ENTECH
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**PAVEMENT DESIGN REPORT**
**STERLING RECYCLING FACILITY**
**STERLING RANCH ROAD**
**EL PASO COUNTY, COLORADO**

**PCD File No. PPR2241**

Prepared for:
**Rhetoric, LLC**
**20 Boulder Crescent, Suite 200**
**Colorado Springs, Colorado 80903**

Attn: Chaz Collins

April 29, 2026

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Lucas Morrison
Geotechnical Engineering Staff

Reviewed by:

COLORADO LICENSED PROFESSIONAL ENGINEER
JOSEPH C GOODE III
52381

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Date: 04/29/26

Joseph C. Goode III, P.E.
Sr. Engineer

LJM:JCG/ed

Entech Job No. 220394

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# 1 Introduction

Entech Engineering, Inc. (Entech) completed this pavement design report for Sterling Ranch Road at the Sterling Recycling Facility. This report describes the subsurface exploration program and laboratory testing program conducted for the proposed roadway improvements and provides pavement section alternatives and construction recommendations. Entech participated in this project as a subconsultant to Rhetoric, LLC. The contents of this report, including the pavement design recommendations, are subject to the limitations and assumptions presented in Section 7.

# 2 Project Description

The site is located southeast of the intersection of Vollmer Road and Marksheffel Road at the Sterling Recycling Facility, in El Paso County, Colorado (Figure 1). The proposed improvements include paving a portion of Sterling Ranch Road for the Sterling Recycling Facility southwest of Marksheffel Road. The extent of our investigation is shown in Figure 2.

At the time of our subsurface exploration program, the existing roadway was rough-graded, and utilities had been installed. Prior to drilling, utility installation and the associated fill were observed and tested by Entech personnel, and the fill within the utility trenches is considered controlled. Surrounding properties comprise an existing subdivision, existing commercial/industrial properties, and vacant land. Based on the development plans, Sterling Ranch Road is designated as a nonresidential collector.

# 3 Subsurface Explorations and Laboratory Testing

## 3.1 Subsurface Exploration Program

Subsurface conditions along Sterling Ranch Road were explored by three test borings, designated TB-1 through TB-3, drilled on March 12, 2026. The locations of the test borings are shown on the Site and Exploration Plan (Figure 2). The borings were drilled to depths of 5 to 10 feet below the existing ground surface (bgs). The drilling was performed using a truck-mounted drill rig utilizing continuous flight auger techniques, supplied and operated by Entech. Descriptive boring logs providing lithologies of the subsurface conditions encountered during drilling are presented in Appendix A. Groundwater levels were measured in each of the open boreholes at the conclusion of, and subsequent to, drilling.

Soil and bedrock samples were obtained from the borings utilizing the Standard Penetration Test (ASTM D1586) using a 2-inch outside diameter split spoon or a 2½-inch modified California sampler. Results of the Standard Penetration Test (SPT) are included on the boring logs in terms of N-values expressed in blows per foot (bpf). Soil samples recovered from the borings were visually classified and recorded on the boring logs. The soil classifications were later verified utilizing laboratory testing and grouped by soil type. The soil type numbers are included on the boring logs. It should be understood that the soil descriptions shown on the boring logs may vary between boring locations and sample depths. It should also be noted that the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil types, and the actual stratigraphic transitions may be more gradual or variable with location.

### 3.2 Geotechnical Index and Engineering Property Testing

Water content testing (ASTM D2216) was performed on the samples recovered from the borings, and the results are shown on the boring logs. Grain-size analysis (ASTM D422) and Atterberg limits testing (ASTM D4318) were performed on selected samples to assist in classifying the materials encountered in the borings. One-dimensional swell/collapse testing (ASTM D4546) was performed to evaluate the expansive characteristics and collapse potential of the cohesive material found on-site. Soluble sulfate testing was performed on select soil samples to evaluate the potential for below-grade degradation of concrete due to sulfate attack.

For pavement design, a Modified Proctor (ASTM D1557) and a California Bearing Ratio (CBR) test (ASTM D1883) were completed. Soluble sulfate testing was performed on select soil samples to evaluate the potential for below-grade degradation of concrete due to sulfate attack. The laboratory testing results are presented in Appendix B and summarized in Table B-1.

## 4 Subgrade Conditions

Two primary soil types and two bedrock types were encountered in the test borings drilled for the subsurface investigation. Each soil and bedrock type was classified in accordance with the Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO) soil classification system using the laboratory testing results and the observations made during drilling.

## 4.1 Subsurface Conditions

Subsurface conditions along the proposed roadway consisted of medium dense silty sand to sand with silt fill (Soil Type 1, A-1-b, A-2-4) from the existing ground surface to depths of 3 to 5 feet bgs. Native medium dense sand with silt (Soil Type 2, A-1-b) was encountered underlying Soil Type 1 in borings TB-1 and TB-2. Sandstone bedrock, or clayey-silty sand when classified as a soil (Soil Type 3, AASHTO A-1-b), was encountered underlying Soil Type 1 in boring TB-3 at a depth of 3 feet and extended to the termination depth of the boring. Claystone bedrock, or sandy clay when classified as a soil (Soil Type 4, AASHTO A-6), was encountered underlying Soil Type 2 in boring TB-2 at a depth of 6 feet and extended to the termination depth of the boring.

Laboratory test results are presented in Appendix B and are summarized in Table B-1.

## 4.2 Groundwater

Groundwater was not encountered in the test borings. Groundwater fluctuations are possible and will depend on seasonal variations, local precipitation, runoff, and other factors; however, we do not anticipate that groundwater will affect the proposed roadway construction.

# 5 Pavement Design Recommendations

Pavement design recommendations were made in accordance with the *El Paso County Engineering Criteria Manual (ECM).*

## 5.1 Subgrade Conditions

California Bearing Ratio (CBR) testing was performed on a representative sample of the pavement subgrade, sand with silt fill (Soil Type 1) from TB-1, to determine the support characteristics of the subgrade soils for the roadway section. The results of the CBR testing are presented in Appendix B and summarized in Exhibit 1.

**Exhibit 1: Subsurface Laboratory Testing Summary**

| Design Parameter | Value |
|---|---|
| Soil Type | 1 – Sand with Silt Fill |
| CBR at 95% | 114.8 |
| Design CBR | 10 |
| Liquid Limit | NV |
| Plasticity Index | NP |
| Percent Passing 200 | 9.0 |
| AASHTO Classification | A-1-b |
| Group Index | 0 |
| Unified Soils Classification | SM |

### 5.2 Swell Mitigation

El Paso County requires swell mitigation of expansive soils criteria for soils with swell testing results greater than 2% under a surcharge of 150 pounds per square foot (psf). One swell test at a depth of 10 feet resulted in a swell of 1.4% and is considered to be below the zone of influence for the proposed roadway. Based on the swell testing completed and given the classification of the soils, mitigation for expansive soils is not required on this site.

### 5.3 Traffic Loading

Traffic data is not available for Sterling Ranch Road for the Sterling Recycling Facility; however, the roadway is classified as an urban nonresidential collector roadway based on current development plans. The *El Paso County Engineering Criteria Manual* provides default 18-kip equivalent single axle loadings (ESAL) based on the street classification. For design, a default ESAL value of 821,000 was used for the urban nonresidential collector designation.

### 5.4 Pavement Design

The pavement sections were determined utilizing the *El Paso County Engineering Criteria Manual*, the CBR testing, and default ESAL. Design parameters used in the pavement analysis are presented in Exhibit 2.

**Exhibit 2: Pavement Design Parameters**

| Design Parameter | Value |
|---|---|
| Reliability | 85% |
| Standard Deviation | 0.45 |
| Serviceability Loss ($\Delta$ psi) | 2.0 |
| Design CBR | 10 |
| Resilient Modulus | 15,000 psi |
| Structural Coefficients | |
| Hot Bituminous Pavement | 0.44 |
| Aggregate Base Course | 0.11 |
| Recycled Concrete Base | 0.11 |

Pavement section alternatives recommended for Sterling Ranch Road are summarized in Exhibit 3. The pavement design calculations are presented in Appendix C.

**Exhibit 3: Recommended Pavement Sections**

| Pavement Area | Design ESAL | Alternative [1] |
|---|---|---|
| Sterling Ranch Road | 821,000 | 1. 4.0 inches HMA over 8.0 inches ABC/RCB |

*ABC = Aggregate Base Course; ESAL = Equivalent Single Axle Loads; HMA = Hot Mix Asphalt; RCB = Recycled Concrete Base*

Notes:

1. All pavement alternatives meet the minimum sections required per the *El Paso County Engineering Criteria Manual.*

## 6 Construction Recommendations

Pavement design recommendations provided herein are contingent on good construction practices, and poor construction techniques may result in poor performance. Our analyses assumed that this project would be constructed according to the *El Paso County Engineering Criteria Manual* and the *Pikes Peak Region Asphalt Paving Specifications*.

### 6.1 Earthwork Recommendations for Pavement Subgrade

Proper subgrade preparation is required for adequate pavement performance. Paving areas should be cleared of all deleterious materials, including but not limited to existing pavements, utility poles, and fence poles. Surface vegetation, if any, should be removed by stripping, with the depth to be field-determined.

We do not anticipate issues with the subgrade in regard to shallow water, frost-susceptible soils, groundwater or drainage conditions, or cold weather construction.

### 6.1.1 Subgrade Preparation

The final subgrade surface should be scarified to a depth of 8 inches, moisture conditioned within +/- 2% of the optimum water content, and recompacted to 95% of the Modified Proctor (ASTM D1557) maximum dry density.

The compacted surface below pavements should be proof rolled with a fully loaded, tandem-axle, 10-yard dump truck or equivalent. Any areas that are delineated to be soft, loose, or yielding during proof rolling should be removed and reconditioned, or replaced.

### 6.1.2 Fill Placement and Compaction

Granular fill placed as part of the pavement subgrade shall consist of nonexpansive, granular soil, free of organic matter, unsuitable materials, debris, and cobbles greater than 3 inches in diameter. Additionally, any granular fill placed as part of the roadway subgrade should have a minimum CBR of 10. All granular fill placed within the pavement subgrade should be compacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density at +/-2% of optimum moisture content. Fill material should be placed in horizontal lifts such that each finished lift has a compacted thickness of 6 inches or less. Entech should approve any imported fill to be used within the pavement subgrade area prior to delivery to the site.

### 6.1.3 Aggregate Base Course and Recycled Concrete Base

Aggregate base course (ABC) or recycled concrete base (RCB) materials shall conform to the *El Paso County Standard Specifications Manual*, Appendix D, Table D-6. ABC or RCB materials should be compacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density within +/-2% of optimum moisture content.

## 6.2 Concrete Degradation Due to Sulfate Attack

Sulfate solubility testing was conducted on several samples recovered from the test borings to evaluate the potential for sulfate attack on concrete. The test results indicated less than 0.01% soluble sulfate (by weight). The test results indicate the sulfate component of the in-place soils presents a low exposure threat to concrete placed below the site grade.

Type 1L cement is recommended for concrete on the site. To further avoid concrete degradation during construction, it is recommended that concrete not be placed on frozen or wet ground. Care should be taken to prevent the accumulation or ponding of water on the subgrade prior to the placement of concrete. If standing water is present on the subgrade, it should be removed by ditching to sumps and pumping the water away from the pavement area prior to concrete placement. If concrete is placed during periods of cold temperatures, the concrete must be kept from freezing. This may require covering the concrete with insulated blankets and adding heat to prohibit freezing.

### 6.3 Construction Observation

Subgrade preparation for pavement structures should be observed by Entech in order to verify that (1) no anomalies are present, (2) materials similar to those described in this report have been encountered or placed, and (3) no soft spots, expansive or organic soil, or debris are present in the pavement subgrade prior to paving.

## 7 Closure

The subsurface investigation, geotechnical evaluation, and recommendations presented in this report are intended for use by Rhetoric, LLC, with application to the paving of Sterling Ranch Road within the Sterling Recycling Facility, in El Paso County, Colorado. In conducting the subsurface investigation, laboratory testing, engineering evaluation, and reporting, Entech Engineering, Inc. endeavored to work in accordance with generally accepted professional geotechnical and geologic practices and principles consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession currently practicing in the same locality and under similar conditions. No other warranty, express or implied, is made. During final design and/or construction, if conditions are encountered that appear different from those described in this report, Entech Engineering, Inc. requests to be notified so that the evaluation and recommendations presented herein can be reviewed and modified as appropriate.

If there are any questions regarding the information provided herein, or if Entech Engineering, Inc. can be of further assistance, please do not hesitate to contact us.


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**VICINITY MAP**

STERLING RECYCLING FACILITY
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JOB NO.
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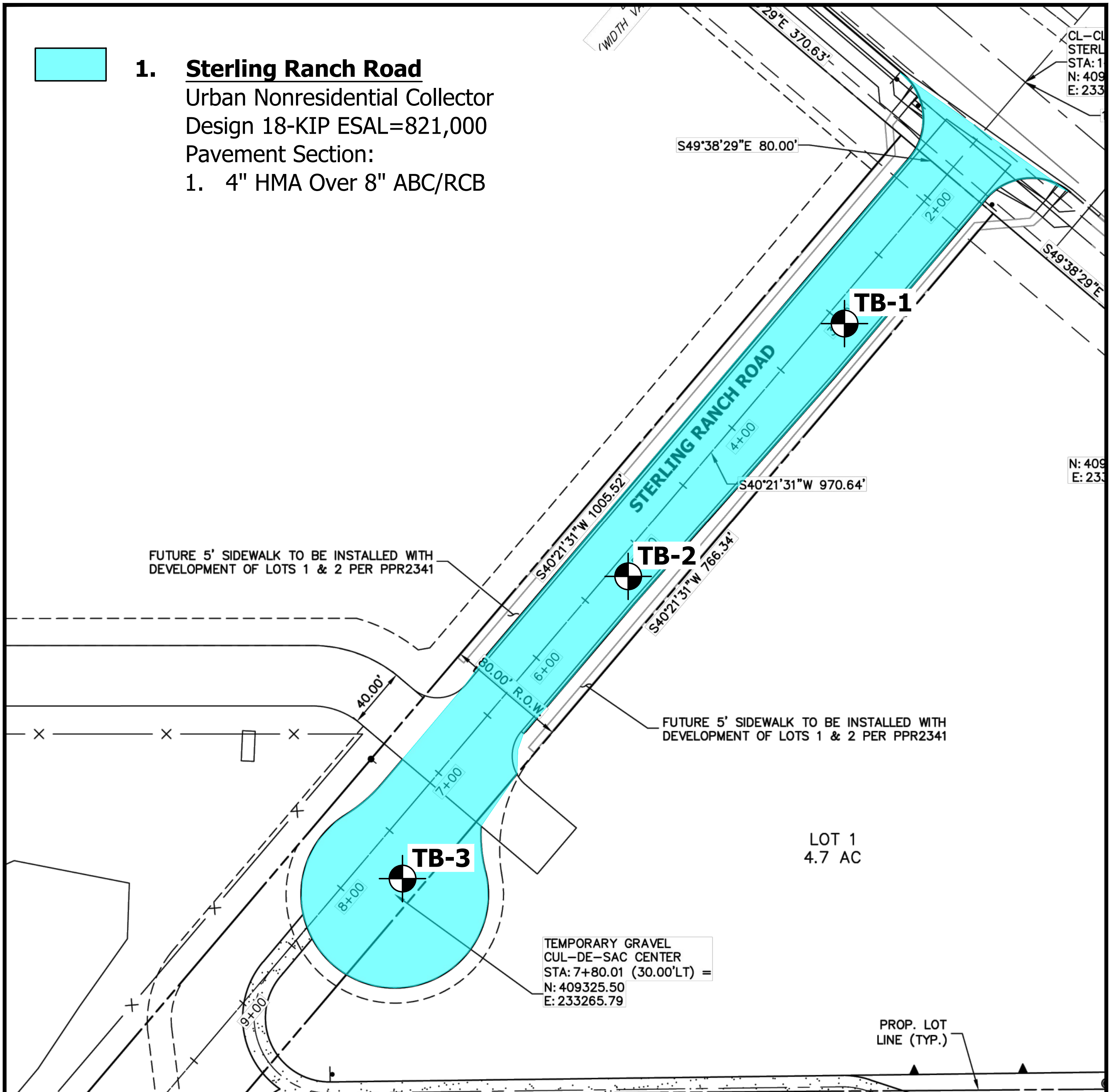
**FIG. 1**




- ROADWAYS INCLUDED WITH THIS INVESTIGATION

TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

SCALE: 0 50 100

N

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## SITE AND EXPLORATION PLAN

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FIG. 2

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# APPENDIX A: Test Boring Logs

TEST BORING 1
DATE DRILLED 3/12/2026

REMARKS

DRY TO 5', 3/12/26

| Description | Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|---|---|---|---|---|---|---|
| FILL 0-4', SAND, WITH SILT, TAN to BROWN, MEDIUM DENSE, MOIST | | | | 18 | 8.4 | 1 |
| SAND, WITH SILT, TAN, MEDIUM DENSE, MOIST | 5 | | | 21 | 7.8 | 2 |
| | 10 | | | | | |
| | 15 | | | | | |
| | 20 | | | | | |

TEST BORING 2
DATE DRILLED 3/12/2026

REMARKS

DRY TO 10', 3/12/26

| Description | Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|---|---|---|---|---|---|---|
| FILL 0-4', SAND, WITH SILT, TAN to BROWN, MEDIUM DENSE, MOIST | | | | 26 | 9.7 | 1 |
| SAND, WITH SILT, TAN, MEDIUM DENSE, MOIST | 5 | | | 13 | 11.9 | 2 |
| CLAYSTONE, VERY WEAK, GRAY, MODERATELY WEATHERED (CLAY, SANDY, HARD, MOIST) | | | | | | |
| | 10 | | | 50/6" | 11.9 | 4 |
| | 15 | | | | | |
| | 20 | | | | | |

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**TEST BORING LOGS**

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**FIG. A-1**

TEST BORING 3
DATE DRILLED 3/12/2026
REMARKS

DRY TO 5', 3/12/26

| Description | Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|---|---|---|---|---|---|---|
| FILL 0-3', SAND, SILTY, TAN, MEDIUM DENSE, MOIST | | | | 20 | 10.9 | 1 |
| SANDSTONE, VERY WEAK, GRAY, HIGHLY WEATHERED (SAND, CLAYEY-SILTY, VERY DENSE, MOIST) | 5 | | | 50/11" | 9.8 | 3 |
| | 10 | | | | | |
| | 15 | | | | | |
| | 20 | | | | | |

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## TEST BORING LOGS

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**FIG. A-2**

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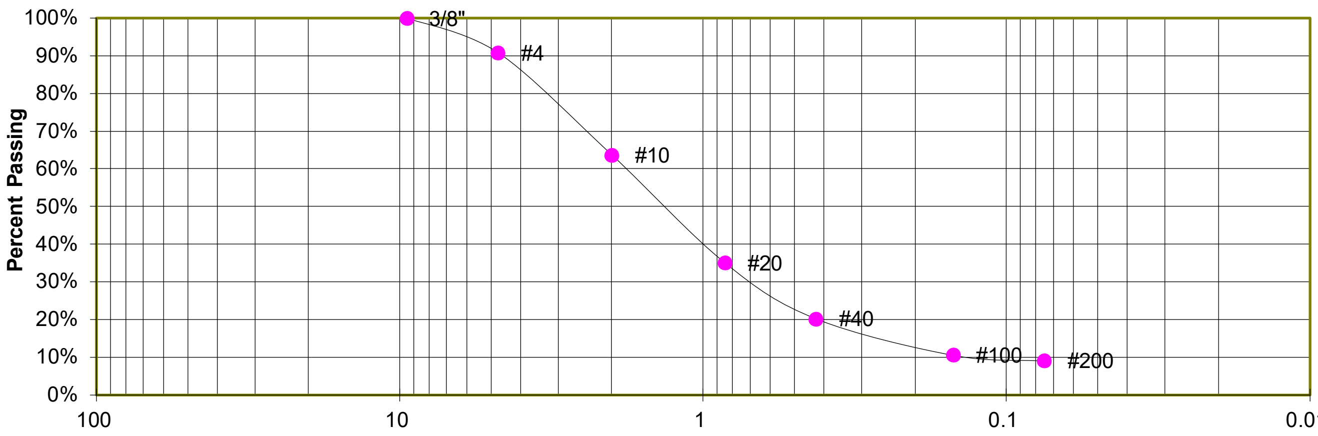
# APPENDIX B: Laboratory Test Results

# TABLE B-1
## SUMMARY OF LABORATORY TEST RESULTS

| SOIL TYPE | TEST BORING NO. | DEPTH (FT) | WATER (%) | DRY DENSITY (PCF) | PASSING NO. 200 SIEVE (%) | LIQUID LIMIT | PLASTIC LIMIT | PLASTIC INDEX | SULFATE (WT %) | SWELL/ COLLAPSE (%) | AASHTO CLASS. (GROUP INDEX) | USCS | SOIL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1, CBR | 1 | 0-3 | 4.9 | | 9.0 | NV | NP | NP | | | A-1-b (0) | SW-SM | FILL, SAND, WITH SILT |
| 1 | 1 | 1-2 | 7.4 | | 6.1 | NV | NP | NP | | | A-1-b (0) | SW-SM | FILL, SAND, WITH SILT |
| 1 | 2 | 1-2 | 9.2 | | 8.6 | NV | NP | NP | <0.01 | | A-1-b (0) | SW-SM | FILL, SAND, WITH SILT |
| 1 | 3 | 1-2 | 11.1 | | 23.9 | 25 | 22 | 3 | | | A-2-4 (0) | SM | FILL, SAND, SILTY |
| 2 | 1 | 5 | 8.2 | | 8.1 | NV | NP | NP | 0.00 | | A-1-b (0) | SW-SM | SAND, WITH SILT |
| 3 | 3 | 5 | 7.8 | | 21.4 | 24 | 19 | 5 | 0.00 | | A-1-b (0) | SC-SM | SANDSTONE (SAND, CLAYEY-SILTY) |
| 4 | 2 | 10 | 11.0 | 117.6 | 51.7 | 32 | 20 | 12 | 0.00 | 1.4 | A-6 (3) | CL | CLAYSTONE (CLAY, SANDY) |

Project: Sterling Recycling Facility
Client: Rhetoric, LLC
Job No: 220394

| TEST BORING | 1 | SOIL DESCRIPTION | FILL, SAND, WITH SILT |
|---|---|---|---|
| DEPTH (FT) | 0-3 | SOIL TYPE | 1, CBR |




***GRAIN SIZE ANALYSIS***

| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 90.8% |
| 10 | 63.6% |
| 20 | 35.1% |
| 40 | 20.2% |
| 100 | 10.6% |
| 200 | 9.0% |

***ATTERBERG LIMITS***

| | |
|---|---|
| Plastic Limit | NP |
| Liquid Limit | NV |
| Plastic Index | NP |

***SOIL CLASSIFICATION***

USCS CLASSIFICATION: SW-SM
AASHTO CLASSIFICATION: A-1-b
AASHTO GROUP INDEX: 0

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**LABORATORY TEST RESULTS**

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JOB NO.
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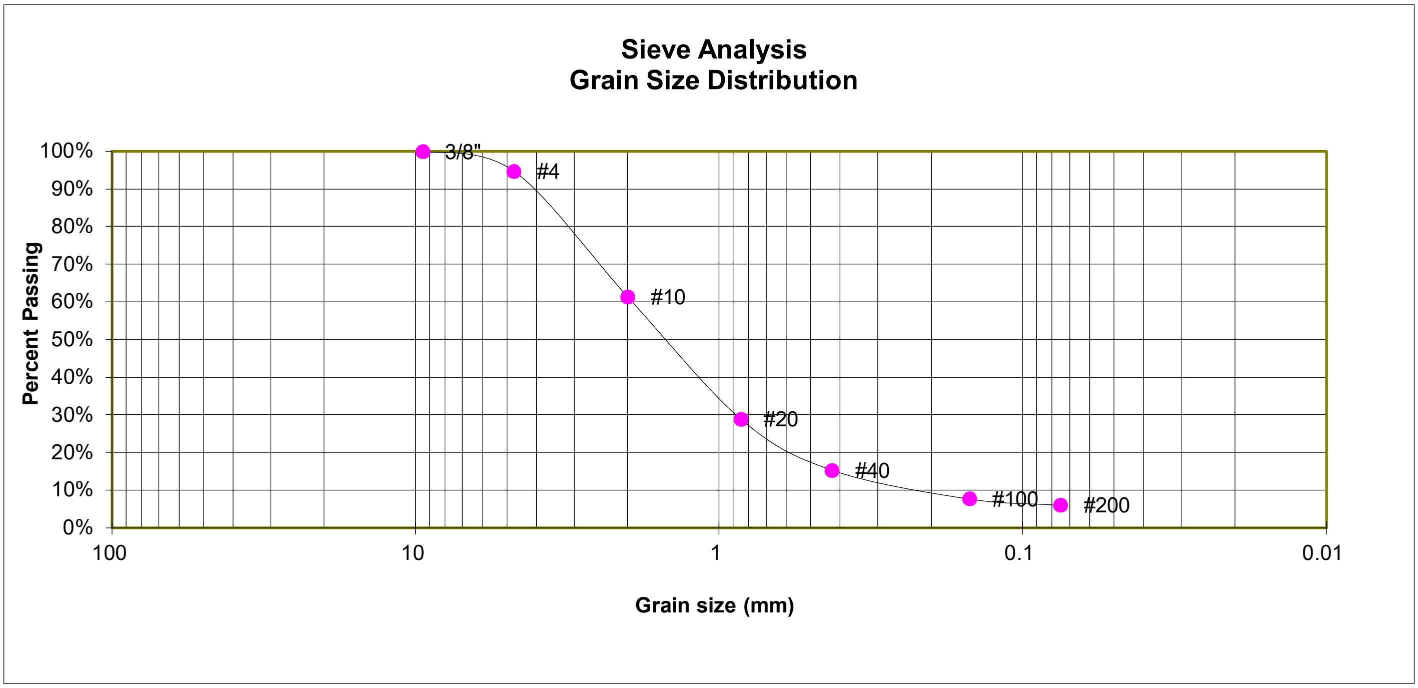
**FIG. B-1**

| | | | |
|---|---|---|---|
| TEST BORING | 1 | SOIL DESCRIPTION | FILL, SAND, WITH SILT |
| DEPTH (FT) | 1-2 | SOIL TYPE | 1 |




***GRAIN SIZE ANALYSIS***

| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 94.8% |
| 10 | 61.4% |
| 20 | 29.0% |
| 40 | 15.3% |
| 100 | 7.7% |
| 200 | 6.1% |

***ATTERBERG LIMITS***

| | |
|---|---|
| Plastic Limit | NP |
| Liquid Limit | NV |
| Plastic Index | NP |

***SOIL CLASSIFICATION***

USCS CLASSIFICATION: SW-SM
AASHTO CLASSIFICATION: A-1-b
AASHTO GROUP INDEX: 0

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**LABORATORY TEST RESULTS**

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JOB NO.
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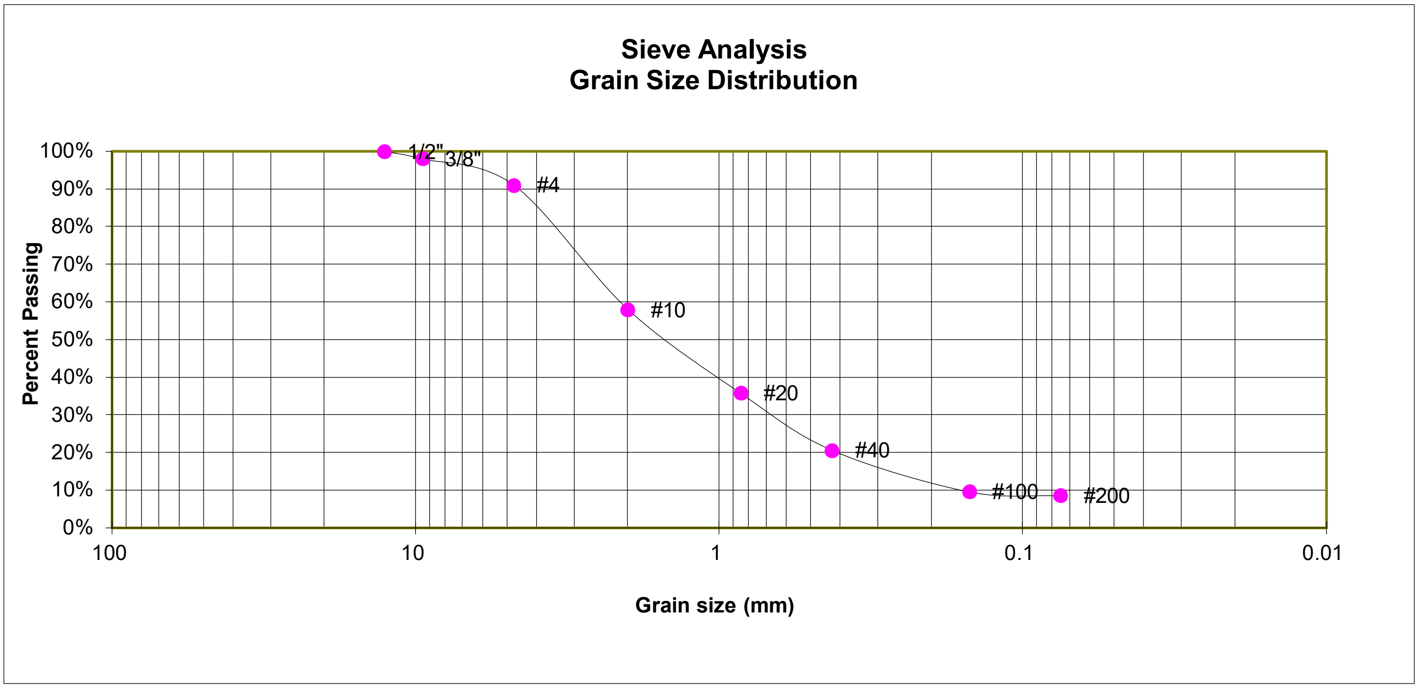
**FIG. B-2**

| TEST BORING | 2 | SOIL DESCRIPTION | FILL, SAND, WITH SILT |
|---|---|---|---|
| DEPTH (FT) | 1-2 | SOIL TYPE | 1 |




***GRAIN SIZE ANALYSIS***

| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | 100.0% |
| 3/8" | 98.1% |
| 4 | 91.0% |
| 10 | 58.0% |
| 20 | 35.8% |
| 40 | 20.6% |
| 100 | 9.7% |
| 200 | 8.6% |

***ATTERBERG LIMITS***

| | |
|---|---|
| Plastic Limit | NP |
| Liquid Limit | NV |
| Plastic Index | NP |

***SOIL CLASSIFICATION***

USCS CLASSIFICATION: SW-SM
AASHTO CLASSIFICATION: A-1-b
AASHTO GROUP INDEX: 0

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**LABORATORY TEST RESULTS**

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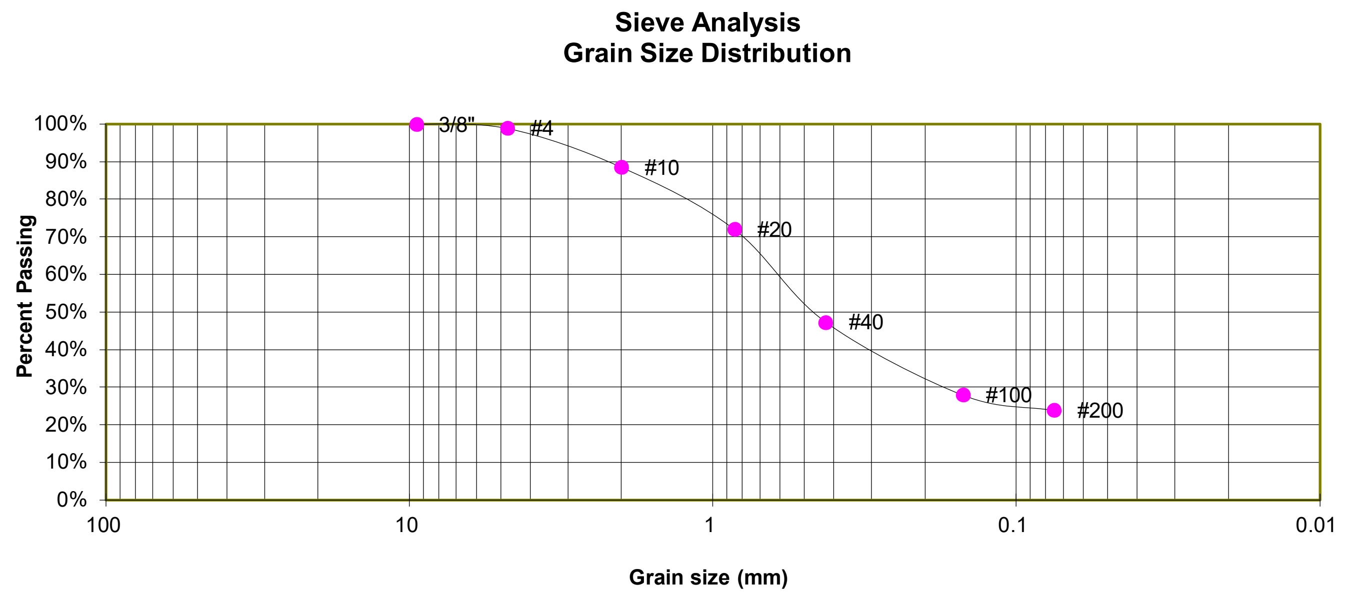
**FIG. B-3**

| | | | |
|---|---|---|---|
| TEST BORING | 3 | SOIL DESCRIPTION | FILL, SAND, SILTY |
| DEPTH (FT) | 1-2 | SOIL TYPE | 1 |




***GRAIN SIZE ANALYSIS***

| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 98.9% |
| 10 | 88.6% |
| 20 | 72.0% |
| 40 | 47.3% |
| 100 | 28.0% |
| 200 | 23.9% |

***ATTERBERG LIMITS***

| | |
|---|---|
| Plastic Limit | 22 |
| Liquid Limit | 25 |
| Plastic Index | 3 |

***SOIL CLASSIFICATION***

| | |
|---|---|
| USCS CLASSIFICATION: | SM |
| AASHTO CLASSIFICATION: | A-2-4 |
| AASHTO GROUP INDEX: | 0 |

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**LABORATORY TEST RESULTS**

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JOB NO.
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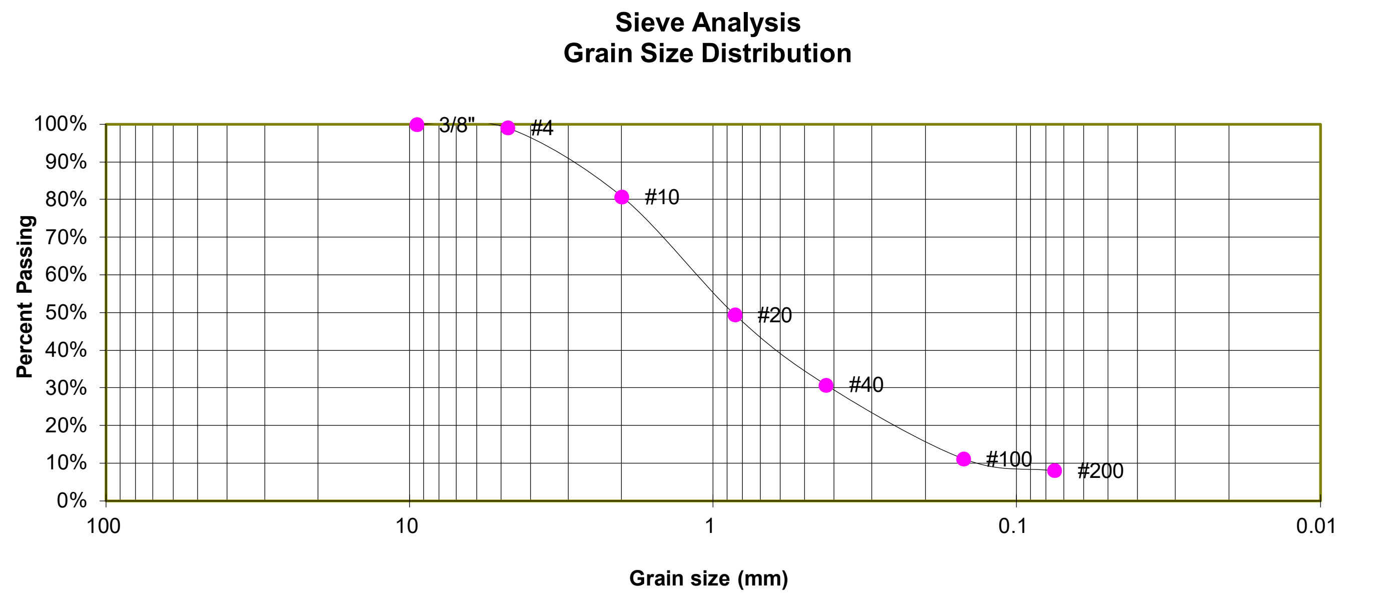
**FIG. B-4**

| TEST BORING | 1 | SOIL DESCRIPTION | SAND, WITH SILT |
|---|---|---|---|
| DEPTH (FT) | 5 | SOIL TYPE | 2 |




***GRAIN SIZE ANALYSIS***

| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 99.1% |
| 10 | 80.8% |
| 20 | 49.5% |
| 40 | 30.8% |
| 100 | 11.2% |
| 200 | 8.1% |

***ATTERBERG LIMITS***

| | |
|---|---|
| Plastic Limit | NP |
| Liquid Limit | NV |
| Plastic Index | NP |

***SOIL CLASSIFICATION***

USCS CLASSIFICATION: SW-SM
AASHTO CLASSIFICATION: A-1-b
AASHTO GROUP INDEX: 0

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**LABORATORY TEST RESULTS**

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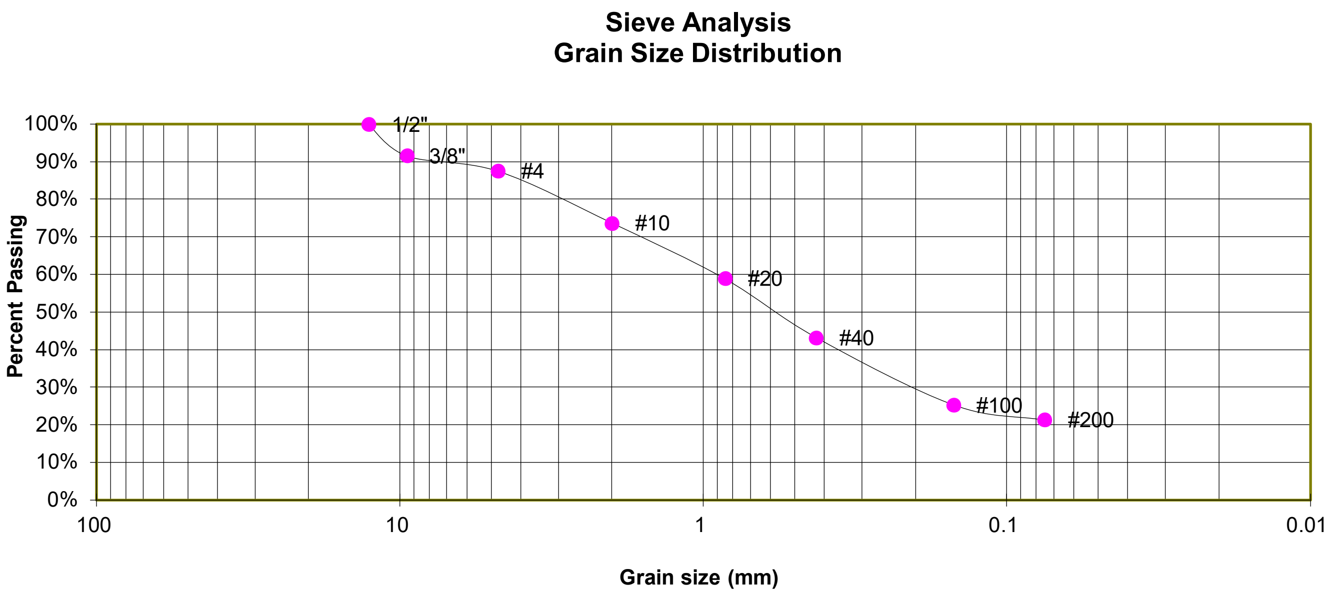
**FIG. B-5**

| TEST BORING | 3 | SOIL DESCRIPTION | SANDSTONE (SAND, CLAYEY-SILTY |
|---|---|---|---|
| DEPTH (FT) | 5 | SOIL TYPE | 3 |




***GRAIN SIZE ANALYSIS***

| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | 100.0% |
| 3/8" | 91.6% |
| 4 | 87.5% |
| 10 | 73.7% |
| 20 | 58.9% |
| 40 | 43.2% |
| 100 | 25.4% |
| 200 | 21.4% |

***ATTERBERG LIMITS***

| | |
|---|---|
| Plastic Limit | 19 |
| Liquid Limit | 24 |
| Plastic Index | 5 |

***SOIL CLASSIFICATION***

| | |
|---|---|
| USCS CLASSIFICATION: | SC-SM |
| AASHTO CLASSIFICATION: | A-1-b |
| AASHTO GROUP INDEX: | 0 |

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**LABORATORY TEST RESULTS**

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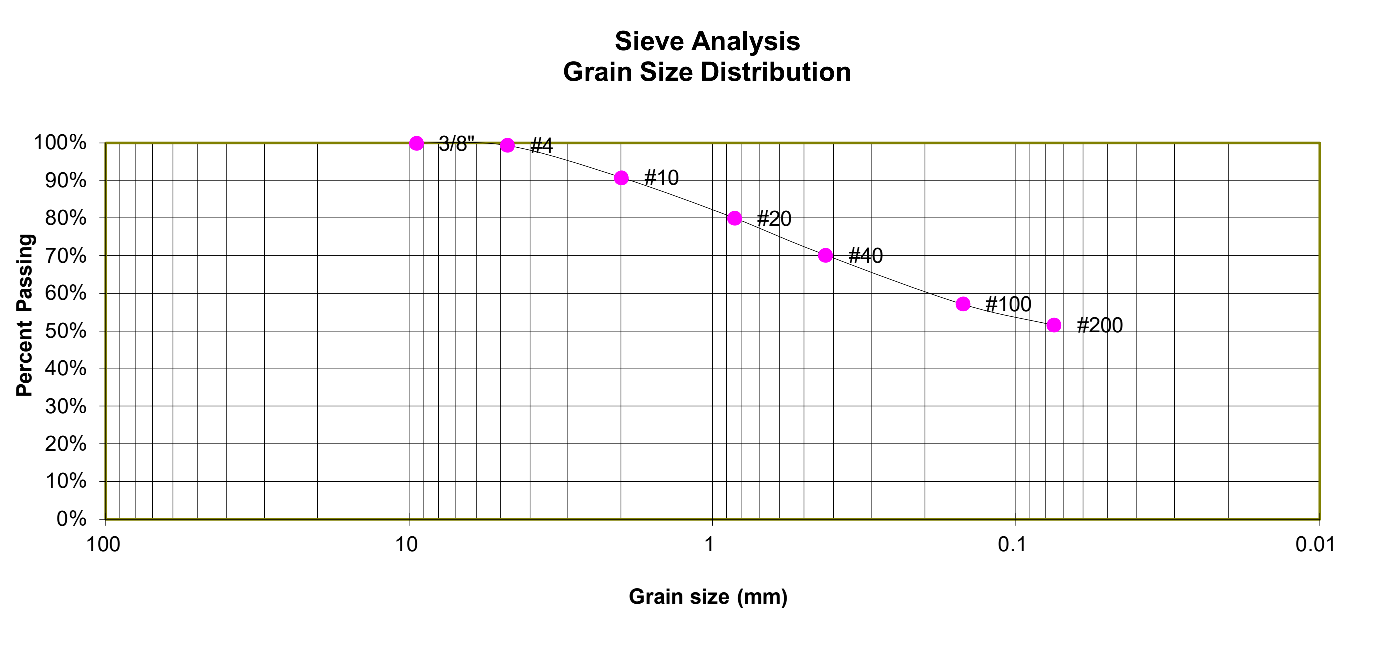
**FIG. B-6**

| | | | |
|---|---|---|---|
| TEST BORING | 2 | SOIL DESCRIPTION | CLAYSTONE (CLAY, SANDY) |
| DEPTH (FT) | 10 | SOIL TYPE | 4 |




***GRAIN SIZE ANALYSIS***

| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 99.4% |
| 10 | 90.9% |
| 20 | 80.1% |
| 40 | 70.2% |
| 100 | 57.2% |
| 200 | 51.7% |

***ATTERBERG LIMITS***

| | |
|---|---|
| Plastic Limit | 20 |
| Liquid Limit | 32 |
| Plastic Index | 12 |

***SOIL CLASSIFICATION***

| | |
|---|---|
| USCS CLASSIFICATION: | CL |
| AASHTO CLASSIFICATION: | A-6 |
| AASHTO GROUP INDEX: | 3 |

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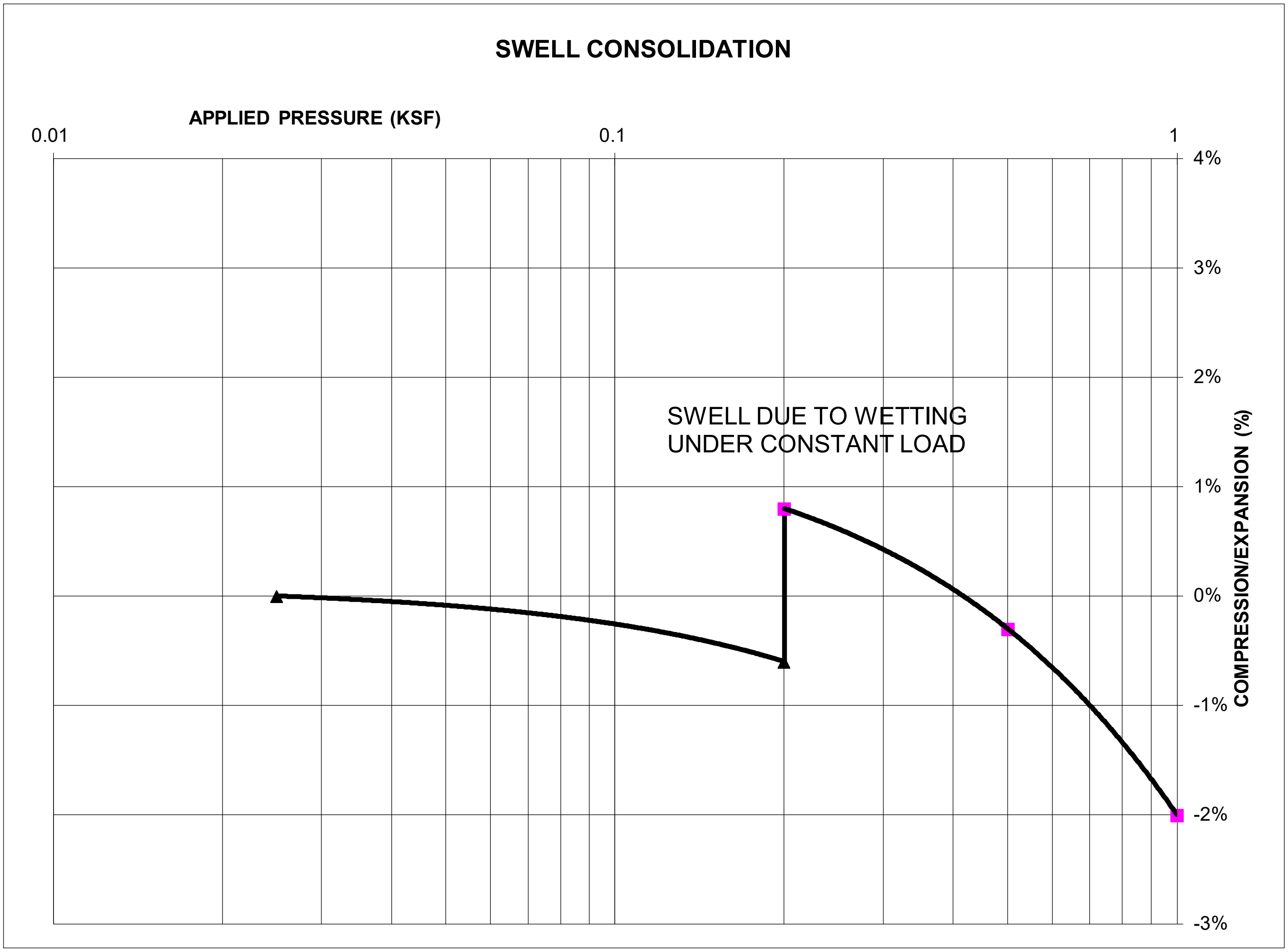
**LABORATORY TEST RESULTS**

STERLING RECYCLING FACILITY
RHETORIC, LLC

JOB NO.
220394

**FIG. B-7**

| | | | |
|---|---|---|---|
| TEST BORING | 2 | SOIL DESCRIPTION | CLAYSTONE (CLAY, SANDY) |
| DEPTH (FT) | 10 | SOIL TYPE | 4 |




***SWELL/COLLAPSE TEST RESULTS***

| | |
|---|---|
| NATURAL UNIT DRY WEIGHT (PCF): | 118 |
| NATURAL MOISTURE CONTENT: | 11.0% |
| SWELL/COLLAPSE (%): | 1.4% |

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**SWELL TEST RESULTS**

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**FIG. B-8**

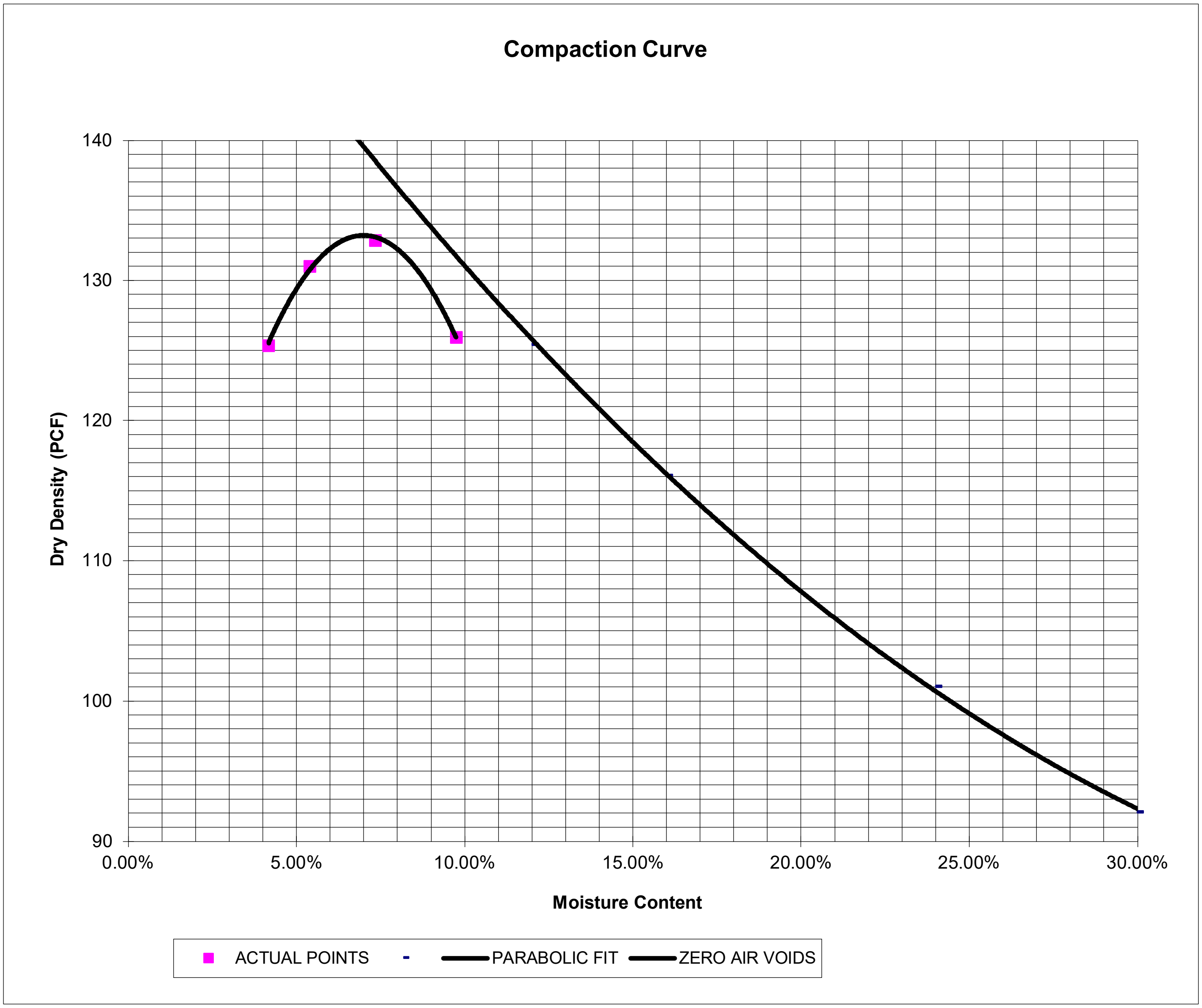
SAMPLE LOCATION TB-1 @ 0-3'

SOIL DESCRIPTION FILL, SAND, WITH SILT, TAN

SOIL TYPE 1

***PROCTOR DATA***

| | |
|---|---|
| IDENTIFICATION: | SM |
| PROCTOR TEST #: | 1 |
| TEST BY: | DK |
| TEST DESIGNATION: | ASTM-1557-A |
| MAXIMUM DRY DENSITY (PCF): | 133.1 |
| OPTIMUM MOISTURE: | 7 |

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**LABORATORY TEST RESULTS**

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**FIG. B-9**

| SAMPLE LOCATION TB-1 @ 0-3' | SOIL DESCRIPTION FILL, SAND, WITH SILT, TAN<br>SOIL TYPE 1 |
|---|---|

***CBR TEST LOAD DATA***

Piston Diameter (cm): 4.958
Piston Area ($in^2$): 2.993

| Penetration Depth (inches) | *10 BLOWS* Mold # 1 Load (lbs) | Stress (psi) | *25 BLOWS* Mold # 2 Load (lbs) | Stress (psi) | *56 BLOWS* Mold # 3 Load (lbs) | Stress (psi) |
|---|---|---|---|---|---|---|
| 0.000 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| 0.025 | 290 | 96.91 | 472 | 157.73 | 2180 | 728.49 |
| 0.050 | 422 | 141.02 | 702 | 234.59 | 3032 | 1013.20 |
| 0.075 | 481 | 160.73 | 831 | 277.69 | 3290 | 1099.41 |
| 0.100 | 545 | 182.12 | 1003 | 335.17 | 3594 | 1201.00 |
| 0.125 | 688 | 229.91 | 1174 | 392.31 | 3910 | 1306.60 |
| 0.150 | 785 | 262.32 | 1297 | 433.42 | 4174 | 1394.82 |
| 0.175 | 860 | 287.38 | 1419 | 474.18 | 4477 | 1496.07 |
| 0.200 | 929 | 310.44 | 1537 | 513.62 | 4780 | 1597.32 |
| 0.300 | 1096 | 366.25 | 1924 | 642.94 | 5598 | 1870.67 |
| 0.400 | 1238 | 413.70 | 2166 | 723.81 | 6000 | 2005.01 |
| 0.500 | 1356 | 453.13 | 2525 | 843.77 | | |

***MOISTURE AND DENSITY DATA***

| | Mold # 1 | Mold # 2 | Mold # 3 |
|---|---|---|---|
| Can # | 500 | 501 | 2 |
| Wt. Can | 8.37 | 8.34 | 8.22 |
| Wt. Can+Wet | 261.1 | 257.82 | 248.33 |
| Wt. Can+Dry | 235.04 | 234.6 | 230.46 |
| Wt. H20 | 26.06 | 23.22 | 17.87 |
| Wt. Dry Soil | 226.67 | 226.26 | 222.24 |
| Moisture Content | 11.50% | 10.26% | 8.04% |
| Wet Density (PCF) | 125.0 | 129.3 | 135.7 |
| Dry Density (PCF) | 116.8 | 120.9 | 126.8 |
| % Compaction | 88% | 91% | 95% |
| CBR | 18.21 | 33.52 | 120.10 |

***PROCTOR DATA***

| | |
|---|---|
| Maximum Dry Density (pcf) | 133.1 |
| Optimum Moisture | 7 |
| 90% of Max. Dry Density (pcf) | 119.8 |
| 95% of Max. Dry Density (pcf) | 126.4 |

CBR at 90% of Max. Density = 29.4 ~ R VALUE 73
CBR at 95% of Max. Density = 114.8 ~ R VALUE 84

ENTECH ENGINEERING, INC.

**LABORATORY TEST RESULTS**

STERLING RECYCLING FACILITY
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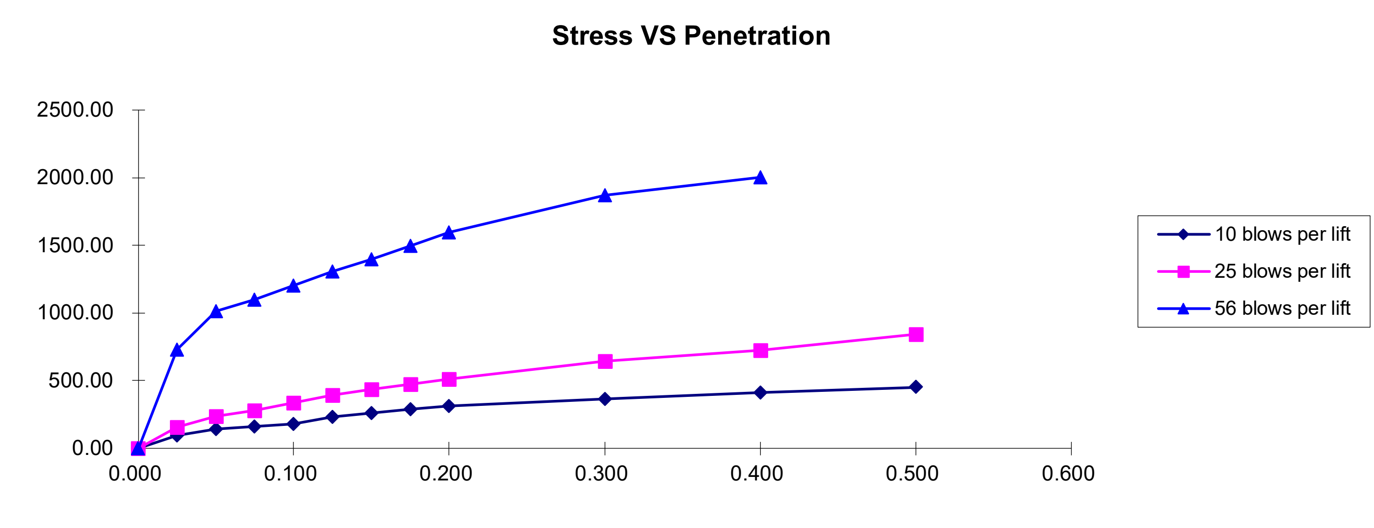
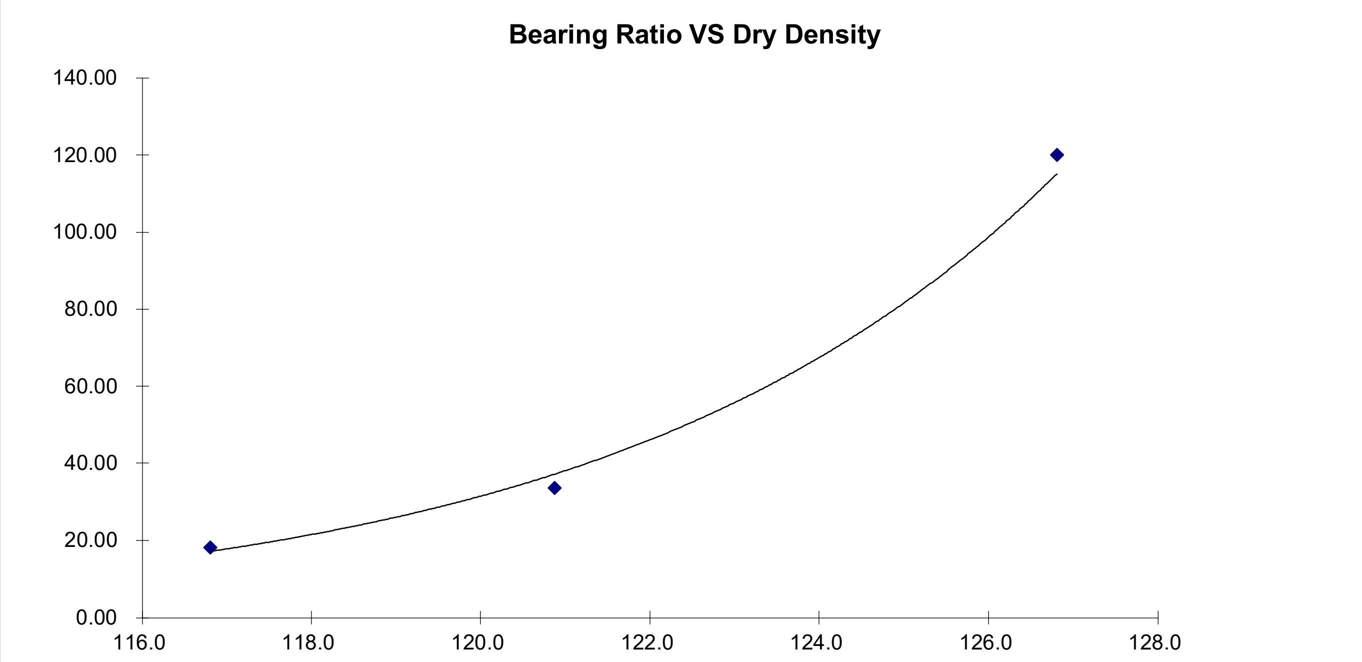
**FIG. B-10**

SAMPLE LOCATION TB-1 @ 0-3' SOIL DESCRIPTION FILL, SAND, WITH SILT, TAN

SOIL TYPE 1

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**LABORATORY TEST RESULTS**

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**FIG. B-11**

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# APPENDIX C: Pavement Design Calculations

# FLEXIBLE PAVEMENT DESIGN

## PROJECT DATA

Project Location: Sterling Recycling Facility

Job Number: 220394

## DESIGN DATA

| | | |
|---|---|---|
| Equivalent (18-kip) Single Axle Load Applications (ESAL): | ESAL ($W_{18}$) = | 821,000 |
| Design CBR | CBR = | 10 |
| Standard Deviation | $S_o$ = | 0.45 |
| Loss in Serviceability | $\Delta$psi = | 2.0 |
| Reliability | Reliability = | 85 |
| Reliability (z-statistic) | $Z_R$ = | -1.04 |
| Soil Resilient Modulus | $M_R$ = | 15,000 psi |

Required Structural Number (SN): → SN = 2.44

## DESIGN EQUATIONS

Resilient Modulus

If using CBR:

$M_R = (CBR) \times 1{,}500$

If using R-Value:

$M_R = 10^{[(S_1 + 18.72)/6.24]}$ where: $S_1 = [(R\text{-value} - 5)/11.29] + 3$

Required Structural Number

$$\log_{10} W_{18} = Z_R * S_O + 9.36 * \log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 * \log_{10} M_R - 8.07$$

Pavement Section Thickness

$SN^* = C_1 D_1 + C_2 D_2$ where:

$C_1$ = Strength Coefficient - HMA

$C_2$ = Strength Coefficient - ABC

$D_1$ = Depth of HMA (inches)

$D_2$ = Depth of ABC (inches)

## RECOMMENED THICKNESSES

| Layer | Material | Structural Layer | Thickness ($D^*_i$) | $SN^*_i$ | SN |
|---|---|---|---|---|---|
| 1 | HMA | $C_1$ = 0.44 | 4.0 inches | 1.764 | - |
| 2 | ABC | $C_2$ = 0.11 | 8.0 inches | 0.880 | |
| | | | | SN* = 2.644 | 2.44 |

Pavement SN > Required SN, Design is Acceptable

FIG. C-1