: CLIENT TYPE OF SAMPLE: Undisturbed

SPECIMEN DATA
DIAMETER;cm: 7.188 INITIAL WEIGHT;pcf: 131.7
LENGTH;cm: 7.252 DRY UNIT WEIGHT;pcf: 108.3
AREA;cm2: 40.58 INITIAL % H2O: 21.6
VOLUME;cm3: 294.3 FINAL % H2O: 21.7
VOID RATIO: 0.5680 FLOW ORIENTATION: V
TEST APPARATUS: GEOTEST

TEST PRESSURES
CELL/CONFINING; psi: 85.0 HEADWATER;cm:
SAMPLE BACK PRESSURE;psi: 57.0 TAILWATER;cm:
HYDRAULIC; GRADIENT: 29.1 DRIVING: 3.00 psi 210.9 cm H2O
PERMEANT LIQUID: 0.005 N CaSO4

TIME OF TEST; SATURATION: 115.9 Hrs PERMEABILITY: 98.0 Hrs
FLOW THRU SPECIMEN; TOTAL: 6.52 ml PERMEABILITY TEST: 1.24 ml
TEMPERATURE CORRECTION; TEMPERATURE: 22.1 C FACTOR: 0.952

REMARKS: Three inch thin-wall Shelby tube sample obtained and delivered by client. See informational sheets on hydraulic conductivity/permeability test procedures.

* Percentage of silt and clay fractions is based on 0.002mm as the division between the fractions (Unified Soil Classification System)

** E-8 equals 10 to the minus 8 (exponent); cm3 equals cubic centimeters; the 2 in H2O is a subscript.

GEOTEXTILE B

Drainage Medium: Compacted Clay

SOIL RETENTION REQUIREMENTS

Particle Size Distribution

Sand: 1% Silt: 66% Clay: 33%

Plasticity Index: 20

Apparent Opening Size (optimal):

$O_{95} < \underline{0.21 \text{ mm}}$

GEOTEXTILE PERMEABILITY REQUIREMENTS

Soil Hydraulic Conductivity: 2.84×10^{-9} cm/sec

Maximum Hydraulic Gradient: 1.5

Minimum Allowable Geotextile Permeability:

$k_g > i_s \cdot k_s = (1.5)(2.84 \times 10^{-9}) = 4.3 \times 10^{-9}$ cm/sec
equivalent flux = 2.6×10^{-6} l/m^2·min

LONG-TERM EFFECTIVENESS REQUIREMENTS

O_{95} should be close to 0.21 mm

Geotextile porosity > 30%

SURVIVABILITY REQUIREMENTS

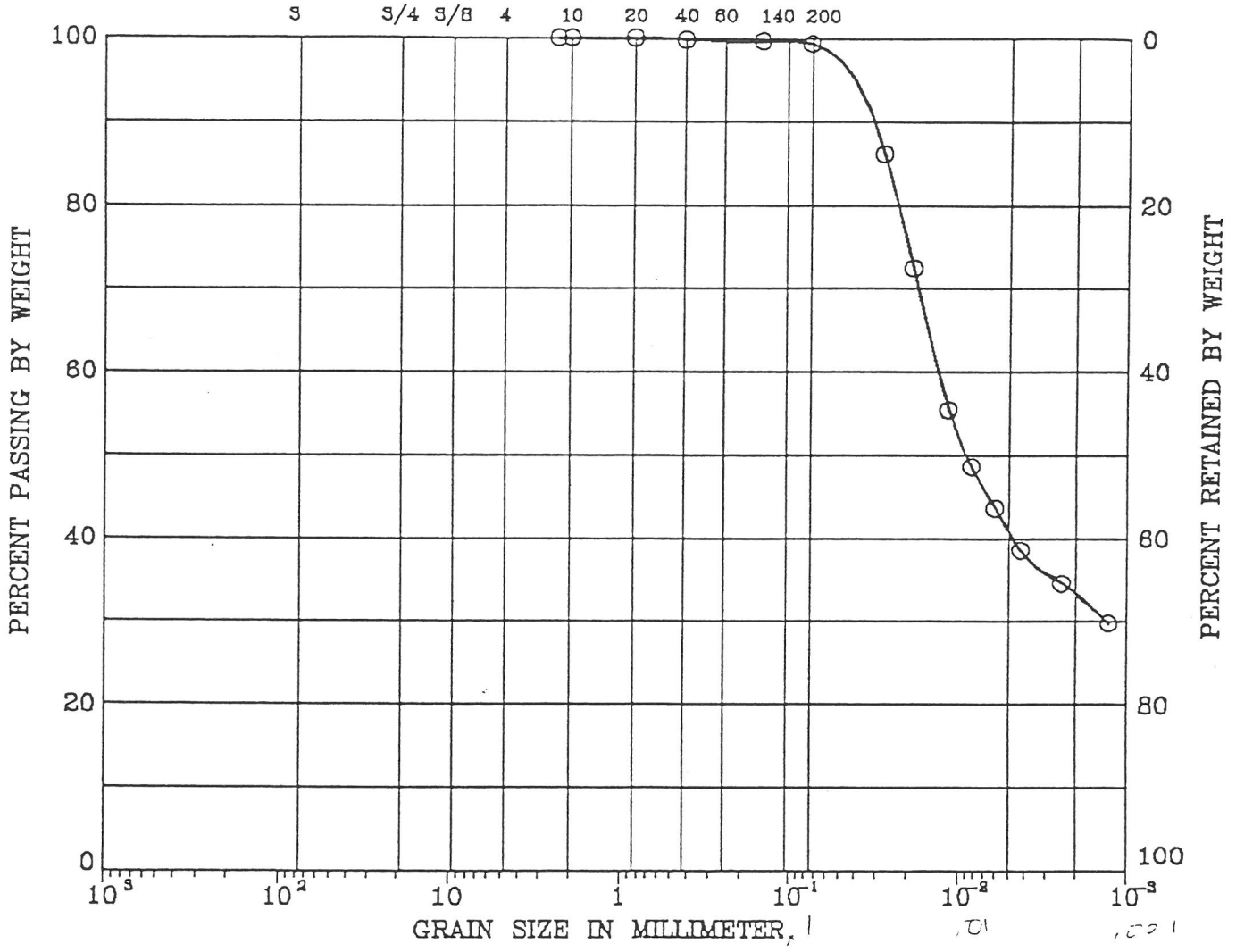
Grab Strength:	180 lb.
Sewn Seam Strength:	160 lb.
Puncture Strength:	80 lb.
Burst Strength:	290 psi
Trapezoid Tear Strength:	50 lb.

SUGGESTED PRODUCTS

Nicolon S800 (8 Oz. Nonwoven)
Nicolon S600 (6 oz. Nonwoven)
Trevira 011/250 (7.1 oz. Nonwoven)
Amoco 4508 (8 oz. Nonwoven)
Amoco 4506 (6 oz. Nonwoven)

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
O	ST-2	531.81	42	20	Mottled Brown, Med. Pl., SILTY CLAY, Trace Sand

Remark : N 5162.5/ E 2192.9

24932	CITY WATER, LIGHT AND POWER; CELL 3
Shaffer, Krimmel Silver & Associates, Inc	GRAIN SIZE DISTRIBUTION

GEOTEXTILE A

Separation layers: Gravel over native soil

SOIL RETENTION REQUIREMENTS

$O_{95} < 0.21$ mm

NOTE: Geotextile A was designed mainly for separation and reinforcement. Flow in the upward direction could occasionally be encountered, so the geotextile must be able to retain the native soil beneath it. The native soil is assumed to be a fairly clayey soil, so an AOS less than or equal to 0.21 mm should be sufficient. The geotextile is not required to allow water to pass through it so permeability requirements are not applicable.

GEOTEXTILE PERMEABILITY REQUIREMENTS

Not Applicable

LONG-TERM EFFECTIVENESS REQUIREMENTS

Not Applicable

SURVIVABILITY REQUIREMENTS

Grab Strength:	180 lb.
Sewn Seam Strength:	160 lb.
Puncture Strength:	80 lb.
Burst Strength:	290 psi
Trapezoid Tear Strength:	50 lb.

SUGGESTED PRODUCTS

Mirafi 800X (Woven)
Amoco 2006 (Woven)

APPENDIX E

Leachate Analysis Results

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
Bartlett , IL 60103
Tel: (708) 289-3100
Fax: (708) 289-5445

ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

12/08/1992

NET Job Number: 92.49393

Enclosed are the Analytical Results for the following samples submitted to NET, Inc. Bartlett Division for analysis:

Project Description: CWLP-City of Springfield; #496B

Sample Number	Sample Description	Date Taken	Date Received
182883	LP1-Leachate Sample	10/05/1992	10/06/1992

Sample analysis in support of the project referenced above has been completed and results are presented on the following pages. Please refer to the enclosed "Key to Abbreviations" for definition of terms. Should you have questions regarding procedures or results, please do not hesitate to call. NET has been pleased to provide these analytical services for you.

Approved By:

Darla Kalicki

Darla Kalicki
Project Manager

OCEAN GROUP

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
Bartlett , IL 60103
Tel: (708) 289-3100
Fax: (708) 289-5445

ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

12/08/1992

Sample No. : 182883

NET Job No.: 92.49393

Sample Description: LP1-Leachate Sample
CWLP-City of Springfield; #496B

Date Taken: 10/05/1992
Time Taken: 15:00
IEPA Cert. No. 100221

Date Received: 10/06/1992
Time Received: 09:24
WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
Gross Alpha	<7.3*	pCi/L	12/07/1992	
Radium, Total	2.8 +/- 0.9	pCi/L	12/07/1992	
Tritium	<100.	pCi/L	12/07/1992	

*Elevated LLD due to high solids content.

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
Bartlett , IL 60103
Tel: (708) 289-3100
Fax: (708) 289-5445

ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

10/23/1992

Sample No. : 182852

NET Job No.: 92.49391

Sample Description: LP1-Leachate Sample
CWLP-City of Springfield; #496B

Date Taken: 10/05/1992
Time Taken: 15:00
IEPA Cert. No. 100221

Date Received: 10/06/1992
Time Received: 09:24
WDNR Cert. No. 999447130

Parameter	Results	Units	Date of Analysis	Analytical Method
BOD, Five Day	42.	mg/L	10/07/1992	405.1(3) 5210B(4)
Chloride	2750.	mg/L	10/12/1992	4500Cl(4) 325.3(3)
COD, Total	341.	mg/L	10/13/1992	410.4(3) 5220(4)
Cyanide, total	<0.002	mg/L	10/12/1992	335.2(3) 4500CN(4)
Fluoride	3.25	mg/L	10/07/1992	4500F(4) 340.2(3)
N-Ammonia	0.93	mg/L	10/16/1992	4500(4) 350.2(3)
N-Nitrate	2.1	mg/L	10/07/1992	4500NO3(4)
FOG, Hexane Soluble	31.	mg/L	10/13/1992	5520B(4) 413.1(3)
pH	8.3	units		150.1(3) 9040(1)
Phenols, colorimetric	0.006	mg/L	10/13/1992	9065(1) 420.1(3)
Solids, Total Dissolved	64.	mg/L	10/09/1992	160.1(3) 2540D(4)
Sulfate	1400.	mg/L	10/07/1992	9038(1) 375.4(3)
Total Organic Carbon	12.6	mg/L	10/14/1992	415.1(3) 5310(4)
Aluminum, ICP	8.18	mg/L	10/21/1992	6010(1) 200.7(3)
Antimony, ICP	<0.50	mg/L	10/15/1992	6010(1) 200.7(3)
Arsenic, AA	<0.0050	mg/L	10/16/1992	7061(1) 206.3(3)
Barium, ICP	0.102	mg/L	10/15/1992	6010(1) 200.7(3)
Beryllium, ICP	<0.0050	mg/L	10/15/1992	6010(1) 200.7(3)
Boron,ICP	98.9	mg/L	10/16/1992	6010(1) 200.7(3)
Cadmium, ICP	<0.010	mg/L	10/15/1992	6010(1) 200.7(3)
Calcium, AA	2300.	mg/L	10/19/1992	7140(1) 215.1(3)
Chromium, ICP	<0.040	mg/L	10/15/1992	6010(1) 200.7(3)
Cobalt, ICP	<0.10	mg/L	10/16/1992	6010(1) 200.7(3)
Copper, ICP	0.018	mg/L	10/15/1992	6010(1) 200.7(3)
Iron, ICP	11.3	mg/L	10/16/1992	6010(1) 200.7(3)
Lead, ICP	<0.080	mg/L	10/15/1992	6010(1) 200.7(3)
Magnesium, AA	210.	mg/L	10/19/1992	6010(1) 200.7(3)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

OCEAN GROUP

NATIONAL ENVIRONMENTAL TESTING, INC.

Bartlett Division
850 W. Bartlett Rd.
Bartlett , IL 60103
Tel: (708) 289-3100
Fax: (708) 289-5445

ANALYTICAL REPORT

Mr. Steve Van Hook
PATRICK ENGINEERING, INC.
109 N. Seventh, Ste. 202
Springfield, IL 62701

10/23/1992

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Parameter	Results	Units	Date of Analysis	Analytical Method
Manganese, ICP	0.712	mg/L	10/16/1992	6010(1) 200.7(3)
Mercury, CVAA	0.0006	mg/L	10/14/1992	7470(1) 245.1(3)
Nickel, ICP	<0.050	mg/L	10/15/1992	6010(1) 200.7(3)
Potassium, AA	7.0	mg/L	10/19/1992	6010(1) 200.7(3)
Selenium, AA	<0.0050	mg/L	10/15/1992	7741(1) 270.3(3)
Silver, AA	0.051	mg/L	10/14/1992	7760(1) 272.1(3)
Sodium, AA	77.	mg/L	10/19/1992	7770(1) 273.1(3)
Strontium, ICP	3.84	mg/L	10/16/1992	6010(1) 200.7(3)
Thallium, ICP	<0.20	mg/L	10/15/1992	6010(1) 200.7(3)
Tin, ICP	<2.0	mg/L	10/16/1992	6010(1) 200.7(3)
Vanadium, ICP	0.012	mg/L	10/16/1992	6010(1) 200.7(3)
Zinc, ICP	0.104	mg/L	10/15/1992	6010(1) 200.7(3)
PESTICIDES/PCB - 8080 AQUEOUS				
Aldrin	<0.05	ug/L	10/16/1992	8080 (1)
alpha-BHC	<0.05	ug/L	10/16/1992	8080 (1)
beta-BHC	<0.05	ug/L	10/16/1992	8080 (1)
delta-BHC	<0.05	ug/L	10/16/1992	8080 (1)
gamma-BHC (Lindane)	<0.05	ug/L	10/16/1992	8080 (1)
Chlordane	<0.5	ug/L	10/16/1992	8080 (1)
4,4'-DDD	<0.1	ug/L	10/16/1992	8080 (1)
4,4'-DDE	<0.1	ug/L	10/16/1992	8080 (1)
4,4'-DDT	<0.1	ug/L	10/16/1992	8080 (1)
Dieldrin	<0.1	ug/L	10/16/1992	8080 (1)
Endosulfan I	<0.05	ug/L	10/16/1992	8080 (1)
Endosulfan II	<0.1	ug/L	10/16/1992	8080 (1)
Endosulfan sulfate	<0.1	ug/L	10/16/1992	8080 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

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Parameter	Results	Units	Date of Analysis	Analytical Method
Endrin	<0.1	ug/L	10/16/1992	8080 (1)
Endrin aldehyde	<0.1	ug/L	10/16/1992	8080 (1)
Heptachlor	<0.05	ug/L	10/16/1992	8080 (1)
Heptachlor epoxide	<0.05	ug/L	10/16/1992	8080 (1)
Methoxychlor	<0.5	ug/L	10/16/1992	8080 (1)
Toxaphene	<0.5	ug/L	10/16/1992	8080 (1)
PCB-1016	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1221	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1232	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1242	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1248	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1254	<1.0	ug/L	10/16/1992	8080 (1)
PCB-1260	<1.0	ug/L	10/16/1992	8080 (1)
HERBICIDES - AQUEOUS				
2,4-D	<2.0	ug/L	10/16/1992	8150 (1)
2,4,5-TP (Silvex)	<2.0	ug/L	10/16/1992	8150 (1)
Parathion	<10.	mg/L	10/16/1992	
TCL VOLATILES - AQUEOUS				
Chloromethane	<10.0	ug/L	10/16/1992	8240 (1)
Vinyl chloride	<10.0	ug/L	10/16/1992	8240 (1)
Bromomethane	<10.0	ug/L	10/16/1992	8240 (1)
Chloroethane	<10.0	ug/L	10/16/1992	8240 (1)
1,1-Dichloroethene	<1.0	ug/L	10/16/1992	8240 (1)
Carbon disulfide	<100.	ug/L	10/16/1992	8240 (1)
Acetone	<100.	ug/L	10/16/1992	8240 (1)

pH analyzed past holding time.

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Parameter	Results	Units	Date of Analysis	Analytical Method
Methylene chloride	<5.0	ug/L	10/16/1992	8240 (1)
trans-1,2-Dichloroethene	<1.0	ug/L	10/16/1992	8240 (1)
1,1-Dichloroethane	<1.0	ug/L	10/16/1992	8240 (1)
Vinyl acetate	<50.0	ug/L	10/16/1992	8240 (1)
2-Butanone	<100.	ug/L	10/16/1992	8240 (1)
cis-1,2-Dichloroethene	<1.0	ug/L	10/16/1992	8240 (1)
Chloroform	<1.0	ug/L	10/16/1992	8240 (1)
1,1,1-Trichloroethane	<1.0	ug/L	10/16/1992	8240 (1)
1,2-Dichloroethane	<1.0	ug/L	10/16/1992	8240 (1)
Benzene	<1.0	ug/L	10/16/1992	8240 (1)
Carbon tetrachloride	<1.0	ug/L	10/16/1992	8240 (1)
1,2-Dichloropropane	<1.0	ug/L	10/16/1992	8240 (1)
Trichloroethene	<1.0	ug/L	10/16/1992	8240 (1)
Bromodichloromethane	<1.0	ug/L	10/16/1992	8240 (1)
2-Chloroethylvinyl ether	<10.0	ug/L	10/16/1992	8240 (1)
trans-1,3-Dichloropropene	<1.0	ug/L	10/16/1992	8240 (1)
4-Methyl-2-pentanone	<50.0	ug/L	10/16/1992	8240 (1)
Toluene	<1.0	ug/L	10/16/1992	8240 (1)
cis-1,3-Dichloropropene	<1.0	ug/L	10/16/1992	8240 (1)
1,1,2-Trichloroethane	<1.0	ug/L	10/16/1992	8240 (1)
Dibromochloromethane	<1.0	ug/L	10/16/1992	8240 (1)
2-Hexanone	<50.0	ug/L	10/16/1992	8240 (1)
Tetrachloroethene	<1.0	ug/L	10/16/1992	8240 (1)
Chlorobenzene	<1.0	ug/L	10/16/1992	8240 (1)
Ethylbenzene	<1.0	ug/L	10/16/1992	8240 (1)
meta & para-Xylene	<1.0	ug/L	10/16/1992	8240 (1)
Bromoform	<1.0	ug/L	10/16/1992	8240 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

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Parameter	Results	Units	Date of Analysis	Analytical Method
Styrene	<1.0	ug/L	10/16/1992	8240 (1)
ortho-Xylene	<1.0	ug/L	10/16/1992	8240 (1)
1,1,2,2-Tetrachloroethane	<1.0	ug/L	10/16/1992	8240 (1)
1,3-Dichlorobenzene	<1.0	ug/L	10/16/1992	8240 (1)
1,4-Dichlorobenzene	<1.0	ug/L	10/16/1992	8240 (1)
1,2-Dichlorobenzene	<1.0	ug/L	10/16/1992	8240 (1)
TCL BASE NEUTRALS - AQUEOUS				
Aniline	<10.	ug/L	10/13/1992	8270 (1)
Bis(2-chloroethyl) ether	<10.	ug/L	10/13/1992	8270 (1)
1,3-Dichlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
1,4-Dichlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
1,2-Dichlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
Benzyl alcohol	<10.	ug/L	10/13/1992	8270 (1)
Hexachloroethane	<10.	ug/L	10/13/1992	8270 (1)
N-Nitrosodi-n-propylamine	<10.	ug/L	10/13/1992	8270 (1)
Bis(2-chloroisopropyl)ether	<10.	ug/L	10/13/1992	8270 (1)
Nitrobenzene	<10.	ug/L	10/13/1992	8270 (1)
N-Nitrosodimethylamine	<10.	ug/L	10/13/1992	8270 (1)
Isophorone	<10.	ug/L	10/13/1992	8270 (1)
Bis(2-chloroethoxy)methane	<10.	ug/L	10/13/1992	8270 (1)
1,2,4-Trichlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
Naphthalene	<10.	ug/L	10/13/1992	8270 (1)
4-Chloroaniline	<10.	ug/L	10/13/1992	8270 (1)
Hexachlorobutadiene	<10.	ug/L	10/13/1992	8270 (1)
2-Methylnaphthalene	<10.	ug/L	10/13/1992	8270 (1)
2-Chloronaphthalene	<10.	ug/L	10/13/1992	8270 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

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Parameter	Results	Units	Date of Analysis	Analytical Method
3-Nitroaniline	<50.	ug/L	10/13/1992	8270 (1)
2-Nitroaniline	<50.	ug/L	10/13/1992	8270 (1)
4-Nitroaniline	<50.	ug/L	10/13/1992	8270 (1)
Acenaphthylene	<10.	ug/L	10/13/1992	8270 (1)
Dimethyl phthalate	<10.	ug/L	10/13/1992	8270 (1)
Acenaphthene	<10.	ug/L	10/13/1992	8270 (1)
Fluorene	<10.	ug/L	10/13/1992	8270 (1)
4-Chlorophenylphenyl ether	<10.	ug/L	10/13/1992	8270 (1)
Dibenzofuran	<10.	ug/L	10/13/1992	8270 (1)
Diethyl phthalate	<10.	ug/L	10/13/1992	8270 (1)
N-Nitrosodiphenylamine	<10.	ug/L	10/13/1992	8270 (1)
Hexachlorocyclopentadiene	<10.	ug/L	10/13/1992	8270 (1)
2,6-Dinitrotoluene	<10.	ug/L	10/13/1992	8270 (1)
2,4-Dinitrotoluene	<10.	ug/L	10/13/1992	8270 (1)
4-Bromophenyl phenyl ether	<10.	ug/L	10/13/1992	8270 (1)
Hexachlorobenzene	<10.	ug/L	10/13/1992	8270 (1)
Phenanthrene	<10.	ug/L	10/13/1992	8270 (1)
Anthracene	<10.	ug/L	10/13/1992	8270 (1)
Di-n-butylphthalate	<10.	ug/L	10/13/1992	8270 (1)
Fluoranthene	<10.	ug/L	10/13/1992	8270 (1)
Pyrene	<10.	ug/L	10/13/1992	8270 (1)
Benzo(a)anthracene	<10.	ug/L	10/13/1992	8270 (1)
Chrysene	<10.	ug/L	10/13/1992	8270 (1)
Benzidine	<50.	ug/L	10/13/1992	8270 (1)
3,3'-Dichlorobenzidine	<20.	ug/L	10/13/1992	8270 (1)
Butyl benzyl phthalate	<10.	ug/L	10/13/1992	8270 (1)
Bis(2-ethylhexyl)phthalate	<10.	ug/L	10/13/1992	8270 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

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Parameter	Results	Units	Date of Analysis	Analytical Method
Benzo(b)fluoranthene	<10.	ug/L	10/13/1992	8270 (1)
Benzo(k)fluoranthene	<10.	ug/L	10/13/1992	8270 (1)
Benzo(a)pyrene	<10.	ug/L	10/13/1992	8270 (1)
Indeno(1,2,3-cd)pyrene	<10.	ug/L	10/13/1992	8270 (1)
Dibenzo (a,h) anthracene	<10.	ug/L	10/13/1992	8270 (1)
Benzo(ghi)perylene	<10.	ug/L	10/13/1992	8270 (1)
Di-n-octylphthalate	<10.	ug/L	10/13/1992	8270 (1)
TCL ACIDS - AQUEOUS				
2-Chlorophenol	<10.	ug/L	10/13/1992	8270 (1)
Phenol	<10.	ug/L	10/13/1992	8270 (1)
2-Methylphenol (o-cresol)	<10.	ug/L	10/13/1992	8270 (1)
4-Methylphenol (p-cresol)	<10.	ug/L	10/13/1992	8270 (1)
Benzoic Acid	<50.	ug/L	10/13/1992	8270 (1)
2-Nitrophenol	<50.	ug/L	10/13/1992	8270 (1)
2,4-Dimethylphenol	<10.	ug/L	10/13/1992	8270 (1)
2,4-Dichlorophenol	<10.	ug/L	10/13/1992	8270 (1)
4-Chloro-3-methylphenol	<10.	ug/L	10/13/1992	8270 (1)
2,4,6-Trichlorophenol	<10.	ug/L	10/13/1992	8270 (1)
2,4,5-Trichlorophenol	<50.	ug/L	10/13/1992	8270 (1)
2,4-Dinitrophenol	<50.	ug/L	10/13/1992	8270 (1)
4-Nitrophenol	<50.	ug/L	10/13/1992	8270 (1)
2-Methyl-4,6-dinitrophenol	<50.	ug/L	10/13/1992	8270 (1)
Pentachlorophenol	<50.	ug/L	10/13/1992	8270 (1)

pH analyzed past holding time.

Approved By: Neal E Cleghorn

Neal E. Cleghorn
Operations Manager

OCEAN GROUP

APPENDIX F

Leachate Collection Piping Cleaning Capability Documentation

NATIONAL POWER RODDING CORP.
Specializing in today's needs for environmental protection.
2500 W. Arthington Avenue • Chicago, IL 60612-4108 • (312) 666-7700 • Fax (312) 666-5810

July 8, 1992

Mr. Andy Rathsack
ANDREWS ENVIRONMENTAL ENGINEERING, INC.
3535 Mayflower
Springfield, Illinois 62707

Dear Mr. Rathsack:

National Power Rodding Corporation has been cleaning leachate lines in landfills for many years.

Cleaning of 6 and 8 inch lines, up to 1,000 feet in length, does not present any problem, providing sufficient access is provided. We will perform these services using our High Velocity Jetter, with a water pressure of 2,000 P.S.I.

I have attached our recent advertisement regarding this service.

Should you have nay questions, please do not hesitate to call.

Very truly yours,

NATIONAL POWER RODDING CORPORATION

Ronald Kwiecinski

Ronald Kwiecinski
General Superintendent
of Field Operations

RK/ck
encl:

ATTACHMENT G:
Final Cover Stability Analysis

1. GEOTECHNICAL INFORMATION

1.1 Unit 2 Landfill Geotechnical Data

A review of the closure plan along with current state of practice for landfill covers was used to develop an appropriate final cover for geotechnical analysis. The materials of the final cover system are provided below in Table 1 along with the effective and total strength values for each material.

TABLE 1

Unit 2 Landfill

Soil Description	Density (pcf)	Total Strengths (Short Term)		Effective Strengths (Long Term)	
		ϕ (degrees)	c (psf)	ϕ' (degrees)	c (psf)
Vegetative Layer	110	0	800	27	0
Compacted Clay	130	0	1800	28	0
Geocomposite Drain/Geomembrane	60	25	0	25	0
Waste	90	0	2000	34	0

2. FINAL COVER STABILITY ANALYSIS

2.1 Long Term Analysis

Slope stability analysis of the final cover was conducted using Slope/W using Morgenstern-Price as it satisfies all conditions of equilibrium. Both circular and block analysis were conducted with the analysis targeting the low strength layers of the final cover, the geosynthetics. The long term analysis utilized the effective strengths for the materials. Below is the factor of safety from each of the final cover stability analysis in Table 2 and the analyses are included in Attachment A.

TABLE 2

Long Term Static Slope Stability Results

Cross Section	Stability Model Results	40 CFR 257.73 Minimum F.S.
Long Term Static Circular	2.884	1.5
Long Term Static Circular at Terrace	2.249	
Long Term Static Block	1.846	

2.2 Seismic Analysis

Seismic slope stability analysis of the final cover was conducted using a seismic coefficient of 0.1g and the total strengths for the materials. Below is the factor of safety from each of the final cover stability analysis in Table 3 and the analyses are included in Attachment B.

TABLE 3

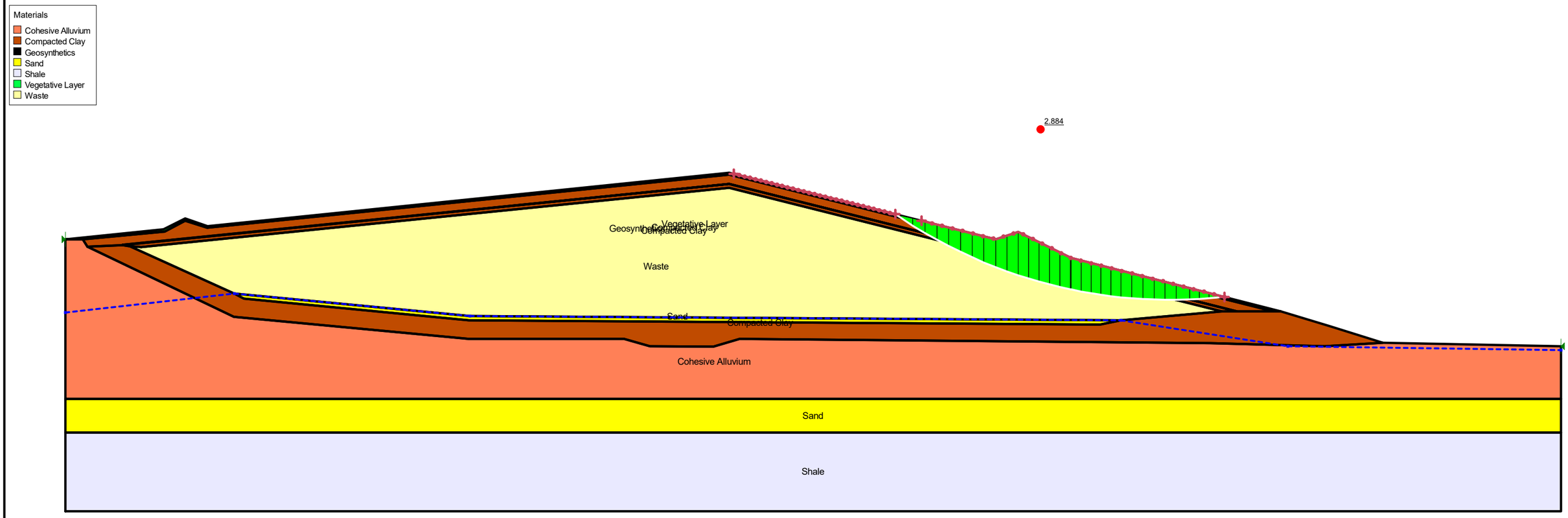
Seismic Slope Stability Results

Cross Section	Stability Model Results	40 CFR 257.73 Minimum F.S.
Seismic Circular	16.489	1.0
Seismic Circular at Terrace	8.696	
Seismic Block	2.284	

The factor of safety is met for all conditions analyzed for the final cover design.

APPENDIX A:
Long Term Static Final Cover Analyses

APPENDIX A-1:
Long Term Static Circular Final Cover Analysis



LT Circular Cover Stability	
Unit 2 Landfill Long Term.gsz	
07/06/2025	1:315

LT Circular Cover Stability

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File Information

File Version: 11.05
Title: CWLP Unit 2 Landfill
Created By: Karl Finke
Last Edited By: Karl Finke
Revision Number: 93
Date: 07/06/2025
Time: 11:28:31 PM
Tool Version: 23.1.2.11
File Name: Unit 2 Landfill Long Term.gsz
Directory: D:\SlopeW\CWLP\Unit 2 Landfill\
Last Solved Date: 07/06/2025
Last Solved Time: 11:29:10 PM

Project Settings

Unit System: U.S. Customary Units
Start Date: Sunday, June 23, 2025

Analysis Settings

LT Circular Cover Stability

Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Intercolumn force function option: Half-Sine
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 1 ft
  - Minimum Slip Surface Volume: 35.314667 ft^3
  - Number of Columns: 30
- Factor of Safety Convergence Settings

Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Cohesive Alluvium

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 135 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Shale

Slope Stability Material Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Surface: 1

Sand

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Compacted Clay

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 130 pcf
Effective Cohesion: 100 psf
Effective Friction Angle: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Waste

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 90 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °

Pore Water Pressure
Piezometric Surface: 1

Vegetative Layer

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 110 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 27 °
Phi-B: 0 °

Geosynthetics

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 60 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (178.77523, 70) ft
Left-Zone Right Coordinate: (222, 59.23774) ft
Left-Zone Increment: 30
Right Type: Range
Right-Zone Left Coordinate: (229, 57.49485) ft
Right-Zone Right Coordinate: (310, 37.17117) ft
Right-Zone Increment: 30
Radius Increments: 10

Slip Surface Limits

Left Coordinate: (0, 52.57) ft
Right Coordinate: (400, 24) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	0 ft	33 ft
Coordinate 2	45.12 ft	38.07 ft
Coordinate 3	108.22 ft	32.07 ft
Coordinate 4	282.31 ft	30.93 ft
Coordinate 5	327 ft	24 ft
Coordinate 6	400 ft	23 ft

Geometry

Name: 2D Geometry

Settings

View: 2D

Element Thickness: 0.1 ft

Points

	X	Y
Point 1	0 ft	52.57 ft
Point 2	26.23 ft	55.2 ft
Point 3	32 ft	58.08 ft
Point 4	38 ft	56.08 ft
Point 5	177.49 ft	70.32 ft
Point 6	248.82 ft	52.56 ft
Point 7	254.87 ft	54.55 ft
Point 8	269.01 ft	47.53 ft
Point 9	325.16 ft	33.34 ft
Point 10	338.17 ft	29.35 ft
Point 11	352.44 ft	24.95 ft
Point 12	4.65 ft	52.57 ft
Point 13	177.49 ft	69.82 ft
Point 14	323.18 ft	33.33 ft
Point 15	15.24 ft	51.03 ft
Point 16	177.49 ft	67.32 ft
Point 17	313.3 ft	33.33 ft
Point 18	20.22 ft	50.48 ft
Point 19	177.49 ft	66.32 ft
Point 20	309.35 ft	33.33 ft
Point 21	45.12 ft	38.07 ft
Point 22	108.22 ft	32.07 ft
Point 23	282.31 ft	30.93 ft
Point 24	17.2 ft	50.65 ft
Point 25	47.72 ft	36.77 ft
Point 26	107.85 ft	30.94 ft
Point 27	276.74 ft	29.83 ft
Point 28	5.88 ft	50.57 ft
Point 29	45 ft	31.91 ft
Point 30	107.84 ft	25.95 ft
Point 31	149.39 ft	25.95 ft
Point 32	156.34 ft	24.01 ft
Point 33	173.34 ft	23.93 ft
Point 34	180.32 ft	25.95 ft
Point 35	306.34 ft	24.81 ft
Point 36	325.25 ft	524.19 ft
Point 37	336.8 ft	24.04 ft
Point 38	400 ft	24 ft
Point 39	0 ft	1 ft
Point 40	400 ft	1 ft

Point 41	0 ft	-20 ft
Point 42	400 ft	-20 ft
Point 43	0 ft	10 ft
Point 44	400 ft	10 ft
Point 45	32 ft	57.45 ft
Point 46	254.87 ft	53.8 ft
Point 47	26.5 ft	54.6 ft
Point 48	37.95 ft	55.6 ft
Point 49	248.8 ft	51.9 ft
Point 50	268.8 ft	47 ft
Point 51	15.24 ft	51.06 ft
Point 52	177.49 ft	67.34 ft
Point 53	313.3 ft	33.35 ft

Regions

	Material	Points	Area
Region 1	Compacted Clay	28,29,30,31,32,33,34,35,37,11,10,9,14,17,20,23,27,26,25,21,24,15	1,848.4 ft²
Region 2	Sand	22,23,27,26,25,21	262.82 ft²
Region 3	Waste	18,19,20,23,22,21,24	6,103.1 ft²
Region 4	Compacted Clay	15,16,17,20,19,18,24	297.28 ft²
Region 5	Compacted Clay	12,28,15,51,52,53,17,14,50,46,49,13,48,45,47	802.04 ft²
Region 6	Vegetative Layer	1,2,3,4,5,6,7,8,9,14,50,46,49,13,48,45,47,12	173.85 ft²
Region 7	Shale	41,42,40,39	8,400 ft²
Region 8	Sand	43,39,40,44	3,600 ft²
Region 9	Cohesive Alluvium	1,43,44,38,11,37,35,34,33,32,31,30,29,28,12	7,062.1 ft²
Region 10	Geosynthetics	51,52,53,17,16,15	6.7725 ft²

Slip Results

Slip Surfaces Analysed: 9941 of 10571 converged

Current Slip Surface

Slip Surface: 10,563
Factor of Safety: 2.884
Volume: 533.80349 ft³
Weight: 60,789.786 lbf
Resisting Moment: 5,440,225.6 lbf·ft
Activating Moment: 1,886,494.7 lbf·ft
Resisting Force: 39,982.979 lbf
Activating Force: 13,860.938 lbf
Slip Rank: 1 of 10,571 slip surfaces
Exit: (310, 37.171173) ft
Entry: (222, 59.23774) ft
Radius: 130.46471 ft
Center: (295.75254, 166.8556) ft

Slip Columns

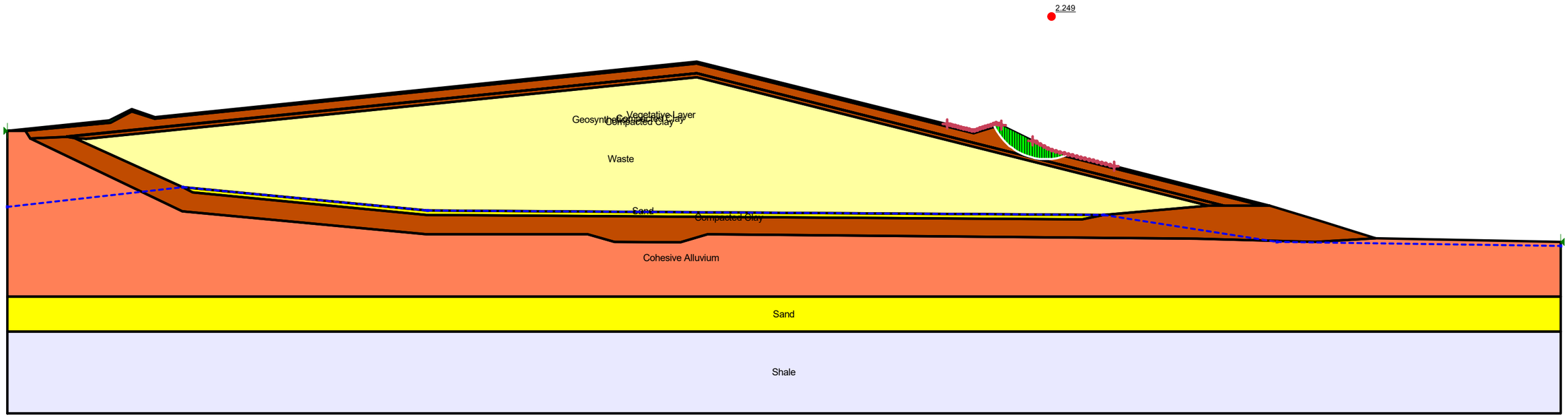
	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Column 1	222.71038 ft	58.75774 ft	0 psf	29.600878 psf	15.082401 psf	0 psf	0 psf	Vegetative Layer
Column 2	225.04592 ft	57.22953 ft	-1,618.4745 psf	113.40489 psf	60.298449 psf	100 psf	0 psf	Compacted Clay
Column 3	228.29625 ft	55.19950 ft	-1,493.068 psf	253.28604 psf	134.67458 psf	100 psf	0 psf	Compacted Clay
Column 4	231.53124 ft	53.30718 ft	-1,376.2523 psf	375.58856 psf	199.70398 psf	100 psf	0 psf	Compacted Clay
Column 5	234.70695 ft	51.56754 ft	-1,268.9444 psf	470.92212 psf	317.64098 psf	0 psf	0 psf	Waste
Column 6	237.83874 ft	49.96258 ft	-1,170.0269 psf	534.46219 psf	360.4993 psf	0 psf	0 psf	Waste
Column 7	240.97053 ft	48.46221 ft	-1,077.6389 psf	591.88631 psf	399.23236 psf	0 psf	0 psf	Waste
Column 8	244.10232 ft	47.06250 ft	-991.53499 psf	643.75324 psf	434.21704 psf	0 psf	0 psf	Waste
Column 9	247.24411 ft	45.75609 ft	-911.26032 psf	690.52167 psf	465.76275 psf	0 psf	0 psf	Waste
Column 10	250.33250 ft	44.56309 ft	-838.04365 psf	832.9968 psf	561.86343 psf	0 psf	0 psf	Waste
Column 11	253.35750 ft	43.48160 ft	-771.76265 psf	1,073.7452 psf	724.25026 psf	0 psf	0 psf	Waste
Column 12	256.26300 ft	42.51944 ft	-712.88252 psf	1,169.3302 psf	788.72315 psf	0 psf	0 psf	Waste
Column 13	259.04900 ft	41.66861 ft	-660.90373 psf	1,115.4782 psf	752.39955 psf	0 psf	0 psf	Waste
Column 14	261.83500 ft	40.88513 ft	-613.12998 psf	1,055.668 psf	712.05708 psf	0 psf	0 psf	Waste
Column 15	264.62100 ft	40.16775 ft	-569.48321 psf	989.33516 psf	667.31499 psf	0 psf	0 psf	Waste
Column 16	267.40700 ft	39.51537 ft	-529.89364 psf	915.93979 psf	617.80919 psf	0 psf	0 psf	Waste
Column 17	268.90500 ft	39.18321 ft	-509.7694 psf	874.56117 psf	589.89896 psf	0 psf	0 psf	Waste
Column 18	270.34000 ft	38.89699 ft	-492.48743 psf	871.9994 psf	588.17103 psf	0 psf	0 psf	Waste
Column 19	273.00000 ft	38.39729 ft	-462.37806 psf	869.07958 psf	586.20158 psf	0 psf	0 psf	Waste
Column 20	275.66000 ft	37.95440 ft	-435.81617 psf	860.16526 psf	580.18879 psf	0 psf	0 psf	Waste
Column 21	278.32000 ft	37.56776 ft	-412.76529 psf	844.89563 psf	569.8893 psf	0 psf	0 psf	Waste
Column 22	280.98000 ft	37.23685 ft	-393.19399 psf	822.95818 psf	555.0923 psf	0 psf	0 psf	Waste
Column 23	283.78784 ft	36.94916 ft	-390.08394 psf	792.13827 psf	534.30401 psf	0 psf	0 psf	Waste
Column 24	286.74352 ft	36.71074 ft	-403.8135 psf	751.34779 psf	506.79048 psf	0 psf	0 psf	Waste

Column 25	289.69919 ft	36.53980 ft	-421.75491 psf	701.76479 psf	473.34632 psf	0 psf	0 psf	Waste
Column 26	292.65487 ft	36.43605 ft	-443.89159 psf	643.49872 psf	434.04537 psf	0 psf	0 psf	Waste
Column 27	295.61055 ft	36.39934 ft	-470.21354 psf	576.83221 psf	389.07824 psf	0 psf	0 psf	Waste
Column 28	298.89202 ft	36.44115 ft	-504.59153 psf	474.09672 psf	252.08169 psf	100 psf	0 psf	Compacted Clay
Column 29	302.02192 ft	36.54838 ft	-541.58622 psf	351.7773 psf	187.04331 psf	100 psf	0 psf	Compacted Clay
Column 30	304.63979 ft	36.70038 ft	-576.41917 psf	240.15779 psf	127.69416 psf	100 psf	0 psf	Compacted Clay
Column 31	307.22298 ft	36.90258 ft	-614.05016 psf	123.49154 psf	65.661617 psf	100 psf	0 psf	Compacted Clay
Column 32	309.25729 ft	37.09388 ft	0 psf	29.821994 psf	15.195065 psf	0 psf	0 psf	Vegetative Layer

APPENDIX A-2:

Long Term Static Circular of Terrace Final Cover Analysis

Materials
- Cohesive Alluvium
- Compacted Clay
- Geosynthetics
- Sand
- Shale
- Vegetative Layer
- Waste



LT Circular Cover Stability of Terrace	
Unit 2 Landfill Long Term.gsz	
07/06/2025	1:315

LT Circular Cover Stability of Terrace

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File Information

File Version: 11.05
Title: CWLP Unit 2 Landfill
Created By: Karl Finke
Last Edited By: Karl Finke
Revision Number: 93
Date: 07/06/2025
Time: 11:28:31 PM
Tool Version: 23.1.2.11
File Name: Unit 2 Landfill Long Term.gsz
Directory: D:\SlopeW\CWLP\Unit 2 Landfill\
Last Solved Date: 07/06/2025
Last Solved Time: 11:29:10 PM

Project Settings

Unit System: U.S. Customary Units
Start Date: Sunday, June 23, 2025

Analysis Settings

LT Circular Cover Stability of Terrace

Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Intercolumn force function option: Half-Sine
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 0.5 ft
  - Minimum Slip Surface Volume: 35.314667 ft^3
  - Number of Columns: 30
- Factor of Safety Convergence Settings

Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Cohesive Alluvium

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 135 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Shale

Slope Stability Material Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Surface: 1

Sand

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Compacted Clay

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 130 pcf
Effective Cohesion: 100 psf
Effective Friction Angle: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Waste

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 90 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °

Pore Water Pressure
Piezometric Surface: 1

Vegetative Layer

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 110 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 27 °
Phi-B: 0 °

Geosynthetics

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 60 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (242, 54.25807) ft
Left-Zone Right Coordinate: (255.97783, 54) ft
Left-Zone Increment: 20
Right Type: Range
Right-Zone Left Coordinate: (264.03481, 50) ft
Right-Zone Right Coordinate: (285, 43.48907) ft
Right-Zone Increment: 20
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (0, 52.57) ft
Right Coordinate: (400, 24) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	0 ft	33 ft
Coordinate 2	45.12 ft	38.07 ft
Coordinate 3	108.22 ft	32.07 ft
Coordinate 4	282.31 ft	30.93 ft
Coordinate 5	327 ft	24 ft
Coordinate 6	400 ft	23 ft

Geometry

Name: 2D Geometry

Settings

View: 2D

Element Thickness: 0.1 ft

Points

	X	Y
Point 1	0 ft	52.57 ft
Point 2	26.23 ft	55.2 ft
Point 3	32 ft	58.08 ft
Point 4	38 ft	56.08 ft
Point 5	177.49 ft	70.32 ft
Point 6	248.82 ft	52.56 ft
Point 7	254.87 ft	54.55 ft
Point 8	269.01 ft	47.53 ft
Point 9	325.16 ft	33.34 ft
Point 10	338.17 ft	29.35 ft
Point 11	352.44 ft	24.95 ft
Point 12	4.65 ft	52.57 ft
Point 13	177.49 ft	69.82 ft
Point 14	323.18 ft	33.33 ft
Point 15	15.24 ft	51.03 ft
Point 16	177.49 ft	67.32 ft
Point 17	313.3 ft	33.33 ft
Point 18	20.22 ft	50.48 ft
Point 19	177.49 ft	66.32 ft
Point 20	309.35 ft	33.33 ft
Point 21	45.12 ft	38.07 ft
Point 22	108.22 ft	32.07 ft
Point 23	282.31 ft	30.93 ft
Point 24	17.2 ft	50.65 ft
Point 25	47.72 ft	36.77 ft
Point 26	107.85 ft	30.94 ft
Point 27	276.74 ft	29.83 ft
Point 28	5.88 ft	50.57 ft
Point 29	45 ft	31.91 ft
Point 30	107.84 ft	25.95 ft
Point 31	149.39 ft	25.95 ft
Point 32	156.34 ft	24.01 ft
Point 33	173.34 ft	23.93 ft
Point 34	180.32 ft	25.95 ft
Point 35	306.34 ft	24.81 ft
Point 36	325.25 ft	524.19 ft
Point 37	336.8 ft	24.04 ft
Point 38	400 ft	24 ft
Point 39	0 ft	1 ft
Point 40	400 ft	1 ft

Point 41	0 ft	-20 ft
Point 42	400 ft	-20 ft
Point 43	0 ft	10 ft
Point 44	400 ft	10 ft
Point 45	32 ft	57.45 ft
Point 46	254.87 ft	53.8 ft
Point 47	26.5 ft	54.6 ft
Point 48	37.95 ft	55.6 ft
Point 49	248.8 ft	51.9 ft
Point 50	268.8 ft	47 ft
Point 51	15.24 ft	51.06 ft
Point 52	177.49 ft	67.34 ft
Point 53	313.3 ft	33.35 ft

Regions

	Material	Points	Area
Region 1	Compacted Clay	28,29,30,31,32,33,34,35,37,11,10,9,14,17,20,23,27,26,25,21,24,15	1,848.4 ft²
Region 2	Sand	22,23,27,26,25,21	262.82 ft²
Region 3	Waste	18,19,20,23,22,21,24	6,103.1 ft²
Region 4	Compacted Clay	15,16,17,20,19,18,24	297.28 ft²
Region 5	Compacted Clay	12,28,15,51,52,53,17,14,50,46,49,13,48,45,47	802.04 ft²
Region 6	Vegetative Layer	1,2,3,4,5,6,7,8,9,14,50,46,49,13,48,45,47,12	173.85 ft²
Region 7	Shale	41,42,40,39	8,400 ft²
Region 8	Sand	43,39,40,44	3,600 ft²
Region 9	Cohesive Alluvium	1,43,44,38,11,37,35,34,33,32,31,30,29,28,12	7,062.1 ft²
Region 10	Geosynthetics	51,52,53,17,16,15	6.7725 ft²

Slip Results

Slip Surfaces Analysed: 11542 of 13671 converged

Current Slip Surface

Slip Surface: 11,366
Factor of Safety: 2.249
Volume: 61.406159 ft³
Weight: 7,731.218 lbf
Resisting Moment: 88,411.73 lbf·ft
Activating Moment: 39,308.205 lbf·ft
Resisting Force: 5,275.2133 lbf
Activating Force: 2,345.9185 lbf
Slip Rank: 1 of 13,671 slip surfaces
Exit: (273.2436, 46.460103) ft
Entry: (253.95973, 54.25059) ft
Radius: 14.607287 ft
Center: (267.4442, 59.866811) ft

Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material

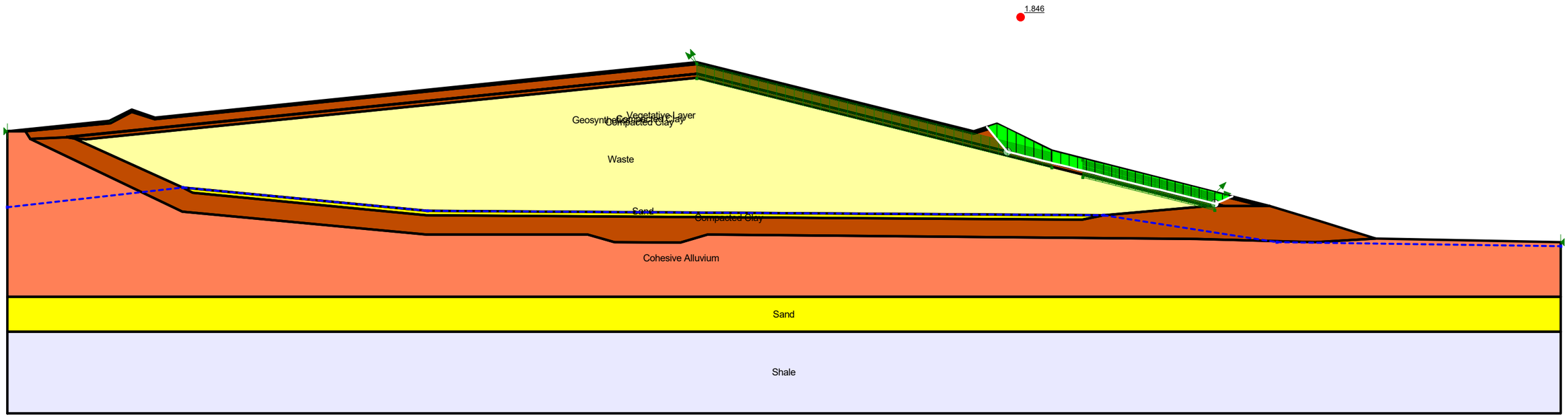
Column 1	254.10343 ft	53.92781 ft	0 psf	26.296472 psf	13.398722 psf	0 psf	0 psf	Vegetative Layer
Column 2	254.55856 ft	53.01899 ft	-1,367.6746 psf	57.513175 psf	30.580298 psf	100 psf	0 psf	Compacted Clay
Column 3	255.19102 ft	51.93692 ft	-1,300.3791 psf	157.83023 psf	83.91982 psf	100 psf	0 psf	Compacted Clay
Column 4	255.83305 ft	51.01958 ft	-1,243.372 psf	218.49184 psf	116.17417 psf	100 psf	0 psf	Compacted Clay
Column 5	256.47509 ft	50.23277 ft	-1,194.5139 psf	267.15584 psf	142.04928 psf	100 psf	0 psf	Compacted Clay
Column 6	257.11712 ft	49.54605 ft	-1,151.9044 psf	307.6783 psf	163.59546 psf	100 psf	0 psf	Compacted Clay
Column 7	257.75916 ft	48.94029 ft	-1,114.3493 psf	342.46227 psf	182.09042 psf	100 psf	0 psf	Compacted Clay
Column 8	258.40119 ft	48.40253 ft	-1,081.0392 psf	373.0691 psf	198.36436 psf	100 psf	0 psf	Compacted Clay
Column 9	259.04323 ft	47.92351 ft	-1,051.3962 psf	400.51999 psf	212.96026 psf	100 psf	0 psf	Compacted Clay
Column 10	259.68526 ft	47.49636 ft	-1,024.9914 psf	425.45708 psf	226.21954 psf	100 psf	0 psf	Compacted Clay
Column 11	260.32730 ft	47.11583 ft	-1,001.4979 psf	448.23374 psf	238.3301 psf	100 psf	0 psf	Compacted Clay
Column 12	260.96934 ft	46.77786 ft	-980.66043 psf	468.96611 psf	249.3537 psf	100 psf	0 psf	Compacted Clay
Column 13	261.61137 ft	46.47919 ft	-962.27718 psf	487.56295 psf	259.24182 psf	100 psf	0 psf	Compacted Clay
Column 14	262.25341 ft	46.21725 ft	-946.18647 psf	503.74366 psf	267.84525 psf	100 psf	0 psf	Compacted Clay
Column 15	262.89544 ft	45.98994 ft	-932.25808 psf	517.05153 psf	274.92118 psf	100 psf	0 psf	Compacted Clay
Column 16	263.55917 ft	45.79013 ft	-920.05507 psf	518.84299 psf	241.94046 psf	0 psf	0 psf	Geosynthetics
Column 17	264.24459 ft	45.61858 ft	-909.62571 psf	521.78613 psf	243.31287 psf	0 psf	0 psf	Geosynthetics
Column 18	264.88821 ft	45.48813 ft	-901.74482 psf	533.7821 psf	283.81698 psf	100 psf	0 psf	Compacted Clay
Column 19	265.49002 ft	45.39402 ft	-896.11494 psf	528.62905 psf	281.07705 psf	100 psf	0 psf	Compacted Clay
Column 20	266.09184 ft	45.32540 ft	-892.07738 psf	517.29609 psf	275.05121 psf	100 psf	0 psf	Compacted Clay
Column 21	266.69365 ft	45.28193 ft	-889.6096 psf	499.06007 psf	265.35495 psf	100 psf	0 psf	Compacted Clay
Column 22	267.29547 ft	45.26338 ft	-888.69758 psf	473.3249 psf	251.67131 psf	100 psf	0 psf	Compacted Clay
Column 23	267.89728 ft	45.26966 ft	-889.33536 psf	439.69238 psf	233.78859 psf	100 psf	0 psf	Compacted Clay
Column 24	268.49909 ft	45.30079 ft	-891.52497 psf	398.02809 psf	211.63529 psf	100 psf	0 psf	Compacted Clay
Column 25	268.90500 ft	45.33313 ft	-893.71026 psf	366.48766 psf	194.86494 psf	100 psf	0 psf	Compacted Clay
Column 26	269.34394 ft	45.38750 ft	-897.28392 psf	339.30355 psf	180.4109 psf	100 psf	0 psf	Compacted Clay

Column 27	270.01182 ft	45.49096 ft	-904.01589 psf	296.62797 psf	157.71989 psf	100 psf	0 psf	Compacted Clay
Column 28	270.67971 ft	45.62648 ft	-912.74935 psf	246.15467 psf	130.88276 psf	100 psf	0 psf	Compacted Clay
Column 29	271.34759 ft	45.79499 ft	-923.54224 psf	189.0926 psf	100.54232 psf	100 psf	0 psf	Compacted Clay
Column 30	272.01547 ft	45.99768 ft	-936.46983 psf	126.92077 psf	67.48497 psf	100 psf	0 psf	Compacted Clay
Column 31	272.79650 ft	46.28393 ft	0 psf	36.420523 psf	18.557183 psf	0 psf	0 psf	Vegetative Layer

APPENDIX A-3:

Long Term Static Block Final Cover Analysis

Materials
- Cohesive Alluvium
- Compacted Clay
- Geosynthetics
- Sand
- Shale
- Vegetative Layer
- Waste



LT Block Cover Stability	
Unit 2 Landfill Long Term.gsz	
07/06/2025	1:315

LT Block Cover Stability

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File Information

File Version: 11.05
Title: CWLP Unit 2 Landfill
Created By: Karl Finke
Last Edited By: Karl Finke
Revision Number: 89
Date: 07/06/2025
Time: 10:47:30 PM
Tool Version: 23.1.2.11
File Name: Unit 2 Landfill Long Term.gsz
Directory: D:\SlopeW\CWLP\Unit 2 Landfill\
Last Solved Date: 07/06/2025
Last Solved Time: 10:53:56 PM

Project Settings

Unit System: U.S. Customary Units
Start Date: Sunday, June 23, 2025

Analysis Settings

LT Block Cover Stability

Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Intercolumn force function option: Half-Sine
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Block
- Critical slip surfaces saved: 1
- Restrict Block Crossing: No
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 1 ft
  - Minimum Slip Surface Volume: 35.314667 ft^3
  - Number of Columns: 30

Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Cohesive Alluvium

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 135 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Shale

Slope Stability Material Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Surface: 1

Sand

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Compacted Clay

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 130 pcf
Effective Cohesion: 100 psf
Effective Friction Angle: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Waste

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 90 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °

Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Vegetative Layer

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 110 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 27 °
Phi-B: 0 °

Geosynthetics

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 60 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Limits

Left Coordinate: (0, 52.57) ft
Right Coordinate: (400, 24) ft

Slip Surface Block

Left Grid
Upper Left: (177.5, 69.9) ft
Lower Left: (177.5, 66.04) ft
Lower Right: (269, 43.14) ft
X Increments: 40
Y Increments: 12
Starting Angle: 115 °
Ending Angle: 135 °
Angle Increments: 4
Right Grid
Upper Left: (277, 45.05) ft
Lower Left: (277, 40.67) ft
Lower Right: (311, 32.16) ft
X Increments: 20
Y Increments: 20
Angle Increments: 4

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	0 ft	33 ft

Coordinate 2	45.12 ft	38.07 ft
Coordinate 3	108.22 ft	32.07 ft
Coordinate 4	282.31 ft	30.93 ft
Coordinate 5	327 ft	24 ft
Coordinate 6	400 ft	23 ft

Geometry

Name: 2D Geometry

Settings

View: 2D

Element Thickness: 0.1 ft

Points

	X	Y
Point 1	0 ft	52.57 ft
Point 2	26.23 ft	55.2 ft
Point 3	32 ft	58.08 ft
Point 4	38 ft	56.08 ft
Point 5	177.49 ft	70.32 ft
Point 6	248.82 ft	52.56 ft
Point 7	254.87 ft	54.55 ft
Point 8	269.01 ft	47.53 ft
Point 9	325.16 ft	33.34 ft
Point 10	338.17 ft	29.35 ft
Point 11	352.44 ft	24.95 ft
Point 12	4.65 ft	52.57 ft
Point 13	177.49 ft	69.82 ft
Point 14	323.18 ft	33.33 ft
Point 15	15.24 ft	51.03 ft
Point 16	177.49 ft	67.32 ft
Point 17	313.3 ft	33.33 ft
Point 18	20.22 ft	50.48 ft
Point 19	177.49 ft	66.32 ft
Point 20	309.35 ft	33.33 ft
Point 21	45.12 ft	38.07 ft
Point 22	108.22 ft	32.07 ft
Point 23	282.31 ft	30.93 ft
Point 24	17.2 ft	50.65 ft
Point 25	47.72 ft	36.77 ft
Point 26	107.85 ft	30.94 ft
Point 27	276.74 ft	29.83 ft
Point 28	5.88 ft	50.57 ft
Point 29	45 ft	31.91 ft
Point 30	107.84 ft	25.95 ft
Point 31	149.39 ft	25.95 ft
Point 32	156.34 ft	24.01 ft
Point 33	173.34 ft	23.93 ft
Point 34	180.32 ft	25.95 ft

Point 35	306.34 ft	24.81 ft
Point 36	325.25 ft	524.19 ft
Point 37	336.8 ft	24.04 ft
Point 38	400 ft	24 ft
Point 39	0 ft	1 ft
Point 40	400 ft	1 ft
Point 41	0 ft	-20 ft
Point 42	400 ft	-20 ft
Point 43	0 ft	10 ft
Point 44	400 ft	10 ft
Point 45	32 ft	57.45 ft
Point 46	254.87 ft	53.8 ft
Point 47	26.5 ft	54.6 ft
Point 48	37.95 ft	55.6 ft
Point 49	248.8 ft	51.9 ft
Point 50	268.8 ft	47 ft
Point 51	15.24 ft	51.06 ft
Point 52	177.49 ft	67.34 ft
Point 53	313.3 ft	33.35 ft

Regions

	Material	Points	Area
Region 1	Compacted Clay	28,29,30,31,32,33,34,35,37,11,10,9,14,17,20,23,27,26,25,21,24,15	1,848.4 ft²
Region 2	Sand	22,23,27,26,25,21	262.82 ft²
Region 3	Waste	18,19,20,23,22,21,24	6,103.1 ft²
Region 4	Compacted Clay	15,16,17,20,19,18,24	297.28 ft²
Region 5	Compacted Clay	12,28,15,51,52,53,17,14,50,46,49,13,48,45,47	802.04 ft²
Region 6	Vegetative Layer	1,2,3,4,5,6,7,8,9,14,50,46,49,13,48,45,47,12	173.85 ft²
Region 7	Shale	41,42,40,39	8,400 ft²
Region 8	Sand	43,39,40,44	3,600 ft²
Region 9	Cohesive Alluvium	1,43,44,38,11,37,35,34,33,32,31,30,29,28,12	7,062.1 ft²
Region 10	Geosynthetics	51,52,53,17,16,15	6.7725 ft²

Slip Results

Slip Surfaces Analysed: 5769901 of 5876325 converged

Current Slip Surface

Slip Surface: 2,201,533
Factor of Safety: 1.846
Volume: 205.62446 ft³
Weight: 25,946.573 lbf
Resisting Moment: 275,622.28 lbf·ft
Activating Moment: 149,263 lbf·ft
Resisting Force: 12,219.027 lbf
Activating Force: 6,619.868 lbf
Slip Rank: 1 of 5,876,325 slip surfaces
Exit: (315.50791, 35.779237) ft
Entry: (252.20538, 53.673537) ft

Radius: 29.766843 ft
Center: (287.6504, 58.147112) ft

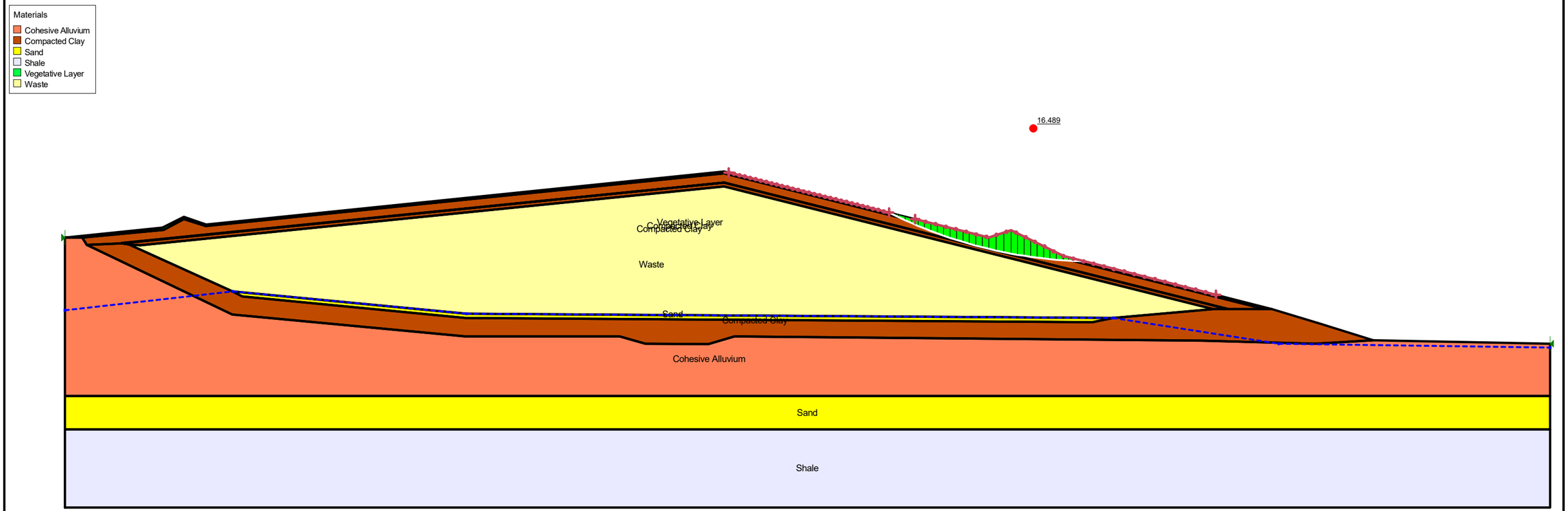
Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Column 1	252.44050 ft	53.39333 ft	0 psf	29.420048 psf	14.990263 psf	0 psf	0 psf	Vegetative Layer
Column 2	253.77281 ft	51.80554 ft	-1,291.5978 psf	167.96851 psf	89.310438 psf	100 psf	0 psf	Compacted Clay
Column 3	256.21062 ft	48.90027 ft	-1,111.2177 psf	397.83826 psf	211.53435 psf	100 psf	0 psf	Compacted Clay
Column 4	258.68062 ft	47.01456 ft	-994.50229 psf	657.78183 psf	306.7287 psf	0 psf	0 psf	Geosynthetics
Column 5	260.93375 ft	46.44523 ft	-959.87993 psf	592.53596 psf	276.30406 psf	0 psf	0 psf	Geosynthetics
Column 6	263.18125 ft	45.88261 ft	-925.67407 psf	526.26937 psf	245.40344 psf	0 psf	0 psf	Geosynthetics
Column 7	265.42875 ft	45.31999 ft	-891.4682 psf	460.17324 psf	214.58231 psf	0 psf	0 psf	Geosynthetics
Column 8	267.67625 ft	44.75736 ft	-857.26233 psf	394.23374 psf	183.83421 psf	0 psf	0 psf	Geosynthetics
Column 9	268.90500 ft	44.44977 ft	-838.56134 psf	358.70666 psf	167.26766 psf	0 psf	0 psf	Geosynthetics
Column 10	270.11833 ft	44.14603 ft	-820.09499 psf	356.5902 psf	166.28074 psf	0 psf	0 psf	Geosynthetics
Column 11	272.33500 ft	43.59112 ft	-786.35839 psf	357.65219 psf	166.77596 psf	0 psf	0 psf	Geosynthetics
Column 12	274.55167 ft	43.03622 ft	-752.62179 psf	358.82417 psf	167.32246 psf	0 psf	0 psf	Geosynthetics
Column 13	276.76833 ft	42.48131 ft	-718.88519 psf	360.08428 psf	167.91006 psf	0 psf	0 psf	Geosynthetics
Column 14	278.98500 ft	41.92641 ft	-685.14859 psf	361.40967 psf	168.5281 psf	0 psf	0 psf	Geosynthetics
Column 15	281.20167 ft	41.37150 ft	-651.41199 psf	362.77676 psf	169.16558 psf	0 psf	0 psf	Geosynthetics
Column 16	283.33464 ft	40.83755 ft	-628.44974 psf	364.10929 psf	169.78695 psf	0 psf	0 psf	Geosynthetics
Column 17	285.38393 ft	40.32455 ft	-616.26183 psf	365.38508 psf	170.38186 psf	0 psf	0 psf	Geosynthetics
Column 18	287.43321 ft	39.81154 ft	-604.07392 psf	366.63721 psf	170.96574 psf	0 psf	0 psf	Geosynthetics
Column 19	289.48250 ft	39.29854 ft	-591.88602 psf	367.84703 psf	171.52989 psf	0 psf	0 psf	Geosynthetics
Column 20	291.53179 ft	38.78554 ft	-579.69811 psf	368.9964 psf	172.06585 psf	0 psf	0 psf	Geosynthetics
Column 21	293.58107 ft	38.27253 ft	-567.5102 psf	370.06789 psf	172.56549 psf	0 psf	0 psf	Geosynthetics
Column 22	295.63036 ft	37.75953 ft	-555.32229 psf	371.04493 psf	173.02109 psf	0 psf	0 psf	Geosynthetics
Column 23	297.67964 ft	37.24652 ft	-543.13439 psf	371.91203 psf	173.42543 psf	0 psf	0 psf	Geosynthetics

Column 24	299.72893 ft	36.73352 ft	-530.94648 psf	372.65486 psf	173.77181 psf	0 psf	0 psf	Geosynthetics
Column 25	301.77821 ft	36.22052 ft	-518.75857 psf	373.26048 psf	174.05422 psf	0 psf	0 psf	Geosynthetics
Column 26	303.82750 ft	35.70751 ft	-506.57067 psf	373.71743 psf	174.2673 psf	0 psf	0 psf	Geosynthetics
Column 27	305.87679 ft	35.19451 ft	-494.38276 psf	374.01581 psf	174.40643 psf	0 psf	0 psf	Geosynthetics
Column 28	307.92607 ft	34.68151 ft	-482.19485 psf	374.14744 psf	174.46781 psf	0 psf	0 psf	Geosynthetics
Column 29	309.97536 ft	34.16850 ft	-470.00694 psf	374.10589 psf	174.44844 psf	0 psf	0 psf	Geosynthetics
Column 30	311.93655 ft	34.29993 ft	-497.19849 psf	404.77629 psf	215.22337 psf	100 psf	0 psf	Compacted Clay
Column 31	313.79940 ft	35.07155 ft	-563.40486 psf	192.69661 psf	102.45861 psf	100 psf	0 psf	Compacted Clay
Column 32	315.11680 ft	35.61724 ft	0 psf	32.766897 psf	16.695568 psf	0 psf	0 psf	Vegetative Layer

APPENDIX B:
Seismic Final Cover Analyses

APPENDIX B-1:
Seismic Circular Final Cover Analysis



Seismic Circular Cover Stability	
Unit 2 Landfill Seismic.gsz	
07/06/2025	1:315

Seismic Circular Cover Stability

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File Information

File Version: 11.05
Title: CWLP Unit 2 Landfill
Created By: Karl Finke
Last Edited By: Karl Finke
Revision Number: 77
Date: 07/06/2025
Time: 09:54:05 PM
Tool Version: 23.1.2.11
File Name: Unit 2 Landfill Seismic.gsz
Directory: D:\SlopeW\CWLP\Unit 2 Landfill\
Last Solved Date: 07/06/2025
Last Solved Time: 09:56:59 PM

Project Settings

Unit System: U.S. Customary Units
Start Date: Sunday, June 23, 2025

Analysis Settings

Seismic Circular Cover Stability

Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Intercolumn force function option: Half-Sine
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 1 ft
  - Minimum Slip Surface Volume: 35.314667 ft^3
  - Number of Columns: 30
- Factor of Safety Convergence Settings

Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Cohesive Alluvium

Slope Stability Material Model: Undrained (Phi=0)
Unit Weight: 135 pcf
Total Cohesion: 1,150 psf
Pore Water Pressure
Piezometric Surface: 1

Shale

Slope Stability Material Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Surface: 1

Sand

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Compacted Clay

Slope Stability Material Model: Undrained (Phi=0)
Unit Weight: 130 pcf
Total Cohesion: 1,800 psf
Pore Water Pressure
Piezometric Surface: 1

Waste

Slope Stability Material Model: Undrained (Phi=0)
Unit Weight: 90 pcf
Total Cohesion: 2,000 psf
Pore Water Pressure
Piezometric Surface: 1

Vegetative Layer

Slope Stability Material Model: Undrained (Phi=0)
Unit Weight: 110 pcf

Total Cohesion: 800 psf

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (178.77523, 70) ft
Left-Zone Right Coordinate: (222, 59.23774) ft
Left-Zone Increment: 30
Right Type: Range
Right-Zone Left Coordinate: (229, 57.49485) ft
Right-Zone Right Coordinate: (310, 37.17117) ft
Right-Zone Increment: 30
Radius Increments: 10

Slip Surface Limits

Left Coordinate: (0, 52.57) ft
Right Coordinate: (400, 24) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	0 ft	33 ft
Coordinate 2	45.12 ft	38.07 ft
Coordinate 3	108.22 ft	32.07 ft
Coordinate 4	282.31 ft	30.93 ft
Coordinate 5	327 ft	24 ft
Coordinate 6	400 ft	23 ft

Seismic Coefficients

Horz Seismic Coef.: 0.1

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 0.1 ft

Points

	X	Y
Point 1	0 ft	52.57 ft
Point 2	26.23 ft	55.2 ft
Point 3	32 ft	58.08 ft

Point 4	38 ft	56.08 ft
Point 5	177.49 ft	70.32 ft
Point 6	248.82 ft	52.56 ft
Point 7	254.87 ft	54.55 ft
Point 8	269.01 ft	47.53 ft
Point 9	325.16 ft	33.34 ft
Point 10	338.17 ft	29.35 ft
Point 11	352.44 ft	24.95 ft
Point 12	4.65 ft	52.57 ft
Point 13	177.49 ft	69.82 ft
Point 14	323.18 ft	33.33 ft
Point 15	15.24 ft	51.03 ft
Point 16	177.49 ft	67.32 ft
Point 17	313.3 ft	33.33 ft
Point 18	20.22 ft	50.48 ft
Point 19	177.49 ft	66.32 ft
Point 20	309.35 ft	33.33 ft
Point 21	45.12 ft	38.07 ft
Point 22	108.22 ft	32.07 ft
Point 23	282.31 ft	30.93 ft
Point 24	17.2 ft	50.65 ft
Point 25	47.72 ft	36.77 ft
Point 26	107.85 ft	30.94 ft
Point 27	276.74 ft	29.83 ft
Point 28	5.88 ft	50.57 ft
Point 29	45 ft	31.91 ft
Point 30	107.84 ft	25.95 ft
Point 31	149.39 ft	25.95 ft
Point 32	156.34 ft	24.01 ft
Point 33	173.34 ft	23.93 ft
Point 34	180.32 ft	25.95 ft
Point 35	306.34 ft	24.81 ft
Point 36	325.25 ft	524.19 ft
Point 37	336.8 ft	24.04 ft
Point 38	400 ft	24 ft
Point 39	0 ft	1 ft
Point 40	400 ft	1 ft
Point 41	0 ft	-20 ft
Point 42	400 ft	-20 ft
Point 43	0 ft	10 ft
Point 44	400 ft	10 ft
Point 45	32 ft	57.45 ft
Point 46	254.87 ft	53.8 ft
Point 47	26.5 ft	54.6 ft
Point 48	37.95 ft	55.6 ft
Point 49	248.8 ft	51.9 ft
Point 50	268.8 ft	47 ft
Point 51	15.24 ft	51.06 ft
Point 52	177.49 ft	67.34 ft

Point 53	313.3 ft	33.35 ft

Regions

	Material	Points	Area
Region 1	Compacted Clay	28,29,30,31,32,33,34,35,37,11,10,9,14,17,20,23,27,26,25,21,24,15	1,848.4 ft²
Region 2	Sand	22,23,27,26,25,21	262.82 ft²
Region 3	Waste	18,19,20,23,22,21,24	6,103.1 ft²
Region 4	Compacted Clay	15,16,17,20,19,18,24	297.28 ft²
Region 5	Compacted Clay	12,28,15,51,52,53,17,14,50,46,49,13,48,45,47	802.04 ft²
Region 6	Vegetative Layer	1,2,3,4,5,6,7,8,9,14,50,46,49,13,48,45,47,12	173.85 ft²
Region 7	Shale	41,42,40,39	8,400 ft²
Region 8	Sand	43,39,40,44	3,600 ft²
Region 9	Cohesive Alluvium	1,43,44,38,11,37,35,34,33,32,31,30,29,28,12	7,062.1 ft²
Region 10		51,52,53,17,16,15	6.7725 ft²

Slip Results

Slip Surfaces Analysed: 928 of 10571 converged

Current Slip Surface

Slip Surface: 10,419
Factor of Safety: 16.489
Volume: 142.05183 ft³
Weight: 17,815.507 lbf
Resisting Moment: 11,520,661 lbf·ft
Activating Moment: 698,674.79 lbf·ft
Resisting Force: 88,946.395 lbf
Activating Force: 5,394.4505 lbf
Slip Rank: 1 of 10,571 slip surfaces
Exit: (274.34844, 46.18089) ft
Entry: (222, 59.23774) ft
Radius: 124.80014 ft
Center: (277.6628, 170.93701) ft

Slip Columns

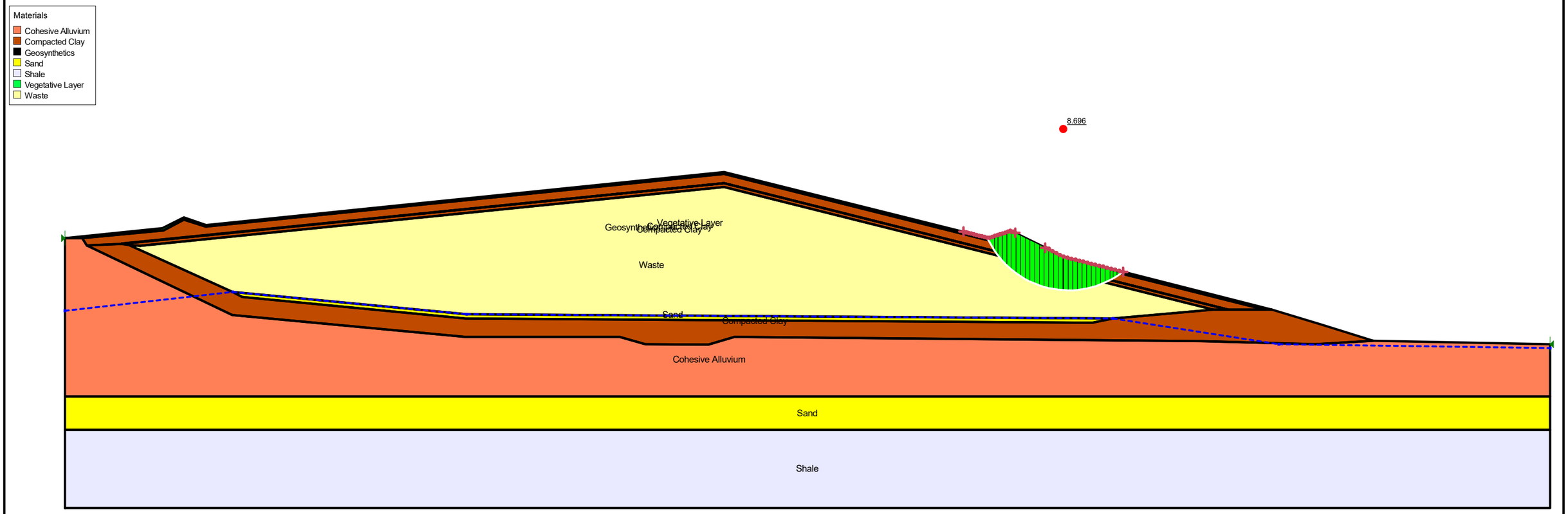
	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Column 1	223.29553 ft	58.61069 ft	0 psf	5.4374978 psf	0 psf	800 psf	0 psf	Vegetative Layer
Column 2	225.45566 ft	57.58542 ft	-1,640.8602 psf	19.765392 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 3	227.18487 ft	56.80481 ft	-1,592.8334 psf	60.286675 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 4	228.91408 ft	56.05553 ft	-1,546.7626 psf	101.32744 psf	0 psf	1,800 psf	0 psf	Compacted Clay

Column 5	230.64329 ft	55.33697 ft	-1,502.6098 psf	142.28958 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 6	232.37250 ft	54.64857 ft	-1,460.3394 psf	182.38822 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 7	234.10171 ft	53.98978 ft	-1,419.9182 psf	220.70419 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 8	235.83092 ft	53.36012 ft	-1,381.3151 psf	256.25885 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 9	237.56013 ft	52.75911 ft	-1,344.5009 psf	288.10196 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 10	239.28934 ft	52.18632 ft	-1,309.4486 psf	315.39947 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 11	241.01855 ft	51.64135 ft	-1,276.1327 psf	337.50783 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 12	242.74776 ft	51.12381 ft	-1,244.5296 psf	354.02368 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 13	244.47697 ft	50.63335 ft	-1,214.6171 psf	364.8035 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 14	246.20618 ft	50.16964 ft	-1,186.3747 psf	369.95306 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 15	247.94539 ft	49.73000 ft	-1,159.6388 psf	369.82795 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 16	249.82833 ft	49.28486 ft	-1,132.6181 psf	459.83938 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 17	251.84500 ft	48.84093 ft	-1,105.7281 psf	633.20105 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 18	253.86167 ft	48.43180 ft	-1,081.0109 psf	791.2081 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 19	255.74062 ft	48.08055 ft	-1,059.85 psf	813.81703 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 20	257.48188 ft	47.78253 ft	-1,041.9565 psf	711.85806 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 21	259.22312 ft	47.50979 ft	-1,025.6414 psf	610.8657 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 22	260.96438 ft	47.26217 ft	-1,010.8943 psf	511.77619 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 23	262.70563 ft	47.03952 ft	-997.70578 psf	415.16037 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 24	264.44687 ft	46.84170 ft	-986.06745 psf	321.26485 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 25	266.18813 ft	46.66858 ft	-975.9719 psf	230.05673 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 26	267.92938 ft	46.52008 ft	-967.4127 psf	141.26657 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 27	268.90500 ft	46.44458 ft	-963.09822 psf	93.149438 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 28	269.67217 ft	46.39471 ft	-960.29836 psf	76.932793 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 29	270.99652 ft	46.31681 ft	-955.97606 psf	53.888551 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 30	272.33113 ft	46.25263 ft	0 psf	38.837572 psf	0 psf	800 psf	0 psf	Vegetative Layer

Column 31	273.67601 ft	46.20238 ft	0 psf	12.175923 psf	0 psf	800 psf	0 psf	Vegetative Layer

APPENDIX B-2:

Seismic Circular of Terrace Final Cover Analysis



Seismic Circular Cover Stability of Terrace	
Unit 2 Landfill Seismic.gsz	
07/06/2025	1:315

Seismic Circular Cover Stability of Terrace

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File Information

File Version: 11.05
Title: CWLP Unit 2 Landfill
Created By: Karl Finke
Last Edited By: Karl Finke
Revision Number: 86
Date: 07/06/2025
Time: 10:56:53 PM
Tool Version: 23.1.2.11
File Name: Unit 2 Landfill Seismic.gsz
Directory: D:\SlopeW\CWLP\Unit 2 Landfill\
Last Solved Date: 07/06/2025
Last Solved Time: 11:18:02 PM

Project Settings

Unit System: U.S. Customary Units
Start Date: Sunday, June 23, 2025

Analysis Settings

Seismic Circular Cover Stability of Terrace

Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Intercolumn force function option: Half-Sine
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 0.5 ft
  - Minimum Slip Surface Volume: 35.314667 ft^3
  - Number of Columns: 30
- Factor of Safety Convergence Settings

Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Cohesive Alluvium

Slope Stability Material Model: Undrained (Phi=0)
Unit Weight: 135 pcf
Total Cohesion: 1,150 psf
Pore Water Pressure
Piezometric Surface: 1

Shale

Slope Stability Material Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Surface: 1

Sand

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Compacted Clay

Slope Stability Material Model: Undrained (Phi=0)
Unit Weight: 130 pcf
Total Cohesion: 1,800 psf
Pore Water Pressure
Piezometric Surface: 1

Waste

Slope Stability Material Model: Undrained (Phi=0)
Unit Weight: 90 pcf
Total Cohesion: 2,000 psf
Pore Water Pressure
Piezometric Surface: 1

Vegetative Layer

Slope Stability Material Model: Undrained (Phi=0)
Unit Weight: 110 pcf

Total Cohesion: 800 psf

Geosynthetics

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 60 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (242, 54.25807) ft
Left-Zone Right Coordinate: (255.97783, 54) ft
Left-Zone Increment: 20
Right Type: Range
Right-Zone Left Coordinate: (264.03481, 50) ft
Right-Zone Right Coordinate: (285, 43.48907) ft
Right-Zone Increment: 20
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (0, 52.57) ft
Right Coordinate: (400, 24) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	0 ft	33 ft
Coordinate 2	45.12 ft	38.07 ft
Coordinate 3	108.22 ft	32.07 ft
Coordinate 4	282.31 ft	30.93 ft
Coordinate 5	327 ft	24 ft
Coordinate 6	400 ft	23 ft

Seismic Coefficients

Horz Seismic Coef.: 0.1

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 0.1 ft

Points

	X	Y
Point 1	0 ft	52.57 ft
Point 2	26.23 ft	55.2 ft
Point 3	32 ft	58.08 ft
Point 4	38 ft	56.08 ft
Point 5	177.49 ft	70.32 ft
Point 6	248.82 ft	52.56 ft
Point 7	254.87 ft	54.55 ft
Point 8	269.01 ft	47.53 ft
Point 9	325.16 ft	33.34 ft
Point 10	338.17 ft	29.35 ft
Point 11	352.44 ft	24.95 ft
Point 12	4.65 ft	52.57 ft
Point 13	177.49 ft	69.82 ft
Point 14	323.18 ft	33.33 ft
Point 15	15.24 ft	51.03 ft
Point 16	177.49 ft	67.32 ft
Point 17	313.3 ft	33.33 ft
Point 18	20.22 ft	50.48 ft
Point 19	177.49 ft	66.32 ft
Point 20	309.35 ft	33.33 ft
Point 21	45.12 ft	38.07 ft
Point 22	108.22 ft	32.07 ft
Point 23	282.31 ft	30.93 ft
Point 24	17.2 ft	50.65 ft
Point 25	47.72 ft	36.77 ft
Point 26	107.85 ft	30.94 ft
Point 27	276.74 ft	29.83 ft
Point 28	5.88 ft	50.57 ft
Point 29	45 ft	31.91 ft
Point 30	107.84 ft	25.95 ft
Point 31	149.39 ft	25.95 ft
Point 32	156.34 ft	24.01 ft
Point 33	173.34 ft	23.93 ft
Point 34	180.32 ft	25.95 ft
Point 35	306.34 ft	24.81 ft
Point 36	325.25 ft	524.19 ft
Point 37	336.8 ft	24.04 ft
Point 38	400 ft	24 ft
Point 39	0 ft	1 ft
Point 40	400 ft	1 ft
Point 41	0 ft	-20 ft
Point 42	400 ft	-20 ft
Point 43	0 ft	10 ft

Point 44	400 ft	10 ft
Point 45	32 ft	57.45 ft
Point 46	254.87 ft	53.8 ft
Point 47	26.5 ft	54.6 ft
Point 48	37.95 ft	55.6 ft
Point 49	248.8 ft	51.9 ft
Point 50	268.8 ft	47 ft
Point 51	15.24 ft	51.06 ft
Point 52	177.49 ft	67.34 ft
Point 53	313.3 ft	33.35 ft

Regions

	Material	Points	Area
Region 1	Compacted Clay	28,29,30,31,32,33,34,35,37,11,10,9,14,17,20,23,27,26,25,21,24,15	1,848.4 ft²
Region 2	Sand	22,23,27,26,25,21	262.82 ft²
Region 3	Waste	18,19,20,23,22,21,24	6,103.1 ft²
Region 4	Compacted Clay	15,16,17,20,19,18,24	297.28 ft²
Region 5	Compacted Clay	12,28,15,51,52,53,17,14,50,46,49,13,48,45,47	802.04 ft²
Region 6	Vegetative Layer	1,2,3,4,5,6,7,8,9,14,50,46,49,13,48,45,47,12	173.85 ft²
Region 7	Shale	41,42,40,39	8,400 ft²
Region 8	Sand	43,39,40,44	3,600 ft²
Region 9	Cohesive Alluvium	1,43,44,38,11,37,35,34,33,32,31,30,29,28,12	7,062.1 ft²
Region 10	Geosynthetics	51,52,53,17,16,15	6.7725 ft²

Slip Results

Slip Surfaces Analysed: 10029 of 13671 converged

Current Slip Surface

Slip Surface: 6,499
Factor of Safety: 8.696
Volume: 275.64951 ft³
Weight: 31,124.222 lbf
Resisting Moment: 1,995,901.2 lbf·ft
Activating Moment: 229,515.06 lbf·ft
Resisting Force: 70,764.782 lbf
Activating Force: 8,137.2086 lbf
Slip Rank: 1 of 13,671 slip surfaces
Exit: (285, 43.489072) ft
Entry: (248.39018, 52.667019) ft
Radius: 24.06966 ft
Center: (270.3282, 62.570132) ft

Slip Columns

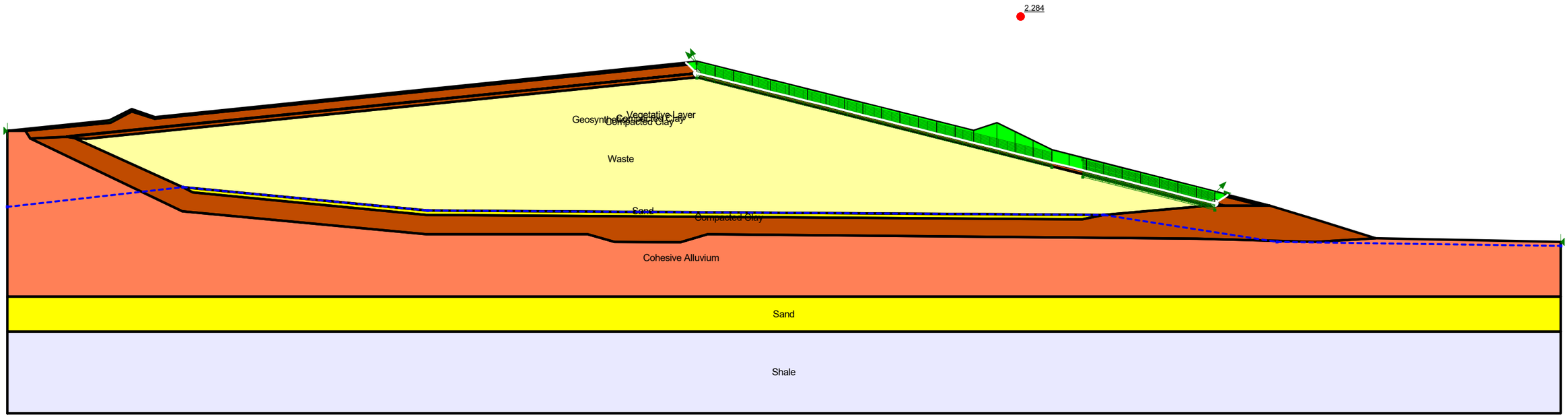
	X	Y	PWP	Base Normal	Frictional Strength	Cohesive Strength	Suction Strength	Base Material

				Stress				
Column 1	248.56816 ft	52.29028 ft	0 psf	-154.71191 psf	0 psf	800 psf	0 psf	Vegetative Layer
Column 2	248.77307 ft	51.85934 ft	-1,292.9121 psf	-325.63333 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 3	248.81000 ft	51.78519 ft	-1,288.298 psf	-312.36499 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 4	249.60147 ft	50.43094 ft	-1,204.0755 psf	-40.28538 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 5	250.83012 ft	48.47791 ft	-1,082.6499 psf	310.57825 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 6	251.87609 ft	47.14299 ft	-999.73831 psf	488.77666 psf	0 psf	2,000 psf	0 psf	Waste
Column 7	253.07365 ft	45.81034 ft	-917.03031 psf	672.25775 psf	0 psf	2,000 psf	0 psf	Waste
Column 8	254.27122 ft	44.65714 ft	-845.52548 psf	832.16762 psf	0 psf	2,000 psf	0 psf	Waste
Column 9	255.50318 ft	43.62492 ft	-781.58752 psf	922.22586 psf	0 psf	2,000 psf	0 psf	Waste
Column 10	256.76955 ft	42.69744 ft	-724.20231 psf	948.89736 psf	0 psf	2,000 psf	0 psf	Waste
Column 11	258.03591 ft	41.88909 ft	-674.25445 psf	970.31342 psf	0 psf	2,000 psf	0 psf	Waste
Column 12	259.30227 ft	41.18626 ft	-630.89447 psf	987.76707 psf	0 psf	2,000 psf	0 psf	Waste
Column 13	260.56864 ft	40.57878 ft	-593.48703 psf	1,001.9112 psf	0 psf	2,000 psf	0 psf	Waste
Column 14	261.83500 ft	40.05889 ft	-561.54779 psf	1,012.9318 psf	0 psf	2,000 psf	0 psf	Waste
Column 15	263.10136 ft	39.62061 ft	-534.70352 psf	1,020.6495 psf	0 psf	2,000 psf	0 psf	Waste
Column 16	264.36773 ft	39.25932 ft	-512.66572 psf	1,024.5832 psf	0 psf	2,000 psf	0 psf	Waste
Column 17	265.63409 ft	38.97147 ft	-495.21285 psf	1,023.9972 psf	0 psf	2,000 psf	0 psf	Waste
Column 18	266.90045 ft	38.75438 ft	-482.17813 psf	1,017.9422 psf	0 psf	2,000 psf	0 psf	Waste
Column 19	268.16682 ft	38.60614 ft	-473.44112 psf	1,005.2991 psf	0 psf	2,000 psf	0 psf	Waste
Column 20	268.90500 ft	38.54281 ft	-469.78932 psf	995.67033 psf	0 psf	2,000 psf	0 psf	Waste
Column 21	269.63207 ft	38.51859 ft	-468.57424 psf	1,000.7885 psf	0 psf	2,000 psf	0 psf	Waste
Column 22	270.87620 ft	38.51476 ft	-468.84351 psf	1,009.1064 psf	0 psf	2,000 psf	0 psf	Waste
Column 23	272.12033 ft	38.57539 ft	-473.1374 psf	1,008.3349 psf	0 psf	2,000 psf	0 psf	Waste
Column 24	273.36446 ft	38.70098 ft	-481.48665 psf	997.25368 psf	0 psf	2,000 psf	0 psf	Waste
Column 25	274.60859 ft	38.89256 ft	-493.95598 psf	974.74967 psf	0 psf	2,000 psf	0 psf	Waste
Column 26	275.85272 ft	39.15177 ft	-510.64679 psf	939.91851 psf	0 psf	2,000 psf	0 psf	Waste

Column 27	277.09685 ft	39.48088 ft	-531.70169 psf	892.16528 psf	0 psf	2,000 psf	0 psf	Waste
Column 28	278.34098 ft	39.88294 ft	-557.31124 psf	831.29373 psf	0 psf	2,000 psf	0 psf	Waste
Column 29	279.58512 ft	40.36194 ft	-587.7237 psf	757.57155 psf	0 psf	2,000 psf	0 psf	Waste
Column 30	280.87846 ft	40.94878 ft	-624.88922 psf	633.92872 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 31	281.92987 ft	41.48550 ft	-658.82649 psf	522.0959 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 32	282.84177 ft	42.01845 ft	-697.40233 psf	415.48858 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 33	283.90532 ft	42.70570 ft	-750.60341 psf	284.88479 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 34	284.71854 ft	43.27912 ft	0 psf	101.70639 psf	0 psf	800 psf	0 psf	Vegetative Layer

APPENDIX B-3:
Seismic Block Final Cover Analysis

Materials
- Cohesive Alluvium
- Compacted Clay
- Geosynthetics
- Sand
- Shale
- Vegetative Layer
- Waste



Seismic Block Cover Stability	
Unit 2 Landfill Seismic.gsz	
07/06/2025	1:315

Seismic Block Cover Stability

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File Information

File Version: 11.05
Title: CWLP Unit 2 Landfill
Created By: Karl Finke
Last Edited By: Karl Finke
Revision Number: 86
Date: 07/06/2025
Time: 10:56:53 PM
Tool Version: 23.1.2.11
File Name: Unit 2 Landfill Seismic.gsz
Directory: D:\SlopeW\CWLP\Unit 2 Landfill\
Last Solved Date: 07/06/2025
Last Solved Time: 11:05:32 PM

Project Settings

Unit System: U.S. Customary Units
Start Date: Sunday, June 23, 2025

Analysis Settings

Seismic Block Cover Stability

Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Intercolumn force function option: Half-Sine
- PWP Conditions from: Piezometric Surfaces
- Apply Phreatic Correction: No
- Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Block
- Critical slip surfaces saved: 1
- Restrict Block Crossing: No
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 1 ft
  - Minimum Slip Surface Volume: 35.314667 ft³
  - Number of Columns: 30
- Factor of Safety Convergence Settings

Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Cohesive Alluvium

Slope Stability Material Model: Undrained (Phi=0)
Unit Weight: 135 pcf
Total Cohesion: 1,150 psf
Pore Water Pressure
Piezometric Surface: 1

Shale

Slope Stability Material Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Surface: 1

Sand

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Compacted Clay

Slope Stability Material Model: Undrained (Phi=0)
Unit Weight: 130 pcf
Total Cohesion: 1,800 psf
Pore Water Pressure
Piezometric Surface: 1

Waste

Slope Stability Material Model: Undrained (Phi=0)
Unit Weight: 90 pcf
Total Cohesion: 2,000 psf
Pore Water Pressure
Piezometric Surface: 1

Vegetative Layer

Slope Stability Material Model: Undrained (Phi=0)
Unit Weight: 110 pcf

Total Cohesion: 800 psf

Geosynthetics

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 60 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Limits

Left Coordinate: (0, 52.57) ft
Right Coordinate: (400, 24) ft

Slip Surface Block

Left Grid
Upper Left: (177.5, 69.9) ft
Lower Left: (177.5, 66.04) ft
Lower Right: (269, 43.14) ft
X Increments: 40
Y Increments: 12
Starting Angle: 115 °
Ending Angle: 135 °
Angle Increments: 4
Right Grid
Upper Left: (277, 45.05) ft
Lower Left: (277, 40.67) ft
Lower Right: (311, 32.16) ft
X Increments: 20
Y Increments: 20
Angle Increments: 4

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	0 ft	33 ft
Coordinate 2	45.12 ft	38.07 ft
Coordinate 3	108.22 ft	32.07 ft
Coordinate 4	282.31 ft	30.93 ft
Coordinate 5	327 ft	24 ft
Coordinate 6	400 ft	23 ft

Seismic Coefficients

Horz Seismic Coef.: 0.1

Geometry

Name: 2D Geometry

Settings

View: 2D

Element Thickness: 0.1 ft

Points

	X	Y
Point 1	0 ft	52.57 ft
Point 2	26.23 ft	55.2 ft
Point 3	32 ft	58.08 ft
Point 4	38 ft	56.08 ft
Point 5	177.49 ft	70.32 ft
Point 6	248.82 ft	52.56 ft
Point 7	254.87 ft	54.55 ft
Point 8	269.01 ft	47.53 ft
Point 9	325.16 ft	33.34 ft
Point 10	338.17 ft	29.35 ft
Point 11	352.44 ft	24.95 ft
Point 12	4.65 ft	52.57 ft
Point 13	177.49 ft	69.82 ft
Point 14	323.18 ft	33.33 ft
Point 15	15.24 ft	51.03 ft
Point 16	177.49 ft	67.32 ft
Point 17	313.3 ft	33.33 ft
Point 18	20.22 ft	50.48 ft
Point 19	177.49 ft	66.32 ft
Point 20	309.35 ft	33.33 ft
Point 21	45.12 ft	38.07 ft
Point 22	108.22 ft	32.07 ft
Point 23	282.31 ft	30.93 ft
Point 24	17.2 ft	50.65 ft
Point 25	47.72 ft	36.77 ft
Point 26	107.85 ft	30.94 ft
Point 27	276.74 ft	29.83 ft
Point 28	5.88 ft	50.57 ft
Point 29	45 ft	31.91 ft
Point 30	107.84 ft	25.95 ft
Point 31	149.39 ft	25.95 ft
Point 32	156.34 ft	24.01 ft
Point 33	173.34 ft	23.93 ft
Point 34	180.32 ft	25.95 ft
Point 35	306.34 ft	24.81 ft
Point 36	325.25 ft	524.19 ft
Point 37	336.8 ft	24.04 ft
Point 38	400 ft	24 ft
Point 39	0 ft	1 ft
Point 40	400 ft	1 ft
Point 41	0 ft	-20 ft

Point 42	400 ft	-20 ft
Point 43	0 ft	10 ft
Point 44	400 ft	10 ft
Point 45	32 ft	57.45 ft
Point 46	254.87 ft	53.8 ft
Point 47	26.5 ft	54.6 ft
Point 48	37.95 ft	55.6 ft
Point 49	248.8 ft	51.9 ft
Point 50	268.8 ft	47 ft
Point 51	15.24 ft	51.06 ft
Point 52	177.49 ft	67.34 ft
Point 53	313.3 ft	33.35 ft

Regions

	Material	Points	Area
Region 1	Compacted Clay	28,29,30,31,32,33,34,35,37,11,10,9,14,17,20,23,27,26,25,21,24,15	1,848.4 ft²
Region 2	Sand	22,23,27,26,25,21	262.82 ft²
Region 3	Waste	18,19,20,23,22,21,24	6,103.1 ft²
Region 4	Compacted Clay	15,16,17,20,19,18,24	297.28 ft²
Region 5	Compacted Clay	12,28,15,51,52,53,17,14,50,46,49,13,48,45,47	802.04 ft²
Region 6	Vegetative Layer	1,2,3,4,5,6,7,8,9,14,50,46,49,13,48,45,47,12	173.85 ft²
Region 7	Shale	41,42,40,39	8,400 ft²
Region 8	Sand	43,39,40,44	3,600 ft²
Region 9	Cohesive Alluvium	1,43,44,38,11,37,35,34,33,32,31,30,29,28,12	7,062.1 ft²
Region 10	Geosynthetics	51,52,53,17,16,15	6.7725 ft²

Slip Results

Slip Surfaces Analysed: 5736162 of 5876325 converged

Current Slip Surface

Slip Surface: 1,817,864
Factor of Safety: 2.163
Volume: 451.79732 ft³
Weight: 56,982.864 lbf
Resisting Moment: 1,550,662.3 lbf·ft
Activating Moment: 716,855.98 lbf·ft
Resisting Force: 34,337.908 lbf
Activating Force: 15,873.428 lbf
Slip Rank: 1 of 5,876,325 slip surfaces
Exit: (314.26471, 36.093412) ft
Entry: (174.78301, 70.043654) ft
Radius: 60.493795 ft
Center: (250.72155, 78.531214) ft

Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material

Column 1	175.00967 ft	69.81700 ft	0 psf	-338.61302 psf	0 psf	800 psf	0 psf	Vegetative Layer
Column 2	176.36316 ft	68.46350 ft	-2,299.9111 psf	-569.80333 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 3	179.87167 ft	66.73679 ft	-2,193.5467 psf	390.93714 psf	182.29698 psf	0 psf	0 psf	Geosynthetics
Column 4	184.63000 ft	65.54205 ft	-2,120.9037 psf	386.05598 psf	180.02086 psf	0 psf	0 psf	Geosynthetics
Column 5	189.38333 ft	64.35230 ft	-2,048.5709 psf	380.7207 psf	177.53298 psf	0 psf	0 psf	Geosynthetics
Column 6	194.13667 ft	63.16256 ft	-1,976.2381 psf	375.34682 psf	175.0271 psf	0 psf	0 psf	Geosynthetics
Column 7	198.89000 ft	61.97281 ft	-1,903.9053 psf	370.05507 psf	172.55951 psf	0 psf	0 psf	Geosynthetics
Column 8	203.64333 ft	60.78307 ft	-1,831.5725 psf	364.96125 psf	170.18423 psf	0 psf	0 psf	Geosynthetics
Column 9	208.39667 ft	59.59332 ft	-1,759.2397 psf	360.1746 psf	167.95218 psf	0 psf	0 psf	Geosynthetics
Column 10	213.15000 ft	58.40357 ft	-1,686.9068 psf	355.79633 psf	165.91055 psf	0 psf	0 psf	Geosynthetics
Column 11	217.90333 ft	57.21383 ft	-1,614.574 psf	351.91828 psf	164.10219 psf	0 psf	0 psf	Geosynthetics
Column 12	222.65667 ft	56.02408 ft	-1,542.2412 psf	348.62189 psf	162.56506 psf	0 psf	0 psf	Geosynthetics
Column 13	227.41000 ft	54.83434 ft	-1,469.9084 psf	345.97717 psf	161.3318 psf	0 psf	0 psf	Geosynthetics
Column 14	232.16333 ft	53.64459 ft	-1,397.5756 psf	344.04193 psf	160.42939 psf	0 psf	0 psf	Geosynthetics
Column 15	236.91667 ft	52.45485 ft	-1,325.2427 psf	342.86117 psf	159.87879 psf	0 psf	0 psf	Geosynthetics
Column 16	241.67000 ft	51.26510 ft	-1,252.9099 psf	342.46656 psf	159.69478 psf	0 psf	0 psf	Geosynthetics
Column 17	246.43333 ft	50.07285 ft	-1,180.4249 psf	342.76727 psf	159.835 psf	0 psf	0 psf	Geosynthetics
Column 18	251.84500 ft	48.71833 ft	-1,098.0741 psf	545.7395 psf	254.48251 psf	0 psf	0 psf	Geosynthetics
Column 19	257.19167 ft	47.38007 ft	-1,016.7123 psf	684.63884 psf	319.25233 psf	0 psf	0 psf	Geosynthetics
Column 20	261.83500 ft	46.21786 ft	-946.05341 psf	557.1005 psf	259.78023 psf	0 psf	0 psf	Geosynthetics
Column 21	266.58333 ft	45.02936 ft	-873.79668 psf	425.96725 psf	198.63179 psf	0 psf	0 psf	Geosynthetics
Column 22	271.22667 ft	43.86715 ft	-803.13776 psf	362.36731 psf	168.97465 psf	0 psf	0 psf	Geosynthetics
Column 23	275.66000 ft	42.75750 ft	-735.67448 psf	365.84894 psf	170.59816 psf	0 psf	0 psf	Geosynthetics
Column 24	280.09333 ft	41.64785 ft	-668.21119 psf	369.73546 psf	172.41048 psf	0 psf	0 psf	Geosynthetics
Column 25	284.70083 ft	40.49461 ft	-620.26566 psf	374.11795 psf	174.45406 psf	0 psf	0 psf	Geosynthetics
Column 26	289.48250 ft	39.29777 ft	-591.8379 psf	378.92723 psf	176.69667 psf	0 psf	0 psf	Geosynthetics
Column 27	294.26417 ft	38.10093 ft	-563.41015 psf	383.88805 psf	179.00994 psf	0 psf	0 psf	Geosynthetics

Column 28	299.04583 ft	36.90409 ft	-534.98239 psf	388.87624 psf	181.33597 psf	0 psf	0 psf	Geosynthetics
Column 29	303.82750 ft	35.70726 ft	-506.55463 psf	393.76332 psf	183.61485 psf	0 psf	0 psf	Geosynthetics
Column 30	308.60917 ft	34.51042 ft	-478.12687 psf	398.41858 psf	185.78564 psf	0 psf	0 psf	Geosynthetics
Column 31	312.34836 ft	34.81295 ft	-533.21281 psf	828.25956 psf	0 psf	1,800 psf	0 psf	Compacted Clay
Column 32	313.98072 ft	35.90365 ft	0 psf	279.32488 psf	0 psf	800 psf	0 psf	Vegetative Layer

ATTACHMENT H:
Run-On Run-Off Analysis

City Water, Light & Power
FGDS Development Unit 2 Landfill
Springfield, Sangamon County, Illinois

Run-on and Run-off Control System Plan for FGDS Development Unit 2 Landfill

July 2025

Prepared for:
City Water, Light & Power
3100 Stevenson Drive
Springfield, Illinois 62703

ANDREWS ENGINEERING

3300 Ginger Creek Drive, Springfield, IL 62711 | 217.787.2334

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1. INTRODUCTION

City Water, Light and Power (CWLP) Flue Gas Desulfurization Sludge (FGDS) Development Landfill was issued Permit No. 1995-243-LFM on November 9, 1995. The active areas of Unit 2 Landfill (Unit 2) have been developed and operated pursuant to the initial permit and subsequent permit modifications. USEPA has indicated to CWLP that Unit 2 is a coal combustion residuals (CCR) landfill.

The Surface Water Drainage Plan of Unit 2 is included as part of the Landfill Permit No. 1995-243-LFM. Andrews Engineering, Inc. (AEI) prepared and submitted the Initial run-on and run-off control system plan in October 2016. AEI has completed a review of this plan for compliance with the requirements under 40 CFR Part 257.81.

> *257.81(c)(4)* ***Frequency for revising the plan.*** *The owner or operator of the CCR unit must prepare periodic run-on and run-off control system plans required by paragraph (c)(1) of this section every five years. The date of completing the initial plan is the basis for establishing the deadline to complete the first subsequent plan. The owner or operator may complete any required plan prior to the required deadline provided the owner or operator places the completed plan into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing a subsequent plan is based on the date of completing the previous plan. For purposes of this paragraph (c)(4), the owner or operator has completed a periodic run-on and run-off control system plan when the plan has been placed in the facility's operating record as required by § 257.105(g)(3).*

Unit 1 landfill, which was filled to capacity and certified closed in February 1993, is not included in this report. Since the landfill ceased receiving CCR prior to October 19, 2015, the above items are not applicable to the Unit 1 landfill as specified under 40 CFR Part 257.50(d).

AEI performed the review of available information, which included the following documents:

- Application for Significant Modification to Permit (dated September 1994 – Log No. 1995-243)
- Report of Stability Analysis (dated September 1994 – Log No. 1995-243)
- Historical Aerial Photographs (April 1995 – July 2023)
- Annual Inspection Report for Coal Combustion Residuals Landfill (January 2025)

2. CCR UNIT INFORMATION

The Design and Construction Plan of the Application for Significant Modification to Permit, prepared by AEI in June 1995 contains a Section covering “Surface Water Drainage” with subsections on “Off-site Run-on Diversion,” “On-Site Runoff Collection,” and “Runoff Collection Ditches and Culverts.” The “Surface Water Drainage” section text on pages 19 through 22 of the aforementioned Design and Construction Plan has been revised and attached to address the 1,000-year storm event for the approximately 3.5-acre closed landfill. The Surface Water Drainage Section of the Design and Construction Plan revision is enclosed (see Appendix A).

Stormwater run-on is addressed in the "Surface Water Drainage" section and states that run-on is prevented by the presence of perimeter berms around the site.

Stormwater run-off is addressed in the "Surface Water Drainage" section and states that stormwater run-off from the landfill is collected in perimeter ditches and will outlet to the evaporation pond to the east. Stormwater will also be pumped out of any excavated or fill area to the evaporation pond. Temporary ditches will be constructed to convey flow from completed portions of the landfill to the permanent perimeter ditches as needed.

Provided in Appendix B is a revised Stormwater Runoff Control Plan, which was previously included as Attachment 20 in the Application for Significant Modification to Permit. The revised Stormwater Runoff Control Plan includes engineering calculations discussed in the Design and Construction Plan. Also included in the revised Stormwater Runoff Control Plan is an "newly graded landfill," which discusses the design and use of temporary drainage structures to manage stormwater run-off prior to the placement of the final cover, and contains the pertinent design calculations.

In order to cease all CCR and Non-CCR waste streams from entering Dallman Ash Pond, a new section of double-walled leachate conveyance line from leachate manhole L303 was installed in August 2022 to route the leachate south towards the Clarification Pond. The discharge from the evaporation pond line was connected to the leachate line at the southwest corner of Unit 2. The combined flows of leachate and evaporation pond water are now conveyed directly into the Clarification Pond through the buried double-walled pipe for discharge into Sugar Creek in accordance with NPDES permit conditions.

After review, AEI has determined that the Surface Water Drainage Plan for Unit 2 meets all of the requirements of 40 CFR Part 257.81, which pertain to the revising the Run-on and Run-off Control System Plan.

3. STATEMENT

This Run-on and Run-off Control System Plan for Coal Combustion Residuals Unit 2 Landfill was completed for CWLP by Andrews Engineering, Inc. in accordance with the requirements under 40 CFR Part 257.81.

Signature: Karl W. Finke

Illinois P.E. No.: 062.068571

Date: 07/11/25

License Expiration: 11/30/25

APPENDIX A

Design and Construction Plan

SURFACE WATER DRAINAGE

Currently, surface water from Unit 2 generally drains to the low areas on-site. The water that does not infiltrate or evaporate is pumped to the Dallman Ash Pond west of the landfill.

In conjunction with the landfill, a surface water control system will be provided which will consist of a means for off-site run-on diversion, on-site run-off collection and the NPDES sampling of all discharges of run-off from disturbed areas to waters of the State. Each of these components of the surface water control system are described in greater detail below:

Off-site Run-on Diversion

Most off-site run-on is prevented by the presence of perimeter berms around the entire site. A minor amount of run-on is received from the north face of Unit 1 until the existing grade is reached.

On-site Run-off Collection

Stormwater run-off from disturbed areas on and immediately adjacent to the landfill will be collected in the perimeter ditches, which exist around the landfill periphery. The perimeter ditches will outlet to the Dallman Ash Pond to the west. The outfall locations are shown on the accompanying set of drawings.

Stormwater will also be pumped out of any excavated or fill area to the ash pond. Leachate will also be disposed by discharging to the ash pond. Minor seepage of groundwater into an excavation will be pumped to the force mains as needed, and the volume of this seepage is expected to be insignificant compared to any run-off generated by a storm. Temporary ditches will be constructed to convey flow from completed portions of the landfill to the permanent perimeter ditches as needed.

Run-off Collection Ditches and Culverts

Run-off from disturbed areas on the landfill will be collected in run-off collection ditches which will be provided around the entire periphery of the unit. These ditches and any associated culverts are designed to carry the run-off without scouring or erosion from the 1,000-year, 24 hour storm when the site is active (disturbed areas present). The sizing is based upon run-off generation estimates using the rational method and assuming final grades are achieved (which tends to maximize tributary drainage area and average watershed slope). Furthermore, for active site conditions, it is generally assumed the first two acres of any tributary area is freshly-graded bare ground and the remaining acreage is poorly vegetated.

All permanent ditches are to be vegetated channels. As necessary, where ditches discharge into existing waterways, riprap, clean broken concrete, or other suitable erosion control measures shall also be employed. Based upon these lining materials and protective measures, these ditches and any receiving channel should be adequately protected from erosion and scouring.

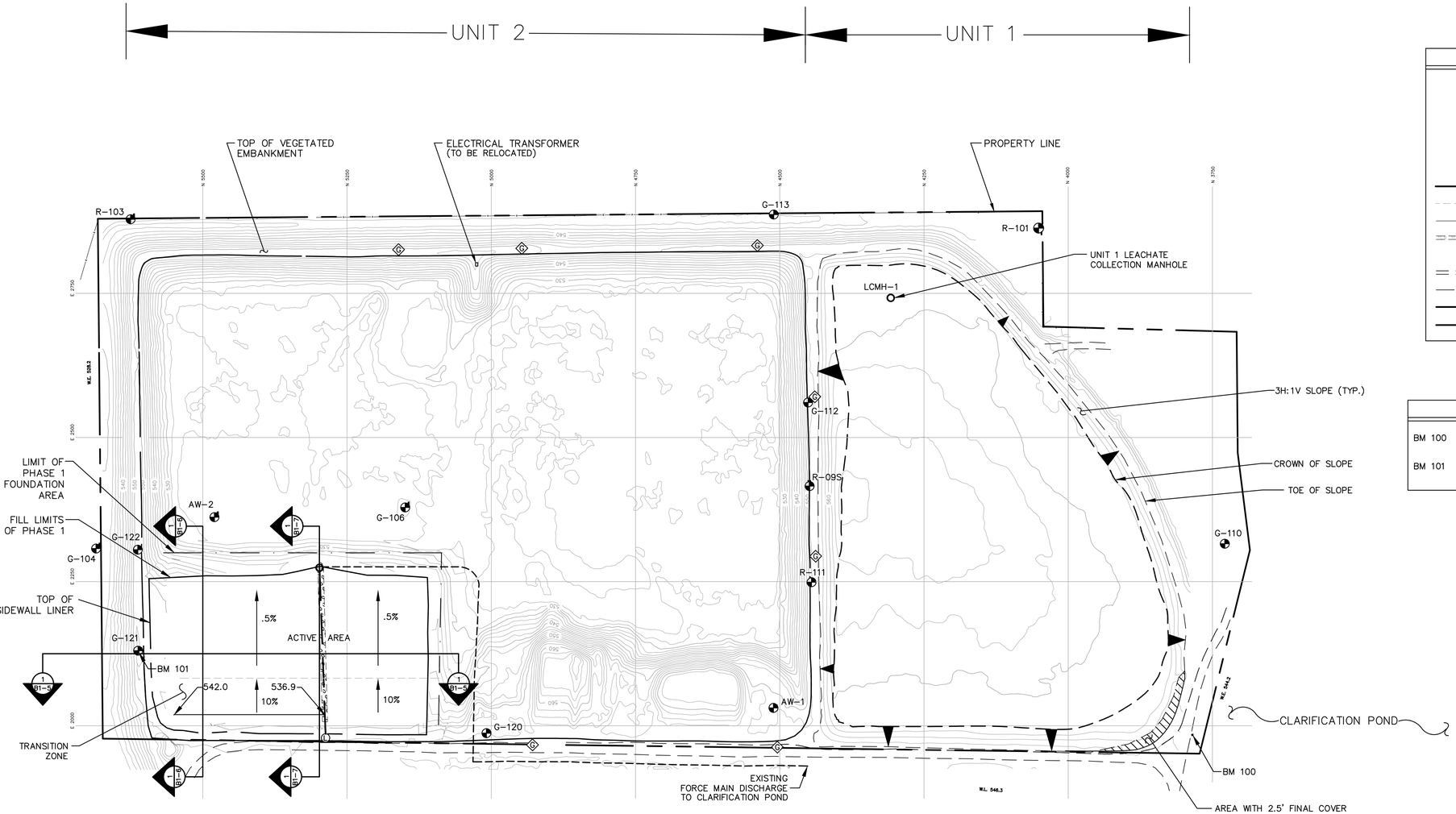
The run-off collection ditching shall be operated as described above until at least such time that the final cover is placed and erosional stability is provided by the vegetation or other approved means over their tributary area. Design calculations for the ditches and ditch outlets are included in the Stormwater Run-off Control Plan, attached to the Run-on and Run-off Control System Plan for FGCS Development Unit 2 Landfill.

Based upon the facility's geometry around the perimeter and physical setting of the landfill, buffer zones shall be left between the sludge placed above grade and the perimeter berm/sidewall liner. This buffer zone will be needed to accommodate the placement of the final cover in the immediate area of the toe of slope of the final cover.

These perimeter buffer zones will also function as drainage swales to remove contaminated water to the landfill's advancing face, where it will be collected as leachate, thus keeping it inside the unit. Given the simplicity of the buffer zone, the temporary nature, incremental construction and the excessive hydraulic capacity of the buffer zone we are not proposing that these buffer zones/drainage swales be included in the Construction Quality Assurance Officer's responsibility. Please refer to the Development drawings and Stormwater Run-off Control Plan.

APPENDIX B

Stormwater Runoff Control Plan



LEGEND

BM-0	BENCHMARK (SEE DESCRIPTION THIS SHEET)
	GROUNDWATER MONITORING WELL (EXISTING)
P	PIEZOMETER (LONG TERM)
	CULVERT
	LEACHATE COLLECTION MANHOLE
L	LEACHATE CLEANOUT RISER
	LEACHATE COLLECTION LINE
	TRENCH INVERT GRADE BREAK POINT
x	FENCE
	FOUNDATION UNDERDRAIN LATERAL
G	FOUNDATION UNDERDRAIN COLLECTION RISER
	ROADWAYS
	STREAM, DITCH OR WATERWAY
	PROPERTY BOUNDARY
	UNIT 2 WASTE BOUNDARY

BENCHMARK DESCRIPTIONS

BM 100	SET RAILROAD SPIKE IN CUT OFF POWER POLE: POWER PLANT COORDINATES N. 3785.14 E. 1984.37 – ELEVATION 554.731
BM 101	CUT CHISELED SQUARE IN CONCRETE 6 INCHES WEST OF MW G-121: POWER PLANT COORDINATES N. 5612.06 E. 2129.53 – ELEVATION 552.364

NOTES:

1. THE CONTOURS SHOWN FOR THE SURROUNDING AREA OF THE LANDFILL WERE GENERATED FROM LIDAR DATA PROVIDED BY HANSON PROFESSIONAL SERVICES, INC. DATED MAY 2023 MERGED WITH TOPOGRAPHIC SURVEY PERFORMED BY ANDREWS ENGINEERING, INC. DATED MARCH 11, 2024.
2. THE PROPERTY LINE LOCATION WAS SUPPLIED BY CWLP, BASED UPON SUBSEQUENT FIELD SURVEYING AND THE ORIGINAL LEGAL DESCRIPTION PREPARED BY MOSS, JOHNSON, SANDOVAL AND ASSOC. LTD.
3. FOR CLARITY NOT ALL SITE FEATURES ARE SHOWN.
4. MONITORING WELL(S) OR PIEZOMETER(S) PLUGGING SHALL BE IN ACCORDANCE WITH THE REGULATIONS, REQUIREMENTS AND/OR GUIDELINES OF THE IEPA AND/OR ILLINOIS DEPARTMENT OF PUBLIC HEALTH.
5. DURING THE OPERATION OF THE FACILITY, THE OPERATOR SHALL COMPLY WITH THE SAFETY STANDARDS PURSUANT TO THE FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970, INCLUDING ALL SUBSEQUENT AMENDMENTS.
6. WHERE THE FOUNDATION UNDERDRAIN SYSTEM DISCHARGES INTO A FORCE MAIN, THE UNDERDRAIN PIPING SHALL BE EQUIPPED WITH AN APPROPRIATE CHECK VALVE TO PREVENT BACKFLOW.
7. UNIT 1 AND UNIT 2 WERE RECOGNIZED AS TWO INDEPENDENT WASTE DISPOSAL ENTITIES BY SUPPLEMENTAL PERMIT NO. 1993-486-SP DATED JANUARY 7, 1994.
8. ACCESS TO THE FACILITY WILL BE CONTROLLED BY THE EXISTING TOPOGRAPHY, LOCKABLE GATES AND FENCING, LOCATED ALONG EAST LAKE SHORE DRIVE, ADJACENT TO THE FACILITY.
9. THE DESIGN SHOWN ON THE DRAWINGS ARE MEANT TO INDICATE A GENERAL DESIGN CONCEPT FOR THE FACILITY. ADJUSTMENTS MAY BE MADE IN THE FIELD BY THE CQAO FOR CONDITIONS ENCOUNTERED. AS APPROPRIATE, ANY ADJUSTMENTS SHALL BE REFLECTED ON THE RECORD DRAWINGS TO BE SUBMITTED TO THE AGENCY FOR OPERATING AUTHORIZATION IN NEWLY DEVELOPED AREAS.
10. WHERE POROUS MATERIALS ARE USED FOR FOUNDATION REPAIR THEY SHALL BE CONNECTED TO THE FOUNDATION UNDERDRAIN SYSTEM, WHERE PRACTICAL, TO FACILITATE ADDITIONAL SUBGRADE DRAINAGE.
11. CWLP OWNS THE SURROUNDING PROPERTY AROUND THE LANDFILL EXCEPT TO THE EAST.

UNIT 1 MONITORING WELL LEGEND
PHASED – 95-469

WELL I.D.	SCREEN MATERIAL	GRADIENT DESCRIPTION
R-101	PVC	UP
G-110	S.S.	UP
R-111	S.S.	UP
G-112	S.S.	UP

UNIT 2 MONITORING WELL LEGEND

WELL I.D.	SCREEN MATERIAL	GRADIENT DESCRIPTION
G-113	PVC	UP
G-120	PVC	UP
G-121	PVC	DOWN
G-122	PVC	DOWN
AW-1	PVC	UP
AW-2	PVC	DOWN
RW-3	PVC	DOWN
G-104	PVC	DOWN
R-103	PVC	DOWN
G-106	PVC	DOWN
R-09S	PVC	DOWN

N

0 100 200 400

SCALE: IN FEET

NO.	DATE	REVISION DESCRIPTION	BY
4	07/2025	REVISED NOTE 2	MPN
3	09/2024	REVISED SITE DEVELOPMENT PLAN, NOTES, AND DATE	MPN
2	12/1995	REVISED MONITORING WELL LABELS	RWH
1	06/1995	REVISED WELL LOCATION AND DATE	VJM

KARL W. FINKE
062.065571
PROFESSIONAL ENGINEER
STATE OF ILLINOIS

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PONTIAC, IL • LOMBARD, IL • INDIANAPOLIS, IN • WARRENTON, MO
APPROVED BY: KWF | DESIGNED BY: DWM | DRAWN BY: MPN

SITE DEVELOPMENT PLAN

PLANS PREPARED FOR
CITY WATER, LIGHT, AND POWER
FGDS DISPOSAL FACILITY
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JULY 2025

PROJECT ID: 230339/0030

SHEET NUMBER: B1-2

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Tab: Layout1 Last Saved: July 10, 2025, by Mike Nguyen Plotted: Thursday, July 10, 2025 12:08:48 PM
C:\Civil 3D Projects\Springfield CWLP\DWG\B4\B1-02.DWG

Stormwater Run-off Control Plan

Stormwater calculations for the 1,000-year, 24-hour storm are provided below and in the attachments to this plan. The Unit 2 Landfill is 2.4 acres in area with a final cover utilizing a 4 to 1 slope. The designed terrace berms for routing stormwater to the letdown structure are triangular with a 4 to 1 slope on the final cover half and a 3 to 1 slope with a 2-foot effective height on the terrace side and a ditch slope of 0.004 feet per feet. The letdown structure is trapezoidal with a 10-foot bottom width with 3 to 1 slopes and a 2-foot effective height for the channel berms. The details of these stormwater conveyance structures are on Sheet Number B1-8.

The run-off curve numbers for the newly graded landfill and vegetated landfill will not change but the 24-hour rainfall and runoff quantities will change. The curve number calculations are attached. For the newly graded landfill, the runoff quantity is calculated using 8.38-inches for the 1,000-year, 24-hour storm multiplied by the curve number of 94 equals 7.88-inches of run-off. For the vegetated landfill, the curve number is 74 and equates to 6.2-inches of run-off. The time of concentration for the final cover conditions are 9.37 minutes with the calculations attached to this plan.

The rational method is used for the peak discharge from the 1,000-year storm for both conditions, the newly graded landfill and the vegetated landfill.

$$Q = CIA$$

C = Curve Number

I = Rainfall Intensity (4.2 inches/1-hour for the 1,000-year storm)

A = Drainage Area (2.4 acres)

For the newly graded landfill, the peak discharge is calculated below:

$$Q = 0.94 \times 4.2 \times 2.4$$

$$Q = 9.48 \text{ cfs}$$

For the vegetated landfill, the peak discharge is calculated below:

$$Q = 0.77 \times 4.2 \times 2.4$$

$$Q = 7.76 \text{ cfs}$$

The Manning Formula for open channel flow is used to determine if the capacity of the ditches are adequate to convey the peak discharges calculated above from the rational method.

$$Q = (K \times A \times R^{2/3} S^{1/2})/n$$

Q = Flow Rate

A = Cross-Sectional Area of Flow

R = Hydraulic Radius

S = Slope of the Channel

n = Surface Roughness

K = Unit Dependent Constant (1.49)

The open channel flow calculation for the terrace ditches on the final cover with 1.25 feet of water in them are provided below:

$$Q = (1.49 \times 5.469 \times (0.6005)^{2/3} \times (0.004)^{1/2})/0.035$$

$$Q = 10.48 \text{ cubic feet per second}$$

The open channel flow calculation for the letdown structure on the east final cover with 0.1 feet of water in it is provided below:

$$Q = (1.49 \times 1.03 \times (0.0969)^{2/3} \times (0.25)^{1/2})/0.035$$

$$Q = 46.24 \text{ cubic feet per second}$$

This open channel flow is adequate to convey the peak discharge for either condition, newly graded landfill or vegetated landfill and for all conveyance structures.

APPENDIX A:
Curve Number Calculations

COMPOSITE RUNOFF CURVE NUMBER (*CN*)

PROJECT: CWLP - Unit 2 Landfill **PERMIT NUMBER:**

LOCATION: Springfield, Sangamon County **DATE:** 7/2/2025

TYPE OF AREA (SELECT WITH DROP-DOWN)

___ DETAINED AREA ___ MAJOR STORMWATER SYSTEM

___ UNRESTRICTED AREA ___ OTHER:

X UPSTREAM AREA

CONDITION (SELECT WITH DROP-DOWN)

X PROPOSED CONDITION ___ EXISTING CONDITION

RUNOFF CURVE NUMBER

Surface Description	Hydrologic Soil Group (HSG)	CN	Area (acres)	Product (CN)(Area)
Clay Cap	Newly Graded, No Veg.	94	2.00	188.00
Clay Cap	Open Space, Poor Cond.	89	0.40	35.60
TOTALS:			2.40	223.60

COMPOSITE RUNOFF CURVE NUMBER

$$\text{Composite CN} = \frac{\text{Total Product}}{\text{Total Area}} = \frac{223.60}{2.40} \rightarrow \textbf{Composite CN} = \textbf{93.17}$$

COMPOSITE RUNOFF CURVE NUMBER (*CN*)

PROJECT: CWLP - Unit 2 Landfill **PERMIT NUMBER:**

LOCATION: Springfield, Sangamon County **DATE:** 7/2/2025

TYPE OF AREA (SELECT WITH DROP-DOWN)

___ DETAINED AREA ___ MAJOR STORMWATER SYSTEM

___ UNRESTRICTED AREA ___ OTHER:

X UPSTREAM AREA

CONDITION (SELECT WITH DROP-DOWN)

X PROPOSED CONDITION ___ EXISTING CONDITION

RUNOFF CURVE NUMBER

Surface Description	Hydrologic Soil Group (HSG)	CN	Area (acres)	Product (CN)(Area)
Vegetative Soil	Native Plantings	77	2.40	184.80
TOTALS:			2.40	184.80

COMPOSITE RUNOFF CURVE NUMBER

$$\text{Composite CN} = \frac{\text{Total Product}}{\text{Total Area}} = \frac{184.80}{2.40} \rightarrow \textbf{Composite CN} = \textbf{77.00}$$

APPENDIX B:
Time of Concentration

NRCS TIME OF CONCENTRATION (T_c) OR TRAVEL TIME (T_t)

PROJECT: CWLP - Unit 2 Landfill **PERMIT NUMBER:**

LOCATION: Springfield, Sangamon County **DATE:** 7/2/2025

CONDITION (SELECT FROM DROP-DOWN)

X PROPOSED CONDITION ___ EXISTING CONDITION

SHEET FLOW

1. Segment ID		Sheet					
2. Surface description		Dense Grass					
3. Manning's roughness coefficient, *n*		0.24					
4. Flow length, *L* (≤ 100 ft)		50	ft				
5. 2-year, 24-hr rainfall, P_2		2.93	in				
6. Land slope, *s*		0.250	ft/ft				
7. Travel time, T_t	$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}s^{0.4}}(60)$	3.12	+		=	3.12	min

SHALLOW CONCENTRATED FLOW

8. Segment ID		Concentrated					
9. Surface description (drop-down list)		Unpaved					
10. Flow length, *L*		25	ft				
11. Watercourse slope, *s*		0.250	ft/ft				
12. Average velocity, *V*		8.07	fps				
13. Travel time, T_t	$T_t = \frac{L}{60V}$	0.05	+		=	0.05	min

OPEN CHANNEL FLOW

14. Segment ID		Terrace					
15. Cross-sectional flow area, *A*		10.72	ft^2				
16. Wetted Perimeter, P_w		12.75	ft				
17. Hydraulic radius, *R*		0.84	ft				
18. Flow Length, *L*		890	ft				
19. Channel slope, *S*		0.004	ft/ft				
20. Manning's roughness coefficient, *n*		0.035					
21. Average velocity, *V*	$V = \frac{1.486}{n}R^{\frac{2}{3}}S^{\frac{1}{2}}$	2.39	fps				
22. Travel time, T_t	$T_t = \frac{L}{60V}$	6.20	+		=	6.20	min

TIME-OF-CONCENTRATION (T_c) OR TRAVEL TIME (T_t)

23. Time-of-Concentration, *Tc,* or Travel Time, *Tt*	$T_c, T_t = \sum T_t$				=	9.37	min