*Prepared for:*

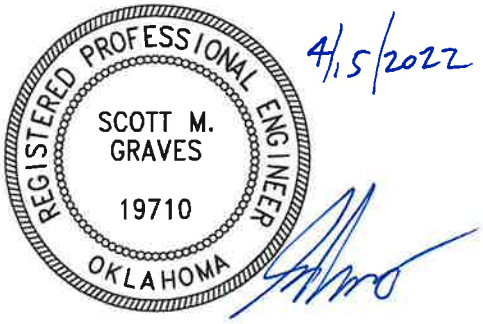
Clean Harbors Environmental Services, Inc.
Lone Mountain Facility
40355 S. County Rd. 236
Waynoka, OK 73860-6302

# ENGINEERING REPORT

To Accompany:

# PROPOSED CLASS 2 PERMIT MODIFICATION
# LANDFILL CELL 15

# LONE MOUNTAIN FACILITY
# WAYNOKA, OKLAHOMA




Geosyntec Consultants
Oklahoma Certificate of Authorization No. 1996
Exp. 06/30/2022

*Prepared by:*

Geosyntec consultants
8217 Shoal Creek Blvd, Suite 200
Austin, Texas 78757

April 2022

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## ENGINEERING REPORT



4/15/2022

REGISTERED PROFESSIONAL ENGINEER
SCOTT M. GRAVES
19710
OKLAHOMA

**DRAWINGS**

# 1. INTRODUCTION

## 1.1 Overview

The Lone Mountain Facility Landfill Cell 15 (Cell 15) is located near Waynoka, Major County, Oklahoma, in Section 28, T23N, R15W, adjacent to (north of) existing Cells 12 and 14 at the facility. Cell 15 is currently permitted as a Resource Conservation and Recovery Act (RCRA) landfill disposal cell, in accordance with Federal and State regulations including the design requirements of Code of Federal Regulations (CFR) 40 CFR 264 and Oklahoma Administrative Code (OAC) 252:205. Cell 15 is designed to occupy a waste disposal plan footprint area of approximately 94.8 acres, and is composed of 22 subcells. Currently, Subcells 1 through 14 (approximately 58.8 acres) have been constructed.

Clean Harbors Environmental Services, Inc. (CHES) is requesting a Class 2 Permit Modification that:

- proposes revisions to the base grading plan as follows;
  - addition of a "large termination berm" that will be situated on the interior of the landfill adjacent to the west sides of Subcells 12 and 14;
  - revised base grades and subcell size (areas) of Subcells 12, 14, 15, 16, and 17;
- does not change the total waste disposal footprint of Cell 15, and results in a minor reduction in disposal capacity;
- does not change the final cover grading plan or final surface water management system design; and
- does not otherwise affect the design components of Cell 15, nor the design basis and supporting engineering analyses previously prepared to support the permitting of Cell 15.

The modification design was prepared by Geosyntec Consultants, Inc. (Geosyntec), and is described in this report.

## 1.2 Report Organization

This report describes the proposed Cell 15 grading and layout revisions and addresses the features and components that are not affected by this modification. The remainder of this report is organized as follows:

- a detailed description of the proposed permit modification is presented in Section 2;
- a discussion of the landfill design components and features that are not proposed to be changed (unaffected by this modification) is presented in Section 3; and
- summary and conclusions are provided in Section 4.

At the end of this report, engineering drawings are provided to show the plan view of the proposed layout changes, along with a cross section and engineering details to show the relevant tie-ins and components.

# 2. DESCRIPTION OF PROPOSED MODIFICATION

It is proposed to add a large termination berm along the west side of Subcell 12 and the west and south sides of Subcell 14. The large termination berm will be constructed to an interim configuration, and then at a later time will be modified to a final configuration that would remain as a permanent lined feature of the landfill base grades.

## 2.1 Design Layout and Development Sequence

### 2.1.1 Initial Construction

The layout of the large termination berm as it would initially be constructed is presented on Drawing 1 at the end of this report. Construction of the large termination berm to its interim conditions as shown on Drawing 1 will involve tying-in and extending the Subcells 12 and 14 sideslope liner system up the interior 3 horizontal to 1 vertical (3H:1V) sideslopes of the large termination berm, and anchoring the liner system at the crest of the berm. As such, the configuration of the large termination berm will resemble the exterior embankment of Cells15. The top elevation of the large termination berm will be at a constant 1420 feet above mean sea level (ft, MSL), and under interim conditions will have a perimeter roadway situated on the top of the berm. The exterior sideslopes will be armored with the same armoring materials as the exterior landfill embankment slopes.

A cross section and engineering details of the large termination berm and associated tie-ins are presented on attached Drawings 4 and 5.

### 2.1.2 Waste Filling to Interim Grades

After the large termination berm construction is completed (including the liner extensions of Subcells 12 and 14), waste filling will be conducted in Subcells 12 through 14. The configuration of the interim grades when waste filling through Subcell 14 is complete is presented on Drawing 2. These interim grades are inclined at the same steepness as the final cover grades (but with the interim grading layout shown on Drawing 2), and will remain at or below the final grades.

### 2.1.3 Continued Subcell Development (Post-Subcell 14)

As subcell development continues beyond Subcell 14, the large termination berm will stay in-place and be lined over the top and on 3H:1V sideslopes. This is shown on the revised overall Cell 15 base grading plan presented on Drawing 3. The cross-sections and details on Drawings 4 and 5 also present information on this layout and the tie-ins.

When it is time to construct Subcell 15 (and again for Subcells 16 and 17) (i.e., the subcells that are adjacent to the large termination berm), the exterior sideslope of the large termination berm will have its armoring removed. The sideslope will be flattened to 3H:1V, and then will be lined

with the sideslope liner system. At the top of the berm, tie-in will be made at the previous anchor trench, to form a continuous liner over and across the large termination berm and down into the adjacent lined subcells.

### 2.1.4 Final Buildout and Completion of Cell 15

The base grades of future Subcells 18 through 22 are not affected by this modification. Also, the current-permitted Cell 15 final cover grading plan is not affected by the large termination berm. As such, the remainder of the landfill will be filled and incrementally closed (and final closed) in accordance with the approved permit.

## 2.3 Changes to Affected Subcell Areas and Volumes

The revised overall grading plan presented on attached Drawing 3 of 5 results in adjustments to several affected subcells that are adjacent to either side of the large termination berm that will ultimately be a lined berm situated on the interior of the landfill. Specifically, the areas of Subcells 12 and 14 are increasing slightly due to the addition of the sideslope liner extension on the large termination berm, while conversely the areas of Subcells 15 through 17 are decreasing somewhat. The previous and updated areas and approximate waste disposal volumes of these subcells are tabulated below.

| **Subcell #** | **Previous 2D Plan Area** (acres) | **Updated 2D Plan Area** (acres) | **Previous Waste Disposal Volume** (cubic yards) | **Updated Waste Disposal Volume** (cubic yards) |
|---|---|---|---|---|
| 12 | 4.5 | 5.2 | 492,700 | 536,755 |
| 14 | 5.8 | 7.4 | 578,900 | 706,000 |
| 15 | 5.9 | 4.8 | 348,900 | 251,260 |
| 16 | 4.8 | 3.9 | 371,500 | 269,260 |
| 17 | 4.8 | 4.5 | 280,400 | 230,290 |

There is no change to the overall Cell 15 disposal footprint area, and there is a minor reduction in volume (discussed below).

## 2.4 Revised Landfill Cell 15 Waste Disposal Volume

The currently approved permit design of Cell 15 provides a total waste disposal capacity of 8,065,500 cubic yards (CY).

The grading changes to add the large termination berm will result in a loss of approximately 78,835 CY of capacity.

The revised total design waste disposal capacity of Cell 15 as reflected in this permit modification request is 7,986,665 CY.

# 3. UNAFFECTED DESIGN ITEMS

## 3.1 Summary

The proposed changes are as described in the preceding section. Based on this, below is an overview summary of the Cell 15 design features and components that will not be affected or changed as a result of this modification.

- Total Landfill Footprint Area/Disposal Limits.
- Final Cover Grading Plan.
- Maximum Final Cover Elevation.
- Geotechnical Design.
- Leachate Collection System (LCS) and Leak Detection System (LDS) Design.
- Final Surface Water Management Plan and Drainage Design.
- Height of embankment, slope angles of liner floor and sideslopes, slope angles of final cover surface and embankment, liner system and final cover system thickness, components and material properties, Construction Quality Assurance (CQA) Plan, and project specifications.

The design topics and analyses noted above and presented as part of the current approved design of Cell 15 capture conditions that are either similar or more critical, and thus continue to be valid design-basis representations of the engineering design of the landfill.

## 3.2 Discussion on Leachate Collection and Leak Detection Systems

### 3.2.1 Critical Subcell for Leachate Collection System Design

Under the previous design, Subcell 14, serving a three-dimensional (3D) tributary area of 6.05 acres, was calculated to be the most critical – with a peak daily flow rate of 11,588 gallons per day (gpd).

The proposed changes reconfigure several subcells as discussed previously. Subcell 14 remains the most critical for leachate collection system design purposes, with its area increasing to approximately 7.4 acres.

### 3.2.2 Head on Liner

The calculated head on liner under the previous design was for a critical (longest) 2% floor slope length of 229 ft. This condition is not changing under the proposed revised base grading plan (i.e., none of the subcell floor areas/drainage lengths are being increased). Therefore, this proposed modification has no effect on the peak and average heads on the liner presented in the previously-approved Landfill Cell 15 Engineering Report, demonstrated to be adequate.

### 3.2.3 LCS Drainage Layer Design

Similar to the above discussion, because the critical case for head on liner (which corresponds to the longest drainage path on the 2% subcell floors) is not changing, this proposed modification has no effect on the LCS drainage layer design (or required transmissivity) presented in the previously-approved Landfill Cell 15 Engineering Report, demonstrated to be adequate.

### 3.2.4 LCS Pipe Design Hydraulic Capacity

On a gallons per acre per day (gpad)-basis, the leachate generation rate will not be changed by this proposed modification. As presented in the previously-approved Landfill Cell 15 Engineering Report, peak daily impingement rate for the most critical condition (maximum flows) is 1,916 gpad. However, as noted, the tributary area of Subcell 14 is increasing to 7.4 acres. Applying the leachate generation rate multiplied by this new acreage results in a revised peak daily flow rate of 14,178 gallons per day (gpd). In comparison, the 6-in. diameter LCS pipe sloped at 1% has a hydraulic capacity of 399,100 gpd using Manning's equation to calculate gravity flow in a pipe (as reported in the previously-approved Landfill Cell 15 Engineering Report). Thus, the 6-in. diameter LCS pipe has adequate hydraulic capacity, with a substantial factor of safety under the revisions proposed by this modification.

### 3.2.5 Leak Detection System

In the previously-approved Landfill Cell 15 Engineering Report, computations were not performed for the LDS design because the flows into the LDS through hypothetical leaks would be substantially less than those experienced in the LCS. This will continue to the be case under the proposed changes of this modification.

### 3.2.6 Sump Capacity

For the LCS sump, the largest subcell will result in a relatively minor calculated increase in peak daily leachate flow rates, from 11,588 gpd (8.05 gallons per minute (gpm) to 14,178 gpd (9.85 gpm). The capacity of the sump is not changing. The computation provided in the previously-approved Landfill Cell 15 Engineering Report showed that for a given (assumed) submersible sump pump of 20 gpm, the proposed leachate sump has adequate storage capacity to provide acceptable pump cycle times considering peak and average daily operation rates. This will continue to be the case for the relatively minor increase in peak flow rates to about 9.85 gpm.

For the LDS sump, calculations provided in the previously-approved Landfill Cell 15 Engineering Report showed that there was adequate sump capacity with room to spare for assumed LDS two-tier inflow rates of 100 gpad and 345 gpad. This will continue to be the case under the slightly larger potential daily inflow that would occur at the revised Subcell 14 (the largest subcell).

# 4. SUMMARY AND CONCLUSIONS

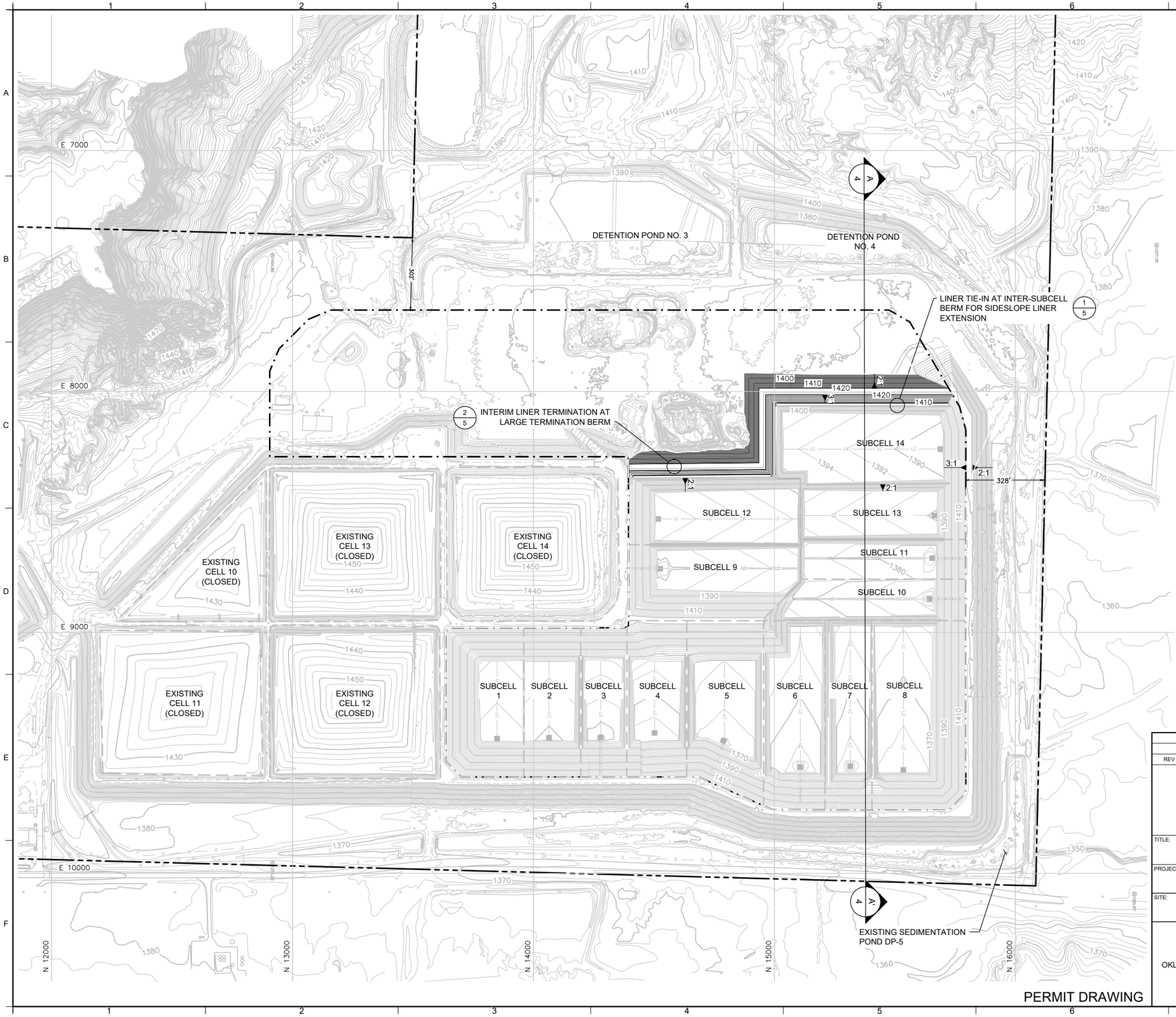
This report describes the engineering design of the proposed revisions to the base grades of Cell 15. The revision involves adding a large termination berm along the west side of Subcell 12 and the west and south sides of Subcell 14. When constructed, the large termination berm will have its exterior slopes armored with the same armoring materials as the exterior landfill embankment slopes. The interior of this large termination berm will be lined with the sideslope liner system.

The interim waste filling/grading that will exist at the point in time when waste placement is completed through Subcell 14 is presented with this modification request. The addition of the large termination berm that will ultimately be situated on the interior of the overall Cell 15 footprint will result in no increase in waste disposal capacity – and in fact will result in a minor loss of landfill capacity. The total lined footprint of Cell 15 will not change, nor will the maximum final cover elevation or other main design components of the landfill (liner system, final cover system, LCS/LDS).

The design revisions are layout changes; they do not affect the existing design of the geotechnical, leachate management, or surface water management systems.

In summary, the proposed revisions are believed to qualify as a minor modification, and they are safe and protective of human health and the environment.

# DRAWINGS




## LEGEND

- 1400 — EXISTING GROUND ELEVATION (FEET) (NOTE 1)
- EXISTING ROAD
- EXISTING FENCE
- E 8000 N 15000 — HORIZONTAL COORDINATES (NOTE 2)
- PROPERTY BOUNDARY
- PROPOSED LIMIT OF WASTE (CELL 15) (NOTE 3)
- PROPOSED PHASE BOUNDARY
- 1380 — PROPOSED TOP OF LINER ELEVATION (FEET) (NOTE 3)
- LC — LC — PROPOSED LEACHATE COLLECTION CORRIDOR
- PROPOSED LEACHATE COLLECTION SUMP

0 200' 400'
SCALE IN FEET

NOTES:

1. THE TOPOGRAPHIC BASE MAP SHOWN WAS COMPILED USING AN AERIAL SURVEY DATED 2013 PROVIDED BY JIVIDENS LAND SURVEY CO., INC. AND AERIAL SURVEY DATED 10 OCTOBER 2020. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (MSL).
2. HORIZONTAL COORDINATE VALUES BASED ON A LOCAL COORDINATE SYSTEM ESTABLISHED FOR THIS FACILITY, CONSISTENT WITH PREVIOUS PERMIT AND CONSTRUCTION SUBMITTALS.
3. WITHIN THE LIMIT OF WASTE, CONTOURS REFER TO THE TOP OF LINER ELEVATIONS, WHICH IS THE TOP OF COMPACTED CLAY LINER (i.e. SURFACE ON WHICH THE BOTTOM GEOMEMBRANE LINER WILL BE INSTALLED). CONTOURS IN EXISTING SUBCELL AREAS REFER TO AS-BUILT OR PERMITTED LINER GRADES AND CONTOURS IN FUTURE LINER EXTENSIONS REFER TO PROPOSED LINER GRADES. OUTSIDE THE LIMIT OF LINER, THE PROPOSED CONTOURS REFER TO FINISHED GRADE.

04/15/2022

REGISTERED PROFESSIONAL ENGINEER
SCOTT M. GRAVES
19710
OKLAHOMA

| REV | DATE | DESCRIPTION | DRN | APP |
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TITLE: BASE GRADING PLAN THROUGH SUBCELL 14

PROJECT: LANDFILL CELL 15 - PERMIT MODIFICATION

SITE: LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

GEOSYNTEC CONSULTANTS
OKLAHOMA CERTIFICATE OF AUTHORIZATION
NO. 1996 EXP. 06/30/2022

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| APPROVED BY: | SMG | | |

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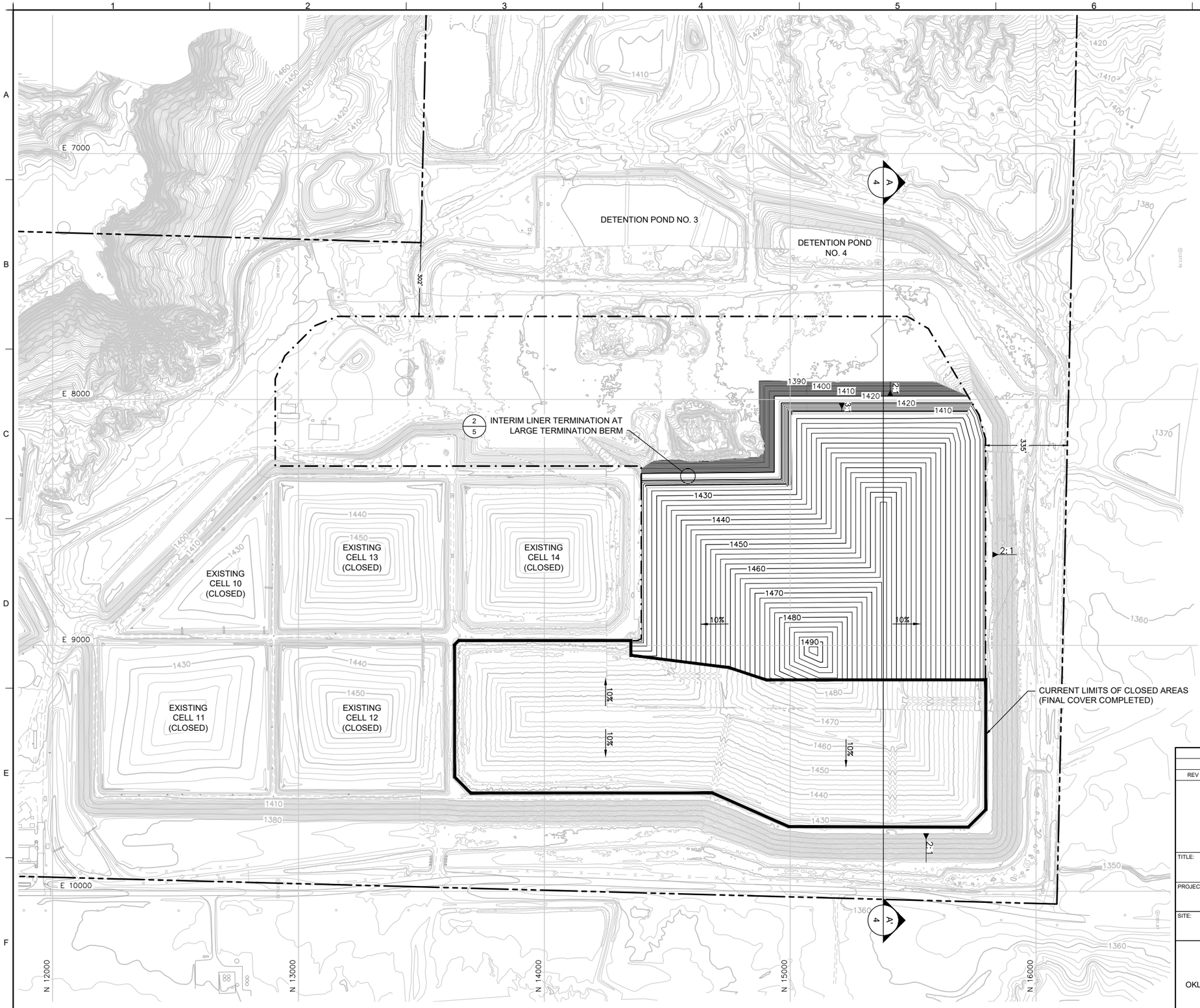


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- EXISTING ROAD
- EXISTING FENCE
- E 8000 N 15000 — HORIZONTAL COORDINATES (NOTE 2)
- PROPERTY BOUNDARY
- PROPOSED LIMIT OF WASTE
- 1400 — PROPOSED TOP OF INTERIM COVER (FEET) (NOTE 3)

0 200' 400'
SCALE IN FEET

NOTES:

1. THE TOPOGRAPHIC BASE MAP SHOWN WAS COMPILED USING AN AERIAL SURVEY DATED 2013 PROVIDED BY JIVIDENS LAND SURVEY CO., INC. AND AERIAL SURVEY DATED 10 OCTOBER 2020. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (MSL).
2. HORIZONTAL COORDINATE VALUES BASED ON A LOCAL COORDINATE SYSTEM ESTABLISHED FOR THIS FACILITY, CONSISTENT WITH PREVIOUS PERMIT AND CONSTRUCTION SUBMITTALS.
3. WITHIN THE LIMIT OF WASTE, PROPOSED CONTOURS REFER TO TOP OF INTERIM COVER ELEVATIONS EXCEPT FOR AREA OUTLINED AS CLOSED COVER. REPRESENTING THE SURFACE ON WHICH THE FINAL COVER SYSTEM WILL BE CONSTRUCTED. OUTSIDE THE LIMIT OF LINER, THE PROPOSED CONTOURS REFER TO FINISHED GRADE.
4. IT IS ANTICIPATED THAT FINAL COVER SYSTEM WILL BE CONSTRUCTED INCREMENTALLY IN PHASES. SEE CELL 15 CLOSURE PLAN FOR ADDITIONAL INFORMATION.

04/15/2022

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TITLE: INTERIM COVER GRADING PLAN THROUGH SUBCELL 14

PROJECT: LANDFILL CELL 15 - PERMIT MODIFICATION

SITE: LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

GEOSYNTEC CONSULTANTS
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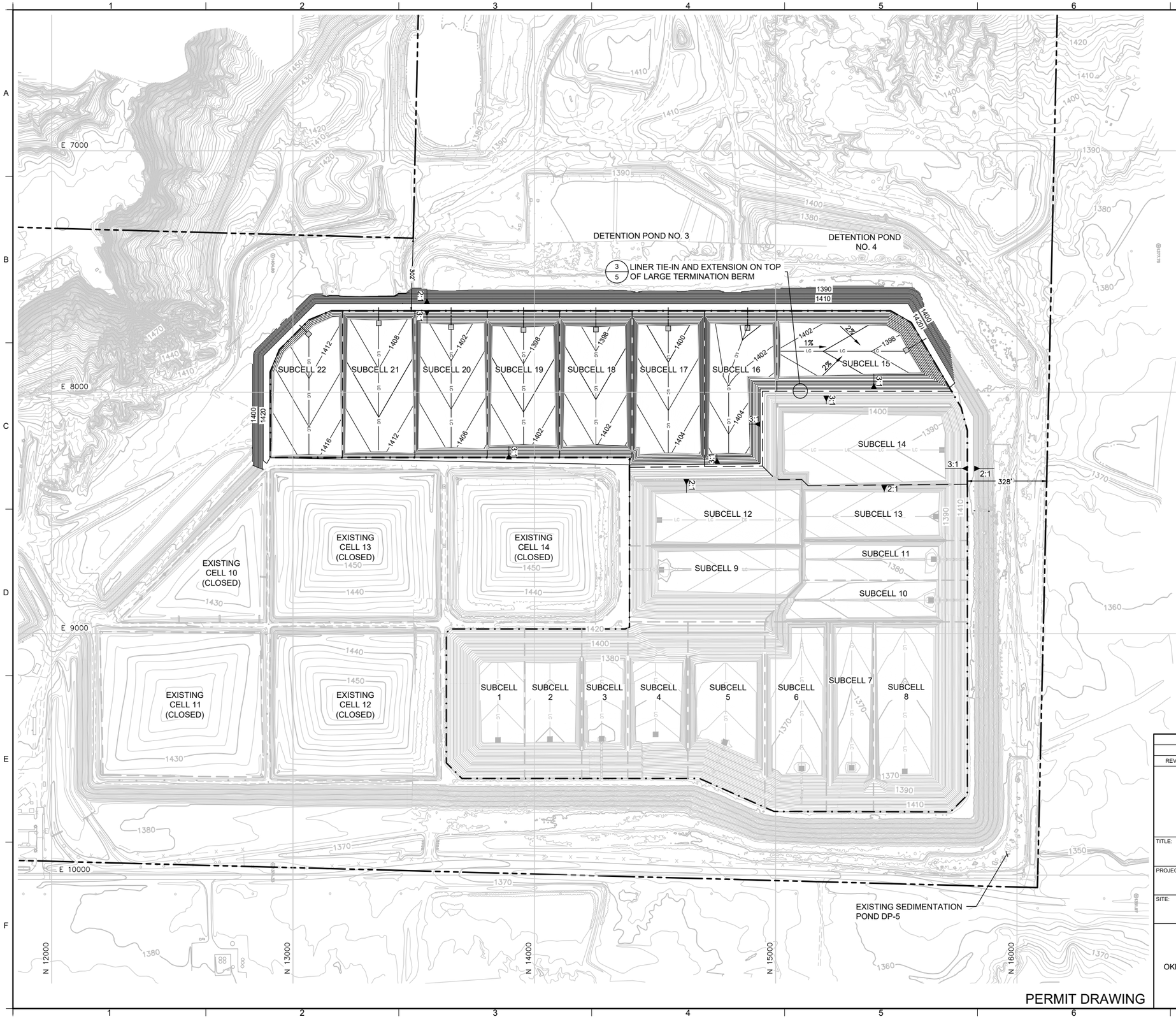


## LEGEND

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| 1400 | EXISTING GROUND ELEVATION (FEET) (NOTE 1) |
| | EXISTING ROAD |
| | EXISTING FENCE |
| E 8000 N 15000 | HORIZONTAL COORDINATES (NOTE 2) |
| | PROPERTY BOUNDARY |
| | PROPOSED LIMIT OF WASTE (CELL 15) (NOTE 3) |
| | PROPOSED PHASE BOUNDARY |
| 1380 | PROPOSED TOP OF LINER ELEVATION (FEET) (NOTE 3) |
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SCALE IN FEET

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04/15/2022

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TITLE: REVISED OVERALL CELL 15 BASE GRADING PLAN

PROJECT: LANDFILL CELL 15 - PERMIT MODIFICATION

SITE: LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

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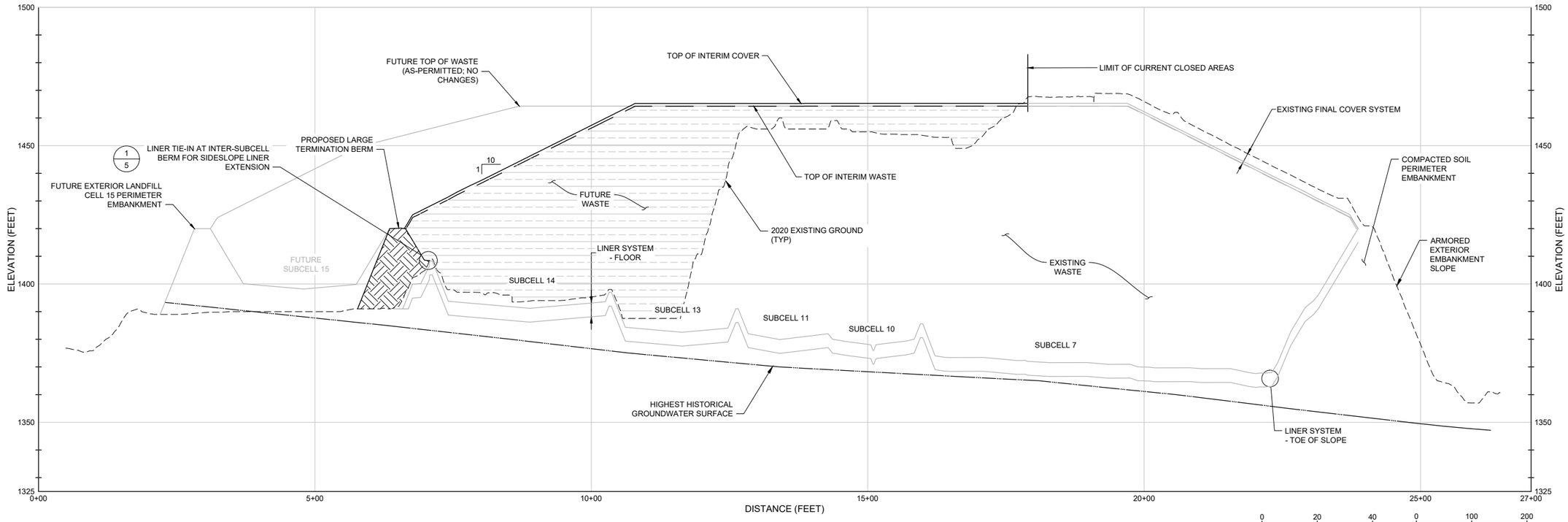


A/2 SECTION
WEST-EAST LANDFILL CROSS-SECTION

04/15/2022

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TITLE: LANDFILL CROSS-SECTION A

PROJECT: LANDFILL CELL 15 - PERMIT MODIFICATION

SITE: LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

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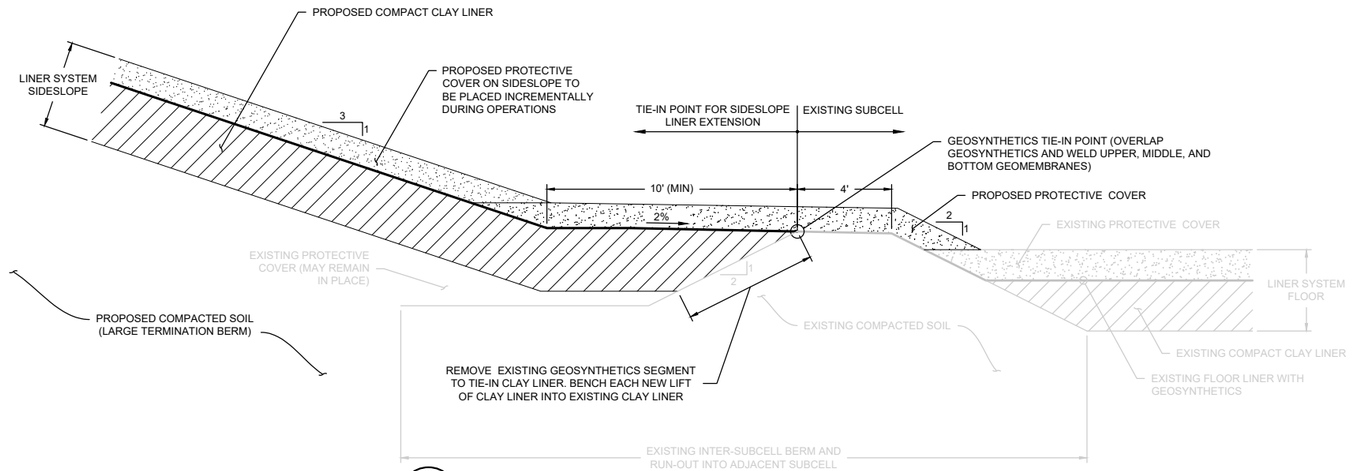


1/1 DETAIL
LINER TIE-IN AT INTER-SUBCELL BERM FOR SIDESLOPE LINER EXTENSION

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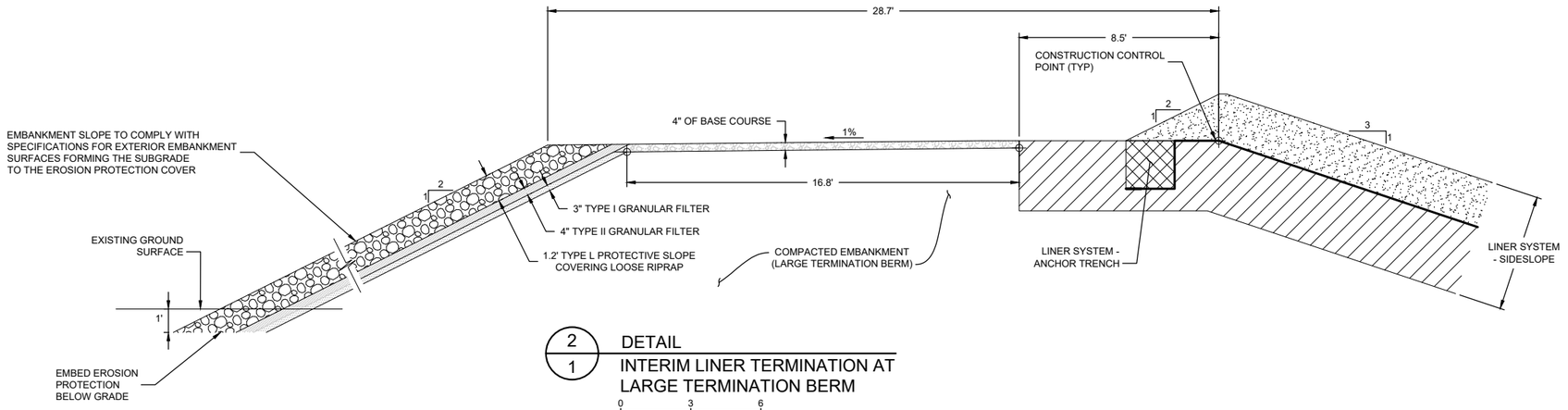
SCALE IN FEET




2/1 DETAIL
INTERIM LINER TERMINATION AT LARGE TERMINATION BERM

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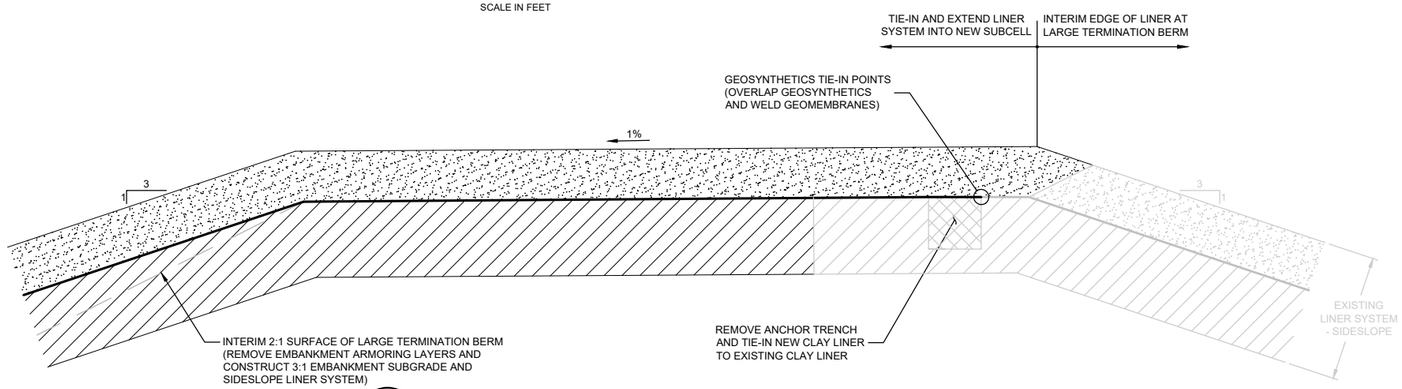
SCALE IN FEET




3/3 DETAIL
LINER TIE-IN AND EXTENSION ON TOP OF LARGE TERMINATION BERM

0 3 6
SCALE IN FEET

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TITLE: ENGINEERING DETAILS

PROJECT: LANDFILL CELL 15 - PERMIT MODIFICATION

SITE: LONE MOUNTAIN FACILITY
WAYNOKA, OKLAHOMA

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| APPROVED BY: | SMG | | |

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