LEACHATE MANAGEMENT PLAN
With Enhanced Minimization Elements

LOCKWOOD ASH DISPOSAL SITE

Prepared on behalf of:

Lockwood Hills LLC
590 Plant Road
Dresden, New York 14441

Prepared by:

DAIGLER ENGINEERING, P.C.
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2620 Grand Island Blvd.
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October 2019

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1 INTRODUCTION

The Lockwood Ash Disposal Site (Landfill or Lockwood) is located off State Route 14, in the Town of Torrey, Yates County, New York. Coal combustion byproducts (CCBPs) produced from coal-fired power plant operations including fly ash, bottom ash, water/wastewater sludge and mill rejects were disposed at the Landfill. The Landfill is identified on the map in Figure 1-1.

The Landfill is owned and operated by Lockwood Hills LLC (Lockwood Hills). The operation of the Landfill is carried out in accordance with the requirements of 6 NYCRR Part 360 Solid Waste Management Facility Permit No. 8-5736-00005/00003. Stormwater and leachate discharge from the Landfill are managed in accordance with the requirements of New York State Department of Environmental Conservation's (NYSDEC's or the Department's) State Pollutant Discharge Elimination System (SPDES) Permit No. NY-0107069. Since 2015, activity at the Landfill has been non-CCBP acceptable wastes such as occasional dewatered wastewater sludges from the Greenidge Station's wastewater treatment plant. In the future, the Landfill is expected to accept wastewater sludges and biomass ash during periods that the primarily natural gas-fired Greenidge Station co-fires with biomass.

1.1 PURPOSE OF THE REPORT

This Leachate Management Plan, which includes minimization measures, is being submitted in accordance with the Department's March 12, 2019 letter, and also addresses the Department's comments included in its February 28, 2019 letter requesting a Leachate Management Plan, including measures that will be undertaken to reduce leachate generation rates and a timeline for implementation. The key objective for this document is to present a phased implementation plan that reduces leachate generation from the Landfill.

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SITE LOCATION

LEACHATE MANAGEMENT WORKPLAN

LOCKWOOD HILLS LLC			FIGURE 1-1
TOWN OF TORREY	YATES COUNTY	NEW YORK	
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2 CURRENT SITE CONDITIONS

The permitted footprint of the Landfill is 44.2 acres and includes five individual baseliner cells (the Original Ash Disposal Site (OADS), and Stages I, II, III (future), and IV (future)), plus overfill liner. To date, 29.8 acres of the Landfill have been constructed. The stormwater management system that covers the entire Landfill is isolated from the waste materials and designed to reduce infiltration, control erosion, and convey stormwater runoff that has not come in contact with any waste materials to Lockwood's two onsite stormwater basins.

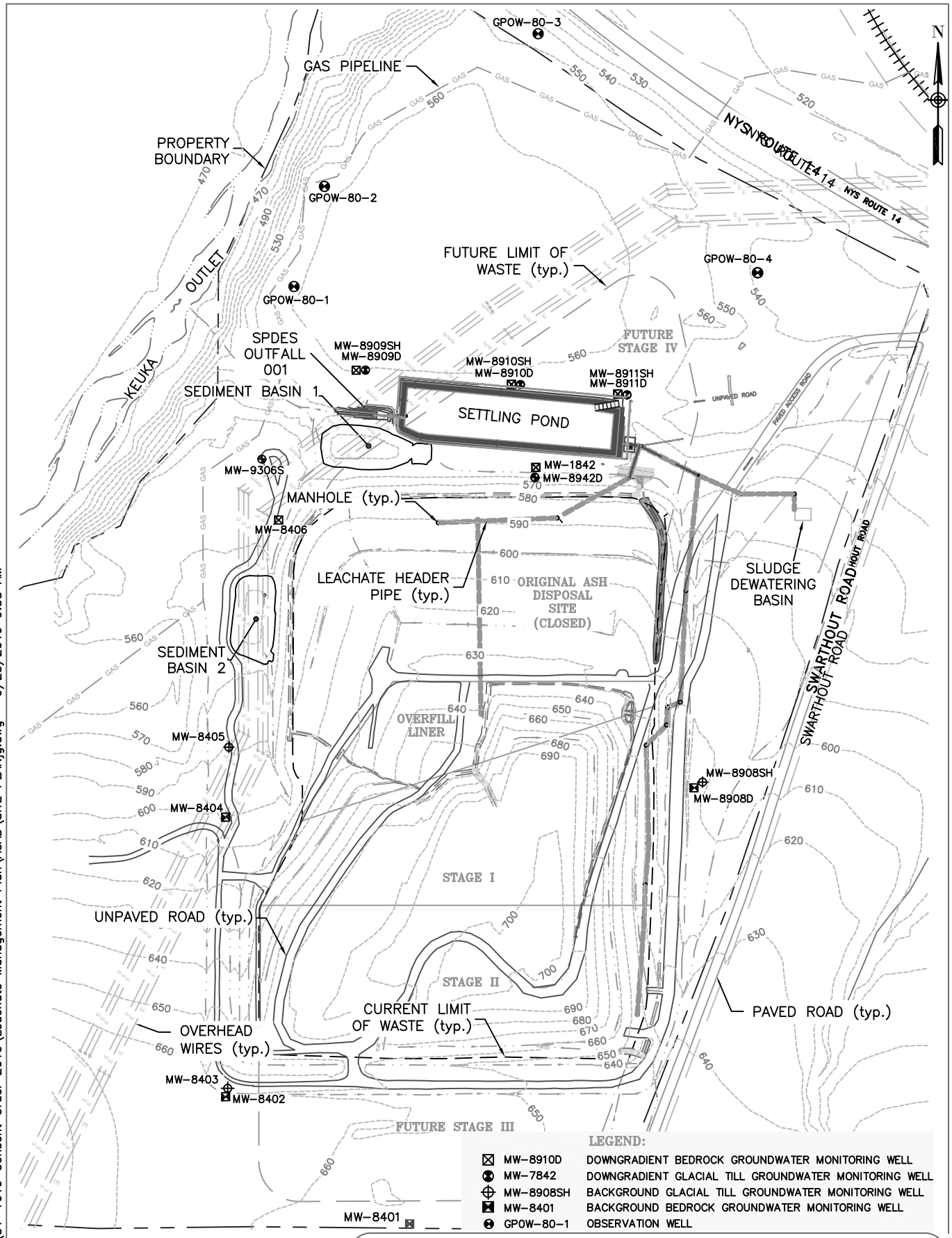
The leachate management system contains, collects, conveys, and treats liquid that drains from the active portions of the Landfill or which has come in contact with waste. The basal liner systems collect the leachate which is then conveyed through the leachate sewer system to the recently constructed step aerator and settling pond for treatment and subsequent discharge though a SPDES permitted outfall to Keuka Outlet. Leachate is metered prior to the step aerator and enters the settling pond from the east. Discharges via the discharge structure on the west side of the settling pond are controlled with a gate valve.

Figure 2-1 illustrates the Landfill stages and infrastructure of the site.

2.1 ORIGINAL ASH DISPOSAL SITE

The 14.08-acre OADS was constructed in two phases, the first in 1979 and the second in 1981. The OADS containment liner system is constructed above a series of groundwater drain trenches and consists of a two-foot thick compacted soil barrier and overlying two-foot thick layer of bottom ash which acts as the leachate drainage layer. An eight-inch diameter perforated polyvinyl chloride (PVC) leachate collection pipe network is installed in the drainage layer. A 12-inch diameter PVC header conveys leachate to the treatment system.

Approximately, 10.56 acres of the OADS is closed and has a soil based final cover system. The remaining portion of the OADS is overlain by the Stage I overfill liner.



SITE LAYOUT

LEACHATE MANAGEMENT PLAN

LOCKWOOD HILLS LLC			
TOWN OF TORREY	YATES COUNTY	NEW YORK	FIGURE 2-1
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2.2 STAGE I

Stage I was constructed in 1989 and 1990 and includes a basal area double liner with underlying groundwater drainage trenches above natural soil deposits, and a single geomembrane overfill liner atop the wastes in the southern portion of the OADS. The total area of Stage I is 10.70 acres. The 7.18-acre basal liner in Stage I consists of the following components in ascending order:

- A two-foot thick compacted soil liner;
- A secondary leachate collection and removal system composed of a four-inch thick sand layer, with embedded band drains (six-inch strips of geocomposite drainage material) and a six-inch diameter PVC header;
- A geotextile cushion layer;
- A 50-mil (PVC) geomembrane liner;
- A geotextile cushion layer; and
- A two-foot thick drainage layer of bottom ash with an embedded six-inch perforated PVC leachate collection pipe network and a six-inch diameter PVC header.

The 3.52-acre Stage I Overfill Liner installed atop the southern portion of the OADS consists of the following components, in ascending order:

- A geotextile cushion layer;
- A 50-mil PVC geomembrane liner;
- A geotextile cushion layer; and
- A one-foot thick drainage layer of bottom ash including a six-inch diameter perforated PVC leachate collection pipe network and a six-inch PVC header.

Stage I has up to 80 feet of ash above its liner and is covered by the interim cover system described in the 2011 Layup Plan prepared for AES as:

- Six to nine inches of clayey/silty soils, sandy soils or gravelly soils, or other NYSDEC approved materials;
- Three to four inches of soil suitable to sustain vegetative growth; and

- Vegetation as needed to control fugitive dust and erosion.

Except for a small wedge of land east of the eastern access road up to Stage II, the remainder of the Overfill Liner area is not considered ready for final cover installation as there is as much as 100 feet of additional permitted airspace over the central portion of the Overfill. Approximately 2.9 acres between the east and west slopes are at or near final grade within the Stage I basal area. Another 4.7 acres are between 40 and 80 feet below permitted final grades.

2.3 STAGE II

Stage II was completed in 1992 as a double-lined cell with a groundwater drainage trench system and basal liner consistent with the liner system in Stage I constructed on natural soil deposits. Stage II is 8.58 acres in size and has been filled to a depth ranging from ten feet at the southern edge to 78 feet at the northeast plateau. Stage II is covered by the interim cover system described earlier. Approximately 2.2 acres on the east and west slopes of Stage II are at or near final grade. Approximately 6.1 acres are below final grades by as much as 40 feet at the center and 80 feet at the southcentral edge of that stage.

Table 2-1 summarizes where Lockwood's current constructed acreage stands related to final covering or ability to be final covered at this time.

TABLE 2-1: ACREAGE SUMMARY

Final Grade Description	Acreage
Part 360 Covered	10.6
At or Near Final Grade	5.1
Below Permitted Final Grade	14.1
TOTAL ACREAGE	**29.8**

2.4 EXISTING LEACHATE GENERATION RATES

The Engineering Report for the Leachate Management and Pond Sediment Removal Plan, last revised in December 2018, provided data showing the average and 80th percentile peak leachate generation rates were 470 gallons per acre per day (gpad) and 620 gpad, respectively.

3 OPERATIONS AND MAINTENANCE

3.1 WASTE PLACEMENT

Due to the uniform nature of the waste, the potential for perched leachate conditions are limited to the interface between waste material and cover soils. Prior to waste placement activity in any area where daily or intermediate cover soil has been placed, this cover material will be stripped from the waste surface to be buried and stockpiled adjacent to the working face for reuse as appropriate. The removal of daily or intermediate cover soils before placement will help maintain the uniform permeability of the waste fill, which in turn, will contribute to minimize surface leachate seeps and perched leachate conditions.

3.2 LEACHATE COLLECTION AND REMOVAL SYSTEM

3.2.1 System Maintenance

The leachate collection and removal system at Lockwood operates entirely by gravity. The primary leachate collection system piping in Stages I and II, including the Stage I overfill liner, is equipped with cleanout risers on the upstream end of each lateral consisting of six-inch diameter PVC pipe that are vertically installed, extending through to the ground surface. These cleanouts allow for periodic flushing and/or jetting (annually as a minimum) of the leachate collection pipe to help assure leachate collection pipes are free and clear of any obstructions that may hinder the free-draining conditions and increase the potential for leachate head build up above the liner system. Sediment removal using a vacuum truck will be utilized as necessary.

In addition to the laterals, the primary leachate collection and removal system also includes headers, a series of manholes and downstream sewer lines to carry the leachate from the landfill to the treatment system. Annual cleaning must include the entire system to maintain efficiency. The six-inch diameter laterals connect to a six-inch header in Stage I and the Stage I overfill liner. These headers are accessible through vertically installed six-inch diameter cleanout risers as well that are attached to the header at regular intervals using saddle wyes. The six-inch laterals in Stage II connect to a greatly oversized 21-inch diameter header. While six-inch diameter cleanout risers are attached to the 21-inch diameter header as well, a more effective cleaning can be performed

using the manholes for access to this header. The downstream sewer system and 12-inch leachate headers in the OADS can also be access for cleaning through manholes.

The annual leachate system maintenance activity is documented on Daily Line Cleaning Record forms, included in Appendix 1. A maintenance log recording start and end dates of annual leachate line cleaning is also included in Appendix 1. Video inspection of the leachate collection system at Lockwood is not required since that system was constructed well before the advent of the Part 363-7.1(g)(2) requirement. These forms, which will be kept onsite, will also be included in the annual report.

3.2.2 Leachate Monitoring

The leachate sewer system routes leachate from all areas of the Landfill (i.e., OADS and synthetic-lined Stages I and II) to a meter pit prior to discharging to the leachate treatment system. A large, 60-degree, V-trapezoidal flume is positioned within the meter pit in-line with an eight-inch diameter, PVC, leachate sewer pipe. An ultrasonic level sensor functions by transmitting pulses of high frequency sound to the surface of leachate flow within the flume's approach, and measures the time for an echo to reflect to the face of the sensor. The depth of leachate flow is effectively calculated by the system and applied to a pre-programmed discharge equation to compute a flowrate. The flowrate is displayed on a monitor and recorded by logging software. The instrument log file is downloaded and processed monthly by Lockwood Hills personnel.

The volume of leachate generated at the site is calculated using instantaneous and totalized flow recorded by the flow meter. The month end totals will be logged on a monthly total leachate generation amount form that will be maintained onsite. The log form is included in Appendix 1. The Stage I and Stage II liner systems include a secondary leachate collection and removal system to monitor the performance of the primary geomembrane liner in these areas. Per paragraph 363-7.1(g)(3), the flow rate from the leak detection system is measured manually and recorded on a daily basis when the facility is operating or weekly at a minimum during periods when the facility is inactive. The leak detection system flow rate measurements will be documented on Daily Operating Secondary Leachate Flow Measurements forms included in Appendix 1, which will be kept onsite. Primary and secondary leachate volumes are reported in the Annual Report as well.

When operating, daily flow rate measurements in the Leak Detection System will be used to compute a 30-day rolling average leakage rate in terms of gallons per acre per day. At a minimum, regardless of operating status, weekly measurements will be recorded. The rolling average will be updated with each new measurement and compared to the allowable leakage rate of 20 gallons per acre per day per paragraph 363-7.1(f)(7). Should this allowable leakage rate be exceeded, the emergency procedures detailed in the Emergency Response Plan (Section 8 of the Facility Manual) must be followed beginning with notification of the Department within 72 hours of the exceedance.

Primary leachate is sampled at five separate locations, and leachate from the secondary system is sampled at the leak detection manhole as described in detail in the Environmental Monitoring Plan (EMP – Section 4 of the Facility Manual). Samples of leachate from the primary and secondary leachate collection systems are analyzed for the parameters identified for groundwater monitoring as described in the EMP. All leachate quality data is presented and discussed in a report provided to the NYSDEC each calendar quarter.

3.3 LEACHATE TREATMENT SYSTEM

The leachate treatment system treats primary and secondary leachate which subsequently is discharged pursuant to SPDES Permit No. NY-0107069 Outfall 001 as a controlled release, batch discharge to the Keuka Outlet. The SPDES Permit restricts the settling pond discharge rate as a function of stream flow rate in the Outlet, as measured and recorded through a data logger at the USGS Gauging Station in the Village of Dresden. The permit requires that the settling pond discharge be limited to no more than 140,000 gallons per day when the stream flow rate in the Outlet is less than 27 cubic feet per second (cfs). When the stream flow rate in the Outlet is greater than 27 cfs, the permit allows that the settling pond discharge rate to be increased to no more than 250,000 gallons per day.

Prior to any discharge, the treated water is sampled and analyzed to confirm the SPDES Permit discharge water quality requirements will be met. In the event the pre-discharge water quality sample analyses indicate that the water is not acceptable quality for discharge, the following activities are initiated:

- Additional samples of the collected water are obtained for laboratory determination of the treatment required; typically, this consists of an adjustment of pH;
- The pH is adjusted, or other treatment technologies are implemented as required;
- Water samples are obtained during the treatment process;
- The treated pond water is retained for a minimum of one day and is re-sampled to assure acceptable water quality prior to discharge; and
- Composite samples are obtained from the discharge to ensure an adequate record of the quality of the water discharged is collected.

Discharge volumes will be calculated for each batch release based on the depth/volume relationship for the pond geometry, and these volumes are to estimate the rate of discharge as reported in the SPDES discharge monitoring report.

4 STANDARD LEACHATE MINIMIZATION MEASURES

One objective of site operations is to minimize leachate production. To achieve this goal, Lockwood, to the extent practicable, operates the Landfill in a way minimizes leachate generation by preventing the ponding of water on the fill area and the erosion of soil covers. In this manner, the site operation promotes a reduction in the infiltration of water into the solid waste, thereby reducing leachate generation.

Runoff control features minimize erosion and convey surface water to Sediment Basin 1 or Sediment Basin 2 in an efficient manner. These structures may include straw bales, silt fences, erosion control mats, and channel linings. In the period following new liner construction, the amount of leachate generated by an open liner condition is minimized using geomembrane flaps. Geomembrane flaps are placed to temporarily divert surface water around the open liner to the stormwater system. At no time will the amount of open liner tributary to the leachate system exceed one-acre in area. Runon control structures are used to help prevent surface water from entering the active landfill area, and direct surface water away from active landfilling. The perimeter berm serves to restrict runon to the active area. Other features include the perimeter channels outside the landfill perimeter berm, and may also include berms, channels and swales to direct surface water away from active areas.

In addition, good operational practices are utilized to minimize leachate generation. These good operational practices include maintaining a minimal working face area to reduce leachate generation and erosion, and re-establishing soil cover material and vegetation in areas where cover soil may have eroded.

Groundwater underneath the facility is maintained at a level below the liner system through the effects of the liner itself (limits infiltration of precipitation into the groundwater system) and the use of groundwater depression drains installed below the liner system. When flowing, the groundwater depression systems from the existing Stages I and II, and future Stages III and IV, which are or will be installed below the liner system and do not come in contact with waste, discharge into the surface water perimeter channels around the site.

5 DESCRIPTION OF ADDITIONAL LEACHATE GENERATION REDUCTION MEASURES

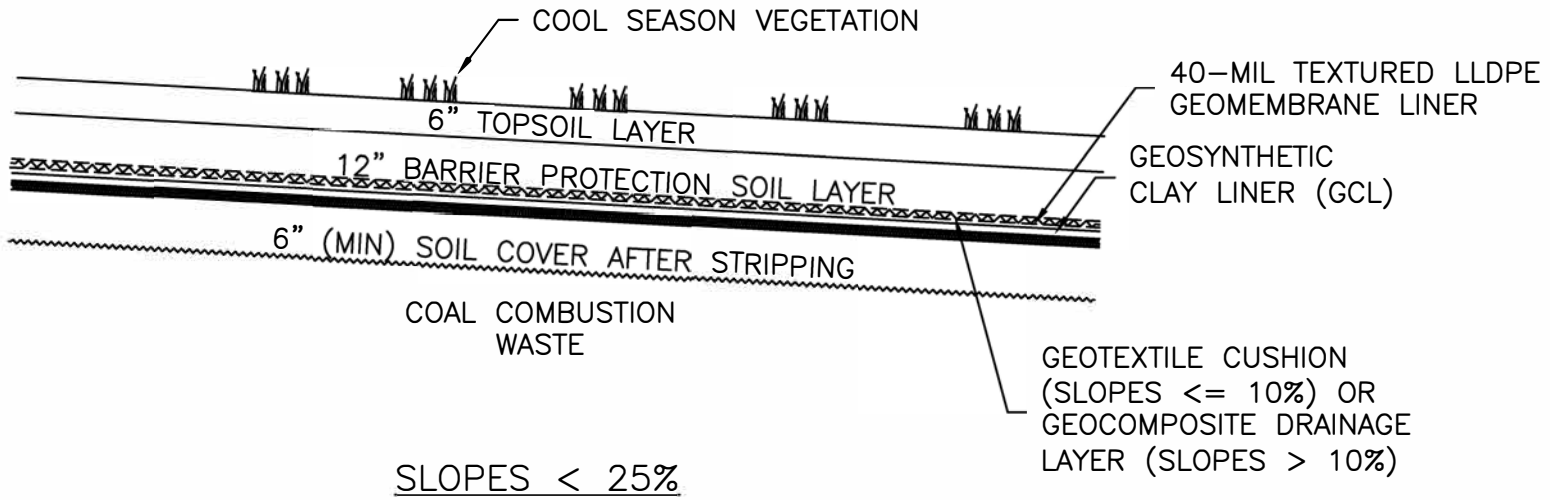
Sequential closure per the Landfill's Closure Plan (Section 10 of the Facility Manual) will minimize leachate to the maximum extent possible. Installation of the cover system on each Landfill cell as it achieves final grades, along with the use of exposed geomembrane as deemed necessary and practicable, will cut off precipitation from infiltrating into the waste mass thereby significantly reducing the volume of leachate generated. This section evaluates final and temporary cover options.

5.1 TRADITIONAL PART 363 FINAL COVER

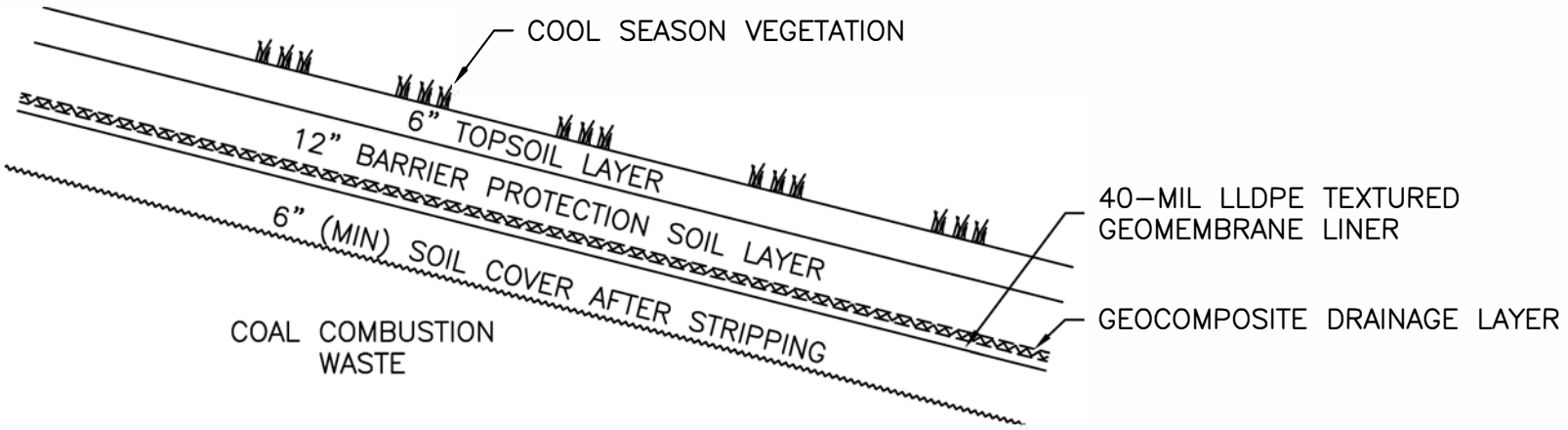
Sections 363-6.16 thru 363-6.18 specify the final cover system components currently required in New York State, unless a variance is obtained. There are two types of final cover systems depending on the slope of the ground surface to be covered. For areas of the Landfill at final grade and with a ground slope less than 25 percent, the final cover consists of the following layers in ascending order:

- Subbase soil layer;
- Geosynthetic clay liner (GCL);
- 40-mil textured LLDPE geomembrane liner;
- Geocomposite drainage (GCD) layer (for slopes greater than 10 percent);
- Geotextile cushion layer for slopes less than or equal to 10 percent;
- 12 inches of barrier protection soil for cool season vegetation; and
- 6 inches of soil suitable to sustain vegetation.

For areas of the Landfill where the slopes are greater than or equal to 25 percent, the GCL is eliminated from the design. Final cover system details for the two types of cover are illustrated in Figure 5-1.



SLOPES < 25%



SLOPES >= 25%

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LOCKWOOD HILLS LLC		TRADITIONAL PART 363 FINAL COVER DETAILS		FIGURE 5-1
SCALE: NOT TO SCALE	REVISION # 0	LEACHATE MANAGEMENT PLAN		
September 2019		TOWN OF TORREY	YATES COUNTY	NEW YORK

Q:\Lockwood Hills LLC\31-1317 Part 360 Permit Renewal App\acad\Figure 5-1 Final Cover Details\G.dwg 9/20/2019 3:40 PM

5.2 EXPOSED GEOMEMBRANE COVER SYSTEM

An exposed geomembrane cover (EGC) system is composed of either a High Density Polyenthylene (HDPE) or a linear low-density polyethylene (LLDPE) material. The geomembrane materials are made with extraction-resistant, antioxidant additives to inhibit degradation from high temperatures and ultraviolet (UV) light. These exposed cover materials come in various colors such as white, black, tan and green. The green color is the preferred selection by Lockwood. A reinforced geomembrane liner can extend the design life of the exposed cover through internal reinforcement rather than by increasing the thickness of the liner material. An example liner material that meets this description is the 36-mil Dura-Skrim LLDPE geomembrane. Information on a material property comparison between unreinforced LLDPE geomembranes (40 and 60-mil) and Dura-Skrim LLDPE geomembranes (30, 36 and 45-mil), as well as installation photographs are provided in Appendix 2. Anchorage of the cover system to the Landfill surface, an important part of an EGC system due to wind uplift (See Section 7.4) can be achieved through anchor trenching or use of mechanical anchors.

For comparison, a typical EGC system would consist of the following components in ascending order:

- Six-inch thick minimum prepared subgrade soil layer after stripping existing topsoil;
- 36-mil Dura-Skrim or similar reinforced geomembrane; and
- An anchoring system.

5.3 BENEFITS OF AN EXPOSED GEOMEMBRANE COVER

Reducing rainfall infiltration into the waste to the greatest extent practicable, while continuing to operate the Landfill reduces leachate generation. The main disadvantage to placing Part 363 traditional final cover at Lockwood at this time is there is not enough area ready for final cover and the areas that are ready are isolated from each other on the east and west slopes.

An EGC provides a significant reduction in rainfall infiltration, on par with the traditional final cover system prescribed by Part 363 for less than half the cost. Compared to traditional Part 363 final cover, this option ultimately allows for a greater area to be covered and a greater reduction in leachate rates to be realized without permanently losing unused airspace in the Landfill. Other

advantages of an EGC are ease and speed of installation. The EGC just needs to be installed and anchored, to result in a significant reduction in leachate generation. A side benefit, according to Geosyntec Consultants, is an exposed cover project like this one can reduce greenhouse gas emissions by up to 80 percent compared to a Subtitle D cover construction[1] since much less fuel is consumed by avoiding the importation of cover soil components.

A reduction in cover soil erosion, operations and maintenance cost and effort are also expected. Finally, veneer stability of the geomembrane on soil will not be an issue[2] (although any material selected for use at Lockwood will be tested against the onsite interim cover soils that will make up the subbase of this cap).

One potential disadvantage, should an EGC be utilized as a final cover, is its longevity. The Geosynthetics Research Institutes White Paper #6 reports a half-life of either an exposed HDPE or LLDPE membrane of 36 years[3] at conditions simulated for El Paso, Texas with a liner temperature of 70 °C. As Dr. Koerner notes, even at half-life, the material still functions, albeit at a decreased performance level. For the immediate need to minimize leachate generation, the reduced longevity is not a concern.

Design considerations when preparing construction level plans and specifications for an EGC system would include designing for wind uplift, accounting for increased volume and velocity of stormwater runoff and damage potential from birds, hail and burrowing animals.

In the case of Lockwood Hills, placing an EGC as described above not only achieves the desired reduction in leachate generation, it creates less greenhouse gases, and allows the Landfill to retain its permitted waste disposal capacity for future needs and/or to be readily accessed for potential materials reuse. Coal fly ash is a traditional ingredient in concrete. As more power plants close or revert to other forms of energy generation, the supply of this ash will diminish to a point where demand will exceed supply. The American Coal Ash Association projects the overall utilization rate of fly ash in ready-mixed concrete will increase from 44 percent in 2013 to 63 percent by

[1] Geosyntec Consultants, SC SWANA Conference, May 10, 2013.
[2] Ibid.
[3] Geomembrane Lifetime Prediction: Unexposed and Exposed Conditions, Robert M. Koerner, et. al., February 8, 2011.

2033[4]. Harvesting techniques to separate out and condition fly ash from bottom ash are improving[5]. Fly ash marketers are beginning to target fly ash stored in active and inactive areas for reclamation[6]. If reclamation occurs, removing a more traditional cover system with soil components will make reclamation more difficult and expensive.

In a newer development, the Department of Energy identified coal ash as a source of rare earth elements and began funding of research projects to find economic and environmentally sound ways to recover these elements. Recent technological advances in extracting rare earth metals from coal ash have been reported[7]. Given the United States relies solely on foreign importation of rare earth metals, existing stores of coal ash may become the new feedstock for this very important commodity.

[4] Key Findings 2015 Coal Combustion Products Utilization, American Coal Ash Association.
[5] EPRI and Georgia Power Team Up on Harvested Ash Research, Ben Gallagher, P.E, and Ken Ladwig, Ash at Work, Issue 1, 2019.
[6] Closure-by-Removal Strategies Facilitating Beneficial Use, Joe Laubenstein, Ash at Work, Issue 1, 2019.
[7] Mining Coal Ash for Rare Earth Elements, John Simpson, Ash at Work, Issue 1, 2019.

6 EXPOSED GEOMEMBRANE COVER LEACHATE REDUCTION IMPACT

6.1 EXPOSED GEOMEMBRANE COVER AREAS

Figure 6-1 is included to illustrate the areas where an EGC is proposed to be progressively installed on the Landfill. Approximately 12.3 acres have been identified by Lockwood for covering with an EGC. Coupled with the closed OADS, Lockwood would have more than 76 percent of the current Landfill covered with more than interim cover. Less than 6.9 acres of the Landfill is proposed to remain with interim cover to provide readily accessible, permitted disposal space for day-to-day needs.

An estimate of the potential leakage through an EGC system was conservatively hand calculated and is included in Appendix 3. Conservative assumptions applied to that calculation included the number of holes per acre (four) and the contact quality between the geomembrane and the underlying soils as "fair". The potential surface water head of six inches was used in the calculation to simulate conditions at an area with all four holes impounded by an inopportune wrinkle. In an EGC system, there is no opportunity for head build up since there are no materials above the membrane to saturate. Subsidence of the ash is not expected to be an issue. The result, with further upward rounding, was 30 gpad.

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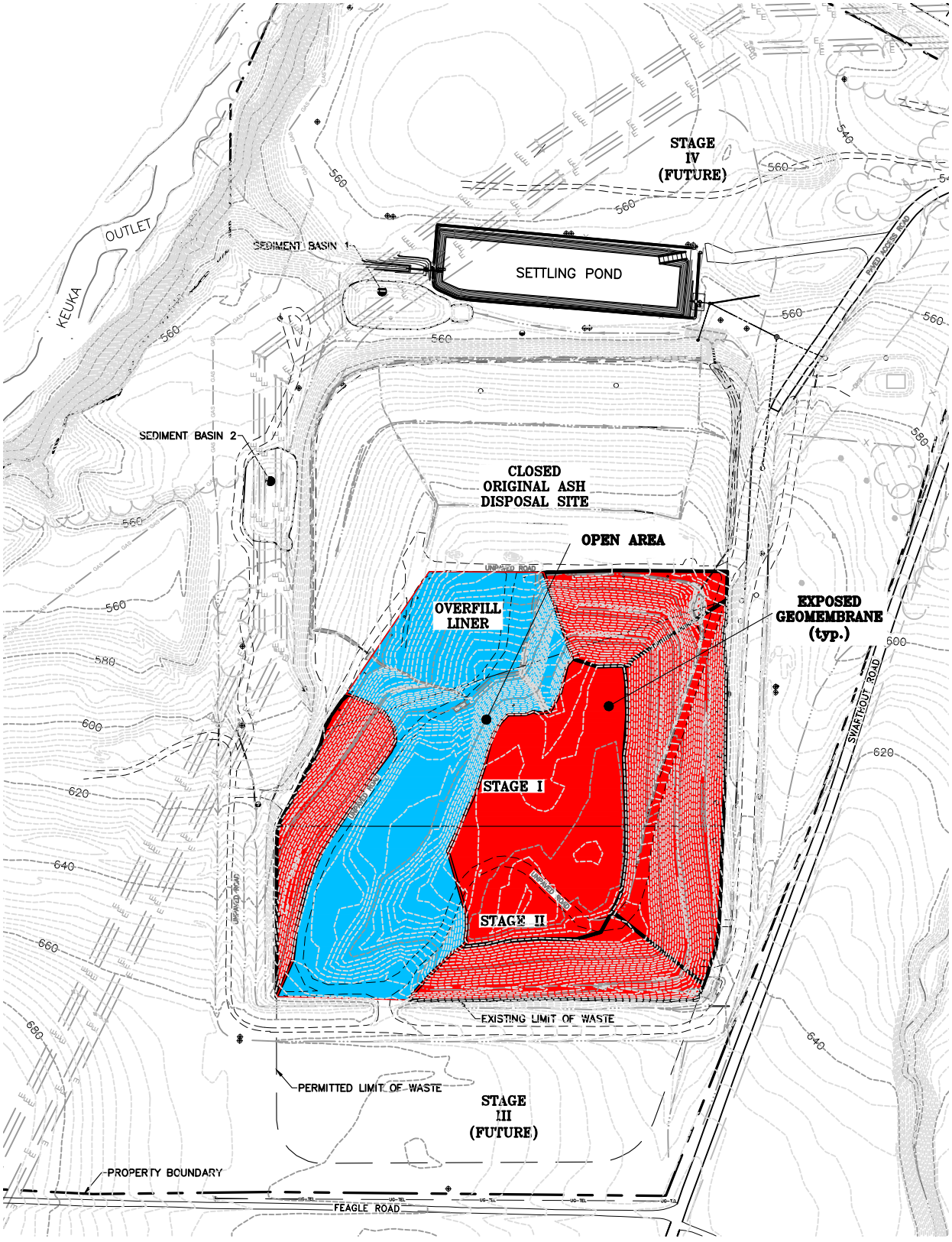

EXPOSED GEOMEMBRANE PLACEMENT

LEACHATE MANAGEMENT PLAN

LOCKWOOD HILLS LLC			FIGURE 6-1
TOWN OF TORREY	YATES COUNTY	NEW YORK	
September 2019	SCALE: NOT TO SCALE	REVISION # 0	

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Q:\Lockwood Hills LLC\31-1619 Consent Order 2019\Leachate Management Plan\ACAD\FIGURE 6-1JG.dwg

Table 6-1 below summarizes the leachate reduction impact of EGC. Compared to the previously established overall leachate generation rate of 470 gpad, the new sitewide rate, conservatively estimated, results in nearly a 60 percent reduction. It should be noted the sitewide average leachate generation rate of 470 gpad applied to the remaining interim covered area in Table 6-1 is an overestimation because the area is more slope than plateau, adding to the conservativeness of this evaluation. Upon completion of the EGC on the proposed areas, actual results for leachate minimization are expected to be superior to this estimate.

TABLE 6-1: EFFECT OF EXPOSED GEOMEMBRANE COVER ON LEACHATE GENERATION

Description	**Average (gpad)**	**Acreage**	**Gallons per day**
Exposed Geomembrane Stage I & II Plateau and sideslopes	30	12.3	369
Interim Covered Stage I & II Plateau and Overfill Slope Area	470	6.9	3,243
	TOTALS	**19.2**	3,612
		AVERAGE GPAD	**188**

7 DESIGN AND MAINTENANCE CONSIDERATIONS FOR EGC

7.1 EXPOSED COVER DESIGN GENERAL DESCRIPTION

Design elements that will be addressed include a global stability analysis and a revised stormwater management program. The revised stormwater management program will address the 100-year, 24-hour storm design requirements as well as the impacts from a 500-year, 24-hour storm to provide an informed contingency response in the event of such a storm. Designing for wind uplift via an anchoring system will also be required.

7.2 EXPOSED GEOMEMBRANE COVER VENEER STABILITY ANALYSIS

Since the EGC does not have any components above it, veneer stability is not an issue. Access road placement above the exposed geomembrane is very limited and local in scope, and slopes of the access road will average ten percent or less. A stone-geotextile-textured geomembrane system can routinely be constructed and remain on these kinds of slopes.

7.3 STORMWATER DRAINAGE DESIGN

Essentially, any precipitation on an EGC will become runoff. The runoff volume and intensity will be greater than a traditional vegetated cover, however the sediment load will be much less, and there will be no contact with waste. From a design standpoint, the perimeter drainage channel sizing will need to be reviewed and enlarged or enhanced with additional armoring, if needed, to handle the increased runoff. The sediment basin capacities will be checked to ensure they can handle the increased volume without overtopping. A benefit of an EGC will be the decreased amount of sediment needing treatment in the basins since the cover is soil-free, which would free up volume for stormwater retention and extend the time between required sediment removal maintenance activities.

7.4 WIND UPLIFT

Geomembrane uplift can occur in windy conditions due to suction as air first encounters an obstruction and then travels over that obstruction and beyond, creating a suction force. The impacts of wind uplift on an EGC include pulling out of anchor trenches or tearing out from mechanical anchors and wrinkling of the membrane if it does not settle back to its original position.

Anchoring of the membrane can be accomplished by the previously mentioned anchor trenches and mechanical anchoring systems such as Wind Defender Geotextile, Platipus Earth Anchors, or simply with placement of weight. In addition, access road placement adds another tool in holding an exposed geomembrane in place. It is likely, due to staging of the construction of the EGC system, that a combination of mechanical anchoring, anchor trenches, stormwater drainage features and placement of an access road will all be used to anchor the cover.

Design considerations will include determining uplift pressures based on historical wind speed and direction information available for the Penn Yan, New York Airport weather station. From that information, anchor spacing and maximum allowable geomembrane strain calculations will be performed to determine minimum required tensile strength for the geomembrane to be selected. Wind speed and direction data is available from the Midwestern Regional Climate Center for the Penn Yan Airport.

7.5 Access

Fortunately, access needs onto the covered portion of the landfill are minimal at Lockwood. Where the current access road exists along the eastern side of the site, a gravel road will be constructed on top of the EGC. A cushion geotextile will provide separation and protection of the underlying geomembrane from the stone access road above it. In addition, this access road, and any other that may be proposed for staged construction would most likely also be incorporated into the stormwater drainage system design.

7.6 Damage Potential

An EGC is susceptible to damage from birds and other animals as well as from hail. Damage can also occur from vehicular traffic off the access road. The advantage with an EGC is any kind of damage is easily visible and can be readily repaired on a temporary basis by landfill personnel while arranging for more permanent repairs as weather conditions permit. Temporary patching of a limited number of small holes can be accomplished simply by cutting a piece of spare membrane material and duct taping it down. More extensive repairs would require a cap strip or cutting out the damaged material and replacing it with new membrane.

7.7 REGRADING EFFORT

Preparing an area for EGC may require regrading to achieve maximum or minimum slopes or to achieve positive drainage off the Landfill. Areas deemed ready for covering must be sloped no steeper than 33 percent and no flatter than four percent. Areas less than four percent slope, or those areas where drainage needs to be rerouted to promote drainage off the cap, also need to be regraded as part of this leachate minimization approach.

Three Interim Grading Plans are included in Appendix 4. Interim Grading Plan 1 (Sheet 1) details how the facility will be graded to facilitate a significant amount of coverage with an EGC as shown in Figure 6-1 within the relatively short timeframes discussed in Section 9.1. Grading is focused on bringing the plateau portion of Stage I and II to a four percent minimum grade. Based on Sheet 1, an additional five feet of fill, on average, is needed to fill the plateau area to an interim grade with minimum four percent slopes. The maximum fill height of Sheet 1 is 706.2 feet (Site vertical datum).

Interim Grading Plan 2 (Sheet 2) provides grades to fill the open area on the western portion of the Landfill (see Figure 6-1) to grades that match what was previously covered on the plateau and along the northern and southern slopes. Grading in this way will allow all EGC installed under Interim Grading Plan 1 to remain in place and the maximum fill height would remain at 706.2 feet as well.

Interim Grading Plan 3 (Sheet 3) shows grading in the current footprint that maximizes the use of the permitted airspace without construction of new overfill or baseliner. This filling plan also indicates additional capacity over the plateau area. Portions of the EGC installed on the plateau area would be removed as filling progresses over that area. The total acreage of EGC removal required to realize the grades in Sheet 3 is approximately 4.2 acres. The maximum fill height of Sheet 3 is 752.2 feet (Site vertical datum), which is below the current permitted Final Grading Plan (Final Grading Plan, March 2007) height of 756.2.

7.8 FILL PROGRESSION

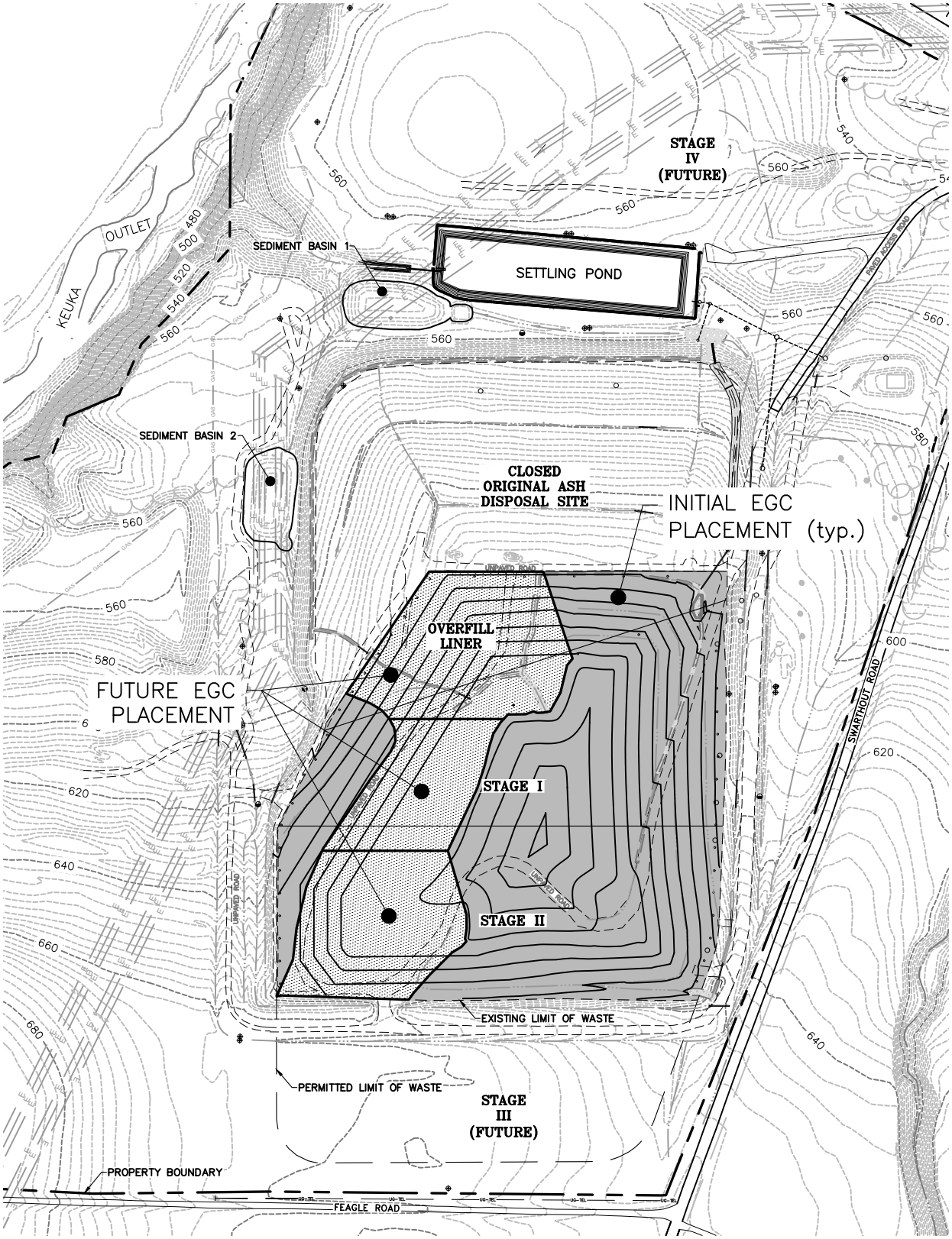
Within Sheet 1, the amount of fill needed to regrade the plateau area is 18,000 cubic yards (cy). The amount of regrading of the east slope needed to reduce it to no more than 3:1 is 19,000 cy.

The excess 1,000 cy from the east slope regrading effort will be placed in the Open Area (See Figure 6-1). While regrading efforts are underway, filling of the Open Area will commence with activities starting at the northern end and working south.

Filling in the Open Area will be guided by Sheet 2. Filling in the Open Area will start in the northern portion and progress south. The Open Area will be graded to match up with the existing western edge of the plateau area. The disposal capacity illustrated on Sheet 2 is approximately 115,000 cy.

EGC will be placed on the Open Area in three phases as they reach the grades shown on Sheet 2. The first phase of future covering will occur on the northwestern third of the Open Area. Referring to Figure 7-1, EGC will be installed and tied into the previously covered areas on the north slope and the plateau area. Each construction phase will encompass between two and two and a half acres. Upon completion, all 19.2 acres of Stages I and II including the Stage I overfill will have an EGC cover.

Sheet 3 is a longer-range fill plan. The additional disposal capacity of Sheet 3 is 276,000 cy. The access road located along the eastern slope of the landfill will be used to access this area. New filling will take place on the plateau area at about elevation 690 and above as shown on Sheet 2 in Appendix 4. Sideslopes are not proposed to be disturbed. Filling will move from the northwestern portion of Stages I and II and progress in quadrants to the southwestern portion, then the southeastern portion and finally ending at the northeastern quadrant. EGC will be removed in around one-acre increments beginning with the northwestern western quadrant to minimize reopened area. Replacement EGC is proposed, in intervals, for two-acre portions of each quadrant once they are filled to the Sheet 3 grades to as a practical approach to minimize open area.



EGC PLACEMENT UNDER INTERIM GRADING PLAN 2

LEACHATE MANAGEMENT PLAN

LOCKWOOD HILLS LLC			
TOWN OF TORREY	YATES COUNTY	NEW YORK	FIGURE 7-1
September 2019	SCALE: NOT TO SCALE	REVISION # 0	

DAIGLER ENGINEERING, P.C.
CIVIL & GEO-ENVIRONMENTAL ENGINEERING
2620 GRAND ISLAND BLVD. GRAND ISLAND, NEW YORK 14072
(716) 773-6872 (716) 773-6873 FAX

8 REGULATORY CONSIDERATIONS

In the future, a variance or variances may be submitted to consider the EGC system an element of final closure. If that comes to pass, aside from the justification required for a variance request under subdivision 360.10(b), a revised Closure and Post Closure cost estimate will be submitted. According to subparagraph 360.10(a)(2)(i), a variance will not be granted which would authorize a landfill to be designed, constructed, operated, closed, or monitored in a manner less stringent than required in 40 CFR Part 258, Criteria for Municipal Solid Waste Landfills. That said, the EGC system satisfies Subtitle D Closure Criteria Standards listed in 40 CFR 258.60 in that the system provides a hydraulic conductivity no greater than 1×10^{-5}cm/sec, and a reduction in infiltration equivalent to 18 inches of earthen material. To improve the EGC system's expected equivalency in environmental performance to a Part 363 traditional final cover and therefore strengthen their variance application, Lockwood Hills may decide to place a geosynthetic clay liner under the 36-mil Dura-Skrim reinforced geomembrane on slopes of less than 25%.

With the variance option in mind, Lockwood Hills intends to submit for review and approval a Construction Engineering Report with supporting calculations and detailed construction drawings, as well as, construction specifications for review and approval by the Department prior to the first construction season. The work will be completed under a NYSDEC approved Construction Quality Assurance/Construction Quality Control (CQA/CQC) Plan prepared pursuant to section 363-4.5. A construction certification report will be prepared after each construction phase is completed.

9 SCHEDULE

9.1 PHASED IMPLEMENTATION

Following Interim Grading Plan 1 (Sheet 1), installation of the EGC is proposed to occur over a five-year period as shown on Figure 9-1. Year 1 would begin the January immediately following receipt of Lockwood's modified Part 363 Solid Waste Management Permit. Refer to Figure 9-1 at the end of this section for the locations where each Year's construction is described.

Year 1

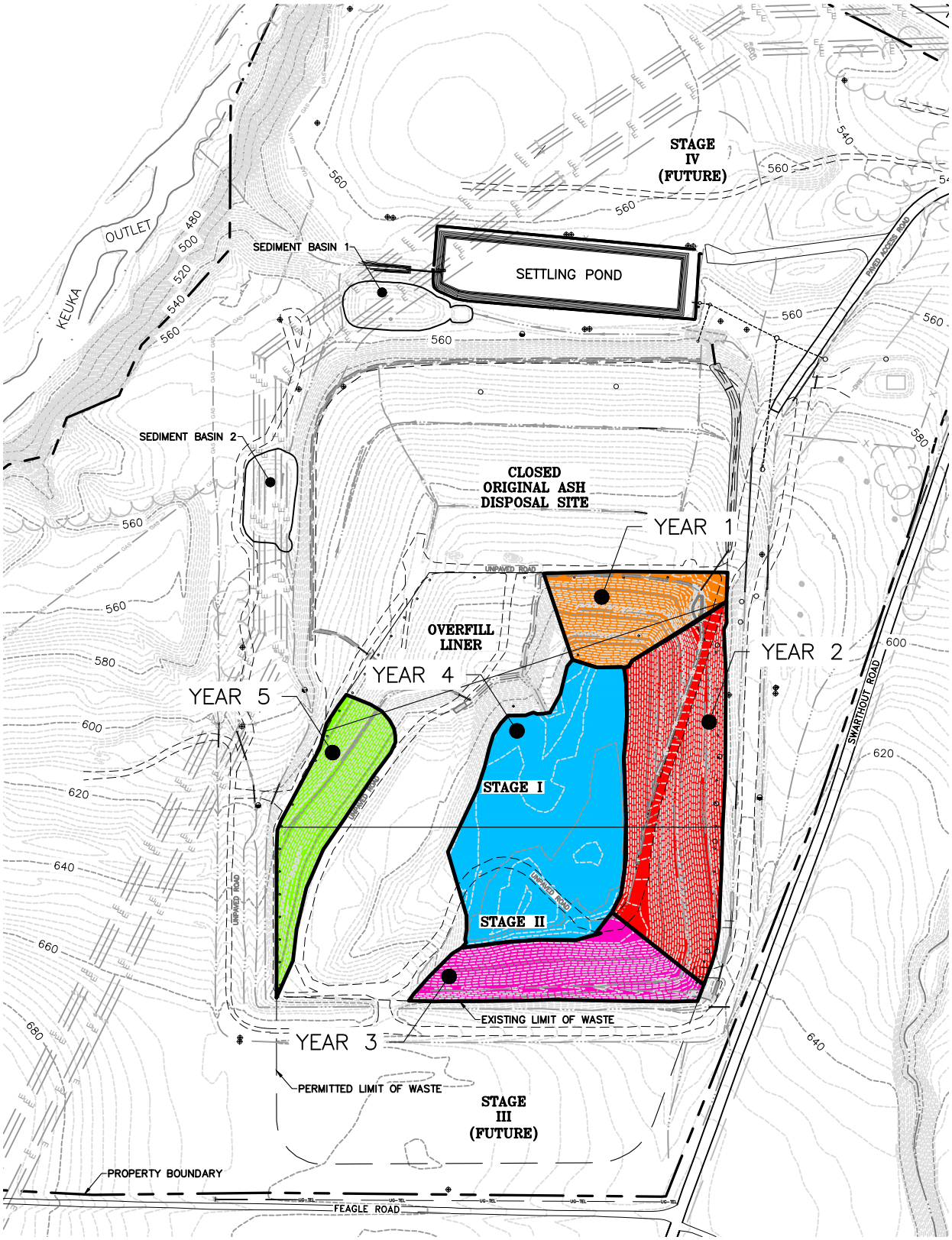
Initial work will consist of addressing any reconstruction or enhancements needed to Sediment Basin 1 and the eastern and northern perimeter channel to Sediment Basin 1, followed by possible replacement or augmentation of the discharge channel and downchute from the toe of the Overfill Liner area, eastward across the OADS and down the east slope to the perimeter channel. Regrading of the northern and eastern face of the Overfill Liner area and covering of that area with the exposed geomembrane would then commence. Excess materials from the regrading efforts would be placed on the plateau area of Stage I and II per the fill progression discussion in discussed in Section 7.8.

Year 2

Work in Year 2 will consist of regrading the entire eastern slope of Stages I and II and placing the EGC on that sideslope. The existing access road configuration will remain as it is an essential part of the Landfill's stormwater management features. Construction documents will include details for installing a new stone access road with a drainage channel on top of the EGC. Excess materials from the regrading effort will be placed on the plateau area of Stages I and II until it is filled to Interim Grading Sheet 1 grades. Additional excess materials will then be placed in the northern portion of the Open Area shown on Figure 6-1.

Year 3

Work during this year will consist of addressing any reconstruction or enhancements needed to Sediment Basin 2, as well as, the southern and western perimeter channels. Regrading and covering the south slope of Stage II would occur at this time as well. Excess regrading materials



PHASED COVERING PLAN

LEACHATE MANAGEMENT PLAN

LOCKWOOD HILLS LLC			
TOWN OF TORREY	YATES COUNTY	NEW YORK	FIGURE 9-1
September 2019	SCALE: NOT TO SCALE	REVISION # 0	

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Q:\Lockwood Hills LLC\31-1619 Consent Order 2019\Leachate Management Plan\ACAD\FIG 9-1JG.dwg 9/11/2019 11:34 AM

will be placed in the northern portion of the Open Area if grades on the plateau area per Interim Grading Sheet 1 are reached.

Year 4

With the drainage work completed from Years 1 and 3, the plateau area can be covered with an EGC. Temporary drainage controls will be designed for the western extent of the EGC to safely convey surface runoff to the existing perimeter drainage channels. Any needed final grading will be performed, and the area covered with an exposed geomembrane, connecting it with the work done in Years 1, 2 and 3 to the north, east and south slopes.

Year 5

By Year 5, the western slope of Stages I and II will be regraded and covered with an EGC during this construction season. Excess regraded materials, if any, will be placed in the Open Area as necessary.

9.2 GENERAL SCHEDULE

The proposed initial schedule based on the actions described in this workplan is as follows:

1. Construction Documents preparation and submittal – 120 days;
2. Year 1 Construction Bidding and selection – 30 days;
3. Year 1 Construction – 90 days*;
4. Year 1 Construction Certification Report submittal – 30 days; and
5. Year 1 Construction Certification Report acceptance by the NYSDEC – 30 days.

* = Shortened construction to allow time for preparation, review and approval of the construction documents that will include a new CQA/CQC Plan, construction drawings with details applicable to all five years of construction and supporting documentation and calculations.

For years 2-5, the schedule will consist of:

1. Preparation and submittal of Construction Documents for that year's work – 90 days beginning each January;

2. Construction Bidding – 30 days;
3. Construction – 150 days;
4. Construction Certification Report – 30 days; and
5. Construction Certification Report acceptance by the NYSDEC – 30 days.

APPENDIX 1

Leachate Management Forms

DAILY LINE CLEANING RECORD

Lockwood Ash Disposal Site
Daily Line Cleaning Record

Site Location: Dresden, NY **Equipment:** _____ **Date:**_____

Client: Lockwood Hills LLC **Nozzle Type:**_____ **Weather:**_____

Pressure:_____ **GPM:**_____ **Company:**_____

Daily Total Gallons Water Used:_____ **Technicians:**_____

Location Stage	Line Segment		Pipe Diameter	Pipe Type	Total Length Linear Footage	Total Linear Footage Cleaned*	No. of Passes	Comments
Stage II	CO-0A		6"	PVC	962			
	CO-0		6"	PVC	969			
	CO-1		6"	PVC	970			
	CO-2		6"	PVC	972			
	CO-3		6"	PVC	973			
	CO-4		6"	PVC	975			
	CO-5		6"	PVC	973			
	CO-38**	~CO-36	6" CO/21" Header	PVC	100			
	CO-36**	~CO-31	6" CO/ 21" Header	PVC	250			
	CO-31**	MH I/II-1	6" CO/ 21" Header	PVC	400			

Notes:_____

_____

_____

*Record approximate length if partially jetted; record "Flushed" if simply flushed with water without entering the line.

Lockwood Ash Disposal Site
Daily Line Cleaning Record

Site Location: Dresden, NY **Equipment:** _____ **Date:**_____

Client: Lockwood Hills LLC **Nozzle Type:**_____ **Weather:**_____

Pressure:_____ **GPM:**_____ **Company:**_____

Daily Total Gallons Water Used:_____ **Technicians:**_____

**CO-38, 36, & 31 are saddled to the header pipe with two 45° wye angled in the downstream direction. Visually verify flow/hose by observing in MH II-1 for CO-38, MH II-2 for CO-36 and MH II-3 for CO-31.

Location Stage	Line Segment		Pipe Diameter	Pipe Type	Total Length Linear Footage	Total Linear Footage Cleaned*	No. of Passes	Water Used Total Gallons	Total Gallons Leachate Vac.
Stage I	CO-6		6"	PVC	973				
	CO-7		6"	PVC	953				
	CO-8		6"	PVC	958				
	CO-9		6"	PVC	987				
	CO-30	MH I/II-1	6" CO/ 6" Header	PVC	200				
	MH II-3	MH I/II-1	21”	PVC	678				
	MH I/II-1	MH I/II-2	21”	PVC	72				

Notes:_____

_____

_____

*Record approximate length if partially jetted; record “Flushed” if simply flushed with water without entering the line.

Lockwood Ash Disposal Site
Daily Line Cleaning Record

Site Location: Dresden, NY **Equipment:** _____ **Date:**_____

Client: Lockwood Hills LLC **Nozzle Type:**_____ **Weather:**_____

Pressure:_____ **GPM:**_____ **Company:**_____

Daily Total Gallons Water Used:_____ **Technicians:**_____

	MH I/II-2	MH I/II-3	21”	PVC	45				

Location Stage	Line Segment		Pipe Diameter	Pipe Type	Total Length Linear Footage	Total Linear Footage Cleaned*	No. of Passes	Comments
Stage I Overfill Liner	CO-10		6”	PVC	962			
	CO-11		6"	PVC	63			
	CO-12		6"	PVC	103			
	CO-13		6"	PVC	146			
	CO-14		6"	PVC	190			
	CO-15		6"	PVC	233			
	CO-17		6"	PVC	317			
	CO-18		6"	PVC	361			
	CO-19		6"	PVC	326			
	CO-20		6"	PVC	279			

Notes:_____

_____

_____

*Record approximate length if partially jetted; record “Flushed” if simply flushed with water without entering the line.

Lockwood Ash Disposal Site
Daily Line Cleaning Record

Site Location: Dresden, NY **Equipment:** _____ **Date:**_____

Client: Lockwood Hills LLC **Nozzle Type:**_____ **Weather:**_____

Pressure:_____ **GPM:**_____ **Company:**_____

Daily Total Gallons Water Used:_____ **Technicians:**_____

	CO-21		6"	PVC	233			
	CO-22		6"	PVC	186			
	CO-23		6"	PVC	141			

Location Stage	Line Segment		Pipe Diameter	Pipe Type	Total Length Linear Footage	Total Linear Footage Cleaned*	No. of Passes	Comments
OADS	MH OADS-1	MH OADS-2	12”	PVC	299			
	MH OADS-2	MH OADS-3	12”	PVC	205			
	CO-44	MH OADS-3	8”	PVC	81			

Notes:_____

_____

_____

*Record approximate length if partially jetted; record “Flushed” if simply flushed with water without entering the line.

Lockwood Ash Disposal Site
Daily Line Cleaning Record

Site Location: Dresden, NY **Equipment:** _____ **Date:**_____

Client: Lockwood Hills LLC **Nozzle Type:**_____ **Weather:**_____

Pressure:_____ **GPM:**_____ **Company:**_____

Daily Total Gallons Water Used:_____ **Technicians:**_____

Location Stage	Line Segment		Pipe Diameter	Pipe Type	Total Length Linear Footage	Total Linear Footage Cleaned*	No. of Passes	Comments
	Upstream	Downstream						
Downstream Sewer System	MH I/II-3	MH I/II-4	21”	PVC	35			
	MH I/II-4	MH I/II-5	21”	PVC	280			
	MH I/II-5	MH I/II/S-1	21”	PVC	292			
	CO-45	MH I/II/S-1	8”	PVC	157			
	MH COM-1**	Inlet to Pond	8”	PVC	34 + 6’ flume			

**This line segment includes the 6’ meter pit and Large 60-Degree V-Trapezoidal Flume. Care needs to be taken not to damage the flume. Visual observation of the cleaning effectiveness should be made in the meter pit. Access through the meter pit itself could be added if necessary.

Notes:_____

_____

_____

*Record approximate length if partially jetted; record “Flushed” if simply flushed with water without entering the line.

Lockwood Ash Disposal Site
Daily Line Cleaning Record

Site Location: Dresden, NY **Equipment:** _____ **Date:**_____

Client: Lockwood Hills LLC **Nozzle Type:**_____ **Weather:**_____

Pressure:_____ **GPM:**_____ **Company:**_____

Daily Total Gallons Water Used:_____ **Technicians:**_____

Manhole	Manhole Diameter	Total Gallons Leachate/Sediment Vacuumed	Comments

Notes:_____

_____

_____

Lockwood Ash Disposal Site
Daily Line Cleaning Record

Site Location: Dresden, NY

Client: Lockwood Hills LLC

Equipment: _____

Nozzle Type:_____

Pressure:_____ **GPM:**_____

Daily Total Gallons Water Used:_____

Date:_____

Weather:_____

Company:_____

Technicians:_____

Notes:_____
_____
_____

DAILY OPERATING RECORD
SECONDARY LEACHATE FLOW MEASUREMENTS

LOCKWOOD ASH DISPOSAL SITE

DAILY OPERATING RECORD

SECONDARY LEACHATE FLOW MEASUREMENTS

DATE	TIME	SECONDARY	
		VOLUME (mL)	TIME (sec)

MONTHLY LEACHATE GENERATION TOTALS

LOCKWOOD ASH DISPOSAL SITE

MONTHLY LEACHATE GENERATION TOTALS

DATE	TOTAL VOLUME (gal)

LEACHATE COLLECTION SYSTEM MAINTENANCE LOG

LOCKWOOD ASH DISPOSAL SITE
LEACHATE COLLECTION SYSTEM
MAINTENANCE LOG

START DATE	END DATE	ACTIVITY

APPENDIX 2

Dura-Skrim Reinforced LLDPE Geomembrane

DURA♦SKRIM® N36BT2

2-SIDE TEXTURED REINFORCED POLYETHYLENE – NSF/ANSI STANDARD 61 CERTIFIED

RAVEN

PRODUCT DESCRIPTION

DURA♦SKRIM® N36BT2 is a double-side textured flexible geomembrane, reinforced with a closely knit 9x9 weft inserted polyester scrim fully encapsulated between two layers of highly UV stabilized linear low density polyethylene. Exceptional toughness, high tensile and puncture strength is achieved with the combination of premium high strength LLDPE and dense scrim reinforcement. A highly stabilized formulation consisting of antioxidants, UV stabilizers and carbon black provide excellent protection for long-term exposed or barrier applications.

DURA♦SKRIM® N36BT2 contains a cast texture surface produced with Raven's exclusive GeoGrip™ technology.. The GeoGrip™ texture is made up of durable random spikes and diamond shaped bidirectional bars for unmatched uniform stabilization and support. DURA♦SKRIM® NT-Series geomembranes are produced in the color black as standard, and are available in other custom manufactured colors with minimum order quantity requirements.

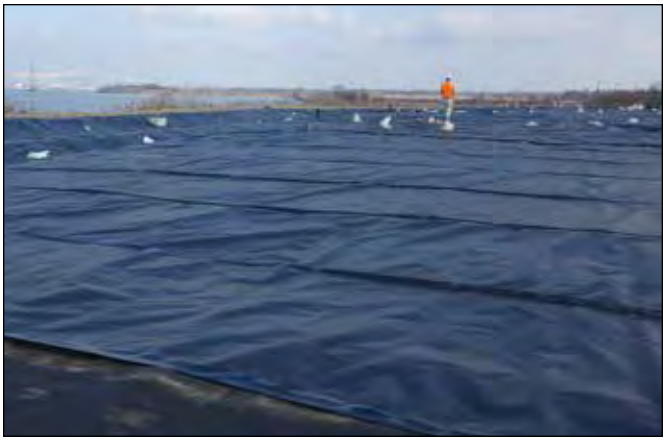
PRODUCT USE

DURA♦SKRIM® textured NT-Series are used for applications that require an anti-skid surface or to provide a high friction surface between unlike soil types and geosynthetic materials for steeper slope designs depending upon application requirements. Common applications include landfill caps, mining leach pads and containment ponds. DURA♦SKRIM® N36BT2 is used in applications that require exceptional outdoor life, high tear properties, exceptional tensile strength, and puncture resistance. DURA♦SKRIM® NT-Series is manufactured from a very chemical-resistant, linear-low-density polyethylene with excellent cold crack performance and resistance to thermal expansion.

DURA♦SKRIM® N36BT2 meets the physical property values as stated in GRI test method GM25, and is certified under the NSF/ANSI Standard 61, Drinking Water System Components – Health Effects.

SIZE & PACKAGING

DURA♦SKRIM® NT-Series is available in a variety of widths and lengths to meet the project requirements. Large diameter mill rolls are available to assure an efficient seaming process. Factory welded panels are produced in a controlled environment and are accordion folded and tightly rolled on a heavy-duty core for ease of handling and time saving installation.



Containment Liner

PRODUCT	PART #
DURA♦SKRIM	N36BT2

APPLICATIONS

- Waste Lagoon Liners
- Landfill Caps
- Canal Liners
- Disposal Pit Liners
- Water Containment Ponds
- Heap Leach Liners
- Tunnel Liners
- Earthen Liners
- Interim Landfill Covers
- Mining Tailing Ponds

DURA♦SKRIM®

DURA♦SKRIM® N36BT2

2-SIDE TEXTURED REINFORCED POLYETHYLENE – NSF/ANSI STANDARD 61 CERTIFIED

PRO-FORMA DATA SHEET

		DURA♦SKRIM® N36BT2			
		IMPERIAL		METRIC	
PROPERTIES	TEST METHOD	MINIMUM	TYPICAL	MINIMUM	TYPICAL
Appearance		Black 2-Side Texture		Black 2-Side Texture	
Core Thickness	ASTM D5994	31 mil	35 mil	0.79 mm	0.89 mm
Asperity Height	ASTM D7466	16 mil	22 mil	0.41 mm	0.56 mm
Weight	ASTM D751	162 lbf/msf	185 lbf/msf	791 g/m^2	903 g/m^2
Construction		Dense scrim reinforced polyethylene			
Tongue Tear Strength	ASTM D5884	80 lbf	115 lbf	356 N	512 N
Grab Tensile at Break	ASTM D7004	240 lbf	310 lbf	1068 N	1379 N
Tensile Elongation at Break	ASTM D7004	22 %	30 %	22 %	30 %
Puncture Resistance	ASTM D4833	85 lbf	110 lbf	378 N	489 N
Standard OIT or High Pressure HPOIT	ASTM D3895 ASTM D5885	100 min 400 min	150 min 2400 min	100 min 400 min	150 min 2400 min
Hydraulic Conductivity		1.83 x 10^{-10} cm/sec			
Maximum Static Use Temperature		180° F		82° C	
Minimum Static Use Temperature		-70° F		-57° C	

PRO-FORMA SHEET CONTENTS: The data listed in the Pro-Forma data sheet is representative of initial production runs. These values may be revised at anytime without notice as additional test data becomes available.

DURA♦SKRIM® N36BT2 is a double-side textured flexible geomembrane, reinforced with a closely knit 9x9 weft inserted polyester scrim fully encapsulated between two layers of highly UV stabilized linear low density polyethylene. Exceptional toughness, high tensile and puncture strength is achieved with the combination of premium high strength LLDPE and dense scrim reinforcement. A highly stabilized formulation consisting of antioxidants, UV stabilizers and carbon black provide excellent protection for long-term exposed or barrier applications

Scan QR Code to download technical data sheets.

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efdsales@ravenind.com
www.ravenefd.com

Comparison - Raven N-Series Textured vs 40 & 60 Mil LLDPE Textured

Properties and Units	Test Method ASTM	N30BT1[1]	N36BT1[1]	N45BT1[1]	40 Mil LLDPE[2]	60 Mil LLDPE[2]
Weight – lb/ft^2 (min. ave.)	D751	.127	.156	.194	.18	.27
Density (min.) g/cc	D1505	.925	.925	.925	.939	.939
Thickness – Mils - Core - Asperity Height	D5199 D7466	27 16	31 16	39 16	40 16	60 16
Tensile Strength - dumbbell – lb/in (min. ave.) - grab - lb (min. ave.)	D6693 – IV D7004	- 267	- 295	- 275	60 -	90 -
Tensile Elongation at Break % - dumbbell – % (min. ave.) - Film Break Elongation - %	D6693 – IV D7003	- 220	- 228	- 312	250 -	250 -
Tear Resistance - nonreinforced – lb (min. ave.) - reinforced – lb (min. ave.)	D1004 D5884	- 70	- 80	- 100	22 -	33 -
Puncture Resistance – lb (min. ave.)	D4833	80	85	90	44	66
Oxidative Induction Time (OIT)[3] - High Pressure OIT (minutes)	D5885	1000	1000	1000	400	400

[1]Values taken from N-Series data sheets MD values and measured against industry standard GRI-GM25 for LLDPE Reinforced PE

[2]Values used are specified from industry standard GRI-GM17 for LLDPE textured geomembranes

[3] OIT values measure anti-oxidant effectiveness of geomembrane.

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Construction: Roll Delivery

RAVEN
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Construction: Roll Deployment

RAVEN
ENGINEERED FILMS

Construction: Liner Deployment

RAVEN
ENGINEERED FILMS

Factory Assembled Panels

APPENDIX 3

Calculations

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SUBJECT Lockwood Exposed Geomembrane Leachate Generation Rate

Use Giroud, et al 1997 Final Cover Infiltration Equation ✓

$$Q = C_{qo}\, n \left(1 + 0.1\left(\frac{h}{t_s}\right)^{0.95}\right) a^{0.1} h^{0.9} k_s^{0.74}$$ ✓

Where: Q = Leakage rate through the defect (m^3/sec)

C_{qo} = Contact quality factor = 0.7 for fair contact

n = # defects in geomembrane

h = Head on geomembrane (m)

t_s = Thickness of soil below geomembrane (m)

a = area of circular defect (m^2)

k_s = Soil permeability (m/sec)

Assumptions: n = 4/acre ✓

h = 6" for water trapped behind a wrinkle = 0.1524 m ✓

t_s = 6" subbase = 0.1524 m ✓

$a = 3.14 \times 10^{-6}\ m^2$ for d = 2 mm circular hole ✓

$k_s = 1 \times 10^{-5}$ cm/sec or 1×10^{-7} m/sec ✓

$$Q = (0.7)(4)\left[1 + 0.1\left(\frac{.1524}{.1524}\right)^{.95}\right]\left(3.14 \times 10^{-6}\ m^2\right)^{.1}(0.1524)^{.9}\left(1 \times 10^{-7}\right)^{.74}$$

$$= 1.05 \times 10^{-6}\ m^3/\text{sec} \times \frac{264.172\ \text{gal}}{m^3} \times \frac{3600\ \text{sec}}{\text{hr}} \times \frac{24\ \text{hr}}{\text{day}}$$ ✓

Q = 24 Gallons per acre per day (gpad) ✓

SAY Q = 30 gpad ✓

APPENDIX 4

Drawings

NOTES:

1. THE UNDERLYING TOPOGRAPHIC INFORMATION SHOWN INSIDE THE LIMIT OF WASTE, INCLUDING THE ORIGINAL ASH DISPOSAL SITE, STAGE I AND STAGE II, HAS BEEN OBTAINED BY A FIELD SURVEY COMPLETED BY RICHARD WILLSON, PLS ON APRIL 18, 2011. ADDITIONAL CONFIRMATORY FIELD SURVEY INFORMATION WAS COLLECTED BY DAIGLER ENGINEERING, PC ON JANUARY 12, 2016. TOPOGRAPHIC AND PLANIMETRIC INFORMATION SHOWN OUTSIDE THE CURRENT LIMIT OF WASTE HAS BEEN OBTAINED FROM AERIAL PHOTOGRAMMETRIC METHODS BY KUCERA INTERNATIONAL INC. (WILLOUGHBY, OHIO) DATED FEBRUARY 4, 2010 AND SUPPLEMENTED WITH 2016 STORMWATER SEPARATION CONSTRUCTION RECORD SURVEY INFORMATION.
2. THE VERTICAL CONTROL IS THE SITE DATUM. HORIZONTAL CONTROL IS REFERENCED TO THE NEW YORK STATE GRID.
3. NOTE THAT THE LIMIT OF ACTIVE AREA IS SLIGHTLY OFFSET FROM THE LIMIT OF WASTE FOR ILLUSTRATING PURPOSES ONLY.

LEGEND

- PROPERTY LINE
- CULVERT
- GROUNDWATER DRAIN DISCHARGE LOCATION
- OHW — OVERHEAD WIRES & POLE (DOMESTIC)
- MANHOLE
- TREE
- TREELINE
- CURRENT LIMIT OF WASTE
- MONITORING WELL LOCATION
- EXISTING CONTOURS
- PROPOSED CONTOURS

NO.	REVISION	BY	DATE

DAIGLER ENGINEERING, P.C.
CIVIL & GEO-ENVIRONMENTAL ENGINEERING
2620 GRAND ISLAND BLVD. GRAND ISLAND, NEW YORK 14072
(716) 773-6872 (716) 773-6873 FAX

JAMES A. DAIGLER, P.E.
NYSPE NO. 061689

DATE: October 2019

PRELIMINARY NOT FOR CONSTRUCTION

SCALE: 1" = 100'

PREPARED FOR: LOCKWOOD HILLS LLC			INTERIM GRADING PLAN 1
DES. BY:	DRW. BY:	CHK. BY:	LEACHATE MANAGEMENT PLAN
DWG. Grading Plan 1_final.dwg			TOWN OF TORREY / YATES COUNTY / STATE OF NEW YORK

SHEET 1

Q:\Lockwood Hills LLC\31-1619 Consent Order 2019\Leachate Management Plan\ACAD\Grading Plan 1_final.dwg 10/3/2019 12:45 PM

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SCALE: 1" = 100'

PREPARED FOR:	LOCKWOOD HILLS LLC		
DES. BY:	DRW. BY:	CHK. BY:	
DWG.	Grading Plan 2_final.dwg		

INTERIM GRADING PLAN 2

LEACHATE MANAGEMENT PLAN

TOWN OF TORREY | YATES COUNTY | STATE OF NEW YORK

SHEET 2

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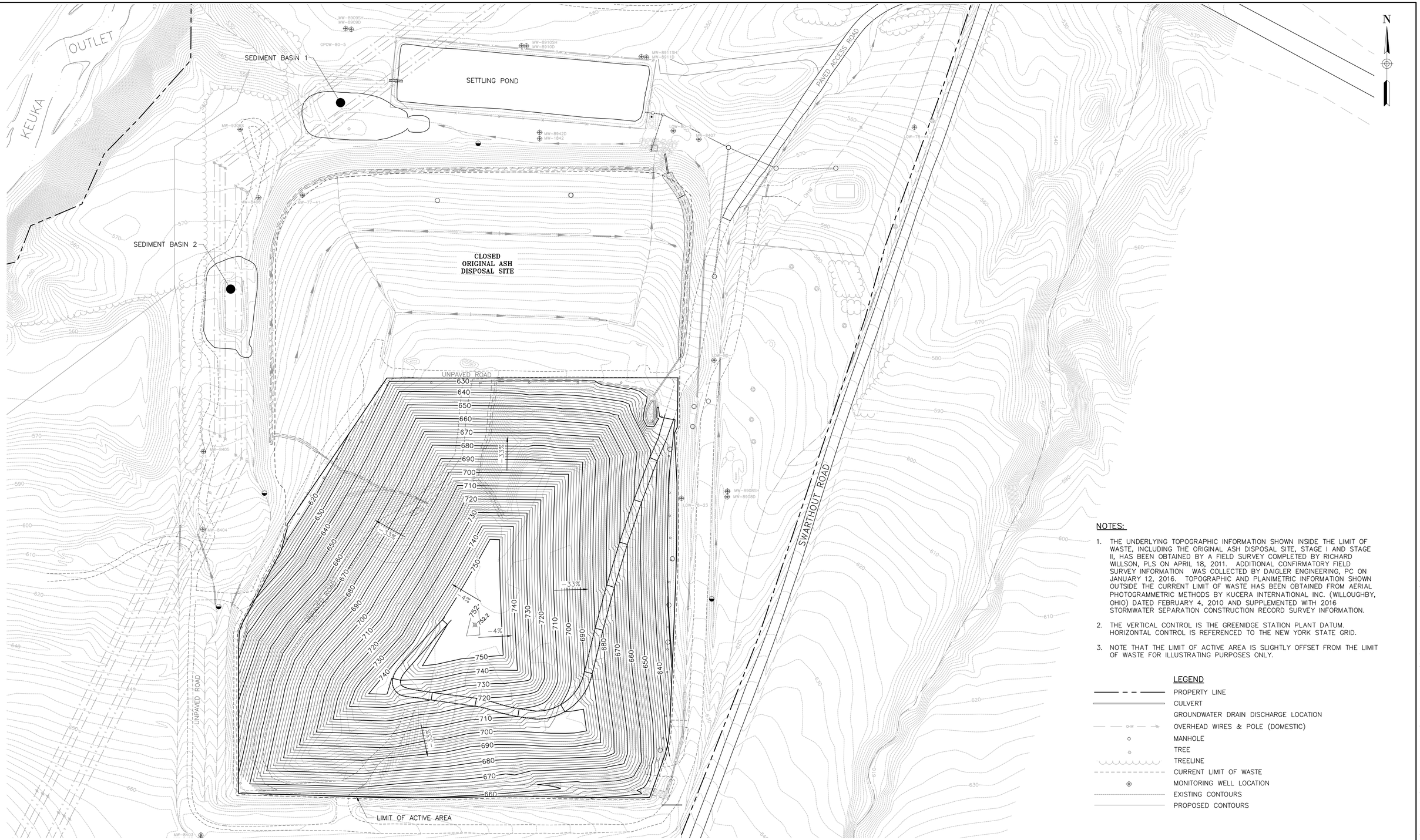

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PREPARED FOR:	LOCKWOOD HILLS LLC		
DES. BY:	DRW. BY:	CHK. BY:	
DWG.	Grading Plan 3_final.dwg		

INTERIM GRADING PLAN 3
LEACHATE MANAGEMENT PLAN

TOWN OF TORREY | YATES COUNTY | STATE OF NEW YORK

SHEET 3

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