

**GEOTECHNICAL INVESTIGATION
REPORT**

for

**LANDFILL SCALES
PAVEMENT PROJECT**

Carson City, Nevada

Prepared for:

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GEOTECHNICAL INVESTIGATION REPORT

Landfill Scale Pavement Design

Carson City, Nevada

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GEOTECHNICAL INVESTIGATION REPORT
for
LANDFILL SCALES PAVEMENT DESIGN
Carson City, Nevada

INTRODUCTION

Submitted herewith are the results of Lumos and Associates, Inc. (Lumos) geotechnical investigation for the proposed Carson City Landfill Scales Pavement project to be located in Carson City, Nevada. The project site boundaries generally consist of Flint Drive southeast of Highway 50 (Plate 1).

It is our understanding that the proposed project will be either paved with concrete or asphalt concrete. We have assumed that final grades at the site will be within five (5) feet from existing grades.

The purpose of our investigation was to characterize the site geology and soil conditions, describe the native soils and determine their engineering properties as they relate to the proposed construction. The investigation was also intended to identify possible adverse geologic, soil, and or water table conditions. However, this study did not include an environmental assessment or an evaluation for soil and/or groundwater contamination at the site.

This report concludes with recommendations for site grading, asphalt concrete, and Portland cement concrete. In addition, information such as logs of all exploratory test pits, laboratory test data are provided in this report.

The recommendations contained herein have been prepared based on our understanding of the proposed construction, as outlined above. Re-evaluation of the recommendations presented in this report should be conducted after the final site grading and construction plans are completed, if there are any variations from the assumptions described herein.

It is possible that subsurface discontinuities may exist between and beyond exploration points. Such discontinuities are beyond the evaluation of the Engineer at this time. No guarantee of the consistency of site geology and sub-surface conditions is implied or intended.

GEOLOGIC SETTING

Carson City is at the extreme western portion of the Great Basin geomorphic province. The Great Basin is characterized by internal drainage and large normal fault-bounded valleys (grabens) separated by high mountain ranges (horst). The Sierra Nevada province to the west is characterized by large granite masses that have been uplifted and tilted a few degrees toward the west. Overlying the granites are older oceanic meta-sedimentary rocks.

Specifically, the site is located in the foothills along the eastern side of Eagle Valley. The surface geology of the project area has been mapped Qa/Qta by E. C. Bingler (1977). The mapping indicates that alluvial-plain deposits of Morgan Mill or the Carson River that are Yellowish-brown to yellowish-gray, that are unbedded to well-bedded silty gravelly sand and sandy pebble to cobble gravel underlie the site.

SITE CONDITIONS AND FIELD EXPLORATION

At the time of our investigation, the site had been previously graded and has some asphalt concrete paving, concrete curbing, the scales, and scale house.

Field exploration included a site reconnaissance and subsurface soil-exploration. During the site reconnaissance, surface conditions were noted and the locations of the exploratory test pits were determined. They were located using existing features and a conceptual plan available to Lumos as a guide. Locations and elevations of the exploratory test pits should be considered accurate only to the degree implied by the method used.

Three (3) exploratory test pits were excavated to a maximum depth of seven (7) feet below-ground-surface (bgs). The approximate locations of the exploratory test pits within the site are shown on Plate 2. The subsurface soils were continuously logged and visually classified in the field by our Geotechnical Intern in accordance with the Unified Soil Classification System. Representative soil samples were collected at material changes in each test pit. All the samples, subsequently, were transported to our Carson City geotechnical laboratory for testing and analysis.

The native subsurface soils consisted generally of light brown silty sands to the depths explored. Groundwater was not encountered at the time of our field investigation. However, seasonal groundwater (water table) fluctuations should be anticipated at the site.

FIELD AND LABORATORY TEST DATA

Field and laboratory data was developed from samples taken and tests conducted during the field exploration and laboratory phases of this project. The test pits were excavated by a backhoe. Representative samples utilizing bulk techniques were collected.

Laboratory tests performed on representative samples included sieve analysis, Atterberg Limits, modified proctor, R-value, and soluble sulfates. Much of this data is displayed on the "logs" of the exploratory test pits to facilitate correlation. Field descriptions presented on the logs have been modified, where appropriate, to reflect laboratory test results. The logs of the exploratory test pits are included in Appendix A of this report as Plates A-1 through A-3. Plate A-4 describes the various symbols and nomenclature shown on the logs.

Individual laboratory test results are presented in Appendix B as Plates B-1 through B-5. Laboratory testing was performed per ASTM standards, except when test procedures are briefly described and no ASTM standard is specifically referenced in the report. Atterberg limits were determined using the dry method of preparation (Plate B-2). Special testing conducted for this project is described below.

Analytical Testing: Silver State Analytical Laboratories, out of Reno, Nevada, conducted this testing. The testing included soluble sulfates. Test results are included (on Silver State letterhead) in Plate B-5.

The soil samples obtained during this investigation will be held in our laboratory for 30 days from the date of this report. The samples may be retained longer at an additional cost to the client or obtained from this office upon request.

DISCUSSION AND RECOMMENDATIONS

General

From a geotechnical viewpoint, the site is considered suitable for the proposed improvements when prepared as recommended herein.

The following recommendations are based upon the construction and our understanding of this project, as outlined in the introduction of this report. If changes in the construction are proposed, they should be presented to the Lumos Geotechnical Department, so that these recommendations can be reviewed and modified in writing, as necessary. As a minimum, final construction drawings should be submitted to the Lumos Geotechnical Department for review prior to actual construction and verification that our geotechnical design recommendations have been implemented. Existing improvements shall be demolished as specified in Appendix D of this report.

General Site Grading

Prior to placement of fill and/or the proposed improvements, the areas to receive fill and/or improvements shall be cleared and grubbed. Clearing and grubbing is anticipated to be minimal.

Root- or organic-laden soils encountered during excavations, should be stockpiled in a designated area on site for later use in landscaping, or removed off site as directed by the owner. Excavated soils free from any organics, debris or otherwise unsuitable material and with particles no larger than three (3) inches in maximum dimension may be stockpiled and moisture conditioned for later use as compacted fill provided it meets the criteria for structural fill soils.

All Surfaces to receive fill and/or improvements should be observed and approved by a Lumos representative prior to placement of fill. Subgrade soils shall be scarified to a minimum depth of 12 inches, moisture conditioned to within two percent (2%) of optimum, and re-compacted to at least ninety-five percent (95%) of the ASTM D1557

standard. Fill material should not be placed, spread or compacted while the ground is frozen or during unfavorable weather conditions. When site grading is interrupted by heavy rain or snow, grading or fill operations should not resume until a Lumos representative approves the moisture content and density conditions of the subgrade or previously placed fill.

Unstable conditions due to yielding and/or pumping soils may be encountered on site. Native soils may yield or pump under heavy equipment loads or where vibratory equipment draws up water. If yielding or pumping conditions are encountered, the soils should be scarified in place, allowed to dry as necessary and re-compacted, where applicable. Alternatively, the unsuitable or saturated soil should be removed, the exposed surface leveled and compacted/tamped as much as practical without causing further pumping, and covered (including the sides) with geotextile stabilizing fabric (Marafi HP370 or other equivalent). The fabric should then be covered with at least 12 inches of 4- to 8-inch **angular rock fill** with enough fines to fill the inter-rock pore spaces. Placement should be by end dumping. No traffic or other action should be allowed over the fabric, which may cause it to deflect/deform prior to cobble placement. Test sections should be used to determine the minimum thickness and/or number of layers required for stabilization.

Stabilization should be evaluated by proof-rolling standards commensurate with the equipment used, and approved by a Lumos representative. The placement of the stabilizing rock-fill may require additional over-excavation to maintain appropriate grading elevations. A filter fabric (Mirafi 180N or equal) should also be placed over the cobble rock fill to prevent piping of fines from covering soils into the stabilizing rock matrix.

Acceptable structural fill soils to be used for this project should consist of non-expansive material (LL less than 35 and/or a PI less than 12, and/or an Expansion Index less than 20), and should be free of contaminants, organics (less than two percent (2%)), rubble, or natural rock larger than three (3) inches in largest dimension. The soluble sulfate content shall be less than 0.1% and the R-Value shall be a minimum of 45. Any import soils should be tested and approved prior to being placed or delivered on-site (seven (7)

day advanced notice). Structural fill soils shall also meet the following gradation requirements (Table 1):

**TABLE 1
STRUCTURAL FILL GRADATION**

Sieve Size	% Passing
3"	100
¾"	70 - 100
#40	15 - 65
#200	10 - 25

Soils not meeting all of the above requirements may be approved for use as structural fill at the discretion of the Geotechnical Engineer. Compacted fill should be placed only on compacted sub-grade or on compacted fill in lifts not exceeding eight (8) inches in loose thickness, moisture conditioned to within two percent (2%) of optimum, and compacted to at least ninety-five percent (95%) relative compaction, as determined by the ASTM D1557 standard. Asphalt grindings may be used as structural fill. If utilized, asphalt grindings shall be proof rolled to the satisfaction of the geotechnical Engineer.

Landscaped areas should be cleared of all organic and objectionable material such as wood, root stumps, etc., if any. In cut areas, no other work is necessary except grading to proper elevation and drainage conditions. In landscape fill areas, fill should be placed in loose lifts not exceeding eight (8) inches, and compacted to at least ninety percent (90%) relative compaction to prevent erosion.

A representative of Lumos should be present during all site clearing, excavation removals, and grading operations to ensure that any unforeseen or concealed conditions within the site are identified and properly mitigated, and to test and observe earthwork construction. This testing and observation is an integral part of our services as acceptance of earthwork construction and is dependent upon compaction and stability of the subgrade soils. The soils engineer may reject any material that does not meet acceptable fill, compaction, and stability requirements. Further, recommendations in this report are provided upon the assumption that earthwork construction will conform to recommendations set forth in this section of the report.

PORTLAND CEMENT CONCRETE DESIGN

The subgrade soils and/or structural fill and/or asphalt grindings in the area shall be scarified in place to a depth of at least 12 inches, moisture conditioned to within two percent (2%) of optimum, and compacted to at least ninety-five percent (95%) of the laboratory maximum dry density determined by the ASTM D1557 standard. The structural section for the Portland cement concrete was determined utilizing the American Concrete Institute 330R-08 Guide for the Design and Construction of Concrete Parking Lots utilizing a modulus of subgrade reaction ($k = 300$ psi/in), Modulus of Rupture (MOR) of 550 psi and a traffic category of C (ADTT = 250) and is provided in Table 2, "Recommended Portland Cement Concrete Sections". This section assumes no dowels will be placed in the concrete section. However, the civil engineer may require rebar to be placed in the concrete section. Aggregate base should consist of Type 2, Class B material or Type 1 Recycled Aggregate Base and meet the requirements of the Standard Specifications for Public Works Construction (SPPWC). Aggregate base/recycled aggregate base material shall be moisture conditioned to within two percent (2%) of optimum, and compacted to at least ninety-five percent (95%) of the laboratory maximum density as determined by the ASTM D1557 standard. Asphalt grindings may be utilized as aggregate base provided it meets the requirements of Type 1 recycled aggregate base.

**TABLE 2
RECOMMENDED PORTLAND CEMENT CONCRETE SECTIONS**

Concrete Apron Area	Minimum Concrete Thickness	Minimum Aggregate Base/Type 1 Recycled Base Thickness	Properly Compacted Subgrade Thickness (Structural Fill or Asphalt Grindings)
MOR = 600psi, Traffic Category C, K = 300 psi/in	6"	9"	12"

The joints shall be sawcut a minimum of 1.5 inches deep on 10 foot maximum centers. All mix designs for Portland cement concrete should be submitted to the Geotechnical Engineer for review and approval a minimum of seven (7) days prior to paving.

ASPHALT CONCRETE PAVEMENT DESIGN

Subgrade and/or structural fill and/or asphalt grindings in the area to be paved shall be scarified in place to a depth of at least 12 inches, moisture conditioned to within two percent (2%) of optimum, and compacted to at least ninety-five percent (95%) of the laboratory maximum dry density determined by the ASTM D1557 standard. Pavement structural section for the asphalt concrete utilizing an R-value of 45 (structural fill specifications) and aggregate base/recycled base utilizing an R-value of 70 is provided in Table 2, "Recommended Asphalt Pavement Sections". A Traffic Index (TI) value of 10 was utilized for design based on the information given to Lumos of 250 trucks per day. Aggregate base should consist of Type 2, Class B or Type 1 recycled base material and meet the requirements of the Standard Specifications for Public Works Construction (SPPWC). Aggregate/recycled base material shall be moisture conditioned to within two percent (2%) of optimum, and compacted to at least ninety-five percent (95%) of the laboratory maximum density as determined by the ASTM D1557 standard. Asphalt grindings may be utilized as aggregate base provided it meets the requirements of Type 1 Recycled Aggregate Base.

**TABLE 3
RECOMMENDED ASPHALT PAVEMENT SECTIONS**

Pavement Area	Minimum Asphalt Pavement Thickness	Minimum Aggregate Base/Recycled Base Thickness	Properly Compacted Subgrade/Structural Fill/AC Grindings
T.I. = 10	6"	9"	12"

In all areas of the project, asphalt concrete should consist of PG64-28NV, and Type 2 asphalt aggregate per applicable standards. We recommend either a 75-blow Marshall mix or a Hveem mix that targets four percent (4%) air voids. Asphalt concrete, in any case, should be compacted to between ninety-two percent (92%) and ninety-seven percent (97%) of the Rice theoretical maximum density.

All mix designs for asphalt concrete should be submitted to the Geotechnical Engineer

for review and approval a minimum of seven (7) days prior to paving.

CORROSION AND CHEMICAL ATTACK

On-site soils have a negligible water soluble sulfate content of less than 0.10% (<0.01% actual). No specific type of cement is required for concrete in direct contact with on-site soils, as required by the International Building Code. However, Type II cement (meeting ASTM C150) is recommended for concrete in direct contact with on-site soils.

All exterior concrete should have between 4.5 and 7.5 percent entrained air, a maximum water-cement ratio of 0.45, and comply with all other ACI recommendations for concrete placed in areas subject to freezing. A minimum compression strength of 4,000 psi is recommended for all external concrete. All interior concrete should also be placed pursuant to ACI recommendations.

SLOPE STABILITY AND EROSION CONTROL

The results of our exploration and testing confirm that 2:1 (H:V) maximum slopes will be stable for on-site materials both in cut and fill. All slopes shall incorporate a brow ditch to direct surface drainage away from the slope face. Slopes steeper than 2:1 will require stabilization, such as retaining walls. Additional investigation should be done to verify these recommendations.

The potential for dust generation is high at this project. Dust control will be mandatory on this project in order to comply with air quality standards. The contractor shall be responsible for submitting a dust control plan and securing any required permits.

Stabilization of all slopes and areas disturbed by construction will be required to prevent erosion and to control dust. Stabilization may consist of rip-rap, revegetation, or dust pallative, depending on the inclination of the slope.

In order to minimize storm water discharge from this site, best management practices should be implemented.

UTILITY EXCAVATIONS

On-site soils are anticipated to be excavatable with conventional construction equipment. Compliance with OSHA regulations should be enforced for Type C soils. Excavated soils may be suitable for backfill of utility trenches after screening any oversize material and debris provided they meet the requirements of Class E backfill. However, on-site soils do not meet the minimum requirements for Class A bedding and should be imported, where required.

MOISTURE PROTECTION, EROSION AND DRAINAGE

The finish surfaces around all structures should slope away from the building and toward appropriate drop inlets or other surface drainage devices. It is recommended that within ten (10) feet of the buildings a minimum slope of five percent (5%) be used for soil subgrades and one percent (1%) be used for pavements. These grades should be maintained for the life of the structures.

Landscaping and downspouts should be planned to prevent discharge adjacent to buildings. Instead, water flow should be conveyed and re-routed to discharge areas away from any improvements.

Backfill adjacent to the proposed building perimeters should be properly compacted to minimize water infiltration into the foundation soils.

CONSTRUCTION SPECIFICATIONS

All work shall be governed by the Standard Specifications and Standard Details for Public Works Construction (SSPWC), as distributed by Carson City, except as modified herein.

LIMITATIONS

This report has been prepared in accordance with the currently accepted engineering practices in Northern Nevada. The analysis and recommendations in this report are based upon exploration performed at the locations shown on the site plan, the proposed improvements as described in the Introduction section of this report and upon the property in its condition as of the date of this report. Lumos makes no guarantee as to the continuity of conditions as subsurface variations may occur between or beyond exploration points and over time. Any subsurface variations encountered during construction should be immediately reported to Lumos so that, if necessary, Lumos' recommendations may be modified.

This report has been prepared for and provided directly to Carson City Public Works Department ("The Client"), and any and all use of this report is expressly limited to the exclusive use of the Client. The Client is responsible for determining who, if anyone, shall be provided this report, including any designers and subcontractors whose work is related to this project. Should the Client decide to provide this report to any other individual or entity, Lumos shall not be held liable for any use by those individuals or entities to whom this report is provided. The Client agrees to indemnify, defend and hold harmless Lumos, its agents and employees from any claims resulting from unauthorized users.

If this report is utilized in the preparation of an Engineer's Estimate of Probable Construction Costs, then the preparer of the estimate acknowledges that the report recommendations are based on the subsurface conditions found at the specific locations investigated on site; that subsurface conditions may vary outside these locations; and that no guaranty or warranty, express or implied, is made that the conditions encountered are representative of the entire site. The preparer of the estimate agrees to indemnify, defend and hold harmless Lumos & Associates, its agents and employees from any and all claims, causes of action or liability arising from any claims resulting from the use of the report in the preparation of an Engineer's Cost Estimate.

This report is not intended for, nor should be utilized for, bidding purposes. If it is utilized for bidding purposes, Client acknowledges that the report recommendations are based on the subsurface conditions found at the specific locations investigated on site; that subsurface conditions may vary outside these locations; and that no guaranty or warranty, express or implied, is made that the conditions encountered are representative of the entire site. The Client agrees to indemnify, defend and hold harmless Lumos & Associates, its agents and employees from any and all claims, causes or action or liability arising from any claims resulting from the use of the report for bidding purposes.

As explained above, subsurface variations may exist and as such, beyond the express findings located in this report, no warranties express, or implied, are made by this report. No affirmation of fact, including but not limited to statements regarding suitability for use of performance shall be deemed to be a warranty or guaranty for any purpose.

Bert Sexton, E.I.
Geotechnical Intern
Lumos and Associates, Inc.

Mitch Burns, P.E.
Construction Services Engineer
Lumos and Associates, Inc.



LANDFILL SCALE PAVING PROJECT

VICINITY MAP

CARSON CITY

NEVADA

Date: JUNE 2014
 Scale: N.T.S.
 Job No: 8511.054
 PLATE 1



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LEGEND

TP-  = APPROXIMATE EXPLORATORY TEST PIT LOCATION



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LANDFILL SCALE PAVING PROJECT

SITE MAP

CARSON CITY

NEVADA

Date: JUNE 2014
Scale: N.T.S.
Job No: 8511.054
PLATE 2

APPENDIX A

TEST PIT No. TP-1

Logged By: **B. Sexton**
 Date Logged: **5-20-2014**
 Drill Type: **Case Backhoe**

Total Depth: **7 feet**
 Water Depth: **No groundwater encountered**
 Ground Elev.: **E.G.S. feet ±**

Depth in Feet	Graphic Log	Sample Type	<input type="checkbox"/> Percolation Test <input type="checkbox"/> Split Spoon <input type="checkbox"/> Ziplock Sample	SPT (N) Blows/Foot	Moisture Content, %	Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index	
			<input checked="" type="checkbox"/> Modified California <input type="checkbox"/> Bulk Sample <input type="checkbox"/> Static Water Table											
SOIL DESCRIPTION														
1			<p>Light Brown Silty SAND (SM), Moist, Medium Dense. Estimated 85% Fine Sand and 15% Non-Plastic Silt.</p>											
2														
3														
4														
5														
6														
7				<p>With Small Amount of Gravel Below 6.5'.</p>	7.0									

Test pit terminated at 7 feet.
 Test Pits backfilled without compaction verification

LUMOS TP FULL PAGE CC LANDFILL SCALES.GPJ US LAB.GDT 7/1/14



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Landfill Scales Pavement Project

LOG OF EXPLORATORY TEST PIT

Job Number: 8511.054

Date: July 2014

PLATE

A-1


TEST PIT No. TP-2

Logged By: **B. Sexton**
 Date Logged: **5-20-2014**
 Drill Type: **Case Backhoe**

Total Depth: **7 feet**
 Water Depth: **No groundwater encountered**
 Ground Elev.: **E.G.S. feet ±**

Depth in Feet	Graphic Log	Sample Type	<input type="checkbox"/> Percolation Test <input checked="" type="checkbox"/> Split Spoon <input type="checkbox"/> Ziplock Sample	SPT (N) Blows/Foot	Moisture Content, %	Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			<input checked="" type="checkbox"/> Modified California <input type="checkbox"/> Bulk Sample <input type="checkbox"/> Static Water Table										
SOIL DESCRIPTION													
			Test Pit is adjacent to existing scale roadway. The upper 6" is a mix of approximately 1" of Asphalt and 4-5" of Asphalt Grindings.	0.5									
1			Light Brown Silty SAND (SM) , Moist, Medium Dense.										
			Field Density Test Taken at 1.5'.		10.2	103.3							
2													
3													
		B	Field Density Test Taken at 3'.		8.5	98.0	NP	NP	0.3	85.1	14.6	77	
4													
5													
6													
7				7.0									
Test pit terminated at 7 feet. Test Pits backfilled without compaction verification													

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LOG OF EXPLORATORY TEST PIT

Job Number: 8511.054

Date: July 2014

PLATE

A-2

TEST PIT No. TP-3

Logged By: **B. Sexton**

Total Depth: **7 feet**

Date Logged: **5-20-2014**

Water Depth: **No groundwater encountered**

Drill Type: **Case Backhoe**

Ground Elev.: **E.G.S. feet ±**

Depth in Feet	Graphic Log	Sample Type	<input type="checkbox"/> Percolation Test <input checked="" type="checkbox"/> Split Spoon <input checked="" type="checkbox"/> Ziplock Sample	SPT (N) Blows/Foot	Moisture Content, %	Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			<input checked="" type="checkbox"/> Modified California <input type="checkbox"/> Bulk Sample <input type="checkbox"/> Static Water Table										
SOIL DESCRIPTION													
			2" Asphalt Concrete.	0.2									
			2" Asphalt Grindings.	0.3									
1			10" of Material Similar to Type II Aggregate Base Rock.										
			Light Brown Silty SAND (SM) , Moist, Medium Dense. Estimated 85% Fine Sand and 15% Non-Plastic Silt.	1.2									
2			Field Density Test Taken at 2'.		10.1	102.6							
3													
4			Field Density Test Taken at 4'.		13.1	98.4							
5													
6													
7				7.0									
Test pit terminated at 7 feet. Test Pits backfilled without compaction verification													

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Landfill Scales Pavement Project
LOG OF EXPLORATORY TEST PIT
 Job Number: 8511.054
 Date: July 2014

PLATE
A-3

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	CLEAN SANDS (LITTLE OR NO FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
HIGHLY ORGANIC SOILS	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		CH	INORGANIC CLAYS OF HIGH PLASTICITY	
	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

Other Tests	
AN	ANALYTICAL TEST (pH, Soluble Sulfate, and Resistivity)
C	CONSOLIDATION TEST
DS	DIRECT SHEAR TEST
MD	MOISTURE DENSITY CURVE

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Landfill Scales Pavement Project

LEGEND

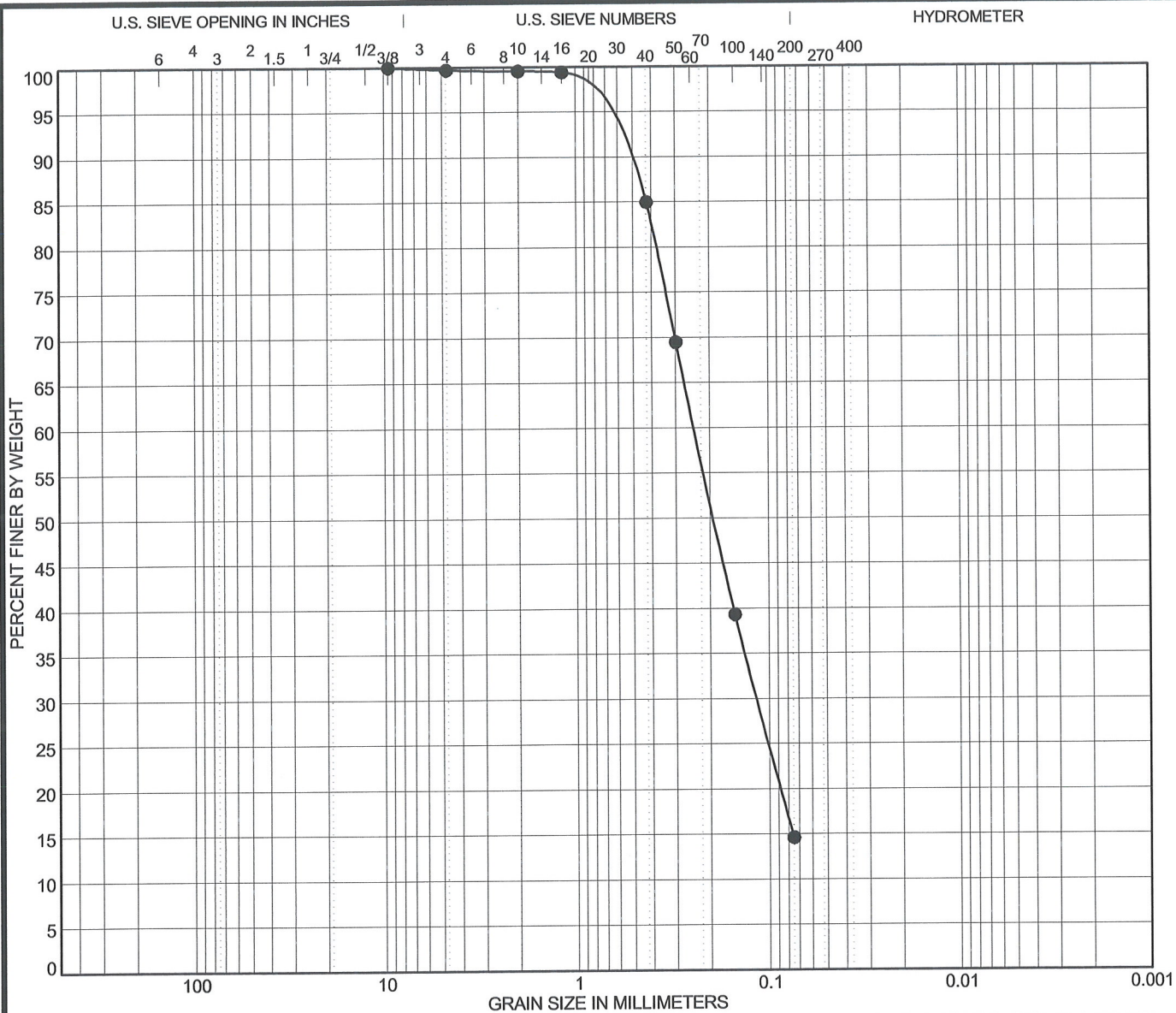
Job Number: 8511.054

Date: July 2014

PLATE

A-4

APPENDIX B



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

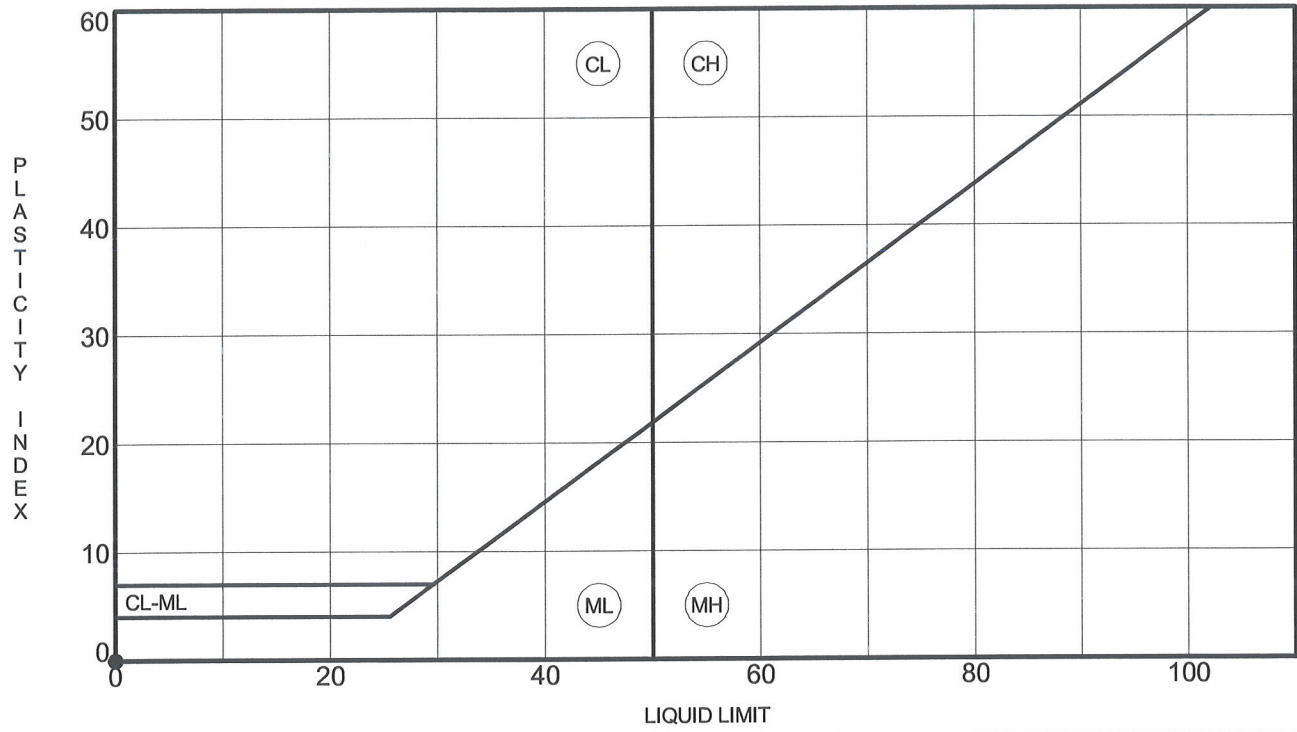
Specimen Identification		Date: 5-22-2014					LL	PL	PI	Cc	Cu
●	TP-2	Classification					NP	NP	NP		
	Depth: 3	Light Brown Silty Sand (SM)									
	Sample Location	TP-2 from 3'-4'									
	USCS	SM									
	AASHTO										
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay		
●	TP-2	9.5	0.241	0.115		0.3	85.1	14.6			
	Depth: 3										
	Natural Moisture	5.1 %		S.E.		Absorption %					
	R-Value	77		Durability Index		Soundness					
	Percentage of Wear (500 rev)	%		Specific Gravity		Direct Shear					

LUMOS GRAIN SIZE CC LANDFILL SCALES.GPJ US LAB.GDT 7/1/14

LUMOS & ASSOCIATES
 800 E College Parkway
 Carson City, NV 89706
 (775) 883-7077
 Fax:

Landfill Scales Pavement Project
GRAIN SIZE DISTRIBUTION
 Job Number: 8511.054
 Date: July 2014

PLATE
B-1



Specimen Identification	LL	PL	PI	Fines	Classification
● TP-2	3.0	NP	NP	15	Light Brown Silty Sand (SM)

LUMOS ATTERBERG LIMITS CC LANDFILL SCALES.GPJ US LAB.GDT 7/1/14

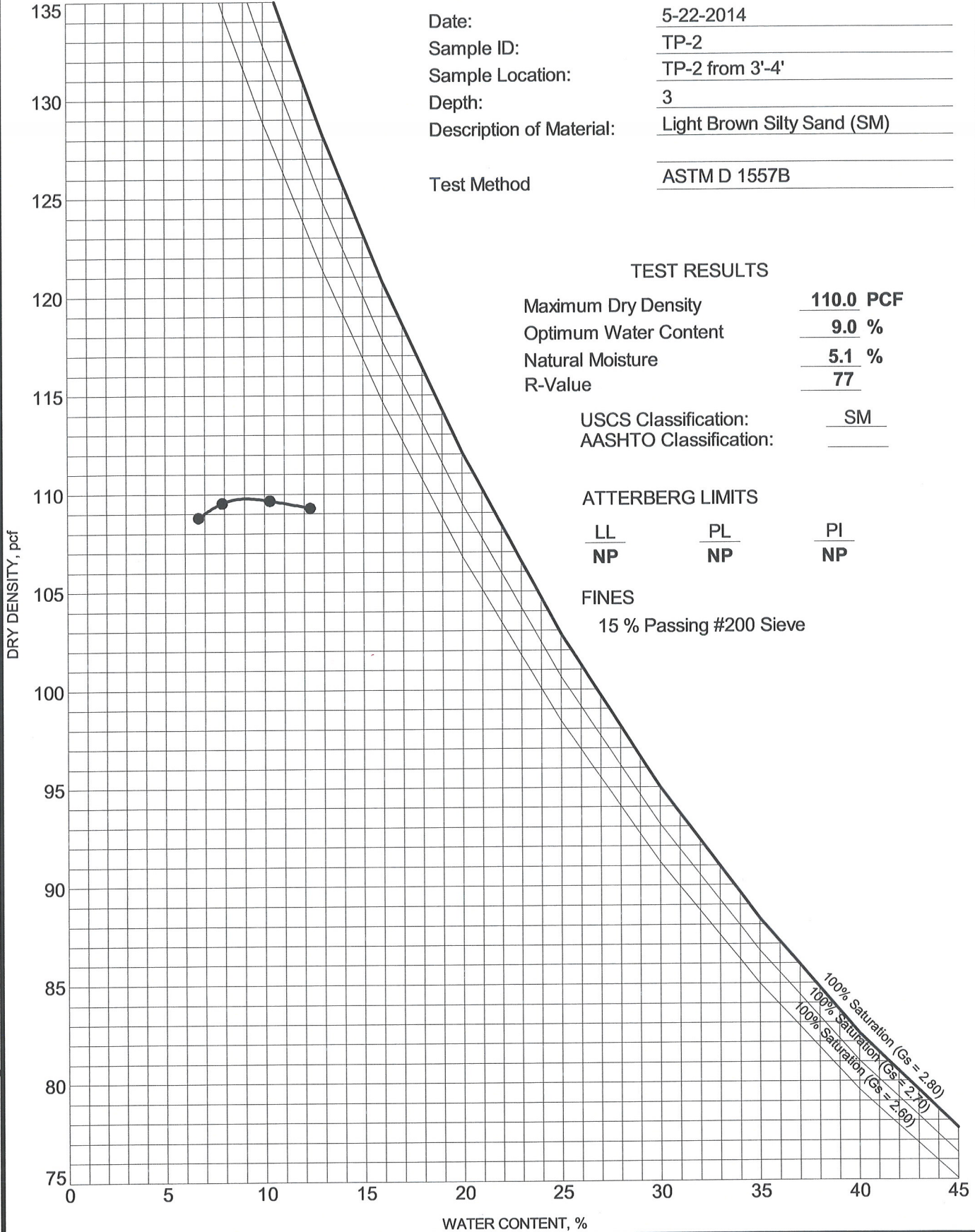


Lumos and Associates
 800 E College Parkway
 Carson City, NV 89706
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 Fax:

Landfill Scales Pavement Project
ATTERBERG LIMITS' RESULTS
 Job Number: 8511.054
 Date: July 2014

PLATE
B-2

Date: 5-22-2014
 Sample ID: TP-2
 Sample Location: TP-2 from 3'-4'
 Depth: 3
 Description of Material: Light Brown Silty Sand (SM)
 Test Method: ASTM D 1557B



TEST RESULTS

Maximum Dry Density 110.0 PCF
 Optimum Water Content 9.0 %
 Natural Moisture 5.1 %
 R-Value 77

USCS Classification: SM
 AASHTO Classification: _____

ATTERBERG LIMITS

LL	PL	PI
NP	NP	NP

FINES

15 % Passing #200 Sieve

LUMOS COMPACTION CC LANDFILL SCALES.GPJ US LAB.GDT 7/1/14



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 Carson City, NV 89706
 (775) 883-7077
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Landfill Scales Pavement Project

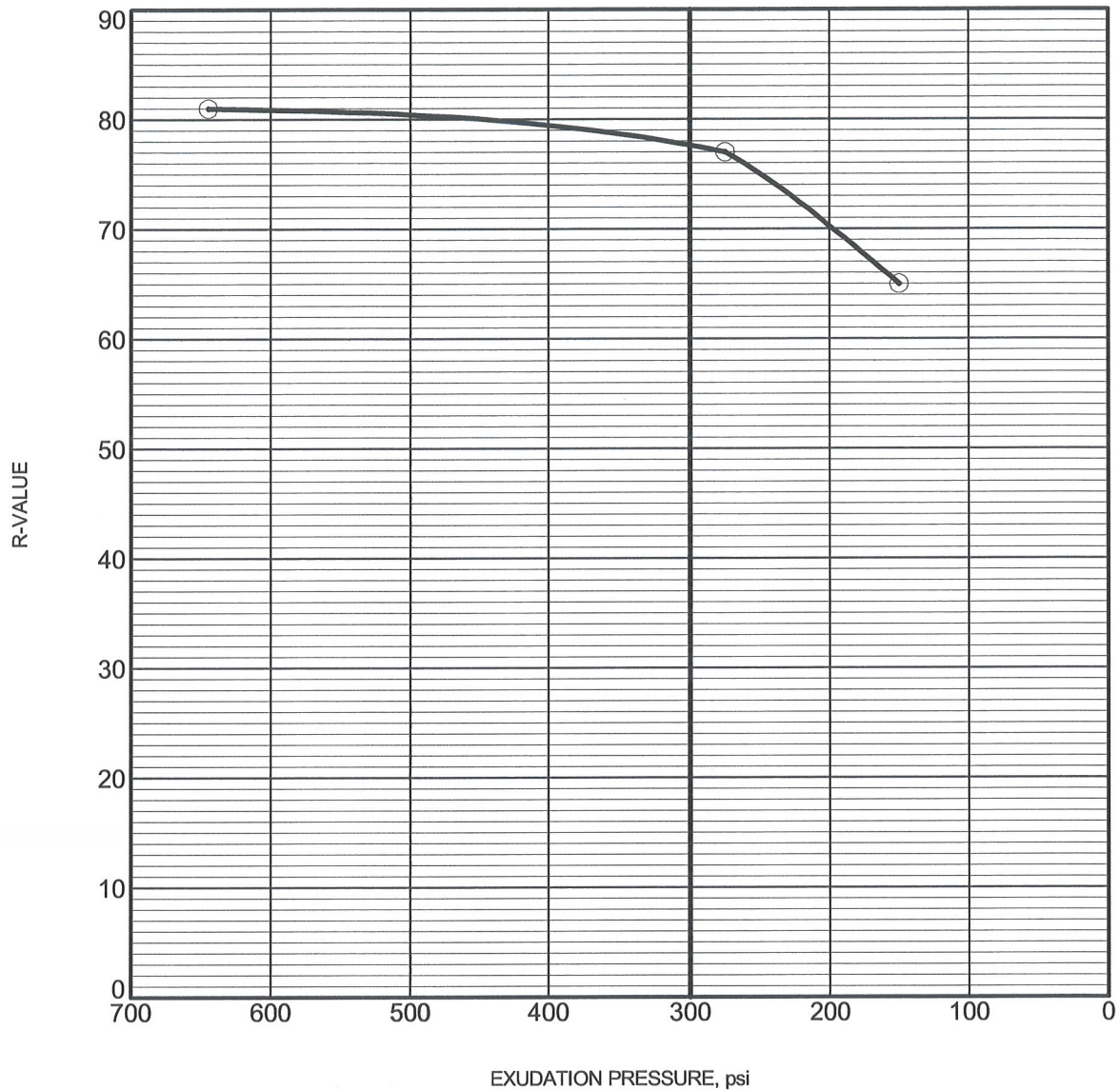
MOISTURE-DENSITY CURVE

Job Number: 8511.054

Date: July 2014

PLATE

B-3



Test Data

Specimen No.	Water Content (%)	Dry Density (pcf)	Expansion (psf)	Exudation (psi)	Test R-Value*
1	11.3	111.7	0.0	645.0	81.0
2	12.8	110.3	0.0	275.0	77.0
3	14.0	109.5	0.0	150.0	65.0

* Reported values have been corrected for sample height, where required.

Test Result

Specimen Identification	Classification	R-Value
TP-2 3.0	Light Brown Silty Sand (SM)	77

R VALUE CC LANDFILL SCALES.GPJ US LAB.GDT 7/1/14



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Landfill Scales Pavement Project

RESISTANCE VALUE TEST

Job Number: 8511.054

Date: July 2014

PLATE

B-4



LABORATORY REPORT

DATE: May 30, 2014

REPORT NUMBER: R14-0160

CLIENT: Lumos & Associates INC
800 East College parkway
Carson City, NV 89706

PAGE: 1

CLIENT PROJECT: 0000175

PO#: 0000175/MTE

Sampled By: Bert
Date Sampled: 05/21/14
Time Sampled: 0700

Submitted By: Bruce Smith
Date Received: 05/21/14
Time Received: 1537

Sample ID: CC Landfill Scales TP-2 from 3'-4'

Test	Result	Unit	Method
Sulfate	<0.01	%	SM4500E
Sodium	<0.01	%	ASTM 3500Na-B
Sodium Sulfate	<0.01	%	Calculation

EPA Flags: None

Note: Sodium, Sulfate, and sodium sulfate Analysis was completed at SSAL-Reno (Reno, NV).
Please direct any questions to the Reno office at 775-825-1127

Note: The results for each constituent denote the percentage (%) for that particular element which is soluble in a 1:5 (soil to water) extraction ratio and corrected for dilution.

REVIEWED BY:

Mello Hebert
Laboratory Manager
EPA: NV00930 (SSAL-LV)
EPA: NV00931 (SSAL-Reno)

3638 East Sunset Road, Suite 100 • Las Vegas, NV 89120 • Tel: 702-873-4478 Fax: 702-873-7967
4587 Longley Lane, No. 2 • Reno, NV 89502 • Tel: 775-825-1127 Fax: 775-825-1167
www.ssalabs.com • www.envirotechonline.com

SOLUBLE SULFATE CC LANDFILL SCALES.GPJ US LAB.GDT 7/1/14



Lumos and Associates

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Carson City, NV 89706
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Fax:

Landfill Scales Pavement Project

SOLUBLE SULFATE

Job Number: 8511.054

Date: July 2014

PLATE

B-5

APPENDIX C

Job # 8511.054
Client: Carson City Public Works Department
Description: **PCC Pavement Calculations**
By: B. Sexton

R-Value for Structural Fill/AC Grindings = 45

Modulus of Rupture (MOR) = $9\sqrt{f'c} = 9\sqrt{4,000} = 569 \Rightarrow 550\text{psi}$

Traffic Category of C with an ADTT = 250 (given to Lumos from CC Landfill)

k = 300 psi/in \Rightarrow with 9" of Base

From ACI 330R-08 Table 3.4-Twenty-year design thickness recommendations, and No Dowels

Therefore, use 6 inches of 4,000 psi air entrained concrete over 9 inches of Type II Class B aggregate base or Type I recycled base over properly prepared suitable subgrade/imported structural fill/AC Grindings.

Joints shall be sawcut a minimum of 1.5 inches deep on 10 foot maximum centers.

PAVEMENT DESIGN CC LANDFILL SCALES.GPJ US LAB.GDT 7/1/14



Lumos and Associates

800 E College Parkway
Carson City, NV 89706
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Landfill Scales Pavement Project

PAVEMENT DESIGN

Job Number: 8511.054

Date: July 2014

PLATE

C-1

APPENDIX D

SPECIFICATIONS FOR DEMOLITION

Demolition shall include the removal of all designated structures/improvements to be removed, i.e. concrete structures, asphalt pavements, utilities, pipes and unsuitable material within the project area. Excavations caused by removal of existing improvements and utilities shall be cleared of all wastes, debris, and any loose/soft soils, and backfilled with properly compacted fill, as specified under the General Site Grading section of this report. All fill compaction should be performed under observation and testing by the Geotechnical Engineer.

Broken concrete, asphalt, and other materials shall be considered waste and shall be removed from the site.

Any existing drain lines, wires, utilities, etc., which are to remain on the site shall be protected from damage. Buried drain lines, pipe conduits, utilities, etc. which are necessarily cut shall be either carefully and permanently capped at the property line as specified by the City Engineer or re-routed as necessary. Utility lines not specifically noted for disposition, but which are encountered in the work area shall be capped, extended, protected or re-routed as necessary for completion of the work, as directed.

All work shall be performed in accordance with the Federal Occupational Safety and Health Administration, the local Division of Occupational Safety and Health requirements, and applicable ordinances of the governing municipality.

Care shall be taken not to damage adjoining utilities or structures to remain after completion of the work. Finished work damaged by operations during demolition and site preparation shall be repaired or replaced to the satisfaction of the Owner at no cost to the Owner.

All materials resulting from demolition and site preparation not designated by the Owner to be recovered or to be relocated by the Contractor shall be removed promptly and disposed of off the site.

Upon completion of demolition and site preparation, the site shall be "raked clean" – if applicable – and all waste, rubble, debris, etc. shall be removed and disposed of off the site.