WORK PLAN

Cell E Liner Seaming Work Plan
Coldwater Road Landfill
Flint, Michigan

Motors Liquidation Company

September 2010

O'BRIEN & GERE
www.obg.com

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1. GENERAL

1.1 INTRODUCTION

This Cell E Work Plan (Work Plan) describes the procedures to be followed during the excavation and exposing; trimming, cleaning and seaming; and subsequent burial of the terminal ends of the primary and secondary liners on the western edge of Cell E for the Coldwater Road Landfill facility located in Flint, Michigan. These activities are being conducted to reduce the amount of infiltration water entering leak detection system (LDS) Vault E. This Work Plan also documents the construction quality assurance (CQA) monitoring that will be implemented during the Cell E seaming activities. Furthermore, a description of the site, the design of the landfill and LDS evaluation activities and findings are provided in the remainder of this section as a basis for the Cell E Liner Seaming Scope of Work described in Section 2.

1.2 SITE DESCRIPTION

The Coldwater Road Landfill facility is located at 6220 Horton Street, Mount Morris, Michigan (Figure 1). The approximate property line of the Coldwater Road Landfill facility is shown on the Site Layout (Figure 2). Motors Liquidation Company (MLC) is responsible for the Post-Closure Care efforts at the Coldwater Road Landfill facility following the bankruptcy of Remediation and Liability Management Company, Inc. (REALM), a wholly owned subsidiary of the now bankrupt General Motors Corporation (GM).

The Coldwater Road Landfill facility consists of several closed Resource Conservation and Recovery Act (RCRA) units, solid waste management units (SWMUs) and other corrective action areas (CAAs), including an on-site RCRA hazardous waste landfill constructed to contain approximately 530,000 cubic yards of stabilized F006 (*i.e.*, plating) sludges and contaminated soil. It is assumed that approximately 496,000 cubic yards were treated with lime and fly ash and approximately 34,000 cubic yards were treated with Portland cement and activated carbon.

The landfill incorporates the following design features:

- The landfill is situated on a minimum of 10 ft of clay soil having a minimum permeability of 10-6 cm/sec.
- The liner system consists of two, 60 mil high density polyethylene (HDPE) liners (*i.e.*, a primary and a secondary liner), separated by 5 ft of compacted clay having a minimum permeability of 10-7 cm/sec. Each liner consists of a 60 ml HDPE liner, a geonet, and a filter fabric layer.
- The secondary liner is designed to collect liquid that may escape from a landfill cell, through a failure in the primary liner, and direct it to the leak detection vault for that cell. The leak detection vaults are expected to contain minimal amounts of liquid. Liquid collected in the leak detection vaults are manually pumped; currently on a monthly basis. In the past, the vault water was pumping into the sumps, which conveyed these liquids to the accumulation tank; however, these liquids are now pumped into a portable storage tank and are transported and pumped directly into the accumulation tank.
- The cap system consists of 3 ft of 10-7 minimum permeability clay, a 60 ml HDPE cap liner, a geonet, and filter fabric layer. The side slopes contain a bonded geonet and textured HDPE liner, while the top consists of smooth HDPE and separate geonet and filter fabric layer. The entire cap is covered by 18 inches of Class II sand and 6 inches of topsoil planted with grass.
- The landfill contains six cells, (A) through (F) as shown on Figure 2. Each of the landfill cells has a leak detection vault and a leachate collection sump. The base of the landfill is sloped towards the west, where a leak detection vault and leachate collection sump are installed above the secondary and primary liner systems, respectively for each of the six landfill cells. Figures 3 and 4 illustrate a cross-section of the landfill design showing the relationship of the leachate collection sumps, leak detection vaults, and primary and secondary liners (note: no "as-built" construction drawings are available for this portion of the landfill). The primary liner is designed to direct leachate draining from the interior of the landfill cells to the leachate collection sumps.

- The leachate collection sumps are equipped with level float controlled pumps that automatically pump accumulated liquids through connecting piping (*i.e.*, a force main) that convey leachate to the on-site accumulation building.
- The force main has a leak detection alarm system with an auto-dial system with automatic notification to the operations, maintenance and monitoring (OMM) contractor.
- The accumulation building was constructed to temporarily store landfill leachate and water removed from the leak detection vaults. Leachate and water from the leak detection vaults is removed monthly or less frequently as necessary. Liquids stored in the accumulation tank are directly discharged to the sanitary sewer in accordance with a sewer user permit (no. 6-08-04-GML1) issued by the City of Flint Department of Public Works and Utilities and by the Beecher Metropolitan District, assuming it meets the required discharge limits; otherwise, it is disposed off site via licensed hazardous waste hauler/treatment and disposal facility.
- The accumulation tank is a 15,000 gallon aboveground, fiberglass tank contained within a concrete secondary containment unit, housed inside the heated accumulation building. The volume of liquid pumped to the tank is measured by a totalizing flow meter. The liquid level in the tank is monitored by an ultrasonic level meter and a single point high level alarm. The high-level alarm will shut down the influent pumps and trigger an alarm. The secondary containment system is sloped to a sump, which is equipped with a single point high level alarm and automatic influent shut-off

1.3 BACKGROUND

Evaluation of the LDS at the Coldwater Road Landfill site began once the landfill construction was completed in 1995. Prior to the corrective measures implemented in 2006 and 2007 and described below, the LDS data consistently identified an accumulation of liquids in the LDS vaults greater than originally anticipated, potentially limiting the effectiveness of the LDS to detect a release.

O'Brien & Gere conducted a LDS study in 2004 and 2005 to evaluate the LDS and identify the source(s) of water entering the LDS in response to the Michigan Department of Natural Resources and Environment (MDNRE, formerly known as the Michigan Department of Environmental Quality [MDEQ]) letter dated August 21, 2003 that noted the volumes of water recovered from the leak detection vaults indicated that surface water and/or groundwater may be entering the vaults, which may be compromising the ability of the LDS to reliably detect a release from the landfill. In 2006 and 2007, further LDS evaluation activities were conducted to better identify the source(s) of water entering the LDS and to implement corrective measures to reduce the volume of water entering the LDS. The LDS Study report (O'Brien & Gere, June 2005), the LDS Evaluation report (O'Brien & Gere, June 2006), and the LDS Evaluation Report Update (O'Brien & Gere, September 2007) provide a detailed description of the activities and findings of the LDS evaluation studies conducted at the Coldwater Road Landfill site. The following provides a brief summary of those activities and findings.

To meet the objectives of the LDS study and evaluations the following activities were conducted:

- The initial LDS study was conducted between July 7, 2004 and December 29, 2004 to evaluate possible sources of water in the leak detection vaults. The initial LDS study included a review of historical landfill design, construction and operation information; fifteen sampling events, which included sampling the six leachate collection sumps, six leak detection vaults and five perched-zone groundwater monitoring wells for cations, anions and other indicator parameters as well as periodic sampling for dissolved metals; and a review of precipitation and groundwater level data in comparison with LDS vault liquid volumes (*i.e.*, dewatering volumes).
- A transducer study was conducted between June 16, 2005 and August 17, 2005 to monitor the change in water levels within the leak detection vaults and groundwater monitoring wells, combined with on-site recording of precipitation to evaluate the potential correlation between precipitation events, leak detection vault water levels, and perched groundwater elevations.

- Dye testing was conducted in April and May 2006 to evaluate whether precipitation was a source of water entering the LDS by introducing dyed water into the drainage swales in the Cells B and C areas and monitoring the associated sumps and vaults.
- Test pitting was conducted in May and June 2006 and again in September 2006 and March 2007 to observe and evaluate the landfill liner system and swale construction to evaluate if ponding swale water may be entering the LDS. Furthermore, drains were installed at selected test pit locations where ponded or accumulated liquids were observed in close proximity to the edge of the primary and secondary liners of the landfill.

The following provides a brief summary of the historical LDS evaluation results:

- The results of the LDS study demonstrated a distinct difference between the leachate collection sump liquid and the LDS vault water, and a similar distinction between the sump liquid and groundwater (O'Brien & Gere, 2005). The LDS study concluded that the leachate collection sump liquid is not impacting the vault water or groundwater, and a mixture of groundwater and surface water (*i.e.*, infiltration) enters the LDS vaults. However, the contribution from groundwater was expected to be minimal based on water level data and construction information. The LDS Evaluation observed ponded or accumulated infiltrating water in the sand/gravel pack surrounding the force main during installation of the test pits and drains along the west side of the landfill. The installation of the drains allows water, which accumulates in the force main backfill to drain away from the LDS, reducing the amount of water that enters the LDS vaults. Based on the general effectiveness of the drains to reduce the volume of water observed in LDS vaults, especially in Cells B and C, which used to produce the greatest volumes of water, it has been further concluded that the water observed in the LDS vaults is predominantly from infiltrating water and little or no groundwater enters the LDS
- The transducer study data did not provide a clear understanding of the source of the water within the leak detection vaults at the site. The data suggested a correlation with groundwater levels (*i.e.*, elevations) in some of the vaults, but the data is not definitive. The data indicates that there is no direct communication between surface water (*i.e.*, infiltration) and vault water, but supports the conclusion that infiltration is entering the vaults. However, the limited or no measured response to precipitation events indicates that water infiltrating into the LDS is likely rate limited by the generally low permeability soils that are in the landfill area
- The dye test results did not clearly indicate dyed water infiltrated into the vaults (*i.e.*, the LDS). The absence of a clear indication that dye entered the LDS supports the conclusion from the transducer study that there is no direct communication between the water in the swales and the drainage layer at the landfill, and the vault water. Again suggesting rate limited infiltration water is entering the LDS.
- The test pitting activities indicated that the cap and primary liners, and the drainage swale and diversion apron were constructed in accordance with the design drawings; the primary and secondary liners do not appear to be welded together; boot seals for vault access piping and/or leachate connection piping were not sealed and were repaired at Cells B and C; water was "ponding" within the gravel and sand filled portions of the force main in close proximity to the liner penetrations and edge of the liner system; and drain installation allowing accumulated water within the force main backfill to drain away from the liner and LDS appear to be effective in reducing the amount of water within the LDS vaults, with the exception of LDS Vault E (*i.e.*, Cell E), which continues to produce an unacceptable volume of liquids
- The test pits conducted on the east side of the landfill indicated that the water ponding at the low points of the access road was not from a subsurface source, and was created by poor surface drainage, which was mitigated by the installation of drains and regrading of the access road along portions of the east side of the landfill. These test pits showed the subsurface to be well-compacted dry clay.

2. CELL E LINER SEAMING SCOPE OF WORK

The continued accumulation of liquids in LDS Vault E appears to indicate that the drains already installed within Cell E are not effective in minimizing the volumes of water entering the LDS in this area of the landfill. Therefore, the following Cell E Liner Seaming Scope of Work (SOW) will be implemented to help reduce the volume of liquids entering Cell E. This Cell E Liner Seaming SOW includes the excavation and exposing; trimming, cleaning and seaming; and subsequent burial of the terminal ends of the primary and secondary liners on the western edge of Cell E at the landfill. The following sections describe the scope associated with each component of the project.

2.1 MOBILIZATION

Mobilization includes both pre-mobilization activities such as preparation of a Job Safety Analysis, training, etc. and the physical mobilization of facilities, equipment, and manpower to the work site. Prior to mobilizing to the work site, a task specific Job Safety Analysis (JSA) will be prepared that will be appended to the existing site-specific Health and Safety Plan (HASP) for the Coldwater Road Landfill site. All MLC and O'Brien & Gere employees, the landfill liner seaming subcontractor and all visitors, including any MDNRE personnel, will be required to meet or exceed the requirements of the site HASP. Although, MLC, subcontractor or MDNRE employees must meet or exceed O'Brien & Gere safety requirements, MLC, subcontractor, or MDNRE are ultimately responsible for the health and safety of their employees.

Construction activities associated with this SOW will not involve contaminated media as they will not involve exposing wastes that are contained above the primary liner or interior to the cap liner systems. All work will be performed in non-contaminated areas.

A Storm Water Pollution Prevention Plan (SWPPP), Soil Erosion and Sedimentation Control permit, or Storm Water Discharge permit are not required for this work because the work area for this SOW will be less than the one (or five) acres required for the submission of these plans/permits. However, storm water pollution prevention measures will be implemented prior to and during the execution of the Cell E Liner Seaming SOW as discussed in Section 2.2.1.

The subcontractor shall provide O'Brien & Gere copies of the qualifications and training certificate(s) for the installation supervisor and personnel performing field seaming operations for the project prior to the start of field activities.

The Coldwater Road Landfill has an approximate mailing address of 6220 Horton Street, Mount Morris, Michigan 48458. Access to the site shall be from the northeast corner of Horton Street and Morris Hills Parkway through the site access gate. The gate will remain closed and locked during non-working hours and an O'Brien & Gere representative will open and close the gate for the subcontractor at the start and end of each work day.

The subcontractor shall mobilize to the site all labor, materials, equipment, tools, etc., required for the Cell E Liner Seaming construction activities. A laydown area is available for use along the entrance way to the landfill or along the access road west of the railroad easement just west of the landfill or adjacent to the control building. The parking/laydown area adjacent to the control building or along the landfill entrance way is an existing concrete slab (see Figure 2).

Mobilization will also include conducting an onsite pre-construction and health and safety meeting, and delivering to the site the personnel, equipment, tools, and materials necessary to perform the work.

Potable water and bathroom facilities are not available at the site; however, non-potable (City of Flint) water is available at the on-site control building (see Figure 2) for use for non-potable (*i.e.*, decontamination, dust control, watering, etc.) purposes. The subcontractor may arrange for portable sanitary facilities for the project duration as they see fit; otherwise, sanitation facilities are available at a number of nearby (<1/2 mile) off-site facilities.

Vehicles and construction equipment may be parked in the paved area adjacent to the control building, or may remain parked in the construction areas or on the shoulders of the south and west loop of the perimeter road at the site. Any equipment left parked on the perimeter road must be located such that a one-way traffic lane remains at all times.

2.2 CONSTRUCTION

The construction activities shall be completed in compliance with the Cell E Liner Seaming drawings and specifications found in Exhibit A. The following sections summarize the general construction tasks.

2.2.1 Installation of Erosion and Sediment Controls

Although a SWPPP and/or erosion control or storm water discharge permits are not required for this work, storm water pollution prevention measures will be implemented prior to and during the execution of the Cell E Liner Seaming SOW. Prior to the beginning of any construction activities, installation of silt fences and/or other erosion protection structures will be accomplished by the subcontractor. Silt fences are considered temporary and will be removed when sufficient vegetation has become established per Section 02980, Topsoil and Seeding.

> Note - Project-specific specifications for construction are referred to throughout this SOW by the specification title, including the section number. Section numbers generally adhere to a Construction Specifications Institute (CSI) organizational structure. Each specification section has a subcontractor assigned specification number; however, all references to the specifications in this SOW use only the specification title and/or section number.

Adequate silt fencing and/or other storm water pollution prevention measures will be implemented in accordance with standard industry and best management practices (BMP) for sediment and erosion controls placing an emphasis on control of erosion at the source rather than at downstream installations.

2.2.2 Clearing and Grubbing

The existing work area does not contain trees and the vegetation in the work area consists of typical landfill grasses, which will not require clearing prior to topsoil stripping, clay material excavation, liner seaming, and backfill placement.

2.2.3 Stripping and Stockpiling of Topsoil

Topsoil from the work area will be stripped and stockpiled for reuse. Stripping of grass and topsoil from the footprint of the Cell E Liner Seaming Area (as shown on Drawing C1) shall be limited to only the area necessary for construction activities. Soils, which contain organic materials, shall be stripped and stockpiled adjacent to the work area (but placed at least 10 feet from the edge of the excavation/work area) or transported to a Topsoil Stockpile Area that may be mutually established by O'Brien & Gere and the subcontractor. The soils will be stockpiled until needed to establish the topsoil layer specified in Section 02980, Topsoil and Seeding. To the extent possible, the subcontractor shall avoid disturbance of vegetated surfaces outside of the work area shown on Drawing C1. The Topsoil Stockpile Area shall be constructed in such a manner to allow the maximum quantity of soil to be placed in the designated area *(i.e.*, to minimize the footprint of this area). Upon completion of construction activities and spreading topsoil on areas to be seeded, the Topsoil Stockpile Area will be seeded as necessary and appropriate.

2.2.4 Cell E Liner Seaming Excavation

Cell E Liner Seaming excavation shall begin at either end of the work area shown on Drawing C1; however, it is suggested that it begin at the north end and work southward. The limits of the excavation are provided on this drawing. A test pit, oriented east to west will be conducted at the end of the work area where work will begin, and will be conducted at the approximate location of where the liner terminations should exist and work outward until the liners are identified. From this location the liner work will begin and continue to proceed along the terminations of the liner. Clay soil will be stockpiled adjacent to the excavation but at a safe distance from the edge of the excavation in accordance with Occupational Safety and Health Administration (OSHA) regulations and guidance, industry standards, and Section 02220, Earthwork (Exhibit A). Storm water pollution

control measures and/or erosion control structures shall be installed by the subcontractor prior to the excavation activities, as necessary and appropriate.

If any unsuitable materials are encountered during excavation, such material shall be transported and dumped in an area specified by the O'Brien & Gere supervisor. Unsuitable materials include muck or material that contains excessive debris, roots, organic matter that are not acceptable for placement in the Topsoil Stockpile Area. Upon discovery of these materials, the subcontractor shall notify the O'Brien & Gere supervisor and shall not excavate and transport the material unless directed to do so by the O'Brien & Gere supervisor.

2.2.5 Repair of Subgrade Undercut Areas

If any undercutting of the final liner subgrade occurs, it will be repaired in accordance with the requirements of specifications Section 02220, Earthwork and Section 02240, Cover Soil. Undercutting may result from unsuitable material removal or unintentional removal of material during excavation activities. If subcontractor excavates below the liner terminations unintentionally, any cost associated with restoration of the clay subgrade shall be at subcontractor's expense.

2.2.6 Liner Trimming, Cleaning and Seaming

Once a sufficient length of the primary and secondary liners have been exposed in the excavation, which will typically be the length that can be seamed in either a single day or in a morning or afternoon work session, excavation activities will cease, and the excavation will be inspected by both the subcontractor and the O'Brien & Gere supervisor to ascertain whether the sloping, shoring, etc. is appropriate to allow workers into the excavation in accordance with OSHA regulations and guidance, industry standards, and Section 02220, Earthwork. The ends of the primary and secondary liners will then be inspected and will be trimmed to allow at least 3-inches of overlap as shown on Drawing C2. The liner surfaces that will be seamed will then be cleaned and will be seamed (*i.e.*, extrusion welded) in accordance with Section 02293, Geomembrane Liner Seaming.

Field sampling and testing will be conducted in accordance with Section 02293, Geomembrane Liner Seaming. Both non-destructive and destructive field seam testing will be conducted in accordance with Subsection 2.2 Sampling and Testing of Section 02293, Geomembrane Liner Seaming. Only after successfully passing the specified testing will the newly seamed liner terminations be able to be covered (*i.e.*, buried). Excavation, seaming, and burial activities will continue until the liners have been seamed along the entire length of Cell E.

2.2.7 Cover Soil Placement and Compaction

The clay soils removed during the excavation activities will be utilized to backfill the excavation and work area once the liner seaming activities have been completed, inspected and verified (*i.e.*, passes testing requirements). Stockpiled clay will be placed in lifts above the seamed liner terminations in accordance with Section 02240, Cover Soil. The cover soil shall be constructed using sequential lifts from the lowest elevation to the highest elevation. The initial lift above the liners will be 12 inches thick to help protect the liners during compaction activities. Subsequent lifts will be 6 inches thick. The cover soils shall be placed and compacted in accordance with Section 02240, Cover Soil. Each lift will be inspected and accepted by the O'Brien & Gere supervisor before the next lift is placed and compacted.

2.2.8 Maintenance of Erosion Control Features

The subcontractor shall be diligent in maintaining erosion control features. Sediment should be controlled at the point of origin as much as possible. The subcontractor shall inspect erosion control features after each rain event and clean out accumulated sediment, as necessary. Sediment removed from these structures may be spread at the Topsoil Stockpile Area.

2.2.9 Restoration of Surfaces

The subcontractor shall restore the surface materials that were disturbed during the performance of the Cell E Liner Seaming SOW following completion of final lift of soil cover placement and compaction in accordance with Section 02502, Restoration of Surfaces (Exhibit A). Surface restoration will include either placement of topsoil and re-establishment of vegetation in those area which previously were vegetated, or placement of stone or

gravel to re-establish the access road adjacent to the landfill. The O'Brien & Gere supervisor will inspect the placement, and as appropriate compaction, of topsoil and/or gravel before accepting the surface restoration work.

2.2.10 Revegetation of Disturbed Areas

The subcontractor shall seed disturbed areas following completion of final grading activities for areas which receive topsoil in accordance with Section 02980, Topsoil and Seeding (Exhibit A). The subcontractor shall place topsoil in accordance with Section 02980 and then seed using the specified seed mixture, or an alternate mixture approved by the O'Brien & Gere supervisor.

Topsoil material stockpiled in the Topsoil Stockpile Area shall be utilized first then, if additional topsoil is needed, the subcontractor in consultation with the O'Brien & Gere supervisor will identify a suitable source for topsoil in the site area. Fertilizer and mulch shall be applied to the seeded areas in accordance with Section 02980.

The subcontractor shall water and maintain the seeded areas in accordance with the requirements of Section 02980, Seeding. Water for use to wet seeded areas is available on site.

2.2.11 Submittals During Construction

The subcontractor shall provide copies of submittals that are required in accordance with the various specifications contained in Exhibit A. Submittals will be provided in a timely manner, usually within a day for field data. Additionally, the subcontractor shall allow O'Brien & Gere's supervisor access to and if requested, copies of preliminary test results from any soil or geomembrane related testing work. Such tests may be stamped or marked "preliminary" if a full quality check has not yet been completed. This data may be necessary to promptly resolve a nonconforming condition or to share results with MLC or the MDNRE.

2.3 DEMOBILIZATION

The subcontractor shall remove all equipment, facilities, or other temporary items installed by subcontractor unless otherwise directed by O'Brien & Gere as part of the demobilization activities. All areas disturbed by subcontractor for equipment lay-down or temporary parking shall be restored to the pre-construction condition.

Areas that have been seeded and not yet accepted by O'Brien & Gere shall continue to be watered and maintained by the subcontractor. These areas shall be maintained until an acceptable stand of grass is achieved as required by Section 02980, Topsoil and Seeding and the area accepted by O'Brien & Gere.

Silt fence structures shall be removed as directed by O'Brien & Gere's supervisor from areas where suitable vegetative cover (if required) has been established and the erosion potential is minimal. Silt fence posts shall be removed or cut off flush with the ground surface. All debris from the removal of silt fences shall be disposed at appropriate disposal facilities by the subcontractor. No temporary silt fences shall be left in place for a time period to exceed 90 days after the completion of construction unless directed by the O'Brien & Gere supervisor.

Post-construction submittals to be furnished by the subcontractor may include any test results/reports from on site or off site testing of soils and/or geomembrane. This may include final, QA-certified copies of any test data that was previously submitted as "preliminary".

2.4 REPORTING

O'Brien & Gere will prepare a brief technical memorandum to summarize and document the Cell E Liner Seaming activities and any findings ascertained during the implementation of this SOW.

3. REFERENCES

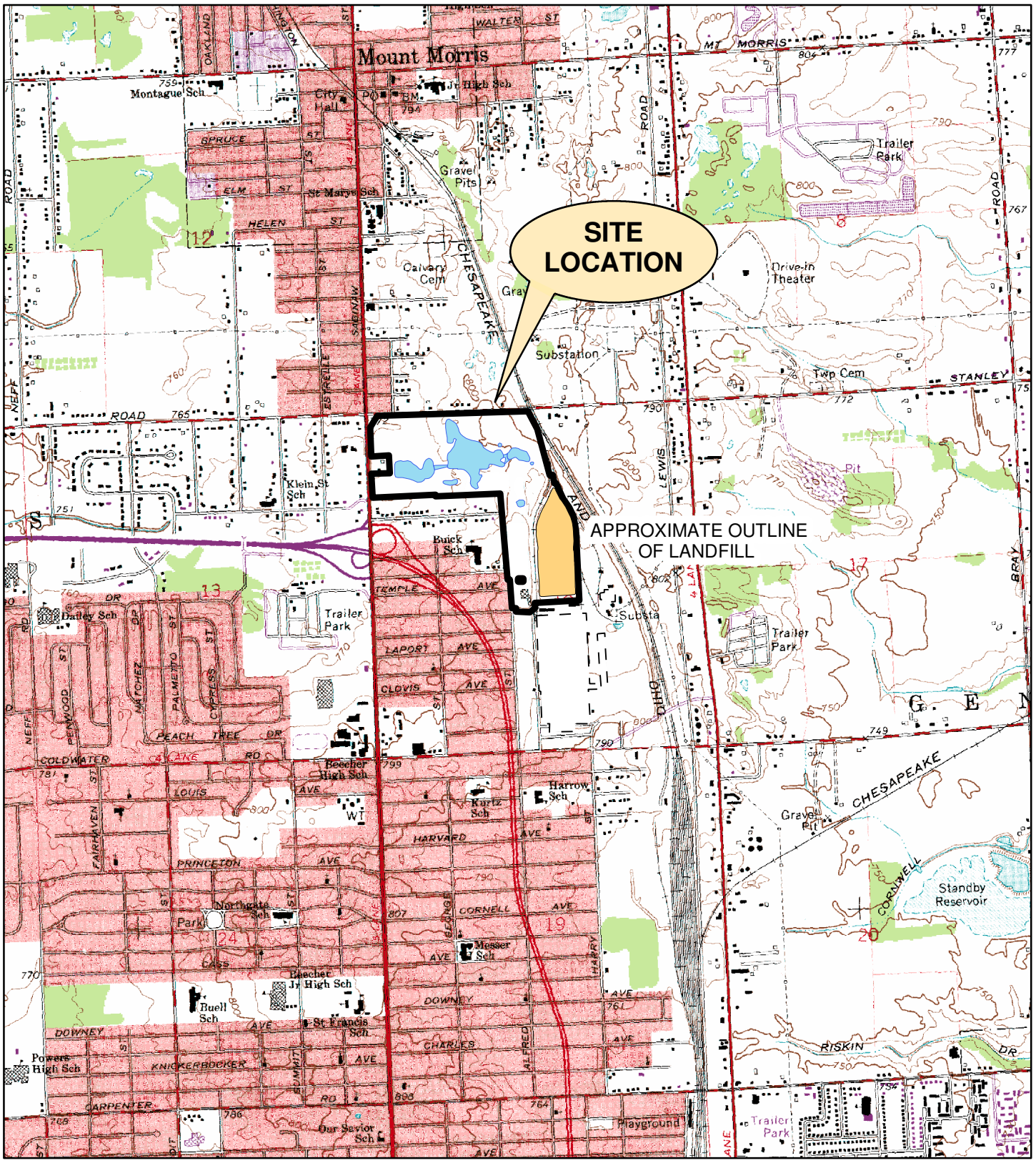
O'Brien & Gere Engineers, Inc. 2005. *Leak Detection System Study Report. Coldwater Road Landfill*. June.

O'Brien & Gere Engineers, Inc. 2006. *Leak Detection System Evaluation Report. Coldwater Road Landfill*. June.

O'Brien & Gere Engineers, Inc. 2007. *Leak Detection System Evaluation Report Update. Coldwater Road Landfill*. September.

FIGURES

FIGURE 1



REALM
COLDWATER ROAD FACILITY
FLINT, MICHIGAN

SITE LOCATION MAP

N

0 1
Miles

JANUARY 2010
4966/39196/001

O'BRIEN & GERE ENGINEERS, INC.

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PLOT DATE: 1/11/2009 jmo

I:\PROJECTS\4966\36196\O&M 2009\DOC\DWG\008.MXD

FIGURE 2

STANLEY ROAD

SAGINAW STREET

KLEIN STREET

WETLANDS

DIRT ROAD / TRAIL

RAILROAD

VAULT A
CELL A
SUMP A
VAULT B
CELL B
SUMP B
VAULT C
CELL C
SUMP C
VAULT D
CELL D
SUMP D
VAULT E
CELL E
SUMP E
SUMP F
CELL F
VAULT F

DRAINAGE SWALE

DRAINAGE CULVERT (TYP)

ABANDONED RAILROAD

CONTROL BUILDING

FENCE

CONCRETE / GRAVEL ROAD

MORRIS HILLS

I-475

MAP USES DATA FROM THE MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION

PLOT DATE: 1/11/2010 jmo

N

LEGEND

LEACHATE COLLECTION SUMP

ACCESS PORT FOR LEAK DETECTION VAULT

REALM
COLDWATER ROAD
LANDFILL FACILITY
FLINT, MICHIGAN

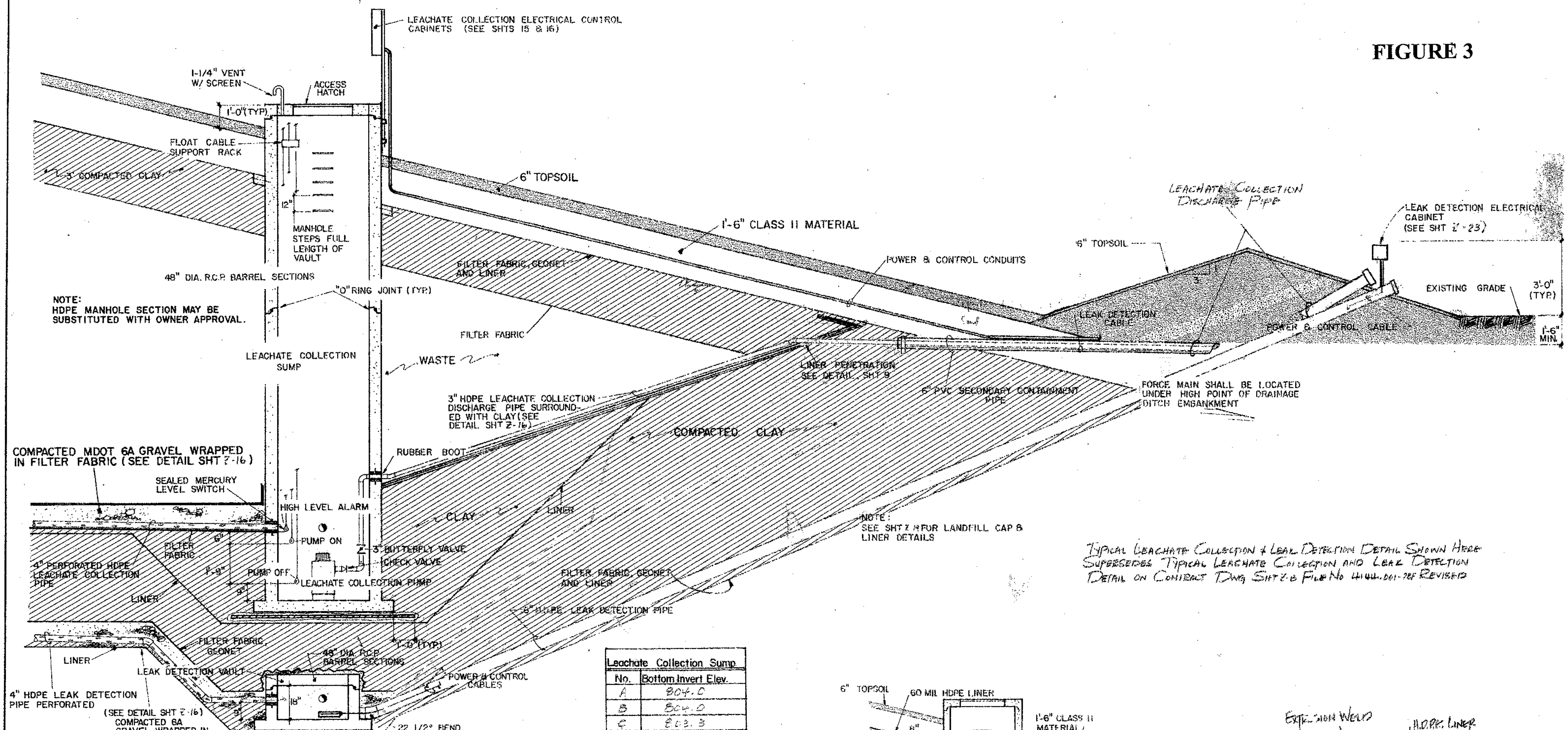
SITE LAYOUT

0 150 300 450 600
Feet

JANUARY 2009
4966/36196-008

O'BRIEN & GERE ENGINEERS, INC.

FIGURE 3



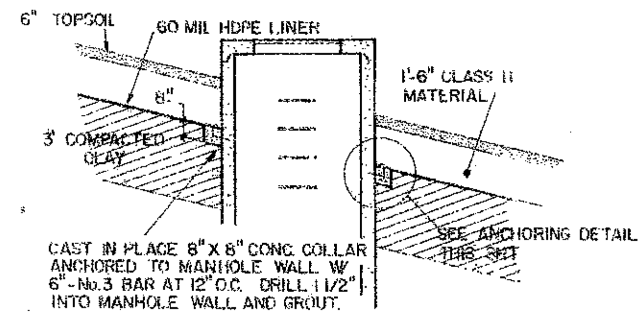
Typical Leachate Collection & Leak Detection Detail Shown Here Supersedes Typical Leachate Collection and Leak Detection Detail on Contract Dwg Sht Z-8 File No 4144.001-78F Revised

TYPICAL LEACHATE COLLECTION & LEAK DETECTION DETAIL

NOT TO SCALE

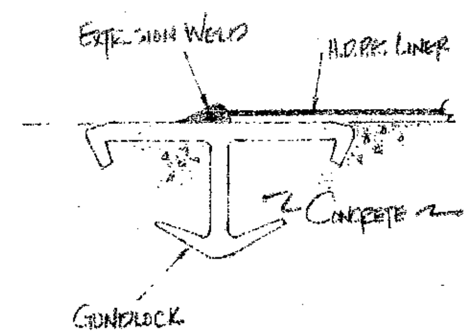
Leachate Collection Sump	
No.	Bottom Invert Elev.
A	804.0
B	804.0
C	803.3
D	803.3
E	803.3
F	803.3

Leak Detection Vault	
No.	Bottom Invert Elev.
A	798.75
C	798.75
C	798.05
D	798.05
E	798.05
F	798.05



LINER TO MANHOLE ATTACHMENT DETAIL

NOT TO SCALE



ANCHORING DETAIL

NOT TO SCALE

DAVID G. VAN ARMAN ENGINEER No. 32788 STATE OF MICHIGAN PROFESSIONAL ENGINEER

In charge of ___ Designed by ___ Checked by ___ Made by ___

SCALE : NONE

NO.	DATE	REVISION	INIT.

O'BRIEN & GERE ENGINEERS, INC. Syracuse New York

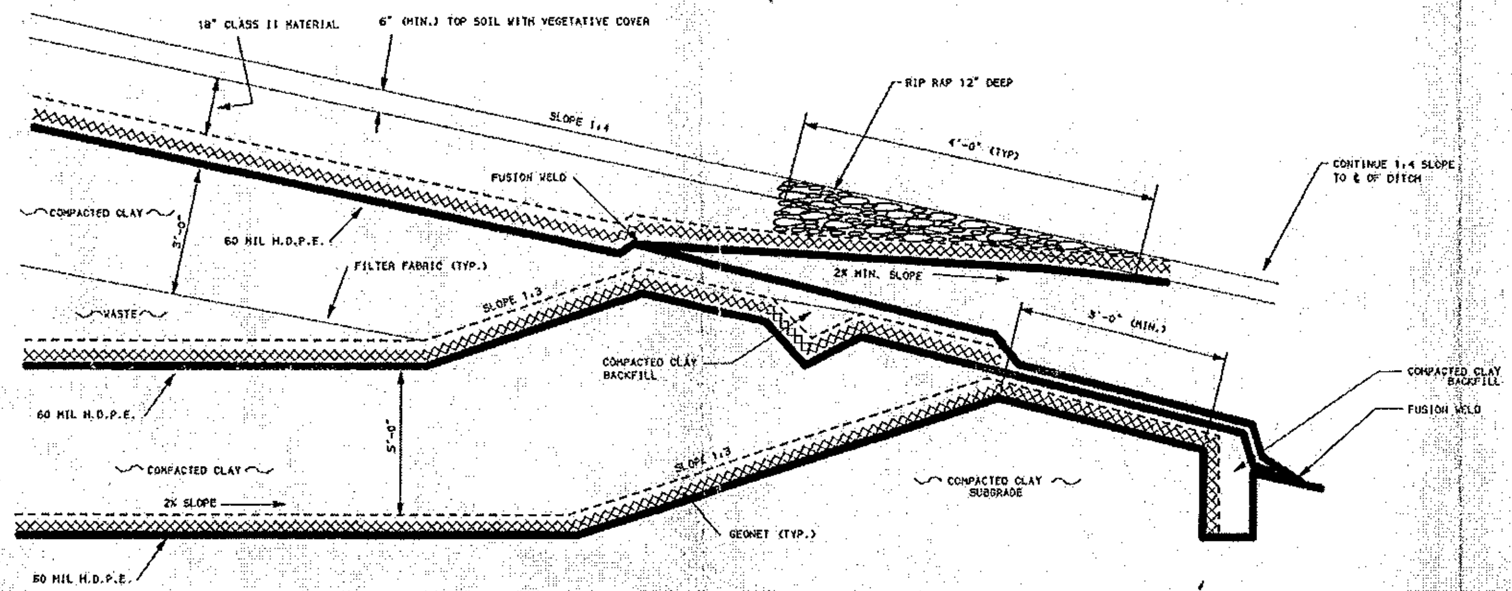
GENERAL MOTORS - FISHER GUIDE DIVISION
COLDWATER ROAD
FLINT MICHIGAN

LEACHATE COLLECTION SUMP AND LEAK DETECTION VAULT DETAILS

FILE NO. 4144.003-08F
DATE FEB 1992
Z-21

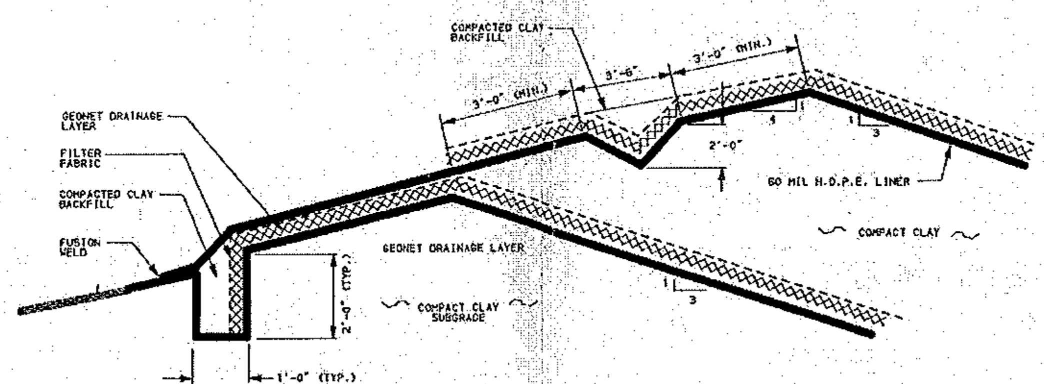
SALIT>FLINT>S.07F

FIGURE 4



CAP & LINER

NOT TO SCALE



TEMPORARY ANCHOR TRENCH DETAIL FOR DOUBLE LINER SYSTEM

NOT TO SCALE

LEGEND

- - - - - - FILTER FABRIC

▬▬▬ H.D.P.E. LINER

XXXXXXXX GEONET DRAINAGE LAYER

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER TO ALTER THIS DOCUMENT.

STATE OF MICHIGAN
DAVID G. VAN ARNAM
ENGINEER
No. 32786
LICENSED PROFESSIONAL ENGINEER

In charge of / Designed by / Checked by / Made by	NOT TO SCALE	NO. / DATE / REVISION / INIT.	O'BRIEN & GERE ENGINEERS, INC. Syracuse, New York	GENERAL MOTORS-FISHER GUIDE DIVISION COLDWATER ROAD FLINT MICHIGAN	LANDFILL CAP & LINER DETAILS

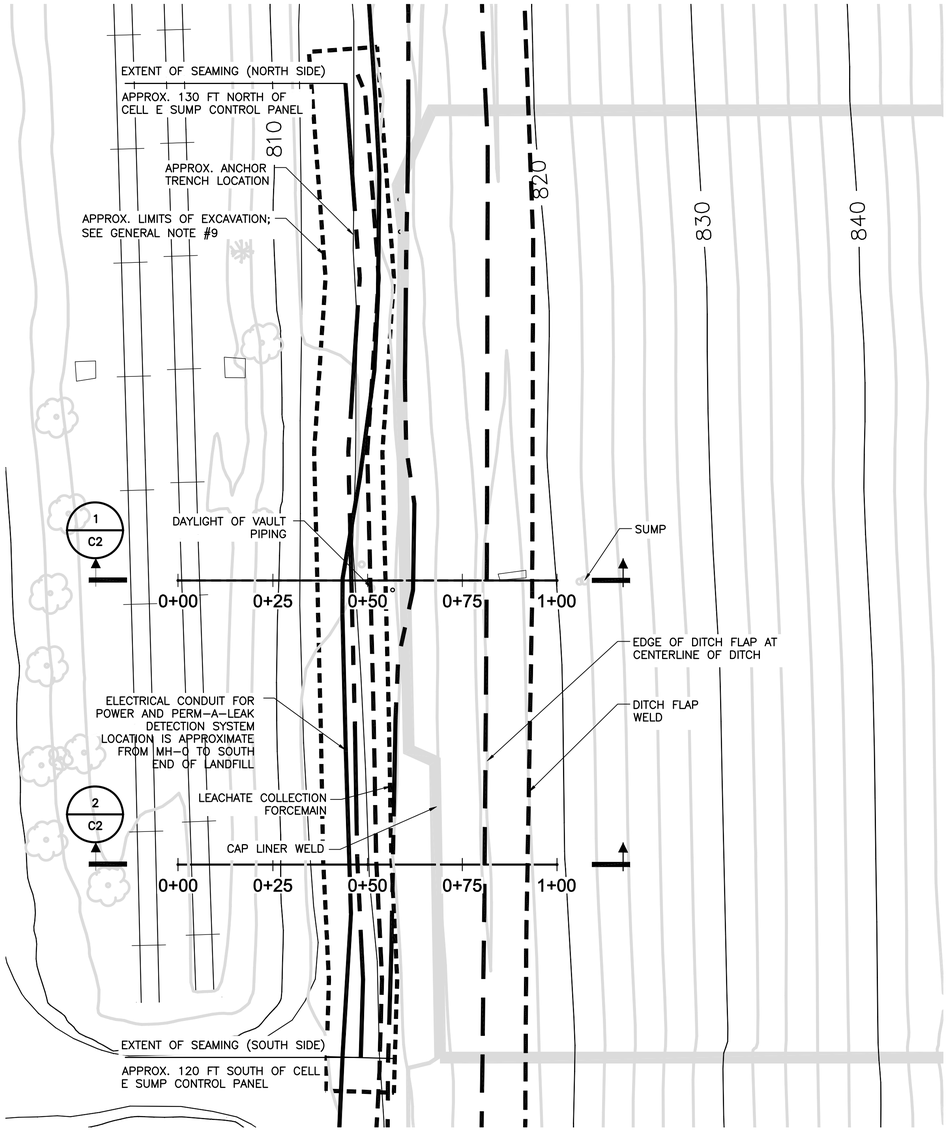
FILE NO. 4144.003-07F

DATE FEB 1992

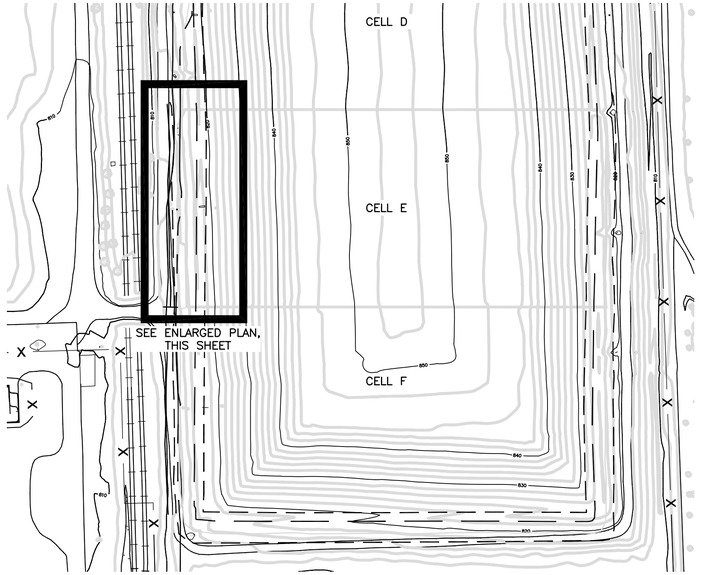
Z-19

EXHIBITS

SAVED: 9/7/10 9:43 AM



ENLARGED PLAN
SCALE: 1"=20'



PLAN
SCALE: 1"=100'

LEGEND

100 EXISTING CONTOUR

CELL BOUNDARY

GENERAL NOTES:

1. PROJECT WORK GENERALLY INCLUDES UNEARTHING APPROXIMATELY 250 LF OF EXISTING PRIMARY AND SECONDARY LINERS, EXTRUSION WELDING PRIMARY AND SECONDARY LINERS TOGETHER IN ACCORDANCE WITH STANDARD INDUSTRY PRACTICE, AND RESTORING SURFACES TO EXISTING CONDITION. SEE SPECIFICATION 02293 – GEOMEMBRANE LINER SEAMING.
2. PROJECT SITE IS LOCATED AT FLINT–COLDWATER ROAD LANDFILL, 6200 HORTON AVE., MT. MORRIS, MICHIGAN. PROPOSED PROJECT WORK IS LOCATED AT CELL E OF LANDFILL. PROJECT SITE ACCESSED BY PRIVATE DRIVE AT SOUTHEAST PORTION OF FACILITY, AT THE CORNER OF HORTON AVE. AND MORRIS HILLS PARKWAY.
3. THE LANDFILL IS A SECURED FACILITY. THE CONTRACTOR SHALL COORDINATE WITH THE ENGINEER FOR ACCESS. THE USE OR PRESENCE OF CAMERAS OR OTHER PHOTOGRAPHIC EQUIPMENT IS FORBIDDEN WITHOUT PRIOR WRITTEN APPROVAL.
4. THE LOCATIONS OF EXISTING UTILITIES SHOWN HERE ARE TO BE CONSIDERED APPROXIMATE ONLY AND SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR AS REQUIRED TO PERFORM THE WORK.
5. OTHER UTILITIES MAY EXIST. THE EXTENT OF WHICH ARE UNKNOWN.
6. CONTRACTOR SHALL VERIFY ALL DIMENSIONS PERTINENT TO THE WORK OF THIS CONTRACT IN THE FIELD.
7. THE CONTRACTOR SHALL REPORT TO ENGINEER ANY CONDITION WHICH PREVENTS THE WORK FROM BEING COMPLETE ACCORDING TO THE PLANS AND SPECIFICATIONS.
8. CONTRACTOR SHALL ERECT AND MAINTAIN SAFETY BARRICADES MEETING OR EXCEEDING OSHA REQUIREMENTS AROUND THE EXCAVATION AREA AT ALL TIMES. EMPLOYEES SHALL AT ALL TIMES WORK IN COMPLIANCE WITH OSHA'S REGULATIONS.
9. APPROXIMATE LIMITS OF EXCAVATION ARE DEPICTED. EXCAVATION WORK SHALL BE COMPLETED IN ACCORDANCE WITH OSHA STANDARDS.
10. ALL WORK SHALL BE DONE IN A NEAT AND WORKMANLIKE MANNER AND SHALL BE IN ACCORDANCE WITH CURRENT GENERALLY ACCEPTED PRACTICES WITHIN THE INDUSTRY.
11. EXISTING SITE PLAN INFORMATION SHOWN ON THIS DRAWING OBTAINED FROM AUTOCAD BASED FILE PROVIDED BY CONESTOGA–ROVERS & ASSOCIATES. DRAWING FILE NAME "12636–40(014)GN–WA030.DWG".

RESTORATION OF SURFACES:

1. CONTRACTOR IS RESPONSIBLE FOR RESTORATION AND MAINTENANCE OF SURFACES AFFECTED BY THIS PROJECT AS OUTLINED IN THE FOLLOWING CONTRACT DOCUMENT SPECIFICATIONS: 02220 – EARTHWORK, 02240 – COVER SOIL, 02502 – RESTORATION OF SURFACES, AND 02980 – TOPSOIL AND SEEDING.
2. ALL AREAS THAT HAVE BEEN DISTURBED SHALL BE TOPSOILED AND SEEDED OR HAVE THE APPROPRIATE SURFACE FINISH AS SHOWN OR SPECIFIED IN THE CONTRACT DRAWINGS OR SPECIFICATIONS.

STATE OF MICHIGAN – JAMES R. HECKATHORNE – ENGINEER – No. 45904 – LICENSED PROFESSIONAL ENGINEER – 9/7/10

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.

IN CHARGE OF JIM R. HECKATHORNE

DESIGNED BY LAT/CSY CHECKED BY SWA

DRAWN BY LAT

1"=20' 20 0 20 40

1"=100' 100 0 100 200

NO.	DATE	REVISION	INIT.
0	08/25/10	ISSUED FOR CONSTRUCTION	JRH

O'BRIEN & GERE

FLINT–COLDWATER ROAD LANDFILL
6200 HORTON AVE.
MT. MORRIS, MICHIGAN

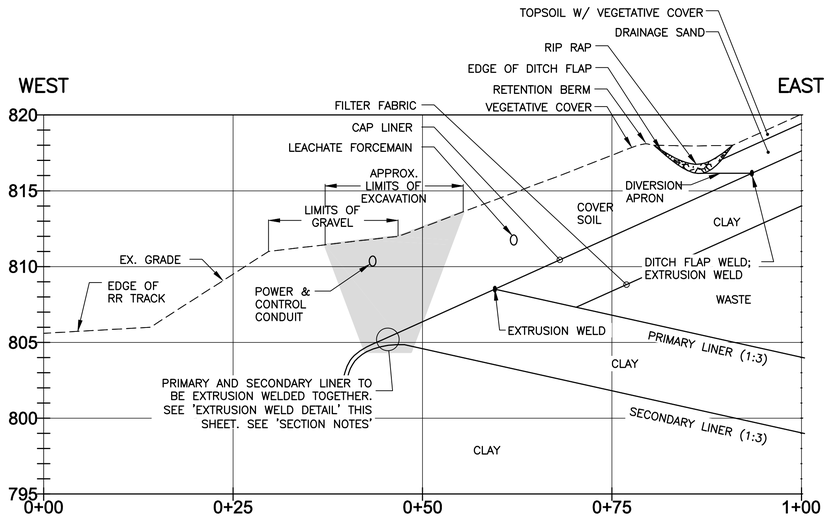
CIVIL
CELL E
LINER SEAMING PLAN

FILE NO. 14774.45042–C1

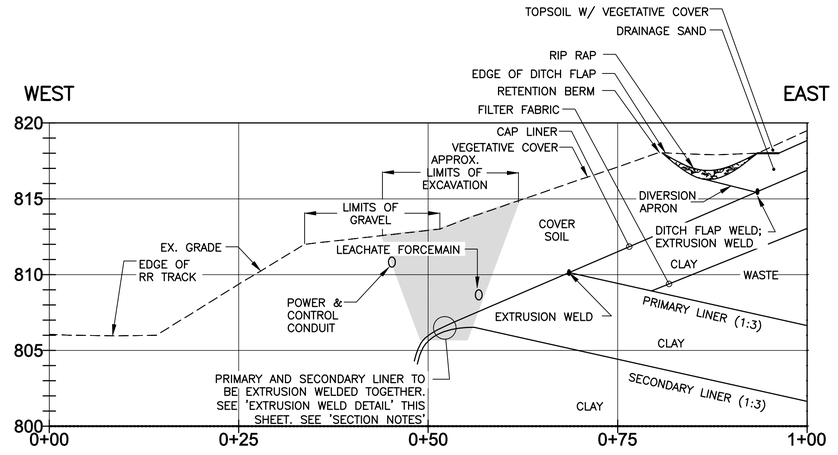
DATE AUGUST 2010

C–1

I:\MLC\14774\45042.MLC–COLDWATER–R\DOCS\DWG\SHEETS\C–1 PLAN VIEW.DWG



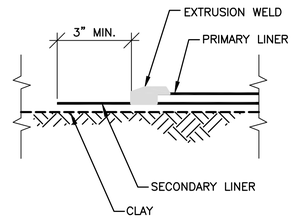
SECTION (1/C1)
SCALE: HORZ 1"=10'
VERT 1"=5'



SECTION (2/C1)
SCALE: HORZ 1"=10'
VERT 1"=5'

SECTION NOTES:

1. TERMINATION OF PRIMARY AND SECONDARY LINERS MAY OCCUR EAST OF LIMITS OF GRAVEL ±5' BASED ON SITE OBSERVATIONS DURING TEST PITTING.
2. TERMINATION OF PRIMARY AND SECONDARY LINERS MAY NOT OCCUR IN AN ANCHOR TRENCH BASED ON SITE OBSERVATIONS DURING TEST PITTING.
3. AREA OF EXTRUSION WELDING (I.E., SEAMING) OF PRIMARY LINER TO SECONDARY LINER. SEE 'EXTRUSION WELD' DETAIL, THIS SHEET.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL EXISTING UTILITIES AS REQUIRED TO PERFORM THE WORK.



EXTRUSION WELD (TYP.)
NOT TO SCALE

DETAIL NOTES:

1. SEE SPECIFICATION 02293 – GEOMEMBRANE FOR WELDING REQUIREMENTS.

IN CHARGE OF JIM R. HECKATHORNE
DESIGNED BY CSY/LAT CHECKED BY SWA
DRAWN BY LAT

(HOR.) 1"=10' 10 0 10 20
(VERT.) 1"=5' 5 0 5 10

NO.	DATE	REVISION	INIT.
0	08/25/10	ISSUED FOR CONSTRUCTION	JRH

O'BRIEN & GERE

FLINT–COLDWATER ROAD LANDFILL
6200 HORTON AVE.
MT. MORRIS, MICHIGAN

CIVIL
CELL E

PROFILE VIEW

FILE NO. 14774.45042–C2
DATE AUGUST 2010

C–2

TECHNICAL SPECIFICATIONS

Cell E Liner Seaming

Flint-Coldwater Road Landfill
6200 Horton Ave.
Mt. Morris, Michigan

August 2010

O'BRIEN & GERE
www.obg.com

TECHNICAL SPECIFICATIONS

- 02220 - Earthwork
- 02240 – Cover Soil
- 02502 – Restoration of Surfaces
- 02293 – Geomembrane Liner Seaming
- 02980 – Topsoil and Seeding

SECTION 02220

EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes excavation and backfilling including the loosening, removing, refilling, transporting, storage and disposal of all materials classified as "earth" necessary to be removed for the construction and completion of all work under the Contract, and as shown on the Contract Drawings, specified or directed.

1.2 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:

1. American Society for Testing and Materials (ASTM)

a. A328 Specification for Steel Sheet Piling

b. D1760 Specification for Pressure Treatment of Timber Products

1.3 DEFINITIONS

A. Excavation (or Trenching)

1. Grubbing, stripping, removing, storing and rehandling of all materials of every name and nature necessary to be removed for all purposes incidental to the construction and completion of all the work under construction.

2. All sheeting, sheetpiling, bracing and shoring, and the placing, driving, cutting off and removing of the same.

3. All diking, ditching, fluming, cofferdamming, pumping, bailing, draining, well pointing, or otherwise disposing of water.

4. The removing and disposing of all surplus materials from the excavations in the manner specified.

5. The maintenance, accommodation and protection of travel and the temporary paving of highways, roads and driveways.

6. The supporting and protecting of all tracks, rails, buildings, curbs, sidewalks, pavements, overhead wires, poles, trees, vines, shrubbery, pipes, sewers, conduits or other structures or property in the vicinity of the work, whether over- or underground or which appear within or adjacent to the excavations, and the restoration of the same in case of settlement or other injury.

7. All temporary bridging and fencing and the removing of same.

B. Earth

1. All materials such as sand, gravel, clay, loam, ashes, cinders, pavements, muck, roots or pieces of timber, soft or disintegrated rock, not requiring blasting, barring, or wedging from their original beds, and specifically excluding all ledge or bedrock and individual boulders or masonry larger than one-half cubic yard in volume.

C. Backfill

1. The refilling of excavation and trenches to the line of filling indicated on the Contract Drawings or as directed using materials suitable for refilling of excavations and trenches; and the compacting of all materials used in filling or refilling by rolling, ramming, watering, puddling, etc., as may be required.

D. Spoil

1. Surplus excavated materials not required or not suitable for backfills or embankments.

E. Embankments

1. Fills constructed above the original surface of the ground or such other elevation as specified or directed.

F. Limiting Subgrade

1. The underside of the pipe barrel for pipelines
2. The underside of footing lines for structures

G. Excavation Below Subgrade

1. Excavation below the limiting subgrades of structures or pipelines.

2. Where materials encountered at the limiting subgrades are not suitable for proper support of structures or pipelines, the Contractor shall excavate to such new lines and grades as required.

PART 2 PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

A. Wood Sheeting and Bracing

1. Shall be sound and straight; free from cracks, shakes and large or loose knots; and shall have dressed edges where directed.

2. Shall conform to National Design Specifications for Stress Grade Lumber having a minimum fiber stress of 1200 pounds per square inch.

3. Sheeting and bracing to be left-in-place shall be pressure treated in accordance with ASTM D1760 for the type of lumber used and with a preservative approved by the Engineer.

B. Steel Sheeting and Bracing

1. Shall be sound

2. Shall conform to ASTM A328 with a minimum thickness of 3/8 inch.

PART 3 EXECUTION

3.1 UNAUTHORIZED EXCAVATION

A. Whenever excavations are carried beyond or below the lines and grades shown on the Contract Drawings, or as given or directed by the Engineer, all such excavated space shall be refilled with special granular materials, concrete or other materials as the Engineer may direct. All refilling of unauthorized excavations shall be at the Contractor's expense.

B. All material which slides, falls or caves into the established limits of excavations due to any cause whatsoever, shall be removed and disposed of at the Contractor's expense and no extra compensation will be paid the Contractor for any materials ordered for refilling the void areas left by the slide, fall or cave-in.

3.2 REMOVAL OF WATER

A. General

1. The Contractor shall at all times provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work or the proper placing of pipes, structures, or other work.

2. Unless otherwise specified, all excavations which extend down to or below the static groundwater elevations shall be dewatered by lowering and maintaining the groundwater beneath such excavations at all times when work thereon is in progress, during subgrade preparation and the placing of the structure or pipe thereon.

3. Water shall not be allowed to rise over or come in contact with any masonry, concrete or mortar, until at least 24 hours after placement, and no stream of water shall be allowed to flow over such work until such time as the Engineer may permit.

4. Water pumped or drained from excavations, or any sewers, drains or water courses encountered in the work, shall be disposed of in a suitable manner without injury to adjacent property, the work under construction, or to

pavements, roads, drives, and water courses. No water shall be discharged to sanitary sewers. Sanitary sewage shall be pumped to sanitary sewers or shall be disposed of by an approved method.

5. Any damage caused by or resulting from dewatering operations shall be the sole responsibility of the Contractor.

B. Work Included

1. The construction and removal of cofferdams, sheeting and bracing, and the furnishing of materials and labor necessary therefor.

2. The excavation and maintenance of ditches and sluiceways.

3. The furnishing and operation of pumps, and appliances needed to maintain thorough drainage of the work in a satisfactory manner.

3.3 STORAGE OF MATERIALS

A. Sod

1. Any sod cut during excavation shall be removed and stored during construction so as to preserve the grass growth. Sod damaged while in storage shall be replaced in like kind at the sole expense of the Contractor.

B. Topsoil

1. Topsoil suitable for final grading shall be removed and stored separately from other excavated material.

C. Excavated Materials

1. All excavated materials shall be stored in locations so as not to endanger the work, and so that easy access may be had at all times to all parts of the excavation. Stored materials shall be kept neatly piled and trimmed, so as to cause as little inconvenience as possible to public travel or to adjoining property holders.

2. Special precautions must be taken to permit access at all times to fire hydrants, fire alarm boxes, police and fire department driveways, and other points where access may involve the safety and welfare of the general public.

3.4 DISPOSAL OF MATERIALS

A. Spoil Material

1. All spoil materials shall be disposed of as required by the local, state or federal regulations pertaining to the area or on the Contract Drawings.

2. The surface of all spoil areas shall be graded and dressed and no unsightly mounds or heaps shall be left on completion of the work.

3.5 SHEETING AND BRACING

A. Installation

1. The Contractor shall furnish, place and maintain such sheeting, bracing and shoring as may be required to support the sides and ends of excavations in such manner as to prevent any movement which could, in any way, injure the pipe, structures, or other work; diminish the width necessary for construction; otherwise damage or delay the work of the Contract; endanger existing structures, pipes or pavements; or cause the excavation limits to exceed the right-of-way limits.

2. In no case will bracing be permitted against pipes or structures in trenches or other excavations.

3. Sheeting shall be driven as the excavation progresses, and in such manner as to maintain pressure against the original ground at all times. The sheeting shall be driven vertically with the edges tight together, and all bracing shall be of such design and strength as to maintain the sheeting in its proper position. Seepage which carries fines through the sheeting shall be plugged to retain the fines.

4. Where breast boards are used between soldier pile, the boards shall be back packed with soil to maintain support.

5. The Contractor shall be solely responsible for the adequacy of all sheeting and bracing.

B. Removal

1. In general, all sheeting and bracing, whether of steel, wood or other material, used to support the sides of trenches or other open excavations, shall be withdrawn as the trenches or other open excavations are being refilled. That portion of the sheeting extending below the top of a pipe or structural foundation shall not be withdrawn, unless otherwise directed, before more than 6 inches of earth is placed above the top of the pipe or structural foundation and before any bracing is removed. The voids left by the sheeting shall be carefully refilled with selected material and rammed tight with tools especially adapted for the purpose or otherwise as may be approved.

2. The Contractor shall not remove sheeting and bracing until the work has attained the necessary strength to permit placing of backfill.

C. Left in Place

1. If, to serve any purpose of his own, the Contractor files a written request for permission to leave sheeting or bracing in the trench or excavation, the Engineer may grant such permission, in writing, on condition that the cost of such sheeting and bracing be assumed and paid by the Contractor.

2. The Contractor shall leave in place all sheeting, shoring and bracing which are shown on the Contract Drawings or specified to be left in place or which the Engineer may order, in writing, to be left in place. All shoring, sheeting and bracing shown or ordered to be left in place will be paid for under the appropriate item of the Contract. No payment allowance will be made for wasted ends or for portions above the proposed cutoff level which are driven down instead of cut-off.

3. In case sheeting is left in place, it shall be cut off or driven down as directed so that no portion of the same shall remain within 12 inches of the street subgrade or finished ground surface.

3.6 BACKFILLING

A. General

1. All excavations shall be backfilled to the original surface of the ground or to such other grades as may be shown, specified or directed.

2. Backfilling shall be done with suitable excavated materials which can be satisfactorily compacted during refilling of the excavation. In the event the excavated materials are not suitable, Special Backfill as specified or ordered by the Engineer shall be used for backfilling.

3. Any settlement occurring in the backfilled excavations shall be refilled and compacted.

B. Unsuitable Materials

1. Stones, pieces of rock or pieces of pavement greater than 1 cubic foot in volume or greater than 1.5 feet in any single dimension shall not be used in any portion of the backfill.

2. All stones, pieces of rock or pavement shall be distributed through the backfill and alternated with earth backfill in such a manner that all interstices between them shall be filled with earth.

3. Frozen earth shall not be used for backfilling.

C. Compaction

1. The compaction shall be as specified for the type of earthwork, i.e., structural, trenching or embankment.

    a. The compaction equipment shall be suitable for the material encountered.

    b. Soil shall not be dropped directly onto the geomembrane from a height greater than 3 feet. The soil shall be pushed out over the geomembrane in an upward tumbling motion. The direction of backfilling shall proceed in the direction of down gradient shingling of geomembrane overlaps; except that on side slopes, soil backfill shall be placed from the bottom of the slope upward.

1) Cover soil shall be placed such that soil does not enter the geomembrane overlap zone and tensile stress is not mobilized in the geomembrane. No equipment shall be operated on the top surface of the geomembrane without permission from the Engineer.

c. Each soil or gravel layer shall be compacted by rolling with self-propelled rollers. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller, as determined by the Engineer. Unless otherwise specified, the initial loose soil lift thickness shall be 12 inches. Equipment with ground pressures less than 7.2 psi shall be used to place the first lift over the geomembrane. Equipment placing cover soil shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding 7.2 ft/s.

1) All materials and equipment needed to complete the placement of the soil cover shall be in the place at the worksite prior to the placement of the geomembrane.

2) The Contractor shall be responsible for all damage or injury done to pipes, structures, property or persons due to improper placing or compacting of cover materials.

2. The Contractor shall be responsible for all damage or injury done to pipes, structures, property or persons due to improper placing or compacting of backfill.

3.7 OTHER REQUIREMENTS

A. Drainage

1. All material deposited in roadway ditches or other water courses shall be removed immediately after backfilling is completed and the section, grades and contours of such ditches or water courses restored to their original condition, in order that surface drainage will be obstructed no longer than necessary.

B. Unfinished Work

1. When, for any reason, the work is to be left unfinished, all trenches and excavations shall be filled and all roadways, sidewalks and watercourses left unobstructed with their surfaces in a safe and satisfactory condition. The surface of all roadways and sidewalks shall have a temporary pavement.

C. Hauling Material on Streets

1. When it is necessary to haul material over the streets or pavements, the Contractor shall provide suitable tight vehicles so as to prevent deposits on the streets or pavements. In all cases where any materials are dropped from the vehicles, the Contractor shall clean up the same as often as required to

keep the crosswalks, streets and pavements clean and free from dirt, mud, stone and other hauled material.

D. Dust Control

1. It shall be the sole responsibility of the Contractor to control the dust created by any and all of his operations to such a degree that it will not endanger the safety and welfare of the general public.

2. Calcium chloride and petroleum products shall not to be used for dust control.

E. Test Pits

1. For the purpose of obtaining detail locations of underground obstructions, the Contractor shall make excavations in advance of the work. Payment for the excavations ordered by the Engineer will be made under an appropriate item of the Contract and shall include sheeting, bracing, pumping, excavation and backfilling.

* * * * *

SECTION 02240

COVER SOIL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes excavation, backfilling, and compacting including the loosening, removing, working, transporting, storage, fill, and disposal of all materials necessary for construction or replacement of the "cover soil", as shown, specified, or directed by the Engineer. The cover soil is defined as any clay layer associated with the landfill construction.

1.2 REFERENCES

A. None

1.3 SUBMITTALS

A. None

1.4 TESTING

A. None

PART 2 PRODUCTS

2.1 COVER SOIL MATERIAL

A. The existing cover soil shall be reused. If purchase of additional cover soil material is required, the Contractor shall coordinate with the Engineer to obtain requirements for borrow source material.

B. The cover soil material must be uniform in composition and texture, clean and free from stones, weeds, stumps, roots, toxic substances, and debris or similar substances. The cover soil material shall be characterized as engineered clay.

PART 3 EXECUTION

3.1 INSTALLATION

A. Placement of the cover soil material shall be in accordance with the provisions of this Section. Any cover soil material which cannot comply with the provisions of this Section will be considered as spoil and will be removed and disposed of at the Contractor's expense.

B. The cover soil material shall be constructed by placing suitable material in lifts. The first lift above the geomembrane shall have a compacted thickness of 12 inches and shall be free from stones greater than 1/4 inch. The remaining material shall be placed in

compacted 6-inch lifts. Compaction of the lifts shall be accomplished as noted in the Earthwork specification.

C. The thickness of the cover soil layer shall be equal to the thickness of the existing cover soil. At no point will the cover soil layer be less than 3.5’ in thickness.

D. Cover soil material containing frozen soil or ice shall not be placed.

E. Compaction or consolidation achieved by traveling trucks, machines, and other equipment will not be accepted unless such procedures are reviewed by the Engineer.

F. Any damage to the completed surface of the cover soil, whether caused by erosion, the Contractor's work, or any other occurrences, shall be immediately repaired and maintained in good condition until completion of the work.

* * * * *

SECTION 02502

RESTORATION OF SURFACES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes restoration and maintenance of all types of surfaces disturbed, damaged or destroyed during the performance of the work under or as a result of the operations of the Contract.

B. The quality of materials and the performance of work used in the restoration shall produce a surface or feature equal to the condition of each before the work began.

1.2 REFERENCES

NOT USED

1.3 SUBMITTALS

NOT USED

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. The replacement of surfaces at any time, as scheduled or as directed, shall not relieve the Contractor of responsibility to repair damages by settlement or other failures.

3.2 STONE OR GRAVEL PAVEMENT

A. All pavement and other areas surfaced with stone or gravel shall be replaced with material to match the existing surface unless otherwise specified.

1. The depth of the stone or gravel shall be at least equal to the existing.

2. After compaction the surface shall conform to the slope and grade of the area being replaced.

3.3 LAWNS AND IMPROVED AREAS

A. The area to receive topsoil shall be graded to a depth of not less than 4 inches or as specified, below the proposed finished surface.

1. If the depth of existing topsoil prior to construction was greater than 4 inches, topsoil shall be replaced to that depth.

B. The furnishing and placing of topsoil, seed and mulch shall be in accordance with the Section entitled "Topsoil and Seeding".

C. When required to obtain germination, the seeded areas shall be watered in such a manner as to prevent washing out of the seed.

D. Any washout or damage which occurs shall be regraded and reseeded until a good sod is established.

E. The Contractor shall maintain the newly seeded areas, including regrading, reseeding, watering and mowing, in good condition.

3.4 MAINTENANCE

A. The finished products of restoration shall be maintained in an acceptable condition for and during a period of one year following the date of Substantial Completion or other such date as set forth elsewhere in the Contract Documents.

* * * * *

SECTION 02293

GEOMEMBRANE LINER SEAMING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the furnishing of all labor, material, equipment and performing all operations required for testing and seaming a 60 mil smooth high-density polyethylene (HDPE) geomembrane, as specified herein, shown on the Contract Drawings or as directed by the Engineer.

1.2 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. American Society for Testing and Materials (ASTM)

a. ASTM D638 Test Method for Tensile Properties of Plastics

b. ASTM D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting

c. ASTM D4437 Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.

2. Federal Test Method Standards (FTMS)

a. FTMS 101 C 2065

3. National Sanitation Foundation (NSF)

a. Standard 54-Standard for Flexible Membrane Liners (NSF 54) Michigan Part 115 of 1994 PA 451

b. Solid Waste Management Act Administrative Rules (R299.4101-R299.4922)

1.3 SUBMITTALS

A. The following items shall be submitted:

1 Contractor Submittals

a. Resumes of the qualifications of the installation supervisor and personnel performing field seaming operations for this project.

b. Daily seam strength test values for peel adhesion and seam shear strength.

c. Notification of any equipment or material problems within two hours of the occurrence and the proposed course of corrective action.

d. Samples of all documentation forms.

e. Summary log of all field quality control work completed by the Contractor.

f. Certification that the material installation is complete and in accordance with the specifications.

g. Statement of Warranty

h. Direct shear laboratory qualifications

2. CQC Geosynthetic Laboratory Submittals

a. Quality control program manual

3. Qualification Submittals

a. The Contractor shall have at least five (5) years continuous experience in the installation of HDPE geomembranes and/or experience totaling at least two million square feet of the proposed geomembrane for at least 10 complete projects. All personnel performing seaming operations shall be qualified by experience or will be required to pass a seaming test in accordance with this Section.

b. The Contractor (i.e., geomembrane installer) shall designate a Certified Welding Technician (CWT). Installation shall be performed under the directions of the CWT, who shall remain on site and be responsible throughout the liner installation for subgrade acceptance, liner layout, seaming, testing and repairs, and all other activities contracted by the Contractor. The CWT shall be present during all seaming operations and shall have a minimum of one million square feet of field seaming experience using the same type of seaming equipment and geomembrane mil thickness specified for this project.

c. The Contractor (technicians and CWT) shall be International Association of Geosynthetic Installer's (IAGI) certified in extrusion welding. Proof of this certification shall be provided prior to the commencement of geomembrane seaming.

d. The Contractor shall hold the IAGI Certified Installer status. Proof of this certification shall be provided prior to the commencement of geomembrane seaming.

1.4 DEFINITIONS

A. CQC Geosynthetic Laboratory:

The third party construction quality control geosynthetic testing (CQC) lab, hired by the Contractor, is responsible for quality control geomembrane seam testing.

B. Contractor:

The person or corporation who is responsible for field handling, deploying, seaming, field construction quality control (CQC) testing and anchoring the geomembrane panels.

C. HDPE:

Abbreviation for high density polyethylene

1.5 EQUIPMENT

A. All equipment, tools and machines used in performance of the work shall be subject to acceptance by the Engineer prior to commencement of work. This equipment shall be maintained in satisfactory working condition at all times.

1.6 WARRANTY

A. The Contractor shall obtain and submit to the Engineer written warranties guaranteeing for a 1 year period from the date of acceptance of the geomembrane that the installation and workmanship specifically provided or performed under this Contract shall be free from defects. Said warranty shall apply to normal use and service by the Owner as described in Contract Specifications and as shown on the Contract Drawings. Such written warranty shall provide for the repair or replacement of the defect or defective area of geomembrane upon written notification and demonstration by the Owner of the specific non-conformance of the geomembrane material or installation with the project specifications. Such defects or non-conformance shall be repaired or replaced within a reasonable period of time of such notification.

PART 2 PRODUCTS

2.1 SEAM FABRICATION / LINER SEAMING

A. All field seams shall be made by extrusion welding and shall meet the minimum shear and peel strength requirements shown in Table 1.

TABLE 1. GEOMEMBRANE PROPERTIES

Parameter	Standard	Criteria
Gauge (nominal)	ASTM D751, ASTM D1593, or ASTM D5199	60 mils
Thickness, absolute minimum	ASTM D751, ASTM D1593, or ASTM D5199	54 mils
Density (minimum)	ASTM D792 or ASTM D1505	$\geq$0.940 g/cm^3
Melt Index (maximum)	ASTM D1238	$\leq$ 1.0 g/10 minutes
Carbon Black Content	ASTM D1603	2% minimum
Minimum Tensile Properties	ASTM D638 (as modified by NSF 54)	--
1. Tensile Strength @ Break	Type IV Specimen @ 2 in./minute	243 lb./in. width
2. Elongation @ Break	Type IV Specimen @ 2 in./minute	700%
Tear Resistance (minimum)	ASTM D1004	42 lb.
Puncture Resistance	FTMS 101 2065	125 lb.
Low Temperature Brittleness	ASTM D746	$\leq$ -107°F.
Dimensional Stability	ASTM D1204 @ 1 hr @ 100°C	±2%
Environmental Stress Crack Resistance (minimum)	ASTM D1693	1500 hrs.
Permeability	ASTM E96	< 1 x 10^{-12} cm/sec
FIELD SEAM REQUIREMENTS		
Extrusion Seaming		
1. Shear Strength (minimum)	ASTM D4437 (as modified by NSF 54)	120 lb./in.
2. Peel Adhesion (minimum)	ASTM D4437 (as modified by NSF 54)	78 lb./in.

2.2 SAMPLING AND TESTING

A. General Requirements

1. All testing services as specified herein necessary for installation of the geomembrane shall be provided by the Contractor. All testing including field services required during construction of the geomembrane shall be provided by the Contractor.

2. Geomembrane testing shall be performed by a testing laboratory accepted by the Engineer and paid for by the Contractor.

3. The Contractor shall provide at least 2 days notice prior to testing.

B. Field Sampling and Testing

1. The Contractor shall visually inspect the geomembrane for uniformity, damage, imperfections, tears, punctures, or blisters before and after exposing the liner to be seamed. Any imperfections must be immediately repaired by the Contractor and re-inspected by the Engineer.

2. Non-Destructive Field Seam Testing

a. The Contractor shall non-destructively test all field seams over their full length using the appropriate test unit and procedure as outlined in this Section. Any deviation from these procedures shall be subject to review by the Engineer prior to use. Testing shall be performed as the seaming work progresses, not at the completion of field seaming. All geomembrane field seams shall be vacuum tested. Any seams which fail shall be documented and repaired in accordance with this Section. All non-destructive testing shall be witnessed by the Engineer and documented by the Contractor.

3. Destructive Field Seam Testing

a. The Contractor shall provide a minimum of one destructive test sample. These samples shall be taken from extra material cut away from the original liner, such that the liner is not damaged and the liner geometry is not altered. Additional test locations may be selected at the direction of the Engineer.

b. The samples shall be a minimum of 18-inches wide by 72-inches long with the seam centered lengthwise. Each sample shall be cut by the Contractor into three pieces with one piece (18 inches by 24 inches) retained by the Contractor, one piece given to an independent laboratory, and the remaining piece given to the Owner for further testing if desired and permanent record. Each sample shall be tagged to identify:
1) seam number,

2) date and time cut,
3) ambient temperature,
4) seaming unit,
5) name of seamer,
6) welding apparatus temperature and pressures, and
7) top sheet.

c. The Contractor shall cut ten 1-inch wide replicate specimens from his sample using the appropriate ASTM cutting tool. Five specimens shall be tested for shear strength and five for peel adhesion in accordance with ASTM D4437. Each specimen will be 1-inch wide and 12-inches long with the field seam at the center of the specimen. To be acceptable, four out of five replicate test specimens must meet the specified property requirements listed in Table 1 and fail in a film tear bond. If the field tests pass, independent laboratory testing shall be conducted in accordance with this Section. If the field tests fail, the seam shall be repaired in accordance with this Section. Certified test results from the Contractor and independent laboratory on all seams shall be submitted prior to acceptance of the seam. No seams shall be covered until acceptance of the seam by the Engineer.

d. The test procedures to be used by the independent laboratory shall be the same as defined in this Section.

C. Non-Destructive Seam Testing Procedures

1. Vacuum Test

a. The vacuum test unit shall comprise the following:

1) A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge.

2) A steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections.

3) A rubber pressure/vacuum hose with fittings and connections.

4) A plastic bucket and wide paint brush.

5) A soapy solution.

b. The vacuum test procedure shall consist of the following steps:

1) Clean the window, gasket surfaces and check for leaks.

2) Energize the vacuum pump and reduce the tank pressure to approximately 5 psi absolute.

3) Wet a strip of geomembrane approximately 12 in. by 48 in. (length of box) with the soapy solution.

4) Place the box over the wetted area and compress.

5) Close the bleed valve and open the vacuum valve.

6) Ensure that a leak tight seal is created.

a) For a period of not less than 15 seconds from the time the vacuum gauge registers the required vacuum, examine the geomembrane through the viewing window for the presence of soap bubbles.

b) If no bubble(s) appear after 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 in. overlap and repeat the process.

7) All areas where soap bubbles appear shall be marked, repaired and retested.

D. Repair of Seam Failures

1. Any seam failing a non-destructive or destructive test shall be reconstructed between the failed location and any passed test location. Seam reconstruction shall be achieved by cutting out the existing seam and seaming in a replacement strip or adding a cap strip. In lieu of this, the seaming path shall be retraced to an intermediate location (at 10 feet minimum each side of the failed seam location). At each location a minimum 12 inch by 12 inch size sample shall be taken for two additional shear strength tests and two additional peel adhesion tests using an approved field tensiometer. If these tests meet the specified property requirements listed in Table 1 and are classified as film tear bond failures, then the remaining sample portion shall be sent to the independent laboratory for two shear strength and two peel adhesion tests. If the field and laboratory tests pass, then the seam shall be reconstructed between that location and the original failed location. If these tests fail to meet the specified property requirements listed in Table 1 and/or are not classified as film tear bond failures, then the process shall be repeated. After reconstruction, the entire reconstructed seam shall be non-destructively tested. In any case, all acceptable seams shall be bounded by two passed test locations and include one test location along the reconstructed seam. All seams will be required to pass non-destructive testing. Certified test results on all repaired seams shall be submitted by the Contractor.

PART 3 EXECUTION

3.1 INSTALLATION

A. Preparation of Subgrade

1. Prior to welding the geomembrane, all vegetation, rocks, debris, etc. and other deleterious materials shall be removed from the surfaces to be covered with the geomembrane. The surface shall be free from stones or clods greater than ¼ - inches in diameter. Any roots ½ inch or over in diameter shall be removed to at least 18 inches below the surface. Any depressions, potholes, ruts, etc., in the surfaces to be covered shall be filled with the appropriate soil material and compacted to final grade. The finished surface shall be smooth with no abrupt projections or depressions to damage the geomembrane.

2. The supporting layer shall be maintained in a smooth, uniform, and compacted condition during installation of the geomembrane. The geomembrane shall rest in intimate contact with the subgrade. The subgrade surface shall be observed daily by the Contractor and Engineer to evaluate the surface condition. Any damage to the subgrade caused by the Contractor's operations shall be repaired at no additional cost to the Owner. No geomembrane or other geosynthetic material shall be placed on a subgrade that has become softened by water or overly dried. The Contractor shall be required to repair or re-work any area of the prepared surface requested by the Engineer.

B. Placement of Geomembrane Liner

1. General

a. The Contractor shall furnish the services of a competent field technical installation supervisor to supervise seaming of the geomembrane. Excess geomembrane shall be cut away to trim the primary and secondary liners back closer to the edge of the landfill, while allowing a minimum of 3 inches of overlap. The geomembrane shall be placed over the existing prepared surfaces formed by the original liner installation where possible. Any portion of geomembrane damaged during excavation shall be repaired.

2. Work Area

a. Only that section of liner that can be exposed and seamed together the same day shall be unearthed.

b. Any equipment used shall not damage the geomembrane by handling, trafficking, or other means.

c. All personnel working on the geomembrane shall not smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane.

d. The method used to unearth the liners shall minimize damage to the liner. Careful hand digging will be performed as necessary to expose the liners.

e. Direct contact of construction equipment with the geomembrane shall not be allowed.

C. Weather Conditions

1. Field seaming shall not be performed when the air or sheet temperature is below 32°F (or manufacturer's recommendations, whichever is greater), when the sheet temperature exceeds 158°F, when the air temperature is above 120°F, during periods of precipitation, or when winds are in excess of 20 miles per hour. Where weather conditions are marginal for seaming, as determined by the Engineer, test seams, as described in this Section, shall be made to decide if production seaming can proceed.

2. If circumstances as accepted by the Contractor and the Engineer require that field seaming be conducted in cold weather conditions (below 32°F), the following procedures shall be followed:

a. The Contractor shall measure surface temperature of the geomembrane at least every 10 feet of seaming length.

b. Preheating of the seaming area under wind protection shall be required if the measured surface temperature is below 32°F.

c. Preheating devices shall be approved by the Contractor and the Engineer prior to operation.

d. Additional destructive tests may be taken by the Contractor to monitor the quality of the installation.

e. No field seaming shall be conducted if ambient temperature is above 120°F unless the Contractor can demonstrate to the satisfaction of the Contractor that the quality of seaming is not compromised. Additional destructive tests may be required by the Contractor for any suspect areas.

D. Field Seams

1. The Contractor shall obtain written approval from the Engineer prior to commencing field seaming.

2. All geomembrane field seams shall be made using extrusion welding.

3. All seaming material shall be of a type recommended and supplied by the manufacturer. The seaming material shall be delivered in the original sealed containers, each with an indelible label bearing the brand name, manufacturer's mark number, and complete directions as to proper storage.

4. All geomembrane liners shall be overlapped 3 inches minimum for extrusion welding.

5. Prior to seaming, the seam area shall be cleaned in a professional manner and free of moisture, dust, dirt, and foreign material.

6. The seam shall be properly heat tacked and abraded prior to welding.

7. The seams shall be welded with the fewest number of unmatched wrinkles or "fishmouths".

8. The seaming apparatus shall be purged for approximately 30 seconds prior to actual extrudate welding.

9. If seam overlap grinding is required, the process shall be completed according to the manufacturer's instructions and in a way that does not damage the geomembrane.

E. Field Seam Testing

1. Test Seams

a. Test seams shall be made on fragment pieces of geomembrane to verify that seaming conditions are adequate. All test seams shall be made at a location selected by the Engineer in the area to be seamed and in contact with the subgrade.

1) Seaming apparatus shall be allowed to warm up a minimum of 10 minutes before performing test seams

b. Test seams shall be made at the beginning of each seaming period, at the Contractor's discretion, whenever there is a change in seaming personnel or equipment, if significant changes in geomembrane temperature are observed, and at least once every four hours, by each seamer and seaming equipment used that day. One sample shall be obtained from each test seam. This sample shall be at least 2 feet long by 1 foot wide with the seam centered lengthwise. The test weld samples shall be labeled with:

1) Date and time
3) Seam number
4) Ambient temperature
5) Welding apparatus
6) Temperature and pressures
7) Welder's initials
8) Top sheet.

c. Five 1 inch wide specimens shall be cut from each opposite end of the sample by the Contractor using the appropriate ASTM cutting tool.

1) Specimens shall be free of sand and grit prior to cutting sample.

2) When cutting specimens from the sample, the inside and outside tracks on the sample shall be identified to assist in troubleshooting problems in case the weld fails. The outside track will be defined as the track, which would be peeled if pulling the overlap exposed in a typical installation, or the seam that is closest to the edge of the top sheet. The inside track is the seam closest to the edge of the bottom sheet.

3) Allow specimens to cool prior to testing.

4) Visually inspect the specimens for squeeze-out, footprint, pressure and general appearance.

d. These specimens shall be field tested by the Contractor for shear strength and peel adhesion using an accepted quantitative tensiometer. Three shear strength tests and two peel adhesion tests shall be performed on one end and two shear strength tests and three peel adhesion tests shall be performed on the opposite end.

1) If the field tests fail to meet the minimum specified seam requirements listed in Table 1 and/or are not classified as film tear bond failures, the entire operation shall be repeated. If the additional test seam fails, the seaming apparatus or seamer shall not be accepted or used for seaming until the deficiencies are corrected and two consecutive successful full test seams are achieved. Remaining samples shall be submitted to the Owner for subsequent laboratory testing, if required.

e. No seaming personnel may begin work until his test weld has passed the on-site shear and peel tests.

F. Defects and Repairs

1. Prior to covering the geomembrane, all seams and non-seam areas shall be visually inspected by the Contractor and Engineer for defects, holes, damage due to windlift or any other cause and any sign of contamination by foreign material. At the Engineer's discretion, the surface of the geomembrane shall be brushed, blown, or washed by the Contractor if the amount of dust or mud inhibits inspection.

2. Each suspect location in seam and non-seam areas shall be non-destructively tested as appropriate. Each location that fails the non-destructive testing shall be marked and documented by the Contractor and Engineer and repaired by the Contractor.

3. Defective seams shall be repaired in accordance with this Section. Tears, holes, blisters and areas with undispersed raw materials or foreign material contamination shall be repaired by patches. Patches shall have rounded corners, be made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects. Corners of patches shall be rounded with a radius of approximately 3 inches. If extrusion materials are used, the surface of the

geomembrane to be seamed shall be abraded no more than one hour prior to seaming. Spot welding or seaming shall be used to repair small tears or other localized flaws. All seams shall be non-destructively vacuum tested, except where the Engineer elects to perform a destructive seam test on a suspect area.

a. Surfaces of the geomembrane which are to be seamed shall be prepared according to this section:

1) All surfaces must be clean and dry at the time of seaming.

2) All seaming equipment used in seaming procedures shall be qualified.

G. Completion

1. Upon completion and acceptance of the geomembrane in an area, the geomembrane shall be covered with the required materials within 7 days as shown on the Contract Drawings and as described in the specifications.

2. Cover materials shall be placed to the limits shown on the Contract Drawings and as approved by the Engineer. The cover soils shall be consistent with materials previously removed from the surface (i.e., clay or topsoil). Excavated material shall be reused.

a. The cover soil (i.e., clay) shall be placed as described in the Section titled “Cover Soil.”

b. The topsoil layer shall be placed as described in the Section titled “Topsoil and Seeding.”

c. Graveled areas shall be installed as specified below.

1) Gravel layers shall consist of 8 inches of clean Michigan Department of Transportation 22AA placed in 4-inch layers.

3. The geomembrane shall not be covered prior to inspection and approval by the Engineer.

4. The Contractor shall commence post-construction care of the installed geomembrane in a timely manner following completion of geomembrane seaming including, but not limited to, covering or temporary weighting using sandbags to prevent damage from wind uplift, construction, and other weather related damage. Only sand shall be used to fill sandbags that will be in contact with the geomembrane.

5. On completion of installation, the Contractor shall dispose of all trash and scrap materials in a Type II landfill, remove equipment used, in connection with the work herein, and shall leave the premises in a neat acceptable manner. No scrap material shall be allowed to remain on the geomembrane surface.

* * * * *

SECTION 02980

TOPSOIL AND SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes topsoil, fertilizer, seed, mulch anchorage, and associated work.

1.2 SUBMITTALS

A. The following items shall be submitted:

1. Analysis of the seed.

2. Should hydroseeder be used, the Installer shall submit all data including material and application rates.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil shall be friable clayey loam with no less than 5% organic content and no more than 20%. Topsoil shall be free from clay lumps, stones, roots, sticks, stumps, brush or foreign objects.

B. Fertilizer shall be a standard quality commercial carrier of available plant food elements. A complete prepared and packaged material containing a minimum of 10 percent nitrogen, 10 percent phosphoric acid and 10 percent potash.

1. Each bag of fertilizer shall bear the manufacturer's guaranteed statement of analysis.

C. Seed mixtures shall be of commercial stock of the current season's crop and shall be delivered in unopened containers bearing the guaranteed analysis of the mix.

1. All seed shall meet the State standards of germination and purity.

D. Seed Mixtures:

Specia	Lawn Areas*	Unmaintained* Areas
Creeping Red Fescue	30	20
Manhattan or Pennfine Ryegrass	70	80

* % by weight

E. Mulch shall be stalks of oats, wheat, rye or other approved crops which are free from noxious weeds.

PART 3 EXECUTION

3.1 INSTALLATION

A. The area to receive topsoil shall be graded to a depth of not less than 6 inches or as specified, below the proposed finished surface. If the depth of topsoil existing prior to construction was greater than 6 inches, the topsoil shall be replaced not less than the greater depth.

1. All debris and inorganic material shall be removed and the surface loosened for a depth of 2 inches prior to the placing of the topsoil.

2. The topsoil shall not be placed until the subgrade is in suitable condition and shall be free of excessive moisture and frost.

B. Satisfactory topsoil removed from the excavations shall be placed on the prepared subgrade to the depth required.

1. In the event the topsoil removed during excavation is unsatisfactory or inadequate to obtain the required finish grades, the Installer shall coordinate with the Engineer for requirements of using off site material.

2. All topsoil shall be free from stones, roots, sticks and other foreign substances and shall not be placed in a frozen or muddy condition.

3. The finished surface shall conform to the lines and grades of the area before disturbed or as shown on the Contract Drawings. Any irregularities shall be corrected before the placement of fertilizer and seed.

C. The fertilizer shall be applied uniformly at the rate of 20 pounds per 1000 square feet.

1. Following the application of the fertilizer and prior to application of the seed, the topsoil shall be scarified to a depth of at least 2 inches with a disc or other suitable method traveling across the slope if possible.

D. When the topsoil surface has been fine graded, the seed mixture shall be uniformly applied upon the prepared surface with a mechanical spreader at a rate of not less than 10 pounds per 1000 square feet.

1. The seed shall be raked lightly into the surface and rolled with a light hand lawn roller.

2. Seeding and mulching shall not be done during windy weather.

E. The mulch shall be hand or machine spread to form a continuous blanket over the seed bed, approximately 2 inches uniform thickness at loose measurement. Excessive amounts or bunching of mulch will not be permitted.

1. Mulch shall be anchored by an acceptable method.

2. Unless otherwise specified, mulch shall be left in place and allowed to disintegrate.

3. Any anchorage or mulch that has not disintegrated at time of first mowing, shall be removed. Anchors may be removed or driven flush with ground surface.

F. Seeded areas shall be watered as often as required to obtain germination and to obtain and maintain a satisfactory sod growth. Watering shall be in such a manner as to prevent washing out of seed.

G. Hydroseeding may be accepted as an alternative method of applying fertilizer, seed and mulch. The Installer shall submit all data regarding materials and application rates to the Engineer for review.

3.2 MAINTENANCE

A. Following the establishment of a good stand of grass and the first mowing, the Contractor's obligation shall end except for the repair of settlement or damage.

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