CAP MAINTENANCE AND REPAIR REPORT SANITARY TRANSFER AND LANDFILL DELAFIELD, WISCONSIN

PROJECT NUMBER 4025

1135 Legion Drive
Elm Grove, Wisconsin 53122

K. SINGH & ASSOCIATES INCORPORATED

Engineers and Environmental Management Consultants

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April 28, 1995

Ms. Margaret Graef
Wisconsin Department of Natural Resources
4041 N. Richards Street
Milwaukee, Wisconsin 53212

Project # 4025

Subject: Cap Maintenance and Repair, Delafied Sanitary Transfer and Landfill, Delafield, Wisconsin

Dear Ms. Graef:

We are pleased to submit this Cap Maintenance and Repair Report for the referenced project. This report is prepared in accordance with the Quality Assurance / Quality Control Plan submitted on May 25, 1994.

Cap repair activities commenced in June 1994 and were completed in August 1994. Approximately 8,300 cubic yards of clay and 14,900 cubic yards of topsoil were used to fill twenty areas of settlement. Nuclear density readings were collected to document that the clay was compacted to greater than 85% of the Standard Proctor Density.

Please call if you have any questions regarding this submittal.

Sincerely,

K. SINGH & ASSOCIATES, INC.

Robert T. Reineke
Staff Engineer

Dilip K. Singh, Ph.D., P.E.
Vice President, Engineering

cc: Ms. Marie Stewart / WDNR

CAP MAINTENANCE AND REPAIR REPORT
DELAFIELD SANITARY TRANSFER AND LANDFILL
DELAFIELD, WI

FOR

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
SOUTHEAST DISTRICT
4041 N. RICHARDS STREET
MILWAUKEE, WI 53212

PREPARED BY

K. SINGH & ASSOCIATES, INC.
1135 LEGION DRIVE
ELM GROVE, WI 53122

JOB # 4025

APRIL 28, 1995

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

SECTION I. INTRODUCTION

1.1 FACILITY DESCRIPTION

The Sanitary Transfer and Landfill is located in Sections 22 and 27, Township 7 North, Range 18 East, in the City of Delafield, Waukesha County. The location of the landfill is shown on Figure 1. The landfill was closed over 10 years ago, and is under a post-closure monitoring and maintenance program.

The topography of the site, as shown on Figure 2 in Appendix A, indicates that the center of the landfill is at an elevation of about 1,070 feet MSL. The elevation around the perimeter of the landfill varies from 1,010 to 1,050 feet MSL. This indicates that surface water will flow in all directions from the center of the site. Groundwater at the site flows in mainly in northeast, southwest, and southeasterly directions.

To the southeast and southwest of the site are private residential areas. Located to the north is Interstate 94, and to the northwest across I-94 are more residences. There are several homes located on the southwest perimeter of the landfill. Ormson Corporation owns an industrial building located east of the landfill. Nichols' buildings are located at the northeast corner of the landfill.

1.2 PROJECT BACKGROUND

Wisconsin Department of Natural Resources retained K. Singh & Associates, Inc. in June 1992 for post closure monitoring and maintenance of the Sanitary Transfer and Landfill, Delafield. Post-closure maintenance and monitoring consists of maintenance of the clay cover, mowing of grass, pumping of leachate, and groundwater and methane gas monitoring.

The surface of the landfill has experienced settlement due to the decomposition of waste constituents in the landfill. Approximately 18 small areas of settlement were noted in a survey performed on April 26, 1994 by Uttech Land Surveying of Beaver Dam, Wisconsin. The locations of the areas are shown on Figure 2 in Appendix A. Surface water was noted to drain into the settled areas and would eventually lead to an increase in the volume of leachate.

A Quality Assurance / Quality Control (QA/QC) Plan was submitted on May 25, 1994 (1). The QA/QC plan included a proposed program for cap repair and maintenance. It was proposed that leachate generation be mitigated by filling the settled areas with compacted clay. Filling the settled areas will result in greater surface water runoff and minimize infiltration into the landfill. It was proposed that the clay used to fill the settled areas be compacted in eight inch lifts. Clay with the following specifications was proposed to be used for filling the settled areas.

1) Maximum Permeability of 1 x 10^{-7} cm/sec;

2) Greater than 50% fines passing #200 sieve;

3) Liquid limit greater than or equal to 30;

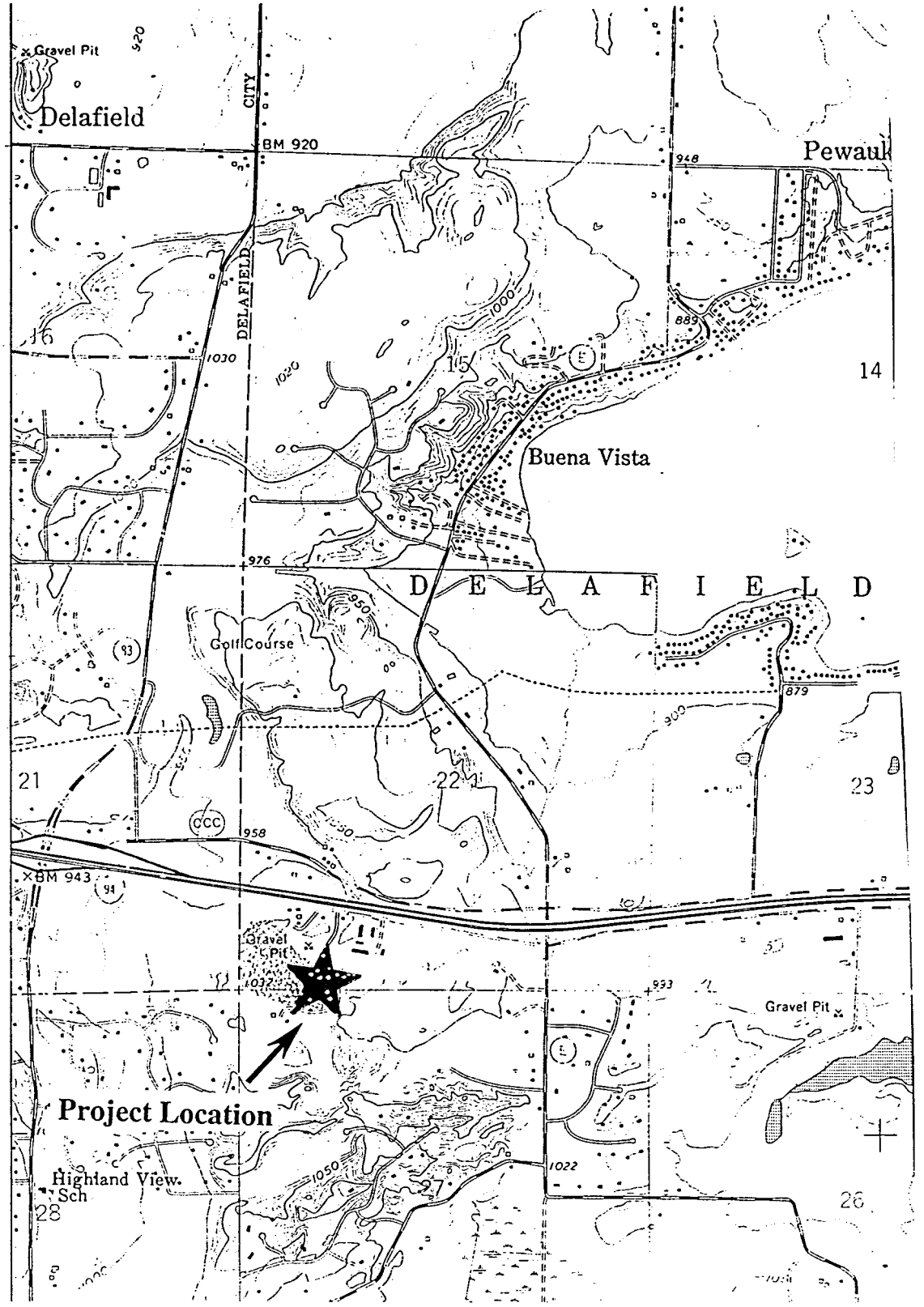


Figure 1. Project Location Map

Scale: 1" = 2000'

4) Plasticity index greater than or equal to 15; and

5) Compaction to at least 85% of Standard Proctor Density.

A proposal for compaction services was sent out and North Shore Environmental Contractors, Inc. of Germantown was awarded the contract for services. Cap repair work was intiated on June 14, 1994.

1.3 PURPOSE AND SCOPE

The purpose of this report is to fulfill the requirement of the Wisconsin Department of Natural Resources (WDNR) to document the program of cap repair and maintenance. This report documents the cap repair activities at the Delafield Landfill in accordance with the Quality Assurance / Quality Control Plan.

The specific objectives of the cap maintenance program are as follows:

1) Backfill settled areas with clay and six inches of topsoil;

2) Perform testing of clay to assure compliance with specifications;

3) Supervise compaction and assure compliance by testing for density; and

4) Prepare a report documenting cap repair and maintenance activities conducted at this site.

1.4 REPORT ORGANIZATION

This report is organized in five sections. Section I is an introduction which includes a facility description, purpose and scope for the report, and the report organization. Section II includes a discussion of cap maintenance and repair activities. Section III includes conclusions and recommendations. Sections IV and V include references and appendices, respectively.

SECTION II. CAP MAINTENANCE AND REPAIR

2.1 GENERAL

The purpose of this repair plan was to limit the infiltration of surface water into the landfill by filling settled areas in compliance with NR 504.07 (2). A description of the procedures employed and the results of confirmation testing are included in this section.

A proposal for compaction services was sent out and North Shore Environmental Contractors, Inc. of Germantown was awarded the contract for services. Cap repair work was intiated on June 14, 1994.

2.2 CLAY CHARACTERISTICS TESTING

A clay source, meeting the proposed specifications, was identified in March 1994. A sample of the clay source was delivered to Wisconsin Testing Laboratories of Menomonee Falls for testing. Test results are included in Appendix B.

Testing revealed that the clay source had a Liquid Limit of 62 and a Plasticity Index of 37. Sieve analysis determined that 64 % of the soil particles passed the #200 sieve. Standard Proctor Density testing indicated that the maximum density of the clay source was 101.9 pounds per cubic foot on a dry weight basis. The optimum moisture content was determined to be 20.1%. The Standard Proctor Test was performed in accordance with ASTM D-698.

Based on the clay characteristics, it was determined that the clay should be compacted to a minimum of 86.6 pcf, on a dry weight basis, to meet the 85% Standard Proctor Density compaction requirements. The clay source would be classified as part of the CH group, according to the Unified Soil Classification System, which is described as "inorganic clays of high plasticity, fat clays."

2.3 BACKFILLING PROCEDURES

Backfilling operations were initiated on June 14, 1994. Before filling each individual area, the turf and near-surface topsoil was tilled so that the added clay would blend with the existing clay layers for a seamless interface. The clay was then hauled to the site using dump trucks and deposited on the perimeter of the fill area. A visual and tactile inspection was then performed by personnel of K. Singh & Associates, Inc. to determine compliance with specifications. The clay was then spread over the fill area in six to eight inch lifts. A sheepsfoot, vibratory drum compactor was then used to compact the clay to greater than 85% of the Standard Proctor Density. Density measurements were performed by personnel of K. Singh & Associates, Inc. to confirm that sufficient compaction had been performed. If compaction was determined to be insufficient, the operator of the compactor was directed to compact the clay until sufficient compaction was confirmed. Topsoil was spread over the clay to a depth of at least six inches once clay compaction was completed. Pictures documenting backfilling operations are included in Appendix C.

During the course of operations, two additional areas were identified for backfilling in order to limit infiltration of groundwater. The additional areas (19 and 20) are shown on Figure 3 in Appendix A.

Backfilling operations were completed on August 30, 1994. A total of 8,327 cubic yards of clay and 14,888 cubic yards of topsoil were used for backfilling. Pictures of the completed areas are included in Appendix C.

2.4 DENSITY VERIFICATION

A series of density measurements were taken from each area where clay was used as backfill. Density measurements were performed in the field with a Seamans C-75 nuclear density meter according to ASTM standards D2922, D2950, and D3017. The Seamans C-75 meter operates on the air gap backscatter method of density measurement. The instrument operation is based on the fact that dense materials absorb more radiation than materials not so dense (3). The nuclear density meter was used because it provides consistent and accurate results for density and moisture content on a real time basis.

Density measurements were performed on a 20 foot by 20 foot grid for each area where clay was compacted. Compaction was continued until it was determined that the clay had achieved 85% of Standard Proctor Density. A summary of the results of the density testing is included in Table 1.

2.5 ADDITIONAL WORK

Following placement of topsoil, approximately 5 acres at the site were reseeded with grass seed, fertilized, and mulched in August 1994 by North Shore Environmental Contractors. The mulched area included fill areas 5, 6, 7, 8, 9, and 19. Approximately 5 to 6 acres remained to be reseeded at the site. Werner Bros., Inc. was contracted to perform the additional reseeding activities in November 1994. Werner Bros., Inc. performed this work in December 1994. In addition, Werner Bros. installed a silt fence along the west edge of the site and placed approximately 300 square yards of erosion mat to prevent further erosion. Any area that does not show growth will be reseeded in the spring of 1995.

Parts of the access road at the site were covered with clay and topsoil during backfilling activities. In addition, some parts of the road were damaged due to the high rate of usage by dump trucks. The access road is scheduled to be replaced in the spring of 1995.

2.6 MAINTENANCE AND REPAIR EVALUATION

A survey of the landfill was performed on February 22, 1995 by Uttech Land Surveying to evaluate the new contours at the site. The new contours are shown on Figure 3 in Appendix A.

Based on the new contours, the scope for the accumulation of surface water and subsequent infiltration has been substantially reduced. Density testing, as shown in Table 1, indicates that the clay used for backfilling was compacted to an average dry density of 92.71 pounds per cubic foot or approximately 92% of Standard Proctor Density. The compacted clay had an average moisture content of 16.10% which is dry of the optimum moisture content.

Table 1

Compaction Verification Results

Delafield Sanitary Transfer and Landfill

Fill Area	Lift	Location / ID	Dry Density (lb / ft^3)	Moisture Content %
1	1	Center	79.90	14.85
	1	Center	103.40	15.03
2	1	E-1	99.09	11.85
	1	W-1	92.96	13.56
	1	E-2	106.10	14.70
	1	C-2	87.23	18.19
	1	W-2	103.50	14.34
	1	E-3	96.00	13.56
	1	C-3	97.33	14.61
	1	W-3	88.56	10.23
3	1	A-1	90.20	15.32
	1	B-1	88.32	14.19
	1	C-1	91.61	15.47
	1	A-2	85.53	15.53
	1	B-2	81.28	15.20
	1	C-2	97.65	19.66
	1	A-3	84.22	14.46
	1	B-3	95.64	22.36
	1	C-3	92.46	16.51
4	1	A-1	93.61	13.08
	1	B-1	85.46	9.58
	1	A-2	88.20	10.12
	1	B-2	86.30	15.10
5		Only 4 loads of clay		
6 & 7	1	A-1	94.44	19.96
	1	A-2	87.22	23.11
	1	A-3	94.36	20.07
	1	B-1	95.36	13.99
	1	B-2	95.01	18.73
	1	B-3	97.97	18.82
	1	C-2	97.29	19.18
	1	C-3	97.10	18.98
	1	D-3	112.00	16.06

	1	E-4	94.84	16.96
	1	F-5	101.80	16.00
8		No Density Results Available		
9		Topsoil Only		
10	1	B-1	88.10	15.20
	1	B-2	103.10	18.48
	1	B-3	121.40	22.98
	1	C-1	87.31	19.82
	1	C-2	100.20	20.15
	1	C-3	87.74	19.90
	2	A-1	93.28	13.95
	2	A-1	87.41	16.36
	2	B-1	87.85	16.39
	2	B-1	84.33	18.83
	2	B-2	89.19	13.84
	2	B-2	106.00	16.01
	2	B-3	85.37	12.82
	2	B-3	91.62	16.45
	2	C-1	92.66	18.80
	2	C-1	88.88	18.02
	2	C-1	89.81	18.84
	2	C-1	96.95	17.52
	2	C-2	85.40	19.53
	2	C-2	93.63	18.38
	3	B-2	88.31	11.04
	3	B-2	101.90	15.39
	3	B-2	95.49	12.89
	3	B-3	96.30	19.79
	3	C-2	90.53	18.47
	3	C-3	93.56	17.53
11	1	A-1	85.02	14.94
	1	A-2	88.17	13.06
	1	A-3	88.63	14.11
	1	A-4	84.74	14.71
	1	B-1	85.81	14.52
	1	B-2	95.19	16.17
	1	B-3	90.41	15.13
	1	B-4	85.33	16.02
	2	A-2	92.83	12.15
	2	A-3	106.40	23.53
	2	A-3	90.51	14.97
	2	B-2	94.80	14.02

	2	B-3	86.20	16.22
12	1	A-2	86.41	15.90
	1	A-3	100.00	17.34
	1	B-2	84.34	15.08
	1	B-3	84.51	18.74
13		Topsoil Only		
14 & 15	1	A-1	95.29	16.43
	1	A-2	86.24	20.92
	1	B-1	88.38	15.52
	1	B-2	84.71	21.28
16 & 17	1	A-1	91.68	13.54
	1	A-2	96.61	12.76
	1	B-1	89.47	12.12
	1	B-2	89.26	13.87
	1	B-3	111.60	15.85
	1	B-4	90.60	12.39
	1	C-1	86.08	13.31
	1	C-2	94.39	16.39
	1	C-3	91.46	13.19
	1	C-4	103.00	14.09
18		Only 2 loads of clay		
19		No Density Results Available		
20		No Density Results Available		
Average			92.71	16.10

2.6 MAINTENANCE PROGRAM

Annual inspections will be performed each year to evaluate whether any further settlement has occurred, the need for additional backfilling activities, the degree of erosion at the site, the need for reseeding, and the general condition of the site. Future cap repair activities will be performed upon appoval of the WDNR project manager.

The landfill will be mowed at least once per year, as part of routine maintenance, as indicated in the Technical Specification (4). Additional mowing may be conducted upon approval of the WDNR project manager.

Access roads will be plowed at least four times a year to maintain access. Additional plowing will be performed as required.

2.7 LEACHATE COLLECTION ROAD REPAIR

In November 1994, Vydrzal Services, Inc. was contracted to raise the access road to the leachate collection pad. The access road was raised to enable access to the collection pad during periods of flooding from runoff.

On November 30, 1994, Vydrazal brought in 127.30 tons of 1-1/2" TB stone, and 235.33 tons of 3/4" crushed asphalt base stone to raise the road. The road was compacted and graded for stability and smoothness.

III. CONCLUSIONS AND RECOMMENDATIONS

3.1 CONCLUSIONS

Cap repair activities were commenced in June 1994 and completed in August 1994. Approximately 8,300 cubic yards of clay and 14,900 cubic yards of topsoil were used to fill twenty areas of settlement. Density measuresments were performed using a Seamans C-75 nuclear density meter. The clay was compacted to an average of 92% of the Standard Proctor Density. The cap was reseeded in 1994. Further reseeding will be performed in spring 1995, if necessary.

3.2 RECOMMENDATIONS

It is recommended that the access road across the top of the landfill be replaced. The access road is in need of repair due to wear sustained during backfilling and compaction activities.

A program of yearly inspections is recommended for the site. Yearly inspections will be performed to evaluate the site for settlement, erosion, and general aesthetics. Future work will be performed based on the results of the inspections and the approval of the WDNR project manager.

SECTION IV. REFERENCES

1. Quality Assurance / Quality Control Plan, Sanitary Transfer & Landfill, Delafield as prepared by K. Singh and Associates, Inc., May 25, 1994.

2. NR 504, Wisconsin Administrative Code.

3. Operator's Manual, C-75-A Meter, prepared by Seaman Nuclear Corporation, 1988.

4. Wisconsin Department of Natural Resources, Contract Documents (Volume 2), Sanitary Transfer & Landfill, Delafield, Wisconsin, April 30, 1993.

APPENDIX A

LARGE FIGURES

APPENDIX B

CLAY CHARACTERISTICS TEST RESULTS

4025

Wisconsin TESTING LABORATORIES

Testing and Inspection of:
Soils
Concrete
Asphalt
Geotechnical Reports
Soil Borings
Rock Coring

March 23, 1994

Dr. Raghu B. Singh
K. Singh & Associates, Inc.
1135 Legion Drive
Elm Grove, Wisconsin 53122

Re: Laboratory Tests
Clay Sample
Sanitary Transfer & Landfill
Delafield, Wisconsin
(L-9418)

Dear Dr. Singh:

We are submitting herewith the results of grain size analysis, Atterberg limits (liquid limit and plastic limit), standard Proctor and moisture content tests performed on the referenced sample, which was delivered to our office on March 14, 1994. The moisture content and Atterberg limits test results are shown on the grain size distribution curve sheet.

If there are any questions, or if we can be of any further assistance, please call. We appreciate the opportunity to be of service to you.

Very truly yours,

Jeffrey G. Smith, P.E.
Geotechnical Engineer

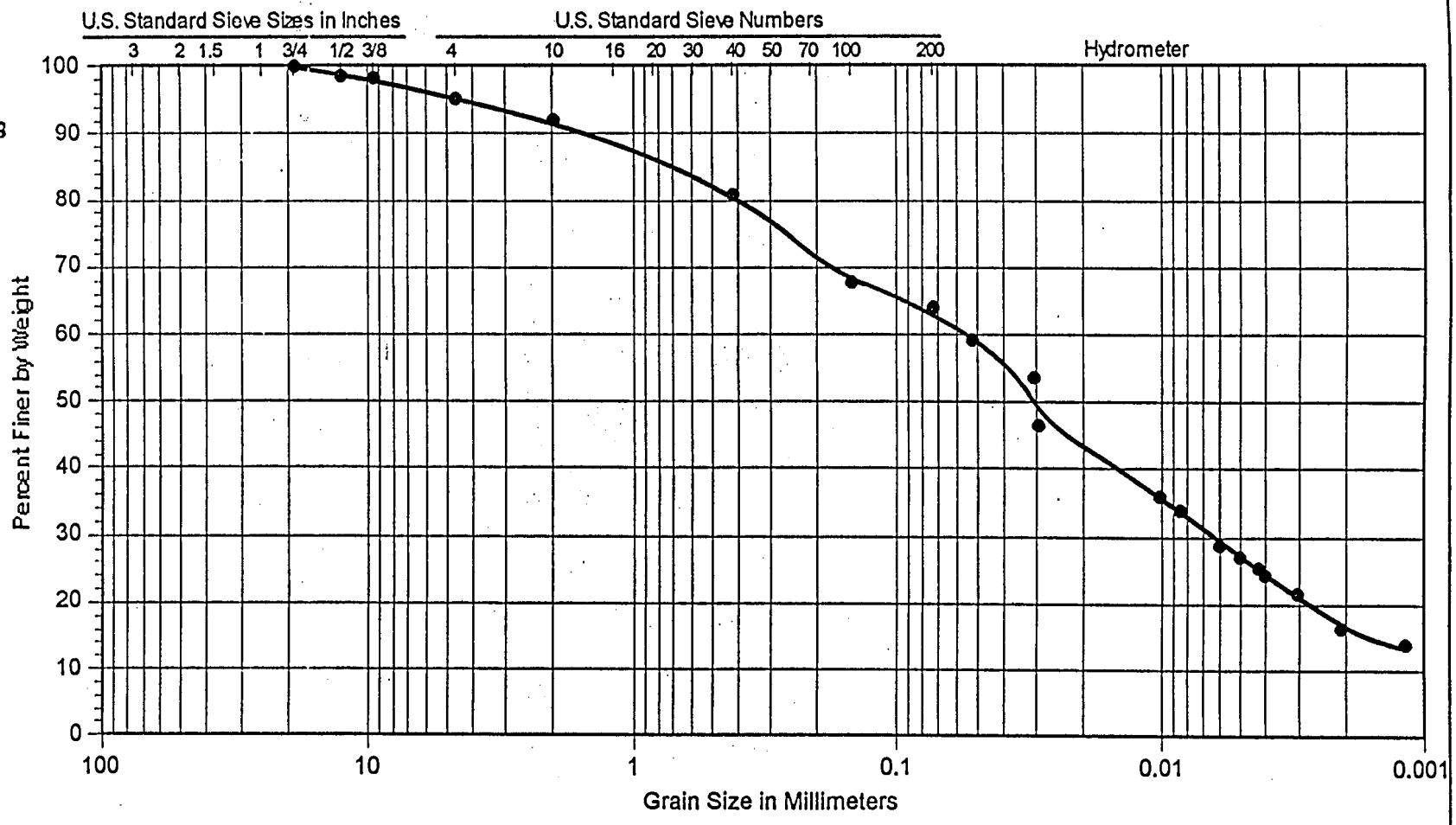
JGS/jlt

Copies (2) Client

N59 W14176 Kaul Avenue/Menomonee Falls, WI 53051/(414) 252-3300

Wisconsin TESTING LABORATORIES

GRAIN SIZE ANALYSIS



Sieve Size	Percent Passing
3/4"	100.0
1/2"	98.7
3/8"	98.2
No.4	95.2
No. 10	92.1
No. 40	81.0
No. 100	67.8
No. 200	64.2

UNIFIED	GRAVEL	SAND	SILT AND CLAY
AASHTO	GRAVEL	SAND	SILT AND CLAY

NUMBER	DEPTH	w	w_L	w_P		CLASSIFICATION
		18.9	62	25		Sandy Fat Clay (CH)

Project: Sanitary Transfer & Landfill
Delafield, Wisconsin
WTL Job No.: L-9418
Client: K. Singh & Associates, Inc.
Date: March 17, 1994

Wisconsin TESTING LABORATORIES

LABORATORY MOISTURE-DENSITY RELATIONS TEST

Contracted with K. Singh & Associates, Inc. Job No. L-9418

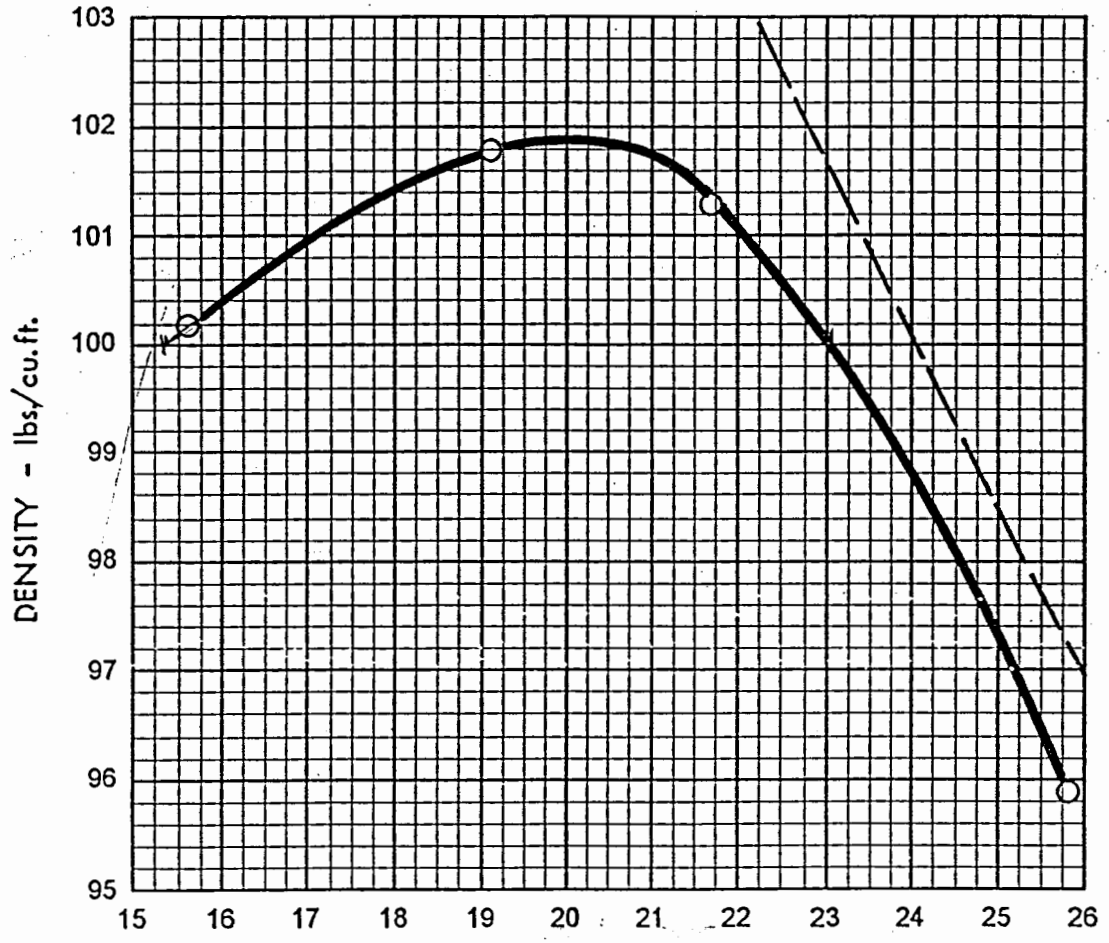
Project Sanitary Transfer & Landfill, Delafield, WI Lab No. 1

Sample From Client (Received on March 14, 1994)

Sample Description Sandy Fat Clay (CH)

Test Type: Standard, Method "A" Proctor; Mold Size 4.00 in.

Hammer wt. 5.5 lbs.; Drop 12 in., 3 layers, 25 blows/layer.



Maximum Dry Density 101.9 lbs./cu.ft. Optimum Moisture 20.1 %

Remarks

Tested By H.A.S. Date March 17, 1994

APPENDIX C

PHOTOGRAPHS

Photograph 1: Area Staked Out for Backfilling

Photograph 2: Compaction Activities

Photograph 3: Closeup of Compacted Fill Area

Photograph 4: Finished Western Edge Prior to Reseeding