June 2023
0120-662-50-38-02

# REVISION TO NOTICE OF CONSTRUCTION DE 90-C153

## Regional Disposal Company

**ROOSEVELT REGIONAL LANDFILL**
**KLICKITAT COUNTY, WASHINGTON**
**AIR OPERATING PERMIT NO. 14AQ-C182**

PREPARED BY

Weaver Consultants Group

Weaver Consultants Group

June 28, 2023
Project #: 0120-662-50-38-02

Ms. Lynnette Haller
Ecology Central Regional Office – Air Quality Program
WA Department of Ecology
Cashiering Unit
P.O. Box 47611
Olympia, WA 98504-7611

Re: Revision to Notice of Construction Application
NOC DE90-C153, Fifth Revision
Roosevelt Regional Landfill
Klickitat County
Air Operating Permit No. 14AQ-C182

Dear Ms. Haller:

On behalf of Regional Disposal Company, please find enclosed the Notice of Construction (NOC) revision application for the Roosevelt Regional Landfill (Site) located in Klickitat County. The Regional Disposal Company is submitting a revision to NOC DE 90-C153 (Fifth Revision) for municipal solid waste (MSW) landfill and associated traffic, equipment movement, wind erosion, rock crushing, and fugitive landfill gas. This NOC application is submitted pursuant to the Washington Administrative Code (WAC) 173-400-110 to revise the size and emissions from the MSW landfill.

The submittal contains the Washington DOE NOC Application Form, process description and basis of emission estimates, regulatory applicability, State Environmental Policy Act (SEPA) Compliance Review, Best Available Control Technology (BACT) evaluation, Ambient Air Impacts Analysis, site map, process flow diagram, and emission calculations.

The Site is located in an attainment area and is a minor source under the Prevention of Significant Deterioration (PSD) Program. This proposed project is a minor modification and as such will not trigger PSD review.

If you have any questions or comments regarding this submittal, please do not hesitate to contact us.

Sincerely,
**Weaver Consultants Group**

Jonathan Lumang
Project Manager

Melissa Green
Project Director

Attachment: Notice of Construction Revision Application

cc: Art Mains, Regional Disposal Company
James Rivard, Washington State Department of Ecology, Central Regional Office

FedEx

# Hi. Your package was delivered Fri, 07/14/2023 at 10:30am.

Delivered to 1250 W ALDER ST, UNION GAP, WA 98903

Received by M.MARISALA

| | |
|---|---|
| **TRACKING NUMBER** | 772737480930 |
| **FROM** | WEAVER CONSULTANTS GROUP<br>7340 E CALEY AVE, STE 110<br>CENTENNIAL, CO, US, 80111 |
| **TO** | Washington Dept of Ecology<br>Lynnette Haller<br>1250 West Alder Street<br>Central Regional Air Qual Program<br>UNION GAP, WA, US, 98903 |
| **DEPARTMENT NUMBER** | 82244 |
| **INVOICE NUMBER** | 82244 |
| **PURCHASE ORDER NUMBER** | 82244 |
| **REFERENCE** | 0120-662-50-38-02 |
| **SHIPPER REFERENCE** | 0120-662-50-38-02 |
| **SHIP DATE** | Thu 7/13/2023 05:50 PM |
| **DELIVERED TO** | Receptionist/Front Desk |
| **PACKAGING TYPE** | FedEx Pak |
| **ORIGIN** | CENTENNIAL, CO, US, 80111 |
| **DESTINATION** | UNION GAP, WA, US, 98903 |
| **NUMBER OF PIECES** | 1 |
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| **TRACKING NUMBER** | 772737506073 |
| **FROM** | WEAVER CONSULTANTS GROUP<br>7340 E CALEY AVE, STE 110<br>CENTENNIAL, CO, US, 80111 |
| **TO** | Washington Dept of Ecology<br>James Rivard<br>1250 West Alder Street<br>Central Regional Air Qual Section<br>UNION GAP, WA, US, 98903 |
| **DEPARTMENT NUMBER** | 82244 |
| **INVOICE NUMBER** | 82244 |
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| **NUMBER OF PIECES** | 1 |
| **TOTAL SHIPMENT WEIGHT** | 3.00 LB |
| **SERVICE TYPE** | FedEx Standard Overnight |

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# 1 INTRODUCTION

## 1.1 Purpose

The purpose of this Notice of Construction (NOC) Application is to authorize fugitive emissions from the proposed expansion of the Municipal Solid Waste (MSW) Landfill at the Roosevelt Regional Landfill (Site) in Klickitat County, Washington. The site is currently authorized under Air Operating Permit No. 14AQ-C182, which was most recently issued on June 16, 2014. With this revision, the site is proposing to increase its total capacity to 360,000,000 cubic yards (cy) or an equivalent design capacity of 324,000,000 tons.

The site is currently authorized under the following NOCs for different emission units at the site:

1. MSW Landfill – NOC DE90-C153, Fifth Revision
2. Ash Monofill – NOC 93AQ-C163, Fourth Revision
3. LFG Flare – NOC DE98AQ-C131, First Revision (under review)
4. Second LFG Flare – NOC 08AQ-C087, Second Revision (under review)
5. Leachate Pond – No NOC assigned yet (under review)

A completed NOC Application form for the landfill is included in Appendix A.

## 1.2 Facility Description

The site is a MSW landfill owned and operated by Regional Disposal Company and is located in Klickitat County. The Site has an existing active landfill gas collection and control system (GCCS). The GCCS is used to extract landfill gas (LFG) from within the landfill. The extracted LFG is then conveyed to two (2) enclosed flares and/or a third-party energy developer. A site map is provided in Appendix B.

The Site is located in an attainment area and is an existing minor source under the Prevention of Significant Deterioration (PSD) regulations. The proposed project is a minor modification and therefore will not trigger PSD review. The MSW landfill emissions are outlined in Table 1.

# Table 1
# MSW Landfill Fugitive Emissions (tons/year)

| | VOC | TSP[a] | $PM_{10}$[a] | $PM_{2.5}$[a] |
|---|---|---|---|---|
| **Currently Authorized** | 93.6 | 513.3 | 113.2 | 20.7 |
| **Proposed Potential Emissions** | 130.42 | 513.3 | 113.2 | 20.7 |
| **Change in Emissions** [b] | +36.82 | -- | -- | -- |

[a] There are no proposed changes to the particulate matter emissions.
[b] Emissions represent a change in fugitive emissions. Fugitive emissions were updated based on a 80% collection efficiency per current NOC. Fugitive emissions are estimates only and should not be considered as maximum allowable limits.

# 2 PROCESS DESCRIPTION AND BASIS OF EMISSION ESTIMATES

The anaerobic decomposition of organic material in the waste results in the generation of a biogas commonly referred to as landfill gas (LFG). Consisting of approximately 50 percent methane and 50 percent carbon dioxide, LFG also includes other trace compounds and water vapor.

The U.S. Environmental Protection Agency's (EPA's) Landfill Gas Emissions Model (LandGEM) was used to determine the LFG generation for the Site. The landfill's historical waste acceptance data, a methane generation rate of 0.02 $yr^{-1}$ and a methane generation capacity of 100 $m^3/Mg$ were used in the model to determine the potential LFG generation rate. With this revision, the site is proposing to increase its total capacity to 360,000,000 cubic yards (cy) or an equivalent design capacity of 324,000,000 tons.

With commencement of construction of the proposed expansion, the site will become subject to 40 Code of Federal Regulations (CFR) §60, Subpart XXX – Standards of Performance for Municipal Solid Waste Landfills (NSPS).

Based on the modeling results, the projected maximum LFG generation rate for the landfill gas is estimated to be 43,709 standard cubic feet per minute (scfm) at 50% methane in 2079. A copy of the LandGEM inputs and results for methane generation is presented in Appendix D.

The landfill is an existing source which is under a continuous program of construction. This NOC revision is intended to represent and authorize the emissions and sources at the completion of construction and all times during the construction of the landfill.

To estimate the fugitive landfill gas emissions, the site's GCCS is assumed to collect approximately 80% (with remaining 20% to be fugitive) of the LFG generated based on the currently authorized NOC. The landfill fugitive volatile organic compounds (VOC) and hazardous air pollutant (HAP) emissions were estimated using AP-42, Section 2.4 for MSW landfill emissions and are included in Appendix E.

# 3 REGULATORY APPLICABILITY

The applicable standards identified below are for the MSW landfill.

## 3.1 New Source Performance Standards

The New Source Performance Standards (NSPS) were developed by the U. S. Environmental Protection Agency (EPA) for specific source categories. The following section discusses applicable NSPS regulations for the entire site.

### 3.1.1 NSPS (40 CFR 60) Subpart XXX

The site has not commenced construction, reconstruction, or modification after July 17, 2014. Upon approval of the proposed expansion and beginning of construction the Site will be subject to the requirements of NSPS Subpart XXX.

## 3.2 Federal Plan (40 CFR 62) Subpart OOO

The site began construction, reconstruction, or modification on or Before July 17, 2014 and Have Not Been Modified or Reconstructed Since July 17, 2014 and has a design capacity greater than 2.5 million megagrams (Mg) and 2.5 million cubic meters ($m^3$). As such, the site is currently subject to the requirements in Federal Plan Subpart OOO for MSW landfills.

## 3.3 National Emission Standards for Hazardous Air Pollutants

National Emission Standards for Hazardous Air Pollutants (NESHAP) found in 40 CFR Parts 61 and 63 are emission standards for hazardous air pollutants (HAPs) that apply to major sources (facilities that exceed the major source thresholds of 10 tons per year (tpy) of a single HAP and 25 tpy of any combination of HAPs) or specifically designated area sources under Part 63. The Part 63 NESHAPs apply to sources in specifically regulated industrial source classifications (Clean Air Act Section 112(d)) or on a case-by-case basis (Clean Air Act Sections 112(g) and 112(j)) where EPA has failed to promulgate a 112(d) standard. The following section discusses applicable NESHAP regulations for the entire site.

### 3.3.1 NESHAP (40 CFR 61) Subpart M

40 CFR Part 61 Subpart M, Section 61.154, Standards for Active Waste Disposal Sites, require each owner or operator of an active waste disposal site that receives asbestos

containing waste material to meet the requirements of the section. Roosevelt Regional Landfill receives asbestos containing materials and is therefore subject to this subpart.

### 3.3.2 NESHAP (40 CFR 63) Subpart AAAA

The estimated NMOC emissions from the site are greater than 50 Mg/yr and is therefore subject to NESHAP Subpart AAAA.

# 4 STATE ENVIRONMENTAL POLICY ACT COMPLIANCE REVIEW

The Washington DOE requires all NOC Applications to review State Environmental Policy Act (SEPA) Compliance.

A SEPA Environmental Impact Statement (EIS) was prepared for the landfill expansion in November 2022, which is attached in Appendix G.

# 5 BEST AVAILABLE CONTROL TECHNOLOGY EVALUATION

The Washington DOE requires all NOC Applications to address Best Available Control Technology (BACT) employed for each emission source to minimize emissions.

The site currently has two (2) enclosed flares which are considered a BACT for landfills to control and minimize emissions. Future flares in anticipation of the proposed expansion will be phased in based on estimated landfill gas generation at the site, and as such this modification to the NOC does not require further BACT analysis.

# 6 AMBIENT AIR IMPACTS ANALYSIS

The Washington DOE requires all NOC Applications to perform an ambient air impacts analysis for each emission source. As such, an ambient air impact analysis was performed for the pollutants released from the leachate ponds.

Given that this NOC addresses fugitive emissions, there are no criteria air pollutants in this project listed under the National Ambient Air Quality Standards (NAAQS) and Washington Ambient Air Quality Standards (WAAQS). The Washington DOE Guidance Document titled “Ambient Air Impacts Analyses” (ECY 070-410e) was used to perform the Ambient Air Impacts Analysis for the Toxic Air Pollutants (TAPs).

Potential emissions from the project were compared to the *de minimis* emission levels specified in WAC 173-460-150 as shown in Table 1. TAPs that exceed their respective *de minimis* emission levels require further analysis as discussed below. No further analysis is required for the TAPs that are below their respective *de minimis* emission levels.

TAPs that exceed their *de minimis* emission levels were also compared to the Small Quantity Emission Rate (SQERs) specified in WAC 173-460-150 also shown in Table 1. TAPs that exceed their respective SQER require further analysis as discussed below. No further analysis is required for the TAPs that are below their respective SQER.

**Table 1.** *de minimis* Emission Level and Small Quantity Emission Rate (SQER) Comparison Demonstration

| Pollutant | Emissions | *de minimis* Emission Levels | Below *de minimis?* | SQER | Below SQER? |
|---|---|---|---|---|---|
| 1,2,3-Trimethylbenzene | 0.53 lb/day | 0.22 lb/day | **NO** | 4.40 lb/day | **YES** |
| 1,2,4-Trimethylbenzene | 3.35 lb/day | 0.22 lb/day | **NO** | 4.40 lb/day | **YES** |
| 1,2-Dichloroethane | 151.85 lb/yr | 0.31 lb/yr | **NO** | 6.20 lb/yr | **NO** |
| 1,3,5-Trimethylbenzene | 1.40 lb/day | 0.22 lb/day | **NO** | 4.40 lb/day | **YES** |
| 1,4-Dichlorobenzene | 261.44 lb/yr | 0.74 lb/yr | **NO** | 15.00 lb/yr | **NO** |
| 1,4-Dioxane | 31.64 lb/yr | 1.60 lb/yr | **NO** | 32.00 lb/yr | **YES** |
| 2-Propanol (Isopropyl alcohol) | 0.61 lb/hr | 0.30 lb/hr | **NO** | 5.90 lb/hr | **YES** |
| Benzene | 587.22 lb/yr | 1.00 lb/yr | **NO** | 21.00 lb/yr | **NO** |
| Carbon Disulfide | 0.23 lb/day | 3.00 lb/day | **YES** | -- | -- |
| Carbonyl Sulfide | 0.86 lb/day | 0.04 lb/day | **NO** | 0.74 lb/day | **NO** |
| Chlorobenzene | 0.14 lb/day | 3.70 lb/day | **YES** | -- | -- |

| Pollutant | Emissions | *de minimis* Emission Levels | Below *de minimis?* | SQER | Below SQER? |
|---|---|---|---|---|---|
| Chlorodifluoromethane | 0.26 lb/day | 190.00 lb/day | **YES** | -- | -- |
| Chloroethane (ethyl chloride) | 0.07 lb/day | 110.00 lb/day | **YES** | -- | -- |
| Cumene (Isopropylbenzene) | 0.66 lb/day | 1.50 lb/day | **YES** | -- | -- |
| Cyclohexane | 1.14 lb/day | 22.00 lb/day | **YES** | -- | -- |
| Ethylbenzene | 3335.35 lb/yr | 3.20 lb/yr | **NO** | 65.00 lb/yr | **NO** |
| Hexane | 1.20 lb/day | 2.60 lb/day | **YES** | -- | -- |
| Hydrogen Sulfide | 63.65 lb/day | 0.0074 lb/day | **NO** | 0.15 lb/day | **NO** |
| m & p Xylenes | 19.66 lb/day | 0.82 lb/day | **NO** | 16.00 lb/day | **NO** |
| Methanol | 10.61 lb/day | 74.00 lb/day | **YES** | -- | -- |
| Methyl butyl ketone | 0.19 lb/day | 0.11 lb/day | **NO** | 2.20 lb/day | **YES** |
| Methyl Ethyl Ketone | 19.67 lb/day | 19.00 lb/day | **NO** | 370.00 lb/day | **YES** |
| Methyl Isobutyl Ketone | 2.46 lb/day | 11.00 lb/day | **YES** | -- | -- |
| Methylene Dichloride | 85.77 lb/yr | 490.00 lb/yr | **YES** | -- | -- |
| Naphthalene | 1991.87 lb/yr | 0.24 lb/yr | **NO** | 4.80 lb/yr | **NO** |
| n-Hexane | 0.97 lb/day | 2.60 lb/day | **YES** | -- | -- |
| o-Xylene | 6.15 lb/day | 0.82 lb/day | **NO** | 16.00 lb/day | **YES** |
| Perchloroethylene (tetrachloroethylene) | 420.53 lb/yr | 1.30 lb/yr | **NO** | 27.00 lb/yr | **NO** |
| Styrene | 0.85 lb/day | 3.20 lb/day | **YES** | -- | -- |
| Tetrahydrofuran | 5.15 lb/day | 7.40 lb/day | **YES** | -- | -- |
| Toluene | 22.87 lb/day | 19.00 lb/day | **NO** | 370.00 lb/day | **YES** |
| Trichloroethylene (trichloroethene) | 112.79 lb/yr | 1.70 lb/yr | **NO** | 34.00 lb/yr | **NO** |
| Vinyl Chloride | 38.40 lb/yr | 0.92 lb/yr | **NO** | 18.00 lb/yr | **NO** |

Table 2 below shows TAPs that exceed their SQER, and as such, AERSCREEN was used to determine if the maximum ground level concentrations ($GLC_{max}$) are below their respective acceptable source impact level (ASIL) specified in WAC 173-460-150. A unitary model (1 lb/hr) was used to run AERSCREEN. Inputs used are all default or conservative estimates as shown in Appendix F. TAPs that exceed their respective ASIL after AERSCREEN require further analysis as discussed below. No further analysis is required for the TAPs that are below their respective ASIL using AERSCREEN. AERSCREEN results can be found in Appendix F.

**Table 2.** Acceptable Source Impact Level (ASIL) Comparison Demonstration using AERSCREEN

| Pollutant | $GLC_{max}$ (µg/m³) | ASIL (µg/m³) | Averaging Period | Below ASIL? |
|---|---|---|---|---|
| 1,2-Dichloroethane (ethylene dichloride) | 0.10 | 0.04 | Year | **NO** |
| 1,4-Dichlorobenzene | 0.17 | 0.09 | Year | **NO** |
| Benzene | 0.39 | 0.13 | Year | **NO** |

| Pollutant | $GLC_{max}$ (µg/m³) | ASIL (µg/m³) | Averaging Period | Below ASIL? |
|---|---|---|---|---|
| Carbonyl Sulfide | 0.21 | 10.00 | 24-hr | **YES** |
| Ethylbenzene | 2.20 | 0.40 | Year | **NO** |
| Hydrogen Sulfide | 15.30 | 2.00 | 24-hr | **NO** |
| m & p Xylenes | 4.73 | 220.00 | 24-hr | **YES** |
| Naphthalene | 1.31 | 0.03 | Year | **NO** |
| Perchloroethylene (tetrachloroethylene) | 0.28 | 0.16 | Year | **NO** |
| Trichloroethylene (trichloroethene) | 0.07 | 0.21 | Year | **YES** |
| Vinyl Chloride | 0.03 | 11.00 | Year | **YES** |

Given that the following TAPs exceed their ASIL using AERSCREEN, the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) was further used to determine if the $GLC_{max}$ are below their respective ASIL. As shown in Table 3 below, ammonia and naphthalene are below their ASIL, and no further analysis is required. Full AERMOD results and a report can be found in Appendix F.

**Table 3.** Acceptable Source Impact Level (ASIL) Comparison Demonstration using AERMOD

| Pollutant | $GLC_{max}$ (µg/m³) | ASIL (µg/m³) | Averaging Period | Below ASIL? |
|---|---|---|---|---|
| 1,2-Dichloroethane (ethylene dichloride) | 0.00354 | 0.038 | Year | **YES** |
| 1,4-Dichlorobenzene | 0.00530 | 0.091 | Year | **YES** |
| Benzene | 0.01238 | 0.13 | Year | **YES** |
| Ethylbenzene | 0.06718 | 0.40 | Year | **YES** |
| Hydrogen Sulfide ($H_2S$)* | 1.97540 | 2.00 | 24-hr | **YES** |
| Naphthalene* | 0.02829 | 0.029 | Year | **YES** |
| Perchloroethylene (tetrachloroethylene) | 0.00884 | 0.16 | Year | **YES** |

**The ability of landfill cover soils to reduce levels of $H_2S$ and methane in landfill gas is widely-accepted and has been tested in the laboratory and in the field in many studies. Specifically, landfill cover soils reduce $H_2S$ and methane levels in landfill gas through a process of sorption and conversion, whereby gas molecules adsorb to the surfaces of landfill cover soils and convert to minerals through reactions with alkaline materials in the soil. As such, fugitive emissions for $H_2S$ and naphthalene for the proposed expansion have been reduced by 60% and 30%, respectively.*

# APPENDIX A

# NOTICE OF CONSTRUCTION APPLICATION FORM

# Notice of Construction Application

A notice of construction permit is required before installing a new source of air pollution or modifying an existing source of air pollution. This application applies to facilities in Ecology's jurisdiction. Submit this application for review of your project. For general information about completing the application, refer to Ecology Forms ECY 070-410a-g, "Instructions for Ecology's Notice of Construction Application."

Ecology offers up to two hours of free pre-application assistance. We encourage you to schedule a pre-application meeting with the contact person specified for the location of your proposal, below. If you use up your two hours of free pre-application assistance, we will continue to assist you after you submit Part 1 of the application and the application fee. You may schedule a meeting with us at any point in the process.

Upon completion of the application, please enclose a check for the initial fee and mail to:

**Department of Ecology**
**Cashiering Unit**
**P.O. Box 47611**
**Olympia, WA 98504-7611**

*For Fiscal Office Use Only:*
001-NSR-216-0299-000404

| **Check the box for the location of your proposal.** For assistance, call the contact listed below: | | |
|---|---|---|
| | **Ecology Permitting Office** | **Contact** |
| ☒ CRO | **Chelan, Douglas, Kittitas, Klickitat, or Okanogan County**<br>Ecology Central Regional Office – Air Quality Program | Lynnette Haller<br>(509) 457-7126<br>lynnette.haller@ecy.wa.gov |
| ☐ ERO | **Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla or Whitman County**<br>Ecology Eastern Regional Office – Air Quality Program | Karin Baldwin<br>(509) 329-3452<br>karin.baldwin@ecy.wa.gov |
| ☐ NWRO | **San Juan County**<br>Ecology Northwest Regional Office – Air Quality Program | David Adler<br>(425) 649-7267<br>david.adler@ecy.wa.gov |
| ☐ IND | **For actions taken at Kraft and Sulfite Paper Mills and Aluminum Smelters**<br>Ecology Industrial Section – Waste 2 Resources Program<br>Permit manager: ____________________ | James DeMay<br>(360) 407-6868<br>james.demay@ecy.wa.gov |
| ☐ NWP | **For actions taken on the US Department of Energy Hanford Reservation**<br>Ecology Nuclear Waste Program | Lilyann Murphy<br>(509) 372-7951<br>lilyann.murphy@ecy.wa.gov |

Check the box below for the fee that applies to your application.

# Notice of Construction Application

**New project or equipment:**

| | |
|---|---|
| ☐ | **$1,500: Basic project** initial fee covers up to 16 hours of review. |
| ☐ | **$10,000: Complex project** initial fee covers up to 106 hours of review. |

**Change to an existing permit or equipment:**

| | |
|---|---|
| ☐ | **$200: Administrative or simple change** initial fee covers up to 3 hours of review<br>Ecology may determine your change is complex during completeness review of your application. If your project is complex, you must pay the additional $675 before we will continue working on your application. |
| ☒ | **$875: Complex change** initial fee covers up to 10 hours of review |
| ☐ | **$350** flat fee: **Replace or alter control technology equipment under WAC 173-400-114**<br>Ecology will contact you if we determine your change belongs in another fee category. You must pay the fee associated with that category before we will continue working on your application. |

Read each statement, then check the box next to it to acknowledge that you agree.

| | |
|---|---|
| ☒ | The initial fee you submitted may not cover the cost of processing your application. Ecology will track the number of hours spent on your project. If the number of hours Ecology spends exceeds the hours included in your initial fee, Ecology will bill you $95 per hour for the extra time. |
| ☒ | You must include all information requested by this application. Ecology may not process your application if it does not include all the information requested. |
| ☒ | Submittal of this application allows Ecology staff to visit and inspect your facility. |

DEPARTMENT OF ECOLOGY
State of Washington

# Notice of Construction Application

## Part 1: General Information

### I. Project, Facility, and Company Information

| |
|---|
| 1. Project Name<br>Roosevelt Regional Landfill |
| 2. Facility Name<br>Roosevelt Regional Landfill |
| 3. Facility Street Address<br>500 Roosevelt Grade Rd, Roosevelt, WA 99356 |
| 4. Facility Legal Description<br>The source is located at 500 Roosevelt Grade Road, in Roosevelt Washington within Sections 22, 23, 26, 27, 28, 33, and 34, Township 4 North, Range 21 East, W.M., Klickitat County. |
| 5. Company Legal Name (if different from Facility Name)<br>Regional Disposal Company |
| 6. Company Mailing Address (street, city, state, zip)<br>P.O. Box 338, Roosevelt, WA 99356 |

### II. Contact Information and Certification

| | |
|---|---|
| 1. Facility Contact Name (who will be onsite)<br>Art Mains | |
| 2. Facility Contact Mailing Address (if different than Company Mailing Address) | |
| 3. Facility Contact Phone Number<br>509-581-0466 | 4. Facility Contact E-mail<br>amains@republicservices.com |
| 5. Billing Contact Name (who should receive billing information)<br>Art Mains | |
| 6. Billing Contact Mailing Address (if different than Company Mailing Address) | |
| 7. Billing Contact Phone Number<br>509-581-0466 | 8. Billing Contact E-mail<br>amains@republicservices.com |
| 9. Consultant Name (optional – if 3rd party hired to complete application elements)<br>Melissa Green | |
| 10. Consultant Organization/Company<br>Weaver Consultants Group | |
| 11. Consultant Mailing Address (street, city, state, zip)<br>7430 E Caley Ave, Suite 110, Centennial, CO 80111 | |
| 12. Consultant Phone Number<br>720-529-0132 | 13.Consultant E-mail<br>mgreen@wcgrp.com |
| 14. Responsible Official Name and Title (who is responsible for project policy or decision-making)<br>Jeff Barcenas, General Manager | |
| 16. Responsible Official Phone<br>509-203-2061 | 17. Responsible Official E-mail<br>jbarcenas@republicservices.com |
| 18. Responsible Official Certification and Signature<br>I certify that the information on this application is accurate and complete.<br>Signature [signature] Date 6/28/23 | |


To request ADA accommodation, call (360) 407-6800, 711 (relay service), or 877-833-6341(TTY).

DEPARTMENT OF ECOLOGY
State of Washington

# Notice of Construction Application

## Part 2: Technical Information

The Technical Information may be sent with this application form to the Cashiering Unit, or may be sent directly to the Ecology regional office with jurisdiction along with a copy of this application form.

For all sections, check the box next to each item as you complete it.

### III. Project Description

Please attach the following to your application.

- ☒ Written narrative describing your proposed project.
- ☒ Projected construction start and completion dates.
- ☐ Operating schedule and production rates.
- ☐ List of all major process equipment with manufacturer and maximum rated capacity.
- ☒ Process flow diagram with all emission points identified.
- ☒ Plan view site map.

- ☐ Manufacturer specification sheets for major process equipment components.
- ☐ Manufacturer specification sheets for pollution control equipment.
- ☐ Fuel specifications, including type, consumption (per hour & per year) and percent sulfur.

### IV. State Environmental Policy Act (SEPA) Compliance

**Check the appropriate box below.**

☒ SEPA review is complete:
Include a copy of the final SEPA checklist and SEPA determination (e.g., DNS, MDNS, EIS) with your application.

☐ SEPA review has not been conducted:

☐ If review will be conducted by another agency, list the agency. You must provide a copy of the final SEPA checklist and SEPA determination before Ecology will issue your permit.
Agency Reviewing SEPA:

______________________________________________

☐ If the review will be conducted by Ecology, fill out a SEPA checklist and submit it with your application. You can find a SEPA checklist online at https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-document-templates

# Notice of Construction Application

## V. Emissions Estimations of Criteria Pollutants

**Does your project generate criteria air pollutant emissions?** ☒ Yes ☐ No

If yes, please provide the following information regarding your criteria emissions in your application.

☒ The names of the criteria air pollutants emitted (i.e., $NO_x$, $SO_2$, CO, $PM_{2.5}$, $PM_{10}$, TSP, VOC, and Pb)

☒ Potential emissions of criteria air pollutants in tons per hour, tons per day, and tons per year (include calculations)

☒ If there will be any fugitive criteria pollutant emissions, clearly identify the pollutant and quantity

## VI. Emissions Estimations of Toxic Air Pollutants

**Does your project generate toxic air pollutant emissions?** ☒ Yes ☐ No

If yes, please provide the following information regarding your toxic air pollutant emissions in your application.

☒ The names of the toxic air pollutants emitted (specified in WAC 173-460-150[1])

☒ Potential emissions of toxic air pollutants in pounds per hour, pounds per day, and pounds per year (include calculations)

☒ If there will be any fugitive toxic air pollutant emissions, clearly identify the pollutant and quantity

## VII. Emission Standard Compliance

☒ Provide a list of all applicable new source performance standards, national emission standards for hazardous air pollutants, national emission standards for hazardous air pollutants for source categories, and emission standards adopted under Chapter 70.94 RCW.
**Does your project comply with all applicable standards identified?** ☒ Yes ☐ No

## VIII. Best Available Control Technology

☒ Provide a complete evaluation of Best Available Control Technology (BACT) for your proposal.

[1] http://apps.leg.wa.gov/WAC/default.aspx?cite=173-460-150

DEPARTMENT OF ECOLOGY
State of Washington

# Notice of Construction Application

## IX. Ambient Air Impacts Analyses

Please provide the following:

☐ Ambient air impacts analyses for Criteria Air Pollutants (including fugitive emissions)

☒ Ambient air impacts analyses for Toxic Air Pollutants (including fugitive emissions)

☒ Discharge point data for each point included in air impacts analyses (include only if modeling is required)

- ☐ Exhaust height
- ☐ Exhaust inside dimensions (ex. diameter or length and width)
- ☐ Exhaust gas velocity or volumetric flow rate
- ☐ Exhaust gas exit temperature
- ☒ The volumetric flow rate
- ☐ Description of the discharges (i.e., vertically or horizontally) and whether there are any obstructions (ex., raincap)
- ☐ Identification of the emission unit(s) discharging from the point
- ☐ The distance from the stack to the nearest property line
- ☐ Emission unit building height, width, and length
- ☐ Height of tallest building on-site or in the vicinity and the nearest distance of that building to the exhaust
- ☒ Whether the facility is in an urban or rural location

**Does your project cause or contribute to a violation of any ambient air quality standard or acceptable source impact level?** ☐ Yes ☒ No

# APPENDIX B

# SITE MAP

N

0 500 1000
SCALE IN FEET

LEGEND

- PROPERTY BOUNDARY LINE ITEM 3(a): 1890
- PERMITTED LIMITS OF WASTE LINE ITEM 5(a) 915
- LIMITS OF EXISTING WASTE LINE ITEM 8(a): 404.8

NOTES:

1. AERIAL PHOTOGRAPH PREPARED BY FIRMATEK, LLC. FROM AERIAL PHOTOGRAPHY FLOWN OCTOBER 17, 2022.

| | |
|---|---|
| ☐ DRAFT | |
| ☒ FOR PERMITTING PURPOSES ONLY | |
| ☐ ISSUED FOR REVIEW | |
| DATE: 06/2023 | DRAWN BY: RSB |
| FILE: 0120-662-50-37-00 | DESIGN BY: JSE |
| CAD: 01-2022 AERIAL PHOTO.DWG | REVIEWED BY: WCH |

Weaver Consultants Group

PREPARED FOR
REGIONAL DISPOSAL COMPANY

REVISIONS

| NO. | DATE | DESCRIPTION |
|---|---|---|
| | | |

SITE MAP

ROOSEVELT REGIONAL LANDFILL
KLICKITAT COUNTY, WASHINGTON

WWW.WCGRP.COM

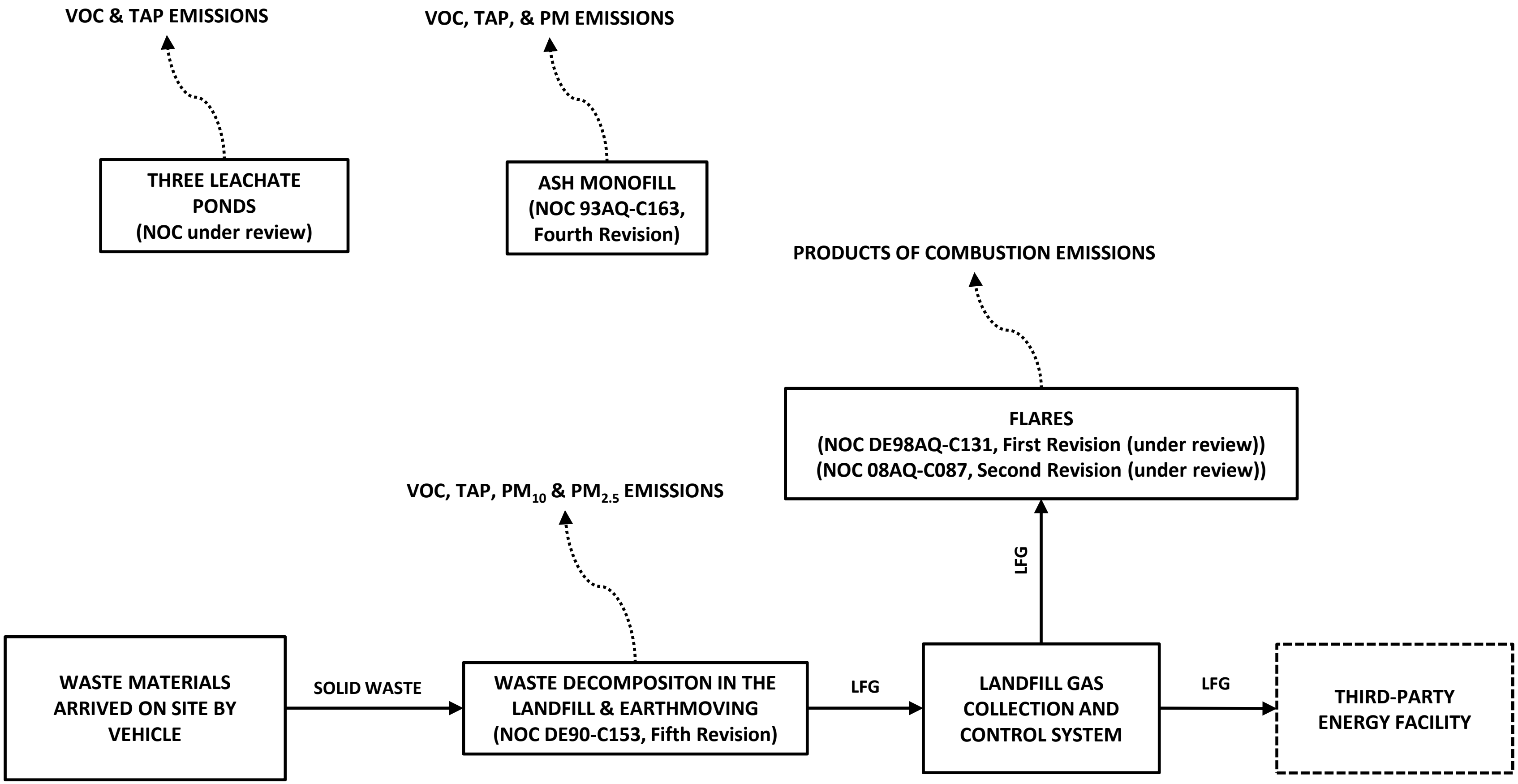
DRAWING 01



P:\LFG\Projects\Allied-BFI\Roosevelt Landfill\2023 Vertical Expansion\01-2022 Aerial Photo.dwg, jlumang

# APPENDIX C

# PROCESS FLOW DIAGRAM




**NOTICE OF CONSTRUCTION APPLICATION**
**PROCESS FLOW DIAGRAM**
**MUNICIPAL SOLID WASTE LANDFILL**

ROOSEVELT REGIONAL LANDFILL
KLICKITAT COUNTY, WASHINGTON
JUNE 2023

Weaver Consultants Group
6420 Southwest Blvd. Suite 206
Fort Worth, TX 76109
(817) 735-9770

**FIGURE 1**

# APPENDIX D

# EPA LANDFILL GAS EMISSIONS MODEL INPUTS AND RESULTS

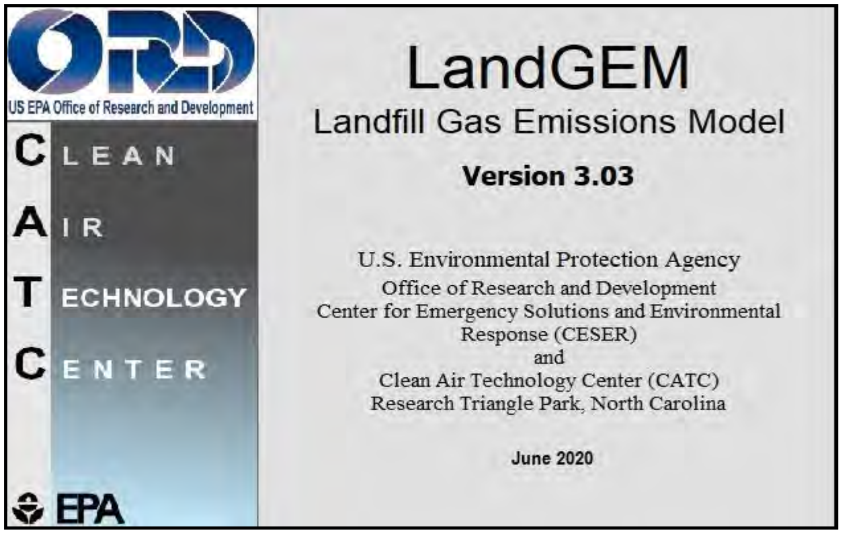
# ESTIMATED METHANE GENERATION RATE

ROOSEVELT REGIONAL LANDFILL - KLICKITAT COUNTY, WASHINGTON

| Year | Waste Accepted (Mg/yr) | Waste In-Place (Mg) | Methane Generation | | |
|---|---|---|---|---|---|
| | | | Run 1 ($m^3$/yr) | Run 2 ($m^3$/yr) | Combined ($m^3$/yr) |
| 1990 | 951 | 0 | 0 | | 0 |
| 1991 | 12,317 | 951 | 1,885 | | 1,885 |
| 1992 | 232,457 | 13,268 | 26,261 | | 26,261 |
| 1993 | 422,881 | 245,725 | 486,497 | | 486,497 |
| 1994 | 701,862 | 668,606 | 1,315,062 | | 1,315,062 |
| 1995 | 872,433 | 1,370,468 | 2,680,192 | | 2,680,192 |
| 1996 | 978,088 | 2,242,901 | 4,356,382 | | 4,356,382 |
| 1997 | 1,072,472 | 3,220,989 | 6,208,802 | | 6,208,802 |
| 1998 | 1,075,774 | 4,293,461 | 8,211,620 | | 8,211,620 |
| 1999 | 1,357,672 | 5,369,235 | 10,181,325 | | 10,181,325 |
| 2000 | 990,994 | 6,726,907 | 12,670,782 | | 12,670,782 |
| 2001 | 1,115,501 | 7,717,901 | 14,384,146 | | 14,384,146 |
| 2002 | 1,211,313 | 8,833,402 | 16,310,370 | | 16,310,370 |
| 2003 | 1,130,491 | 10,044,715 | 18,388,363 | | 18,388,363 |
| 2004 | 1,158,394 | 11,175,206 | 20,265,010 | | 20,265,010 |
| 2005 | 1,073,269 | 12,333,600 | 22,159,805 | | 22,159,805 |
| 2006 | 1,213,359 | 13,406,869 | 23,848,352 | | 23,848,352 |
| 2007 | 1,344,293 | 14,620,228 | 25,781,138 | | 25,781,138 |
| 2008 | 1,242,073 | 15,964,521 | 27,935,179 | | 27,935,179 |
| 2009 | 1,170,570 | 17,206,594 | 29,843,955 | | 29,843,955 |
| 2010 | 1,135,604 | 18,377,164 | 31,573,208 | | 31,573,208 |
| 2011 | 1,114,064 | 19,512,768 | 33,198,912 | | 33,198,912 |
| 2012 | 1,120,974 | 20,626,832 | 34,749,731 | | 34,749,731 |
| 2013 | 1,171,632 | 21,747,806 | 36,283,538 | | 36,283,538 |
| 2014 | 1,203,602 | 22,919,438 | 37,887,383 | | 37,887,383 |
| 2015 | 1,096,499 | 24,123,040 | 39,522,838 | | 39,522,838 |
| 2016 | 1,153,560 | 25,219,539 | 40,913,619 | | 40,913,619 |
| 2017 | 1,246,732 | 26,373,099 | 42,389,962 | | 42,389,962 |
| 2018 | 1,412,654 | 27,619,831 | 44,021,749 | | 44,021,749 |
| 2019 | 1,426,781 | 29,032,485 | 45,950,100 | | 45,950,100 |
| 2020 | 1,442,995 | 30,459,266 | 47,868,268 | | 47,868,268 |
| 2021 | 1,407,043 | 31,902,261 | 49,780,593 | | 49,780,593 |
| 2022 | 4,535,000 | 33,309,304 | 51,583,791 | | 51,583,791 |
| 2023 | 4,535,000 | 37,844,304 | 59,551,248 | | 59,551,248 |
| 2024 | 4,535,000 | 42,379,304 | 67,360,939 | | 67,360,939 |
| 2025 | 4,535,000 | 46,914,304 | 75,015,987 | | 75,015,987 |
| 2026 | 4,535,000 | 51,449,304 | 82,519,456 | | 82,519,456 |
| 2027 | 4,535,000 | 55,984,304 | 89,874,346 | | 89,874,346 |
| 2028 | 4,535,000 | 60,519,304 | 97,083,599 | | 97,083,599 |
| 2029 | 4,535,000 | 65,054,304 | 104,150,099 | | 104,150,099 |
| 2030 | 4,535,000 | 69,589,304 | 111,076,674 | | 111,076,674 |
| 2031 | 4,535,000 | 74,124,304 | 117,866,093 | | 117,866,093 |
| 2032 | 4,535,000 | 78,659,304 | 124,521,072 | | 124,521,072 |
| 2033 | 4,535,000 | 83,194,304 | 131,044,274 | | 131,044,274 |
| 2034 | 4,535,000 | 87,729,304 | 137,438,308 | | 137,438,308 |
| 2035 | 4,535,000 | 92,264,304 | 143,705,732 | | 143,705,732 |
| 2036 | 4,535,000 | 96,799,304 | 149,849,053 | | 149,849,053 |

## ESTIMATED METHANE GENERATION RATE
ROOSEVELT REGIONAL LANDFILL - KLICKITAT COUNTY, WASHINGTON

| Year | Waste Accepted (Mg/yr) | Waste In-Place (Mg) | Methane Generation | | |
|---|---|---|---|---|---|
| | | | Run 1 ($m^3$/yr) | Run 2 ($m^3$/yr) | Combined ($m^3$/yr) |
| 2037 | 4,535,000 | 101,334,304 | 155,870,727 | | 155,870,727 |
| 2038 | 4,535,000 | 105,869,304 | 161,773,164 | | 161,773,164 |
| 2039 | 4,535,000 | 110,404,304 | 167,558,726 | | 167,558,726 |
| 2040 | 4,535,000 | 114,939,304 | 173,229,725 | | 173,229,725 |
| 2041 | 4,535,000 | 119,474,304 | 178,788,431 | | 178,788,431 |
| 2042 | 4,535,000 | 124,009,304 | 184,237,068 | | 184,237,068 |
| 2043 | 4,535,000 | 128,544,304 | 189,577,814 | | 189,577,814 |
| 2044 | 4,535,000 | 133,079,304 | 194,812,806 | | 194,812,806 |
| 2045 | 4,535,000 | 137,614,304 | 199,944,139 | | 199,944,139 |
| 2046 | 4,535,000 | 142,149,304 | 204,973,864 | | 204,973,864 |
| 2047 | 4,535,000 | 146,684,304 | 209,903,994 | | 209,903,994 |
| 2048 | 4,535,000 | 151,219,304 | 214,736,501 | | 214,736,501 |
| 2049 | 4,535,000 | 155,754,304 | 219,473,318 | | 219,473,318 |
| 2050 | 4,535,000 | 160,289,304 | 224,116,340 | | 224,116,340 |
| 2051 | 4,535,000 | 164,824,304 | 228,667,424 | | 228,667,424 |
| 2052 | 4,535,000 | 169,359,304 | 233,128,390 | | 233,128,390 |
| 2053 | 4,535,000 | 173,894,304 | 237,501,023 | | 237,501,023 |
| 2054 | 4,535,000 | 178,429,304 | 241,787,072 | | 241,787,072 |
| 2055 | 4,535,000 | 182,964,304 | 245,988,252 | | 245,988,252 |
| 2056 | 4,535,000 | 187,499,304 | 250,106,243 | | 250,106,243 |
| 2057 | 4,535,000 | 192,034,304 | 254,142,692 | | 254,142,692 |
| 2058 | 4,535,000 | 196,569,304 | 258,099,214 | | 258,099,214 |
| 2059 | 4,535,000 | 201,104,304 | 261,977,392 | | 261,977,392 |
| 2060 | 4,535,000 | 205,639,304 | 265,778,776 | | 265,778,776 |
| 2061 | 4,535,000 | 210,174,304 | 269,504,888 | | 269,504,888 |
| 2062 | 4,535,000 | 214,709,304 | 273,157,219 | | 273,157,219 |
| 2063 | 4,535,000 | 219,244,304 | 276,737,228 | | 276,737,228 |
| 2064 | 4,535,000 | 223,779,304 | 280,246,348 | | 280,246,348 |
| 2065 | 4,535,000 | 228,314,304 | 283,685,983 | | 283,685,983 |
| 2066 | 4,535,000 | 232,849,304 | 287,057,509 | | 287,057,509 |
| 2067 | 4,535,000 | 237,384,304 | 290,362,274 | | 290,362,274 |
| 2068 | 4,535,000 | 241,919,304 | 293,601,600 | | 293,601,600 |
| 2069 | 4,535,000 | 246,454,304 | 296,776,784 | | 296,776,784 |
| 2070 | 4,535,000 | 250,989,304 | 299,889,094 | 0 | 299,889,094 |
| 2071 | 4,535,000 | 255,524,304 | 293,950,892 | 8,988,885 | 302,939,777 |
| 2072 | 4,535,000 | 260,059,304 | 288,130,275 | 17,799,777 | 305,930,052 |
| 2073 | 4,535,000 | 264,594,304 | 282,424,913 | 26,436,203 | 308,861,115 |
| 2074 | 4,535,000 | 269,129,304 | 276,832,525 | 34,901,615 | 311,734,140 |
| 2075 | 4,535,000 | 273,664,304 | 271,350,874 | 43,199,402 | 314,550,275 |
| 2076 | 4,535,000 | 278,199,304 | 265,977,766 | 51,332,881 | 317,310,647 |
| 2077 | 4,535,000 | 282,734,304 | 260,711,054 | 59,305,306 | 320,016,360 |
| 2078 | 4,535,000 | 287,269,304 | 255,548,629 | 67,119,867 | 322,668,496 |
| **2079** | **2,063,696** | **291,804,304** | **250,488,427** | **74,779,689** | **325,268,116** |
| 2080 | | 293,868,000 | 245,528,424 | 77,389,432 | 322,917,856 |
| 2081 | | 293,868,000 | 240,666,635 | 75,857,018 | 316,523,654 |
| 2082 | | 293,868,000 | 235,901,117 | 74,354,949 | 310,256,065 |
| 2083 | | 293,868,000 | 231,229,962 | 72,882,622 | 304,112,584 |




# Summary Report

**Landfill Name or Identifier:** Roosevelt Regional Landfill - 1 of 2

**Date:** Wednesday, June 28, 2023

**Description/Comments:**

Waste intake rates for years 1990 through 2002 provided by Republic Services. Waste intake for 2003 through 2019 from the 2019 Emission Calcs for WEIRS spreadsheet prepared by WCG. Parameters : User defined k = 0.02 year-1 and inventory arid area Lo = 100 m3/Mg

**About LandGEM:**

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left( \frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,

$Q_{CH4}$ = annual methane generation in the year of the calculation *($m^3$/year)*
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate (*$year^{-1}$*)
$L_0$ = potential methane generation capacity (*$m^3$/Mg*)

$M_i$ = mass of waste accepted in the $i^{th}$ year (*Mg*)
$t_{ij}$ = age of the $j^{th}$ section of waste mass $M_i$ accepted in the $i^{th}$ year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

## Input Review

LANDFILL CHARACTERISTICS

| | | |
|---|---|---|
| Landfill Open Year | **1990** | |
| Landfill Closure Year (with 80-year limit) | **2069** | |
| *Actual Closure Year (without limit)* | ***2069*** | |
| Have Model Calculate Closure Year? | **No** | |
| Waste Design Capacity | **293,868,000** | *megagrams* |

MODEL PARAMETERS

| | | |
|---|---|---|
| Methane Generation Rate, k | **0.020** | *$year^{-1}$* |
| Potential Methane Generation Capacity, $L_0$ | **100** | *$m^3/Mg$* |
| NMOC Concentration | **600** | *ppmv as hexane* |
| Methane Content | **50** | *% by volume* |

GASES / POLLUTANTS SELECTED

| | |
|---|---|
| Gas / Pollutant #1: | **Total landfill gas** |
| Gas / Pollutant #2: | **Methane** |
| Gas / Pollutant #3: | |
| Gas / Pollutant #4: | |

WASTE ACCEPTANCE RATES

| Year | Waste Accepted | | Waste-In-Place | |
|---|---|---|---|---|
| | *(Mg/year)* | *(short tons/year)* | *(Mg)* | *(short tons)* |
| 1990 | 951 | 1,046 | 0 | 0 |
| 1991 | 12,317 | 13,549 | 951 | 1,046 |
| 1992 | 232,457 | 255,703 | 13,268 | 14,595 |
| 1993 | 422,881 | 465,169 | 245,725 | 270,298 |
| 1994 | 701,862 | 772,048 | 668,606 | 735,467 |
| 1995 | 872,433 | 959,676 | 1,370,468 | 1,507,515 |
| 1996 | 978,088 | 1,075,897 | 2,242,901 | 2,467,191 |
| 1997 | 1,072,472 | 1,179,719 | 3,220,989 | 3,543,088 |
| 1998 | 1,075,774 | 1,183,351 | 4,293,461 | 4,722,807 |
| 1999 | 1,357,672 | 1,493,439 | 5,369,235 | 5,906,159 |
| 2000 | 990,994 | 1,090,093 | 6,726,907 | 7,399,598 |
| 2001 | 1,115,501 | 1,227,051 | 7,717,901 | 8,489,691 |
| 2002 | 1,211,313 | 1,332,444 | 8,833,402 | 9,716,742 |
| 2003 | 1,130,491 | 1,243,540 | 10,044,715 | 11,049,187 |
| 2004 | 1,158,394 | 1,274,233 | 11,175,206 | 12,292,727 |
| 2005 | 1,073,269 | 1,180,596 | 12,333,600 | 13,566,960 |
| 2006 | 1,213,359 | 1,334,695 | 13,406,869 | 14,747,556 |
| 2007 | 1,344,293 | 1,478,722 | 14,620,228 | 16,082,251 |
| 2008 | 1,242,073 | 1,366,280 | 15,964,521 | 17,560,973 |
| 2009 | 1,170,570 | 1,287,627 | 17,206,594 | 18,927,253 |
| 2010 | 1,135,604 | 1,249,164 | 18,377,164 | 20,214,880 |
| 2011 | 1,114,064 | 1,225,470 | 19,512,768 | 21,464,045 |
| 2012 | 1,120,974 | 1,233,071 | 20,626,832 | 22,689,515 |
| 2013 | 1,171,632 | 1,288,795 | 21,747,806 | 23,922,587 |
| 2014 | 1,203,602 | 1,323,962 | 22,919,438 | 25,211,382 |
| 2015 | 1,096,499 | 1,206,149 | 24,123,040 | 26,535,344 |
| 2016 | 1,153,560 | 1,268,916 | 25,219,539 | 27,741,493 |
| 2017 | 1,246,732 | 1,371,405 | 26,373,099 | 29,010,409 |
| 2018 | 1,412,654 | 1,553,919 | 27,619,831 | 30,381,814 |
| 2019 | 1,426,781 | 1,569,459 | 29,032,485 | 31,935,734 |
| 2020 | 1,442,995 | 1,587,295 | 30,459,266 | 33,505,192 |
| 2021 | 1,407,043 | 1,547,748 | 31,902,261 | 35,092,487 |
| 2022 | 4,535,000 | 4,988,500 | 33,309,304 | 36,640,234 |
| 2023 | 4,535,000 | 4,988,500 | 37,844,304 | 41,628,734 |
| 2024 | 4,535,000 | 4,988,500 | 42,379,304 | 46,617,234 |
| 2025 | 4,535,000 | 4,988,500 | 46,914,304 | 51,605,734 |
| 2026 | 4,535,000 | 4,988,500 | 51,449,304 | 56,594,234 |
| 2027 | 4,535,000 | 4,988,500 | 55,984,304 | 61,582,734 |
| 2028 | 4,535,000 | 4,988,500 | 60,519,304 | 66,571,234 |
| 2029 | 4,535,000 | 4,988,500 | 65,054,304 | 71,559,734 |

WASTE ACCEPTANCE RATES (Continued)

| Year | Waste Accepted | | Waste-In-Place | |
|---|---|---|---|---|
| | *(Mg/year)* | *(short tons/year)* | *(Mg)* | *(short tons)* |
| 2030 | 4,535,000 | 4,988,500 | 69,589,304 | 76,548,234 |
| 2031 | 4,535,000 | 4,988,500 | 74,124,304 | 81,536,734 |
| 2032 | 4,535,000 | 4,988,500 | 78,659,304 | 86,525,234 |
| 2033 | 4,535,000 | 4,988,500 | 83,194,304 | 91,513,734 |
| 2034 | 4,535,000 | 4,988,500 | 87,729,304 | 96,502,234 |
| 2035 | 4,535,000 | 4,988,500 | 92,264,304 | 101,490,734 |
| 2036 | 4,535,000 | 4,988,500 | 96,799,304 | 106,479,234 |
| 2037 | 4,535,000 | 4,988,500 | 101,334,304 | 111,467,734 |
| 2038 | 4,535,000 | 4,988,500 | 105,869,304 | 116,456,234 |
| 2039 | 4,535,000 | 4,988,500 | 110,404,304 | 121,444,734 |
| 2040 | 4,535,000 | 4,988,500 | 114,939,304 | 126,433,234 |
| 2041 | 4,535,000 | 4,988,500 | 119,474,304 | 131,421,734 |
| 2042 | 4,535,000 | 4,988,500 | 124,009,304 | 136,410,234 |
| 2043 | 4,535,000 | 4,988,500 | 128,544,304 | 141,398,734 |
| 2044 | 4,535,000 | 4,988,500 | 133,079,304 | 146,387,234 |
| 2045 | 4,535,000 | 4,988,500 | 137,614,304 | 151,375,734 |
| 2046 | 4,535,000 | 4,988,500 | 142,149,304 | 156,364,234 |
| 2047 | 4,535,000 | 4,988,500 | 146,684,304 | 161,352,734 |
| 2048 | 4,535,000 | 4,988,500 | 151,219,304 | 166,341,234 |
| 2049 | 4,535,000 | 4,988,500 | 155,754,304 | 171,329,734 |
| 2050 | 4,535,000 | 4,988,500 | 160,289,304 | 176,318,234 |
| 2051 | 4,535,000 | 4,988,500 | 164,824,304 | 181,306,734 |
| 2052 | 4,535,000 | 4,988,500 | 169,359,304 | 186,295,234 |
| 2053 | 4,535,000 | 4,988,500 | 173,894,304 | 191,283,734 |
| 2054 | 4,535,000 | 4,988,500 | 178,429,304 | 196,272,234 |
| 2055 | 4,535,000 | 4,988,500 | 182,964,304 | 201,260,734 |
| 2056 | 4,535,000 | 4,988,500 | 187,499,304 | 206,249,234 |
| 2057 | 4,535,000 | 4,988,500 | 192,034,304 | 211,237,734 |
| 2058 | 4,535,000 | 4,988,500 | 196,569,304 | 216,226,234 |
| 2059 | 4,535,000 | 4,988,500 | 201,104,304 | 221,214,734 |
| 2060 | 4,535,000 | 4,988,500 | 205,639,304 | 226,203,234 |
| 2061 | 4,535,000 | 4,988,500 | 210,174,304 | 231,191,734 |
| 2062 | 4,535,000 | 4,988,500 | 214,709,304 | 236,180,234 |
| 2063 | 4,535,000 | 4,988,500 | 219,244,304 | 241,168,734 |
| 2064 | 4,535,000 | 4,988,500 | 223,779,304 | 246,157,234 |
| 2065 | 4,535,000 | 4,988,500 | 228,314,304 | 251,145,734 |
| 2066 | 4,535,000 | 4,988,500 | 232,849,304 | 256,134,234 |
| 2067 | 4,535,000 | 4,988,500 | 237,384,304 | 261,122,734 |
| 2068 | 4,535,000 | 4,988,500 | 241,919,304 | 266,111,234 |
| 2069 | 4,535,000 | 4,988,500 | 246,454,304 | 271,099,734 |

## Results

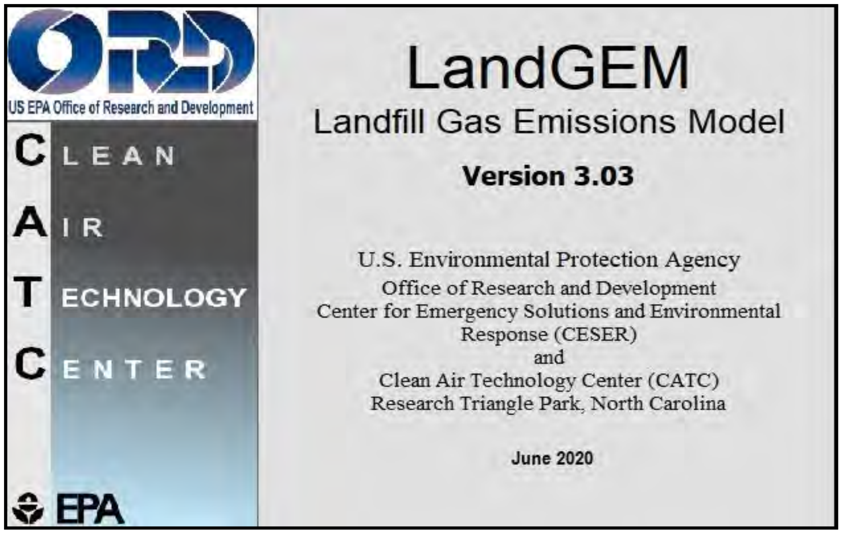
| Year | Total landfill gas | | | Methane | | |
|---|---|---|---|---|---|---|
| | (Mg/year) | ($m^3$/year) | (av ft^3/min) | (Mg/year) | ($m^3$/year) | (av ft^3/min) |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 4.708E+00 | 3.770E+03 | 2.533E-01 | 1.258E+00 | 1.885E+03 | 1.267E-01 |
| 1992 | 6.559E+01 | 5.252E+04 | 3.529E+00 | 1.752E+01 | 2.626E+04 | 1.764E+00 |
| 1993 | 1.215E+03 | 9.730E+05 | 6.538E+01 | 3.246E+02 | 4.865E+05 | 3.269E+01 |
| 1994 | 3.285E+03 | 2.630E+06 | 1.767E+02 | 8.773E+02 | 1.315E+06 | 8.836E+01 |
| 1995 | 6.694E+03 | 5.360E+06 | 3.602E+02 | 1.788E+03 | 2.680E+06 | 1.801E+02 |
| 1996 | 1.088E+04 | 8.713E+06 | 5.854E+02 | 2.906E+03 | 4.356E+06 | 2.927E+02 |
| 1997 | 1.551E+04 | 1.242E+07 | 8.343E+02 | 4.142E+03 | 6.209E+06 | 4.172E+02 |
| 1998 | 2.051E+04 | 1.642E+07 | 1.103E+03 | 5.478E+03 | 8.212E+06 | 5.517E+02 |
| 1999 | 2.543E+04 | 2.036E+07 | 1.368E+03 | 6.792E+03 | 1.018E+07 | 6.841E+02 |
| 2000 | 3.165E+04 | 2.534E+07 | 1.703E+03 | 8.453E+03 | 1.267E+07 | 8.513E+02 |
| 2001 | 3.593E+04 | 2.877E+07 | 1.933E+03 | 9.596E+03 | 1.438E+07 | 9.665E+02 |
| 2002 | 4.074E+04 | 3.262E+07 | 2.192E+03 | 1.088E+04 | 1.631E+07 | 1.096E+03 |
| 2003 | 4.593E+04 | 3.678E+07 | 2.471E+03 | 1.227E+04 | 1.839E+07 | 1.236E+03 |
| 2004 | 5.061E+04 | 4.053E+07 | 2.723E+03 | 1.352E+04 | 2.027E+07 | 1.362E+03 |
| 2005 | 5.535E+04 | 4.432E+07 | 2.978E+03 | 1.478E+04 | 2.216E+07 | 1.489E+03 |
| 2006 | 5.956E+04 | 4.770E+07 | 3.205E+03 | 1.591E+04 | 2.385E+07 | 1.602E+03 |
| 2007 | 6.439E+04 | 5.156E+07 | 3.464E+03 | 1.720E+04 | 2.578E+07 | 1.732E+03 |
| 2008 | 6.977E+04 | 5.587E+07 | 3.754E+03 | 1.864E+04 | 2.794E+07 | 1.877E+03 |
| 2009 | 7.454E+04 | 5.969E+07 | 4.010E+03 | 1.991E+04 | 2.984E+07 | 2.005E+03 |
| 2010 | 7.886E+04 | 6.315E+07 | 4.243E+03 | 2.106E+04 | 3.157E+07 | 2.121E+03 |
| 2011 | 8.292E+04 | 6.640E+07 | 4.461E+03 | 2.215E+04 | 3.320E+07 | 2.231E+03 |
| 2012 | 8.679E+04 | 6.950E+07 | 4.670E+03 | 2.318E+04 | 3.475E+07 | 2.335E+03 |
| 2013 | 9.062E+04 | 7.257E+07 | 4.876E+03 | 2.421E+04 | 3.628E+07 | 2.438E+03 |
| 2014 | 9.463E+04 | 7.577E+07 | 5.091E+03 | 2.528E+04 | 3.789E+07 | 2.546E+03 |
| 2015 | 9.871E+04 | 7.905E+07 | 5.311E+03 | 2.637E+04 | 3.952E+07 | 2.656E+03 |
| 2016 | 1.022E+05 | 8.183E+07 | 5.498E+03 | 2.730E+04 | 4.091E+07 | 2.749E+03 |
| 2017 | 1.059E+05 | 8.478E+07 | 5.696E+03 | 2.828E+04 | 4.239E+07 | 2.848E+03 |
| 2018 | 1.100E+05 | 8.804E+07 | 5.916E+03 | 2.937E+04 | 4.402E+07 | 2.958E+03 |
| 2019 | 1.148E+05 | 9.190E+07 | 6.175E+03 | 3.066E+04 | 4.595E+07 | 3.087E+03 |
| 2020 | 1.196E+05 | 9.574E+07 | 6.433E+03 | 3.194E+04 | 4.787E+07 | 3.216E+03 |
| 2021 | 1.243E+05 | 9.956E+07 | 6.690E+03 | 3.321E+04 | 4.978E+07 | 3.345E+03 |
| 2022 | 1.288E+05 | 1.032E+08 | 6.932E+03 | 3.441E+04 | 5.158E+07 | 3.466E+03 |
| 2023 | 1.487E+05 | 1.191E+08 | 8.002E+03 | 3.973E+04 | 5.955E+07 | 4.001E+03 |
| 2024 | 1.682E+05 | 1.347E+08 | 9.052E+03 | 4.494E+04 | 6.736E+07 | 4.526E+03 |
| 2025 | 1.874E+05 | 1.500E+08 | 1.008E+04 | 5.005E+04 | 7.502E+07 | 5.040E+03 |
| 2026 | 2.061E+05 | 1.650E+08 | 1.109E+04 | 5.505E+04 | 8.252E+07 | 5.544E+03 |
| 2027 | 2.245E+05 | 1.797E+08 | 1.208E+04 | 5.996E+04 | 8.987E+07 | 6.039E+03 |
| 2028 | 2.425E+05 | 1.942E+08 | 1.305E+04 | 6.477E+04 | 9.708E+07 | 6.523E+03 |
| 2029 | 2.601E+05 | 2.083E+08 | 1.400E+04 | 6.948E+04 | 1.042E+08 | 6.998E+03 |
| 2030 | 2.774E+05 | 2.222E+08 | 1.493E+04 | 7.410E+04 | 1.111E+08 | 7.463E+03 |
| 2031 | 2.944E+05 | 2.357E+08 | 1.584E+04 | 7.863E+04 | 1.179E+08 | 7.919E+03 |
| 2032 | 3.110E+05 | 2.490E+08 | 1.673E+04 | 8.307E+04 | 1.245E+08 | 8.367E+03 |
| 2033 | 3.273E+05 | 2.621E+08 | 1.761E+04 | 8.743E+04 | 1.310E+08 | 8.805E+03 |
| 2034 | 3.433E+05 | 2.749E+08 | 1.847E+04 | 9.169E+04 | 1.374E+08 | 9.234E+03 |
| 2035 | 3.589E+05 | 2.874E+08 | 1.931E+04 | 9.587E+04 | 1.437E+08 | 9.656E+03 |
| 2036 | 3.743E+05 | 2.997E+08 | 2.014E+04 | 9.997E+04 | 1.498E+08 | 1.007E+04 |
| 2037 | 3.893E+05 | 3.117E+08 | 2.095E+04 | 1.040E+05 | 1.559E+08 | 1.047E+04 |
| 2038 | 4.041E+05 | 3.235E+08 | 2.174E+04 | 1.079E+05 | 1.618E+08 | 1.087E+04 |
| 2039 | 4.185E+05 | 3.351E+08 | 2.252E+04 | 1.118E+05 | 1.676E+08 | 1.126E+04 |

## Results (Continued)

| Year | Total landfill gas | | | Methane | | |
|---|---|---|---|---|---|---|
| | (Mg/year) | ($m^3$/year) | (av ft^3/min) | (Mg/year) | ($m^3$/year) | (av ft^3/min) |
| 2040 | 4.327E+05 | 3.465E+08 | 2.328E+04 | 1.156E+05 | 1.732E+08 | 1.164E+04 |
| 2041 | 4.466E+05 | 3.576E+08 | 2.403E+04 | 1.193E+05 | 1.788E+08 | 1.201E+04 |
| 2042 | 4.602E+05 | 3.685E+08 | 2.476E+04 | 1.229E+05 | 1.842E+08 | 1.238E+04 |
| 2043 | 4.735E+05 | 3.792E+08 | 2.548E+04 | 1.265E+05 | 1.896E+08 | 1.274E+04 |
| 2044 | 4.866E+05 | 3.896E+08 | 2.618E+04 | 1.300E+05 | 1.948E+08 | 1.309E+04 |
| 2045 | 4.994E+05 | 3.999E+08 | 2.687E+04 | 1.334E+05 | 1.999E+08 | 1.343E+04 |
| 2046 | 5.120E+05 | 4.099E+08 | 2.754E+04 | 1.367E+05 | 2.050E+08 | 1.377E+04 |
| 2047 | 5.243E+05 | 4.198E+08 | 2.821E+04 | 1.400E+05 | 2.099E+08 | 1.410E+04 |
| 2048 | 5.363E+05 | 4.295E+08 | 2.886E+04 | 1.433E+05 | 2.147E+08 | 1.443E+04 |
| 2049 | 5.482E+05 | 4.389E+08 | 2.949E+04 | 1.464E+05 | 2.195E+08 | 1.475E+04 |
| 2050 | 5.598E+05 | 4.482E+08 | 3.012E+04 | 1.495E+05 | 2.241E+08 | 1.506E+04 |
| 2051 | 5.711E+05 | 4.573E+08 | 3.073E+04 | 1.526E+05 | 2.287E+08 | 1.536E+04 |
| 2052 | 5.823E+05 | 4.663E+08 | 3.133E+04 | 1.555E+05 | 2.331E+08 | 1.566E+04 |
| 2053 | 5.932E+05 | 4.750E+08 | 3.192E+04 | 1.584E+05 | 2.375E+08 | 1.596E+04 |
| 2054 | 6.039E+05 | 4.836E+08 | 3.249E+04 | 1.613E+05 | 2.418E+08 | 1.625E+04 |
| 2055 | 6.144E+05 | 4.920E+08 | 3.306E+04 | 1.641E+05 | 2.460E+08 | 1.653E+04 |
| 2056 | 6.247E+05 | 5.002E+08 | 3.361E+04 | 1.669E+05 | 2.501E+08 | 1.680E+04 |
| 2057 | 6.348E+05 | 5.083E+08 | 3.415E+04 | 1.696E+05 | 2.541E+08 | 1.708E+04 |
| 2058 | 6.446E+05 | 5.162E+08 | 3.468E+04 | 1.722E+05 | 2.581E+08 | 1.734E+04 |
| 2059 | 6.543E+05 | 5.240E+08 | 3.520E+04 | 1.748E+05 | 2.620E+08 | 1.760E+04 |
| 2060 | 6.638E+05 | 5.316E+08 | 3.572E+04 | 1.773E+05 | 2.658E+08 | 1.786E+04 |
| 2061 | 6.731E+05 | 5.390E+08 | 3.622E+04 | 1.798E+05 | 2.695E+08 | 1.811E+04 |
| 2062 | 6.823E+05 | 5.463E+08 | 3.671E+04 | 1.822E+05 | 2.732E+08 | 1.835E+04 |
| 2063 | 6.912E+05 | 5.535E+08 | 3.719E+04 | 1.846E+05 | 2.767E+08 | 1.859E+04 |
| 2064 | 7.000E+05 | 5.605E+08 | 3.766E+04 | 1.870E+05 | 2.802E+08 | 1.883E+04 |
| 2065 | 7.085E+05 | 5.674E+08 | 3.812E+04 | 1.893E+05 | 2.837E+08 | 1.906E+04 |
| 2066 | 7.170E+05 | 5.741E+08 | 3.857E+04 | 1.915E+05 | 2.871E+08 | 1.929E+04 |
| 2067 | 7.252E+05 | 5.807E+08 | 3.902E+04 | 1.937E+05 | 2.904E+08 | 1.951E+04 |
| 2068 | 7.333E+05 | 5.872E+08 | 3.945E+04 | 1.959E+05 | 2.936E+08 | 1.973E+04 |
| 2069 | 7.412E+05 | 5.936E+08 | 3.988E+04 | 1.980E+05 | 2.968E+08 | 1.994E+04 |
| 2070 | 7.490E+05 | 5.998E+08 | 4.030E+04 | 2.001E+05 | 2.999E+08 | 2.015E+04 |
| 2071 | 7.342E+05 | 5.879E+08 | 3.950E+04 | 1.961E+05 | 2.940E+08 | 1.975E+04 |
| 2072 | 7.196E+05 | 5.763E+08 | 3.872E+04 | 1.922E+05 | 2.881E+08 | 1.936E+04 |
| 2073 | 7.054E+05 | 5.648E+08 | 3.795E+04 | 1.884E+05 | 2.824E+08 | 1.898E+04 |
| 2074 | 6.914E+05 | 5.537E+08 | 3.720E+04 | 1.847E+05 | 2.768E+08 | 1.860E+04 |
| 2075 | 6.777E+05 | 5.427E+08 | 3.646E+04 | 1.810E+05 | 2.714E+08 | 1.823E+04 |
| 2076 | 6.643E+05 | 5.320E+08 | 3.574E+04 | 1.774E+05 | 2.660E+08 | 1.787E+04 |
| 2077 | 6.512E+05 | 5.214E+08 | 3.503E+04 | 1.739E+05 | 2.607E+08 | 1.752E+04 |
| 2078 | 6.383E+05 | 5.111E+08 | 3.434E+04 | 1.705E+05 | 2.555E+08 | 1.717E+04 |
| 2079 | 6.256E+05 | 5.010E+08 | 3.366E+04 | 1.671E+05 | 2.505E+08 | 1.683E+04 |
| 2080 | 6.132E+05 | 4.911E+08 | 3.299E+04 | 1.638E+05 | 2.455E+08 | 1.650E+04 |
| 2081 | 6.011E+05 | 4.813E+08 | 3.234E+04 | 1.606E+05 | 2.407E+08 | 1.617E+04 |
| 2082 | 5.892E+05 | 4.718E+08 | 3.170E+04 | 1.574E+05 | 2.359E+08 | 1.585E+04 |
| 2083 | 5.775E+05 | 4.625E+08 | 3.107E+04 | 1.543E+05 | 2.312E+08 | 1.554E+04 |
| 2084 | 5.661E+05 | 4.533E+08 | 3.046E+04 | 1.512E+05 | 2.267E+08 | 1.523E+04 |
| 2085 | 5.549E+05 | 4.443E+08 | 2.985E+04 | 1.482E+05 | 2.222E+08 | 1.493E+04 |
| 2086 | 5.439E+05 | 4.355E+08 | 2.926E+04 | 1.453E+05 | 2.178E+08 | 1.463E+04 |
| 2087 | 5.331E+05 | 4.269E+08 | 2.868E+04 | 1.424E+05 | 2.135E+08 | 1.434E+04 |
| 2088 | 5.226E+05 | 4.185E+08 | 2.812E+04 | 1.396E+05 | 2.092E+08 | 1.406E+04 |
| 2089 | 5.122E+05 | 4.102E+08 | 2.756E+04 | 1.368E+05 | 2.051E+08 | 1.378E+04 |
| 2090 | 5.021E+05 | 4.020E+08 | 2.701E+04 | 1.341E+05 | 2.010E+08 | 1.351E+04 |

## Results (Continued)

| Year | Total landfill gas | | | Methane | | |
|---|---|---|---|---|---|---|
| | (Mg/year) | ($m^3$/year) | (av ft^3/min) | (Mg/year) | ($m^3$/year) | (av ft^3/min) |
| 2091 | 4.921E+05 | 3.941E+08 | 2.648E+04 | 1.315E+05 | 1.970E+08 | 1.324E+04 |
| 2092 | 4.824E+05 | 3.863E+08 | 2.595E+04 | 1.289E+05 | 1.931E+08 | 1.298E+04 |
| 2093 | 4.728E+05 | 3.786E+08 | 2.544E+04 | 1.263E+05 | 1.893E+08 | 1.272E+04 |
| 2094 | 4.635E+05 | 3.711E+08 | 2.494E+04 | 1.238E+05 | 1.856E+08 | 1.247E+04 |
| 2095 | 4.543E+05 | 3.638E+08 | 2.444E+04 | 1.213E+05 | 1.819E+08 | 1.222E+04 |
| 2096 | 4.453E+05 | 3.566E+08 | 2.396E+04 | 1.189E+05 | 1.783E+08 | 1.198E+04 |
| 2097 | 4.365E+05 | 3.495E+08 | 2.348E+04 | 1.166E+05 | 1.748E+08 | 1.174E+04 |
| 2098 | 4.278E+05 | 3.426E+08 | 2.302E+04 | 1.143E+05 | 1.713E+08 | 1.151E+04 |
| 2099 | 4.194E+05 | 3.358E+08 | 2.256E+04 | 1.120E+05 | 1.679E+08 | 1.128E+04 |
| 2100 | 4.111E+05 | 3.292E+08 | 2.212E+04 | 1.098E+05 | 1.646E+08 | 1.106E+04 |
| 2101 | 4.029E+05 | 3.226E+08 | 2.168E+04 | 1.076E+05 | 1.613E+08 | 1.084E+04 |
| 2102 | 3.950E+05 | 3.163E+08 | 2.125E+04 | 1.055E+05 | 1.581E+08 | 1.062E+04 |
| 2103 | 3.871E+05 | 3.100E+08 | 2.083E+04 | 1.034E+05 | 1.550E+08 | 1.041E+04 |
| 2104 | 3.795E+05 | 3.039E+08 | 2.042E+04 | 1.014E+05 | 1.519E+08 | 1.021E+04 |
| 2105 | 3.720E+05 | 2.978E+08 | 2.001E+04 | 9.935E+04 | 1.489E+08 | 1.001E+04 |
| 2106 | 3.646E+05 | 2.919E+08 | 1.962E+04 | 9.738E+04 | 1.460E+08 | 9.808E+03 |
| 2107 | 3.574E+05 | 2.862E+08 | 1.923E+04 | 9.546E+04 | 1.431E+08 | 9.614E+03 |
| 2108 | 3.503E+05 | 2.805E+08 | 1.885E+04 | 9.357E+04 | 1.402E+08 | 9.423E+03 |
| 2109 | 3.434E+05 | 2.749E+08 | 1.847E+04 | 9.171E+04 | 1.375E+08 | 9.237E+03 |
| 2110 | 3.366E+05 | 2.695E+08 | 1.811E+04 | 8.990E+04 | 1.347E+08 | 9.054E+03 |
| 2111 | 3.299E+05 | 2.642E+08 | 1.775E+04 | 8.812E+04 | 1.321E+08 | 8.874E+03 |
| 2112 | 3.234E+05 | 2.589E+08 | 1.740E+04 | 8.637E+04 | 1.295E+08 | 8.699E+03 |
| 2113 | 3.170E+05 | 2.538E+08 | 1.705E+04 | 8.466E+04 | 1.269E+08 | 8.527E+03 |
| 2114 | 3.107E+05 | 2.488E+08 | 1.672E+04 | 8.299E+04 | 1.244E+08 | 8.358E+03 |
| 2115 | 3.045E+05 | 2.439E+08 | 1.638E+04 | 8.134E+04 | 1.219E+08 | 8.192E+03 |
| 2116 | 2.985E+05 | 2.390E+08 | 1.606E+04 | 7.973E+04 | 1.195E+08 | 8.030E+03 |
| 2117 | 2.926E+05 | 2.343E+08 | 1.574E+04 | 7.815E+04 | 1.171E+08 | 7.871E+03 |
| 2118 | 2.868E+05 | 2.297E+08 | 1.543E+04 | 7.661E+04 | 1.148E+08 | 7.715E+03 |
| 2119 | 2.811E+05 | 2.251E+08 | 1.512E+04 | 7.509E+04 | 1.126E+08 | 7.562E+03 |
| 2120 | 2.755E+05 | 2.206E+08 | 1.483E+04 | 7.360E+04 | 1.103E+08 | 7.413E+03 |
| 2121 | 2.701E+05 | 2.163E+08 | 1.453E+04 | 7.214E+04 | 1.081E+08 | 7.266E+03 |
| 2122 | 2.647E+05 | 2.120E+08 | 1.424E+04 | 7.072E+04 | 1.060E+08 | 7.122E+03 |
| 2123 | 2.595E+05 | 2.078E+08 | 1.396E+04 | 6.932E+04 | 1.039E+08 | 6.981E+03 |
| 2124 | 2.544E+05 | 2.037E+08 | 1.369E+04 | 6.794E+04 | 1.018E+08 | 6.843E+03 |
| 2125 | 2.493E+05 | 1.996E+08 | 1.341E+04 | 6.660E+04 | 9.982E+07 | 6.707E+03 |
| 2126 | 2.444E+05 | 1.957E+08 | 1.315E+04 | 6.528E+04 | 9.785E+07 | 6.574E+03 |
| 2127 | 2.395E+05 | 1.918E+08 | 1.289E+04 | 6.399E+04 | 9.591E+07 | 6.444E+03 |
| 2128 | 2.348E+05 | 1.880E+08 | 1.263E+04 | 6.272E+04 | 9.401E+07 | 6.317E+03 |
| 2129 | 2.302E+05 | 1.843E+08 | 1.238E+04 | 6.148E+04 | 9.215E+07 | 6.192E+03 |
| 2130 | 2.256E+05 | 1.806E+08 | 1.214E+04 | 6.026E+04 | 9.032E+07 | 6.069E+03 |




# Summary Report

**Landfill Name or Identifier:** Roosevelt Regional Landfill - 2 of 2

**Date:** Wednesday, June 28, 2023

**Description/Comments:**

Waste intake rates for years 1990 through 2002 provided by Republic Services. Waste intake for 2003 through 2019 from the 2019 Emission Calcs for WEIRS spreadsheet prepared by WCG. Parameters : User defined k = 0.02 year-1 and inventory arid area Lo = 100 m3/Mg

**About LandGEM:**

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left( \frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,

$Q_{CH4}$ = annual methane generation in the year of the calculation *($m^3$/year)*
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate (*$year^{-1}$*)
$L_0$ = potential methane generation capacity (*$m^3$/Mg*)

$M_i$ = mass of waste accepted in the $i^{th}$ year (*Mg*)
$t_{ij}$ = age of the $j^{th}$ section of waste mass $M_i$ accepted in the $i^{th}$ year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

# Input Review

LANDFILL CHARACTERISTICS

| | | |
|---|---|---|
| Landfill Open Year | **2070** | |
| Landfill Closure Year (with 80-year limit) | **2079** | |
| *Actual Closure Year (without limit)* | ***2079*** | |
| Have Model Calculate Closure Year? | **No** | |
| Waste Design Capacity | **293,868,000** | *megagrams* |

MODEL PARAMETERS

| | | |
|---|---|---|
| Methane Generation Rate, k | **0.020** | *$year^{-1}$* |
| Potential Methane Generation Capacity, $L_0$ | **100** | *$m^3/Mg$* |
| NMOC Concentration | **600** | *ppmv as hexane* |
| Methane Content | **50** | *% by volume* |

GASES / POLLUTANTS SELECTED

| | |
|---|---|
| Gas / Pollutant #1: | **Total landfill gas** |
| Gas / Pollutant #2: | **Methane** |
| Gas / Pollutant #3: | |
| Gas / Pollutant #4: | |

WASTE ACCEPTANCE RATES

| Year | Waste Accepted | | Waste-In-Place | |
|---|---|---|---|---|
| | *(Mg/year)* | *(short tons/year)* | *(Mg)* | *(short tons)* |
| 2070 | 4,535,000 | 4,988,500 | 0 | 0 |
| 2071 | 4,535,000 | 4,988,500 | 4,535,000 | 4,988,500 |
| 2072 | 4,535,000 | 4,988,500 | 9,070,000 | 9,977,000 |
| 2073 | 4,535,000 | 4,988,500 | 13,605,000 | 14,965,500 |
| 2074 | 4,535,000 | 4,988,500 | 18,140,000 | 19,954,000 |
| 2075 | 4,535,000 | 4,988,500 | 22,675,000 | 24,942,500 |
| 2076 | 4,535,000 | 4,988,500 | 27,210,000 | 29,931,000 |
| 2077 | 4,535,000 | 4,988,500 | 31,745,000 | 34,919,500 |
| 2078 | 4,535,000 | 4,988,500 | 36,280,000 | 39,908,000 |
| 2079 | 2,063,696 | 2,270,066 | 40,815,000 | 44,896,500 |
| 2080 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2081 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2082 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2083 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2084 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2085 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2086 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2087 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2088 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2089 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2090 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2091 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2092 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2093 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2094 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2095 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2096 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2097 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2098 | 0 | 0 | 42,878,696 | 47,166,566 |
| 2099 | 0 | 0 | 42,878,696 | 47,166,566 |

## Results

| Year | Total landfill gas | | | Methane | | |
|---|---|---|---|---|---|---|
| | (Mg/year) | ($m^3$/year) | (av ft^3/min) | (Mg/year) | ($m^3$/year) | (av ft^3/min) |
| 2070 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2071 | 2.245E+04 | 1.798E+07 | 1.208E+03 | 5.997E+03 | 8.989E+06 | 6.040E+02 |
| 2072 | 4.446E+04 | 3.560E+07 | 2.392E+03 | 1.188E+04 | 1.780E+07 | 1.196E+03 |
| 2073 | 6.603E+04 | 5.287E+07 | 3.552E+03 | 1.764E+04 | 2.644E+07 | 1.776E+03 |
| 2074 | 8.717E+04 | 6.980E+07 | 4.690E+03 | 2.328E+04 | 3.490E+07 | 2.345E+03 |
| 2075 | 1.079E+05 | 8.640E+07 | 5.805E+03 | 2.882E+04 | 4.320E+07 | 2.903E+03 |
| 2076 | 1.282E+05 | 1.027E+08 | 6.898E+03 | 3.425E+04 | 5.133E+07 | 3.449E+03 |
| 2077 | 1.481E+05 | 1.186E+08 | 7.969E+03 | 3.957E+04 | 5.931E+07 | 3.985E+03 |
| 2078 | 1.676E+05 | 1.342E+08 | 9.020E+03 | 4.478E+04 | 6.712E+07 | 4.510E+03 |
| 2079 | 1.868E+05 | 1.496E+08 | 1.005E+04 | 4.989E+04 | 7.478E+07 | 5.024E+03 |
| 2080 | 1.933E+05 | 1.548E+08 | 1.040E+04 | 5.163E+04 | 7.739E+07 | 5.200E+03 |
| 2081 | 1.895E+05 | 1.517E+08 | 1.019E+04 | 5.061E+04 | 7.586E+07 | 5.097E+03 |
| 2082 | 1.857E+05 | 1.487E+08 | 9.992E+03 | 4.961E+04 | 7.435E+07 | 4.996E+03 |
| 2083 | 1.820E+05 | 1.458E+08 | 9.794E+03 | 4.862E+04 | 7.288E+07 | 4.897E+03 |
| 2084 | 1.784E+05 | 1.429E+08 | 9.600E+03 | 4.766E+04 | 7.144E+07 | 4.800E+03 |
| 2085 | 1.749E+05 | 1.400E+08 | 9.410E+03 | 4.672E+04 | 7.002E+07 | 4.705E+03 |
| 2086 | 1.714E+05 | 1.373E+08 | 9.224E+03 | 4.579E+04 | 6.864E+07 | 4.612E+03 |
| 2087 | 1.680E+05 | 1.346E+08 | 9.041E+03 | 4.489E+04 | 6.728E+07 | 4.520E+03 |
| 2088 | 1.647E+05 | 1.319E+08 | 8.862E+03 | 4.400E+04 | 6.595E+07 | 4.431E+03 |
| 2089 | 1.615E+05 | 1.293E+08 | 8.686E+03 | 4.313E+04 | 6.464E+07 | 4.343E+03 |
| 2090 | 1.583E+05 | 1.267E+08 | 8.514E+03 | 4.227E+04 | 6.336E+07 | 4.257E+03 |
| 2091 | 1.551E+05 | 1.242E+08 | 8.346E+03 | 4.143E+04 | 6.211E+07 | 4.173E+03 |
| 2092 | 1.520E+05 | 1.218E+08 | 8.181E+03 | 4.061E+04 | 6.088E+07 | 4.090E+03 |
| 2093 | 1.490E+05 | 1.193E+08 | 8.019E+03 | 3.981E+04 | 5.967E+07 | 4.009E+03 |
| 2094 | 1.461E+05 | 1.170E+08 | 7.860E+03 | 3.902E+04 | 5.849E+07 | 3.930E+03 |
| 2095 | 1.432E+05 | 1.147E+08 | 7.704E+03 | 3.825E+04 | 5.733E+07 | 3.852E+03 |
| 2096 | 1.404E+05 | 1.124E+08 | 7.552E+03 | 3.749E+04 | 5.620E+07 | 3.776E+03 |
| 2097 | 1.376E+05 | 1.102E+08 | 7.402E+03 | 3.675E+04 | 5.508E+07 | 3.701E+03 |
| 2098 | 1.349E+05 | 1.080E+08 | 7.256E+03 | 3.602E+04 | 5.399E+07 | 3.628E+03 |
| 2099 | 1.322E+05 | 1.058E+08 | 7.112E+03 | 3.531E+04 | 5.292E+07 | 3.556E+03 |
| 2100 | 1.296E+05 | 1.038E+08 | 6.971E+03 | 3.461E+04 | 5.188E+07 | 3.486E+03 |
| 2101 | 1.270E+05 | 1.017E+08 | 6.833E+03 | 3.392E+04 | 5.085E+07 | 3.417E+03 |
| 2102 | 1.245E+05 | 9.968E+07 | 6.698E+03 | 3.325E+04 | 4.984E+07 | 3.349E+03 |
| 2103 | 1.220E+05 | 9.771E+07 | 6.565E+03 | 3.259E+04 | 4.885E+07 | 3.283E+03 |
| 2104 | 1.196E+05 | 9.577E+07 | 6.435E+03 | 3.195E+04 | 4.789E+07 | 3.218E+03 |
| 2105 | 1.172E+05 | 9.388E+07 | 6.308E+03 | 3.132E+04 | 4.694E+07 | 3.154E+03 |
| 2106 | 1.149E+05 | 9.202E+07 | 6.183E+03 | 3.070E+04 | 4.601E+07 | 3.091E+03 |
| 2107 | 1.126E+05 | 9.020E+07 | 6.060E+03 | 3.009E+04 | 4.510E+07 | 3.030E+03 |
| 2108 | 1.104E+05 | 8.841E+07 | 5.940E+03 | 2.949E+04 | 4.421E+07 | 2.970E+03 |
| 2109 | 1.082E+05 | 8.666E+07 | 5.823E+03 | 2.891E+04 | 4.333E+07 | 2.911E+03 |
| 2110 | 1.061E+05 | 8.494E+07 | 5.707E+03 | 2.834E+04 | 4.247E+07 | 2.854E+03 |
| 2111 | 1.040E+05 | 8.326E+07 | 5.594E+03 | 2.777E+04 | 4.163E+07 | 2.797E+03 |
| 2112 | 1.019E+05 | 8.161E+07 | 5.484E+03 | 2.722E+04 | 4.081E+07 | 2.742E+03 |
| 2113 | 9.990E+04 | 8.000E+07 | 5.375E+03 | 2.669E+04 | 4.000E+07 | 2.688E+03 |
| 2114 | 9.792E+04 | 7.841E+07 | 5.269E+03 | 2.616E+04 | 3.921E+07 | 2.634E+03 |
| 2115 | 9.599E+04 | 7.686E+07 | 5.164E+03 | 2.564E+04 | 3.843E+07 | 2.582E+03 |
| 2116 | 9.409E+04 | 7.534E+07 | 5.062E+03 | 2.513E+04 | 3.767E+07 | 2.531E+03 |
| 2117 | 9.222E+04 | 7.385E+07 | 4.962E+03 | 2.463E+04 | 3.692E+07 | 2.481E+03 |
| 2118 | 9.040E+04 | 7.238E+07 | 4.864E+03 | 2.415E+04 | 3.619E+07 | 2.432E+03 |
| 2119 | 8.861E+04 | 7.095E+07 | 4.767E+03 | 2.367E+04 | 3.548E+07 | 2.384E+03 |

# APPENDIX E

# EMISSION CALCULATIONS

# POTENTIAL EMISSIONS SUMMARY
# NOTICE OF CONSTRUCTION MODIFICATION
## ROOSEVELT REGIONAL LANDFILL - KLICKITAT COUNTY, WASHINGTON

**Emissions Estimations of Criteria Pollutants:**

| Pollutant | Emissions | | |
|---|---|---|---|
| | tons/hr | tons/day | tons/yr |
| Volatile Organic Compound | 4.20E-03 | 0.10 | 36.82 |

**Emissions Estimations of Toxic Air Pollutants:**

| Pollutant | Emissions | | |
|---|---|---|---|
| | lb/hr | lb/day | lb/yr |
| 1,2,3-Trimethylbenzene | 0.02 | 0.53 | 195.21 |
| 1,2,4-Trimethylbenzene | 0.14 | 3.35 | 1,223.88 |
| 1,2-Dichloroethane (ethylene dichloride) | 0.02 | 0.42 | 151.85 |
| 1,3,5-Trimethylbenzene | 0.06 | 1.40 | 512.48 |
| 1,4-Dichlorobenzene | 0.03 | 0.72 | 261.44 |
| 1,4-Dioxane | 3.61E-03 | 0.09 | 31.64 |
| 2-Propanol (Isopropyl alcohol) | 0.61 | 14.60 | 5,328.39 |
| Benzene | 0.07 | 1.61 | 587.22 |
| Carbon Disulfide | 9.39E-03 | 0.23 | 82.22 |
| Carbonyl Sulfide | 0.04 | 0.86 | 313.42 |
| Chlorobenzene | 5.91E-03 | 0.14 | 51.78 |
| Chlorodifluoromethane | 1.09E-02 | 0.26 | 95.33 |
| Chloroethane (ethyl chloride) | 3.12E-03 | 0.07 | 27.33 |
| Cumene (Isopropylbenzene) | 0.03 | 0.66 | 241.40 |
| Cyclohexane | 0.05 | 1.14 | 415.51 |
| Ethylbenzene | 0.38 | 9.14 | 3,335.35 |
| Hexane | 0.05 | 1.20 | 437.57 |
| Hydrogen Sulfide | 2.65 | 63.65 | 23,231.02 |
| m & p Xylenes | 0.82 | 19.66 | 7,176.96 |
| Methanol | 0.44 | 10.61 | 3,873.75 |
| Methyl butyl ketone (2-Hexanone) | 7.73E-03 | 0.19 | 67.71 |
| Methyl Ethyl Ketone (2-Butanone) | 0.82 | 19.67 | 7,181.02 |
| Methyl Isobutyl Ketone (4-Methyl-2-pentanone) | 0.10 | 2.46 | 896.29 |
| Methylene Dichloride | 9.79E-03 | 0.23 | 85.77 |
| Naphthalene | 0.23 | 5.46 | 1,991.87 |
| n-Hexane | 0.04 | 0.97 | 352.96 |
| o-Xylene | 0.26 | 6.15 | 2,245.40 |
| Perchloroethylene (tetrachloroethylene) | 0.05 | 1.15 | 420.53 |
| Styrene | 0.04 | 0.85 | 309.69 |
| Tetrahydrofuran | 0.21 | 5.15 | 1,879.20 |
| Toluene | 0.95 | 22.87 | 8,347.68 |
| Trichloroethylene (trichloroethene) | 1.29E-02 | 0.31 | 112.79 |
| Vinyl Chloride | 4.38E-03 | 0.11 | 38.40 |

# POTENTIAL EMISSION CALCULATIONS FOR LANDFILL
# NOTICE OF CONSTRUCTION MODIFICATION
## ROOSEVELT REGIONAL LANDFILL - KLICKITAT COUNTY, WASHINGTON

## Required:

Determine the potential emissions from the landfill at the maximum LFG generation. Estimates for VOCs and TAPs will be calculated utilizing the U.S. EPA's *Compilation of Air Pollutant Emission Factors* (AP-42), Section 2.4 for Municipal Solid Waste (MSW) Landfills.

## References:

1. AP-42 equations used to calculate emissions of VOCs and TAPs:

   A. Section 2.4.4.1, Equation 3 is used to calculate the total uncontrolled emission rate of LFG pollutants in $m^3$/yr using the following equation:

   $$Q_p = 2\ Q_{CH4}\ C_p \,/\, 1{,}000{,}000$$

   Where:

   | | |
   |---|---|
   | $Q_p$ = | emission rate of pollutant p, $m^3$/yr |
   | $Q_{CH4}$ = | $CH_4$ generation rate, $m^3$/yr |
   | $C_p$ = | concentration of pollutant p in LFG, $ppm_v$ |
   | 2 = | assumes LFG contains 50% $CH_4$ (per AP-42) |

   B. Section 2.4.4.1, Equation 4 is used to calculate the total uncontrolled mass emissions per year of LFG pollutants in kg/yr using the following equation:

   $$UM_p = (Q_p\ MW_p\ P) \,/\, (1{,}000\ R\ T)$$

   Where:

   | | |
   |---|---|
   | $UM_p$ = | uncontrolled or collected and not combusted mass emission rate of pollutant p, kg/yr |
   | $Q_p$ = | emission rate of pollutant p, $m^3$/yr |
   | $MW_p$ = | molecular weight of pollutant p, g/g-mol |
   | P = | atmospheric pressure, atm |
   | R = | universal gas constant, $m^3$-atm/gmol-K |
   | T = | standard temperature (77°F), Kelvin |

2. Conversion Factors:

| | | | |
|---|---|---|---|
| 35.315 | $ft^3$ | = | 1 $m^3$ |
| 525,600 | min | = | 1 yr |
| 6.719E-05 | scfm $CH_4$ | = | 1 $m^3$/yr |
| 2,000 | lbs | = | 1 ton |
| 8,760 | hr | = | 1 yr |
| 1.10E-03 | tons | = | 1 kg |
| 77 | °F | = | 298 K |

# POTENTIAL EMISSION CALCULATIONS FOR LANDFILL
# NOTICE OF CONSTRUCTION MODIFICATION
ROOSEVELT REGIONAL LANDFILL - KLICKITAT COUNTY, WASHINGTON

## Assumptions:

1. Estimated maximum $CH_4$ generation rate from the landfill predicted by the EPA's Landfill Gas Emissions Model (LandGEM) version 3.03 is:

| | | |
|---|---|---|
| $Q_{CH4,max}$ = | 325,268,116 | $m^3$/yr of $CH_4$ |
| | 21,855 | scfm of $CH_4$ |

Assuming LFG contains 50% $CH_4$, the maximum LFG generation rate from the landfill is:

| | | |
|---|---|---|
| $Q_{LFG,max}$ = | 43,709 | scfm of LFG |

2. The peak LFG production before the proposed expansion is determined to be 33,254 scfm. As such, the increase for this proposed expansion project is calculated as:

| | | |
|---|---|---|
| $Q_{LFG,max,proposed}$ = | 43,709 | scfm of LFG |
| $Q_{LFG,max,existing}$ = | 33,254 | scfm of LFG |
| $Q_{LFG,max,increase}$ = | 10,455 | scfm of LFG |
| $Q_{CH4,max,increase}$ = | 5,227 | scfm of $CH_4$ |

3. As per AP-42, Section 2.4.4.2, an average of 75% of LFG generated is commonly assumed to be collectable and controllable. The remainder of the LFG is released as fugitive emissions. However, the site's GCCS is assumed to collect approximately 80% of the LFG generated within the landfill in order to be conservative. Based on the maximum LFG generated by the landfill, the uncontrollable (or fugitive) portion of LFG and $CH_4$ are:

(i) $Q_{LFG,FUG} = Q_{LFG,max,increase}$ (20%)

| | | |
|---|---|---|
| $Q_{LFG,FUG}$ = | 2,091 | scfm of LFG |

(ii) $Q_{CH4,FUG} = Q_{CH4,max,increase}$ (20%)

| | | |
|---|---|---|
| $Q_{CH4,FUG}$ = | 1,045 | scfm of $CH_4$ |
| | 15,560,215 | $m^3$/yr of $CH_4$ |

4. The following conditions are assumed in calculating the emissions of VOCs and TAPs using Equation 4 provided in Reference 1.

| | | |
|---|---|---|
| P = | 1 | atm |
| R = | 8.205E-05 | $m^3$-atm/gmol-K |
| T = | 298 | K |

# POTENTIAL EMISSION CALCULATIONS FOR LANDFILL
# NOTICE OF CONSTRUCTION MODIFICATION
## ROOSEVELT REGIONAL LANDFILL - KLICKITAT COUNTY, WASHINGTON

**VOC and TAP Speciated Emissions:**

Estimated potential landfill fugitive $CH_4$ emission rate: 15,560,215 $m^3/yr$

| Speciated LFG Compounds | CAS No. | TAP | VOC | MW | Conc. [a] | Fugitive Emissions[b] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (g/g-mol) | ($ppm_v$) | lb/hr | lb/day | lb/yr | tons/hr | tons/day | tons/yr |
| 1,2,3-Trimethylbenzene | 526-73-8 | X | X | 120.19 | 0.58 | 0.02 | 0.53 | 195.21 | 1.11E-05 | 2.67E-04 | 0.10 |
| 1,2,4-Trimethylbenzene | 95-63-6 | X | X | 120.19 | 3.63 | 0.14 | 3.35 | 1,223.88 | 6.99E-05 | 1.68E-03 | 0.61 |
| 1,2-Dichloroethane (ethylene dichloride) | 107-06-2 | X | X | 98.96 | 0.55 | 0.02 | 0.42 | 151.85 | 8.67E-06 | 2.08E-04 | 0.08 |
| 1,3,5-Trimethylbenzene | 108-67-8 | X | X | 120.19 | 1.52 | 0.06 | 1.40 | 512.48 | 2.93E-05 | 7.02E-04 | 0.26 |
| 1,4-Dichlorobenzene | 95-50-1 | X | X | 147.00 | 0.63 | 0.03 | 0.72 | 261.44 | 1.49E-05 | 3.58E-04 | 0.13 |
| 1,4-Dioxane | 123-91-1 | X | X | 88.11 | 0.13 | 3.61E-03 | 0.09 | 31.64 | 1.81E-06 | 4.33E-05 | 0.02 |
| 1-Butene | 106-98-9 | | X | 56.11 | 0.85 | 1.53E-02 | 0.37 | 134.09 | 7.65E-06 | 1.84E-04 | 0.07 |
| 1-Hexene | 592-41-6 | | | 84.16 | 0.08 | 2.18E-03 | 0.05 | 19.12 | 1.09E-06 | 2.62E-05 | 9.56E-03 |
| 1-Pentene | 109-67-1 | | X | 70.13 | 0.18 | 3.93E-03 | 0.09 | 34.43 | 1.97E-06 | 4.72E-05 | 0.02 |
| 2,2,4-Trimethylpentane | 540-84-1 | | X | 114.23 | 0.90 | 0.03 | 0.79 | 289.67 | 1.65E-05 | 3.97E-04 | 0.14 |
| 2,2-Dimethylbutane | 75-83-2 | | | 86.18 | 0.36 | 9.88E-03 | 0.24 | 86.54 | 4.94E-06 | 1.19E-04 | 0.04 |
| 2,3,4-Trimethylpentane | 565-75-3 | | X | 114.23 | 0.31 | 1.13E-02 | 0.27 | 99.34 | 5.67E-06 | 1.36E-04 | 0.05 |
| 2,3-Dimethylbutane | 79-29-8 | | | 86.18 | 0.17 | 4.61E-03 | 0.11 | 40.37 | 2.30E-06 | 5.53E-05 | 0.02 |
| 2,3-Dimethylpentane | 565-59-3 | | | 100.20 | 1.12 | 0.04 | 0.86 | 314.81 | 1.80E-05 | 4.31E-04 | 0.16 |
| 2,4-Dimethylpentane | 108-08-7 | | | 100.20 | 0.17 | 5.29E-03 | 0.13 | 46.38 | 2.65E-06 | 6.35E-05 | 0.02 |
| 2-Methylheptane | 592-27-8 | | | 114.23 | 0.81 | 0.03 | 0.71 | 259.55 | 1.48E-05 | 3.56E-04 | 0.13 |
| 2-Methylhexane | 591-76-4 | | | 100.20 | 1.42 | 0.05 | 1.09 | 399.13 | 2.28E-05 | 5.47E-04 | 0.20 |
| 2-Methylpentane | 107-83-5 | | | 86.18 | 0.82 | 0.02 | 0.54 | 197.03 | 1.12E-05 | 2.70E-04 | 0.10 |
| 2-Methylthiophene | 554-14-3 | | | 98.17 | 0.42 | 1.32E-02 | 0.32 | 115.94 | 6.62E-06 | 1.59E-04 | 0.06 |
| 2-Propanol (Isopropyl alcohol) | 67-63-0 | X | X | 60.11 | 31.60 | 0.61 | 14.60 | 5,328.39 | 3.04E-04 | 7.30E-03 | 2.66 |
| 3-Methylheptane | 589-81-1 | | | 114.23 | 0.72 | 0.03 | 0.64 | 232.00 | 1.32E-05 | 3.18E-04 | 0.12 |
| 3-Methylhexane | 589-34-4 | | | 100.20 | 2.38 | 0.08 | 1.83 | 668.97 | 3.82E-05 | 9.16E-04 | 0.33 |
| 3-Methylpentane | 96-14-0 | | | 86.18 | 0.68 | 0.02 | 0.45 | 164.87 | 9.41E-06 | 2.26E-04 | 0.08 |
| 3-Methylthiophene | 616-44-4 | | | 98.17 | 0.20 | 6.16E-03 | 0.15 | 53.98 | 3.08E-06 | 7.39E-05 | 0.03 |
| 4-Ethyltoluene | 622-96-8 | | X | 120.19 | 1.30 | 0.05 | 1.20 | 438.30 | 2.50E-05 | 6.00E-04 | 0.22 |
| Acetone | 67-64-1 | | | 58.08 | 28.70 | 0.53 | 12.81 | 4,675.96 | 2.67E-04 | 6.41E-03 | 2.34 |
| Acetylene | 74-86-2 | | X | 26.04 | 0.30 | 2.52E-03 | 0.06 | 22.06 | 1.26E-06 | 3.02E-05 | 1.10E-02 |
| Benzene | 71-43-2 | X | X | 78.11 | 2.68 | 0.07 | 1.61 | 587.22 | 3.35E-05 | 8.04E-04 | 0.29 |
| Carbon Disulfide | 75-15-0 | X | X | 76.13 | 0.39 | 9.39E-03 | 0.23 | 82.22 | 4.69E-06 | 1.13E-04 | 0.04 |
| Carbonyl Sulfide | 463-58-1 | X | X | 60.07 | 1.86 | 0.04 | 0.86 | 313.42 | 1.79E-05 | 4.29E-04 | 0.16 |
| Chlorobenzene | 108-90-7 | X | X | 112.56 | 0.16 | 5.91E-03 | 0.14 | 51.78 | 2.96E-06 | 7.09E-05 | 0.03 |
| Chlorodifluoromethane | 75-45-6 | X | | 86.47 | 0.39 | 1.09E-02 | 0.26 | 95.33 | 5.44E-06 | 1.31E-04 | 0.05 |
| Chloroethane (ethyl chloride) | 75-00-3 | X | X | 64.52 | 0.15 | 3.12E-03 | 0.07 | 27.33 | 1.56E-06 | 3.74E-05 | 1.37E-02 |
| cis-1,2-Dichloroethene | 156-59-2 | | X | 96.95 | 0.70 | 0.02 | 0.52 | 190.10 | 1.09E-05 | 2.60E-04 | 0.10 |
| cis-2-Butene | 590-18-1 | | X | 56.10 | 0.36 | 6.52E-03 | 0.16 | 57.13 | 3.26E-06 | 7.83E-05 | 0.03 |
| cis-2-Pentene | 627-20-3 | | X | 70.13 | 0.09 | 2.11E-03 | 0.05 | 18.49 | 1.06E-06 | 2.53E-05 | 9.25E-03 |
| Cumene (Isopropylbenzene) | 98-82-8 | X | | 120.19 | 0.72 | 0.03 | 0.66 | 241.40 | 1.38E-05 | 3.31E-04 | 0.12 |
| Cyclohexane | 110-82-7 | X | X | 84.16 | 1.76 | 0.05 | 1.14 | 415.51 | 2.37E-05 | 5.69E-04 | 0.21 |
| Cyclopentane | 287-92-3 | | X | 70.10 | 0.40 | 8.93E-03 | 0.21 | 78.26 | 4.47E-06 | 1.07E-04 | 0.04 |
| Dichlorodifluoromethane | 75-71-8 | | | 120.91 | 0.39 | 1.49E-02 | 0.36 | 130.92 | 7.47E-06 | 1.79E-04 | 0.07 |
| Dichlorofluoromethane | 75-43-4 | | X | 102.92 | 0.52 | 0.02 | 0.41 | 149.55 | 8.54E-06 | 2.05E-04 | 0.07 |
| Dimethyl Sulfide | 75-18-3 | | X | 62.13 | 6.25 | 0.12 | 2.98 | 1,089.29 | 6.22E-05 | 1.49E-03 | 0.54 |
| Ethane | 74-84-0 | | | 30.07 | 6.10 | 0.06 | 1.41 | 514.55 | 2.94E-05 | 7.05E-04 | 0.26 |
| Ethanol | 64-17-5 | | X | 46.08 | 79.00 | 1.17 | 27.98 | 10,211.79 | 5.83E-04 | 1.40E-02 | 5.11 |
| Ethyl Acetate | 141-78-6 | | X | 88.11 | 4.41 | 0.12 | 2.99 | 1,090.00 | 6.22E-05 | 1.49E-03 | 0.54 |

# POTENTIAL EMISSION CALCULATIONS FOR LANDFILL
# NOTICE OF CONSTRUCTION MODIFICATION
## ROOSEVELT REGIONAL LANDFILL - KLICKITAT COUNTY, WASHINGTON

| Speciated LFG Compounds | CAS No. | TAP | VOC | MW | Conc. [a] | Fugitive Emissions[b] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (g/g-mol) | ($ppm_v$) | lb/hr | lb/day | lb/yr | tons/hr | tons/day | tons/yr |
| Ethyl Mercaptan | 75-08-1 | | X | 62.13 | 0.35 | 7.04E-03 | 0.17 | 61.70 | 3.52E-06 | 8.45E-05 | 0.03 |
| Ethylbenzene | 100-41-4 | X | X | 106.16 | 11.20 | 0.38 | 9.14 | 3,335.35 | 1.90E-04 | 4.57E-03 | 1.67 |
| Ethylene | 74-85-1 | | X | 28.05 | 8.86 | 0.08 | 1.91 | 697.15 | 3.98E-05 | 9.55E-04 | 0.35 |
| Fluorotrichloromethane | 75-69-4 | | X | 137.38 | 0.16 | 7.21E-03 | 0.17 | 63.20 | 3.61E-06 | 8.66E-05 | 0.03 |
| Heptane | 142-82-5 | | X | 100.21 | 3.70 | 0.12 | 2.85 | 1,040.10 | 5.94E-05 | 1.42E-03 | 0.52 |
| Hexane | 110-54-3 | X | X | 86.18 | 1.81 | 0.05 | 1.20 | 437.57 | 2.50E-05 | 5.99E-04 | 0.22 |
| Hydrogen Sulfide | 7783-06-4 | X | | 34.08 | 243.00 | 2.65 | 63.65 | 23,231.02 | 1.33E-03 | 3.18E-02 | 11.62 |
| Isobutane | 106-97-8 | | X | 58.12 | 8.82 | 0.16 | 3.94 | 1,437.99 | 8.21E-05 | 1.97E-03 | 0.72 |
| Isobutyl Mercaptan | 513-44-0 | | | 90.18 | 0.41 | 1.18E-02 | 0.28 | 103.47 | 5.91E-06 | 1.42E-04 | 0.05 |
| Isopentane | 78-78-4 | | X | 72.15 | 5.62 | 0.13 | 3.12 | 1,137.46 | 6.49E-05 | 1.56E-03 | 0.57 |
| Isoprene | 78-79-5 | | | 68.12 | 0.10 | 2.27E-03 | 0.05 | 19.87 | 1.13E-06 | 2.72E-05 | 9.94E-03 |
| Isopropyl Mercaptan | 75-33-2 | | | 76.16 | 7.61 | 0.19 | 4.45 | 1,625.83 | 9.28E-05 | 2.23E-03 | 0.81 |
| m & p Xylenes | 1330-20-7 | X | X | 106.16 | 24.10 | 0.82 | 19.66 | 7,176.96 | 4.10E-04 | 9.83E-03 | 3.59 |
| m-Diethylbenzene | 141-93-5 | | | 134.22 | 0.86 | 0.04 | 0.89 | 323.42 | 1.85E-05 | 4.43E-04 | 0.16 |
| Methanol | 67-56-1 | X | X | 32.04 | 43.10 | 0.44 | 10.61 | 3,873.75 | 2.21E-04 | 5.31E-03 | 1.94 |
| Methyl butyl ketone (2-Hexanone) | 591-78-6 | X | X | 100.16 | 0.24 | 0.01 | 0.19 | 67.71 | 3.86E-06 | 9.28E-05 | 0.03 |
| Methyl Ethyl Ketone (2-Butanone) | 78-93-3 | X | X | 72.11 | 35.50 | 0.82 | 19.67 | 7,181.02 | 4.10E-04 | 9.84E-03 | 3.59 |
| Methyl Isobutyl Ketone (4-Methyl-2-pentanone) | 108-10-1 | X | X | 100.16 | 3.19 | 0.10 | 2.46 | 896.29 | 5.12E-05 | 1.23E-03 | 0.45 |
| Methyl Mercaptan | 74-93-1 | | X | 48.11 | 6.62 | 0.10 | 2.45 | 893.42 | 5.10E-05 | 1.22E-03 | 0.45 |
| Methylcyclohexane | 108-87-2 | | | 98.19 | 2.41 | 0.08 | 1.82 | 663.79 | 3.79E-05 | 9.09E-04 | 0.33 |
| Methylcyclopentane | 96-37-7 | | | 84.16 | 0.68 | 0.02 | 0.44 | 160.77 | 9.18E-06 | 2.20E-04 | 0.08 |
| Methylene Dichloride | 75-09-2 | X | | 84.93 | 0.36 | 9.79E-03 | 0.23 | 85.77 | 4.90E-06 | 1.17E-04 | 0.04 |
| m-Ethyltoluene | 620-14-4 | | | 120.20 | 3.43 | 0.13 | 3.17 | 1,156.54 | 6.60E-05 | 1.58E-03 | 0.58 |
| Naphthalene | 91-20-3 | X | | 128.17 | 5.54 | 0.23 | 5.46 | 1,991.87 | 1.14E-04 | 2.73E-03 | 1.00 |
| n-Butane | 106-97-8 | | X | 58.12 | 7.54 | 0.14 | 3.37 | 1,229.30 | 7.02E-05 | 1.68E-03 | 0.61 |
| n-Butyl Mercaptan | 109-79-5 | | | 90.19 | 0.13 | 3.87E-03 | 0.09 | 33.90 | 1.94E-06 | 4.64E-05 | 0.02 |
| n-Decane | 124-18-5 | | | 142.29 | 6.29 | 0.29 | 6.88 | 2,510.66 | 1.43E-04 | 3.44E-03 | 1.26 |
| n-Dodecane | 112-40-3 | | | 170.33 | 0.77 | 0.04 | 1.01 | 368.87 | 2.11E-05 | 5.05E-04 | 0.18 |
| n-Hexane | 110-54-3 | X | X | 86.18 | 1.46 | 0.04 | 0.97 | 352.96 | 2.01E-05 | 4.84E-04 | 0.18 |
| n-Octane | 111-65-9 | | | 114.23 | 2.43 | 0.09 | 2.13 | 778.66 | 4.44E-05 | 1.07E-03 | 0.39 |
| Nonane | 111-84-2 | | | 128.20 | 5.80 | 0.24 | 5.71 | 2,085.83 | 1.19E-04 | 2.86E-03 | 1.04 |
| n-Pentane | 109-66-0 | | X | 72.15 | 2.86 | 0.07 | 1.59 | 578.85 | 3.30E-05 | 7.93E-04 | 0.29 |
| n-Propyl Mercaptan | 107-03-9 | | | 76.16 | 0.23 | 5.54E-03 | 0.13 | 48.50 | 2.77E-06 | 6.64E-05 | 0.02 |
| n-Propylbenzene | 103-65-1 | | | 120.20 | 1.12 | 0.04 | 1.03 | 377.65 | 2.16E-05 | 5.17E-04 | 0.19 |
| n-Undecane | 1120-21-4 | | | 156.31 | 3.29 | 0.16 | 3.95 | 1,442.60 | 8.23E-05 | 1.98E-03 | 0.72 |
| o-Ethyltoluene | 611-14-3 | | | 120.19 | 0.80 | 0.03 | 0.74 | 269.39 | 1.54E-05 | 3.69E-04 | 0.13 |
| o-Xylene | 1330-20-7 | X | X | 106.16 | 7.54 | 0.26 | 6.15 | 2,245.40 | 1.28E-04 | 3.08E-03 | 1.12 |
| p-Diethylbenzene | 25340-17-4 | | | 134.22 | 1.26 | 0.05 | 1.30 | 474.41 | 2.71E-05 | 6.50E-04 | 0.24 |
| Perchloroethylene (tetrachloroethylene) | 127-18-4 | X | | 165.83 | 0.90 | 0.05 | 1.15 | 420.53 | 2.40E-05 | 5.76E-04 | 0.21 |
| Propane | 74-98-6 | | X | 44.09 | 56.80 | 0.80 | 19.25 | 7,025.07 | 4.01E-04 | 9.62E-03 | 3.51 |
| Propene/Propylene | 115-07-1 | | | 42.08 | 17.50 | 0.24 | 5.66 | 2,065.74 | 1.18E-04 | 2.83E-03 | 1.03 |
| sec-Butyl Mercaptan/Thiophene | 513-53-1 | | | 90.18 | 7.23 | 0.21 | 5.01 | 1,828.99 | 1.04E-04 | 2.51E-03 | 0.91 |
| Styrene | 100-42-5 | X | X | 104.15 | 1.06 | 0.04 | 0.85 | 309.69 | 1.77E-05 | 4.24E-04 | 0.15 |
| tert-Butyl Mercaptan | 75-66-1 | | | 90.18 | 0.45 | 1.31E-02 | 0.31 | 114.60 | 6.54E-06 | 1.57E-04 | 0.06 |
| Tetrahydrofuran | 109-99-9 | X | X | 72.11 | 9.29 | 0.21 | 5.15 | 1,879.20 | 1.07E-04 | 2.57E-03 | 0.94 |
| Tetrahydrothiophene | 110-01-0 | | X | 88.10 | 9.20E-05 | 2.60E-06 | 6.23E-05 | 0.02 | 1.30E-09 | 3.11E-08 | 1.14E-05 |
| Thiophenol | 108-98-5 | | | 110.19 | 0.33 | 1.15E-02 | 0.28 | 100.46 | 5.73E-06 | 1.38E-04 | 0.05 |
| Toluene | 108-88-3 | X | X | 92.13 | 32.30 | 0.95 | 22.87 | 8,347.68 | 4.76E-04 | 1.14E-02 | 4.17 |

# POTENTIAL EMISSION CALCULATIONS FOR LANDFILL
# NOTICE OF CONSTRUCTION MODIFICATION
## ROOSEVELT REGIONAL LANDFILL - KLICKITAT COUNTY, WASHINGTON

| Speciated LFG Compounds | CAS No. | TAP | VOC | MW (g/g-mol) | Conc. [a] ($ppm_v$) | Fugitive Emissions[b] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | lb/hr | lb/day | lb/yr | tons/hr | tons/day | tons/yr |
| trans-1,3-Dichloropropene | 10061-02-6 | | X | 110.97 | 0.12 | 4.41E-03 | 0.11 | 38.60 | 2.20E-06 | 5.29E-05 | 0.02 |
| trans-2-Butene | 624-64-6 | | X | 57.11 | 0.42 | 7.66E-03 | 7.66E-03 | 67.13 | 3.83E-06 | 9.20E-05 | 0.03 |
| trans-2-Pentene | 646-04-8 | | X | 70.13 | 0.11 | 2.47E-03 | 0.06 | 21.64 | 1.24E-06 | 2.96E-05 | 1.08E-02 |
| Trichloroethylene (trichloroethene) | 79-01-6 | X | X | 131.40 | 0.31 | 1.29E-02 | 0.31 | 112.79 | 6.44E-06 | 1.55E-04 | 0.06 |
| Vinyl Chloride | 75-01-4 | X | X | 62.50 | 0.22 | 4.38E-03 | 0.11 | 38.40 | 2.19E-06 | 5.26E-05 | 0.02 |
| **Total VOCs** | | | | | | -- | -- | -- | **4.20E-03** | **0.10** | **36.82** |
| **Total TAPs** | | | | | | -- | -- | -- | **4.08E-03** | **0.10** | **35.75** |

[a] Concentration for LFG compounds obtained from site-specific analysis.

[b] These emissions were calculated by using the equations # 3 and # 4 from AP-42, Section 2.4 (11/98), the site-specific concentration for each compound, and the fugitive methane emission rate.

# APPENDIX F

# MODELING RESULTS

# AERSCREEN RESULTS

```
AERSCREEN 16216 / AERMOD 18081                                          04/20/22
                                                                        13:00:46

TITLE: RRLF

----------------------------------------------------------------------------
******************************  AREA PARAMETERS  ****************************
----------------------------------------------------------------------------

SOURCE EMISSION RATE:            0.1260 g/s                1.000 lb/hr

AREA EMISSION RATE:           0.904E-07 g/(s-m2)       0.718E-06 lb/(hr-m2)
AREA HEIGHT:                       0.00 meters              0.00 feet
AREA SOURCE LONG SIDE:          1524.00 meters           5000.00 feet
AREA SOURCE SHORT SIDE:          914.40 meters           3000.00 feet
INITIAL VERTICAL DIMENSION:     1524.00 meters           5000.00 feet
RURAL OR URBAN:                   RURAL

INITIAL PROBE DISTANCE =          5000. meters            16404. feet


----------------------------------------------------------------------------
***********************  BUILDING DOWNWASH PARAMETERS  **********************
----------------------------------------------------------------------------

               BUILDING DOWNWASH NOT USED FOR NON-POINT SOURCES


----------------------------------------------------------------------------
**************************  FLOW SECTOR ANALYSIS  ***************************
                 25 meter receptor spacing: 1. meters - 5000. meters
----------------------------------------------------------------------------


   MAXIMUM  IMPACT  RECEPTOR

   Zo         SURFACE   1-HR CONC  RADIAL  DIST   TEMPORAL
   SECTOR    ROUGHNESS  (ug/m3)    (deg)   (m)    PERIOD
  -----------------------------------------------------
      1*       0.500     5.755      30   875.0     WIN
* = worst case diagonal


----------------------------------------------------------------------------
*********************  MAKEMET METEOROLOGY PARAMETERS  *********************
```

---

MIN/MAX TEMPERATURE: 249.8 / 310.9 (K)

MINIMUM WIND SPEED: 0.5 m/s

ANEMOMETER HEIGHT: 10.000 meters

SURFACE CHARACTERISTICS INPUT: AERMET SEASONAL TABLES

DOMINANT SURFACE PROFILE: Deciduous Forest
DOMINANT CLIMATE TYPE: Average Moisture
DOMINANT SEASON: Winter

ALBEDO: 0.50
BOWEN RATIO: 1.50
ROUGHNESS LENGTH: 0.500 (meters)

SURFACE FRICTION VELOCITY (U*) NOT ADUSTED

METEOROLOGY CONDITIONS USED TO PREDICT OVERALL MAXIMUM IMPACT

| YR | MO | DY | JDY | HR |
|---|---|---|---|---|
| 10 | 01 | 02 | 2 | 12 |

| H0 | U* | W* | DT/DZ | ZICNV | ZIMCH | M-O LEN | Z0 | BOWEN | ALBEDO | REF WS |
|---|---|---|---|---|---|---|---|---|---|---|
| 2.11 | 0.085 | 0.100 | 0.020 | 16. | 57. | -24.8 | 0.500 | 1.50 | 0.50 | 0.50 |

| HT | REF TA | HT |
|---|---|---|
| 10.0 | 280.4 | 2.0 |

---

*********************** AERSCREEN AUTOMATED DISTANCES *********************
OVERALL MAXIMUM CONCENTRATIONS BY DISTANCE

---

| DIST (m) | MAXIMUM 1-HR CONC (ug/m3) | DIST (m) | MAXIMUM 1-HR CONC (ug/m3) |
|---|---|---|---|
| 1.00 | 3.109 | 2525.00 | 5.103 |
| 25.00 | 3.183 | 2550.00 | 5.100 |

| | | | |
|---|---|---|---|
| 50.00 | 3.260 | 2575.00 | 5.096 |
| 75.00 | 3.337 | 2600.00 | 5.093 |
| 100.00 | 3.413 | 2625.00 | 5.089 |
| 125.00 | 3.489 | 2650.00 | 5.086 |
| 150.00 | 3.565 | 2675.00 | 5.082 |
| 175.00 | 3.642 | 2700.00 | 5.079 |
| 200.00 | 3.719 | 2725.00 | 5.075 |
| 225.00 | 3.796 | 2750.00 | 5.072 |
| 250.00 | 3.872 | 2775.00 | 5.068 |
| 275.00 | 3.949 | 2800.00 | 5.065 |
| 300.00 | 4.027 | 2825.00 | 5.061 |
| 325.00 | 4.104 | 2850.00 | 5.058 |
| 350.00 | 4.181 | 2875.00 | 5.054 |
| 375.00 | 4.259 | 2900.00 | 5.051 |
| 400.00 | 4.332 | 2925.00 | 5.047 |
| 425.00 | 4.405 | 2950.00 | 5.044 |
| 450.00 | 4.479 | 2975.00 | 5.040 |
| 475.00 | 4.552 | 2999.99 | 5.036 |
| 500.00 | 4.625 | 3025.00 | 5.033 |
| 525.00 | 4.698 | 3050.00 | 5.029 |
| 550.00 | 4.772 | 3075.00 | 5.025 |
| 575.00 | 4.845 | 3100.00 | 5.022 |
| 600.00 | 4.919 | 3125.00 | 5.018 |
| 625.00 | 4.996 | 3150.00 | 5.014 |
| 650.00 | 5.074 | 3175.00 | 5.011 |
| 675.00 | 5.151 | 3200.00 | 5.007 |
| 700.00 | 5.228 | 3225.00 | 5.003 |
| 725.00 | 5.306 | 3250.00 | 5.000 |
| 750.00 | 5.383 | 3275.00 | 4.996 |
| 775.00 | 5.460 | 3300.00 | 4.993 |
| 800.00 | 5.537 | 3325.00 | 4.989 |
| 825.00 | 5.615 | 3350.00 | 4.985 |
| 850.00 | 5.679 | 3375.00 | 4.981 |
| 875.00 | 5.755 | 3400.00 | 4.978 |
| 900.00 | 5.723 | 3425.00 | 4.974 |
| 925.00 | 5.700 | 3450.00 | 4.970 |
| 950.00 | 5.630 | 3475.00 | 4.966 |
| 975.00 | 5.565 | 3500.00 | 4.963 |
| 1000.00 | 5.512 | 3525.00 | 4.959 |
| 1025.00 | 5.469 | 3550.00 | 4.955 |
| 1050.00 | 5.434 | 3575.00 | 4.951 |
| 1075.00 | 5.379 | 3600.00 | 4.948 |
| 1100.00 | 5.368 | 3625.00 | 4.944 |
| 1125.00 | 5.358 | 3650.00 | 4.940 |
| 1150.00 | 5.349 | 3675.00 | 4.937 |
| 1175.00 | 5.340 | 3700.00 | 4.933 |
| 1200.00 | 5.331 | 3725.00 | 4.929 |
| 1225.00 | 5.323 | 3750.00 | 4.926 |
| 1250.00 | 5.316 | 3775.00 | 4.922 |
| 1275.00 | 5.309 | 3800.00 | 4.918 |

| | | | |
|---|---|---|---|
| 1300.00 | 5.303 | 3825.00 | 4.914 |
| 1325.00 | 5.297 | 3850.00 | 4.911 |
| 1350.00 | 5.291 | 3875.00 | 4.907 |
| 1375.00 | 5.285 | 3900.00 | 4.905 |
| 1400.00 | 5.279 | 3925.00 | 4.902 |
| 1425.00 | 5.273 | 3950.00 | 4.899 |
| 1450.00 | 5.267 | 3975.00 | 4.896 |
| 1475.00 | 5.262 | 4000.00 | 4.893 |
| 1500.00 | 5.256 | 4025.00 | 4.890 |
| 1525.00 | 5.250 | 4050.00 | 4.888 |
| 1550.00 | 5.244 | 4075.00 | 4.885 |
| 1575.00 | 5.239 | 4100.00 | 4.882 |
| 1600.00 | 5.233 | 4125.00 | 4.879 |
| 1625.00 | 5.228 | 4149.99 | 4.876 |
| 1650.00 | 5.222 | 4175.00 | 4.873 |
| 1675.00 | 5.216 | 4200.00 | 4.870 |
| 1700.00 | 5.211 | 4225.00 | 4.867 |
| 1725.00 | 5.205 | 4250.00 | 4.864 |
| 1750.00 | 5.200 | 4275.00 | 4.861 |
| 1775.00 | 5.195 | 4300.00 | 4.858 |
| 1800.00 | 5.191 | 4325.00 | 4.855 |
| 1825.00 | 5.189 | 4350.00 | 4.852 |
| 1850.00 | 5.186 | 4375.01 | 4.849 |
| 1875.00 | 5.183 | 4400.00 | 4.846 |
| 1899.99 | 5.181 | 4425.00 | 4.843 |
| 1925.00 | 5.178 | 4450.00 | 4.840 |
| 1950.00 | 5.175 | 4475.00 | 4.836 |
| 1975.00 | 5.172 | 4500.00 | 4.833 |
| 2000.01 | 5.170 | 4525.00 | 4.830 |
| 2025.00 | 5.167 | 4550.00 | 4.827 |
| 2050.00 | 5.164 | 4575.00 | 4.824 |
| 2075.00 | 5.161 | 4600.00 | 4.820 |
| 2100.00 | 5.158 | 4625.00 | 4.817 |
| 2124.99 | 5.155 | 4650.00 | 4.814 |
| 2150.00 | 5.152 | 4675.00 | 4.811 |
| 2175.00 | 5.148 | 4700.00 | 4.808 |
| 2200.00 | 5.145 | 4725.00 | 4.805 |
| 2225.00 | 5.142 | 4750.00 | 4.801 |
| 2250.00 | 5.139 | 4775.00 | 4.798 |
| 2275.00 | 5.136 | 4800.00 | 4.794 |
| 2300.00 | 5.133 | 4825.00 | 4.791 |
| 2325.00 | 5.129 | 4850.00 | 4.788 |
| 2350.00 | 5.126 | 4875.00 | 4.787 |
| 2375.00 | 5.123 | 4900.00 | 4.785 |
| 2400.00 | 5.120 | 4925.00 | 4.784 |
| 2425.00 | 5.116 | 4950.00 | 4.782 |
| 2449.99 | 5.113 | 4975.00 | 4.781 |
| 2475.00 | 5.110 | 5000.00 | 4.779 |
| 2500.00 | 5.106 | | |

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## ********************* AERSCREEN MAXIMUM IMPACT SUMMARY *********************

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3-hour, 8-hour, and 24-hour scaled
concentrations are equal to the 1-hour concentration as referenced in
SCREENING PROCEDURES FOR ESTIMATING THE AIR QUALITY
IMPACT OF STATIONARY SOURCES, REVISED (Section 4.5.4)
Report number EPA-454/R-92-019
http://www.epa.gov/scram001/guidance_permit.htm
under Screening Guidance

| CALCULATION PROCEDURE | MAXIMUM 1-HOUR CONC (ug/m3) | SCALED 3-HOUR CONC (ug/m3) | SCALED 8-HOUR CONC (ug/m3) | SCALED 24-HOUR CONC (ug/m3) | SCALED ANNUAL CONC (ug/m3) |
|---|---|---|---|---|---|
| FLAT TERRAIN | 5.770 | 5.770 | 5.770 | 5.770 | N/A |

DISTANCE FROM SOURCE 880.00 meters

| | | | | | |
|---|---|---|---|---|---|
| IMPACT AT THE AMBIENT BOUNDARY | 3.109 | 3.109 | 3.109 | 3.109 | N/A |

DISTANCE FROM SOURCE 1.00 meters

# FIRST TIER REVIEW – AERMOD

# FIRST TIER REVIEW–AERMOD
# REVISION TO NOTICE OF CONSTRUCTION APPLICATION
***ROOSEVELT REGIONAL LANDFILL***
***REGIONAL DISPOSAL COMPANY***

## Summary

When preforming the WAC 173-460-150 Analysis at the Roosevelt Regional Landfill located in Klickitat County, Washington for the proposed revision, emissions of the compounds listed in Table 1 below exceeded the small quantity emission rate (SQER) for the respective averaging period.

| Compounds | CAS No. | Emission Rates (lb/hr) |
|---|---|---|
| 1,1 - Dichloroethane (ethylidene dichloride) | 107-06-2 | 0.02 |
| 1,4 - Dichlorobenzene | 95-50-1 | 0.03 |
| Benzene | 71-43-2 | 0.07 |
| Ethylbenzene | 100-41-4 | 0.38 |
| Naphthalene | 91-20-3 | 0.16 |
| Perchloroethylene (tetrachloroethylene) | 127-18-4 | 0.05 |
| Hydrogen Sulfide ($H_2S$) | 7783-06- | 1.06 |

As such, the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) was used to determine if the maximum ground level concentration ($GLC_{max}$) of these compounds is below the acceptable source impact level (ASIL). The modeling parameters and results are provided in the sections below. The modeling output files and dispersion maps are provided at the end of this report.

## AERMOD Parameters

### AERMOD Source Type Justification

AERMOD Version 19191 dispersion model allows emission units to be represented as point, line, area or volume sources. In this dispersion modeling analysis, the landfill working face was modeled as an area source since the emissions occur at the surface (ground-level) which will disperse in two dimensions with little or no plume rise.

***Table 1. Modeling Parameters***

| Model ID | Source Type | Area (Acres) |
|---|---|---|
| LFUG | Area | 917 |

## Meteorological Data

The annual metrological data used in the dispersion modeling analysis is from year 1992 for Weather Station 24157, which is located at Spokane International Airport. The surface and upper air data was obtained from WebMet and processed using AERMET Version No. 19191.

## Terrain Data

The United States Geological Survey (USGS) 75M Digital Elevation Model (DEM) data was obtained from WebGIS and processed using AERMAP Version 18081.

## Receptor Grid

The receptor grid spacing used in the modeling analysis, as recommended in the State of Washing Department of Ecology (DOE) *Guidance on First, Second, and Third Tier Review of Air Toxics* document, is provided in Table 1 below:

***Table 2. Receptor Grid Spacing***

| Distance from Source (m) | Grid Spacing (m) |
|---|---|
| 0-150 | 12.5 |
| 150-400 | 25 |
| 400-900 | 50 |
| 900-2,000 | 100 |
| 2,000-4,500 | 300 |
| >4,500 | 600 |

## Additional Dispersion Modeling Options

- No building downwash
- Rural area dispersion option
- Elevated terrain (default option)

## AERMOD Dispersion Modeling Results

***Table 3. First Tier Review for A Revision to Notice of Construction Application at Roosevelt Regional Landfill Comparison of $GLC_{max}$ from AERMOD to ASIL***

| Chemical Species [CAS] | Averaging Period | ASIL (µg/m³) | $GLC_{max}$ (µg/m³) | Is $GLC_{max}$ < ASIL? |
|---|---|---|---|---|
| 1,1 - Dichloroethane (ethylidene dichloride) | Annual | 0.038 | 0.00354 | Yes |
| 1,4 - Dichlorobenzene | Annual | 0.091 | 0.00530 | Yes |
| Benzene | Annual | 0.13 | 0.01238 | Yes |
| Ethylbenzene | Annual | 0.40 | 0.06718 | Yes |
| Naphthalene | Annual | 0.029 | 0.02829 | Yes |
| Perchloroethylene (tetrachloroethylene) | Annual | 0.16 | 0.00884 | Yes |
| Hydrogen Sulfide ($H_2S$) | 24-HR | 2.00 | 1.97540 | Yes |

Since all emissions are below the appropriate ASIL and all other compounds are below *de minimis* emission levels as specified in WAC 173-460-150 (SQER), the revision project meets the requirements of the first tier review.

# AERMOD MOELING OUTPUT FILES AND DISPERSION MAPS

# Control Pathway

AERMOD

## Dispersion Options

**Titles**

Rossevelt 2023 Mod

**Dispersion Options**

- [x] Regulatory Default
- [ ] Non-Default Options

**Dispersion Coefficient**

Rural

**Output Type**

- [x] Concentration
- [ ] Total Deposition (Dry & Wet)
- [ ] Dry Deposition
- [ ] Wet Deposition

**Plume Depletion**

- [ ] Dry Removal
- [ ] Wet Removal

**Output Warnings**

- [ ] No Output Warnings
- [ ] Non-fatal Warnings for Non-sequential Met Data

## Pollutant / Averaging Time / Terrain Options

**Pollutant Type**

OTHER - 107062

**Averaging Time Options**

Hours: [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 6 [ ] 8 [ ] 12 [ ] 24

[ ] Month [ ] Period [x] Annual

**Exponential Decay**

Option not available

**Terrain Height Options**

[ ] Flat [x] Elevated

SO: Meters
RE: Meters
TG: Meters

**Flagpole Receptors**

[ ] Yes [x] No

Default Height = 0.00 m

# Source Pathway

AERMOD

## Building Downwash Information

Option not in use

## Emission Rate Units for Output

| For Concentration | |
|---|---|
| Unit Factor: | 1E6 |
| Emission Unit Label: | GRAMS/SEC |
| Concentration Unit Label: | MICROGRAMS/M**3 |

# Meteorology Pathway

AERMOD

## Met Input Data

### Surface Met Data

Filename: ..\..\Roosevelt\roosevelt2.SFC

Format Type: Default AERMET format

### Profile Met Data

Filename: ..\..\Roosevelt\roosevelt2.PFL

Format Type: Default AERMET format

### Wind Speed

☐ Wind Speeds are Vector Mean (Not Scalar Means)

### Wind Direction

Rotation Adjustment [deg]:

### Potential Temperature Profile

Base Elevation above MSL (for Primary Met Tower): 2,358.00 [m]

### Meteorological Station Data

| Stations | Station No. | Year | X Coordinate [m] | Y Coordinate [m] | Station Name |
|---|---|---|---|---|---|
| Surface | | 1992 | | | SPOKANE/INT'L ARPT |
| Upper Air | | 1992 | | | SPOKANE/INT'L ARPT |

## Data Period

### Data Period to Process

Start Date: 1/1/1992 Start Hour: 1 End Date: 12/31/1992 End Hour: 24

## Wind Speed Categories

| Stability Category | Wind Speed [m/s] | Stability Category | Wind Speed [m/s] |
|---|---|---|---|
| A | 1.54 | D | 8.23 |
| B | 3.09 | E | 10.8 |
| C | 5.14 | F | No Upper Bound |

# Results Summary

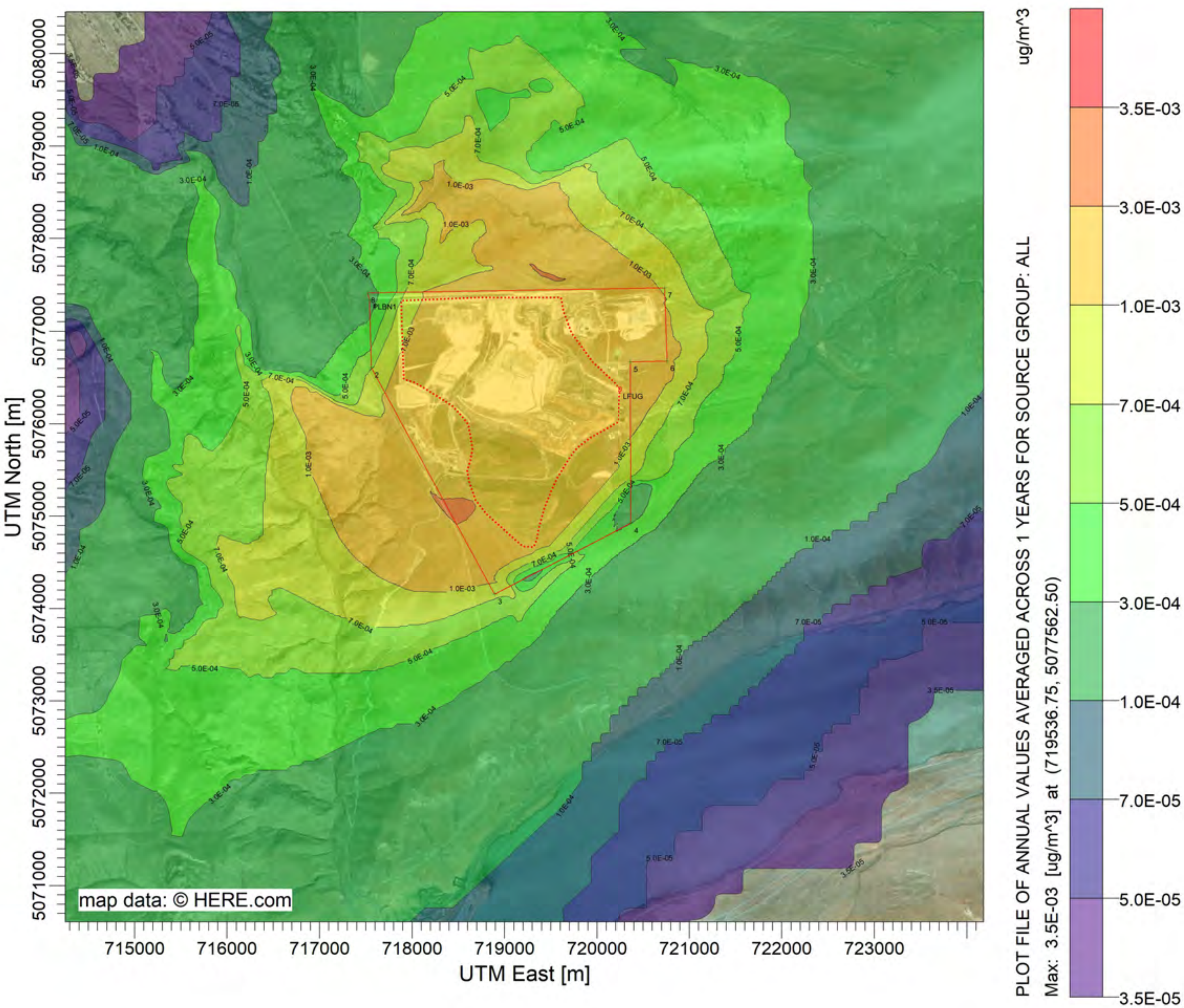
Rossevelt 2023 Mod

**107062 - Concentration - Source Group: ALL**

| Averaging Period | Rank | Peak | Units | X (m) | Y (m) | ZELEV (m) | ZFLAG (m) | ZHILL (m) | Peak Date, Start Hour |
|---|---|---|---|---|---|---|---|---|---|
| ANNUAL | | 0.00354 | | 719536.75 | 5077562.50 | 466.56 | 0.00 | 534.00 | |

PROJECT TITLE:

**Annual Results for 1,1 - Dichloroethane (107-06-2)**
**Roosevelt Regional Landfill**




COMMENTS:

SOURCES:
**1**

RECEPTORS:
**135105**

OUTPUT TYPE:
**Concentration**

MAX:
**3.5E-03 ug/m^3**

COMPANY NAME:
**WCG**

MODELER:
**M. Moore**

DATE:
**6/21/2023**

SCALE: 1:67,016

0 2 km

PROJECT NO.:

# Results Summary

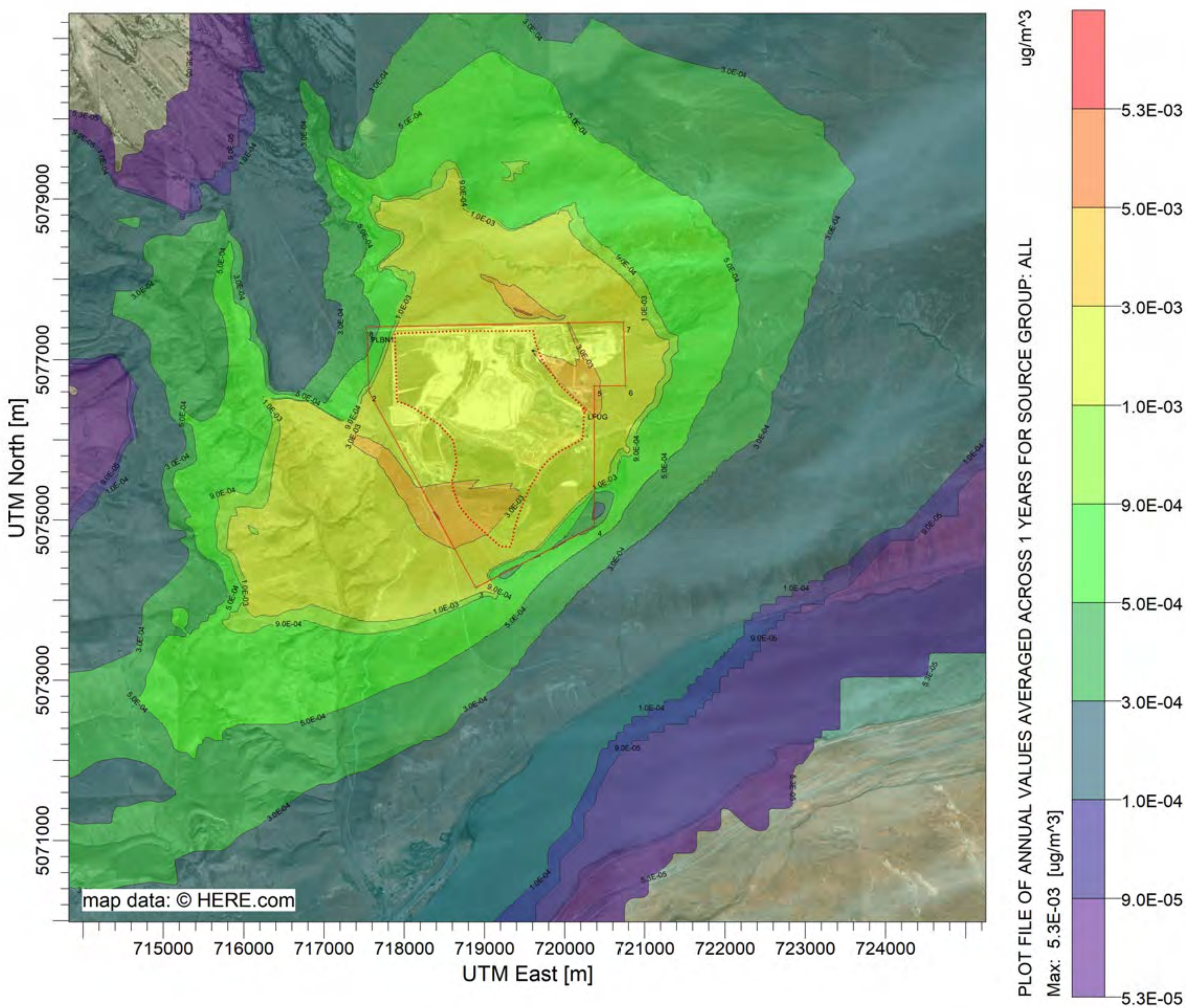
Roosevelt 2023 Mod

**95501 - Concentration - Source Group: ALL**

| Averaging Period | Rank | Peak | Units | X (m) | Y (m) | ZELEV (m) | ZFLAG (m) | ZHILL (m) | Peak Date, Start Hour |
|---|---|---|---|---|---|---|---|---|---|
| ANNUAL | | 0.00530 | ug/m^3 | 719511.75 | 5077575.00 | 465.42 | 0.00 | 534.00 | |

PROJECT TITLE:

**Annual Results for 1,4 - Dichlorobenzene (95-50-1)**
**Roosevelt Regional Landfill**




COMMENTS:

SOURCES:
**1**

RECEPTORS:
**135105**

OUTPUT TYPE:
**Concentration**

MAX:
**5.3E-03 ug/m^3**

COMPANY NAME:
**WCG**

MODELER:
**M. Moore**

DATE:
**6/20/2023**

SCALE: 1:77,131

0 2 km

PROJECT NO.:

# Results Summary

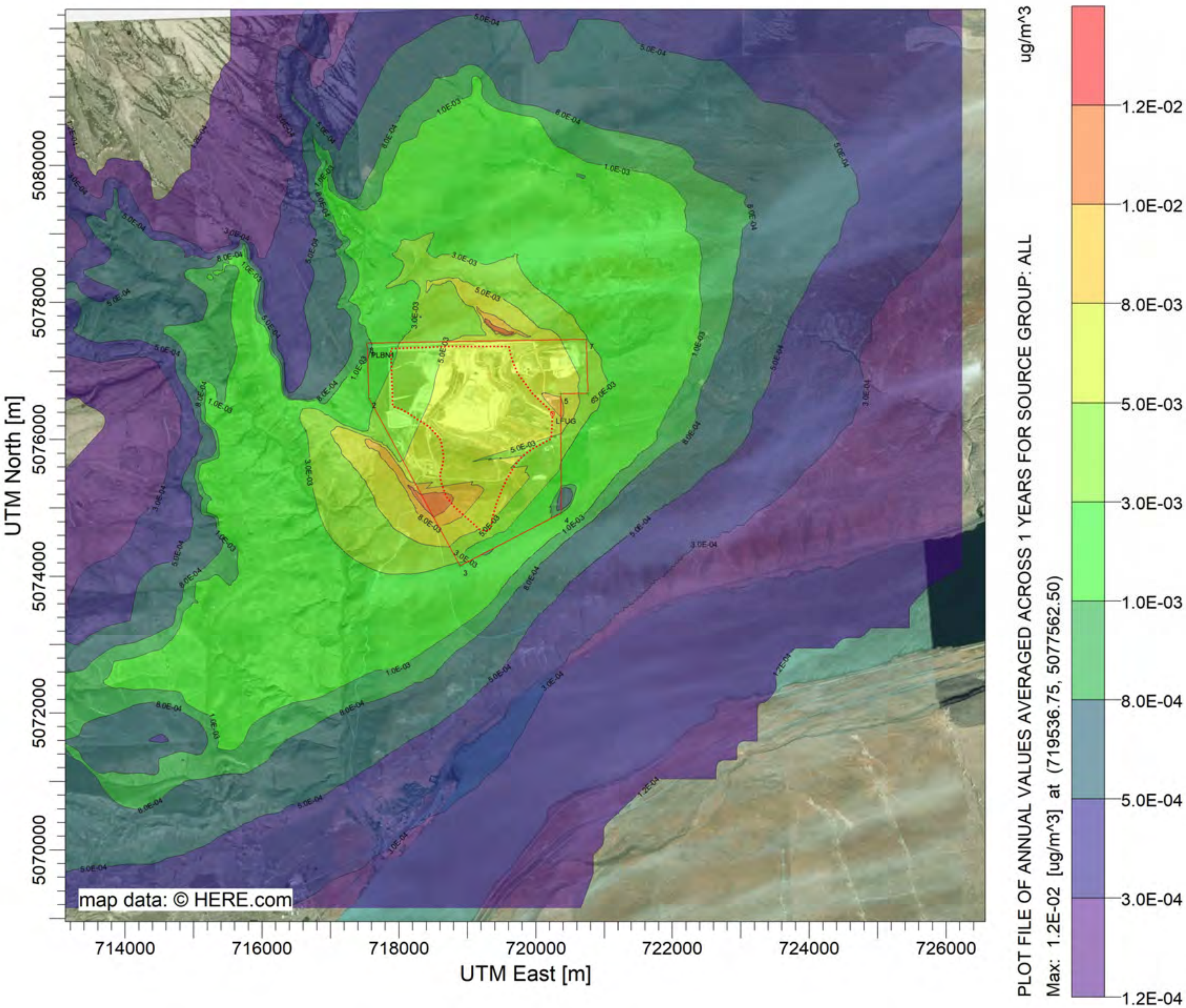
Roosevelt 2023 Mod

**71432 - Concentration - Source Group: ALL**

| Averaging Period | Rank | Peak | Units | X (m) | Y (m) | ZELEV (m) | ZFLAG (m) | ZHILL (m) | Peak Date, Start Hour |
|---|---|---|---|---|---|---|---|---|---|
| ANNUAL | | 0.01238 | ug/m^3 | 719536.75 | 5077562.50 | 466.56 | 0.00 | 534.00 | |

PROJECT TITLE:

**Annual Results for Benzene (71-43-2)**
**Roosevelt Regional Landfill**




COMMENTS:

SOURCES:
**1**

RECEPTORS:
**135105**

OUTPUT TYPE:
**Concentration**

MAX:
**1.2E-02 ug/m^3**

COMPANY NAME:
**WCG**

MODELER:
**M. Moore**

DATE:
**6/20/2023**

SCALE: 1:90,742

0 3 km

PROJECT NO.:

# Results Summary

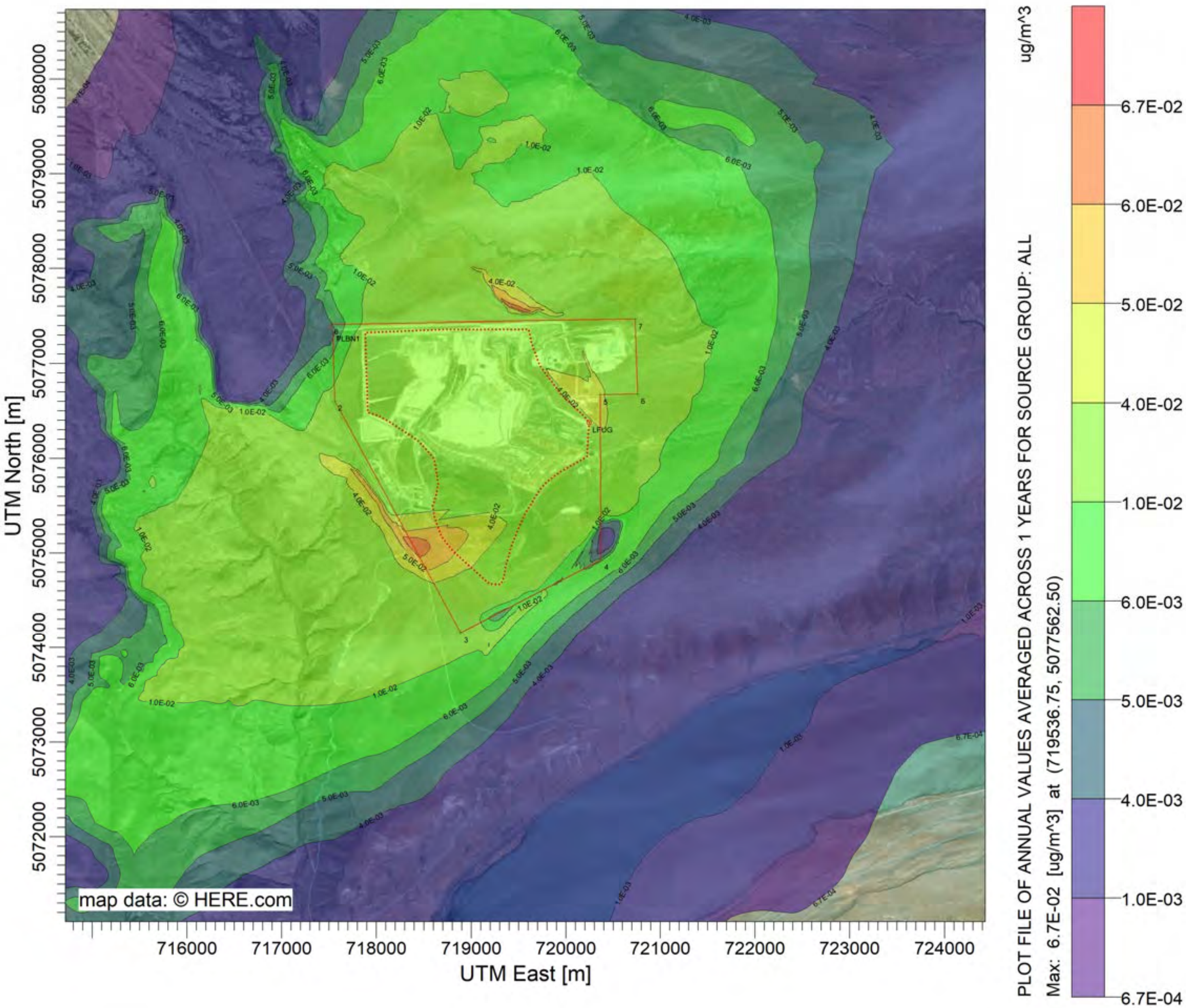
Roosevelt 2023 Mod

**100414 - Concentration - Source Group: ALL**

| Averaging Period | Rank | Peak | Units | X (m) | Y (m) | ZELEV (m) | ZFLAG (m) | ZHILL (m) | Peak Date, Start Hour |
|---|---|---|---|---|---|---|---|---|---|
| ANNUAL | | 0.06718 | ug/m^3 | 719536.75 | 5077562.50 | 466.56 | 0.00 | 534.00 | |

PROJECT TITLE:

**Annual Results for Ethylbenzene (100-41-4)**
**Roosevelt Regional Landfill**




| | |
|---|---|
| COMMENTS: | |
| SOURCES: | **1** |
| RECEPTORS: | **135105** |
| OUTPUT TYPE: | **Concentration** |
| MAX: | **6.7E-02 ug/m^3** |
| COMPANY NAME: | **WCG** |
| MODELER: | **M. Moore** |
| DATE: | **6/20/2023** |
| SCALE: | 1:65,560 (0 — 2 km) |
| PROJECT NO.: | |

# Results Summary

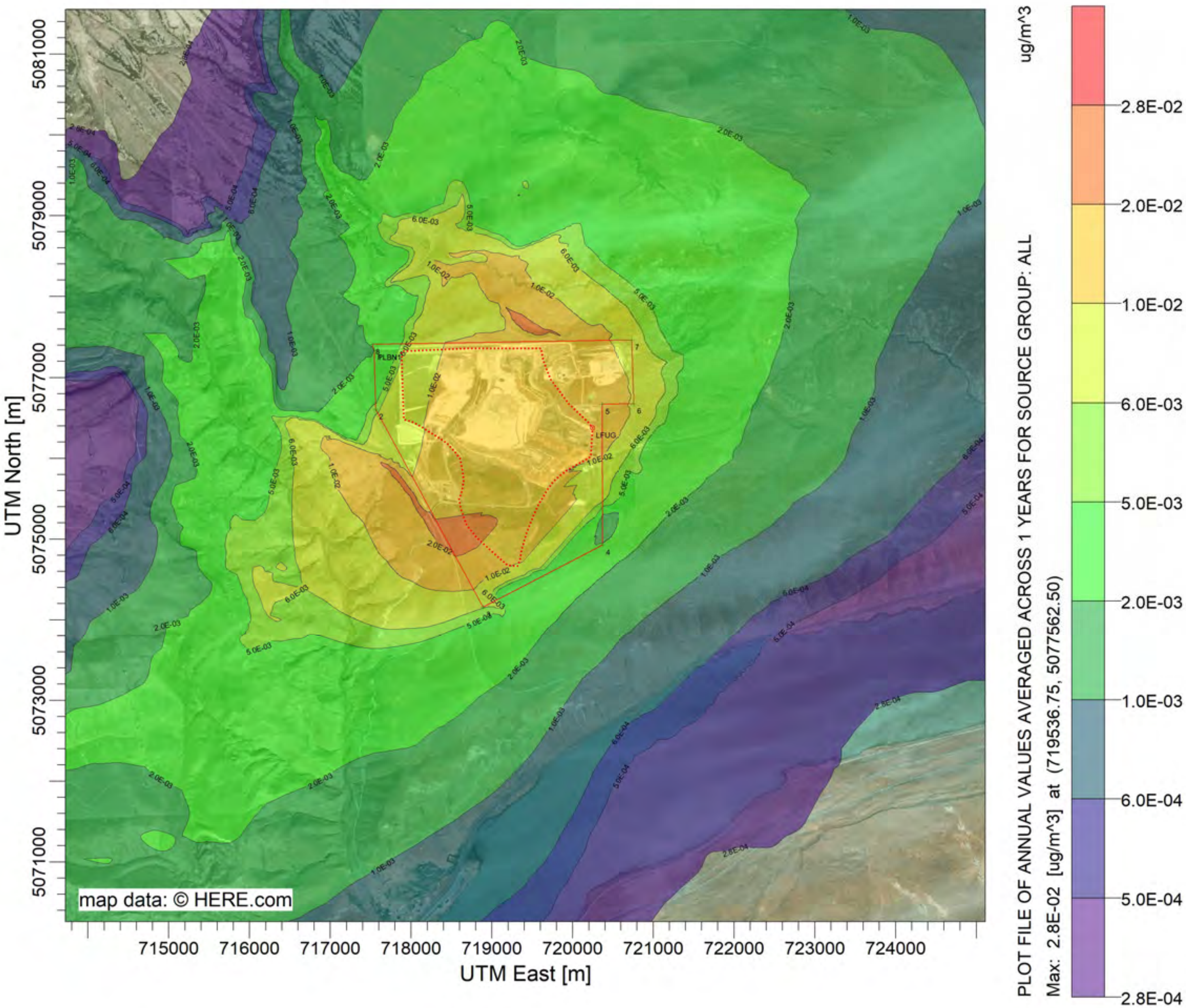
Roosevelt 2023 Mod

**91203 - Concentration - Source Group: ALL**

| Averaging Period | Rank | Peak | Units | X (m) | Y (m) | ZELEV (m) | ZFLAG (m) | ZHILL (m) | Peak Date, Start Hour |
|---|---|---|---|---|---|---|---|---|---|
| ANNUAL | | 0.02829 | ug/m^3 | 719536.75 | 5077562.50 | 466.56 | 0.00 | 534.00 | |

PROJECT TITLE:

**Annual Results for Naphthalene (91-20-3)**
**Roosevelt Regional Landfill**




COMMENTS:

SOURCES:
**1**

RECEPTORS:
**135105**

OUTPUT TYPE:
**Concentration**

MAX:
**2.8E-02 ug/m^3**

COMPANY NAME:
**WCG**

MODELER:
**M. Moore**

DATE:
**6/20/2023**

SCALE: 1:76,872

0 — 2 km

PROJECT NO.:

# Results Summary

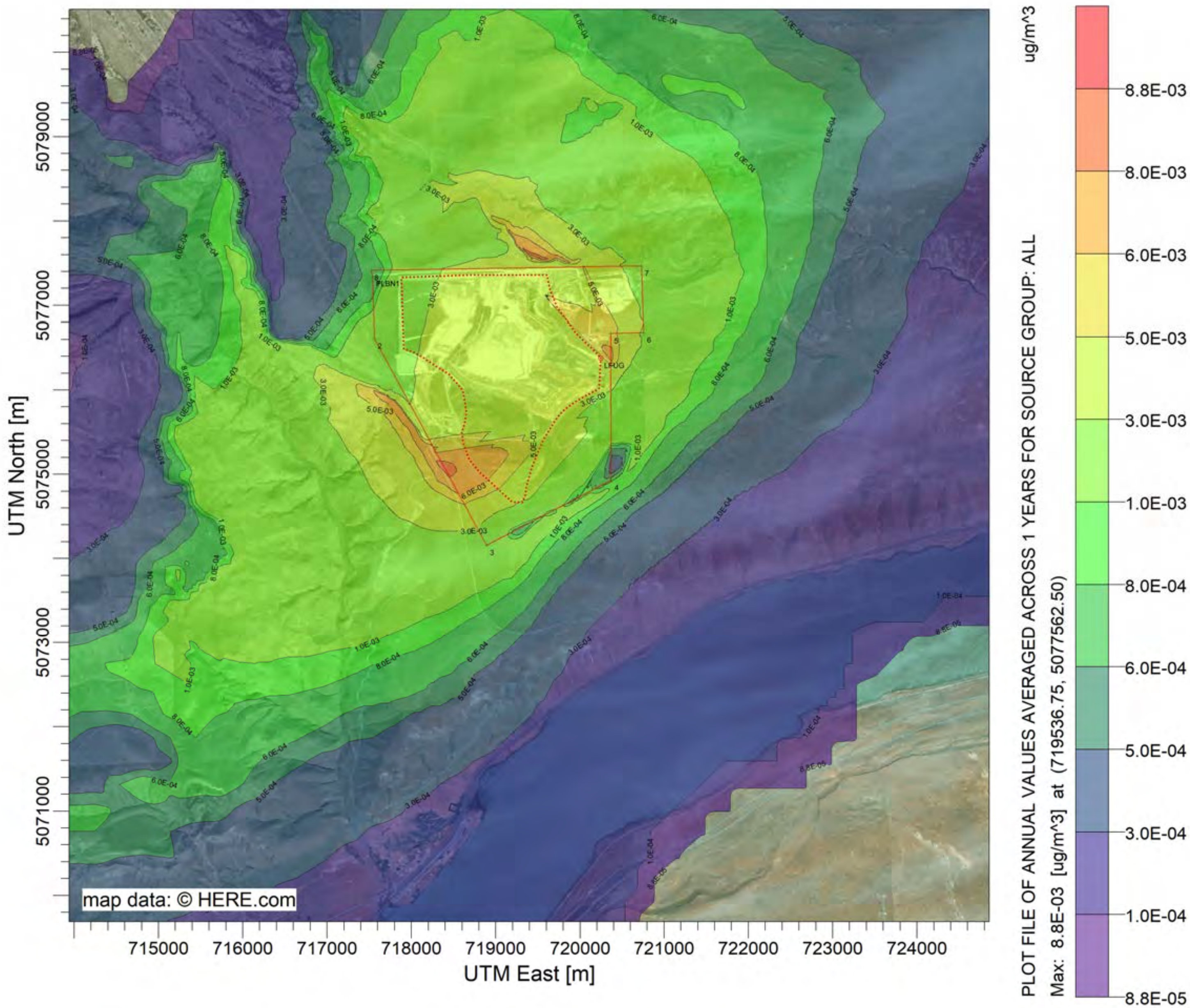
Roosevelt 2023 Mod

**127184 - Concentration - Source Group: ALL**

| Averaging Period | Rank | Peak | Units | X (m) | Y (m) | ZELEV (m) | ZFLAG (m) | ZHILL (m) | Peak Date, Start Hour |
|---|---|---|---|---|---|---|---|---|---|
| ANNUAL | | 0.00884 | ug/m^3 | 719536.75 | 5077562.50 | 466.56 | 0.00 | 534.00 | |

PROJECT TITLE:

**Annual Results for Perchloroethylene (127-18-4)**
**Roosevelt Regional Landfill**




COMMENTS:

SOURCES:
**1**

RECEPTORS:
**135105**

OUTPUT TYPE:
**Concentration**

MAX:
**8.8E-03 ug/m^3**

COMPANY NAME:
**WCG**

MODELER:
**M. Moore**

DATE:
**6/20/2023**

SCALE: 1:73,671

0 2 km

PROJECT NO.:

# Control Pathway

AERMOD

## Dispersion Options

**Titles**

Roosevelt 2023 Mod

**Dispersion Options**

- [x] Regulatory Default
- [ ] Non-Default Options

**Dispersion Coefficient**

Rural

**Output Type**

- [x] Concentration
- [ ] Total Deposition (Dry & Wet)
- [ ] Dry Deposition
- [ ] Wet Deposition

**Plume Depletion**

- [ ] Dry Removal
- [ ] Wet Removal

**Output Warnings**

- [ ] No Output Warnings
- [ ] Non-fatal Warnings for Non-sequential Met Data

## Pollutant / Averaging Time / Terrain Options

**Pollutant Type**

OTHER - H2S

**Averaging Time Options**

Hours

| 1 | 2 | 3 | 4 | 6 | 8 | 12 | 24 |
|---|---|---|---|---|---|---|---|
| [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [x] |

- [ ] Month
- [ ] Period
- [ ] Annual

**Exponential Decay**

Option not available

**Terrain Height Options**

- [ ] Flat
- [x] Elevated

SO: Meters
RE: Meters
TG: Meters

**Flagpole Receptors**

- [ ] Yes
- [x] No

Default Height = 0.00 m

# Source Pathway



## Building Downwash Information

Option not in use

## Emission Rate Units for Output

| For Concentration | |
|---|---|
| Unit Factor: | 1E6 |
| Emission Unit Label: | GRAMS/SEC |
| Concentration Unit Label: | MICROGRAMS/M**3 |

# Receptor Pathway

AERMOD

## Receptor Networks

Note: Terrain Elevations and Flagpole Heights for Network Grids are in Page RE2 - 1 (if applicable)
Generated Discrete Receptors for Multi-Tier (Risk) Grid and Receptor Locations for Fenceline Grid are in Page RE3 - 1 (if applicable)

## Discrete Receptors

## Plant Boundary Receptors

### Cartesian Plant Boundary

Primary

| Record Number | X-Coordinate [m] | Y-Coordinate [m] | Group Name (Optional) | Terrain Elevations | Flagpole Heights [m] (Optional) |
|---|---|---|---|---|---|
| 1 | 717539.44 | 5077342.26 | FENCEPRI | 548.31 | |
| 2 | 717559.43 | 5076609.48 | FENCEPRI | 523.20 | |
| 3 | 718889.09 | 5074156.92 | FENCEPRI | 439.60 | |
| 4 | 720368.89 | 5074927.79 | FENCEPRI | 483.84 | |
| 5 | 720361.95 | 5076671.06 | FENCEPRI | 467.19 | |
| 6 | 720759.02 | 5076680.05 | FENCEPRI | 448.30 | |
| 7 | 720732.82 | 5077468.11 | FENCEPRI | 421.06 | |
| 8 | 717518.84 | 5077413.16 | FENCEPRI | 538.22 | |

## Multi-Tier Grid (Risk)

### Grid Settings

| | | |
|---|---|---|
| Grid Origin: | 719236.74 | 5076149.85 |
| Number of Tiered Segments: | 6 | |

| Segment Number | Distance from Center (Origin) [m] | Spacing [m] |
|---|---|---|
| 1 | 2150.00 | 12.50 |
| 2 | 2400.00 | 25.00 |
| 3 | 2900.00 | 50.00 |
| 4 | 4000.00 | 100.00 |
| 5 | 6500.00 | 300.00 |
| 6 | 7000.00 | 600.00 |

## Receptor Groups

| Record Number | Group ID | Group Description |
|---|---|---|
| 1 | FENCEPRI | Cartesian plant boundary Primary Receptors |
| 2 | FENCEGRD | Receptors generated from Fenceline Grid |
| 3 | RISK | Receptors generated from Risk Grid |

# Meteorology Pathway

AERMOD

## Met Input Data

**Surface Met Data**

Filename: ..\..\Roosevelt\roosevelt2.SFC

Format Type: Default AERMET format

**Profile Met Data**

Filename: ..\..\Roosevelt\roosevelt2.PFL

Format Type: Default AERMET format

**Wind Speed**

☐ Wind Speeds are Vector Mean (Not Scalar Means)

**Wind Direction**

Rotation Adjustment [deg]:

**Potential Temperature Profile**

Base Elevation above MSL (for Primary Met Tower): 2,358.00 [m]

**Meteorological Station Data**

| Stations | Station No. | Year | X Coordinate [m] | Y Coordinate [m] | Station Name |
|---|---|---|---|---|---|
| Surface | | 1992 | | | SPOKANE/INT'L ARPT |
| Upper Air | | 1992 | | | SPOKANE/INT'L ARPT |

## Data Period

**Data Period to Process**

Start Date: 1/1/1992 Start Hour: 1 End Date: 12/31/1992 End Hour: 24

## Wind Speed Categories

| Stability Category | Wind Speed [m/s] | Stability Category | Wind Speed [m/s] |
|---|---|---|---|
| A | 1.54 | D | 8.23 |
| B | 3.09 | E | 10.8 |
| C | 5.14 | F | No Upper Bound |

# Output Pathway

AERMOD

## Tabular Printed Outputs

| Short Term Averaging Period | RECTABLE Highest Values Table | | | | | | | | | | MAXTABLE Maximum Values Table | DAYTABLE Daily Values Table |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | 9th | 10th | | |
| 24 | ☒ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | | No |

## Contour Plot Files (PLOTFILE)

**Path for PLOTFILES:** H2S.AD

| Averaging Period | Source Group ID | High Value | File Name |
|---|---|---|---|
| 24 | ALL | 1st | 24H1GALL.PLT |

# Results Summary

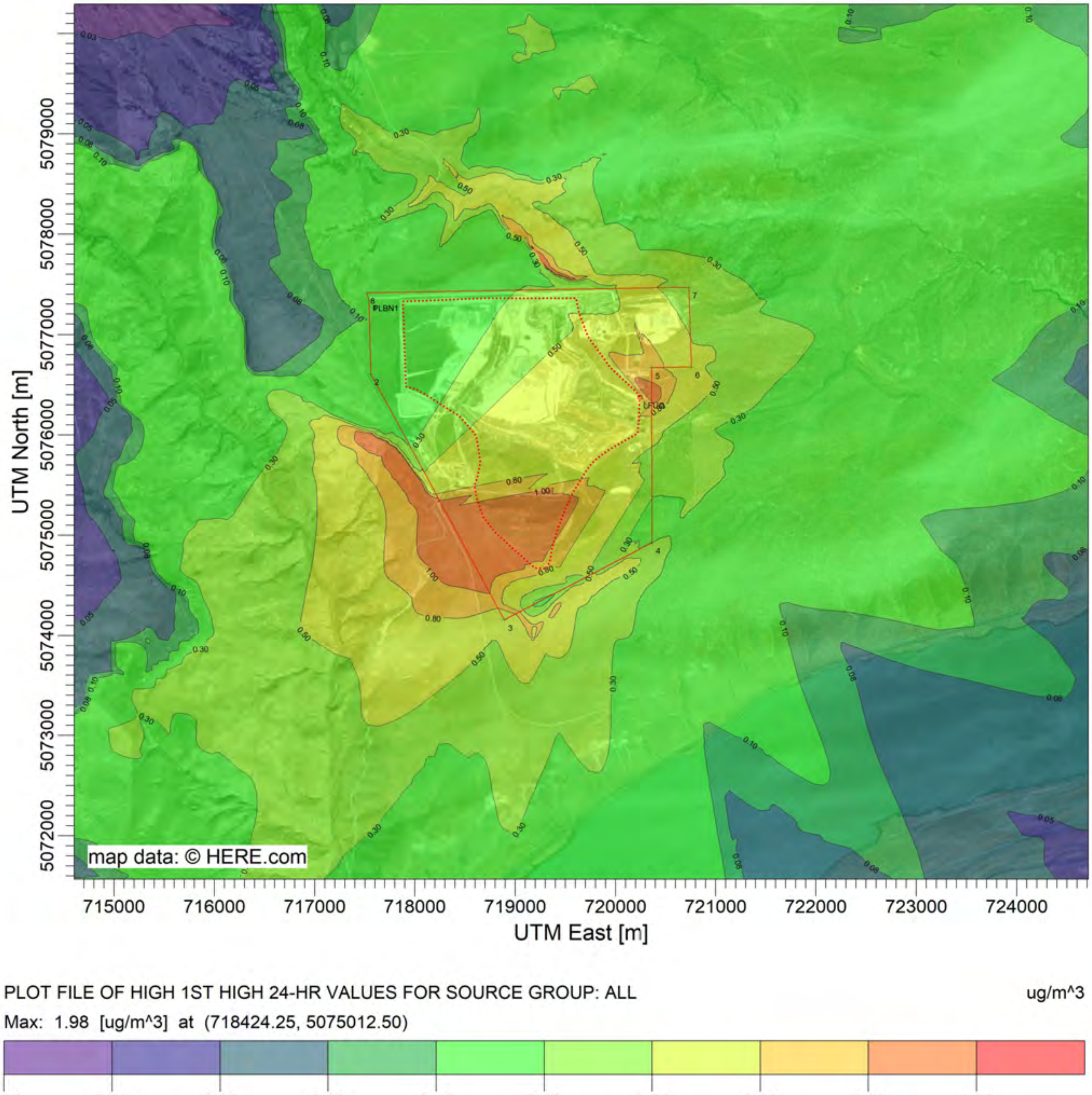
Roosevelt 2023 Mod

**H2S - Concentration - Source Group: ALL**

| Averaging Period | Rank | Peak | Units | X (m) | Y (m) | ZELEV (m) | ZFLAG (m) | ZHILL (m) | Peak Date, Start Hour |
|---|---|---|---|---|---|---|---|---|---|
| 24-HR | 1ST | 1.97540 | ug/m^3 | 718424.25 | 5075012.50 | 464.75 | 0.00 | 501.00 | 1/18/1992, 24 |

PROJECT TITLE:

**24-HR Results for Hydrogen Sulfide (7783-06-4)**
**Roosevelt Regional Landfill**




| COMMENTS: | SOURCES: | COMPANY NAME: | |
|---|---|---|---|
| | **1** | **WCG** | |
| | RECEPTORS: **135105** | MODELER: **M. Moore** | |
| | OUTPUT TYPE: **Concentration** | SCALE: 1:63,555 (0 — 2 km) | |
| | MAX: **1.98 ug/m^3** | DATE: **6/20/2023** | PROJECT NO.: |

# APPENDIX G

# SEPA ENVIRONMENTAL IMPACT STATEMENT

# Roosevelt Regional Landfill
# Maximum Elevation Increase

## Final Supplemental
## Environmental Impact Statement

Klickitat County Planning Department
Klickitat County Services Building
115 West Court Street # 302
Goldendale, Washington 98620

November 2022

# Summary

## A. Nature and Location of Proposal

Regional Disposal Company (RDC), owner and operator of the Roosevelt Regional Landfill in Klickitat County (Figure 1), proposes to increase the landfill's permitted maximum elevation from 1,820 MSL to 2,050 MSL.

The current landfill is permitted with an annual tonnage limit of 5 million tons per year, and permitted to operate through 2041.

The Proposed Action would continue the elements of the Klickitat County Solid Waste Project as currently permitted; however, the current conditional use permit language would be amended to revise Condition 7.6 to read "The maximum elevation of the landfill shall not exceed 2,050 MSL." This change would also be made to the Klickitat County Comprehensive Solid Waste Management Plan.

The proposed increase in maximum elevation would not result in any increase in the annual tonnage nor the landfill footprint. The proposed increase in maximum elevation would increase the disposal capacity of the landfill from the existing permitted capacity of 245 million cubic yards (218 million tons) to approximately 360 million cubic yards (324 million tons). The resulting operational life of the landfill site would be extended from the year 2041 to an estimated year of 2130. No significant improvements would be required at the Roosevelt intermodal yard, and no change in permitted hours of operation are proposed. Modifications to the stormwater drainage plan would be made to accommodate the revised maximum elevation and corresponding landfill waste grading plan.

This Supplemental EIS (SEIS) evaluates the Proposal and the No Action Alternative in detail. In addition, the SEIS considers an alternative that would achieve the proposed annual tonnage and waste disposal capacity but would expand the landfill footprint; and an alternative that would further increase the annual tonnage and waste disposal capacity. The SEIS discusses the reasons for eliminating these alternatives from detailed study.

## B. Proponent and Date of Implementation

Regional Disposal Company (RDC) is the project proponent. Upon receipt of the necessary permits (and approvals), RDC would complete the final design and begin to implement the approved changes.

## C. Lead Agency, Responsible Official, and Contact Persons

The Klickitat County Planning Department is the SEPA lead agency. The SEPA responsible official and contact person for the SEIS is as follows:

Mo-chi Lindblad, Planning Director
Klickitat County Planning Department
Klickitat County Services Building

115 West Court Street, #302
Goldendale, WA 98620
Phone: (509) 773-5703
Fax: (509) 773-6206
Email: mo-chil@klickitatcounty.org

The contact for amending the Klickitat County Solid Waste Management Plan is:

Klickitat County Solid Waste Department
115 West Court St., Room 204
Goldendale, WA 98620
Phone: (509) 773-4448
Email: klickitatcountysolidwaste@klickitatcounty.org

## D. Permits and Approvals Required

The following permits and approvals may have to be issued, revised, or amended to implementthe Proposal:

| Permit/Approval | Issuing Agency |
|---|---|
| Conditional Use permit #CUP2006-01 | Klickitat County Planning |
| Solid Waste Handling Permit #20-0001 | Klickitat County Department of Public Health |
| Special Incinerator Ash Permit | Washington State Department of Ecology |
| Air Operating Permit No. 14AQ-C182 | Washington State Department of Ecology |
| Air Quality Permits<br>• Air Quality Permit, NOC DE90-C153 (MSW Landfill)<br>• Air Quality Permit, NOC DE98AQ-C131 (LFG Flare)<br>• Air Quality Permit, NOC 08AQ-C087 (LFG Flare) | Washington State Department of Ecology |
| National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge Baseline General Permit for Stormwater Discharges Associated with Industrial Activities<br>Landfill: WAR000939E and Intermodal: WAR008953 | Washington State Department of Ecology |

## E. Authors and Principal Contributors

| Kathy Kinsland, Geo-Logic Associates | Primary Author |
|---|---|
| Aaron Ogorzalek, Geo-Logic Associates | Project Manager, Design engineer, AutoCAD graphics, Visual impact graphics |

## F. Previous and Subsequent Environmental Review

This SEIS supplements five previous EISs: the EIS on the *1990 Klickitat County Solid Waste Management Plan Update;* the SEIS on the *1992 Addendum to the 1990 Klickitat County Solid Waste Management Plan Update;* the 1989 EIS on the Klickitat County Solid Waste Project; and the 1992 SEIS on the Roosevelt Regional Landfill Modification and Expansion, and the 2002 Addendum to the Final Supplemental EIS. These documents are available for review at the Klickitat County Planning Department (see address in Section C above).

No subsequent environmental review of the proposed project is anticipated. If additional jurisdictions decide to use the Roosevelt Regional Landfill, appropriate environmental review would be conducted to evaluate the impacts of transportation routes or facilities not covered in this SEIS or previous EISs.

## G. Location of Background Data

Background data for this SEIS are contained primarily in the technical appendices in Volume 2 of the 1992 SEIS; the previous EISs listed in Section F above; the Operations Plan and Engineering Report for the landfill; existing landfill permits; and landfill records, including results of monitoring programs. Other documents that provide background data are the *2021 Final Klickitat County Solid Waste Management Plan for Years 2021-2026;* the 1977 *Klickitat County Comprehensive Plan,* as amended in 1979; the 1990 *Roosevelt Community Subarea Plan,* as updated in 1995; and *Klickitat County Zoning Ordinance No.* 62678, enacted in 1979. These documents are available for review at the Klickitat County Planning Department (see address in Section C above).

# Table of Contents

## Volume 1. FSEIS Summary and Text, Appendix A

# List of Figures (At End of Document)

# List of Tables



# Abbreviations

| | |
|---|---|
| ASIL | acceptable source impact level |
| BACT | best available control technology |
| BMP | best management practice |
| CFR | Code of Federal Regulations |
| CUP | conditional use permit |
| cy | cubic yard |
| dBA | A-weighted decibel |
| Ecology | Washington Department of Ecology |
| EDNA | Environmental Designation for Noise Abatement |
| EIS | environmental impact statement |
| EPA | U.S. Environmental Protection Agency |
| FHWA | Federal Highway Administration |
| FSEIS | Final Supplemental Environmental Impact Statement |
| GCL | geosynthetic clay liner |
| lb/cy | pounds per cubic yard |
| mcy | million cubic yards |
| MSL | mean sea level |
| MSW | municipal solid waste |
| O3 | ozone |
| OR | Oregon |
| Pb | lead |
| PM10 | Particulate matter less than or equal to 10 microns in diameter (a micron is one millionth of a meter) |
| ppm | parts per million |
| PSD | Prevention of Significant Deterioration |
| PUD | Public Utility District |
| R | Residential zoning designation |
| RACT | reasonably available control technology |
| RC | Rural Center zoning designation |
| RDC | Regional Disposal Company |
| RR2 | Rural Residential zoning designation, with a minimum lot size of 2 acres |
| scfm | standard cubic feet per minute |
| SEIS | supplemental environmental impact statement |
| SEPA | State Environmental Policy Act |
| S02 | State Historic Preservation Officer |
| SR | State Route |
| WA | Washington |

# Section 1

## Background, Objectives, and Alternatives, Including the Proposed Action

# Section 1. Background, Objectives, and Alternatives, Including the Proposed Action

## 1.1 Background

### 1.1.1 Location

Regional Disposal Company (RDC) owns and operates the Roosevelt Regional Landfill in Klickitat County. The municipal landfill is located on a 2,129-acre site in southeast Klickitat County, approximately 3 miles northeast of the community of Roosevelt and 5 miles via Roosevelt Grade Road (East Road) (Figure 2). The currently permitted landfill footprint occupies 915 acres of the site. The current landfill is permitted with an annual tonnage limit of 5 million tons per year (MTY), and permitted to operate through 2041.

### 1.1.2 Previous Environmental Review

This Supplemental EIS (SEIS) supplements five previous EISs:

- EIS on the *1990 Klickitat County Solid Waste Management Plan Update* (the 1990 Plan EIS);
- SEIS on the *1992 Addendumto the 1990 Klickitat County Solid Waste Management Plan Update* (the 1992 Plan SEIS);
- 1989 Final EIS on the Klickitat County Solid Waste Project (the 1989 Project EIS);
- 1992 SEIS on the Roosevelt Regional Landfill Modification and Expansion (the 1992 Project SEIS);
- 2002 Final Supplemental EIS on Roosevelt Regional Landfill Volume Expansion.

These documents are available for review at the Klickitat County Planning Department (see Section C of the Summary for address).

## 1.2 Proposed Action

The Proposed Action would continue the elements of the Klickitat County Solid Waste Project as currently permitted; however, the current conditional use permit language would be amended to revise Condition 7.6 to read "The maximum elevation of the landfill shall not exceed 2,050 MSL." This change would also be made to the Klickitat County Comprehensive Solid Waste Management Plan.

The proposed increase in elevation would not result in any increase in the annual tonnage nor landfill footprint. The proposed increase in maximum elevation would increase the disposal capacity of the landfill from the existing permitted capacity of 245 million cubic yards (218 million tons) to approximately 360 million cubic yards (324 million tons). The resulting operational life of the landfill site would be extended from the year 2041 to an estimated year of 2130. No significant improvements would be required at the Roosevelt intermodal yard, and no change in permitted hours of operation are proposed. Modifications to the stormwater drainage plan would be made to accommodate the revised maximum elevation and corresponding landfill waste grading plan.

## 1.3 Objectives and Need

The primary objective of the proposal is to assure Klickitat County and other existing RDC customers of secure long-term disposal and to increase the waste disposal capacity at the landfill without increasing the currently permitted footprint.

## 1.4 Description of Alternatives

### 1.4.1 Alternatives Evaluated in this SEIS

In addition to the Proposed Action/Proposal, this SEIS evaluates the No Action Alternative, which represents continued operation of the landfill under limitations imposed through existing permits. No changes beyond what has already been approved would be implemented. The existing maximum elevation limitation would remain at 1,820 MSL.

The analysis of the No Action Alternative provides the baseline for analyzing the impacts of the Proposed Action. Table 1 shows the key characteristics of the No Action Alternative and the Proposed Action.

The objective of the Proposed Action is to maximize the volume of the permitted footprint area while taking into consideration engineering restrictions that include 1) slope stability, 2) pipe strength of existing and future leachate collection pipes at the bottom of the landfill, and 3) maintaining the minimum required top deck slope of 5% for stormwater drainage. Different profiles were evaluated and the profile that met the project objectives was selected as the Proposed Action. No other alternatives were considered beyond the Proposed Action and the No Action Alternative.

### 1.4.2 Issues Not Analyzed In this SEIS

Several potential issue areas are not evaluated in this SEIS because there would be no potential to affect these resources given there is no proposed horizontal expansion of the permitted landfill footprint, increase in maximum annual waste tonnage rate, increase in traffic generation, nor modification to any landfill operation (such as the Intermodal facility). The issues not carried forward in the environmental evaluation include the following:

- ***Cultural Resources***
  - Cultural resources would continue to be managed in accordance with the existing Memorandum of Understanding (MOU) among the Washington State Department of Archeological and Historic Preservation, Klickitat County, and Regional Disposal Company.
- ***Transportation***
  - The Proposed Action would not require development or use of any new haul roads or improvements to any onsite or offsite roadways. No change to solid waste delivery to the intermodal yard is proposed. No new employees are needed as a result of the

landfill maximum elevation increase; thus, no new traffic generation would occur as a result of the Proposed Action.

- ***Public Services***

  - Under both the No Action Alternative and the Proposal, public schools in the Roosevelt and Bickleton school districts would not be affected by either alternative. No change in the number of employees would be needed under either alternative.

  - There would be adequate emergency medical response to the landfill under either alternative. The Roosevelt Fire Department maintains an emergency aid truck in Roosevelt; ambulance service is available from Goldendale, approximately 48 miles east of the landfill; and RDC maintains an emergency response team at the landfill that is trained and equipped to handle personal injury accidents. Like current employees, new employees would be trained in first aid, cardio-pulmonary resuscitation, and health and safety.

**Table 1- Key Characteristics of the No Action Alternative and the Proposed Action at Final Grade**

| Element | No Action Alternative (Currently Permitted) | Proposed |
|---|---|---|
| Landfill Property | 2,129 acres | No change |
| Operational End Date | 2041 | 2130 [1] |
| Maximum Elevation | 1,820 MSL | 2,050 MSL |
| Maximum Slope | 3H:1V | No change |
| Landfill Footprint | 915 acres | No change |
| Total Landfill Capacity [2] | 218 MT | 324 MT |
| Total Landfill Capacity [3] | 245 MCY | 360 MCY |
| Average Waste Depth | 170 feet | 300 feet |
| Maximum Waste Depth | 320 feet | 350 feet |
| Soil Remaining to be Excavated | 27 MCY | 27 MCY |
| Total Soil Required | 34 MCY | 51 MCY |
| Operational Hours | No change | No change |
| Storm Drainage System | No change | Modified to accommodate new profile/drainage areas |
| Expanded Work Force (employees) | No change | No change |
| Landfill Equipment | No change | No change |

[1] Operational end date is estimated based on existing waste tonnage and density. Actual operational end date may vary based on tonnage and densities achieved, up to the maximum permitted tonnage of 5 MTY.
[2] Assumes 1800 lb (0.9 ton) waste per cubic yard of available airspace, in million tons (MT).
[3] Available airspace for disposal of waste in million cubic yards (MCY).

## 1.4.3 Environmental Controls

The No Action Alternative would continue to implement the existing environmental controls required by federal, state, andlocal regulations. Currently planned environmental controls include the following:

- A program for detecting and preventing the disposal of dangerous waste.

- A bottom liner system to prevent contact with groundwater and offsite migration of leachate.

- A leachate management system. Leachate is contaminated water generated from precipitation falling on open areas and infiltrating into the waste. Leachate is collected in pipes installed in the drainage aggregate on top of the bottom liner, and flows by gravity to a leachate collection pond. From there, it is pumped to other ponds and reintroduced into the landfill. Leachate reintroduction results in earlier decomposition andstabilization of organic waste in the landfill.

- Use of *daily cover* over each day's compacted waste to control disease vectors, fires, odor, and blowing litter; *interim cover* over areas that have received waste but will be inactive forsome time; and *final cover* over the entire landfill to minimize erosion and infiltration of rainwater once the landfill reaches final grades. Cover materials comply with applicable regulations.

- A stormwater management system that prevents stormwater run-on from flowing into the active area, and collects and controls stormwater runoff from a wide range of storm events.

- Runoff from areas with interim cover are managed as stormwater, while runoff from areas without interim cover are managed as leachate.

- Best management practices (BMPs) to minimize erosion and sedimentation, including hydroseeding exposed inactive excavations, stockpiles, and covered refuse slopes; controlling peak runoff rates; and trapping sediment in onsite detention/sedimentation basins.

- Dust control, including paving onsite haul roads to within 100 feet of the bottom liner, spraying water as needed, wheel-washing, and control of dust from rock crushing, as specified in the air operating permit.

- Landfill gas control. Landfill gas would continue to be actively collected and either burned in high-temperature flares or directed to Klickitat County PUD No. 1 and used as a beneficial resource.

- Pest and disease vector control. RDC implements measures to control agricultural pests, as well as potential disease vectors such as rodents, flies, mosquitoes, and gulls.

- Vegetated buffers at least 250-feet wide between the landfill footprint and the site boundary.

- Monitoring programs for groundwater, leachate, landfill gas, and particulate matter (dust); and two annual surface water inspections (one wet weather and one dry weather).

- A program of routine inspection and maintenance to ensure that landfill equipment and environmental controls remain in working order. This includes regular inspection and maintenance of solid waste containers to ensure they are kept clean and leak resistant.

- Contingency plans to deal with emergencies and other occurrences that require immediate attention, such as fire and explosion, leachate seeps on the side slopes of the landfill, surface water or groundwater contamination observed in monitoring programs, severe storms, leachate spills, and discovery of historic or cultural resources.

Under the Proposed Action, these environmental control systems and procedures would continue to be used. Modifications to the stormwater management plan would be needed to accommodate the new waste grading plan and landfill drainage areas, and minor modifications to other environmental controls would be needed to accommodate the new landfill profile.

### 1.4.4 Development of Disposal Areas

**General Construction Practices**

Under either alternative, the landfill would be developed through phased construction of lined permitted disposal areas. Cell construction (subgrade preparation, bottom liner installation, and placement of drainage layer and leachate collection pipes) usually takes a complete construction season and is performed in phases averaging approximately 20 acres every 1-2 years. Geosynthetic clay liner (GCL) was a previously approved alternative to the 2-foot compacted clay liner starting with Area 11 and has continued to be used in subsequent landfill expansions ever since. The most recent phase of cell construction was Area 22 in 2021. Under the either alternative, waste filling would occur in waste disposal areas from new construction phases and on top of previously permitted constructed disposal areas. Final cover and revegetation would be implemented over 40-60 acres at a time when that much area has been filled to capacity and sufficient time has elapsed to allow settlement to occur. No additional disposal areas outside of the currently permitted area would be required under the Proposed Action since the disposal would occur over currently permitted footprint. All other construction practices would remain unchanged by the Proposed Action, as described in the 2002 Final Supplemental EIS on Roosevelt Regional Landfill Volume Expansion.

**Availability of Soils**

Approximately 27.4 million cubic yards of soil material remains to be excavated from the landfill footprint under the currently approved landfill operational permit. An additional estimated 8.2 million cubic yards of soil materials are available in on-site stockpiles and borrow areas owned by the landfill. RDC would continue to use currently permitted borrow sites and will import additional materials as needed to satisfy site soil requirements.

No excavation or stockpiling would occur within the 250-foot buffer zones, on the south-facing side of the ridge near the southern boundary of the site, nor in the east half of the east half of Section 27. Avoidance of these areas would protect two potentially significant cultural resource sites identified in cultural resource surveys in 1989 and 1992 (see Section 2.8 of the 2002 Final Supplemental EIS on Roosevelt Regional Landfill Volume Expansion). As soon as needed soil materials were removed, borrow areas would be reclaimed in accordance with a reclamation plan approved by Klickitat County or the Washington Department of Natural Resources, depending on the size of the area. Areas where soil stockpiling has occurred would be graded and vegetated to resemble natural conditions. Further detail on the issue of soils availability is provided in Section 2.1, Earth.

# Section 2

## Affected Environment, Impacts, and Mitigation Measures

# Section 2.Affected Environment, Impacts, and Mitigation Measures

## 2.1 Earth

### 2.1.1 Affected Environment

The topography and geology of the landfill are described in detail in the 1989 Project EIS and 1992 Project SEIS. This section provides a brief synopsis of that information, updated to reflect the current level of site development, and effects as a result of the Proposed Action.

**Topography**

The landfill site lies on the rim of a large shallow topographic depression, or bowl-shaped area, that slopes gradually to the east and southeast. Site elevations range from nearly 1,800 feet in the northwest corner of the site to 1,450 feet on the east side of the site (see Figure 3). The original ground slopes in the area proposed for landfill development range from 3 to 30%, with an average across the site of approximately 4%.

Approximately 405 acres of the proposed 915-acre footprint have been developed into landfill disposal areas (see Figure 3). RDC has constructed an average of one new disposal area per year with an average size of 20 acres. Current elevations in the developed area range from approximately 1,460 to 1,790 feet MSL. Disposal areas have been filled with waste to a maximum depth of approximately 233 feet, with side slopes generally ranging from 4H:1V to 5H:1V and a maximum slope of 3H:1V in a few isolated areas.

**Geology and Soils**

The site geology consists of alternating layers of volcanic flows (basalt) and sedimentary deposits typical of the geologic structure encountered east of the Cascades (Klickitat County 1992). The following paragraphs provide a general description of the soil and rock layers found on site, from the top layer down.

- **Loess**. Much of the undeveloped portion of the site is overlain by a layer of windblown silt and ash called loess. The thickness of this layer ranges from 0 to 8 feet. Where development has occurred, this material has been stripped and stockpiled for future use in final cover.
- **Elephant Mountain Basalt**. This layer is known locally as the "cap rock." Because the site was near the margin of the volcanic flow, Elephant Mountain Basalt only occurs over parts of the site, at a maximum thickness of only 17 feet. This material has historically been used at the site to generate rock needed for constructing haul roads, drainage layers, and other uses. The material is generally excavated by ripping, but occasional blasting is required.
- **Rattlesnake Ridge Sediments**. This is the predominant soil unit across the site, ranging in thickness from 50-88 feet. It consists of interbedded sandstone, siltstone, and claystone, as well as localized deposits of gravel. The lowest zone of this layer has historically been mined for claystone to construct clay liners. The overburden material above the claystone has been used for landfill operations (daily and intermediate cover) or road building, or has been stockpiled for future use.
- **Pomona Basalt**. This layer derives from a single volcanic flow, and ranges from 113-131 feet thick. The bottom of the existing MSW landfill has been excavated to approximately the top of this layer.

- **Selah Member Sediments**. Underlying the entire site, this is a low-permeability sedimentary layer that at one point on the site was verified to be 341 feet thick. As discussed in Section 2.2, this layer greatly restricts the movement of groundwater from saturated fractures in the Pomona Basalt to underlying deep aquifers.

### 2.1.2 Impacts

**No Action Alternative**:

**Topography**

Figure 4 shows the final grading plan for the No-Action Alternative. Topographic changes to the site would occur gradually throughout the life of the landfill. New lined disposal areas approximately 10-35 acres in size would be constructed every year or every other year over the next 20 years. At final grade, the landfill would have a maximum elevation of approximately 1,820 feet MSL with maximum side slopes of 3H:1V and maximum waste thickness of 320 feet. No change to earth resources, elevation or slopes would occur beyond what is currently permitted.

**Soils**

The primary soil types used in the landfill development would continue to be rock (primarily Elephant Mountain Basalt), and soil (loess and the upper layers of the Rattlesnake Ridge sediments). Rock would be used to construct drainage layers as part of the liner or cover systems, and for haul roads and tipping decks on and outside of the landfill footprint. Other soils would be used for construction of berms, daily and intermediate cover in the landfill, and for final cover. Clay is no longer used as bottom liner at the site, as GCL has been an approved alternative low-permeability soil layer since Area 11. Any clay that is encountered in future excavations may be used for berms, daily and intermediate cover in the landfill, and for final cover.

Soil requirements of the No Action Alternative are summarized in Table 2 and estimated to be approximately 33.5 million cubic yards (MCY). No change to soil or rock resources would occur beyond what is currently permitted.

**Table 2- Estimated Soil Needs Over Site Life**

| Element | No Action Alternative (Currently Permitted) (CY) | Proposed Action (CY) |
|---|---|---|
| Soil Required for Cell Construction | 2,209,100 | 2,209,100 |
| Soil Required for Capping Construction | 4,480,700 | 4,548,800 |
| Soil Required for Daily Operations | 26,843,500 | 44,543,500 |
| Total Soil Needs | 33,533,300 | 51,301,400 |

**Proposed Action Alternative**:

**Topography**

Figure 5 shows the final grading plan for the Proposed Action. The bottom grading plan would be the same as that for the No Action Alternative (see Figure 6). Like the No Action Alternative, topographic changes to the site would occur gradually throughout the life of the landfill. New lined disposal areas approximately 10-35 acres in size would be constructed every year or every other year over the next 109 years. Subsequent filling would occur on top of previously constructed disposal areas. At final grade, the landfill would have a maximum elevation of approximately 2,050 feet MSL with maximum side slopes of 3H:1V and maximum waste thickness of 350 feet.

Figures 7 and 8 compare several cross sections of the No Action Alternative and the Proposed Action Alternative. The maximum waste thickness of the Proposed Action exceeds the maximum depth assumed in the previous leachate collection pipe strength calculations (Thiel Engineering, 2001). Therefore, supplemental calculations for pipe strength of the Proposed Action are included in Appendix A. The supplemental pipe strength calculations suggest that the additional waste thickness associated with the Proposed Action would have a negligible impact on the strength and durability of the leachate collection pipes. Updated slope stability analyses associated with the revised final grades of the Proposed Action show that the proposed slopes meet State requirements for slope stability of landfills. The slope stability analysis is provided in Appendix A.

**Soils**

Soil requirements of the Proposed Action are summarized in Table 2 and estimated to be approximately 51.3 MCY. Rock and soil would continue to be used in the same manner as the No Action Alternative. Soil and rock requirements for cell construction and capping would remain relatively the same (capping soil requirements would increase slightly, see Table 2). However, since the duration of landfilling operations under the Proposed Action would be longer than under the No Action Alternative, the Proposed Action would utilize more soil and rock for daily operations. Based on the available soil and rock estimates described in Section 1.4.4, it is estimated that approximately 2.1 MCY of soil surplus exists under the No Action Alternative, and an approximate 15.6 MCY deficit exists under the Proposed Action. As described in Section 1.4.4, the site would continue to utilize excavation materials from the future landfill footprint and borrow sources on existing parcels and would import additional materials as needed to satisfy site soil requirements. Any new on-site borrow sources would undergo review and approval by the County.

### 2.1.3 Mitigation Measures

BMPs for erosion and sedimentation control are incorporated into both alternatives, as discussed in Section 1.4.3. These include regular inspection and maintenance of control measures. Borrow areas outside the landfill footprint would be reclaimed in accordance with a reclamation plan approved by Klickitat County or the Washington Department of Natural Resources, depending on the size of the area. Areas where soil stockpiling has occurred would be graded and vegetated to resemble natural conditions. Erosion and sediment control of final cover material at final grade would be minimized by constructing drainage terraces at approximately 150-foot spacing to accommodate storm water drainage, and seeding final cover slopes. Mitigation measures are expected to perform equally well for both alternatives.

### 2.1.4 Significant Unavoidable Adverse Impacts

With the mitigation measures incorporated into the project, no significant adverse impacts related to earth resources would be expected.

## 2.2 Surface Water

### 2.2.1 Affected Environment

The affected environment for surface and ground water are described in the 1989 Project EIS and 1992 Project SEIS. This section provides a brief synopsis of that information, updated to reflect the current level of site development.

Most of the 915-acre landfill footprint lies within the Coyote Creek drainage basin, with a small portion in the northwest corner draining to Wood Gulch Creek. Coyote Creek flows east to northeast for approximately 1.5 miles to Pine Creek, which flows southeast approximately 3 miles to the Columbia River. Wood Gulch Creek flows approximately 3 miles south to the Columbia River. All of the drainages that carry surface water through the site are intermittent. Most precipitation that creates surface water flow in these drainages occurs during the winter and spring.

Currently approximately 405 acres of the proposed 915-acre landfill footprint have been developed into lined waste disposal areas. Stormwater run-on from the west is diverted around the disposal areas by a run-on control ditch and berm. Stormwater runoff from active portions of the landfill without interim cover is prevented from entering the stormwater management system. This runoff is managed as leachate, and allowed to infiltrate into the waste or directed to a leachate pond. Stormwater that falls onto inactive areas of the landfill is managed as clean stormwater runoff. Inactive areas are covered with soil and graded to direct stormwater runoff to the toe of the waste fill, where it is conveyed in ditches to stormwater sedimentation/detention basins.

The stormwater management system at the landfill is designed to handle peak flows from a wide range of storm events, from the 2-year 24-hour storm to the 100-year, 24-hour storm. In addition, the system is designed handle the rapid snowmelt resulting from a Chinook wind, the equivalent of one inch of water in 24 hours. A variety of BMPs are currently implemented at the landfill to control erosion and sediment transport. These controls and described in more detail in Section 1.4.3.

The Stormwater Pollution Prevention Plan for the landfill (RDC 1998a), which is a requirement of the NPDES permit, specifies that RDC will conduct two annual stormwater inspections, one during wet weather and one during dry weather. Based on observations during these inspections, BMPs in use at the landfill have been effective in preventing landfill-related pollution of stormwater.

### 2.2.2 Impacts

**No Action Alternative:**
No change to the stormwater system or water management system would be required under the No Action Alternative beyond what has already been permitted.

**Proposed Action Alternative:**
Under the Proposed Action, the stormwater management system for the landfill would remain unchanged in the short-term. However, for long-term stormwater management, the maximum elevation increase would require modification to the landfill's stormwater management system plan to continue to meet BMPs and permit conditions. The change would include moving or extending stormwater interception drains, deploying additional drains or stormwater controls, and re-evaluating the location and size of stormwater detention ponds. A Stormwater Master Plan for the site would be developed addressing stormwater design and BMP's for future development phases of the landfill.

### 2.2.3 Mitigation Measures

A number of mitigation measures for potential impacts on surface water would be incorporated into the project under either alternative. These are discussed in detail in the 2002 Final Supplemental EIS on Roosevelt Regional Landfill Volume Expansion. Mitigation measures are expected to perform equally well for both alternatives.

### 2.2.4 Significant Unavoidable Adverse Impacts

With the mitigation measures incorporated into the project, no significant adverse impacts related to surface water would be expected.

## 2.3 Groundwater

### 2.3.1 Affected Environment

Groundwater conditions at the site are characterized in detail in the 1989 Project EIS, the 1992 Project SEIS, and the 2002 Project SEIS. Key characteristics are described below.

**Groundwater Occurrence and Quality**

The first aquifer beneath the site consists of saturated fractures within the Pomona Basalt approximately 50 to 200 feet below ground level (an aquifer is a water-saturated layer of high-permeability materials large enough to provide water to a well or spring). The aquifer occurs primarily in the more fractured bottom section of the basalt flow immediately above the Selah Member clays. The direction of flow is generally west to east. Flow depths range from zero in the western portion of the site to several tens of feet in the southeastern portion. The quality of groundwater in the Pomona aquifer beneath the site appears to have been affected by agricultural use, and does not meet federal and state secondary drinking water standards. Secondary drinking water standards are not for health purposes, but relate to aesthetic considerations such as taste, smell, and appearance.

The low-permeability layer of Selah Member clays and silts, estimated to be approximately 340-feet thick at the landfill site, is a major aquitard, greatly limiting the rate of groundwater flow from the Pomona aquifer to underlying deep aquifers. Regional aquifers lie beneath the site at depths of 1,000 feet or more. Travel time calculations indicate it would take approximately 1,500 years for groundwater to move through the Selah member clays and silts to the underlying deep aquifer, and another 100 years to reach water supply wells in Roosevelt.

**Beneficial Use**

Roosevelt is served by 5 water supply wells that tap the regional aquifer. Three other water supply wells are also located within a 20-mile radius of the site, as well as 14 springs, some of which are used for stock-watering. RDC uses groundwater from a water supply well in the western portion of the site (Figure 3) for a variety of uses, including domestic supply, dust control, fire protection, and continuous construction and maintenance of landfill facilities. The well taps the regional aquifer at a depth of approximately 1000 feet.

On an annual basis, the predominant use of groundwater at the site is for landfill operations, primarily dust control. The greatest monthly water use was historically during months when the clay liner was being constructed for a new disposal area. However, since GCL has replaced clay liner, and clay liner is no longer used at the site, water consumption for clay liner construction is now zero.

**Environmental Controls**

As discussed in detail in Section 1.4.3, a number of environmental controls are incorporated into the design and operation of the landfill for the purpose of minimizing potential impacts on groundwater quality. These measures, which are required by federal, state, and local regulations, include the bottom liner system, which is subject to a rigorous quality control program during construction; control systems for leachate, stormwater, and landfill gas; and monitoring programs for groundwater, surface water, leachate, and landfill gas.

### 2.3.2 Impacts

**No Action Alternative:**
No change to the groundwater quality, demand, nor environmental controls beyond the current usage and management under the No Action Alternative.

**Proposed Action Alternative:**
Under the Proposed Action, groundwater usage for operational practices and dust control as well as environmental controls and monitoring would be extended by an estimated 89 years. No other changes to the groundwater quality nor environmental controls are anticipated under the Proposed Action.

### 2.3.3 Mitigation Measures

A number of mitigation measures for potential impacts on groundwater would be incorporated into the project under either alternative. These are discussed in detail in the 2002 Final Supplemental EIS on Roosevelt Regional Landfill Volume Expansion. Mitigation measures are expected to perform equally well for both alternatives.

### 2.3.4 Significant Unavoidable Adverse Impacts

With the mitigation measures incorporated into the project, no significant adverse impacts related to groundwater would be expected.

## 2.4 Air Quality

### 2.4.1 Affected Environment

The Roosevelt Regional Landfill and landfill-related operations generate various types of air emissions, including: fugitive emissions of landfill gas, products of combustion and unburned contaminants from the burning of landfill gas in flares or energy-generating facilities, and fugitive dust and exhaust emissions from heavy equipment and trucks operating at the landfill and the intermodal yard.

### 2.4.2 Impacts

**No Action Alternative:**
Under the No Action Alternative, total landfill gas generation is predicted to peak at 38,800 scfm in the year 2042. In 2006, it was estimated that the landfill generated 4,000 scfm. This number is based on modeling performed in 2006 for the previous SEIS. In that study, the landfill gas generation would increase from 22,700 scfm in 2030 to 38,800 by 2042 (the currently permitted closure date). This represents an annual increase in total landfill gas of 1,342 scfm per year between 2030 and 2042. It is estimated that the landfill gas collection system would collect at least 90% of this gas and direct it to flares or energy-generating facilities for combustion, while the remaining 10% or less would escape through the landfill cover as fugitive landfill gas emissions. The number of flares required to burn all the collected gas depends on their capacity.

The maximum number of flares required for the existing landfill is six.

Technical air quality analyses performed in 2006 demonstrate that landfill emissions would not cause exceedances of any ambient air quality standards; will remain below PSD increments and Washington State health-based screening criteria for toxic air pollutants; and will meet U.S. Forest Service criteria designed to protect visibility, forest ecosystems, and aquatic ecosystems in national parks and wilderness areas (referred to as Class I areas).

**Proposed Action Alternative:**
Given the landfill maximum elevation modification associated with the Proposed Action would extend the landfill life to 2130, it is expected that the total landfill gas generation peak would also increase since the landfill would operate an additional 89 years. However, it is assumed the landfill gas collection system would continue to collect at least 90% of the gas as it would under the No Action Alternative, leaving 10% or less of the gas as fugitive landfill gas. Based on the modeling performed in 2006 for the SEIS, and assuming a similar annual increase in landfill gas per year (1,300 scfm), the predicted total landfill gas generation under the Proposed Action is estimated to be 152,000 scfm (a total increase of 113,200 scfm), by 2130.

No increase in mobile emissions is anticipated since there would be no increase in equipment usage under this alternative.

### 2.4.3 Mitigation Measures

A number of mitigation measures for potential impacts on air quality would be incorporated into the project under either alternative. Mitigation measures are expected to perform equally well for both alternatives. These are discussed in detail in the 2002 Final Supplemental EIS on Roosevelt Regional Landfill Volume Expansion, include:

- An active landfill gas collection system that would continue to collect at least 90% of the generated gas and direct it to the Klickitat County PUD energy-recovery facility or to high-temperature shielded flares, where it would be burned to destroy toxic constituents. As noted previously, the Roosevelt Regional Landfill would be expected to be at the upper end of feasible landfill gas collection efficiency, and may even exceed the 90% level assumed in air quality modeling. Not only does the landfill have a low permeability bottom liner, but the spacing of collection pipes in the landfill is conducive to a high level of collection efficiency. Most modern landfills place gas collection pipes in horizontal trenches that are 200 feet or more apart or vertical wells spaced 300 feet apart. The horizontal trenches at the Roosevelt Regional Landfill are approximately 140-160 feet apart and vertical wells 150-200 feet apart, increasing the amount of generated gas that is captured by the vacuum and directed to flares or to the PUD facility. The landfill gas collection system in future disposal areas would continue to be designed to achieve a high level of collection efficiency.
- Use of daily, interim, and final cover to minimize fresh garbage odors, and improve the efficiency of the gas collection system.
- Phased construction of lined disposal areas to minimize the amount of soil exposed at any one time, thereby minimizing wind erosion and fugitive dust.
- An aggressive dust control program, including paving roads used by solid waste hauling vehicles to within 100 feet of the bottom liner; wetting paved and unpaved roads, areas where construction or excavation is occurring, and exposed soil stockpiles, as needed to control dust;

erosion control best management practices; and control of fugitive dust emissions from rock crushing, in accordance with the air operating permit.

- Maintenance of 250-foot minimum buffers between the active landfill area and the site boundary.
- Routine inspection and maintenance of solid waste containers to minimize the potential for leakage and associated odor.
- Compliance with conditions of the air operating permit, including surface emissions monitoring for methane and implementation of any needed improvements in the gas collection system; testing of flare emissions; ambient air quality monitoring for PM10 and lead; and visible emissions surveys to monitor the effectiveness of dust control measures.
- Quickly stabilize exposed soils at the landfill site to reduce the potential for fugitive dust.

### 2.4.4 Significant Unavoidable Adverse Impacts

With the mitigation measures incorporated into the project, no significant adverse impacts related to air quality would be expected.

## 2.5 Noise

### 2.5.1 Affected Environment

In 2006 an update noise analysis was prepared (Geomatrix 2006) to model impacts related to expanding the hours of operation of the landfill intermodal facility to 24 hours and increased nighttime truck traffic on the landfill's haul road. The 2006 SEIS found that the predicted sound levels from proposed landfill changes in 2006 would be gradual over a number of year and likely not discernible.

### 2.5.2 Impacts

**No Action Alternative**:
Under the No Action Alternative, the landfill would continue to operate at it's currently permitted level and configuration, and noise from landfill activity would comply with the state noise limit at the nearest site boundary and the nearest residence.

**Proposed Action:**
Under the Proposed Action, no changes in operations of the landfill, especially near residence, is proposed, and the landfill would continue to operate at it's currently permitted level and configuration and in compliance with state noise limits. There is no anticipated change in the noise levels generated by the landfill with the maximum elevation increase under the Proposed Action.

### 2.5.3 Mitigation Measures

RDC would continue to supply all equipment and trucks with effective, well maintained mufflers and other sound control devices.

### 2.5.4 Significant Unavoidable Adverse Impacts

With the mitigation measures incorporated into the project, no significant adverse impacts related to noise would be expected.

## 2.6 Land Use and Plan Consistency

### 2.6.1 Affected Environment

The existing landfill is consistent with the *Klickitat County Comprehensive Plan,* the *Roosevelt Community Subarea Plan,* and *Zoning Ordinance No. 62678. and the 2021 Klickitat County Solid Waste Management Plan Update, as approved by the County, included an annual tonnage limit of 5 MTY.*

As currently designed and approved, the landfill would be developed and closed in phases and revegetated. In 2006, the County extend the life of the landfill to the year 2041 and approved the additional of roughly an additional 104 employees.

### 2.6.2 Impacts

**No Action Alternative:**
Under the No Action Alternative, the landfill would continue to operate under current permit conditions and would operate until 2041.

**Proposed Action Alternative**:
No changes or alterations to the landfill, other than the height modification from a maximum elevation of 1,820 MSL to 2,050 MSL would occur. The landfill's total capacity would expand from 245 MCY to 360 MCY, an increase of 118 MCY over an estimated additional 89 years of landfill life. However, the permitted maximum annual tonnage would not change and would remain capped at 5 MTY. No increase to the workforce would be needed to accommodate these changes, therefore no impacts to the County from an increased demand for housing or public services would be required for this alternative. The County would benefit from an additional 89 years of landfill life relative to the No Action Alternative.

### 2.6.3 Mitigation Measures

None required.

### 2.6.4 Significant Unavoidable Adverse Impacts

No significant adverse impacts related to land use and plan consistency would be expected.

## 2.7 Aesthetics/Light and Glare

### 2.7.1 Affected Environment

**Visual Character**
The following discussion of the visual aspects of the site and surrounding area are summarized from the 1989 Project EIS and 1992 Project SEIS, updated to reflect current conditions.

The landfill is located in a region of south central Washington known for its dry climate, hilly topography, sparse vegetation, and the scenic Columbia River Gorge. The Gorge is heavily used for recreational fishing, water sports, and other activities. Wood Gulch, located just west of the site, is the most significant topographic feature in the vicinity of the landfill. The walls of the gulch descend to Wood Gulch Creek, which flows south to the Columbia River. The area surrounding the site is characterized by rounded hills, grass, and sparse trees and shrubs.

The appearance of the portions of the site in pasture and wheat cultivation change color seasonally, from bare earth to green and brown crops to brown stubble. They have a consistent, solid texture. The area used for grazing is like other native rangeland in the area. Clumps of grass and sagebrush present a mottled brown, green, and yellow appearance when viewed from nearby locations, and a light brown appearance when viewed from farther away. The remainder of the site consists of open space, the existing MSW landfill and ash monofill, borrow areas, and various landfill facilities (see Figure 3). These provide a variety of colors and textures that contrast with adjacent areas in agricultural use.

**Light and Glare**

The lights at the landfill that have the greatest potential to be visible offsite are the portable "light plants" used to light the working area when landfilling or daily cover occurs after dark. A light plant consists of a trailer-mounted generator, with a bank of lights mounted on a telescoping standard. Currently, five light plants are used to light the working area. One has a bank of 16 lights, which is typically telescoped to a height of 35-40 feet. The other four have banks of 6 lights, which are typically telescoped to a height of 25-30 feet. The light bulbs are 1000-watt metal halide bulbs, each of which is fully enclosed, with a reflector dish in back and a glass cover in front. To minimize the potential for offsite effects, RDC directs the lights downward and toward the center of the site.

Currently, the working area lights are not visible from the nearest residences or the community of Roosevelt, but the large light plant at the working area is visible from higher elevations at some distance north of the landfill. When fog occurs in the area, the lights at the working area cause a glow in the sky. However, no direct light extends offsite, and the lights do not cause glare on nearby roadways.

There are also banks of lights at the working area of the intermodal yard. However, no change would be expected in the type or location of these lights under the No Action Alternative or the Proposal. Therefore, these lights are not discussed in the impact analysis below.

**Litter Potential**

High winds at the site can result in windblown litter and associated aesthetic impacts. As discussed in Section 1.4.3, RDC implements aggressive litter control measures to minimize the potential for impacts. These include portable litter control fences placed around the active face of the landfill, and a fixed litter fence with catchment at the eastern boundary (the predominant wind direction is to the east.) Although the portable litter fences are effective much of the time, there can be some accumulation of litter on the site after periods of high winds. RDC has historically maintained a litter patrol of 9-17 people to pick up litter on the site.

## 2.7.2 Impacts

**No Action Alternative**:

**Visual Character**

Over time, as more lined areas are added to the existing MSW landfill, the visual character of the site would change. Portions of the landfill footprint now used for agricultural uses would gradually be developed for waste disposal. Final cover and revegetation would occur 40 to 60 acres at a time when that much area has been filled to capacity and sufficient time has elapsed to allow settlement to occur.

The topography of the landfill footprint would change over time as the landfill expands horizontally and vertically. As evident in the final grading plan in Figure 4, the No Action Alternative would create three ridges 1,820 feet high. The longest ridge (approximately 6,250 feet long) would extend from the top of the southeast side slopes to the northwest corner of the landfill. At either end of this long ridge, there would be a shorter ridge perpendicular to it in the southwest-northeast direction, forming an "H" shape (Figure 4). The northern perpendicular ridge would be approximately 3,250 feet long, while the southern perpendicular ridge would be approximately 4,750 feet long. The sides of the landfill along the longest ridge would be contoured to resemble natural landforms in the site vicinity. When the entire footprint is developed and final cover has been applied and seeded, the landfill would resemble a natural grassy hill, green in winter and spring, and brown in summer and fall.

Changes in the visual character of the site over time would also occur outside the landfill footprint. Some areas currently in agricultural use would be used as borrow areas for clay and rock. Stockpiles of soil materials would be placed near the borrow areas or within the landfill footprint near the place of intended use. As noted previously, after borrow areas are no longer needed, they would be reclaimed and revegetated. Excess soil in stockpiles would also be contoured and revegetated to create a natural appearance. Most of the site would be vegetated following landfill closure, although landfill environmental controls and support facilities would remain for decades to allow post-closure care of the facility.

**Visibility of the Landfill**

The U.S. Forest Service (1973) uses the following criteria to define the visibility of landscape features at different distances:

- **Foreground**: 0 to 0.25-0.5 mile from the viewer. Within this zone, there is discernment of detail, color, and scale.
- **Middleground**: 0.25-0.5 to 3-5 miles from the viewer. Visual simplification occurs; detail becomes less discernible and color softens.
- **Background**: 3-5 miles to infinity. Objects are viewed mostly as patterns of light and dark.

A visual impact analysis was performed using 3-dimensional (3D) graphical depictions to evaluate the visibility of the landfill from surrounding viewpoints. Landfill final grades and surrounding topography were electronically introduced into the digitized 3D graphical software. Four viewpoints were selected for further analysis, consistent with the 2002 Final Supplemental EIS. The locations of the viewpoints are shown in Figure 9, and 3D depictions are included in Appendix A. The following paragraphs describe the locations of the selected viewpoints, as well as the degree to which the landfill would be visible from each under the No Action Alternative.

- Viewpoint 1 (elevation 1,720 feet) is located on Roosevelt Grade Road (East Road) approximately 1 mile north of the site access road. In the direction of view shown in Figure 9, this viewpoint is approximately 0.2 mile from the landfill footprint. From Viewpoint 1, the view of the No Action Alternative would be of a 3H:1V side slope that rises to almost 1,800 feet and blocks the top of the ridge (see 3D depiction in Appendix A). The top of the ridge would be visible, however, in a more northerly or southerly view direction from the same viewpoint. When landfill operations occur on and above the western side slopes of the landfill, tippers and other operations equipment would be clearly visible. The top of the 3H:1V slope would be approximately the same height as the 1,800-foot hill directly north of this viewpoint, which currently dominates views from this location. However, the landfill would be a much larger landform than this hill.
- Viewpoint 2 (elevation 1,700 feet) is located at the intersection of East Road and Six Prong Road,

a dirt road classified as primitive. In the direction of view, this viewpoint is approximately 1.8 miles from the landfill footprint. The landfill ridge would be barely visible in this view direction (see 3D depictions in Appendix A), but would be visible in a more southerly view direction due to the absence of steep side slopes. As the landfill reaches its final elevations, tippers and other operations equipment would be visible, though indistinct. At closure, the landfill would not be a prominent feature of the landscape – its textures and colors would be similar to those of adjoining land.

- Viewpoint 3 (elevation 1,540 feet) is located on Six Prong Road, approximately at the intersection of Six Prong Road and Whitmore Road, also a dirt road classified as primitive. In the direction of view, this viewpoint is approximately 2.5 miles from the landfill footprint. The entire long ridgeline, as well the northeastern ends of the perpendicular ridges would be visible from this viewpoint (see 3D depictions in Appendix A). As the landfill reaches higher elevations, tippers and other operations equipment may be visible, but would not be readily discernible because of the distance of the viewpoint from the site (2.5 miles). At this distance, the ridgelines of the Proposal would tend to blend in with other ridgelines of similar elevations west of the site.
- Viewpoint 4 (elevation 1,600 feet) is located on Roosevelt Grade Road (East Road) just north of the site access road. In the direction of view, this viewpoint is approximately 0.3 mile from the landfill footprint. The view of the No Action Alternative would be toward a 3H:1V side slope that rises to approximately 1780 feet and blocks the top of the ridge from this viewpoint (see 3D depictions in Appendix A). The top of the ridge would be visible in a more northerly or southerly view direction, however. When landfill operations occur on and above the western side slopes of the landfill, tippers and other operations equipment would be clearly visible.

The 2002 SEIS visual impact analysis indicated that approximately the top 15-20 feet of the northeastern tip of the northern perpendicular ridge might be visible from the nearest residence when the No Action Alternative is at final grade. The nearest residence is located in Pine Creek Canyon approximately 1.2 miles northwest of the site. It appears that the very tip of the ridge might be visible in a narrow view corridor directly down the canyon, unless there are intervening trees between the residence and the landfill site. The No Action Alternative would not be visible at any other angle of view from this residence. Because only a very small portion of the landfill (if any) might be visible, the view corridor would be narrow, and no significant views would be blocked; this is not considered a significant view impact.

The completed landfill would also be potentially visible within a 3-mile radius from some other areas to the west, northwest, north, northeast, and east, but not from the other nearest residence. That residence is located in a low area, with nearby hills that would screen the landfill from view. The landfill would also not be visible within a 3-mile radius from the south or southeast. From the southwest, the completed landfill would be visible only from Roosevelt Grade Road (East Road) adjacent to the site. It would not be visible from Roosevelt or from SR 14. However, at the maximum elevation of 1,820 feet MSL under the No Action Alternative, the upper elevations would be visible from a stretch of I-84 approximately 1to 2.5 miles west of Arlington (southwest of the landfill).

In general, the No Action Alternative would alter the topography visible from local viewpoints. However, there would be little public exposure to views of the landfill, the landfill would be similar in color and texture to other hills in the vicinity, and there would be no blockage of significant views. Therefore, impacts on visual quality would not be significant.

**Light and Glare**

As the elevation of the landfill increases under the No Action Alternative, the lights on the working area would become visible from more offsite locations. At locations described above from which the top of the landfill would be visible, the working area lights would likely be visible before the top of the landfill comes into view. This includes some areas within a 3-mile radius to the west, northwest, north, northeast, and east. The lights would also be visible at times from Roosevelt Grade Road (East Road) southwest of the site, and as the landfill reaches its final elevations, from a stretch of I-84 approximately 1 to 2.5 miles west of Arlington (this view would be at a distance greater than 3 miles).

When operations are occurring near final elevation on the northwestern end of the landfill ridge, the working area lights may be visible from the nearest residence, located in Pine Creek canyon approximately 1.2 miles northwest of the site. To minimize the potential visibility of working area lights from the nearest residence, RDC would continue to direct the lights downward and toward the center of the site, and if necessary would reduce the height of the standards to the extent feasible. The lights would likely not be visible from the other residence 1.7 miles north of the site. The lights would also not be visible from the community of Roosevelt or SR 14. No direct light would extend to offsite areas, and there would be no glare effect on nearby roadways.

**Litter Potential**

As annual tonnage increased under the No Action Alternative, the working face of the landfill would become larger to accommodate additional tippers, dozers, and compactors. As a result, there would be an increase in litter potential. RDC would keep the size of the working face at the minimum necessary to allow equipment to operate. In addition, as discussed in Section 1.4.3, RDC would take whatever measures are necessary to control litter at the site, including adding more and higher portable and fixed litter fences, and additional litter patrol personnel.

**Proposed Action**:
**Visual Character**
The discussion of the changes in visual character of the landfill site under the No Action Alternative also generally applies to the Proposal. However, the mass of the landfill would be noticeably greater under the Proposed Action. The landfill would be graded to a single top-deck with a maximum elevation of approximately 2,050 feet MSL in the northwest corner, graded down at a 5% inclination to the southeast where the minimum top deck elevation is 1,800 feet MSL.

The following paragraphs describe the 3D graphical depictions from the four selected viewpoints (discussed above), as well as the degree to which the landfill would be visible from each under the Proposed Action:

- Viewpoint 1 (elevation 1,720 feet, 0.2 mile from landfill footprint). In the direction of view shown in Figure 9, the view of the Proposed Action would be toward the southeast end of the northern perpendicular ridge described above. Whereas the view of the No Action Alternative would be up a 3H:1V slope to the top of the 1,820-foot ridge, the view of the Proposed Action would be of a larger 3H:1V sideslope that rises to almost 2,050 feet (see 3D depictions in Appendix A). The top of the landfill in the northwest corner would be visible. When landfill operations occur on and above the western sideslopes of the landfill, tippers and other operations equipment would be clearly visible. The top of the 3H:1V slope would be approximately 250 feet higher than the 1,800-foot hill directly north of this viewpoint, which currently dominates views from this location.
- Viewpoint 2 (elevation 1700 feet, 1.8 miles from landfill footprint). In the direction of view shown in Figure 9, the view of the Proposed Action would be toward a 3H:1V sideslope that rises to the top of the landfill at approximately 2,050 feet. The landfill ridge would be clearly visible in this view direction (see 3D depictions in Appendix A). As the landfill reaches its final elevations, tippers and other operations equipment would be visible, though indistinct from this

distance. At closure, the landfill would be a moderately prominent feature of the landscape, but its textures and colors would be similar to those of adjoining land.

- Viewpoint 3 (elevation 1,540 feet, 2.5 miles from landfill footprint). In the direction of view shown in Figure 9, the prominent view of the Proposed Action would be toward the northeastern corner of the landfill, where the top deck ridge peaks out at approximately 1,970 feet. The entire northern ridgeline would be visible from this viewpoint (see 3D depictions in Appendix A). As the landfill reaches higher elevations, tippers and other operations equipment may be visible, but would not be readily discernible because of the distance of the viewpoint from the site (2.5 miles). At this distance, the ridgelines of the Proposed Action would be moderately distinguishable from other ridgelines of lower height to the west of the site.
- Viewpoint 4 (elevation 1,600 feet, 0.3 mile from landfill footprint). In the direction of view shown in Figure 9, the view of the Proposal would be toward the western side slope of the landfill. Whereas the view of the No Action Alternative from this viewpoint would be up a 3H:1V slope that dominates the right half of the field of view from this viewpoint, the view of the Proposed Action would be toward a 3H:1V sideslope that dominates the entire field of view from this viewpoint (see 3D depictions in Appendix A). The top of the ridge would be similar to the No Action Alternative on the right side of the field of view from this viewpoint, and the left side of the field of view from this viewpoint would add an approximate 225 foot 3H:1V side slope to the top of the ridge at approximately 2000 feet. The top of the landfill in the northwestern corner would not be visible from this viewpoint. When landfill operations occur on and above the western sideslopes of the landfill, tippers and other operations equipment would be clearly visible.

In general, the Proposed Action's greater mass compared to the No Action Alternative would be evident from these viewpoints. However, like the No Action Alternative, there would be little public exposure to views of the landfill, the landfill would be similar in color and texture to other hills in the vicinity, and there would be no blockage of significant views. Therefore, impacts on visual quality would not be significant.

Like the No Action Alternative, the upper elevations of the Proposed Action would be visible from a stretch of I-84 approximately 1 to 2.5 miles west of Arlington, Oregon. The Proposed Action would be somewhat more visible than the No Action Alternative from this stretch of I-84 because of the increase in maximum elevation. Nonetheless, at the distance of this stretch of I-84 from the site (over 3 miles), the landfill would likely be indistinguishable from surrounding hills.

**Light and Glare**

The discussion of light and glare under the No Action Alternative also generally applies to the Proposed Action. Because more of the landfill would be at higher elevations, there would be a greater potential for working area lights to be visible from offsite locations, including the nearest residence, as the landfill reaches its final elevations. To minimize the potential visibility of working area lights from the nearest residence, RDC would continue to direct the lights downward and toward the center of the site, and if necessary would reduce the height of the standards to the extent feasible.

**Litter Potential**

As the annual tonnage increases under the Proposed Action, the working face of the landfill would gradually increase to accommodate additional tippers and other equipment. There would be no change to the size of the working face relative to the No Action Alternative; therefore, the potential for windblown litter would be no greater. RDC would keep the size of the working face at the minimum necessary to allow equipment to operate. In addition, as discussed in Section 1.4.3, RDC would take whatever measures are necessary to control litter at the site, including adding more and higher portable and fixed litter fences, and additional litter patrol personnel.

### 2.7.3 Mitigation Measures

Since the Proposed Action would increase the visibility of the night work and working face, the following mitigation measures are recommended:

- RDC should evaluate the required night light height and determine whether shorter lighting would be possible, taking into consider the need to maintain safe night-time working conditions.

RDC must take whatever measures are necessary to provide adequate litter control, including adding more and higher portable and fixed litter fences and additional litter patrol personnel to minimize litter generation from the landfill face.

### 2.7.4 Significant Unavoidable Adverse Impacts

With the mitigation measures incorporated into the project, no significant adverse impacts related to aesthetics/light and glare would be expected.

# Section 3

References

# Section 3. References


Geomatrix, 2006. Letter Report Re: Roosevelt Regional Landfill Intermodal Facility Expanded Hours of Operation Noise Study, 12536.000.0, July 12, 2006.

Klickitat County, 1977. Klickitat County Comprehensive Plan, as amended. Goldendale, WA.

Klickitat County, 1979. Zoning Ordinance No. 62678, as amended. Goldendale, WA.

Klickitat County, 1989. Final Environmental Impact Statement, Klickitat County Solid Waste Project. Planning Department. Goldendale, WA.

Klickitat County, 1990. Roosevelt Community Subarea Plan, amended in 1995. Planning Department. Goldendale, WA.

Klickitat County, 1992. Final Supplemental Environmental Impact Statement, Roosevelt Regional Landfill Modification and Expansion. Planning Department. Goldendale, WA.

Klickitat County, 1995. Second Amended Agreement Regarding Solid Waste Handling between Klickitat County and Regional Disposal Company, August 7, 1995. Goldendale, WA.

Klickitat County, 2021. Final Klickitat County Solid Waste Management Plan For Years 2021-2016, Prepared for Klickitat County Solid Waste Department, Goldendale, WA, Prepared by HDR, June 2021.

Klickitat County Economic Development Organization and Mid-Columbia Economic Development District, 1995. Roosevelt Community Action Plan for Roosevelt, Washington.

Regional Disposal Company, 1998. Stormwater Pollution Prevention Plan, Roosevelt Regional Landfill. Roosevelt, WA.

Thiel Engineering, 2001. Supplemental durability calculations for buried leachate collection pipe, Roosevelt Regional Landfill. Oregon House, CA.

U.S. Forest Service, 1973. Distance zones used in landscape management. In Klickitat County, 1992.

# Section 4

## Distribution List

# Section 4. Distribution List

The following agencies, organizations, and individuals were sent a copy of the Draft SEIS and the Final SEIS. The Final SEIS is available at the Klickitat County Planning Department and other public review locations indicated below.

Klickitatcountysolidwaste@klicktiatcounty.org

Fire District #9 rural9office@gmail.com

Fire District #2
PO BOX 82
Bickleton, WA 99322

Dan Christopher
Board of County Commissioners
danc@klickitatcounty.org

Jacob Anderson
Board of County Commissioners
jacoba@klickitatcounty.org

Lynn Ward
Klickitat County Building & Compliance Director
lynnw@klickitatcounty.org

Gordon Kelsey
KC Public Works Director

Klickitat Co. Prosecuting Attorney
rebeccas@klickitatcounty.org
davidq@klickitatcounty.org

Amber Johnson, WDFW
amber.johnson@dfw.wa.gov
Mike Ritter, WDFW
Michael.Ritter@dfw.wa.gov
US Fish & Wildlife
Stephen_Lewis@fws.gov

WatsonD@wsdot.wa.gov
sw-sepa-review@wsdot.wa.gov
VanAntB@wsdot.wa.gov
gilkc@wsdot.wa.gov

WA State Dept. of Ecology
crosepacoordinator@ecy.wa.gov
sepaunit@ecy.wa.gov

Brian Yearout
WA State Parks and Recreation Commission
Brian.Yearout@parks.wa.gov

WA Dept of A & H P
sepa@dahp.wa.gov
Dept. of drinking water
Jamie.gardipe@doh.wa.gov

Yakama Indian Nation Cultural Resources
PO Box 151
Toppenish, WA 98948

Yakama Indian Nation
Tribal Council
PO Box 151
Toppenish, WA 98948

Columbia River Gorge Commission
PO BOX 730
White Salmon, WA 98672

Casey Gatz, Land Management Planner
Forest Service Columbia River Gorge National Scenic Area cgatz@fs.fed.us

The Columbia Gorge News
wanews@gorgenews.com
Goldendale Sentinel
lmarzeles@goldendalesentinel.com

Federal Aviation Administration
Northwest Mountain Region
2200 S. 216th Street
Des Moines, WA 98198

Klickitat County Natural Resources
Economic Development
davem@klickitatcounty.org

Kimberly N. Peacher
Community Planning and Liaison Officer
Northwest Training Range Complex
Kimberly.peacher@navy.mil

National Park Service
Pacific West Region
333 Bush Street, Suite 500
San Francisco, CA 94104-2828

Confederated Tribes of the
Umatilla Indian Reservation
6411 Timine Way
Pendleton , OR 97801

USDA NRCS Goldendale Office
1107 South Columbus Ave
Goldendale WA 98620

US EPA Region 10
1200 Sixth Ave Ste155
Seattle, WA 98101

Roosevelt School District
PO BOX 248
Roosevelt, WA 99356

City of Goldendale
pmunyan@ci.goldendale.wa.us
mcanon@ci.goldendale.wa.us

City of White Salmon
Administrator@ci.white-salmon.wa.us
Mayor@ci.white-salmon.wa.us

WA UTC
621 Woodland Square Lp SE
Lacey, WA 98503

UNITED STATES OF AMERICA
PO BOX 2946
PORTLAND OR 97208-2946

NATIVE AMERICAN LANDS
PO BOX 632
TOPPENISH WA 98948

PINE CREEK RANCHES LLC
1489 EAST RD
BICKLETON WA 99322

DAVENPORT, JIMJACK
486 HOCTOR RD
GOLDENDALE WA 98620

Dave Sauter
Board of County Commissioners

YAKAMA Indian Nation contacts
enviroreview@yakama.com
elizabeth_sanchey@yakama.com
phil_rigdon@yakama.com ethan@yakamanation-olc.org
kate_valdez@yakama.com
jessica_lally@yakama.com
jeanette@ykfp.org
BKent@yakama.com
Bureau of Indian Affairs
rocco.clarkjr@bia.gov

Klickitat Co. Assessor- email
realproperty@klickitatcounty.org

Health Dept. David Kavaughn
Davidk@klickitatcounty.org &
Marty Hudson Weed Control
martyh@co.klickitat.wa.us

Evan Carnes- Army Corp
5525 S. 11th St Ridgefield WA 98642
206 316 3049
Evan.g.carnes@usace.army.mil

PUD Contacts aestey@klickpud.com
mgarner@klickpud.com
lmata@klickpud.com
rpatton@klickpud.com water/sewer
sblodgett@klickpud.com
Bwalter@klickpud.com

WSDOT Aviation
PO Box 47361
Olympia, WA 98504

becky.kennedy@dnr.wa.gov
WA State Dept. of Natural Resource
DNR SEPA CENTER: sepacenter@dnr.wa.gov

Bickleton School District
P O Box 10
Bickleton, WA 99322

Confederated Tribes of Warm Springs
1233 Veterans Street, PO Box C
Warm Springs , OR 97761

City of Bingen
cityhall@bingenwashington.org

Federal Hwy Administration
1200 New Jersey Ave SE
Washington DC 20590

WHITE RANCH INC
782 OLD HWY 8
ROOSEVELT WA 99356

WHITMORE & SON INC
1 WHITMORE RD
BICKLETON WA 99322

David Niemela
527 Cameron Rd
Centerville, WA 98613

# Section 5

## Comments and Responses

# Section 5. Comments and Responses

This section contains comments and comment letters on the Draft SEIS that were received from the 30-day public comment period that took place between September 15, 2022 and October 17, 2022. Following each comment letter are responses to the comments.

The responsible official received one comment letter and one in-person verbal comment. The comments are listed below in the order in which they are included in this section.

- Washington Department of Ecology, Lucila Cornejo, SEPA Coordinator, letter dated October 13, 2022 (see response on page 28).

- Verbal comment received at the Klickitat County Planning Department counter by Mr. David Niemela on October 7, 2022 (see response on page 29).

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Central Region Office
1250 West Alder St., Union Gap, WA 98903-0009 • 509-575-2490

October 13, 2022

Lori Anderson
Klickitat County
115 West Court St
Goldendale, WA 98620

RE: 202204661, SEPA2022-19

Dear Lori Anderson,

Thank you for the opportunity to comment on the Environmental Impact Statement for the SEPA2022-19 Roosevelt Regional Landfill. We have reviewed the documents and have the following comments.

**WATER QUALITY**

Project with Potential to Discharge Off-Site

If your project anticipates disturbing ground with the potential for stormwater discharge off-site, the NPDES Construction Stormwater General Permit is recommended. This permit requires that the SEPA checklist fully disclose anticipated activities including building, road construction and utility placements. Obtaining a permit may take 38-60 days.

The permit requires that a Stormwater Pollution Prevention Plan (Erosion Sediment Control Plan) shall be prepared and implemented for all permitted construction sites. These control measures must be able to prevent soil from being carried into surface water and storm drains by stormwater runoff. Permit coverage and erosion control measures must be in place prior to any clearing, grading, or construction.

In the event that an unpermitted Stormwater discharge does occur off-site, it is a violation of Chapter 90.48 RCW, Water Pollution Control and is subject to enforcement action.

More information on the stormwater program may be found on Ecology's stormwater website at: http://www.ecy.wa.gov/programs/wq/stormwater/construction/. Please submit an application or contact Lloyd Stevens, Jr. at the Dept. of Ecology, (509) 571-3866 or lloyd.stevensjr@ecy.wa.gov with questions about this permit.

Sincerely,

Lucila Cornejo

Lucila Cornejo
SEPA Coordinator
Central Regional Office
(509) 208-4590
crosepacoordinator@ecy.wa.gov

**Response to Washington Department of Ecology, Lucila Cornejo, SEPA Coordinator, letter dated October 13, 2022**

The Roosevelt Regional Landfill is subject to the State's Industrial Stormwater General Permit (ISGP) and has active permit coverage. As part of that coverage, the facility has an Industrial Stormwater Pollution Prevention Plan (SWPPP). In accordance with the ISGP, the landfill must update their SWPPP *"…whenever there is a change in design, construction, operation, or maintenance at the facility that significantly changes the nature of pollutants discharged in stormwater from the facility, or significantly increases the quantity of pollutants discharged."* Accordingly, the SWPPP update will include update of the SWPPP site mapping in accordance with the ISGP Section S3. B.1, list of pollutants, discharge locations, and proposed best management practices. The commenter recommends that the landfill apply for a Construction Stormwater General Permit for any anticipated ground disturbance associated with the proposal that has potential for stormwater discharge off-site. However, dual coverage under both the Industrial and Construction Stormwater Permits is not required. Since the proposed landfill vertical expansion is to be part of the facility's operational industrial activities, implementation of stormwater management protections is subject to the ISGP.

Update of the existing facility SWPPP must be completed prior to implementation of any of the planned operational modifications.

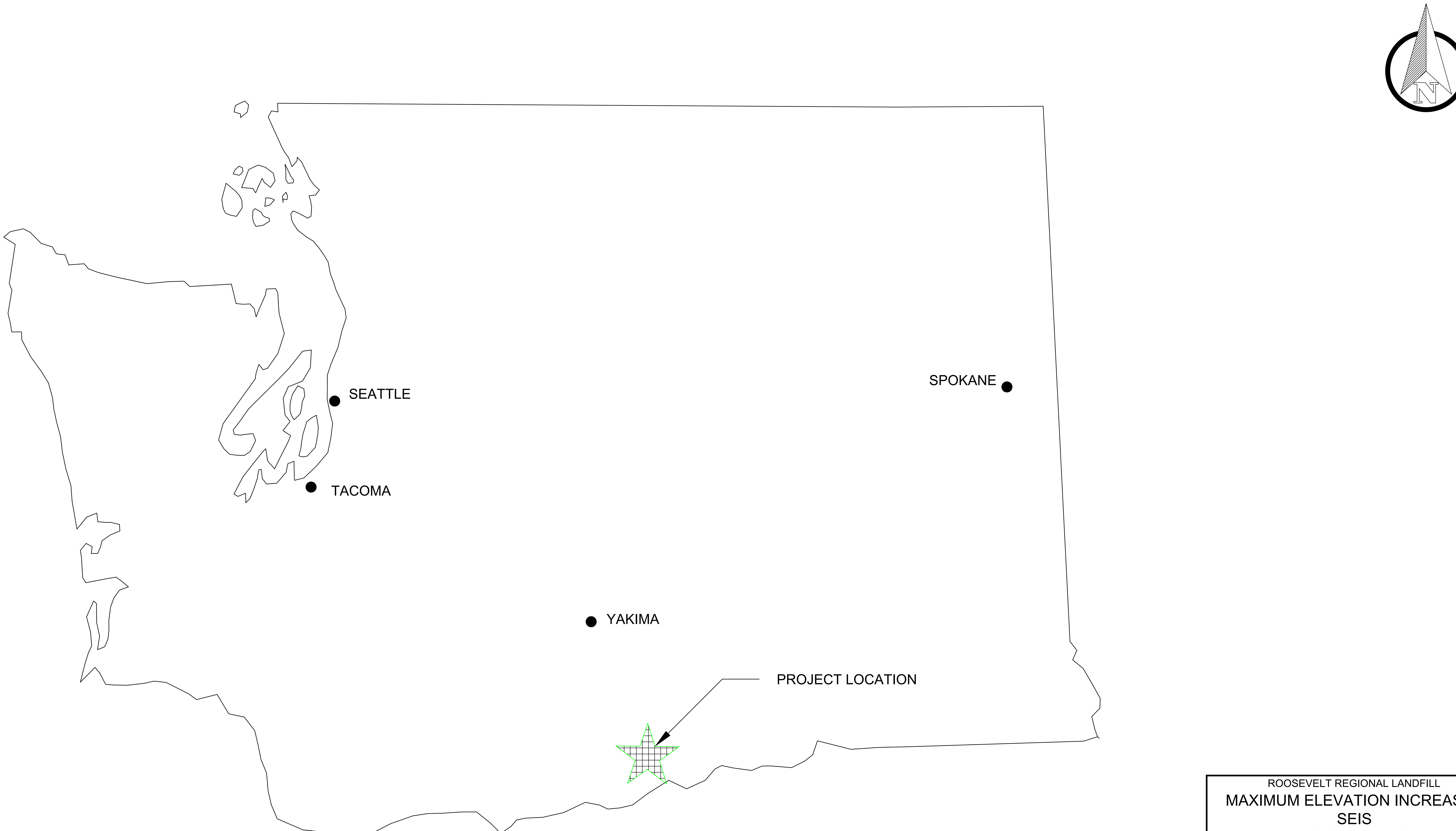
**Verbal comment received at the Klickitat County Planning Department counter by Mr. David Niemela on October 7, 2022**

The basis of the verbal comment was to ensure "the fire and emergency response plans, remain in place; and all managers, supervisors and lead personnel will be trained in first aid, including CPR."

**Response to Verbal comment received at the Klickitat County Planning Department counter by Mr. David Niemela on October 7, 2022**

The only change in conditions for the conditional use permit (CUP) is condition #7.6 regarding the maximum elevation of the landfill. All other conditions will stay in place, including but not limited to Section 3.0 of the CUP, which address Fire Protection and Medical Emergency Plans and specifically, Section 3.5 – Medical or Personal Injury Emergency which requires that "all managers, supervisors, and lead personnel will be trained in first aid, including CPR."

# Figures




| ROOSEVELT REGIONAL LANDFILL<br>MAXIMUM ELEVATION INCREASE - SEIS<br>ROOSEVELT, WASHINGTON | | | FIGURE NO.<br>**1** |
|---|---|---|---|
| **SITE LOCATION** | | | PROJECT NO.<br>**AU20.1209.00** |
| DATE OF ISSUE: 11/19/2021 | DRAWN BY: CRP | APPROVED BY: SAH | |

**Geo-Logic**
ASSOCIATES

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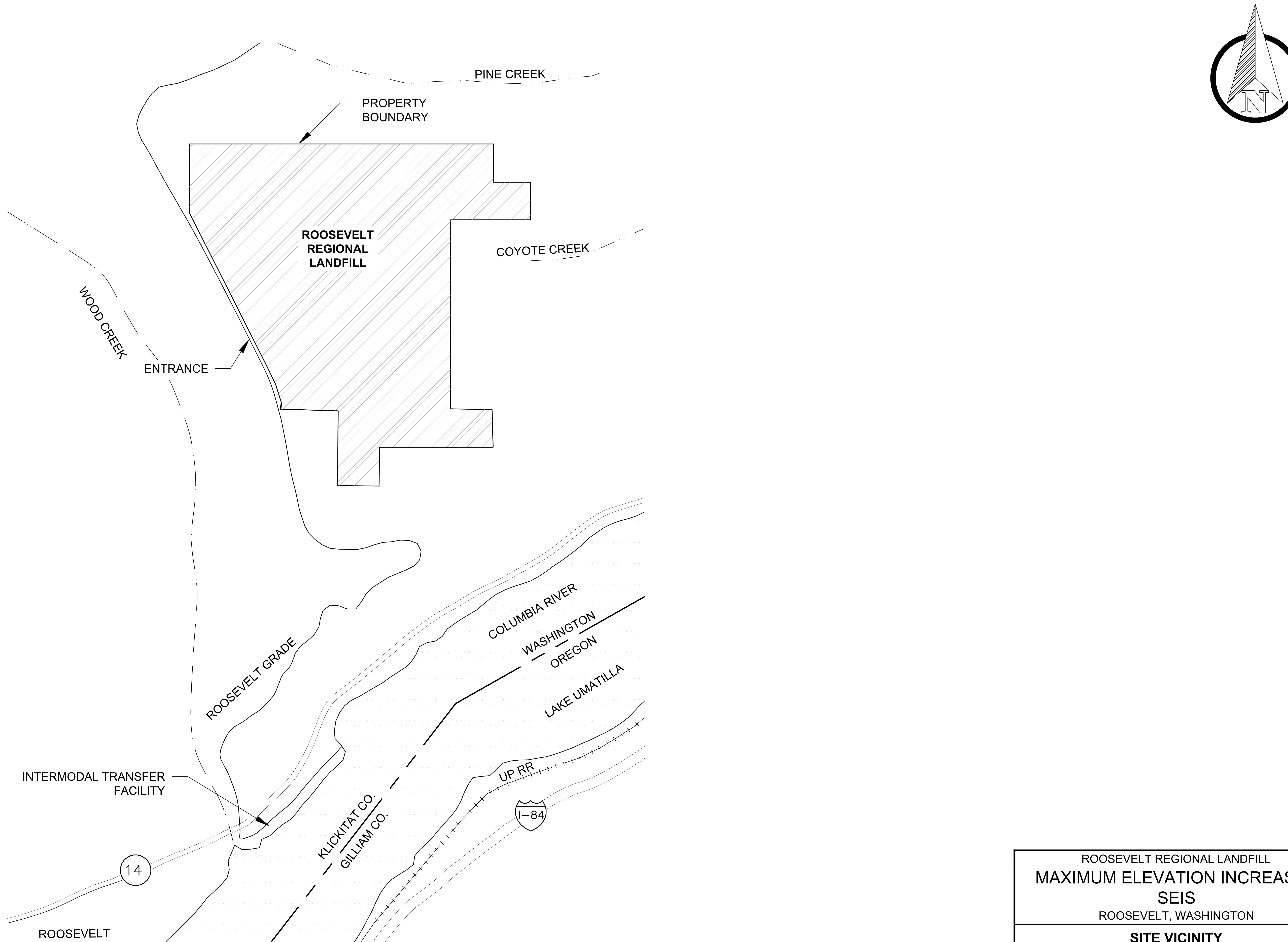


ROOSEVELT REGIONAL LANDFILL

MAXIMUM ELEVATION INCREASE - SEIS

ROOSEVELT, WASHINGTON

**SITE VICINITY**

**FIGURE NO.** 2

**PROJECT NO.** AU20.1209.00

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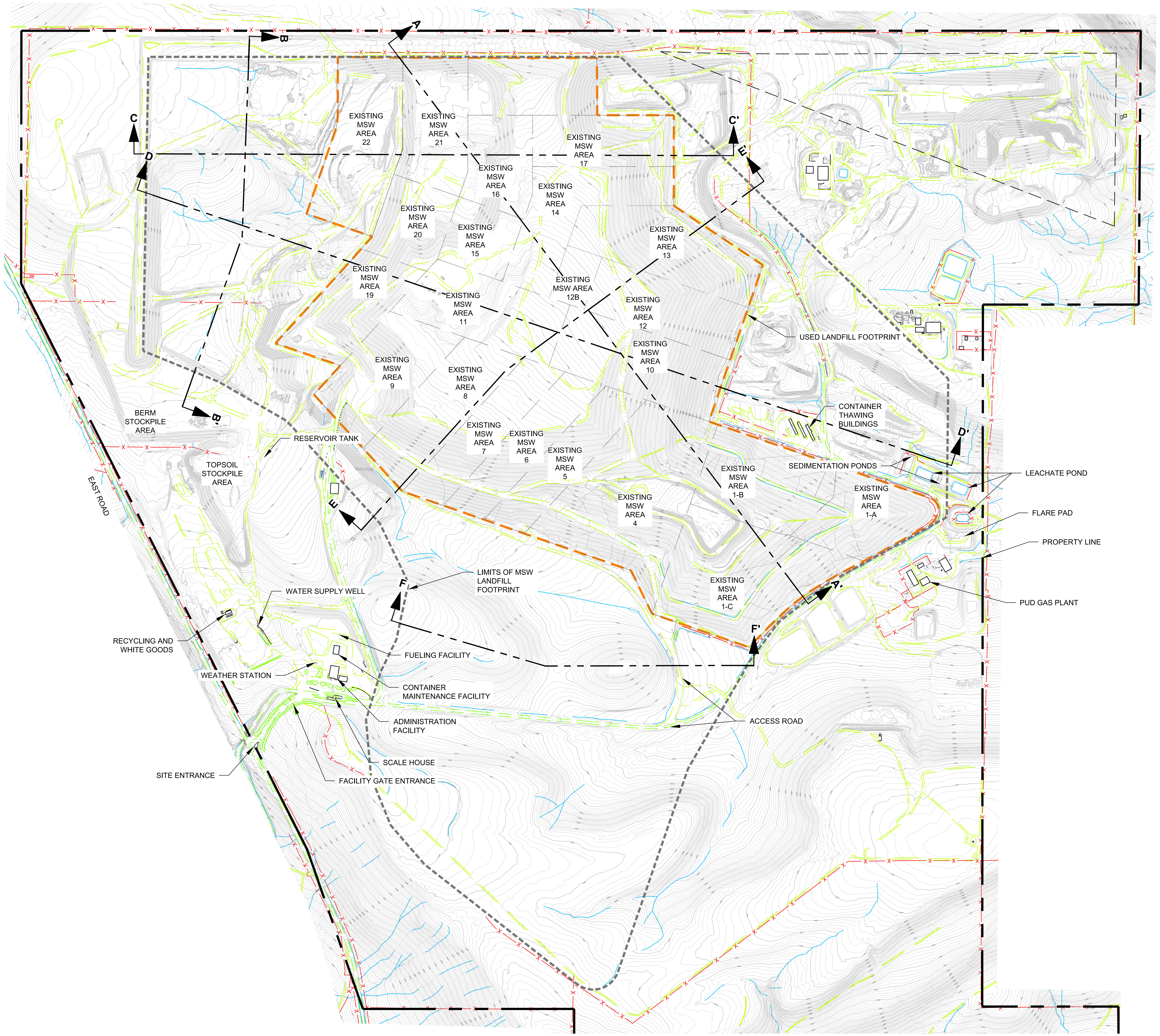


## LEGEND

| | |
|---|---|
| 1700 | EXISTING 10' CONTOUR(1) |
| | EXISTING 2' CONTOUR(1) |
| x x x | EXISTING FENCE |
| | EXISTING PAVED ROAD |
| | EXISTING UNPAVED ROAD |
| | EXISTING LINER LIMITS |
| | LIMITS OF MONFILL AREA |
| | EXISTING DRAINAGE |
| | PROPERTY LINE |
| | LIMITS OF MSW LANDFILL FOOTPRINT |
| | USED LANDFILL FOOTPRINT |

NOTES

1. AERIAL TOPOGRAPHY BASED ON MARCH 30, 2021 PERFORMED BY COOPER AERIAL SURVEY COMPANY.

ROOSEVELT REGIONAL LANDFILL

# MAXIMUM ELEVATION INCREASE - SEIS

ROOSEVELT, WASHINGTON

## SITE PLAN

FIGURE NO. 3

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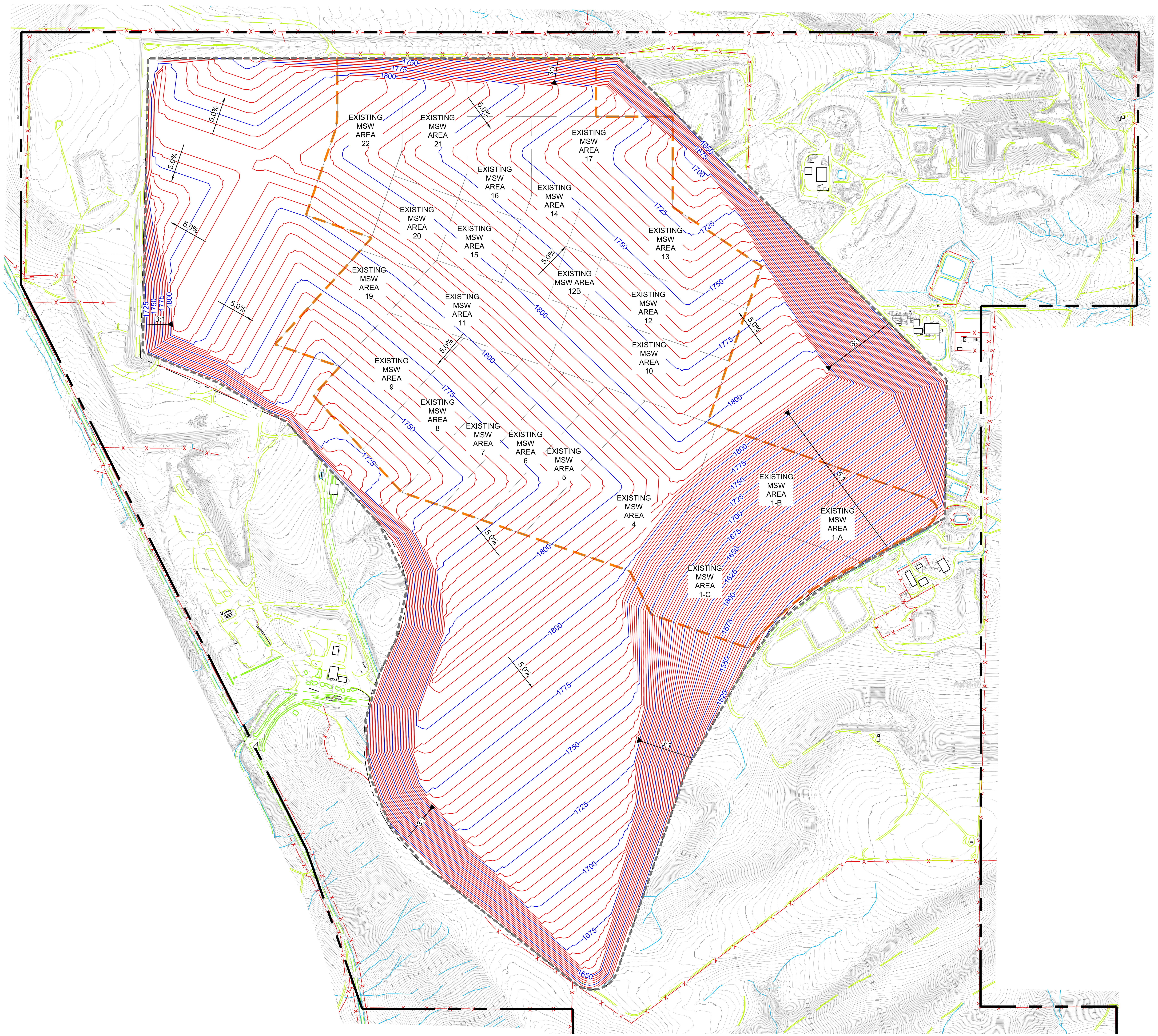


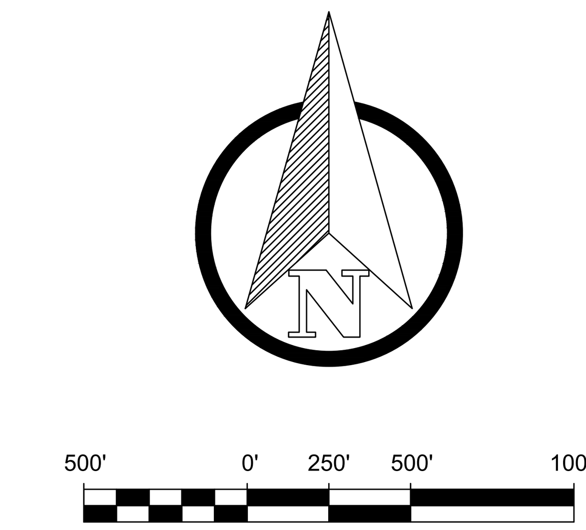


## LEGEND

| | |
|---|---|
| 1700 | EXISTING 10' CONTOUR[1] |
| | EXISTING 2' CONTOUR[1] |
| 1700 | FINAL GRADING 25' CONTOUR |
| | FINAL GRADING 5' CONTOUR |
| x — x — x | EXISTING FENCE |
| | EXISTING PAVED ROAD |
| | EXISTING UNPAVED ROAD |
| | EXISTING DRAINAGE |
| | PROPERTY LINE |
| | LIMITS OF MSW LANDFILL FOOTPRINT |
| | EXISTING LINER LIMITS |
| | USED LANDFILL FOOTPRINT |

NOTES

1. AERIAL TOPOGRAPHY BASED ON MARCH 30, 2021 PERFORMED BY COOPER AERIAL SURVEY COMPANY.

ROOSEVELT REGIONAL LANDFILL

# MAXIMUM ELEVATION INCREASE - SEIS

ROOSEVELT, WASHINGTON

## FINAL GRADING PLAN - NO ACTION ALT.

FIGURE NO. 4

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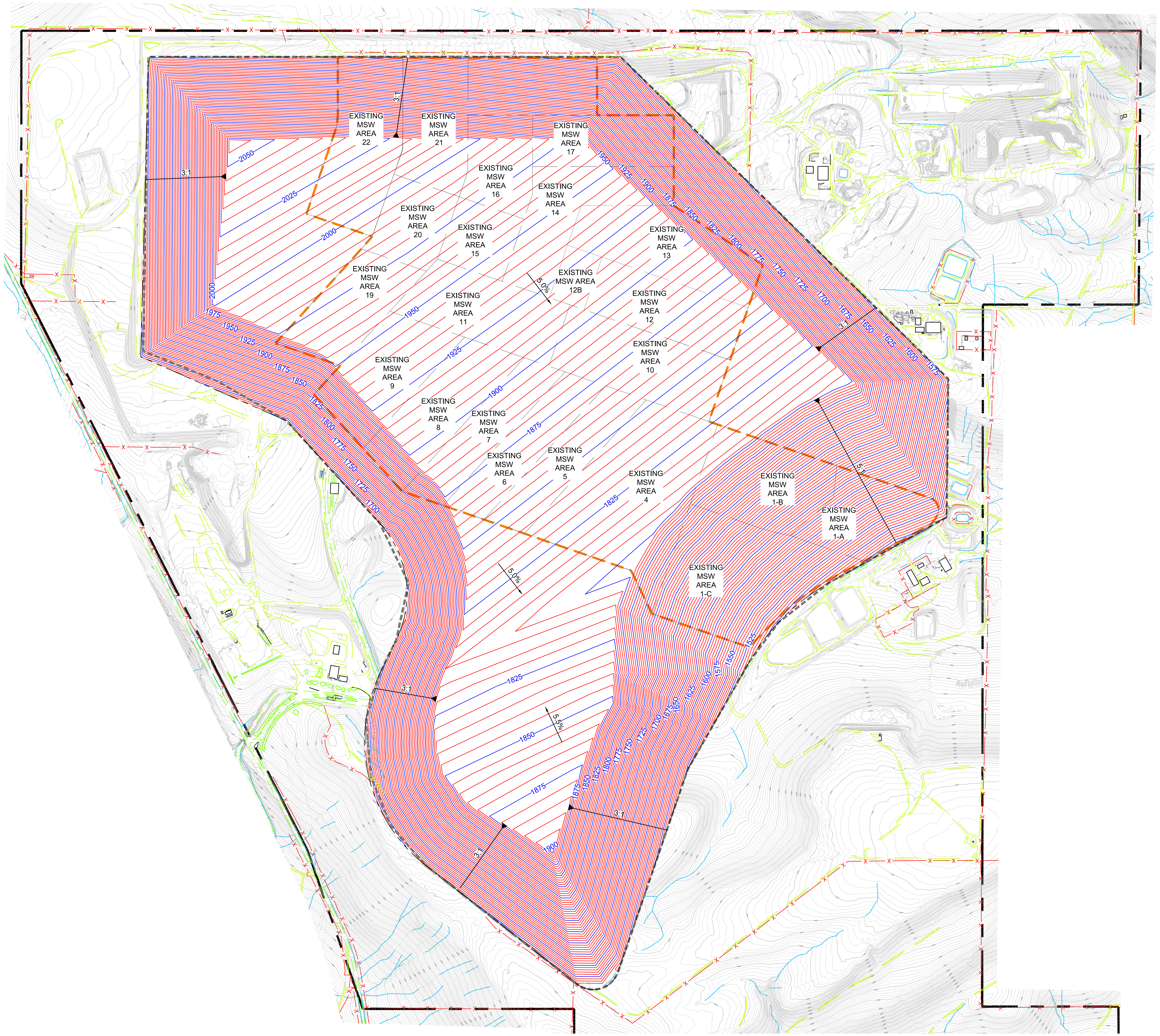
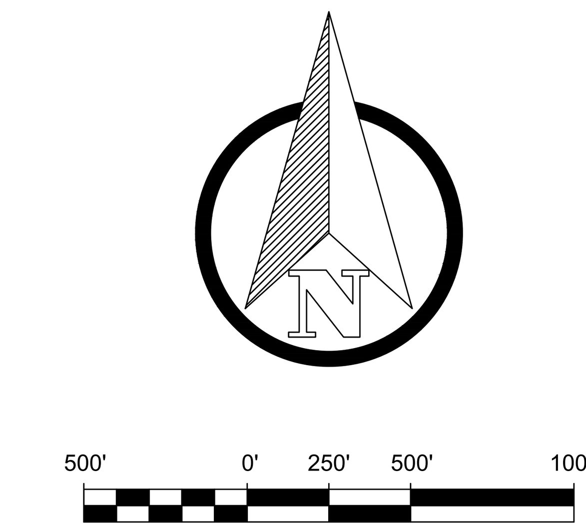
N:\ROOSEVELT\AU20.1209 VERTICAL EXPANSION\5_ENGINEERING\1_CIVIL\DRAWINGS\FIGURES\EIS\FIGURE 5 - FINAL GRADING PLAN - NAA.DWG November 19, 2021 - 9:31 AM BY: GLA USER

N:\ROOSEVELT\AU20.1209 VERTICAL EXPANSIONS\5_ENGINEERING\1_CIVIL\DRAWINGS\FIGURES\EIS\FIGURE 7 - FINAL GRADING PLAN_PROPOSED ACTION - NAA.DWG November 19, 2021 - 9:35 AM BY: GLA USER




## LEGEND

| | |
|---|---|
| 1700 | EXISTING 10' CONTOUR[1] |
| | EXISTING 2' CONTOUR[1] |
| 1700 | BOTTOM GRADING 10' CONTOUR |
| | BOTTOM GRADING 2' CONTOUR |
| —x—x—x | EXISTING FENCE |
| | EXISTING PAVED ROAD |
| | EXISTING UNPAVED ROAD |
| | EXISTING LINER LIMITS |
| | EXISTING DRAINAGE |
| | PROPERTY LINE |
| | LIMITS OF MSW LANDFILL FOOTPRINT |
| | EXISTING LINER LIMITS |
| | USED LANDFILL FOOTPRINT |

NOTES

1. AERIAL TOPOGRAPHY BASED ON MARCH 30, 2021 PERFORMED BY COOPER AERIAL SURVEY COMPANY.

ROOSEVELT REGIONAL LANDFILL

# MAXIMUM ELEVATION INCREASE - SEIS

ROOSEVELT, WASHINGTON

## FINAL GRADING PLAN - PROPOSED ACTION

FIGURE NO. 5

PROJECT NO. AU20.1209.00

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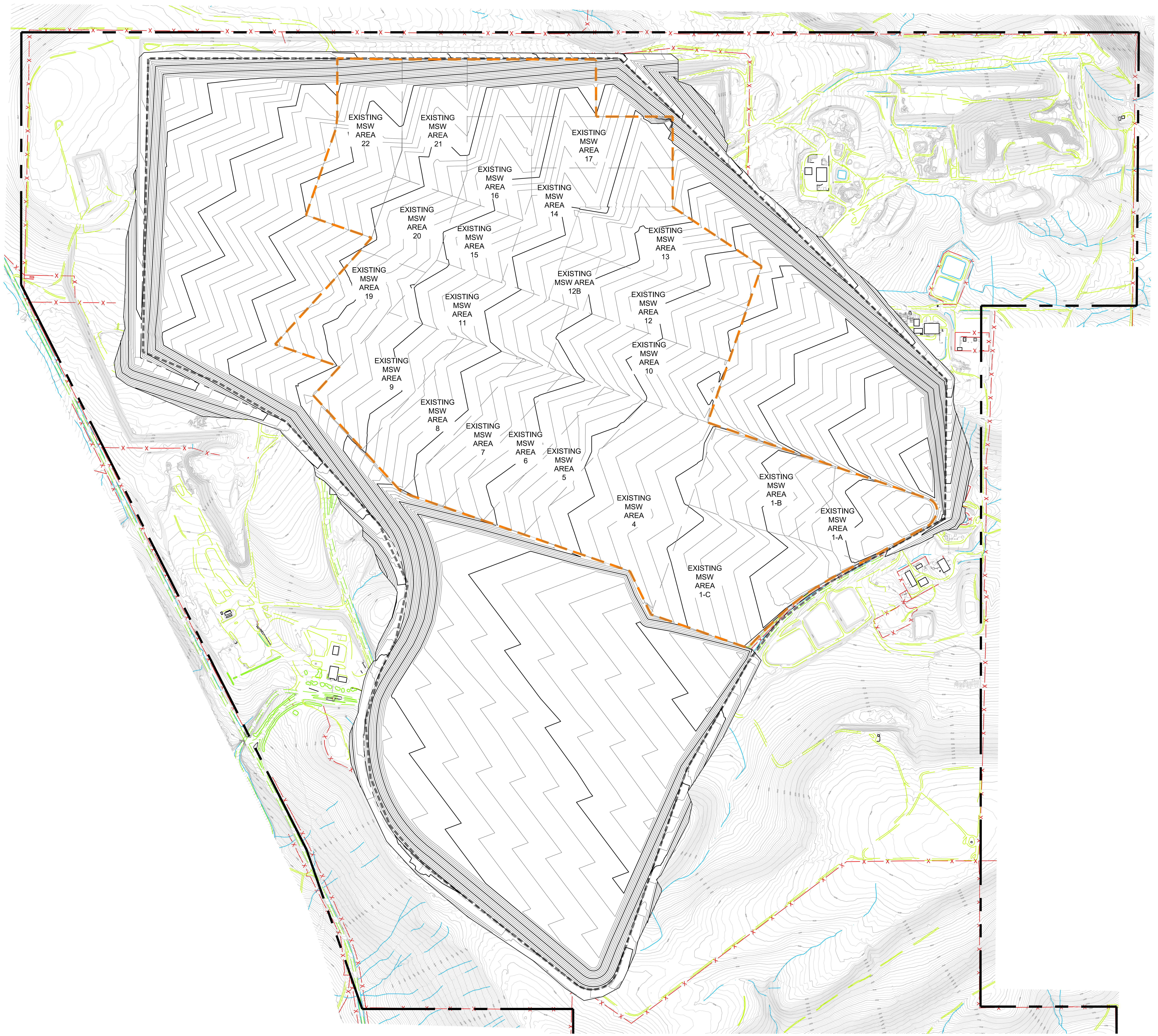


500' 0' 250' 500' 1000'

## LEGEND

| | |
|---|---|
| 1700 | EXISTING 10' CONTOUR(1) |
| | EXISTING 2' CONTOUR(1) |
| 1700 | BOTTOM GRADING 25' CONTOUR(2) |
| | BOTTOM GRADING 5' CONTOUR(2) |
| x x x | EXISTING FENCE |
| | EXISTING PAVED ROAD |
| | EXISTING UNPAVED ROAD |
| | EXISTING LINER LIMITS |
| | EXISTING DRAINAGE |
| | PROPERTY LINE |
| | LIMITS OF MSW LANDFILL FOOTPRINT |
| | EXISTING LINER LIMITS |
| | USED LANDFILL FOOTPRINT |

NOTES

1. AERIAL TOPOGRAPHY BASED ON MARCH 30, 2021 PERFORMED BY COOPER AERIAL SURVEY COMPANY.
2. ACTUAL BASE GRADES OF THE LANDFILL MAY VARY BASED ON FINAL CELL DESIGNS AT THE TIME OF CONSTRUCTION.

ROOSEVELT REGIONAL LANDFILL

# MAXIMUM ELEVATION INCREASE - SEIS

ROOSEVELT, WASHINGTON

**SUBGRADE PLAN**

**FIGURE NO.** **6**

**PROJECT NO.** AU20.1209.00

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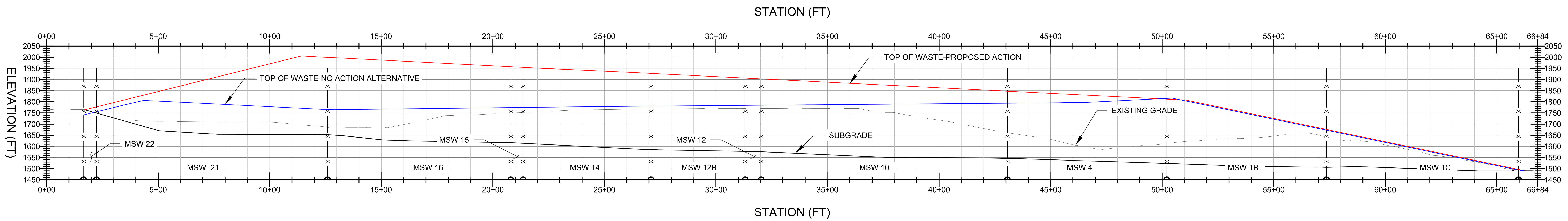
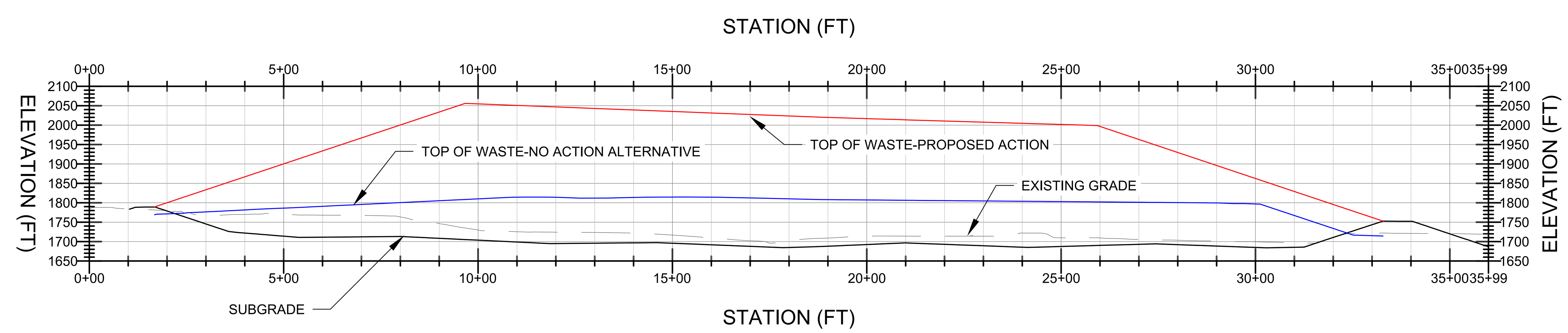
N:\ROOSEVELT\AU20.1209 VERTICAL EXPANSION\5_ENGINEERING\1_CIVIL\DRAWINGS\FIGURES\EIS\FIGURE 6 - BOTTOM GRADING PLAN_PROPOSED ACTION - NAA.DWG November 19, 2021 - 10:57 AM BY: GLA USER



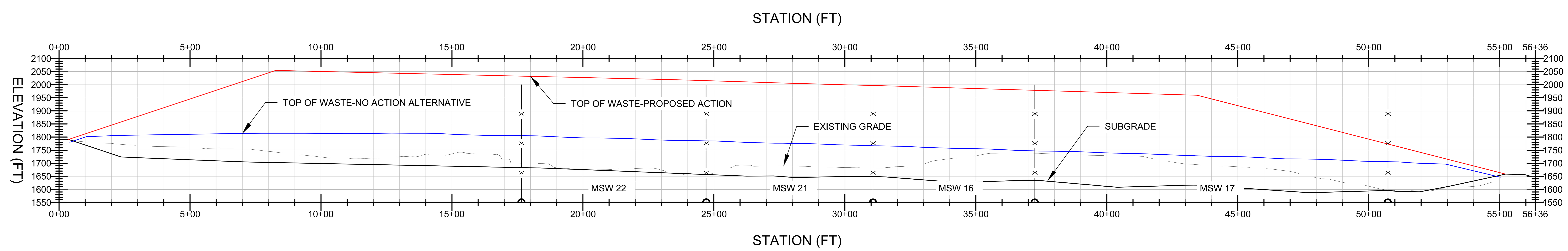

## SECTION A-A'

**HORIZ. SCALE: 1" = 250'**
**VERT. SCALE: 1" = 125'**




## SECTION B-B'

**HORIZ. SCALE: 1" = 250'**
**VERT. SCALE: 1" = 125'**




## SECTION C-C'

**HORIZ. SCALE: 1" = 250'**
**VERT. SCALE: 1" = 125'**

## LEGEND

- EXISTING GRADE
- TOP OF WASTE - NO ACTION ALTERNATIVE
- TOP OF WASTE - PROPOSED ACTION
- SUBGRADE
- CELL LIMIT

ROOSEVELT REGIONAL LANDFILL
MAXIMUM ELEVATION INCREASE - SEIS
ROOSEVELT, WASHINGTON

**SECTIONS**

**FIGURE NO.** 7

**PROJECT NO.** AU20.1209.00

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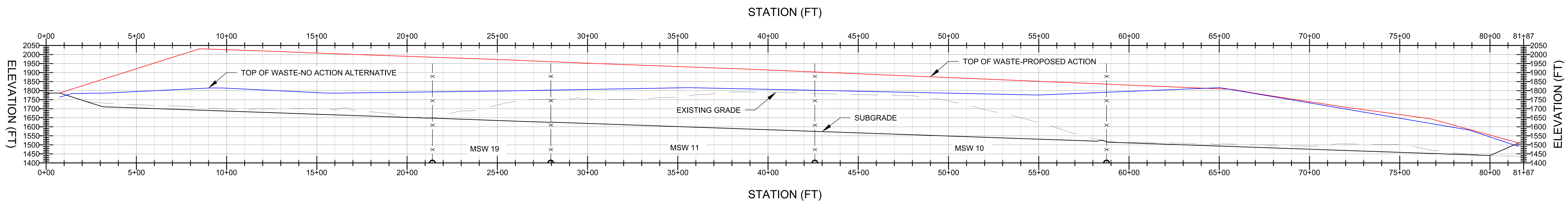
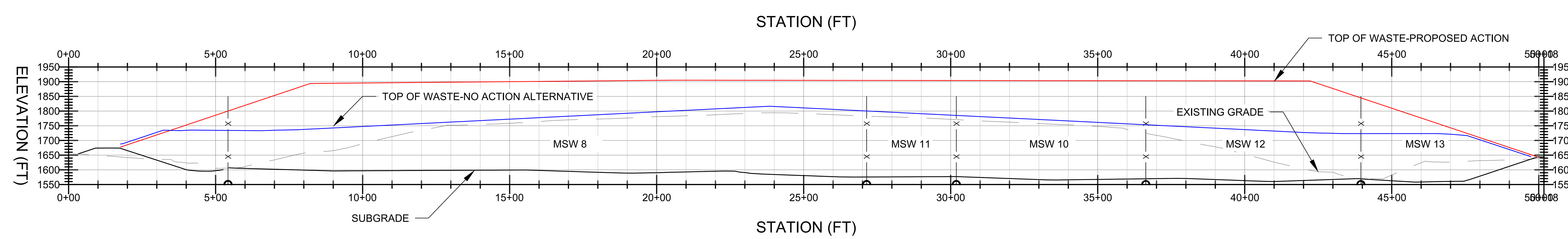


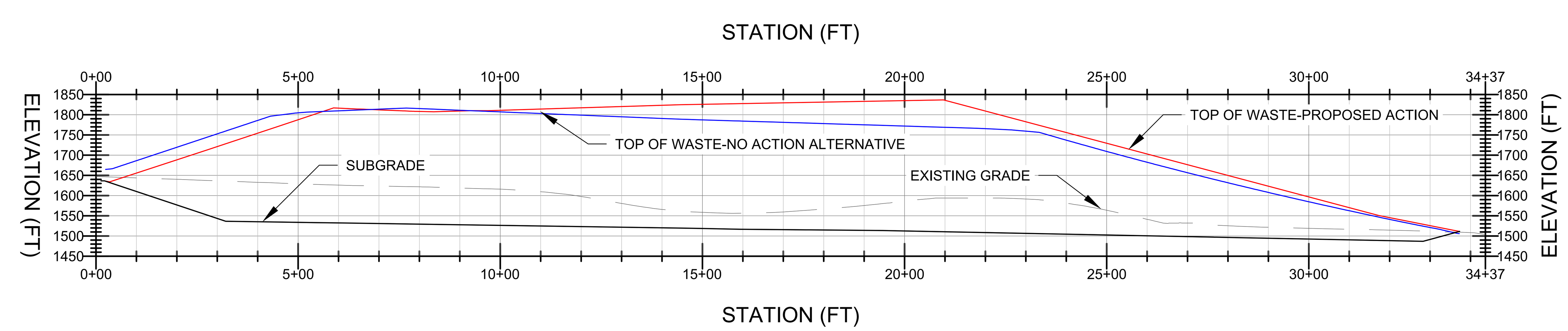

## SECTION D-D'

**HORIZ. SCALE: 1" = 300'**
**VERT. SCALE: 1" = 150'**




## SECTION E-E'

**HORIZ. SCALE: 1" = 250'**
**VERT. SCALE: 1" = 125'**




## SECTION F-F'

**HORIZ. SCALE: 1" = 250'**
**VERT. SCALE: 1" = 125'**

### LEGEND

- EXISTING GRADE
- TOP OF WASTE - NO ACTION ALTERNATIVE
- TOP OF WASTE - PROPOSED ACTION
- SUBGRADE
- —x—x— CELL LIMIT

ROOSEVELT REGIONAL LANDFILL

# MAXIMUM ELEVATION INCREASE - SEIS

ROOSEVELT, WASHINGTON

**SECTIONS**

**FIGURE NO.** 8

**PROJECT NO.** AU20.1209.00

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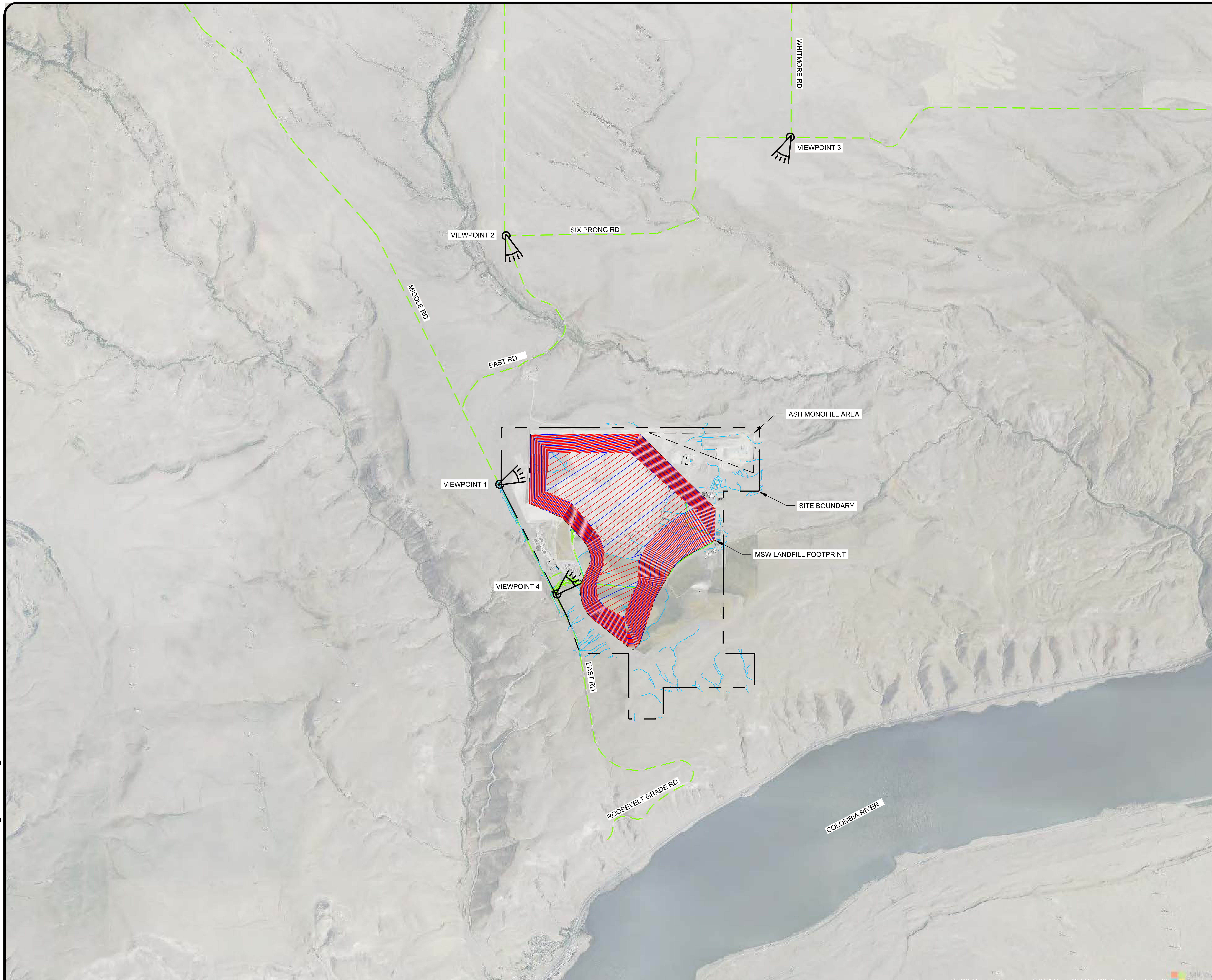


## LEGEND

- PROPOSED 50' CONTOUR
- PROPOSED 10' CONTOUR
- EXISTING PAVED ROAD
- LIMITS OF MONFILL AREA
- EXISTING DRAINAGE
- PROPERTY LINE

| ROOSEVELT REGIONAL LANDFILL<br>MAXIMUM ELEVATION INCREASE - SEIS<br>ROOSEVELT, WASHINGTON | FIGURE NO.<br>9 |
|---|---|
| **VISUAL IMPACT VIEWPOINT LOCATIONS** | PROJECT NO.<br>AU20.1209.00 |

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N:\ROOSEVELT\AU20.1209 VERTICAL EXPANSION\5_ENGINEERING\1_CIVIL\DRAWINGS\FIGURES\EIS\FIGURE 10 - VIEW LOCATIONS.DWG November 19, 2021 - 9:43 AM BY: GLA USER

# Appendix A

Supplemental Information

# Table of Contents

# Appendix A.1

Slope Stability Analysis

# Slope Stability Report
# Maximum Elevation Increase

## Roosevelt Regional Landfill
## Klickitat County, Washington

Submitted to:

Regional Disposal Company
500 Roosevelt Grade Road
PO Box 338
Roosevelt, Washington 99356

Prepared by:


Geo-Logic
ASSOCIATES

803 SW Industrial Way, Suite 211
Bend, Oregon 97702
www.geo-logic.com


Project #AU20.1209.00

November 2021

# Certification

This report was prepared in accordance with generally accepted professional engineering principles and practices. This report makes no other warranties, either expressed or implied as to the professional advice or data included in it. This report has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

**GEO-LOGIC ASSOCIATES**


Aaron Ogorzalek, PE
Senior Engineer
Geo-Logic Associates
803 SW Industrial Way, Suite 211
Bend, Oregon 97702

November 18, 2021

# Table of Contents



# List of Tables



# List of Figures

# List of Attachments

# 1. Introduction

## 1.1 Project Description

The Roosevelt Regional Landfill (RRL), owned and operated by Regional Disposal Company (RDC) is an active municipal solid waste (MSW) disposal facility located in Klickitat County approximately 5 miles north of Washington State Highway 14 and the town of Roosevelt, Washington. The RRL is located on a 2,129-acre site with a permitted landfill footprint of 915 acres. The RRL is constructed in individual units/cells, named MSW Areas 1, 2, 3, etc. Existing MSW Areas consist of MSW Area 1 through 22. The currently used footprint of the active landfill is approximately 405 acres. The RRL receives approximately 2.3 million tons of waste per year. The waste stream is reportedly comprised of approximately 60% MSW, 20% construction demolition and land-clearing (CDL) waste, and 20% "other" (mostly soil).

The RRL is in the process of amending its Conditional Use Permit (CUP) that would increase the maximum elevation of the landfill from 1,820 feet above mean sea level (MSL) to 2,050 feet MSL. A revised top-of-waste grading plan has been developed to support the CUP amendment request, which would increase the maximum waste depth from 120 feet to 350 feet in the northwest portion of the landfill footprint, and from 320 feet to 325 feet in the eastern portion of the landfill. The top deck would be graded at a 5% slope trending from the northwest to the southeast, and maximum side slope inclination would remain at 3:1 (horizontal:vertical). The top deck elevation and approximate 5:1 side slope over existing lined Areas 1A-1C would remain unchanged. The proposed grading plan is shown in Figure 1.

## 1.2 Purpose and Scope

The objective of this report is to present an assessment of the slope stability of the RRL associated with the proposed maximum elevation increase of the permitted top-of-waste grades of the landfill. The scope of work performed to meet this objective included:

- Review of the proposed waste grading plan and selection of representative cross sections for analysis
- Review of available data describing existing liner system configurations and identification of material properties for use in analyses

- Review of the seismic hazard evaluation for the landfill and site-specific response analysis (performed by Geo-Logic Associates, 2018)
- Completion of static and seismic stability analyses, and
- Preparation of this report summarizing the results of the analyses

The evaluations described below were focused on global stability of the landfill along the liner system for the proposed final buildout conditions of the landfill. The maximum slopes of the landfill would not change; therefore cover stability analysis was outside the scope of this evaluation. Subsurface investigation and laboratory testing were outside the scope of this study and were not performed. Because all material properties used for this analysis were assumed, shear strength testing during construction of future expansion areas should be performed to confirm that all materials used for construction will meet or exceed the material strengths assumed herein.

# 2. Design Criteria

For slope stability design of landfills, results are typically expressed by a factor of safety (FS) against failure. The state of practice for static stability of landfill slopes is to design for a FS equal to or greater than 1.5 for final slopes. Interim slopes are often designed with a lower minimum static FS criterion, such as 1.3. The slopes of the RRL that are being evaluated herein represent final buildout conditions of the landfill. Thus, a minimum static FS criterion of 1.5 was adopted for the current evaluation.

For seismic stability of landfill slopes, the state-of-practice approach is not to express a FS, but to calculate the amount of permanent displacement accumulated during a design seismic event. For lined landfills, a displacement threshold of no more than 6-12 inches is generally considered acceptable, and for unlined facilities and landfill covers that do not contain geosynthetic components, a threshold of up to 1 meter is considered acceptable (Seed and Bonaparte, 1992).

# 3. Method of Analysis

The slope stability of proposed slopes was evaluated using the computer program SLOPE/W (v. 11.1.2) to calculate the 2D safety factors for two critical cross sections using the Morgenstern-

Price (1965) limit equilibrium method. SLOPE/W is a 2D slope stability analysis program based on the limit equilibrium principles. It allows for evaluation of FS of a sliding mass based upon assumptions of rigid body behavior, shape of failure surface, and inclination of interslice forces within a failure surface. The FS against failure is defined as the ratio of total shear stress calculated along the critical failure surface to available shear strength along that same surface.

The calculations of FS of the slopes were performed for non-circular translational failure surfaces through the MSW and along the liner system. The surface optimization tool, as coded in SLOPE/W, was used. With the surface optimization tool, the lowest FS for a potential slip surface at the end of a standard limit-equilibrium search is iterated on a segment-wise basis to find potentially lower FS (and often non-circular) slip surfaces. Use of this procedure will always result in a FS that is as low or lower than if it had not been used (i.e. it is conservative). A phreatic water surface was not included in the analyses, as it is assumed that the leachate collection system will remain functional and a phreatic surface will not form above the liner system.

# 4. Conditions Analyzed

## 4.1 Cross Sectional Profiles

The global stability of the proposed landfill slopes was assessed with six two-dimensional (2D) cross sections through the proposed final waste fill slopes of the landfill that were judged to be critical. The cross sections were “cut” using Civil 3D from three-dimensional surfaces representing the landfill’s as-built and future expansion subgrade plan and the proposed top-of-waste fill plan. The six cross sections are named A-A’, B-B’, C-C’, D-D’, E-E’ and F-F.’ The section locations, the proposed fill plan, subgrade plan, and existing site conditions are shown in Figures 1 and 2. The detailed cross sections are depicted in Figures 3 and 4.

## 4.2 Liner Systems

MSW Areas 1A, 1B, 1C, and 4-10 were constructed with a single composite bottom liner system with compacted clay as the soil barrier component and a single-side textured high density polyethylene (HDPE) geomembrane with the smooth side facing up in contact with an overlying cushion geotextile. Geosynthetic clay liner (GCL) replaced the compacted clay as the soil barrier component of the bottom liner system beginning with MSW Area 11, and has continued to be used in subsequent MSW Area expansions.

The critical interface of the liner systems in MSW Areas 1A, 1B, 1C, and 4-10 was judged to be between the upper smooth surface of the HDPE liner and the overlying nonwoven geotextile. MSW Areas 10, 12, and 13 were constructed with double-sided textured liner for the first 600 feet from the exterior (eastern) perimeter inward, per the recommendation of Thiel (2002) for slope stability purposes, as depicted in the stability output in Attachment 1. The critical interface for these outer 600 feet was judged to be between the textured HDPE geomembrane and either the overlying nonwoven geotextile or the underlying nonwoven geotextile component of the GCL (MSW Areas 12 and 13). The interior portions of MSW Areas 10, 11, and 12 as well as MSW Areas 13-17 were constructed with single-sided textured HDPE with the smooth side up in contact with the overlying nonwoven geotextile, similar to MSW Areas 1A, 1B, 1C, and 4-9. MSW Area 18 introduced the landfill's first side slope liner where double-sided textured HDPE liner was used overlying the GCL on the side slopes, and single-sided textured HDPE with the smooth side up was used on the floor. Beginning with MSW Area 19, double-sided textured HDPE liner was used throughout the entire cell area (i.e., floor and side slopes). MSW Area 22 introduced a double-sided geocomposite drainage layer on the side slopes as an alternative to the cushion geotextile and the 1-foot thick gravel drainage layer overlying the HDPE geomembrane.

# 5. Material Properties

The material properties used in this evaluation are summarized in Table 1 and are based on assumed typical values that are consistent with past stability analyses at the site (Thiel 2000, 2001, 2002, and Geo-Logic Associates 2018). Interface strength testing has not been a requirement during past construction projects until recently with MSW Area 21, and was therefore not available for lined Areas prior to Area 21. The MSW Area 21 and 22 liner systems were modeled using shear-normal functions represented by the minimum measured shear stresses from construction conformance interface shear strength testing of the respective construction projects (see Figure 5).

The base grades of the landfill reportedly follow the top of a basalt surface that dips to the southeast at a slope of approximately 3%. Considering the desire to evaluate the effects of the liner system on stability, GLA assigned an infinite strength model to subgrade materials below the liner to force block failures along or above the landfill liner.

The material properties of the refuse were based on recent information published by Kavazanjian et al. (2013) for municipal solid waste.

**Table 1**

**Summary of Material Properties**

| MSW Area | Clay Component | Critical Interface | Liner Strength | |
|---|---|---|---|---|
| | | | Phi (˚) | C (psf) |
| MSW 1A, 1B, 1C (All Floor) | Compacted Clay | Smooth HDPE -to- NW Geotextile | 9 | 0 |
| MSW 4-9 (All Floor) | Compacted Clay | Smooth HDPE -to- NW Geotextile | 9 | 0 |
| MSW 10 [1] (All Floor) | Compacted Clay | Smooth HDPE -to- NW Geotextile | 9 | 0 |
| MSW 11 (All Floor) | GCL | Smooth HDPE -to- NW Geotextile | 9 | 0 |
| MSW 12[1] (All Floor) | GCL | Smooth HDPE -to- NW Geotextile | 9 | 0 |
| MSW 13[1] (All Floor) | GCL | Smooth HDPE -to- NW Geotextile | 9 | 0 |
| MSW 14-18 (Floor) | GCL | Smooth HDPE -to- NW Geotextile | 9 | 0 |
| MSW 18 (Side Slope) | GCL | Textured HDPE -to- NW Geotextile or GCL | 11 | 0 |
| MSW 19-20 (Floor) | GCL | Textured HDPE -to- NW Geotextile or GCL | 16 | 0 |
| MSW 19-20 (Side Slope) | GCL | Textured HDPE -to- NW Geotextile or GCL | 11 | 0 |
| MSW 21-22 (Floor) | GCL | Textured HDPE -to- NW Geotextile or GCL | S-N Function[2] | |
| MSW 22 (Side Slope) | GCL | Textured HDPE -to- Geocomposite or GCL | S-N Function[2] | |
| Future Cell (Floor) | GCL | Texture HDPE -to- NW Geotextile or GCL | 16 | 0 |
| Future Cell (Side Slope) | GCL | Textured HDPE -to- Geocomposite or GCL | 9 | 0 |

Notes:

[1] - Geomembrane is double textured for 600' from the east perimeter (toe), and single textured (smooth side up) on the interior of MSW Areas 10, 12 & 13. Double-textured HDPE -to- NW Geotextile interface was characterized with a friction angle of 16° and 0 psf cohesion after Thiel (2002).
[2] - Shear-Normal function using post-peak shear stresses based on construction conformance testing (see Figure 5).

# 6. Seismic Hazard

A probabilistic seismic hazard analysis update was performed for the site by Geo-Logic Associates (2018). Details of the seismic hazard analysis are described in Geo-Logic Associates (2018) and are summarized herein. The seismic parameters developed from the 2018 analysis were reviewed and are considered applicable to the slope stability evaluations described in this document (https://earthquake.usgs.gov/hazards/interactive/).

A USGS seismic hazard deaggregation analysis was performed for the design probabilistic event (10% probability of exceedance in 250 years, or 2% probability of exceedance in 50 years), which indicated a PGA of 0.19g. The mean of all contributing sources consists of a magnitude 6.35 earthquake approximately 34 km from the site. The major (i.e., modal) contributing source is a magnitude 5.5 earthquake approximately 11 km from the site. The nearest interface of the Cascadia Megathrust subduction earthquake (approximate magnitude 9) is reported at 259 km from the site and is therefore not considered a significant contributing source. The USGS probabilistic acceleration response spectrum is shown in the seismic displacement calculations in Attachment 2.

# 7. Results

Results of the slope stability analyses that incorporate the proposed waste grading plan are summarized in Table 2, and SLOPE/W output files are included in Attachment 1. The output from SLOPE/W shows the cross-section dimensions, the material properties, material transitions, and the locations of the critical failure surfaces with the lowest factors of safety. Seismic displacement calculations are included in Attachment 2.

**Table 2**

**Summary of Stability Results**

| Cross Section | R/L | Condition Analyzed | Static $FS_{min}$ | Seismic Yield, $K_y$ | Bray Seismic Displacement (cm) |
|---|---|---|---|---|---|
| A-A' | Right | South East Slope, Area 1 | 1.58 | 0.09g | < 1 |
| B-B' | Right | North Slope of West Wing, through Max Elevation | 1.81 | 0.19g | < 1 |
| | Left | South Slope of West Wing | 1.90 | 0.21g | < 1 |
| C-C' | Right | North East Slope, Area 17 | 1.56 | 0.10g | < 1 |
| | Left | West Slope of West Wing, through Max Elevation | 1.90 | 0.22g | < 1 |
| D-D' | Right | East Slope, through Sump of Eastern Expansion Area | 2.24 | 0.19g | < 1 |
| E-E' | Right | North East Slope, Area 13 | 1.85 | 0.15g | < 1 |
| | Left | South West Slope, Area 8 | 1.79 | 0.15g | < 1 |
| F-F' | Right | East Slope, through Sump of South Wing | 1.91 | 0.19g | < 1 |
| | Left | West Slope of South Wing | 2.30 | 0.26g | < 1 |

# 8. Conclusions and Recommendations

The results indicate a minimum static FS greater than 1.5 and estimated permanent seismic deformation less than 1 cm for the proposed waste slopes represented by the six cross sections evaluated. Given the range of conditions evaluated, the stability results were found to be acceptable relative to the design criteria presented in Section 2 of this report, the standards set forth in WAC 173-315, and generally accepted standard of practice for landfill slope stability. It is therefore our recommendation that the proposed grading plan associated with the maximum elevation increase of the landfill be accepted with regard to slope stability.

The analyses presented herein are based largely on assumed parameters and on information gathered by others. The shear strengths for the specific materials that will be used for the construction of future expansions of the landfill should be verified by CQA testing during construction, and the acceptability of test results below those assumed herein must be verified by slope stability analyses based on test results.

# 9. Limitations

The data, analyses, results, and recommendations presented in this document pertain only to the Roosevelt Regional Landfill site in Klickitat County, Washington and assume that the conditions do not deviate substantially from those reported. If any variations or conditions are encountered that are materially inconsistent with those used in this document, or if the proposed development differs from that anticipated herein, GLA should be notified so that supplemental evaluations can be provided.

This document has not been prepared for use by parties or projects other than those named above. It may not contain sufficient information for other parties or other purposes. This document conforms to generally accepted civil and geoenvironmental engineering practice and makes no other warranties, either expressed or implied, as to the professional advice or data included.

# 10. References

Geo-Logic Associates, Inc. (2018), Letter Report Re: Interim Slope Stability Evaluation, Roosevelt Regional Landfill, Roosevelt, Washington, Project No. AU18.1075.00, November 8.

GeoStudio (2021 R2), Slope/W slope stability software module, Version 11.1.2.22321, GEO-SLOPE International Ltd., Calgary, Alberta, Canada.

Morgenstern, N.R. and Price, V.E., (1965), "The Analysis of the Stability of General Slip Surfaces," *Geotechnique*, Vol. 15, pp. 70-93.

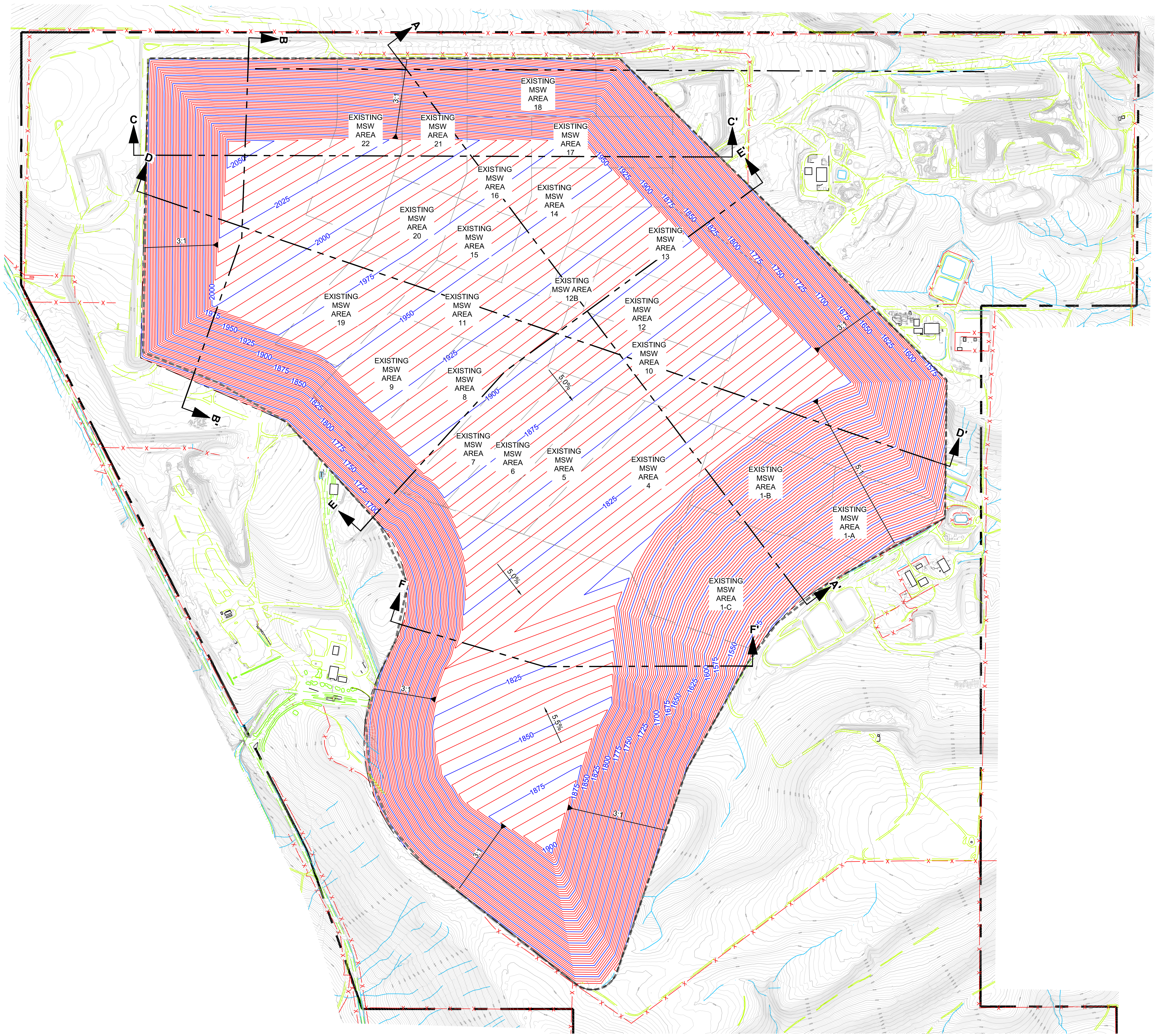
Seed, R.B., and Bonaparte, R. (1992), Seismic Analysis and Design of Lined Waste Fills: Current Practice, Proceedings of the Conference on Stability and Performance of Slopes and Embankments – II, ASCE Special Geotechnical Publication No. 31, pp. 1521-1545.

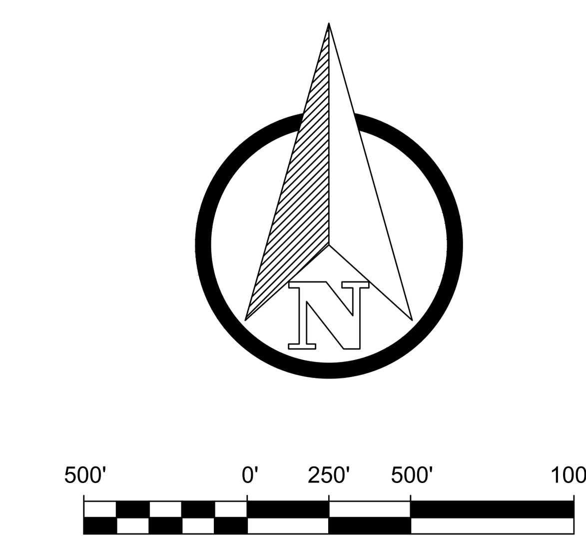
Thiel Engineering, (2000), Fax To: Bill Borlaug, Re: Slope Stability, Roosevelt Regional Landfill, June 15.

Thiel Engineering, (2001), "Slope Stability Analysis, Roosevelt MSW Area 9, as Appendix 4-B3 in the 2004 Permit Reissuance Engineering Report, Roosevelt Regional Landfill, December 30, 2003.

Thiel Engineering, Inc., (2002), Fax To: Bill Borlaug, Re: Area 10 Stability, Roosevelt Regional Landfill, May 13.

# FIGURES




## LEGEND

| | |
|---|---|
| 1700 | EXISTING 10' CONTOUR[1] |
| | EXISTING 2' CONTOUR[1] |
| 1700 | BOTTOM GRADING 10' CONTOUR |
| | BOTTOM GRADING 2' CONTOUR |
| x — x — x | EXISTING FENCE |
| | EXISTING PAVED ROAD |
| | EXISTING UNPAVED ROAD |
| | EXISTING LINER LIMITS |
| | EXISTING DRAINAGE |
| | PROPERTY LINE |
| | LIMITS OF MSW LANDFILL FOOTPRINT |

NOTES

1. AERIAL TOPOGRAPHY BASED ON MARCH 30, 2021 PERFORMED BY COOPER AERIAL SURVEY COMPANY.

ROOSEVELT REGIONAL LANDFILL

# SLOPE STABILITY REPORT

ROOSEVELT, WASHINGTON

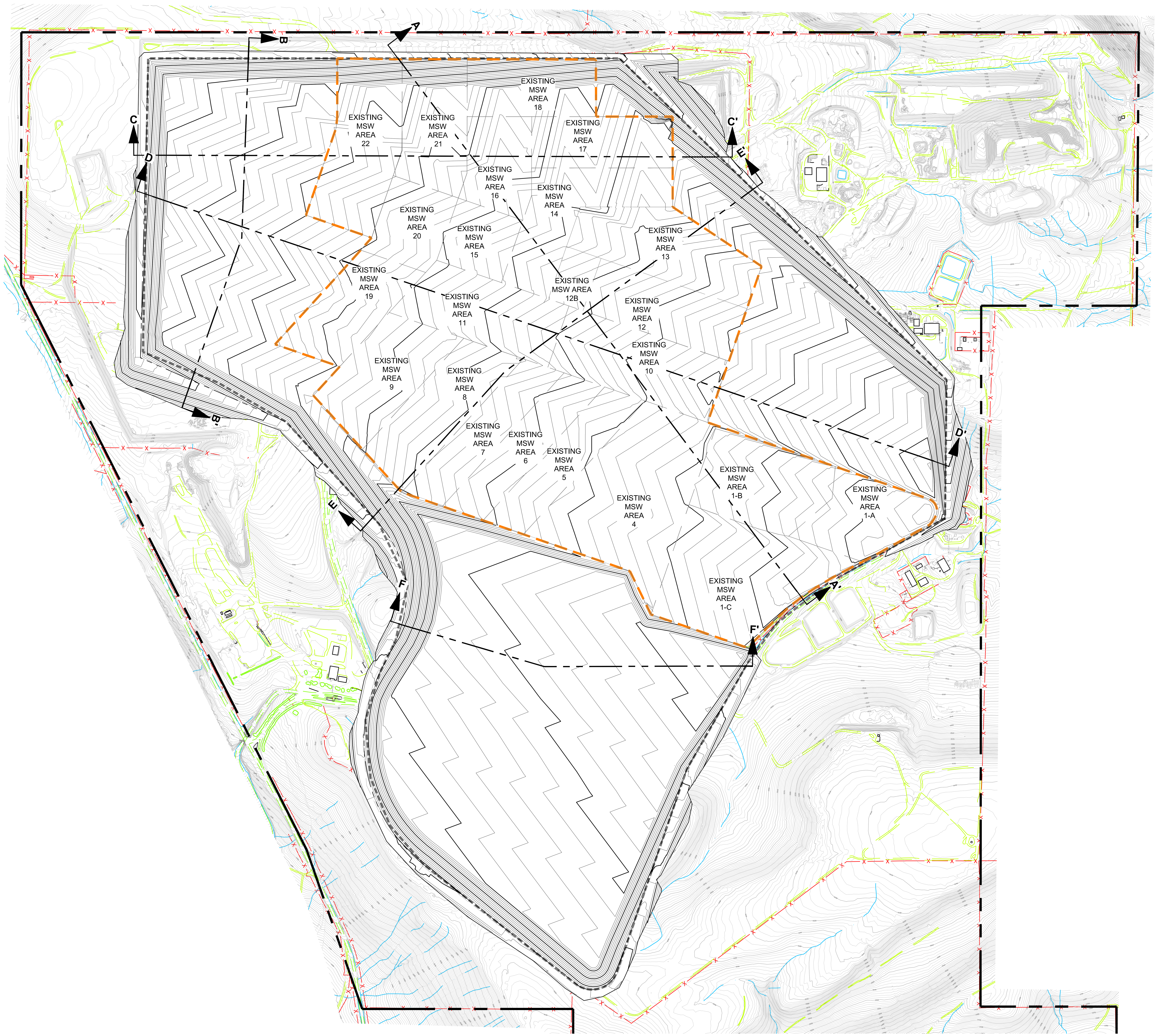
## TOP OF WASTE GRADING PLAN

FIGURE NO. 1

PROJECT NO. AU20.1209.00

| DATE OF ISSUE: | 11/19/2021 | DRAWN BY: | RDD | APPROVED BY: | SAH |
|---|---|---|---|---|---|


Geo-Logic ASSOCIATES
803 SW Industrial Way, Suite 211, Bend, OR 97702
geo-logic.com | 541.678.5733




N

500' 0' 250' 500' 1000'

## LEGEND

| | |
|---|---|
| 1700 | EXISTING 10' CONTOUR(1) |
| | EXISTING 2' CONTOUR(1) |
| 1700 | BOTTOM GRADING 25' CONTOUR |
| | BOTTOM GRADING 5' CONTOUR |
| —x—x—x— | EXISTING FENCE |
| | EXISTING PAVED ROAD |
| | EXISTING UNPAVED ROAD |
| | EXISTING LINER LIMITS |
| | EXISTING DRAINAGE |
| | PROPERTY LINE |
| | LIMITS OF MSW LANDFILL FOOTPRINT |
| | USED LANDFILL FOOTPRINT |

NOTES

1. AERIAL TOPOGRAPHY BASED ON MARCH 30, 2021 PERFORMED BY COOPER AERIAL SURVEY COMPANY.

ROOSEVELT REGIONAL LANDFILL

SLOPE STABILITY REPORT

ROOSEVELT, WASHINGTON

**BASE GRADING PLAN**

FIGURE NO. 2

PROJECT NO. AU20.1209.00

| DATE OF ISSUE: | 11/19/2021 | DRAWN BY: | RDD | APPROVED BY: | SAH |
|---|---|---|---|---|---|

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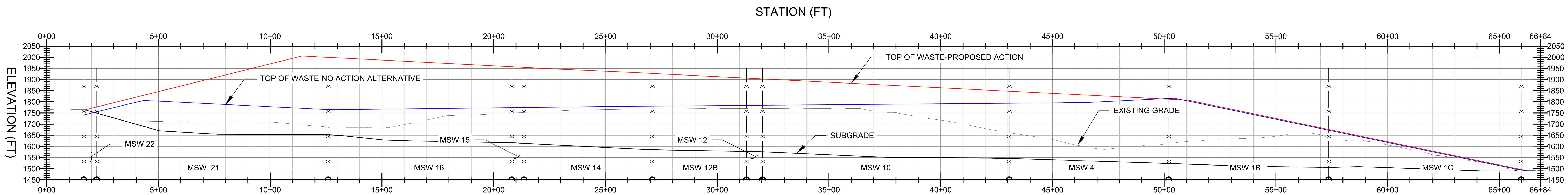
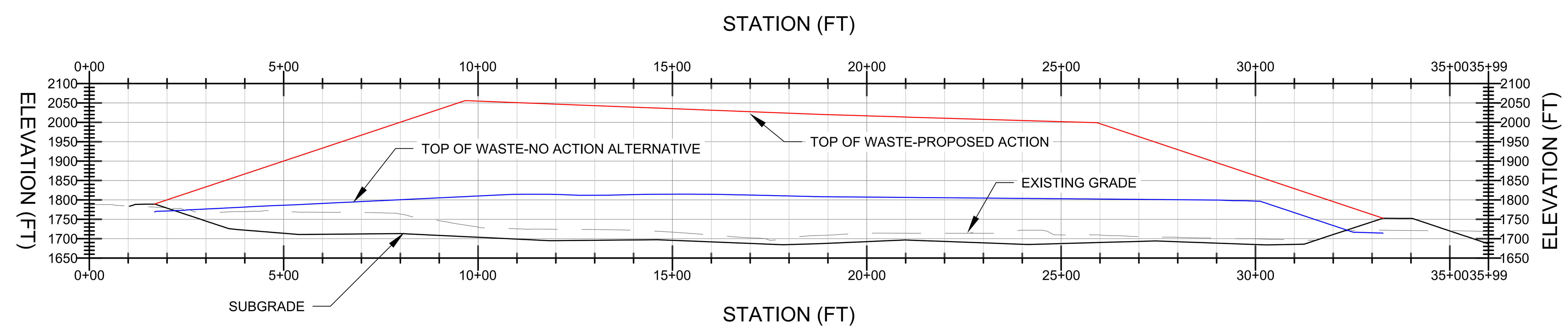
N:\ROOSEVELT\AU20.1209 VERTICAL EXPANSIONS\5_ENGINEERING\1_CIVIL\DRAWINGS\FIGURES\EIS\SLOPE STABILITY - FIGURE 2 BASE.DWG November 18, 2021 - 8:45 AM BY: GLA USER



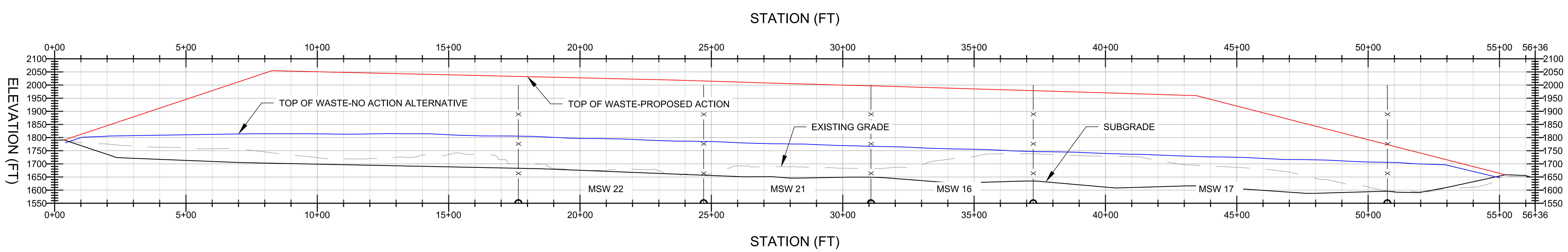

## SECTION A-A'

**HORIZ. SCALE: 1" = 250'**
**VERT. SCALE: 1" = 125'**




## SECTION B-B'

**HORIZ. SCALE: 1" = 250'**
**VERT. SCALE: 1" = 125'**




## SECTION C-C'

**HORIZ. SCALE: 1" = 250'**
**VERT. SCALE: 1" = 125'**

## LEGEND

- EXISTING GRADE
- TOP OF WASTE - NO ACTION ALTERNATIVE
- TOP OF WASTE - PROPOSED ACTION
- SUBGRADE
- CELL LIMIT

ROOSEVELT REGIONAL LANDFILL

SLOPE STABILITY REPORT

ROOSEVELT, WASHINGTON

**CROSS SECTIONS**

**FIGURE NO.** 3

**PROJECT NO.** AU20.1209.00

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|---|---|---|---|---|---|

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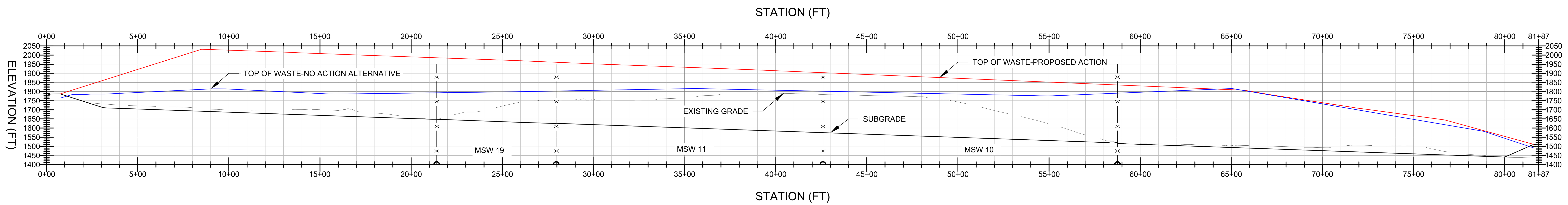
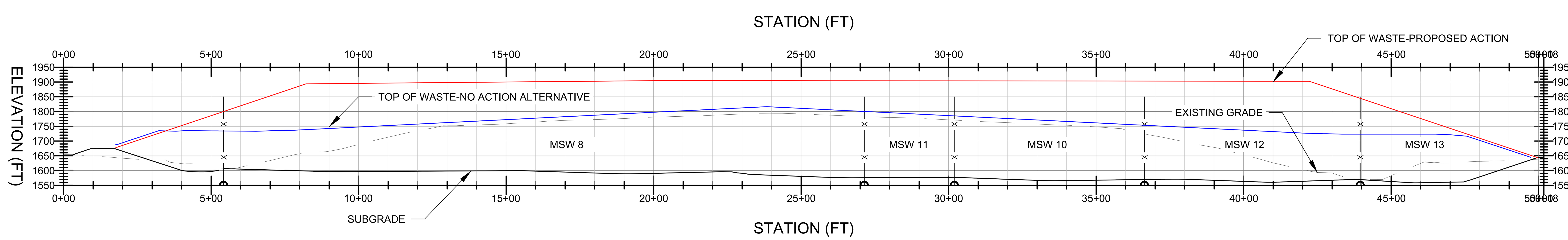


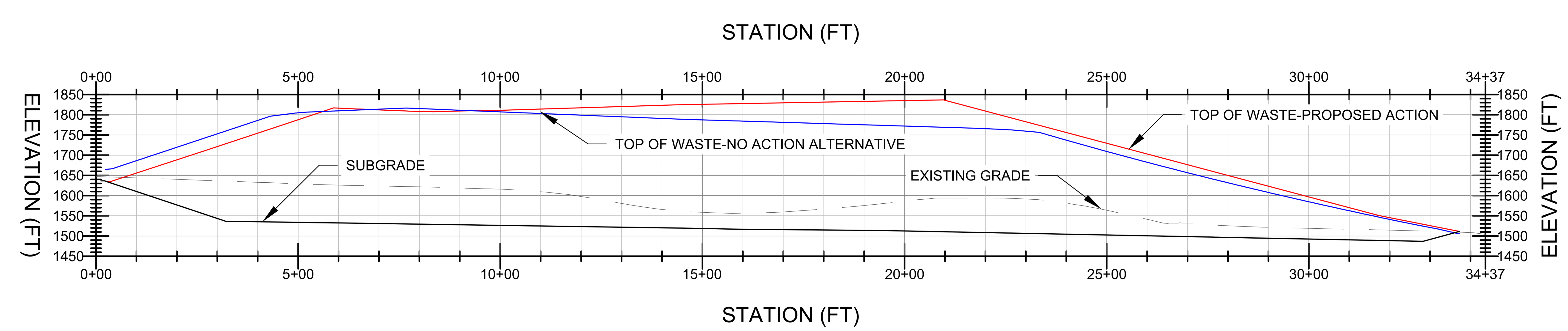

## SECTION D-D'

**HORIZ. SCALE: 1" = 300'**
**VERT. SCALE: 1" = 150'**




## SECTION E-E'

**HORIZ. SCALE: 1" = 250'**
**VERT. SCALE: 1" = 125'**




## SECTION F-F'

**HORIZ. SCALE: 1" = 250'**
**VERT. SCALE: 1" = 125'**

LEGEND

- EXISTING GRADE
- TOP OF WASTE - NO ACTION ALTERNATIVE
- TOP OF WASTE - PROPOSED ACTION
- SUBGRADE
- CELL LIMIT

ROOSEVELT REGIONAL LANDFILL

SLOPE STABILITY REPORT

ROOSEVELT, WASHINGTON

**CROSS SECTIONS**

**FIGURE NO.** 4

**PROJECT NO.** AU20.1209.00

**DATE OF ISSUE:** 11/19/2021 **DRAWN BY:** RDD **APPROVED BY:** SAH

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N:\ROOSEVELT\AU20.1209 VERTICAL EXPANSION\5_ENGINEERING\1_CIVIL\DRAWINGS\FIGURES\EIS\SLOPE STABILITY - FIGURE 3 & 4 SECTIONS.DWG November 17, 2021 - 10:15 AM BY: GLA USER

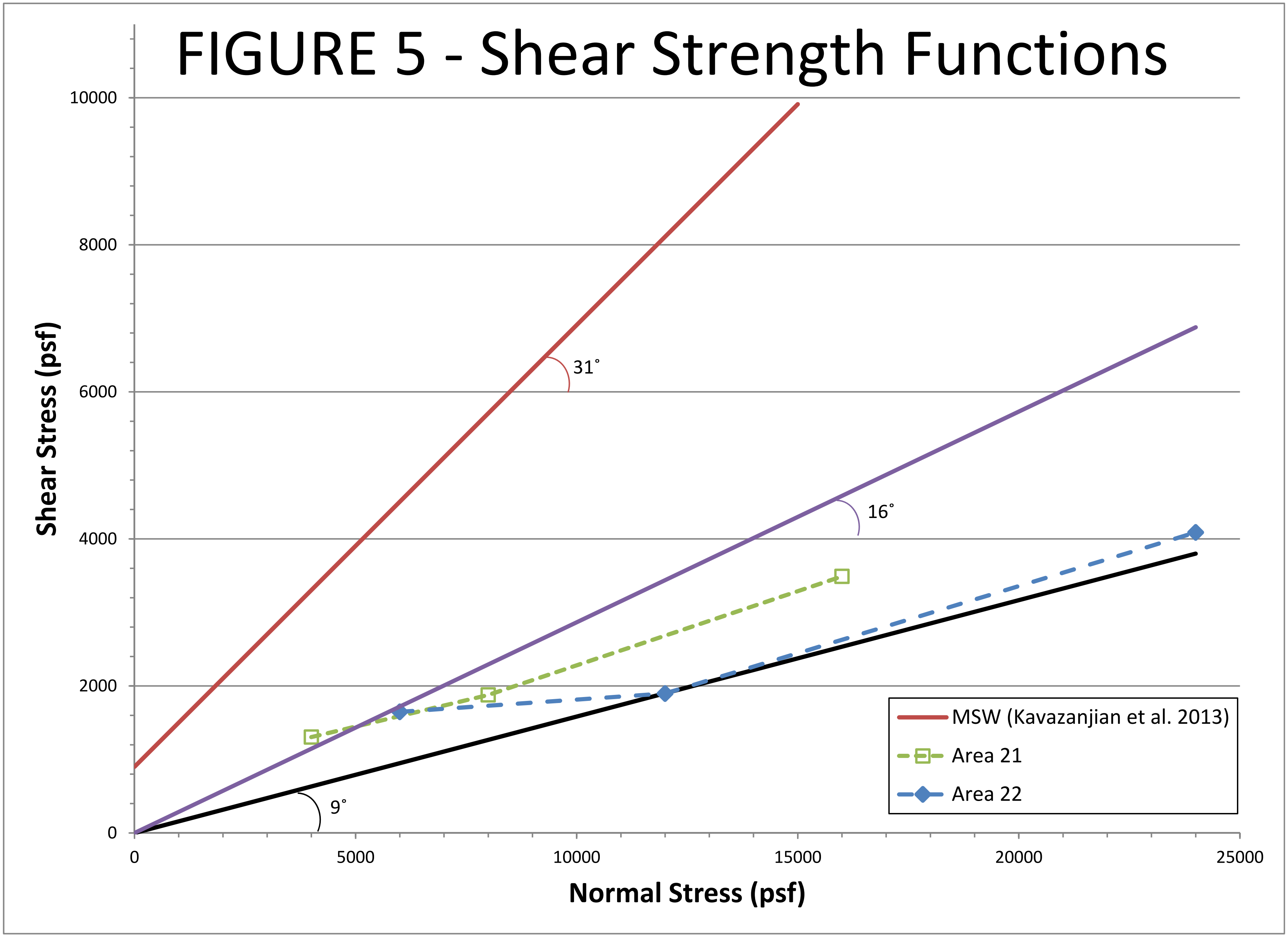


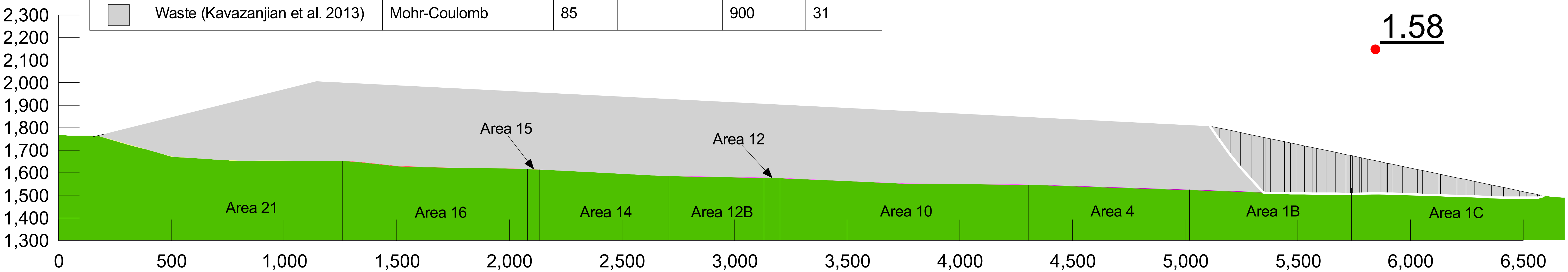
FIGURE 5 - Shear Strength Functions
Shear Stress (psf)
10000
8000
6000
4000
2000
0
Normal Stress (psf)
0
5000
10000
15000
20000
25000
31˚
16˚
9˚
MSW (Kavazanjian et al. 2013)
Area 21
Area 22

# ATTACHMENT 1

# SLOPE/W OUTPUT

Horz Seismic Coef.: 0

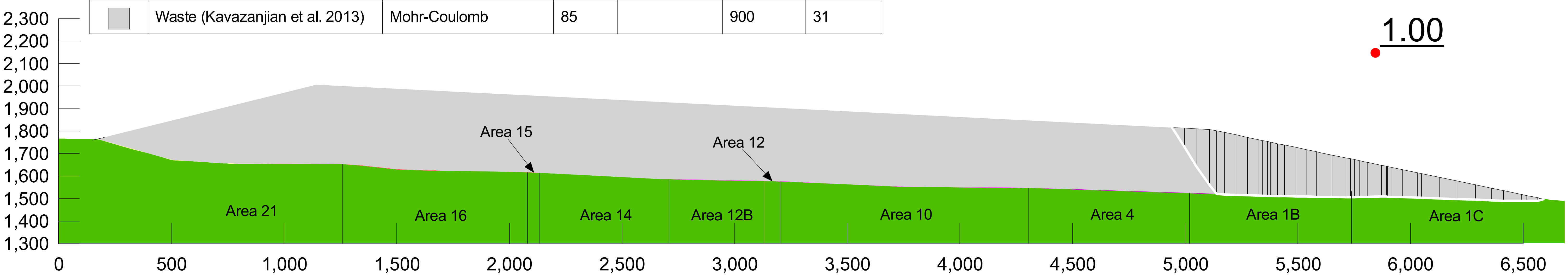
| Color | Name | Material Model | Unit Weight (pcf) | Strength Function | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|---|
| (magenta) | Liner_Area _1-9 Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | | 0 | 9 |
| (pink) | Liner_Area 10-13 Interior Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | | 0 | 9 |
| (red) | Liner_Area 14-18 Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | | 0 | 9 |
| (yellow) | Liner_Area 21 | Shear/Normal Fn. | 100 | Area 21 Conformance Testing | | |
| (green) | Subgrade | Bedrock (Impenetrable) | | | | |
| (gray) | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section A-A' | |
| Roosevelt_Vertical Exp._Section A-A'_01.gsz | |
| 11/15/2021 | 1:5,331 |

Horz Seismic Coef.: 0.087

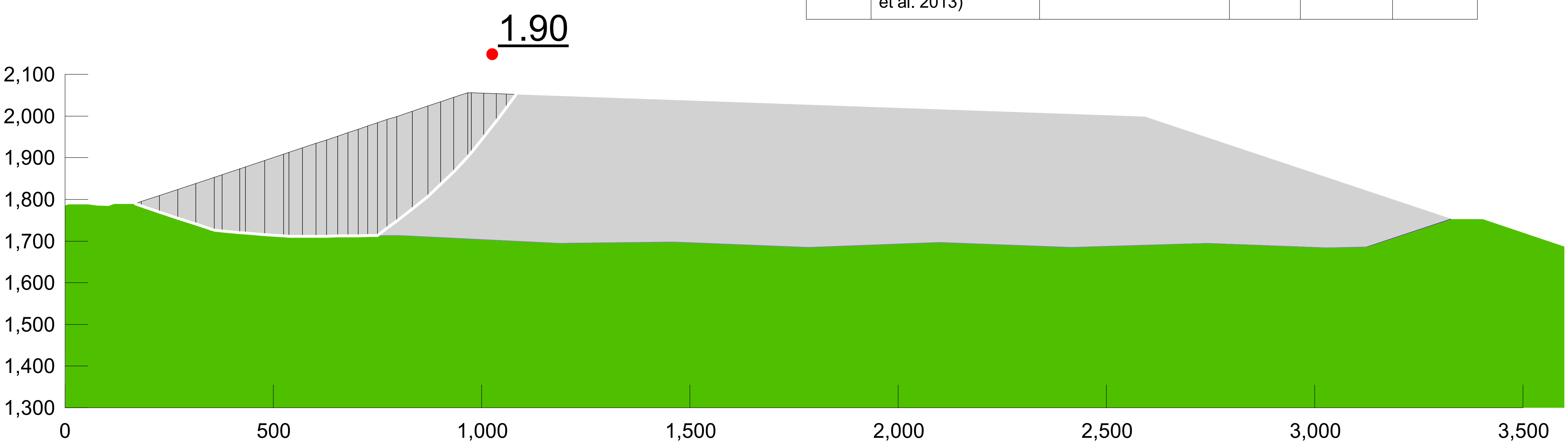
| Color | Name | Material Model | Unit Weight (pcf) | Strength Function | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|---|
| (magenta) | Liner_Area _1-9 Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | | 0 | 9 |
| (pink) | Liner_Area 10-13 Interior Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | | 0 | 9 |
| (red) | Liner_Area 14-18 Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | | 0 | 9 |
| (yellow) | Liner_Area 21 | Shear/Normal Fn. | 100 | Area 21 Conformance Testing | | |
| (green) | Subgrade | Bedrock (Impenetrable) | | | | |
| (grey) | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section A-A' | |
| Roosevelt_Vertical Exp._Section A-A'_01_EQ.gsz | |
| 11/15/2021 | 1:5,331 |

Horz Seismic Coef.: 0

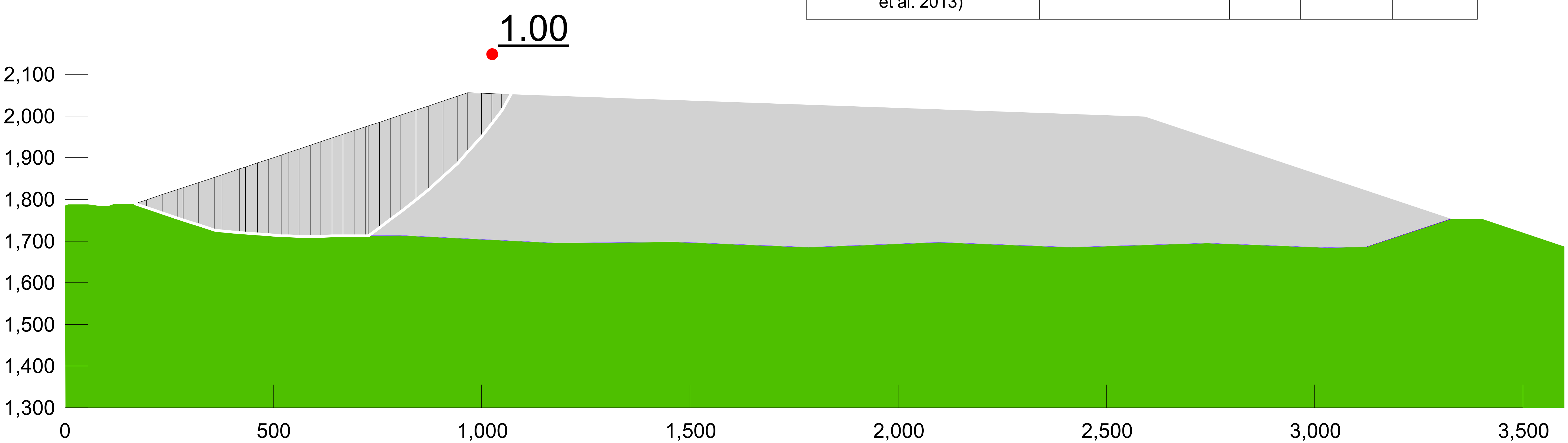
| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section B-B' | |
| Roosevelt_Vertical Exp._Section B-B'_(Left)_01.gsz | |
| 11/15/2021 | 1:3,000 |

Horz Seismic Coef.: 0.21

| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |



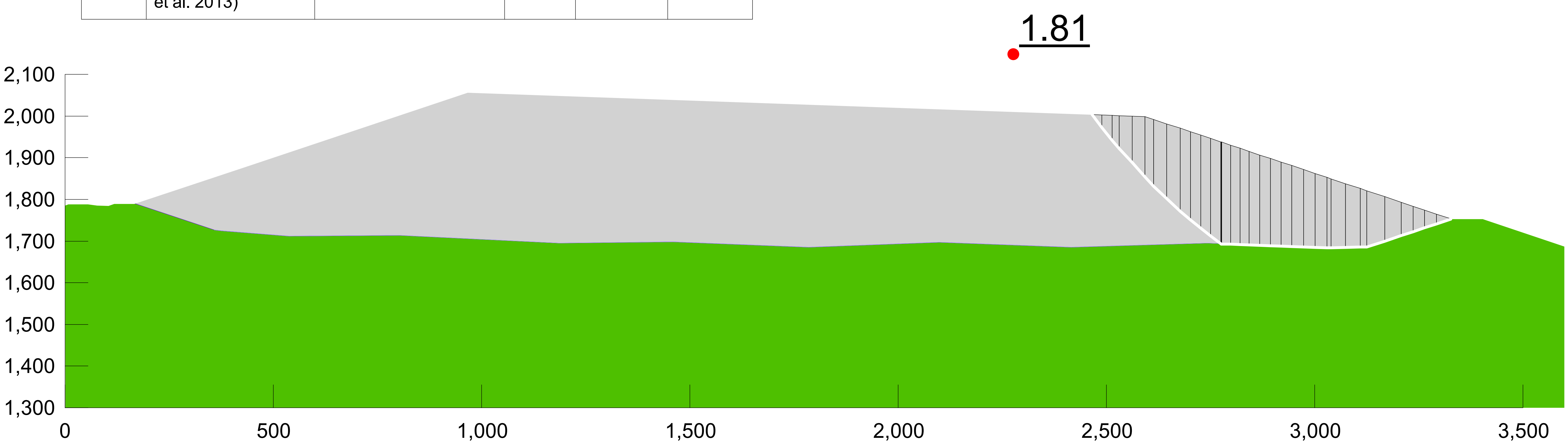

Roosevelt Regional Landfill Description: Section B-B'

Roosevelt_Vertical Exp._Section B-B'_(Left)_01_EQ.gsz

11/15/2021 1:3,000

Horz Seismic Coef.: 0

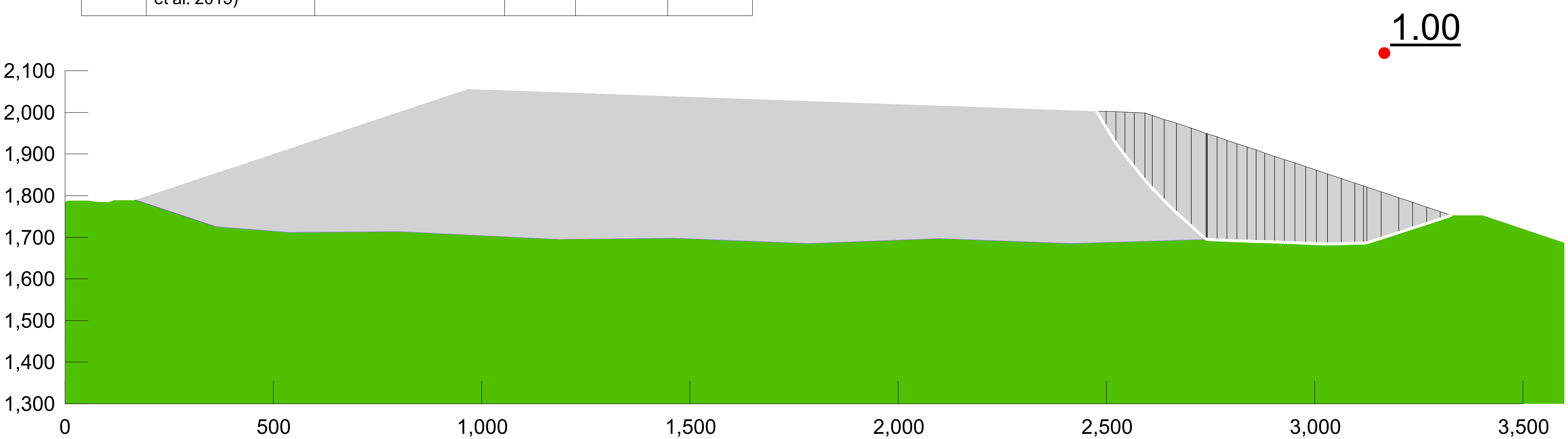
| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section B-B' | |
| Roosevelt_Vertical Exp._Section B-B'_(Right)_01.gsz | |
| 11/15/2021 | 1:3,000 |

Horz Seismic Coef.: 0.187

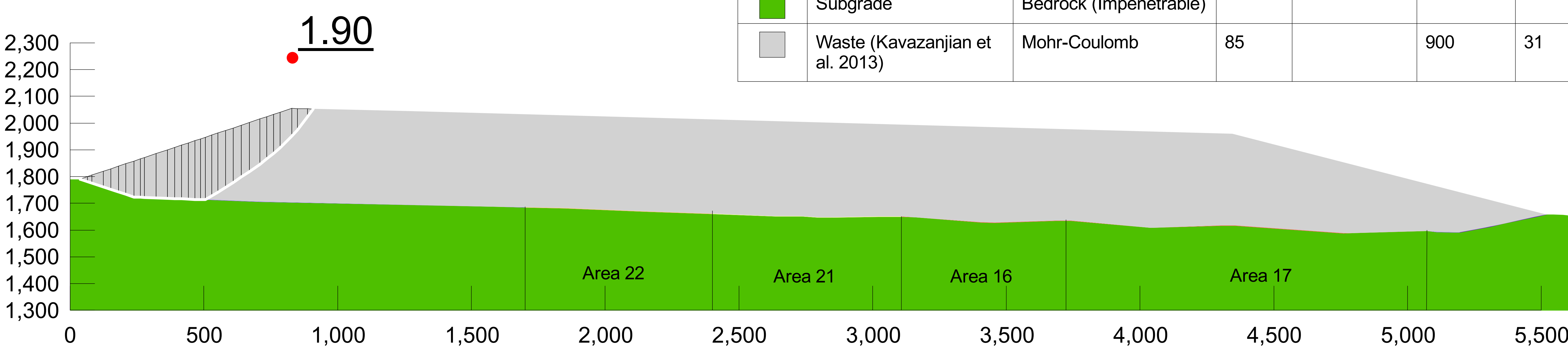
| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section B-B' | |
| Roosevelt_Vertical Exp._Section B-B'_(Right)_01_EQ.gsz | |
| 11/15/2021 | 1:3,000 |

Horz Seismic Coef.: 0

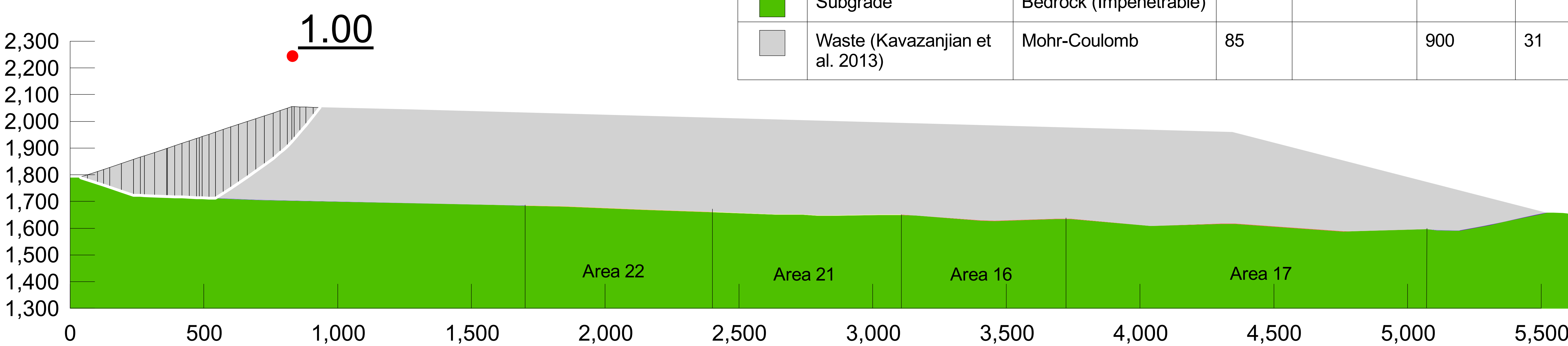
| Color | Name | Material Model | Unit Weight (pcf) | Strength Function | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|---|
| | Liner_Area 14-18 Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | | 0 | 9 |
| | Liner_Area 21 | Shear/Normal Fn. | 100 | Area 21 Conformance Testing | | |
| | Liner_Area 22 | Shear/Normal Fn. | 100 | Area 22 Conformance Testing | | |
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section C-C' | |
| Roosevelt_Vertical Exp._Section C-C'_(Left)_01.gsz | |
| 11/15/2021 | 1:4,600 |

Horz Seismic Coef.: 0.22

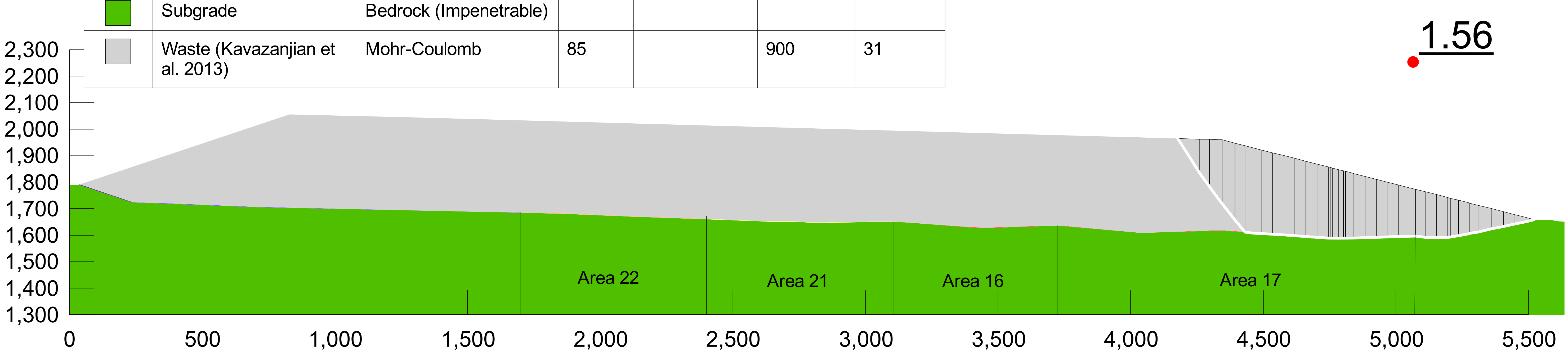
| Color | Name | Material Model | Unit Weight (pcf) | Strength Function | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|---|
| Red | Liner_Area 14-18 Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | | 0 | 9 |
| Light yellow | Liner_Area 21 | Shear/Normal Fn. | 100 | Area 21 Conformance Testing | | |
| Light orange | Liner_Area 22 | Shear/Normal Fn. | 100 | Area 22 Conformance Testing | | |
| Light purple | Liner_Future Cell Floor | Mohr-Coulomb | 100 | | 0 | 16 |
| Dark purple | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | | 0 | 9 |
| Green | Subgrade | Bedrock (Impenetrable) | | | | |
| Grey | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section C-C' | |
| Roosevelt_Vertical Exp._Section C-C'_(Left)_01_EQ.gsz | |
| 11/15/2021 | 1:4,600 |

Horz Seismic Coef.: 0

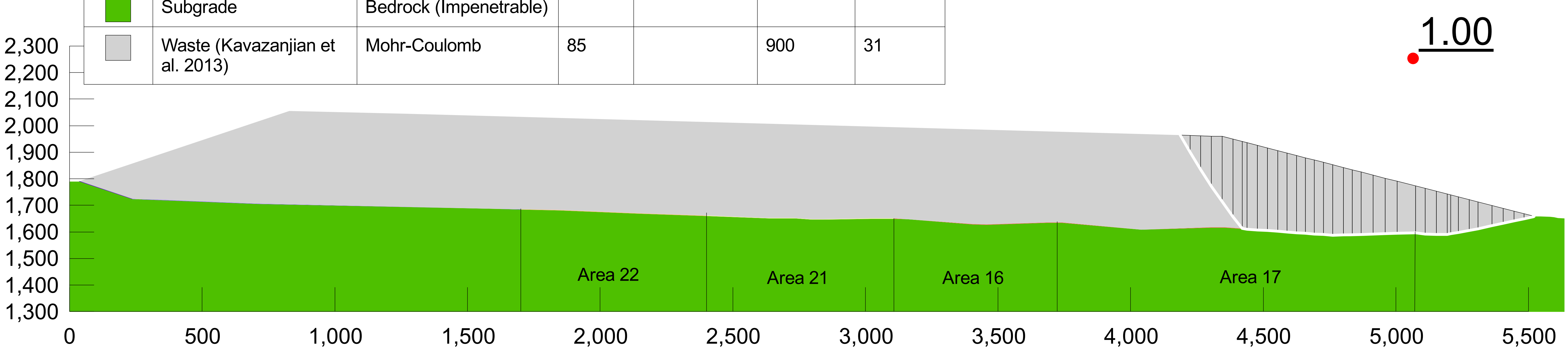
| Color | Name | Material Model | Unit Weight (pcf) | Strength Function | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|---|
| | Liner_Area 14-18 Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | | 0 | 9 |
| | Liner_Area 21 | Shear/Normal Fn. | 100 | Area 21 Conformance Testing | | |
| | Liner_Area 22 | Shear/Normal Fn. | 100 | Area 22 Conformance Testing | | |
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section C-C' | |
| Roosevelt_Vertical Exp._Section C-C'_(Right)_01.gsz | |
| 11/15/2021 | 1:4,600 |

Horz Seismic Coef.: 0.095

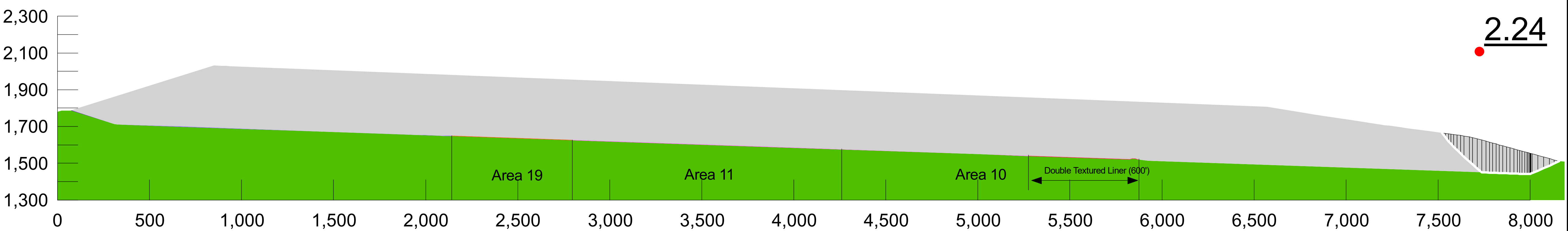
| Color | Name | Material Model | Unit Weight (pcf) | Strength Function | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|---|
| | Liner_Area 14-18 Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | | 0 | 9 |
| | Liner_Area 21 | Shear/Normal Fn. | 100 | Area 21 Conformance Testing | | |
| | Liner_Area 22 | Shear/Normal Fn. | 100 | Area 22 Conformance Testing | | |
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section C-C' | |
| Roosevelt_Vertical Exp._Section C-C'_(Right)_01_EQ.gsz | |
| 11/15/2021 | 1:4,600 |

Horz Seismic Coef.: 0

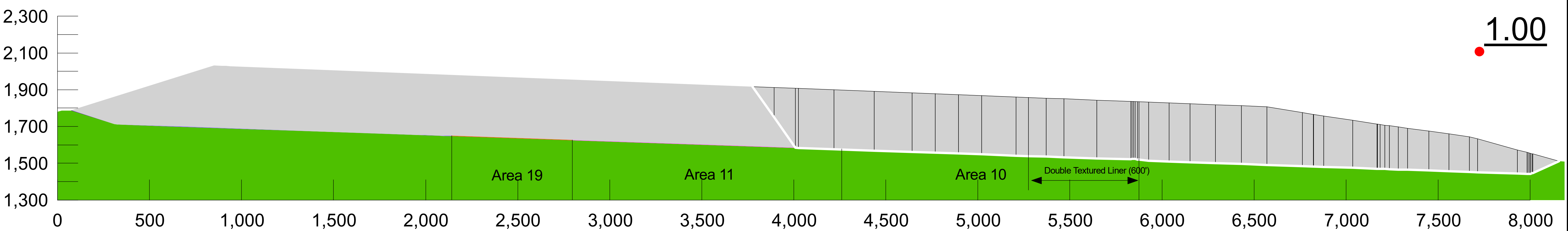
| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Area 10-13 Exterior Floor Liner (Textured HDPE-to-Geotextile) | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Area 10-13 Interior Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | 0 | 9 |
| | Liner_Area 19-20 Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| Roosevelt Regional Landfill Description: Section D-D' | |
|---|---|
| Roosevelt_Vertical Exp._Section D-D'_01.gsz | |
| 11/15/2021 | 1:6,400 |

Horz Seismic Coef.: 0.193

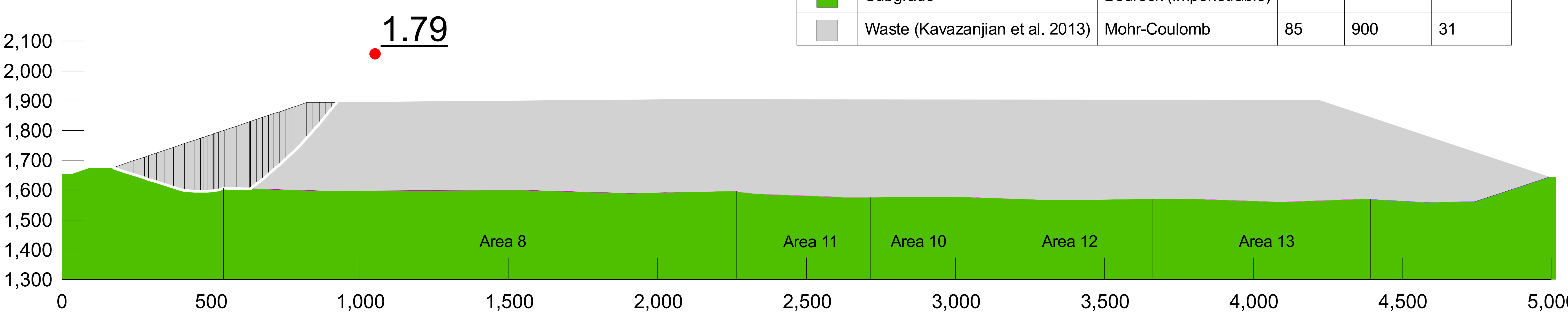
| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Area 10-13 Exterior Floor Liner (Textured HDPE-to-Geotextile) | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Area 10-13 Interior Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | 0 | 9 |
| | Liner_Area 19-20 Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section D-D' | |
| Roosevelt_Vertical Exp._Section D-D'_01_EQ.gsz | |
| 11/15/2021 | 1:6,400 |

Horz Seismic Coef.: 0

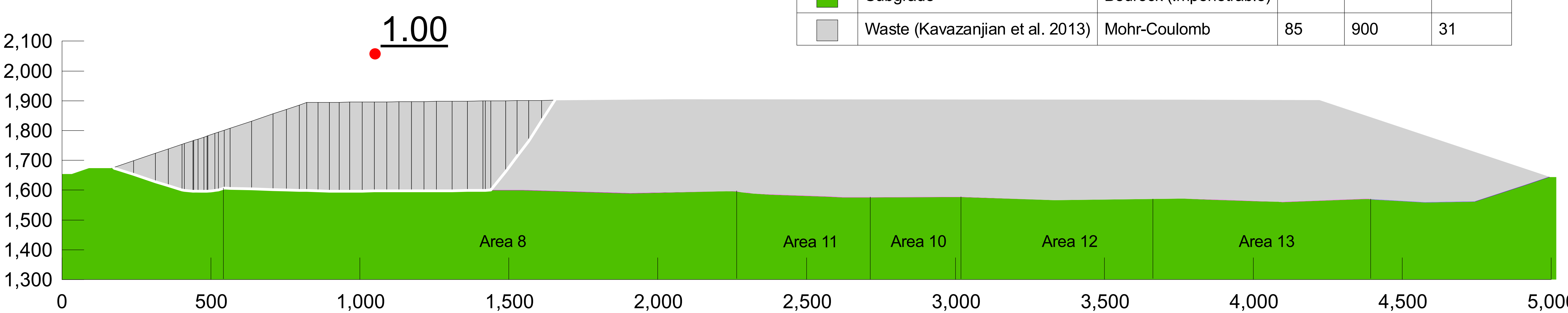
| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Area _1-9 Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | 0 | 9 |
| | Liner_Area 10-13 Interior Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | 0 | 9 |
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section E-E' | |
| Roosevelt_Vertical Exp._Section E-E'_(Left)_01.gsz | |
| 11/16/2021 | 1:4,000 |

Horz Seismic Coef.: 0.152

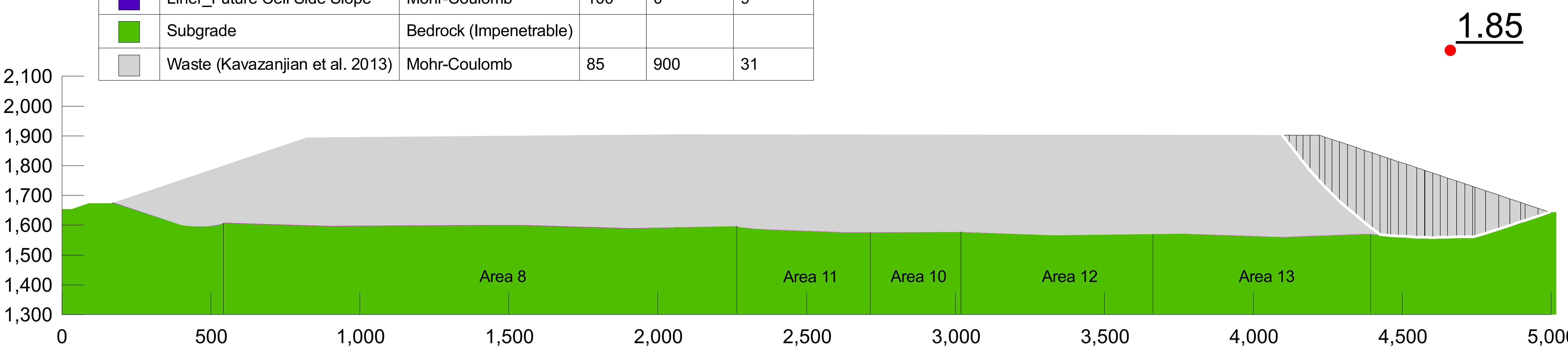
| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Area _1-9 Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | 0 | 9 |
| | Liner_Area 10-13 Interior Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | 0 | 9 |
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section E-E' | |
| Roosevelt_Vertical Exp._Section E-E'_(Left)_01_EQ.gsz | |
| 11/16/2021 | 1:4,000 |

Horz Seismic Coef.: 0

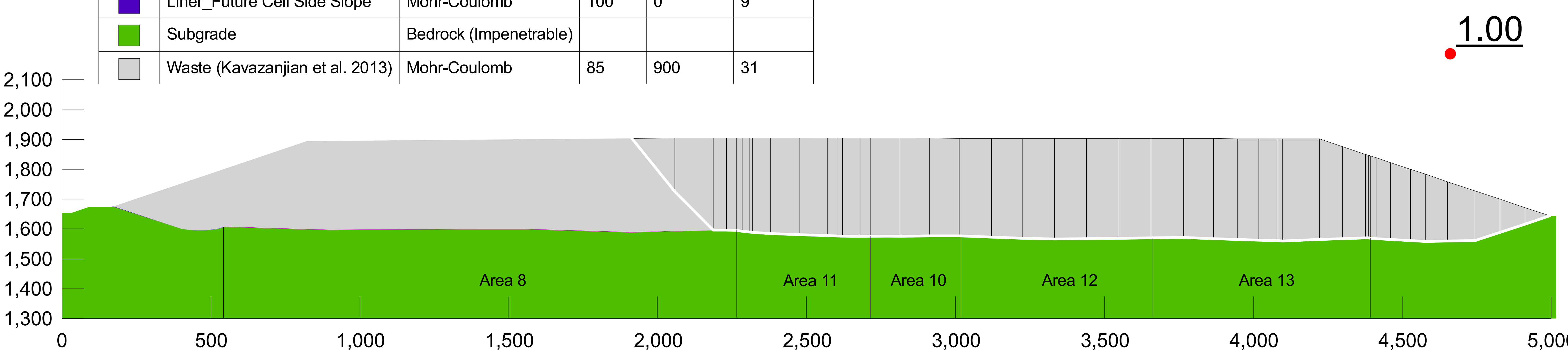
| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Area _1-9 Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | 0 | 9 |
| | Liner_Area 10-13 Interior Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | 0 | 9 |
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section E-E' | |
| Roosevelt_Vertical Exp._Section E-E'_(Right)_01.gsz | |
| 11/16/2021 | 1:4,000 |

Horz Seismic Coef.: 0.15

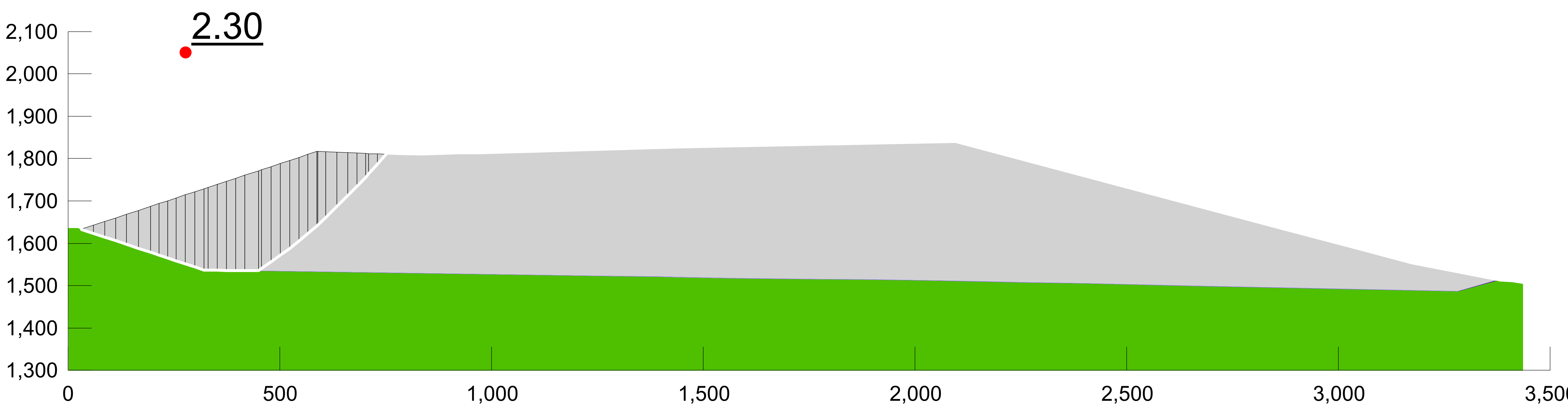
| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Area _1-9 Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | 0 | 9 |
| | Liner_Area 10-13 Interior Floor (Smooth HDPE-to-Geotextile) | Mohr-Coulomb | 100 | 0 | 9 |
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section E-E' | |
| Roosevelt_Vertical Exp._Section E-E'_(Right)_01_EQ.gsz | |
| 11/16/2021 | 1:4,000 |

Horz Seismic Coef.: 0

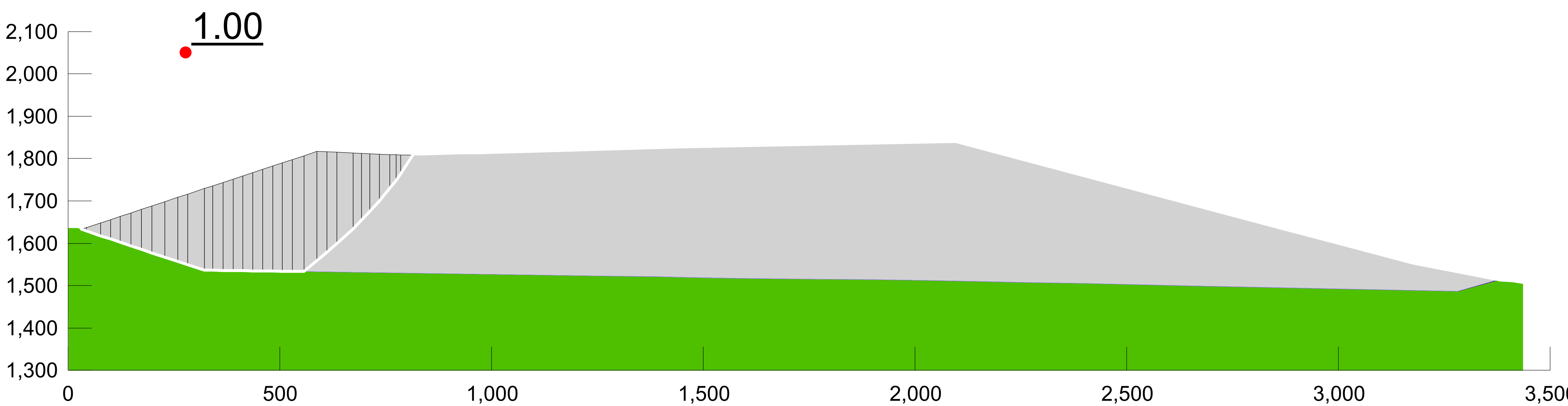
| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section F-F' | |
| Roosevelt_Vertical Exp._Section F-F'_(Left)_01.gsz | |
| 11/16/2021 | 1:3,000 |

Horz Seismic Coef.: 0.26

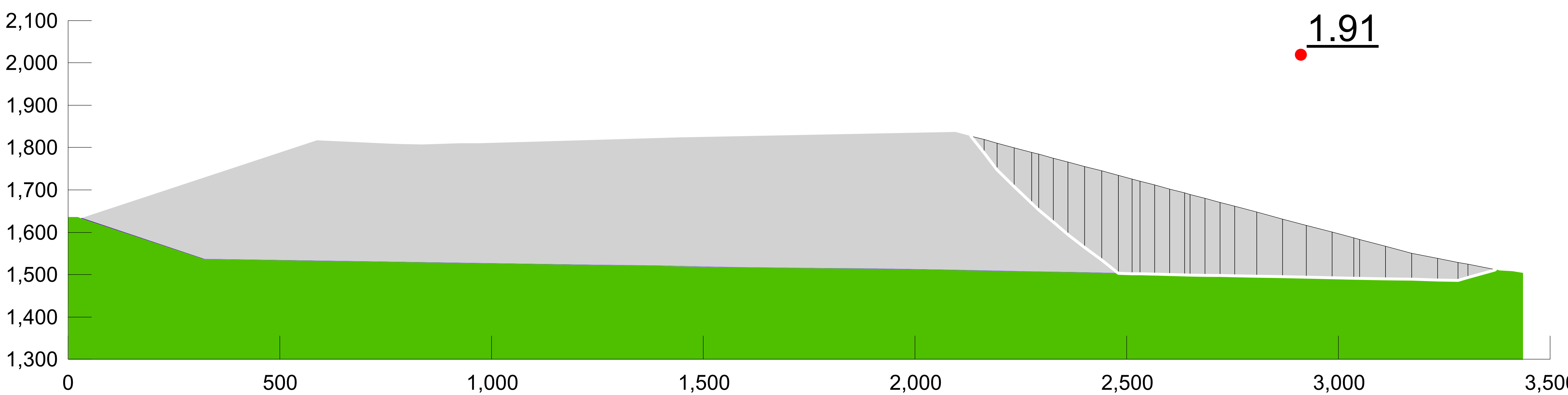
| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section F-F' | |
| Roosevelt_Vertical Exp._Section F-F'_(Left)_01_EQ.gsz | |
| 11/16/2021 | 1:3,000 |

Horz Seismic Coef.: 0

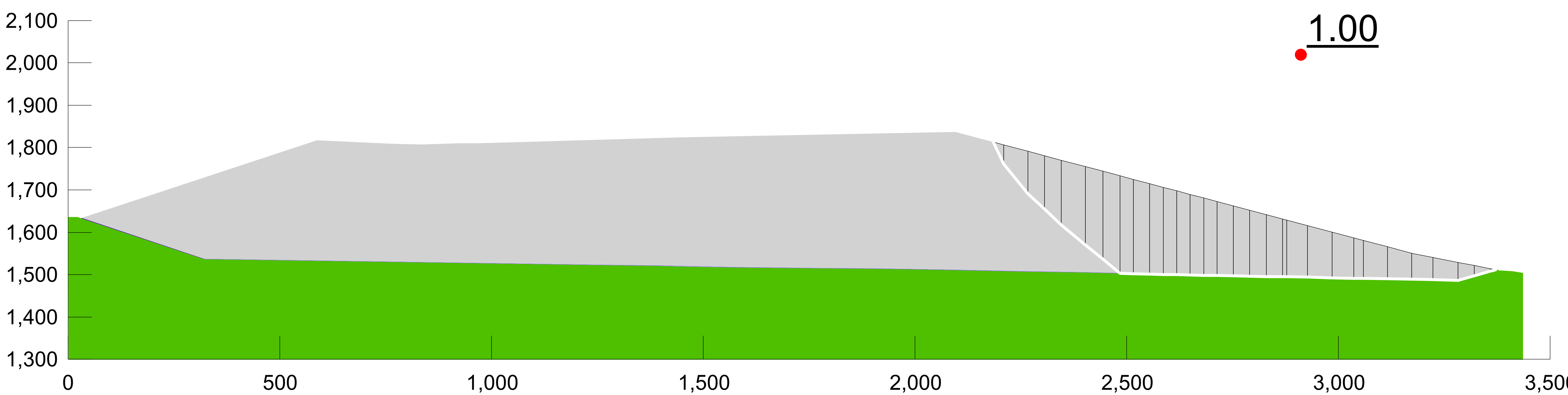
| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section F-F' | |
| Roosevelt_Vertical Exp._Section F-F'_(Right)_01.gsz | |
| 11/16/2021 | 1:3,000 |

Horz Seismic Coef.: 0.185

| Color | Name | Material Model | Unit Weight (pcf) | Effective Cohesion (psf) | Effective Friction Angle (°) |
|---|---|---|---|---|---|
| | Liner_Future Cell Floor | Mohr-Coulomb | 100 | 0 | 16 |
| | Liner_Future Cell Side Slope | Mohr-Coulomb | 100 | 0 | 9 |
| | Subgrade | Bedrock (Impenetrable) | | | |
| | Waste (Kavazanjian et al. 2013) | Mohr-Coulomb | 85 | 900 | 31 |




| | |
|---|---|
| Roosevelt Regional Landfill Description: Section F-F' | |
| Roosevelt_Vertical Exp._Section F-F'_(Right)_01_EQ.gsz | |
| 11/16/2021 | 1:3,000 |

# ATTACHMENT 2

# SEISMIC DISPLACEMENT CALCULATIONS

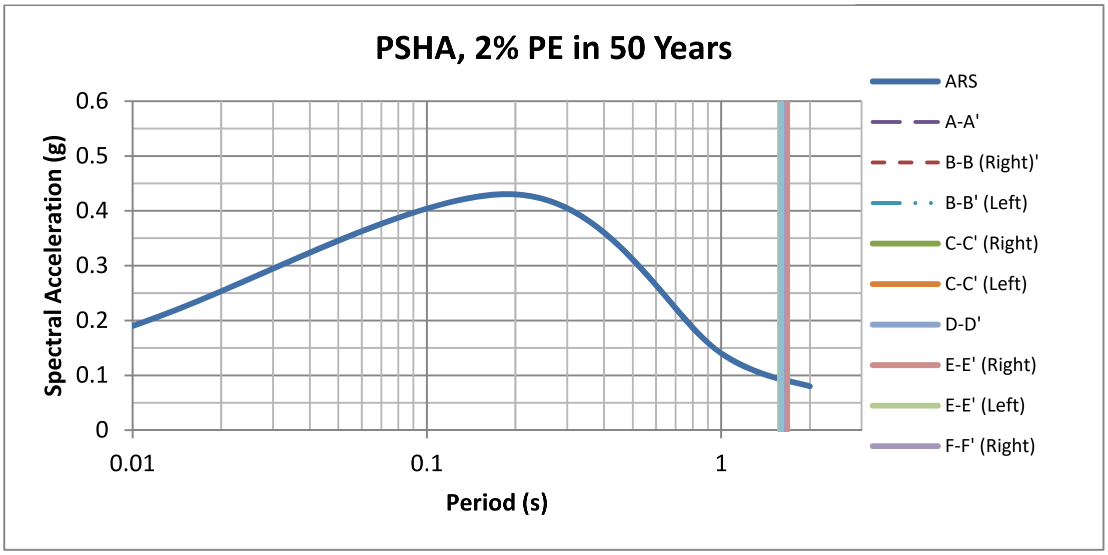
# Roosevelt Regional Landfill
# Displacement Analysis
## Input Summary Page

**Summary:**
Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements
by Jonathan D. Bray and Thaleia Travasarou

**Input Parameters and Calclated Maximum Permanent Seismic Displacements**

| Cross Section | $K_y$ (g) | H (ft) | $(V_s)_{avg}$ (ft/s) | $T_s$ (s) | $T_d$ (s) | $S_a$ @ $T_d$ (g) | $D_{50}$ (cm) |
|---|---|---|---|---|---|---|---|
| A-A' | 0.09 | 262 | 812 | 1.07 | 1.60 | 0.09 | < 1 |
| B-B' (Right) | 0.19 | 260 | 804 | 1.07 | 1.60 | 0.09 | < 1 |
| B-B' (Left) | 0.21 | 284 | 845 | 1.11 | 1.66 | 0.09 | < 1 |
| C-C' (Right) | 0.10 | 289 | 853 | 1.12 | 1.68 | 0.09 | < 1 |
| C-C' (Left) | 0.22 | 285 | 845 | 1.11 | 1.67 | 0.09 | < 1 |
| D-D' | 0.19 | 289 | 853 | 1.12 | 1.68 | 0.09 | < 1 |
| E-E' (Right) | 0.15 | 284 | 845 | 1.11 | 1.66 | 0.09 | < 1 |
| E-E' (Left) | 0.15 | 248 | 776 | 1.06 | 1.58 | 0.10 | < 1 |
| F-F' (Right) | 0.19 | 270 | 820 | 1.09 | 1.63 | 0.09 | < 1 |
| F-F' (Left) | 0.26 | 233 | 722 | 1.07 | 1.60 | 0.10 | < 1 |

$k_y$ = yield acceleration of sliding mass (from pseudostatic slope stabiliy evaluation)
H = Representative thickness of waste fill from pseudostatic slope stability evaluation
$(V_s)_{avg}$ = Average (over H) shear wave velocity of waste fill
$T_s$ = Initial fundamental period of waste fill (3.3 H / $(V_s)_{avg}$)
$T_d$ = 1.5 $T_s$ = Degraded initial fundamental period of waste fill
$S_a$ = Spectral Acceleration (mean value)
$S_a$ @ $T_d$ = Spectral Acceleration evaluated at $T_d$ (see chart below)
$D_{50}$ = Displacement with a 50 percent probability of exceedance




**References:**
Bray, J.D. and Travasarou, T. (2007), *"Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements," Journal of Geotechnical and Geoenvironmental Engineering,* ASCE, Vol 133, No. 4, pp 381-392.

Kavazanjian, E., Matasovic, N., and Bachus, R.C. (2013), *"11th Peck Lecture: Pre-Design Geotechnical Investigation for the OII Superfund Site Landfill," ASCE Journal of Geoenvironmental Engineering*, Vol. 139, No. 11, pp 1849-1863.

# Appendix A.2

Pipe Strength Calculations

# SUPPLEMENTAL DURABILITY CALCULATIONS FOR BURIED LEACHATE COLLECTION PIPE

Calculations were performed to demonstration that a 12" diameter SDR 17 leachate collection pipe will survive without crushing or buckling beneath 340 feet of waste. The pipe is assumed to have 2 feet of gravel over its crown, but no granular bedding layer. The gravel over the pipe crown will be placed without compaction. Similar calculations had been performed previously by Thiel Engineering for waste heights up to 300 feet (Thiel 2000). These revised calculations were performed for the 2001 Supplemental EIS.

**Givens and Assumptions:** The pipe will be embedded in crushed gravel such that a minimum of 2 feet of gravel will exist over the pipe crown. The pipe will lay directly on the geotextile cushion on a geomembrane liner. There will be no special pipe bedding. The following geometric and material parameters were assumed:

- A conservative soil modulus for the gravel of 1000 psi was assumed (ref. Driscopipe, 1991) to represent gravel without compaction. Assumptions related to the pipe modulus and acceptable pipe deformations were taken as the default values from Driscopipe (1997).
- A conservatively high waste density of 95 pounds per cubic foot (pcf) was assumed. This was estimated by assuming that one cubic yard of in-place waste mass consists of 1600 lbs of gate-received waste, 420 lbs of soil (15% of volume), and a 25% safety factor to allow for densification that might occur due to moisture addition from rain or leachate reintroduction. The decrease in density due to landfill gas formation was neglected.
- The maximum waste depth was assumed to be 340 feet.
- There will be 2 feet of gravel installed over the crown of the pipe.
- The pipe is 12-inch diameter SDR 17 HDPE.

**Approach:** Since the pipe is buried in crushed gravel, significant stress and strain relief on the pipe will be provided by soil arching action of the gravel around the pipe since the pipe allows for some deformation for arching to occur. The calculation for stress relief due to arching is provided by Terzaghi (1943). The input to the calculation is the uniform vertical stress at the top of the gravel layer (calculated as the waste thickness times the waste density), the pipe diameter, the unit weight of the gravel, the friction angle of the gravel, and the thickness of gravel above the top of the pipe. The output result of the calculation is the vertical stress at the top of the pipe.

To determine if the resulting stress at the top of the pipe is acceptable, the durability formulae provided by Driscopipe (1991) are used to check for pipe crushing, wall buckling, and ring deflection. These formulae are encoded in a computer program provided by Driscopipe (1997), which was used in this analysis. The input to this program includes the Dimension Ratio (DR) used for the pipe, the thickness and unit weight of the soil above the top of the pipe, the modulus of the soil surrounding the pipe, and the pipe modulus. The computer program default values for the pipe modulus and allowable stresses and deflections in the pipe were used for Driscopipe 1000 (standard industrial grade HDPE pipe). The product of the unit weight and thickness of soil above the pipe were adjusted to equal the vertical stress at the top of the pipe that was calculated from the Terzaghi soil-arching equation.

**Results:** Results of the soil-arching analysis are presented in Table C1 on the attached spreadsheet. The results show that for a 2-foot gravel covering over a 1-foot diameter pipe under 340 feet of waste, the stress at the top of the pipe is approximately 1,189 pounds per square foot (psf).

To simulate the pressure of 1,189 psf at the top of the pipe, a soil density of 110 pcf and burial depth of 9.6 feet were entered into the Driscopipe Direct Burial program. The computed pipe survivability calculation results are as follows:

- Crushing factor of safety: 22.7
- Wall buckling factor of safety: 12.4
- Ring deflection: 0.83% (acceptable)

These results are applicable for gravel placed against the springline of the pipe, and over the pipe to the depth assumed in the analysis. The results are independent of the bedding conditions. The results are comparable to the previous Thiel Engineering (2000) calculations, and demonstrate that increasing the waste thickness from 300' to 340' has a negligible effect on the pipe durability.

**References:**

Driscopipe. 1991. Engineering Characteristics. Design guide available from manufacturer.

Driscopipe. 1997. Design and Applications, computer program version 3.5, release date June 1, 1997.

Terzahgi, K. 1943. *Theoretical Soil Mechanics.* John Wiley & Sons, New York, pp. 66-76

Thiel Engineering. (2000) Pipe Burial Calculations for Roosevelt Regional Landfill. Pages 1-8.

Table C1 – Results of Pipe Arching Calculation

| Waste unit wt (pcf) | Height of Waste (ft) | Pipe Diam. (ft) | Thick-ness of gravel above pipe (ft) | Gravel unit wt (pcf) | Friction angle of gravel (deg) | n | a | b | Vertical Stress (psf) | Pipe SDR | Compres-sive Stress - Drisco formula (psi) | Drisco-pipe Safety Factor for Wall Crushing |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 95 | 340 | 1 | 0 | 110 | 40 | 0 | - | 1.00 | 32,300 | 17 | 1,794 | 0.84 |
| 95 | 340 | 1 | 0.5 | 110 | 40 | 1 | 0.68 | 0.43 | 13,994 | 17 | 777 | 1.93 |
| 95 | 340 | 1 | 1 | 110 | 40 | 2 | 0.97 | 0.19 | 6,084 | 17 | 338 | 4.44 |
| 95 | 340 | 1 | 1.5 | 110 | 40 | 3 | 1.10 | 0.08 | 2,666 | 17 | 148 | 10.13 |
| **95** | 340 | **1** | **2** | **110** | **40** | **4** | **1.15** | **0.03** | **1,189** | **17** | **66** | **22.70** |
| 95 | 340 | 1 | 2.5 | 110 | 40 | 5 | 1.17 | 0.02 | 551 | 17 | 31 | 48.99 |
| 95 | 340 | 1 | 3 | 110 | 40 | 6 | 1.18 | 0.01 | 275 | 17 | 15 | 98.06 |
| 95 | 340 | 1 | 3.5 | 110 | 40 | 7 | 1.19 | 0.00 | 156 | 17 | 9 | 172.85 |
| 95 | 340 | 1 | 4 | 110 | 40 | 8 | 1.19 | 0.00 | 105 | 17 | 6 | 257.83 |
| 95 | 340 | 1 | 4.5 | 110 | 40 | 9 | 1.19 | 0.00 | 82 | 17 | 5 | 327.38 |
| 95 | 340 | 1 | 5 | 110 | 40 | 10 | 1.19 | 0.00 | 73 | 17 | 4 | 370.57 |
| 95 | 340 | 1 | 5.5 | 110 | 40 | 11 | 1.19 | 0.00 | 69 | 17 | 4 | 392.97 |
| 95 | 340 | 1 | 6 | 110 | 40 | 12 | 1.19 | 0.00 | 67 | 17 | 4 | 403.51 |
| 95 | 340 | 1 | 10 | 110 | 40 | 20 | 1.19 | 0.00 | 66 | 17 | 4 | 411.91 |

# STRUCTURAL PIPE CALCULATION WORKSHEET

Geo-Logic ASSOCIATES

Project Name: Roosevelt Regional Landfill
SEIS - Maximum Elevation Increase
Project Number: AU20.1209.00
Calculation By: ASO
Calculation Date: November 18, 2021

Description: Check whether existing pipe strength is acceptable for proposed action fill plan grades

## Compressive Stress

| Description | Units | Areas 1-8 | Areas 9-11 | Areas 12-22 and Future Cells |
|---|---|---|---|---|
| Unit Weight of Waste | pcf | 95.0 | 95.0 | 95.0 |
| Waste Fill Height | ft | 315 | 340 | 350 |
| Final Cover Unit Weight | pcf | 120 | 120 | 120 |
| Final Cover Height | ft | 4 | 4 | 4 |
| Overburden Stress | psf | 30405 | 32780 | 33730 |
| Overburden Stress | psi | 211 | 228 | 234 |
| Nominal Outer Diameter of Pipe | in | 12 | 8 | 8 |
| Outer Diameter of Pipe | in | 13.2 | 9.05 | 9.05 |
| Dimension Ratio (DR) | -- | 15.5 | 17 | 11 |
| Pipe Wall Thickness (t) | in | 0.85 | 0.53 | 0.82 |
| Mean Radius of Pipe ($r_m$) | in | 6.17 | 4.26 | 4.11 |
| Perforation Diameter | in | 0.25 | 0.5 | 0.5 |
| Perforation Spacing | in | 6 | 6 | 6 |
| Number of Perforations Around Pipe | -- | 4 | 4 | 4 |
| Reduced Pipe Length Accounting for Perforations ($L_p$) | in | 2 | 4 | 4 |
| Length Based on Overburden Correction | in | 1.20 | 1.50 | 1.50 |
| Reduced Pipe Area to Account for Perforations ($L_a$) | $in^2$ | 0.39 | 1.57 | 1.57 |
| Area Based Overburden Correction | -- | 1.002 | 1.010 | 1.010 |
| Design Overburden Stress | psf | 30456 | 33104 | 34075 |
| Design Overburden Stress | psi | 212 | 230 | 237 |
| Constrained Modulus of Pipe Backfill ($M_s$)<br>Assumes Gravelly Sand/Gravel at 95% Std Proctor (McGrath, 1998) | psi | 11014 | 11668 | 11929 |
| Assumed Pipe Temperature | ˚F | 100 | 100 | 100 |
| Assumed Load Duration | years | 100 | 100 | 100 |
| Pipe Apparent Elastic Modulus (E) | psi | 28000 | 28000 | 28000 |
| Temperature Multiplier | -- | 0.73 | 0.73 | 0.73 |
| Long Term Pipe Modulus of Elasticity (E) | psi | 20440 | 20440 | 20440 |
| Hoop Thrust Stiffness ($S_A$) | -- | 5.59 | 6.53 | 4.17 |
| Vertical Arching Factor (VAF) | -- | 0.48 | 0.45 | 0.54 |
| Radial Directed Earth Pressure ($P_{RD}$) | psf | 14537 | 14737 | 18483 |
| Ring Compressive Stress (S) | psi | 782.4 | 869.9 | 705.9 |
| Allowable Compressive Stress at 100˚F | psi | 897 | 897 | 897 |
| Compressive Stress OK? | -- | YES | YES | YES |

## Ring Deflection Using the Watkins-Gaube Graph

| Description | | Areas 1-8 | Areas 9-11 | Areas 12-22 and Future Cells |
|---|---|---|---|---|
| Poisson's Ratio of Backfill Material (μ) | -- | 0.3 | 0.3 | 0.3 |
| Secant Modulus of Soil ($E_S$) | psi | 8182 | 8667 | 8861 |
| Ridgitity Factor ($R_F$) | -- | 14644 | 20842 | 5202 |
| Deformation Factor ($D_F$) | -- | 1.9 | 2.0 | 1.6 |
| Soil Strain ($\varepsilon_s$) | % | 2.6 | 2.6 | 2.6 |
| Deflection | % | 4.9 | 5.3 | 4.2 |
| Acceptable Deflection | % | 7.5 | 7.5 | 7.5 |
| Defelction OK? | -- | YES | YES | YES |

## Moore-Selig Constrained Pipe Wall Buckling (for dry soil)

| Description | Units | Areas 1-8 | Areas 9-11 | Areas 12-22 and Future Cells |
|---|---|---|---|---|
| Calibration Factor (φ) | -- | 0.55 | 0.55 | 0.55 |
| Geometry Factor ($R_H$) | -- | 1.0 | 1.0 | 1.0 |
| Pipe Wall Moment of Inertia (I) | $in^4/in$ | 0.051 | 0.013 | 0.046 |
| Mod Secant Modulus of Soil ($E_S$*) | -- | 11689 | 12382 | 12659 |
| Moore-Selig Critical Buckling Pressure ($P_{CR}$) | psi | 560.0 | 527.3 | 856.3 |
| Acceptable Factor of Safety | -- | 2 | 2 | 2 |
| Factor of Safety | -- | 5.55 | 5.15 | 6.67 |
| Buckling OK? | -- | YES | YES | YES |

## Luscher Constrained Pipe Wall Buckling

| Description | Units | Areas 1-8 | Areas 9-11 | Areas 12-22 and Future Cells |
|---|---|---|---|---|
| Height of Fill (H) | ft | 315 | 340 | 350 |
| Height of Groundwater ($H_{GW}$) | ft | 0 | 0 | 0 |
| Elastic Support Coefficient (B') | -- | 1.0 | 1.0 | 1.0 |
| Buoyancy Reduction Factor (R) | -- | 1.0 | 1.0 | 1.0 |
| Luscher's Critical Buckling Pressure ($P_{CR}$ @ N=1) | psi | 443.2 | 393.6 | 805.4 |
| Acceptable Factor of Safety | -- | 2 | 2 | 2 |
| Factor of Safety | -- | 4.4 | 3.8 | 6.3 |
| Buckling OK? | -- | YES | YES | YES |

# STRUCTURAL PIPE CALCULATION WORKSHEET

Pipe calculations are as presented by the Plastic Pipe Institute in the Second Edition Handbook of PE Pipe

(3-21) $$VAF = 0.88 - 0.71\frac{S_A - 1}{S_A + 2.5}$$

**WHERE**
$VAF$ = Vertical Arching Factor
$S_A$ = Hoop Thrust Stiffness Ratio

(3-22) $$S_A = \frac{1.43\, M_S\, r_{CENT}}{EA}$$

**WHERE**
$r_{CENT}$ = radius to centroidal axis of pipe, in
$M_S$ = one-dimensional modulus of soil, psi
$E$ = apparent modulus of elasticity of pipe material, psi (See Appendix, Chapter 3)
$A$ = profile wall average cross-sectional area, in²/in, or wall thickness (in) for DR pipe

(3-23) $$P_{RD} = (VAF)wH$$

**WHERE**
$P_{RD}$ = radial directed earth pressure, lb/ft²
$W$ = unit weight of soil, pcf
$H$ = depth of cover, ft

(3-13) $$S = \frac{(P_E + P_L)\, DR}{288}$$

**WHERE**
$P_E$ = vertical soil pressure due to earth load, psf
$P_L$ = vertical soil pressure due to live-load, psf
$S$ = pipe wall compressive stress, lb/in²
$DR$ = Dimension Ratio, $D_O/t$
$D_O$ = pipe outside diameter (for profile pipe $D_O = D_I + 2H_P$), in
$D_I$ = pipe inside diameter, in
$H_P$ = profile wall height, in
$A$ = profile wall average cross-sectional area, in²/in
(Obtain the profile wall area from the manufacturer of the profile pipe.)

(3-26) $$E_S = M_S\frac{(1+\mu)(1-2\mu)}{(1-\mu)}$$

**TABLE 3-13**
Typical range of Poisson's Ratio for Soil (Bowles [21])

| Soil Type | Poisson's Ratio, μ |
|---|---|
| Saturated Clay | 0.4-0.5 |
| Unsaturated Clay | 0.1-0.3 |
| Sandy Clay | 0.2-0.3 |
| Silt | 0.3-0.35 |
| Sand (Dense) | 0.2-0.4 |
| Coarse Sand (Void Ratio 0.4-0.7) | 0.15 |
| Fine-grained Sand (Void Ratio 0.4-0.7) | 0.25 |

(3-24) $$R_F = \frac{12\, E_S\,(DR-1)^3}{E}$$

**WHERE**
DR = Dimension Ratio
$E_S$ = Secant modulus of the soil, psi
E = Apparent modulus of elasticity of pipe material, psi
I = Pipe wall moment of inertia of pipe, in⁴/in
$D_m$ = Mean diameter ($D_I$ + 2z or $D_O$ – t), in

(3-27) $$\varepsilon_S = \frac{wH}{144E_S}$$

**WHERE**
w = unit weight of soil, pcf
H = depth of cover (height of fill above pipe crown), ft
$E_S$ = secant modulus of the soil, psi

The designer can find the pipe deflection as a percent of the diameter by multiplying the soil strain, in percent, by the deformation factor:

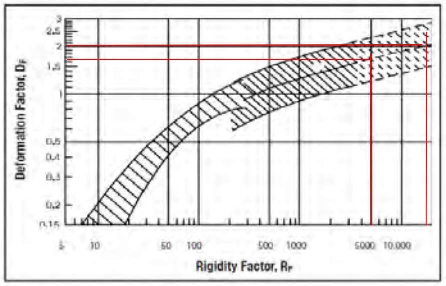



**Figure 3-6** Watkins-Gaube Graph

(3-28) $$\frac{\Delta X}{D_M}(100) = D_F\varepsilon_S$$

(3-29) $$P_{CR} = \frac{2.4\,\varphi\, R_H}{D_M}(EI)^{\frac{1}{3}}(E_S^*)^{\frac{2}{3}}$$

**WHERE**
$P_{CR}$ = Critical constrained buckling pressure, psi
φ = Calibration Factor, 0.55 for granular soils
$R_H$ = Geometry Factor
$E$ = Apparent modulus of elasticity of pipe material, psi
$I$ = Pipe wall moment of Inertia, in⁴/in (t³/12, if solid wall construction)
$E_S^*$ = $E_S$ /(1-μ)
$E_S$ = Secant modulus of the soil, psi
$\mu_S$ = Poisson's Ratio of Soil (Consult a textbook on soil for values. Bowles (1982) gives typical values for sand and rock ranging from 0.1 to 0.4.)

(3-17) $$R = 1 - 0.33\frac{H_{GW}}{H}$$

**WHERE**
$R$ = buoyancy reduction factor
$H_{GW}$ = height of ground water above pipe, ft
$H$ = depth of cover, ft

(3-18) $$B' = \frac{1}{1 + 4e^{(-0.065H)}}$$

**WHERE**
$e$ = natural log base number, 2.71828
$E'$ = soil reaction modulus, psi
$E$ = apparent modulus of elasticity, psi
$DR$ = Dimension Ratio
$I$ = pipe wall moment of inertia, in⁴/in (t³/12, if solid wall construction)
$D_M$ = Mean diameter ($D_I$ + 2z or $D_O$ – t), in

(3-15) $$P_{WC} = \frac{5.65}{N}\sqrt{RB'E'\frac{E}{12(DR-1)^3}}$$

**WHERE**
$P_{WC}$ = allowable constrained buckling pressure, lb/in²
$N$ = safety factor

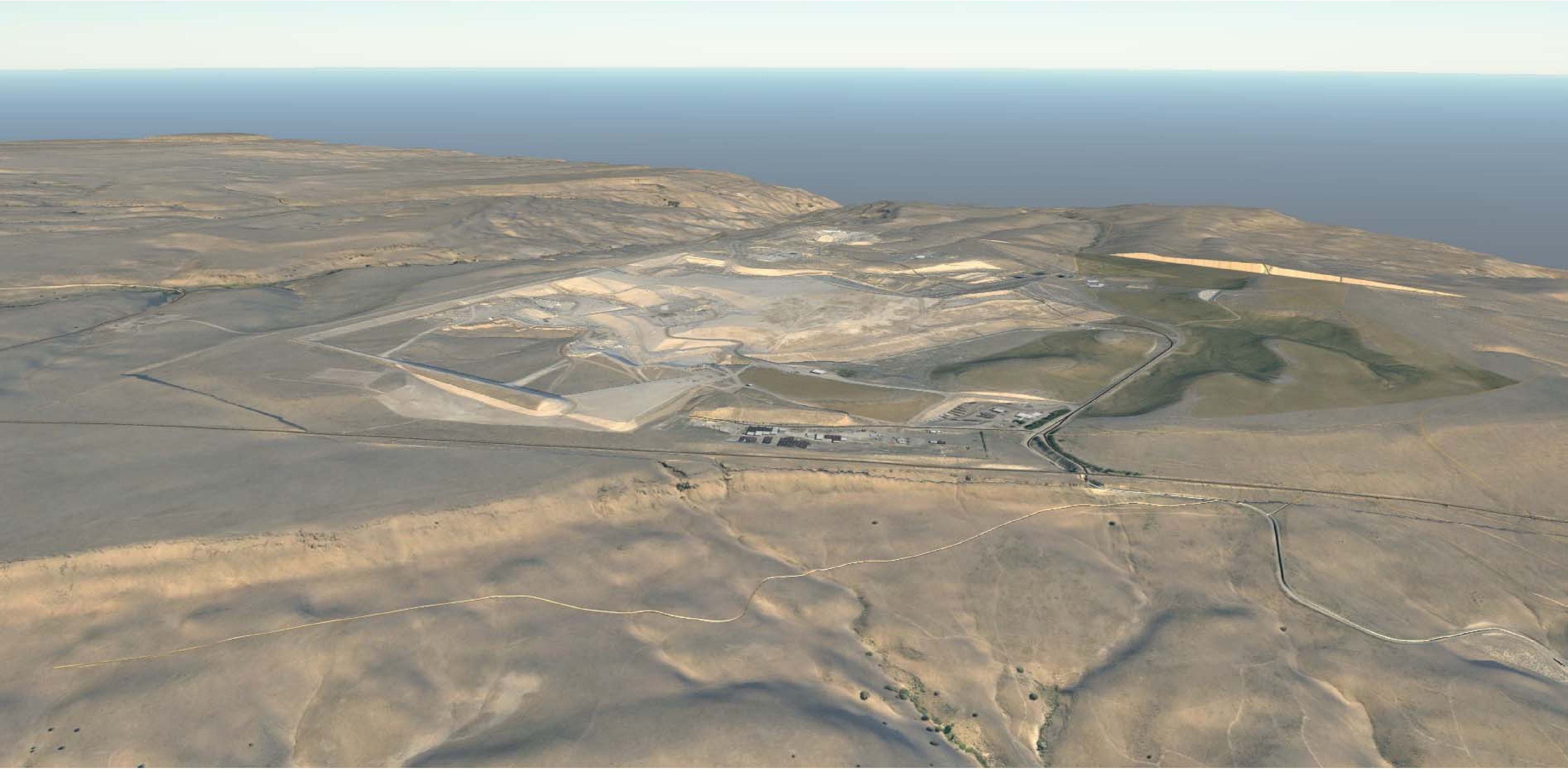

Reference Information:
Plastic Pipe Institute, 2012. *Handbook of Polyethlyene Pipe,* 2nd Edition, June 6. Retrieved from: https://plasticpipe.org/publications/pe-handbook.html. Retrieved on April 17, 2018.
Plastic Pipe Institute, 2010. *Large Scale Constrained Modulus Test,* February 8. Retrieved from https://plasticpipe.org/pdf/ms-study-report.pdf. Retrieved on April 17, 2018.

# Appendix A.3

## Aerial and Viewsheds for the No Action and Proposed Action Alternatives

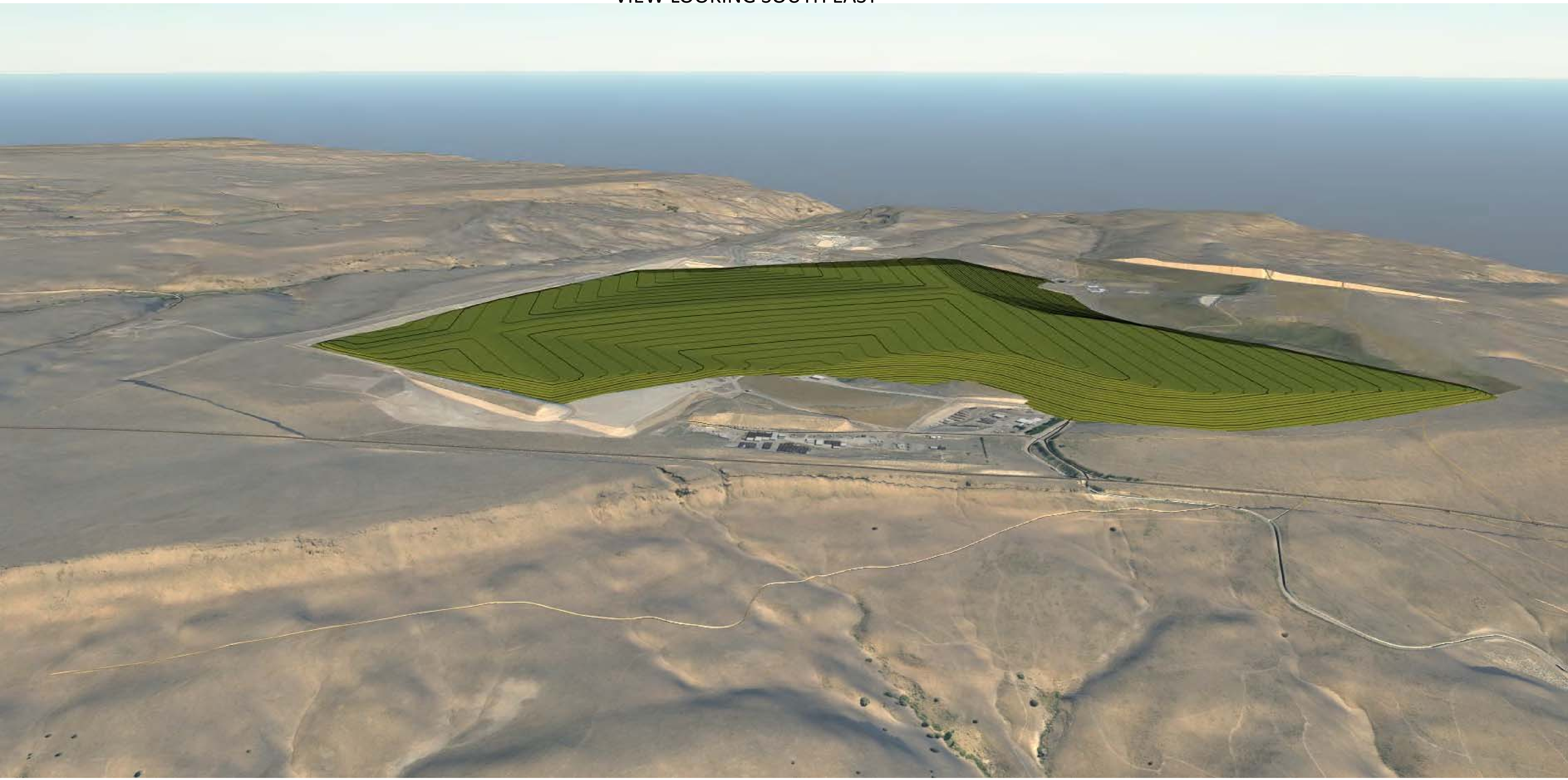
# AERIAL PERSPECTIVE – EXISTING CONDITIONS

VIEW LOOKING SOUTH EAST



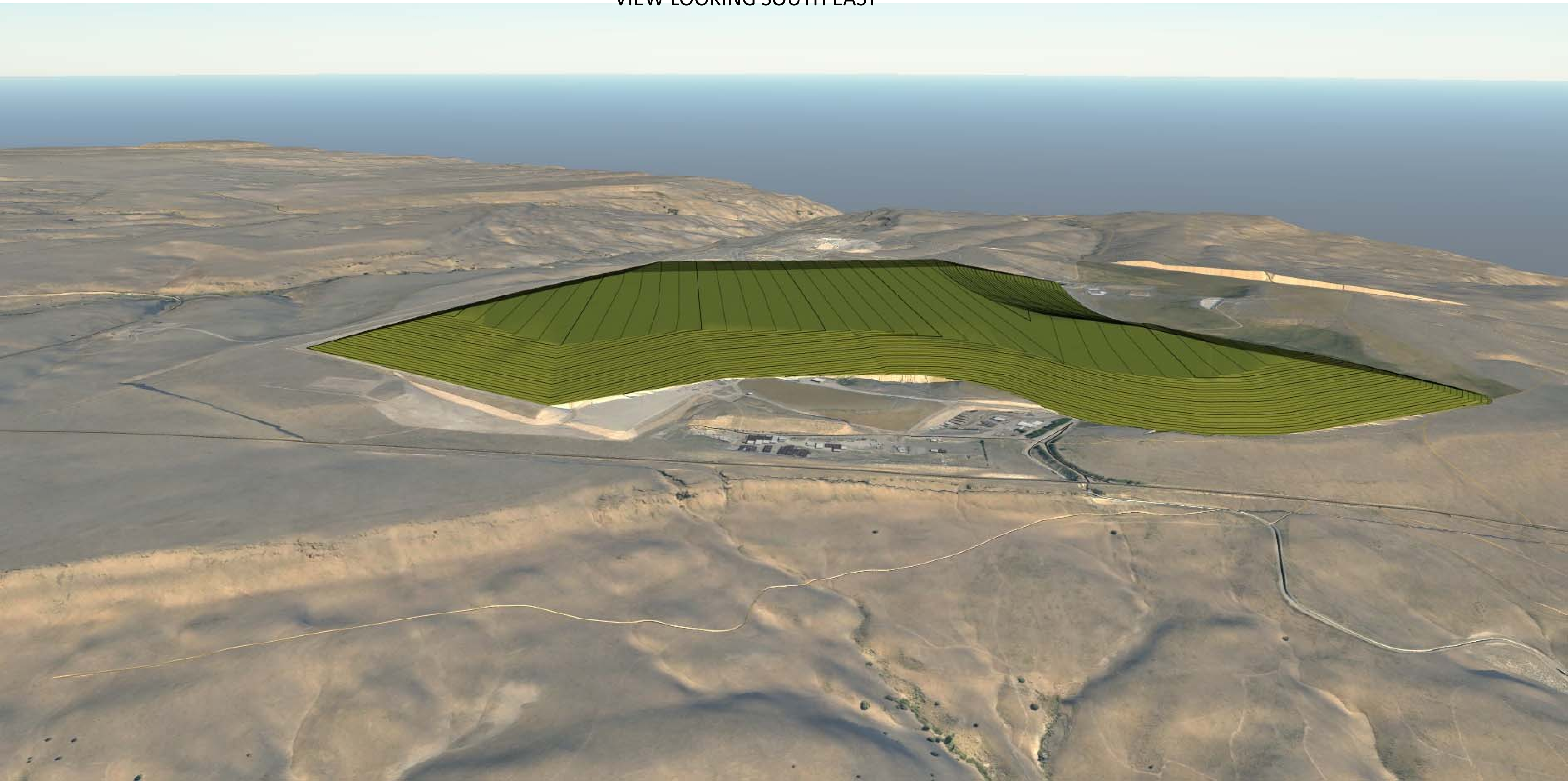
# AERIAL PERSPECTIVE – PERMITTED GRADES (No Action)

VIEW LOOKING SOUTH EAST



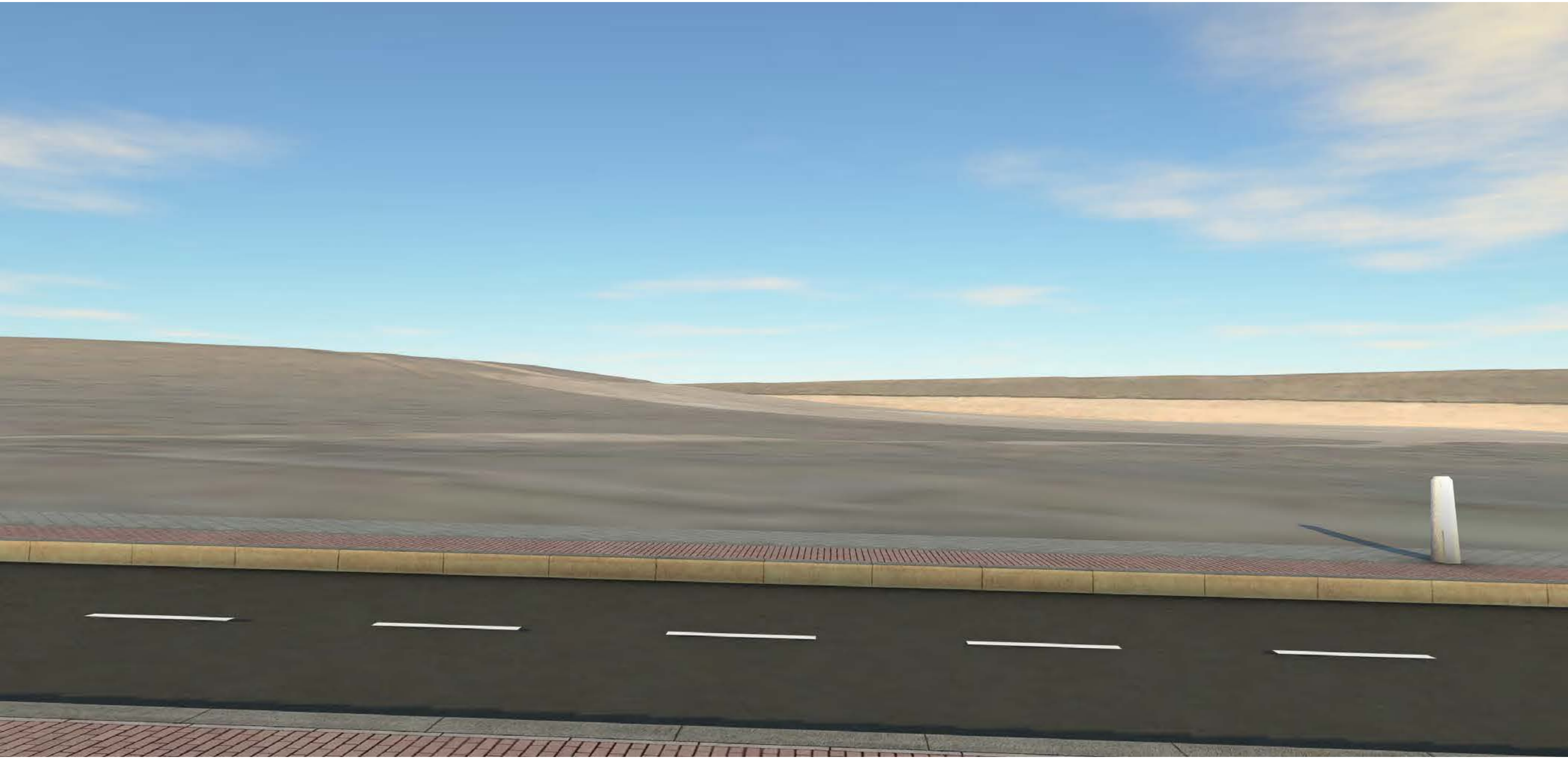
# AERIAL PERSPECTIVE – PROPOSED ACTION GRADES

VIEW LOOKING SOUTH EAST



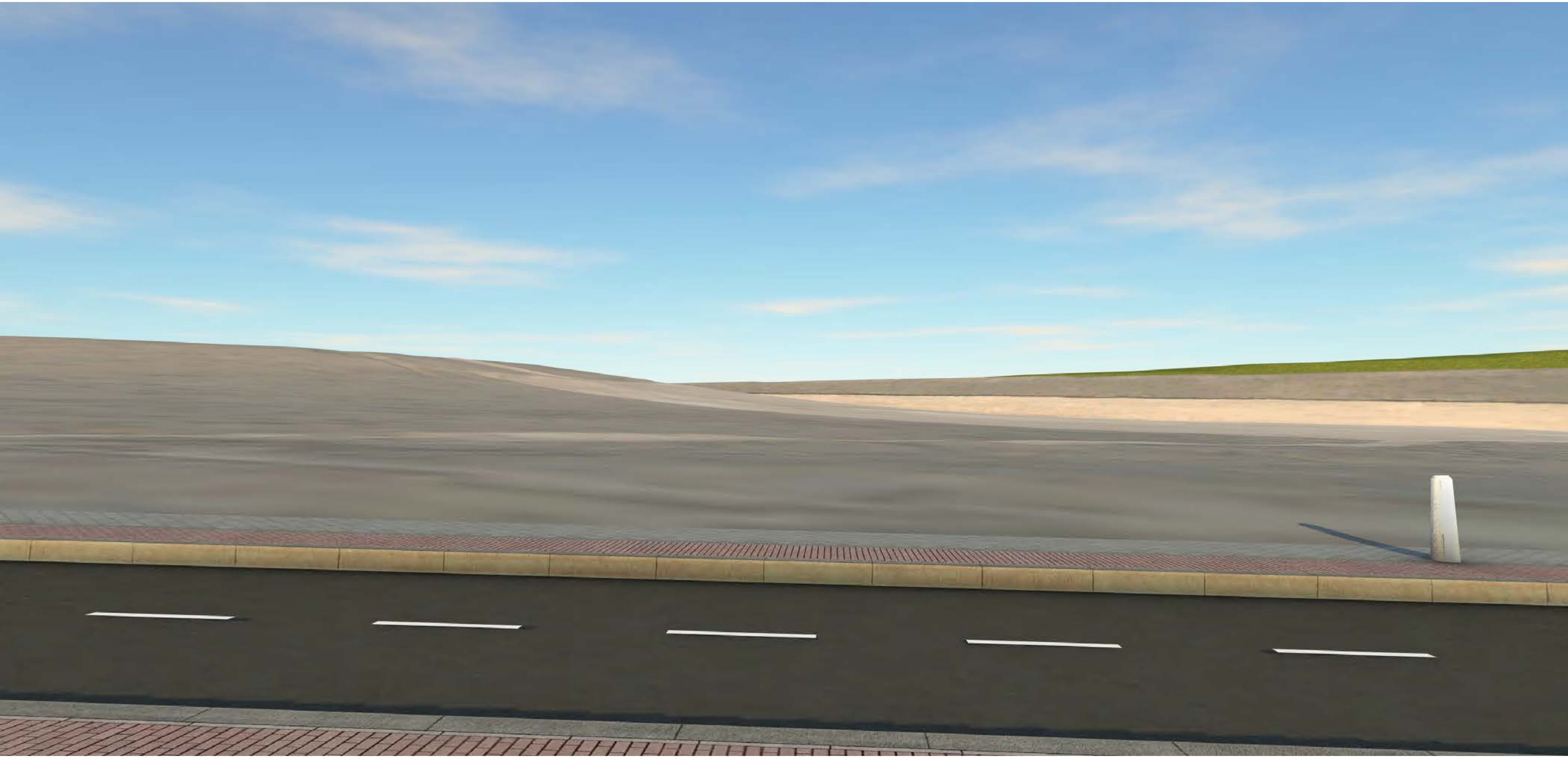
# VIEWPOINT 1 – EXISTING CONDITIONS

VIEW LOOKING EAST FROM EAST ROAD



# VIEWPOINT 1 – NO ACTION ALTERNATIVE

VIEW LOOKING EAST FROM EAST ROAD

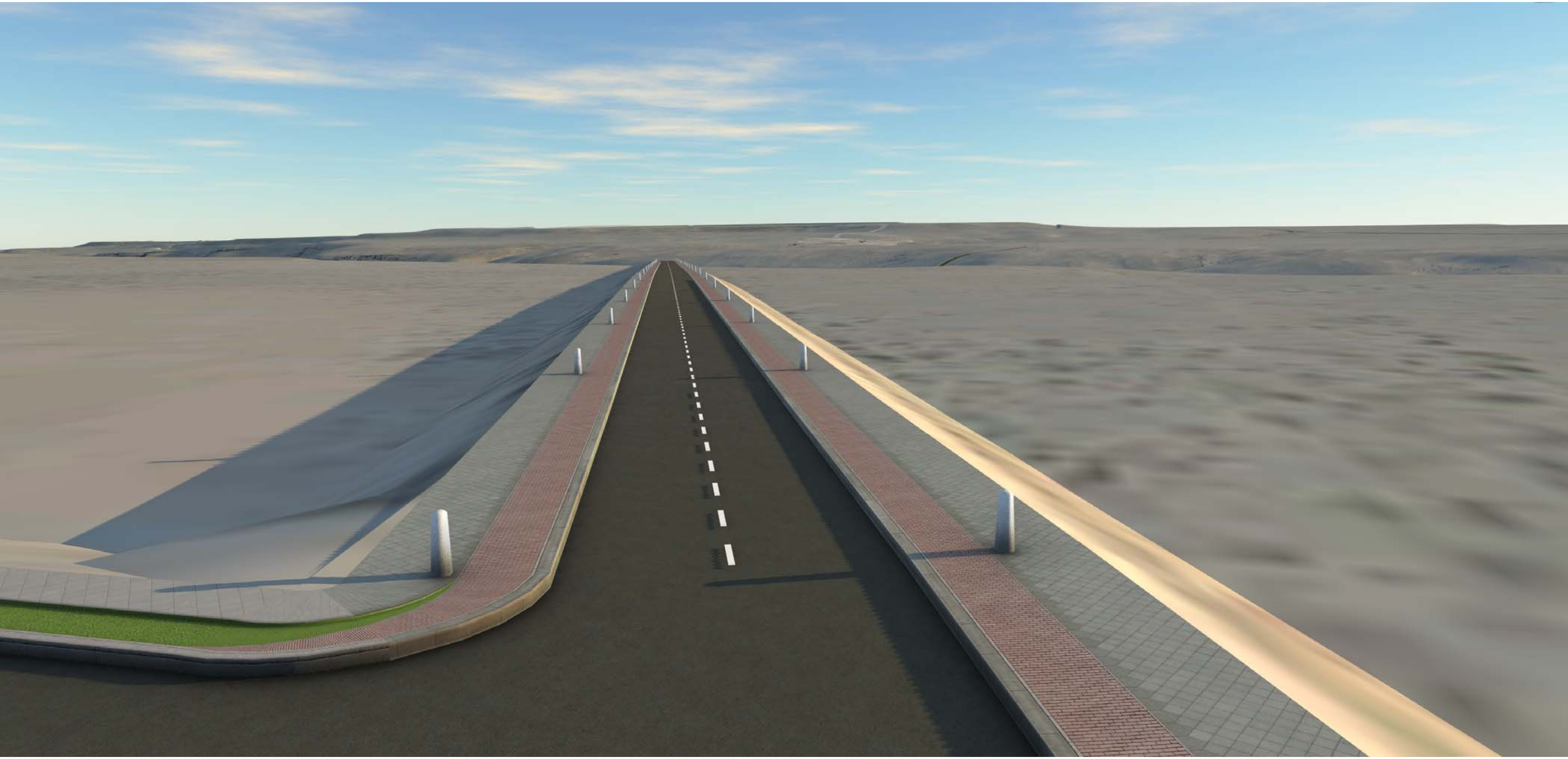


# VIEWPOINT 1 – PROPOSED ACTION ALTERNATIVE

VIEW LOOKING EAST FROM EAST ROAD

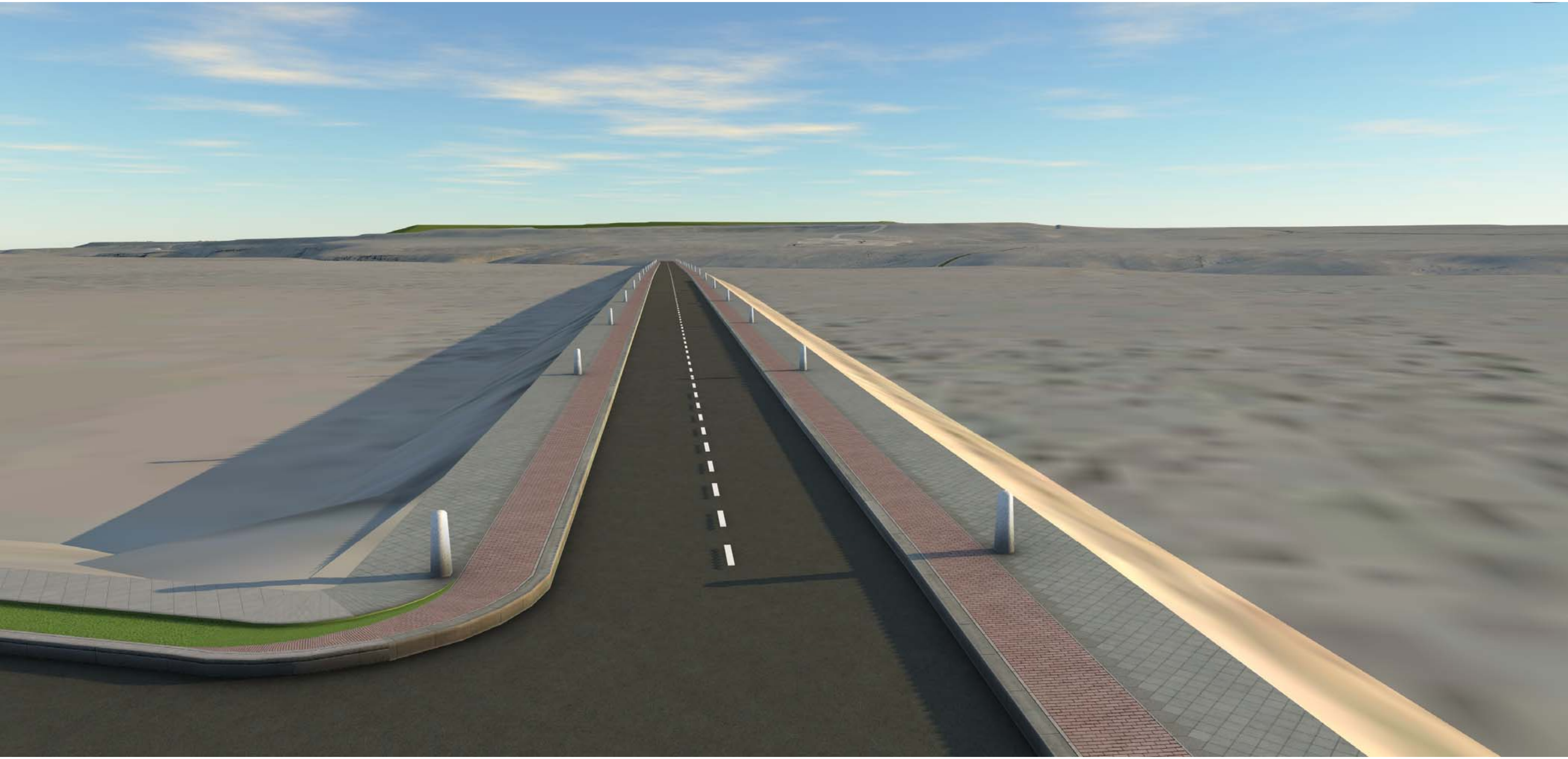
# VIEWPOINT 2 – EXISTING CONDITIONS

VIEW LOOKING SOUTH FROM THE INTERSECTION OF EAST ROAD AND SIX PRONG ROAD



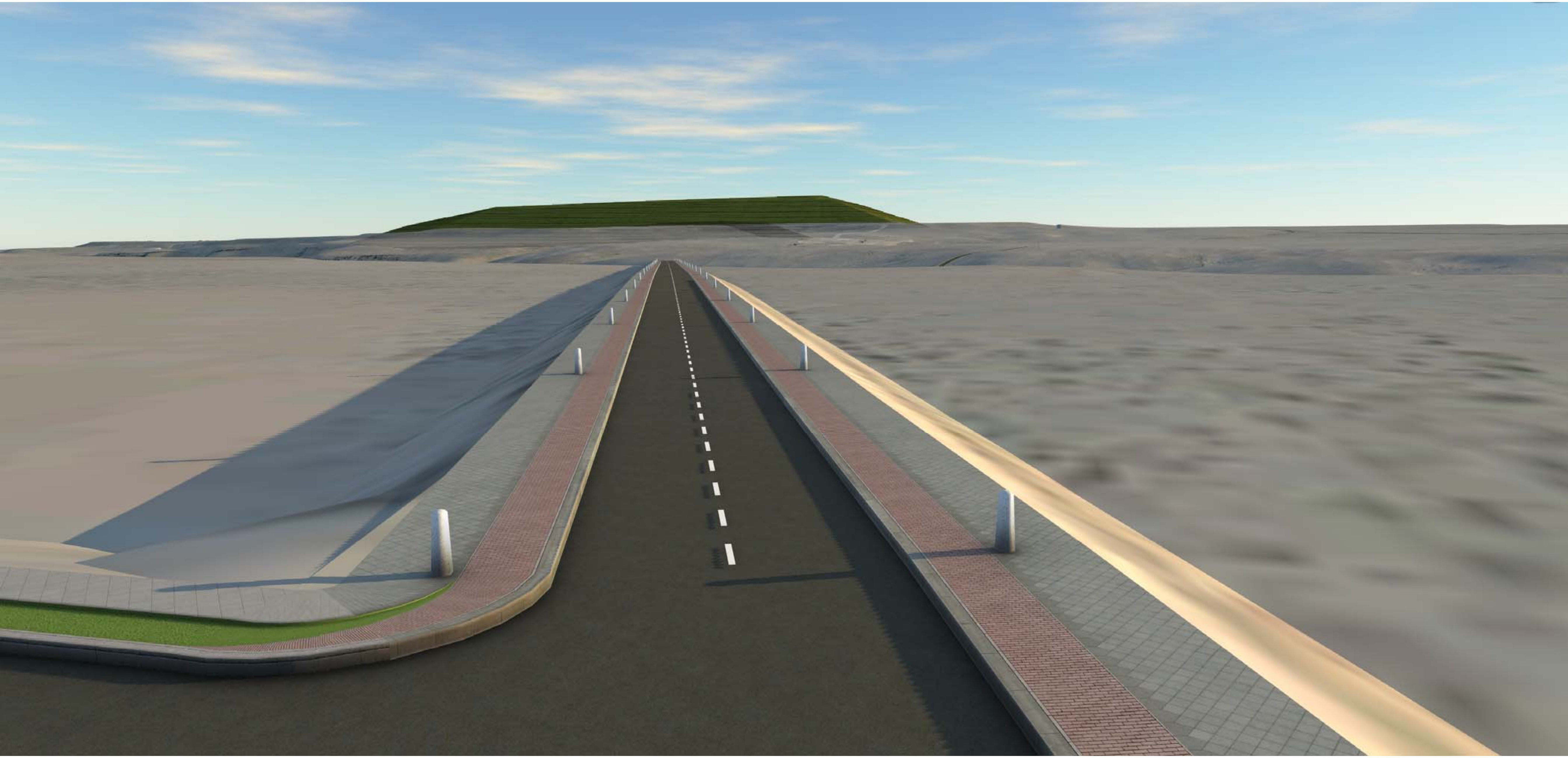
# VIEWPOINT 2 – NO ACTION ALTERNATIVE

VIEW LOOKING SOUTH FROM THE INTERSECTION OF EAST ROAD AND SIX PRONG ROAD



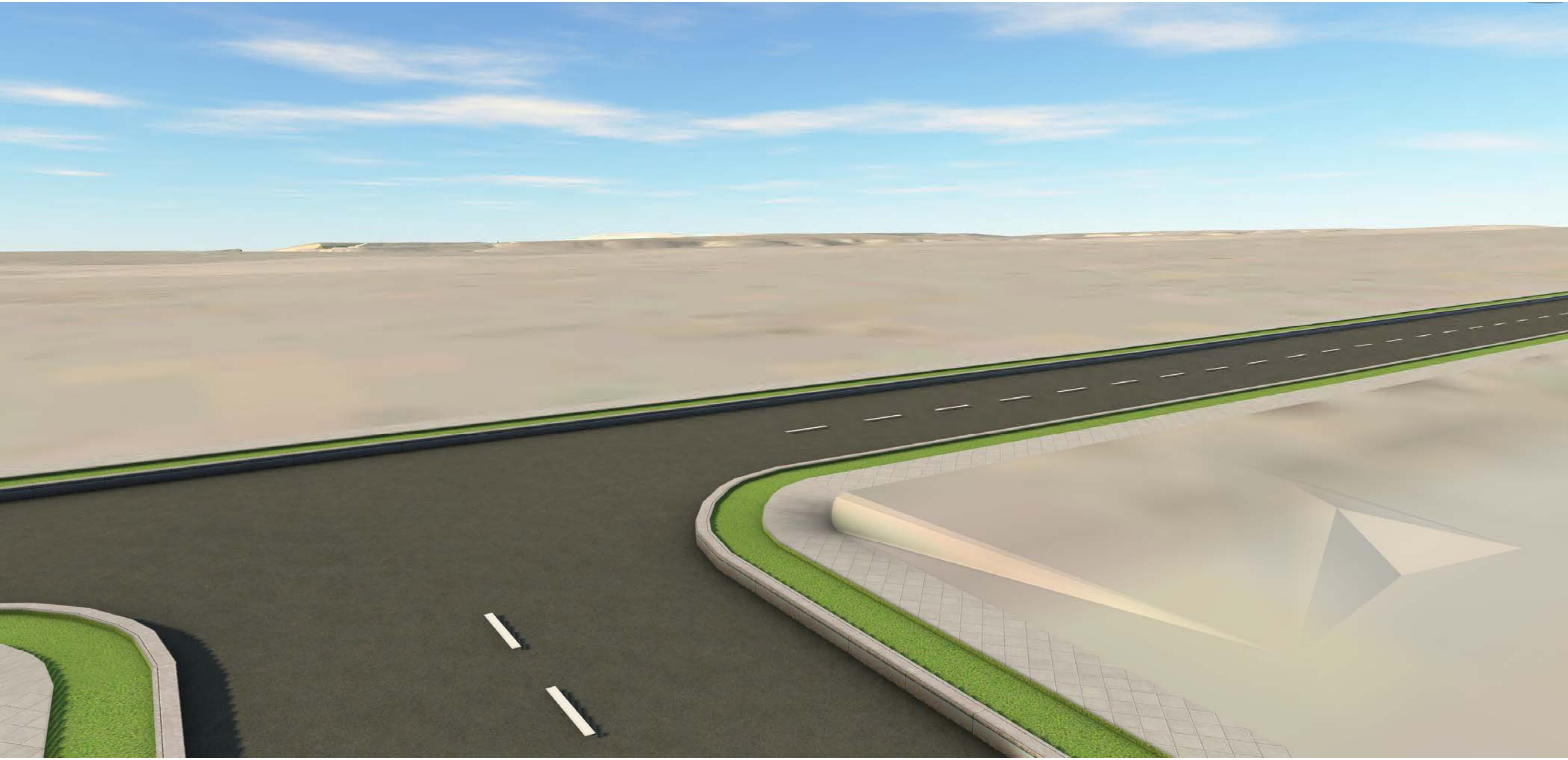
# VIEWPOINT 2 – PROPOSED ACTION ALTERNATIVE

VIEW LOOKING SOUTH FROM THE INTERSECTION OF EAST ROAD AND SIX PRONG ROAD



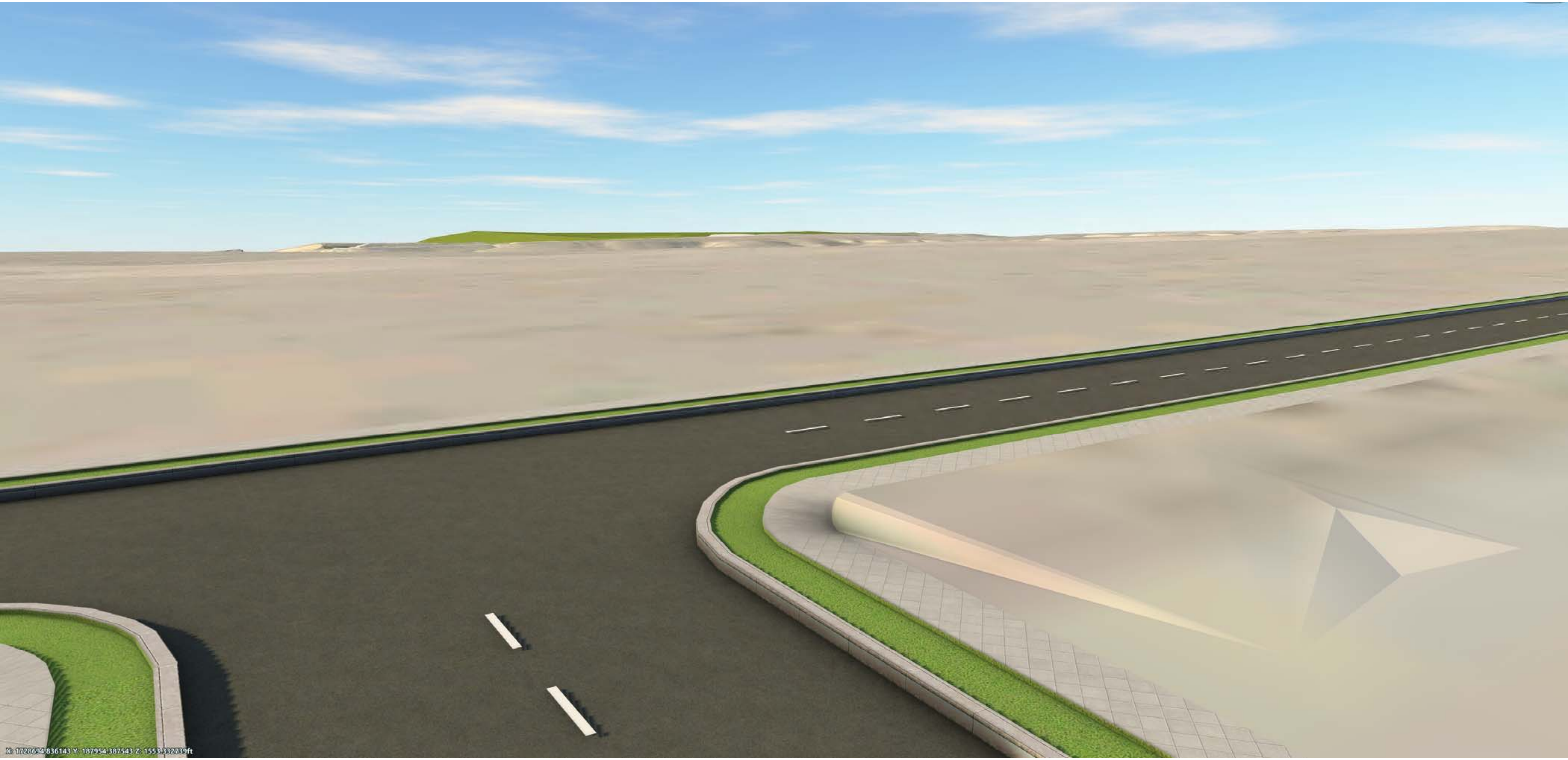
# VIEWPOINT 3 – EXISTING CONDITIONS

VIEW LOOKING SOUTH WEST FROM THE INTERSECTION OF SIX PRONG ROAD AND WHITMORE ROAD



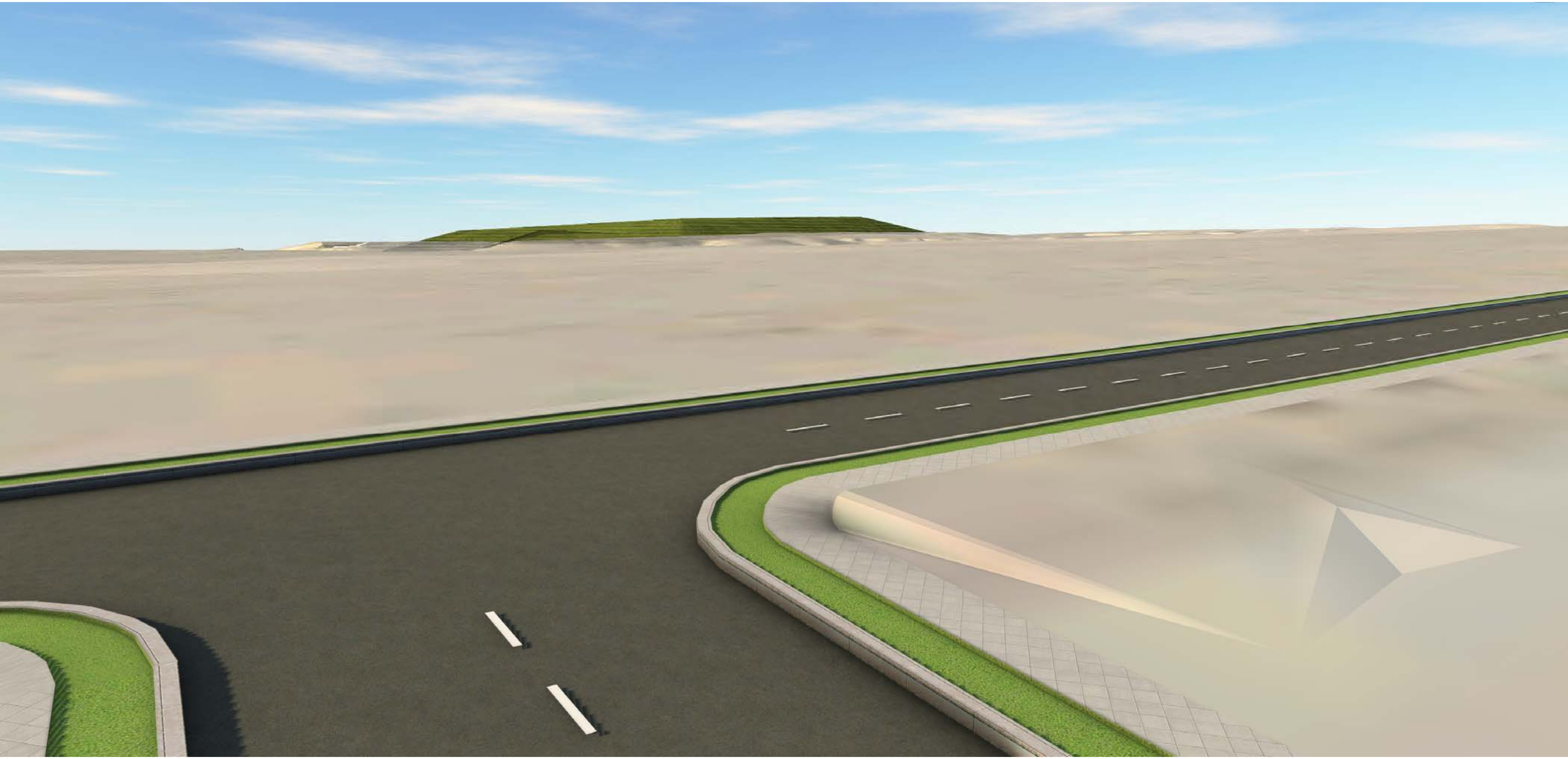
# VIEWPOINT 3 – NO ACTION ALTERNATIVE

VIEW LOOKING SOUTH WEST FROM THE INTERSECTION OF SIX PRONG ROAD AND WHITMORE ROAD



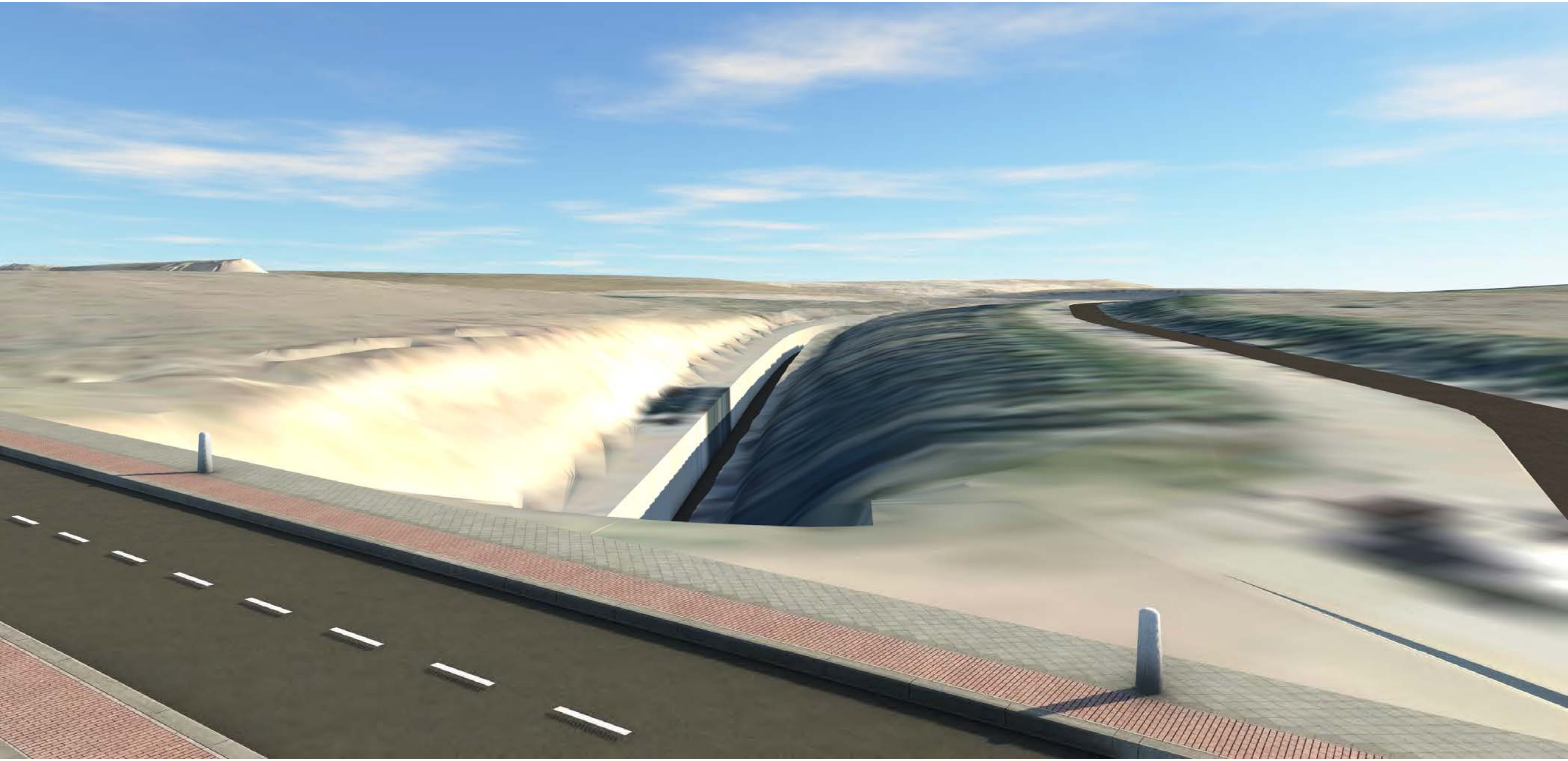
# VIEWPOINT 3 – PROPOSED ACTION ALTERNATIVE

VIEW LOOKING SOUTH WEST FROM THE INTERSECTION OF SIX PRONG ROAD AND WHITMORE ROAD



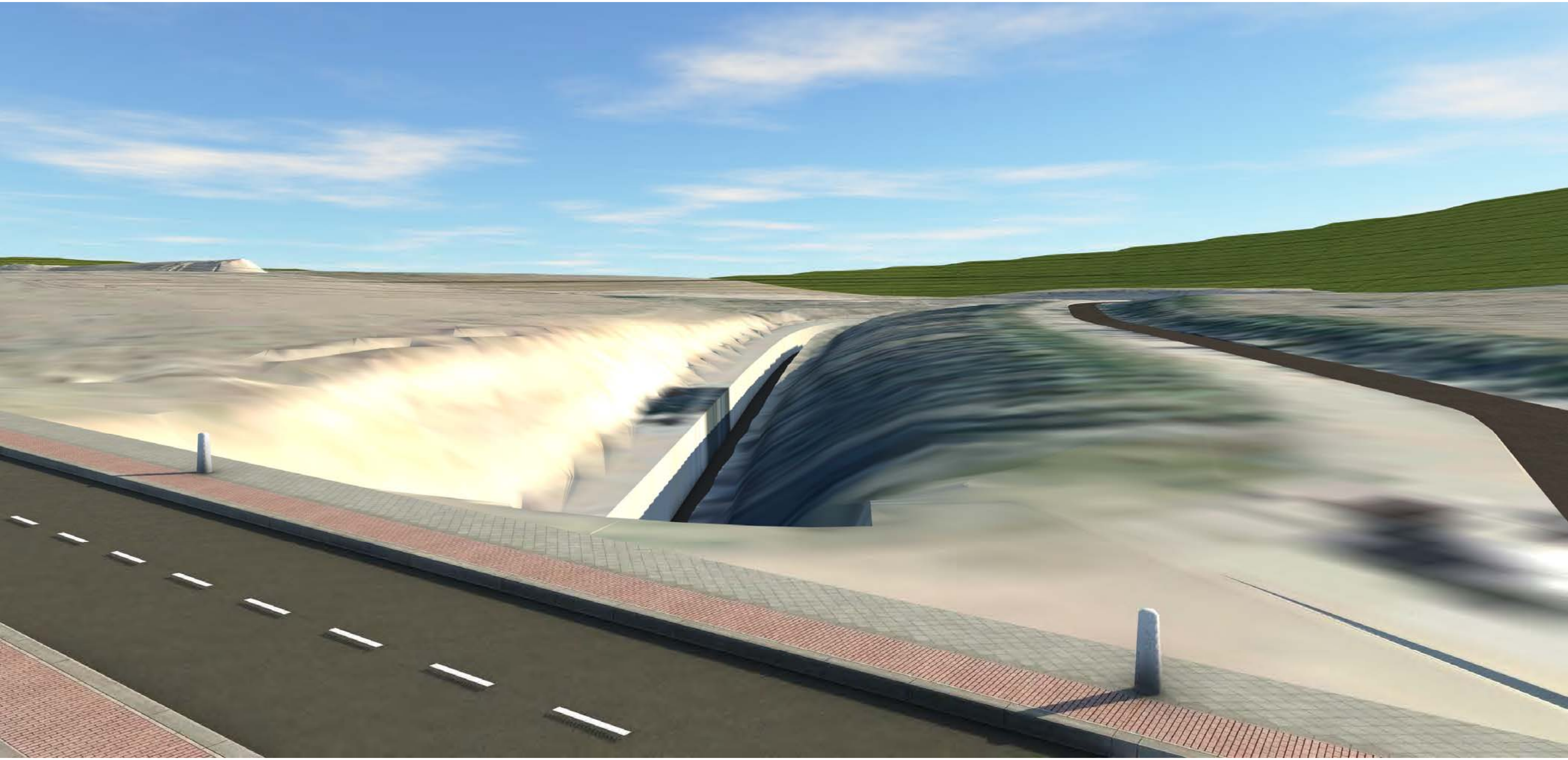
# VIEWPOINT 4 – EXISTING CONDITIONS

VIEW LOOKING NORTH EAST FROM THE INTERSECTION OF EAST ROAD AND THE FACILITY ENTRANCE



# VIEWPOINT 4 – NO ACTION ALTERNATIVE

VIEW LOOKING NORTH EAST FROM THE INTERSECTION OF EAST ROAD AND THE FACILITY ENTRANCE



# VIEWPOINT 4 – PROPOSED ACTION ALTERNATIVE

VIEW LOOKING NORTH EAST FROM THE INTERSECTION OF EAST ROAD AND THE FACILITY ENTRANCE