Ecology
Lake Goodwin LF
Snohomish CO.

Golder Associates Inc.
CONSULTING ENGINEERS

December 12, 1991

Our ref: 913-1178.300

Snohomish County Department of Public Works
Solid Waste Management Division
5th Floor, Wall Street Building
2930 Wetmore Avenue
Everett, WA 98201

ATTENTION: Mr. Ken Miller

RE: GEOLOGIC LOGGING AND CONSTRUCTION OBSERVATION OF THE INSTALLATION OF MONITORING WELL LG-5 AT LAKE GOODWIN SANITARY LANDFILL, SNOHOMISH COUNTY, WASHINGTON

Dear Mr. Miller:

We are pleased to submit the documentation of the drilling, sampling and installation of monitoring well LG-5 at the Lake Goodwin Sanitary Landfill, Lakewood, Washington.

This work has been completed under Work Authorization No. 2 of the Consultant Agreement for On-Call Engineering Services (Master Agreement No. 9012) between GAI and Snohomish County as executed June 20, 1990 by the Snohomish County Executive.

The scope of work for the monitoring of well construction was presented in a proposal dated July 3, 1991 and included the following three tasks: a background information review and site visit, borehole logging and construction observation of monitoring well installation, and preparing a brief letter report summarizing activities and documenting the details of the monitoring well installation.

The scope of work was expanded to include documentation of the resolution of drilling and equipment problems encountered by the driller. The increases to the scope of work were documented in a Revised Change Order request, dated November 7, 1991, which resulted in Snohomish County issuing Work Authorization No. 7 under the above referenced contract, for completion of the work.

1. INTRODUCTION

In response to Snohomish County's request, Golder Associates Inc. (GAI) provided services to document the construction of monitoring well LG-5 at the Lake Goodwin Landfill in Lakewood, Washington, in south central Snohomish County.

The drilling and construction program had two objectives: to drill and log an exploratory borehole "well into till" which underlies the Lake Goodwin Landfill, followed by installation of a downgradient monitoring well at the margin of the landfill. The depth of borehole from 10 feet below the water table to the bottom of the exploratory hole was backfilled and sealed with bentonite chips. The down gradient direction was determined by work completed by Converse Consultants NW in the draft Phase II Hydrogeologic Study, Cathcart Landfill (Converse Consultants NW, September, 1989).

GAI provided a staff hydrogeologist to log the borehole construction and monitor the monitoring well installation activities. Documentation activities included:

- geologic logging the drilling of the borehole;
- sampling the borehole at five foot depth intervals for sieve analysis and Atterburg Limit testing;
- taking environmental samples at the surface, and just above and below the water table for chemical analysis;
- monitoring the installation of monitoring well components to Washington State standards; and
- monitoring of well development and the installation of a dedicated sampling pump and water level measurement apparatus.

A site visit by GAI, Snohomish County, and drilling contractor representatives was conducted on July 9, 1991 to identify the best location for the borehole and to identify any problems or hazards which might exist on the site. A site specific Health and Safety Plan (HSP) was then prepared to GAI standards which identified the physical and chemical hazards which might potentially be encountered on a sanitary landfill site during drilling. The HSP included environmental monitoring for organic vapors, for methane gas concentration, and for oxygen concentrations. The latter two gases were monitored for evaluation of potentially explosive conditions. The HSP identified on-site health and safety responsibilities, the locations of the nearest medical facilities, and the appropriate monitoring and emergency procedures to be taken if and when needed. The complete HSP is included as Appendix A.

2. Drilling and Sampling Activities

2.1 Initial Exploratory Boring

The drilling contractor for the project was John Mathes & Associates, Inc., working under contract directly to the Snohomish County Division of Solid Waste Management (SWM). Drilling was scheduled to begin on July 23, 1991, using a Guspack Brute 22R air rotary drill rig. Drilling actually began on July 24, 1991, after a false start due to difficulties constructing a fill pad to support the drill rig. Landfill waste was encountered from just below the surface to a depth of 20 feet below ground surface (bgs), at which point the hole was determined to be within the landfill perimeter and was abandoned. Six bags of bentonite chips were deployed and hydrated to seal the borehole to the surface. This borehole was labeled LG-5A and located with a survey stake. The location was approximately 40 feet to the north-north-west from the final LG-5 installed location.

2.2 Borehole Drilling and Sampling

Drilling of the final LG-5 borehole began on July 25, 1991, following additional consultation with Ken Miller (Snohomish County SWM) to select a more appropriate down gradient location and to clear and construct a suitable drill pad. The final location of monitoring well LG-5, as well as LG-5A, was to be surveyed by a Snohomish County survey crew; the results are not included here.

The drillers opted to use 4.25 inch inner diameter (8.5 inch outer diameter) hollow stem auger as casing down to the 95 feet bgs level to accommodate environmental and geologic sampling using a split spoon sampler, before switching to air rotary drilling to complete the exploratory investigation to 190 feet bgs. The borehole log for LG-5 is included on the LG-5 Monitoring Well Installation Log, presented in Figure 1. The log includes a stratigraphic description based on geologic sample identification, the USCS Classification for each sample, the location type of each sample taken, the blow counts required to advance the sampler six inches.

Environmental samples were taken at depths of 10, 71 and 95 feet below ground surface (bgs). These depths correspond to near surface, and above and below the water table elevations, respectively. The water table was encountered at 83 feet bgs. The environmental samples were split into separate containers for analysis of metals, volatile organics (VOA), petroleum hydrocarbons (TPH), and total organic carbon (TOC). The samples were placed in a cooler with sealed ice containers, and shipped for analysis under security seal and chain-of-custody (COC) directly to Laucks Laboratories, the County contracted laboratory. The analytical procedures used are summarized below:

Analysis	EPA Test Method
Metals	EPA 7000
VOA's	EPA 8240
TPH	EPA 418.1
TOC	EPA 9060

The results of the environmental analyses are presented in Appendix B. The only note worthy result is a detection of methylene chloride and acetone. Since methylene chloride and acetone were only detected in one sample, were also detected in a trip blank sample (TB), and are common laboratory contaminants (used in cleaning laboratory analytical equipment), the significance of these detections was discounted.

Geologic samples were collected at five feet intervals from ground surface to the bottom of hole at 190 feet bgs. Samples to a depth of 95 feet bgs were collected with a split spoon sampler as the hollow stem auger flights were advanced. Following collection of the final environmental sample, the driller switched over to the air rotary drilling method. Due to problems encountered with the air rotary equipment, additional auger flights were drilled and placed as well casing to a depth of 115 feet bgs.

Geologic samples were collected from 95 to 190 feet bgs from air rotary drill cuttings. The sample at 10 feet bgs was missed by the driller. Samples between 60 and 80 feet were not available due to extremely hard soils resulting in minimal sample recovery. The sample at 95 feet was dedicated as an environmental sample. The geologic samples were sent to the GAI Redmond, Washington, soils lab for determination of grain size distribution. In addition, samples at 150, 170, 180, 185 and 190 feet bgs were cohesive enough to permit testing of Atterburg Limits. The soils laboratory test results are presented in Appendix C.

2.3 Drilling Problems

Problems with the drilling equipment began on July 30, 1991 and continued through August 8, 1991. The drilling of LG-5 to 190 feet bgs was completed on July 30, 1991. The water table was measured several times during the drilling and varied between 82 and 83.3 feet bgs. Backfilling of the borehole with bentonite chips from 190 to approximately 95 feet bgs began once drilling was completed. While attempting to begin to remove the auger flights when the bentonite backfill reached the 115 feet bgs level, the hydraulic cylinder of the drill rig failed catastrophically, leaving no way to remove the augers from the ground.

The 22R air rotary rig was replaced with a CME 75 auger drill rig on August 3, 1991. The bentonite chips in the water column at the time of the hydraulic cylinder failure resulted in a 1.5 feet thick plug in the bottom auger flight. With no way to drill out the plug with the CME 75, the driller unsuccessfully tried to flush the plug free with water. The activity resulted in 15 feet of heave in the bottom three auger flights. Finally, additional equipment was brought on site permitting the plug to be drilled out. The augers, however, were seized into the surrounding formation. With great difficulty, they were finally freed on August 8, 1991.

GAI personnel were asked to remain on-site during the problem resolution to document the methods employed and the condition of the borehole. The additional monitoring resulted in a Change Order request, and issuance of Work Authorization 7 to complete the monitoring of the well installation.

GAI was also asked to evaluate the condition of the borehole, and determine the likelihood of obtaining a monitoring well which would meet Washington State requirements.

Following a review of the activities and the condition of the borehole, GAI responded that despite the delay, the borehole was not significantly damaged, and that a normal monitoring well installation was still possible. Complete documentation of all field activities is contained on History of Hole forms and geologic field notes, presented in Appendix D.

3. Monitoring Well Construction

Installation of monitoring well components began on August 7, 1991, before the augers were completely free to spin in the borehole. Bentonite chips were placed from 115 to 102 feet bgs. This followed by minor sloughing of the borehole walls, resulting in a mixture of formation sand (heave) and bentonite chips from 102 to 98 feet bgs. Formation sand (heave) followed by approximately six inches of 8-12 clean Colorado sand span the interval from 98 to 94.7 feet bgs. Twenty feet of two inch diameter stainless steel, V-wire wrapped 20-slot size screen 80 feet of stainless steel riser were then placed in the borehole.

Colorado sand was placed as filter pack material around the screen to an elevation of 91 feet bgs, at which time pulling back of the auger flights resulted in 12 feet of sandy heave collapsing against the screen. Geologic samples taken at this elevation indicated a fine to coarse sand, with little gravel, thin laminae of shale, and a trace silt lens. GAI made a field determination that this natural material would function adequately as a filter pack material, and would not impede flow of groundwater to the monitoring well screen. Accordingly, placement of Colorado sand continued, to an elevation of 70 feet bgs. A bentonite pellet seal was placed from 70 to 62 feet bgs, and the remainder of the borehole was grouted to the surface with a five percent bentonite grout. The stainless steel riser was trimmed to Snohomish County specifications, and a 60 inch steel surface casing was placed in a concrete foundation at the surface over the riser. The trimmed top of the stainless steel riser was measured at 0.9 feet above ground surface. The completed monitoring well installation is shown diagrammatically on the LG-5 Monitoring Well Installation Log in Figure 1.

4. Pump Installation and Well Development

Installation of the monitoring well was completed on August 9, 1991. However, due to availability from Instrumentation Northwest, well development and installation of the dedicated Hydrostar pump and the bubbler gauge (water elevation measurement apparatus) was delayed until August 14, 1991.

Well development began on August 14, 1991, using a self priming, siphoning bailer. Essentially a small, manually activated pump, this plastic siphon had a ball valve which was selectable from the surface. In one position, it permitted pumping of the well; in the other it permitted surging of the water within the well screen back against the formation. During the two hour development process, approximately 325 gallons, or 19 well volumes, of water were pumped from the well.

Turbidity was measured with a turbidimeter, standardized to 0.9 and 9 NTU. Initial turbidity was in excess on 100 NTU (the limit of the meter). Final turbidity values did not drop below 35 NTU (as the last 100 gallons were pumped from the well). This value is

above the 5 NTU standard for monitoring groundwater. GAI recommends that the pumping up to 20 additional well volumes of water from the well prior to taking the first round of environmental samples from the well. Turbidity should be measured during this process. If the turbidity does not drop below 5 NTU, it is recommended to take both filtered and unfiltered samples to determine the significance of the particulates with respect to metals content.

During construction of the monitoring well, it was noted that approximately six inches of very fine sediment had settled in the bottom of the well, inside the well screen. Following well development, the same amount of material still remained; it was not flushed out by the development process. While worthy of notation, this sediment will not adversely impact the functioning of the monitoring well or the hydrostar pump.

The hydrostar pump was installed in the well immediately following well development on August 14, 1991. The bottom of the pump was placed at an elevation of 92.6 feet bgs. The geometry of the pump and the bubbler gauge are such that the bubble gauge inlet is at 90.1 feet bgs. This value is used to accurately convert bubbler gauge pressure readings into water table elevations.

The drive head fitting for the pump was not installed at this time, because precise fitting required that the pump motor be available on-site; this was not possible as the motor was in use on another site. The drive head fitting was installed on August 29, 1991, and ecology blocks were placed around the well on August 30, 1991, completing the monitoring well installation.

If you have any questions or concerns regarding the contents of this letter report, please do not hesitate to contact us.

Sincerely,

GOLDER ASSOCIATES INC.

for John S. Velimesis
Project Hydrologist

Douglas J. Morell
Associate

JSV/DJM/kew

Attachments

Job No.: 913–1178.200 Project: Snohomish Co./Lake Goodwin LF/WA Geologist: M. Fairhurst

Drilling Contractor: John Mathes & Assoc. Inc. Drilling Method: 0.0 – 115.0 ft. 4–1/2" HSA

Driller: G. Gauf 115.0 – 190.0 ft. 4" Air rotary

Dates: Started – 7/25/91 08:00 Weather: Fair Temp: 60–85 °F

Completed – 8/14/91 14:30

Ground Surface Elevation: Est. 230 ft. MSL Water Depth: 81.15 ft. BGS

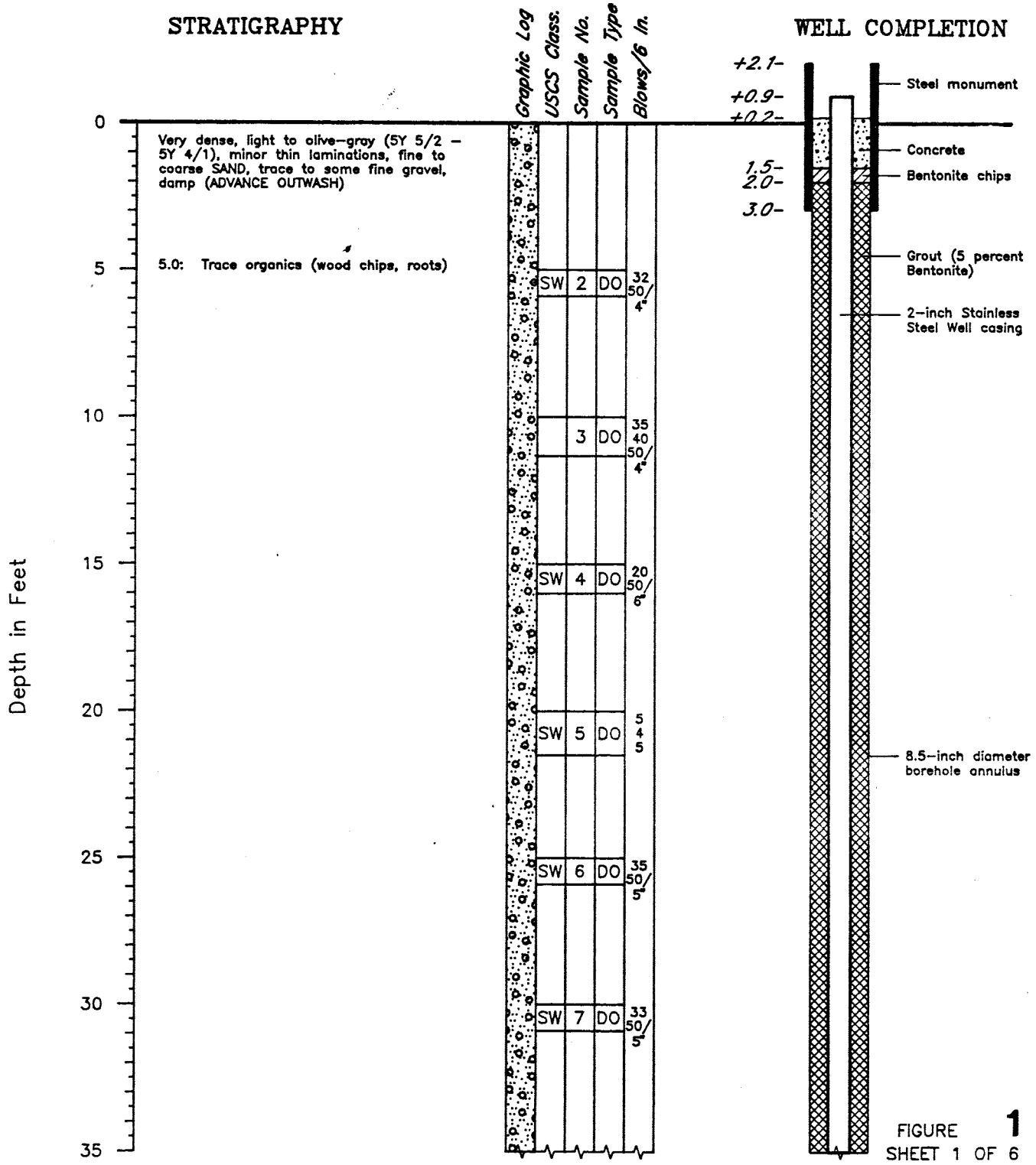


FIGURE 1

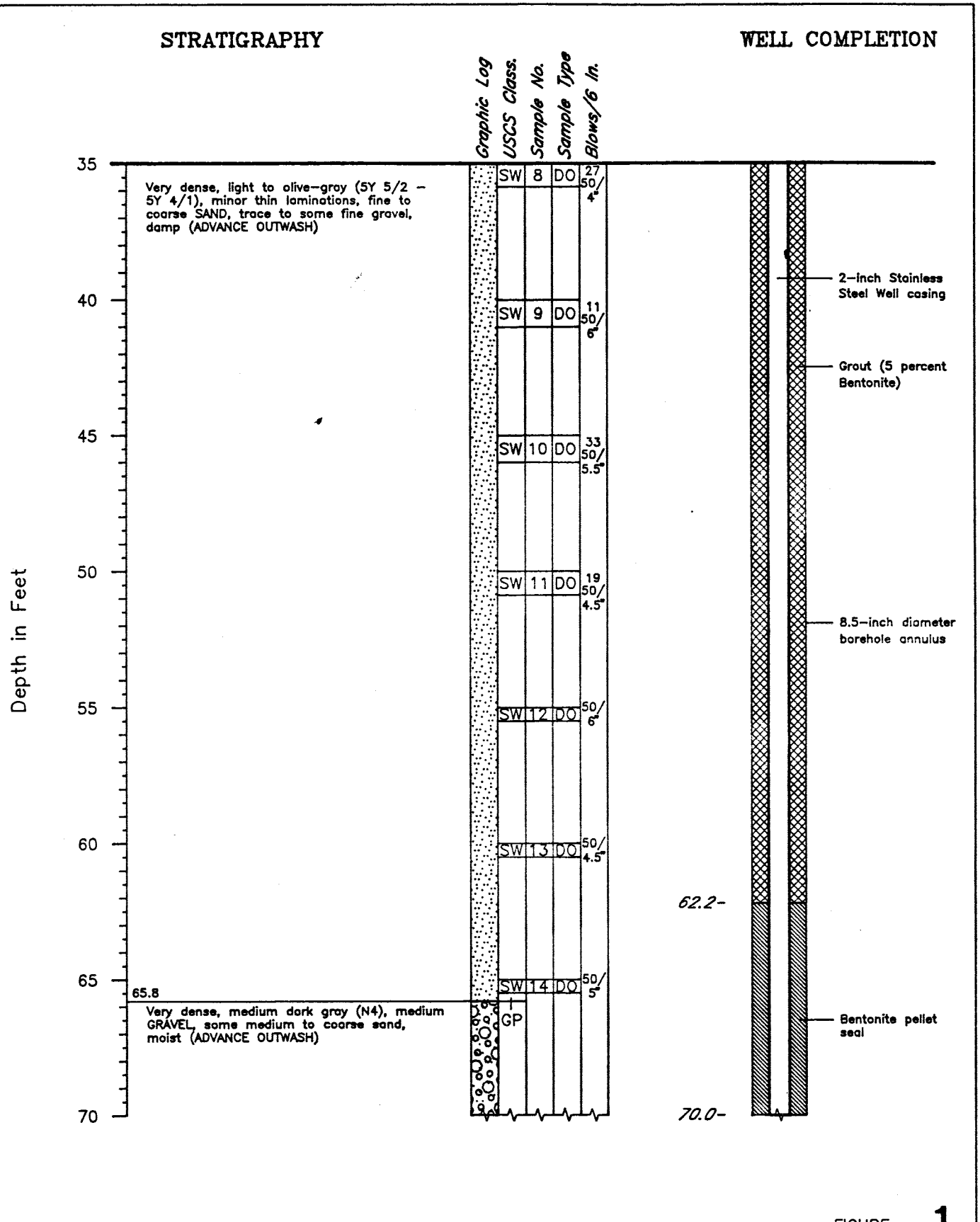
SHEET 1 OF 6

BORING LG5

RECORD OF DRILLHOLE

LAKE GOODWIN LANDFILL

PROJECT NO 913–1178.300 DWG NO 35891 DATE 12/9/91 DRAWN JSS



Date: 7/25/91
Geologist: M. Fairhurst
Drilling Contractor: Mathes
Drill Method: 22R/CME75

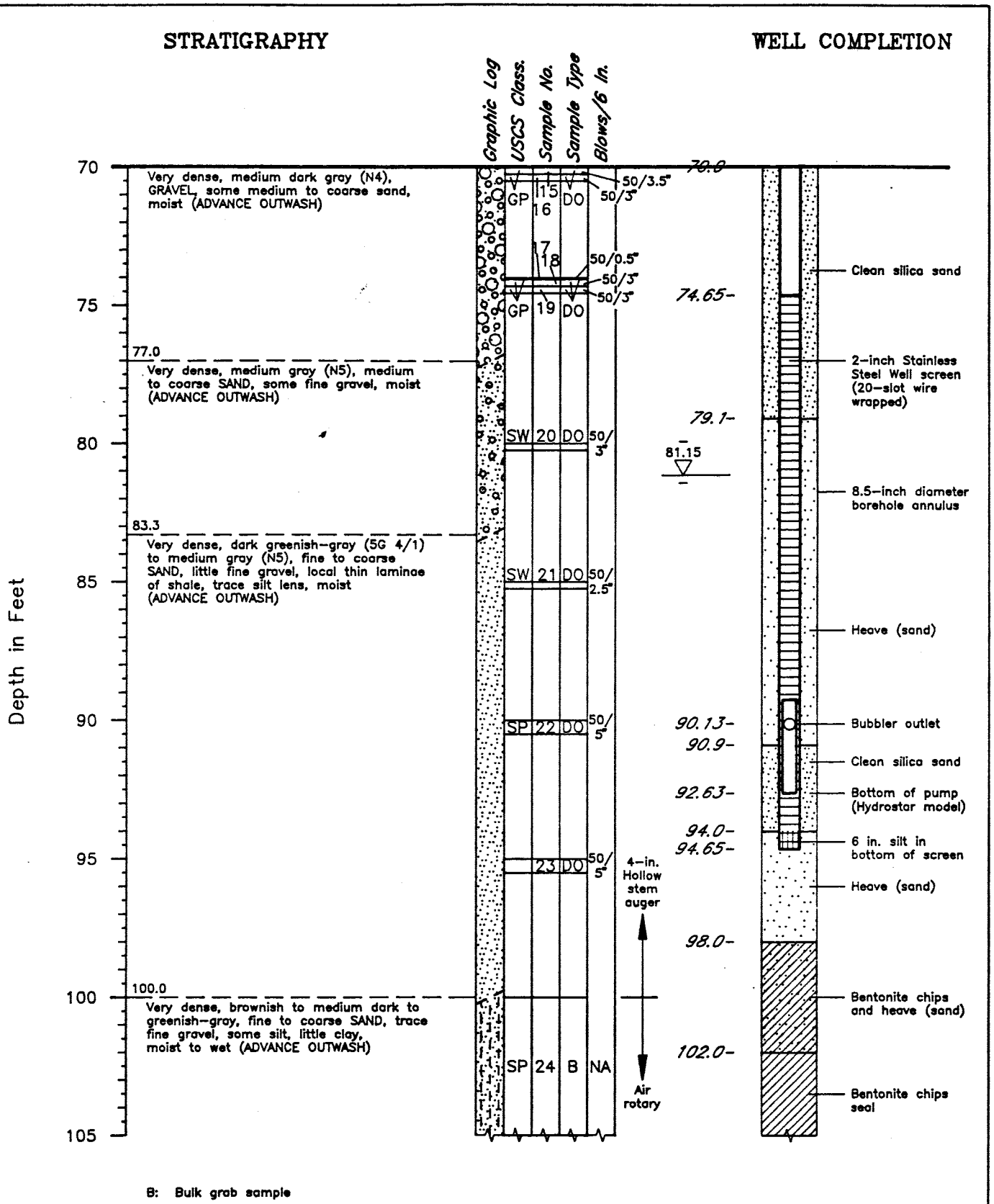
FIGURE 1
SHEET 2 OF 6

BORING **LG5**

RECORD OF DRILLHOLE

LAKE GOODWIN LANDFILL

PROJECT NO 913-1178.300 DWG NO 35777 DATE 12/9/91 DRAWN JSS

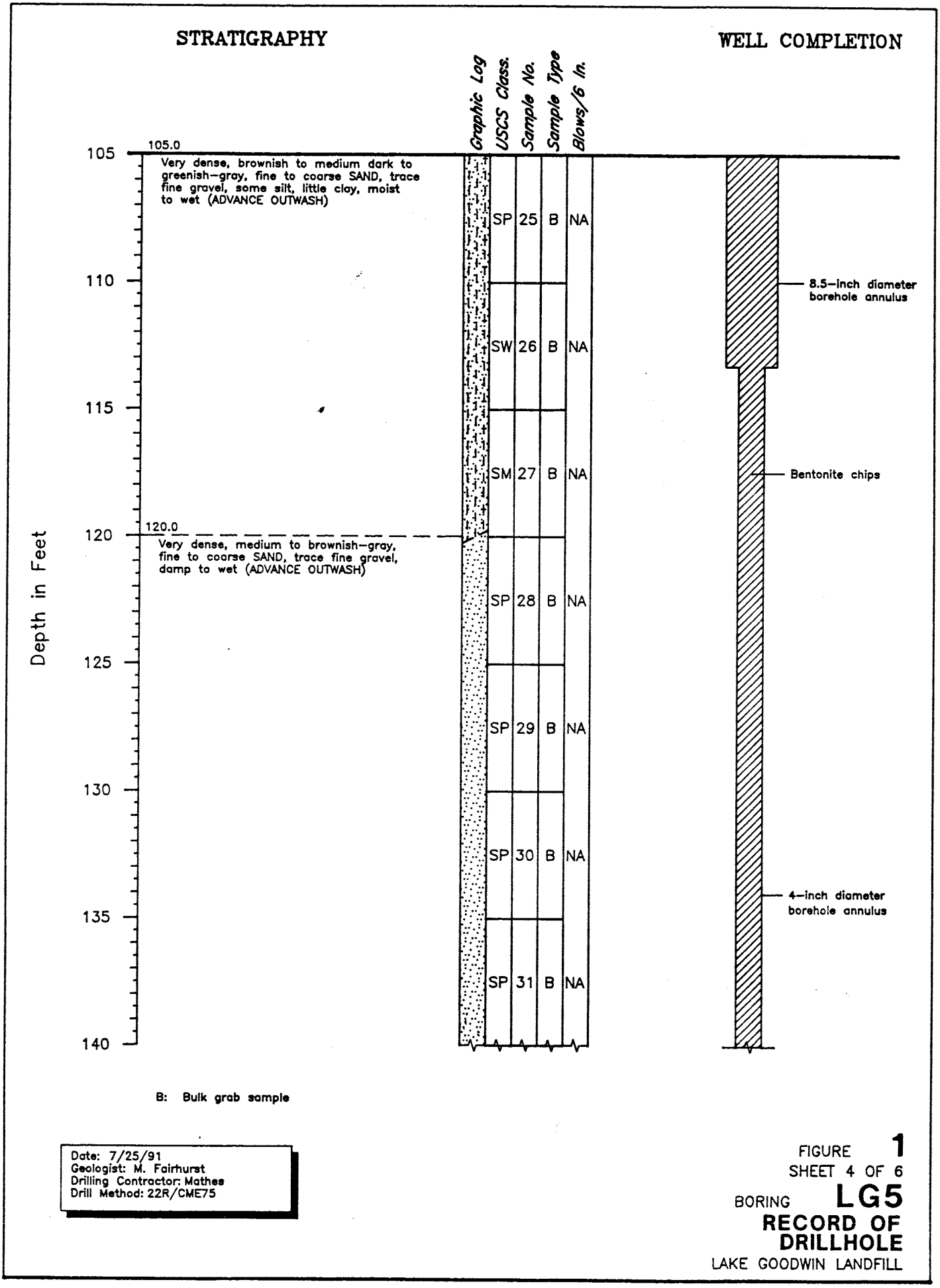


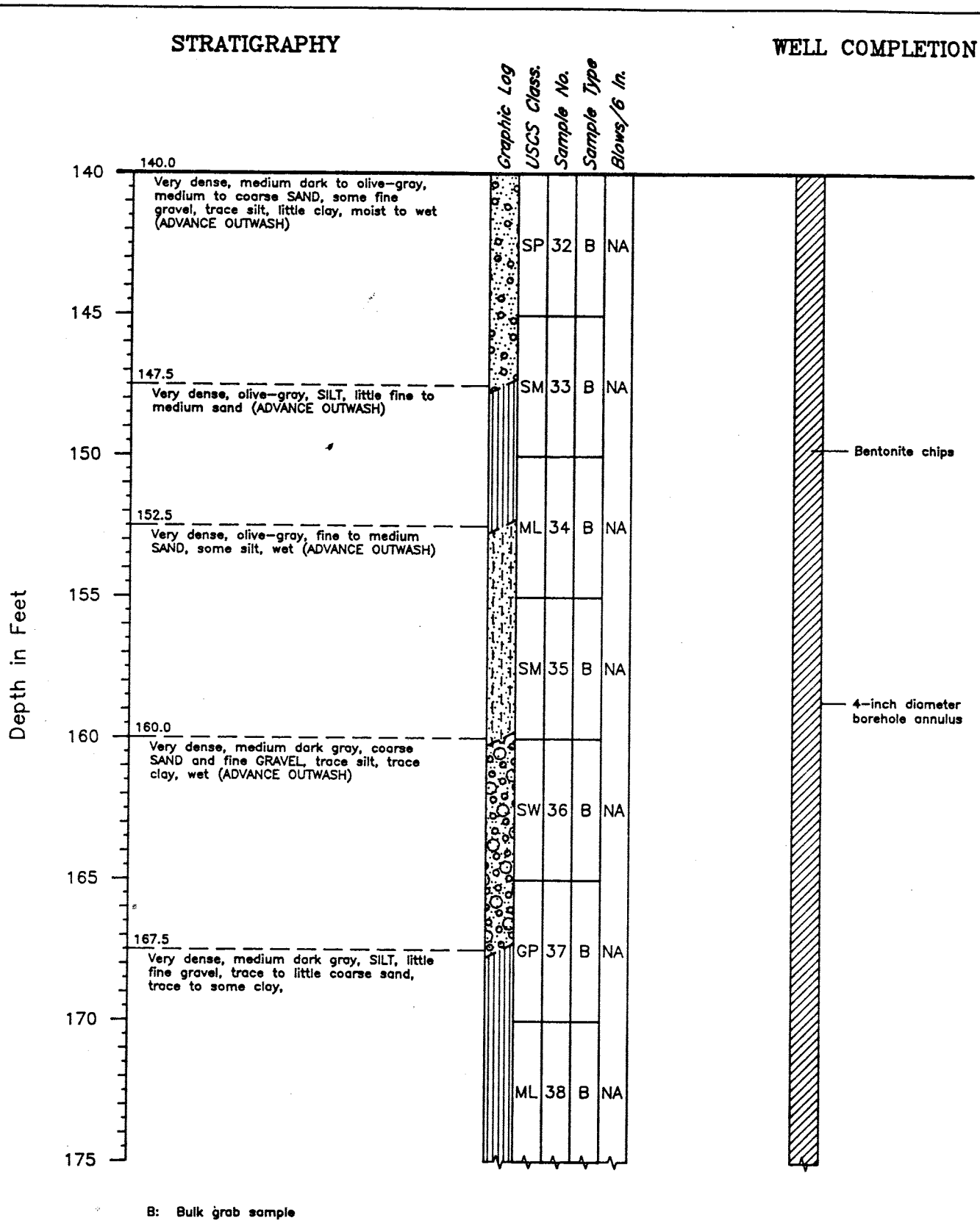
B: Bulk grab sample

Date: 7/25/91
Geologist: M. Fairhurst
Drilling Contractor: Mathes
Drill Method: 22R/CME75

FIGURE 1
SHEET 3 OF 6
BORING LG5
RECORD OF DRILLHOLE
LAKE GOODWIN LANDFILL

PROJECT NO 913-1178.300 DWG NO 35778 DATE 12/9/91 DRAWN JSS


STRATIGRAPHY
WELL COMPLETION
Graphic Log
USCS Class.
Sample No.
Sample Type
Blows/6 in.
105.0
Very dense, brownish to medium dark to greenish-gray, fine to coarse SAND, trace fine gravel, some silt, little clay, moist to wet (ADVANCE OUTWASH)
120.0
Very dense, medium to brownish-gray, fine to coarse SAND, trace fine gravel, damp to wet (ADVANCE OUTWASH)
Depth in Feet
105
110
115
120
125
130
135
140
SP 25 B NA
SW 26 B NA
SM 27 B NA
SP 28 B NA
SP 29 B NA
SP 30 B NA
SP 31 B NA
8.5-inch diameter borehole annulus
Bentonite chips
4-inch diameter borehole annulus
B: Bulk grab sample
Date: 7/25/91
Geologist: M. Fairhurst
Drilling Contractor: Mathes
Drill Method: 22R/CME75
FIGURE 1
SHEET 4 OF 6
BORING LG5
RECORD OF DRILLHOLE
LAKE GOODWIN LANDFILL
PROJECT NO 913-1178.300 DWG NO 35779 DATE 12/9/91 DRAWN JSS

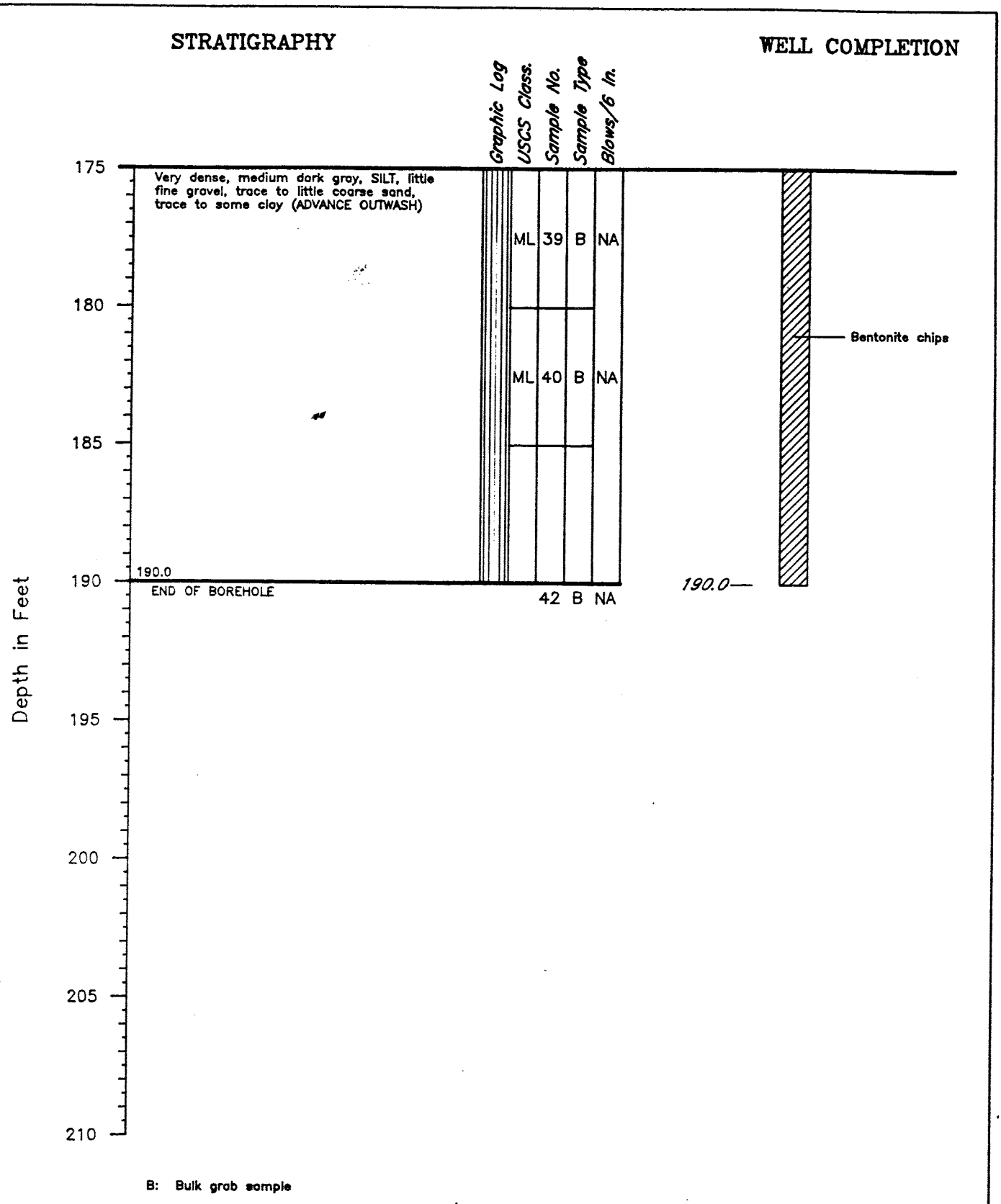


B: Bulk grab sample

Date: 7/25/91
Geologist: M. Fairhurst
Drilling Contractor: Mathes
Drill Method: 22R/CME75

FIGURE 1
SHEET 5 OF 6
BORING LG5
RECORD OF DRILLHOLE
LAKE GOODWIN LANDFILL

PROJECT NO 913-1178.300 DWG NO 35780 DATE 12/9/91 DRAWN JSS



Date: 7/25/91
Geologist: M. Fairhurst
Drilling Contractor: Mathes
Drill Method: 22R/CME75

FIGURE 1
SHEET 6 OF 6
BORING LG5
RECORD OF DRILLHOLE
LAKE GOODWIN LANDFILL

PROJECT NO 913-1178.300 DWG NO 35781 DATE 12/10/91 DRAWN JSS

APPENDIX A

HEALTH AND SAFETY PLAN

1. Items 1-9 to be completed by Project Manager.

Project Name Snohomish County/Lake Goodwin Landfill/WA

Task 200: Log Borehole and Install Monitoring Well

Requested by John Velimesis

Proposed Start-Up Date July 23, 1991 Project/Task No. 913-1178.200

Rev. Level 0

Prepared by/Reviewed by Health and Safety Officer

Printed Name Erik Still

Signature [signature] Date 23 July 1991

Reviewed by Project Health and Safety Coordinator

Printed Name JOHN VELIMESIS

Signature [signature] Date July 23, 1991

Approved by Project Manager

Printed Name John Velimesis

Signature [signature] Date July 23, 1991

Title PROJECT HYDROLOGIST

Note to Project Managers:

A signed and completed copy of the Health and Safety Plan and a signed and completed copy of the safety briefing (p. 14) must be included in the project file.

2. ProjectDescription:

Drill and install monitoring well immediately adjacent to perimeter of a closed municipal landfill. Borehole to be drilled to 150-200 feet for geologic information; backfilled to approximately 100 feet depth; monitoring well then installed to Snohomish County specifications.

3. Location:

General: Lake Goodwin Landfill, near Lake Goodwin, Snohomish County, WA.
Specific: Approximately 1½ miles N.W. of Lake Goodwin on the west side of Frank Waters Road; 5½ miles south of Stanwood, WA.

4. Facility/WorkSiteDescription:

A closed municipal landfill located in an old gravel pit. Landfill site is open, grassy slope. Adjacent property is wooded. Four existing monitoring wells, completed final cover, but no bottom liner, no leachate or gas collection system. Refuse includes municipal waste, garbage, demolition debris and some industrial waste.

5. Proposed Personnel and Tasks:

Project Manager John Velimesis

Field Team Leader John Velimesis

Proposed Field Team	Job Function/Tasks
Maggie Fairhurst	Log borehole and observe/document monitoring well installation to Snohomish County specifications.

6. Confined Space Entry

A confined space is defined as any space not currently used or intended for human occupancy, having a limited means of egress, which is subject to the accumulation of toxic contaminants, a flammable or oxygen deficient atmosphere, or other hazards, such as engulfment, or electrical or mechanical hazards should equipment be inadvertently activated while an employee is in the space. Confined spaces include but are not limited to storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, air pollution control devices, smoke stacks, underground utility vaults, sewers, septic tanks, and open top spaces more than four feet in depth such as test pits, waste disposal trenches, sumps and vats.

Will this task require entry into any confined or partially confined space? ____ YES - Describe below
__X__ No

7. Cutting and Welding

Will this task involve use of a cutting torch or welding? ____ YES - Describe below
__X__ No

8. Other Potential Hazards

___ Chemical
___ Radiological
_X_ Fire/Explosion
___ Heat Stress
___ Electrical
_X_ Machinery/Mechanical Equipment
_X_ Trips, Slips, Falls
___ Trenching/Shoring
___ Heavy Equipment/Vehicular Traffic
___ Overhead Hazards
___ Unstable/Uneven Terrain
___ Other - Describe below

6,7,8 Description/Other

Drilling via air rotary in soils adjacent to closed, capped landfill. Absence of gas collection system indicates potential methane accumulation. Drill rig expected to have overhead hoists, presenting both high fall and rotational machine hazards. Site may become cluttered with equipment and tools. Care to be exercised at all times.

9. I, John Velimesis, attest that this information is accurate to the best of my knowledge and hereby request a Health and Safety Plan for the task(s) designated above.

John A. Velimesis 7-10-91
Signature Date

Project Hydrologist
Title

10. Chemical/Radiological Hazard Evaluation

Waste Media

- [X] Airborne Contamination Possible
- [ ] Surface Contamination
- [X] Contaminated Soil Possible
- [ ] Contaminated Groundwater
- [ ] Contaminated Surface Water
- [X] Solid Waste Possible
- [ ] Liquid Waste
- [ ] Sludge

Hazardous Characteristics

- [X] Ignitible Possible
- [ ] Corrosive (H_2S Possible)
- [ ] Reactive
- [X] Explosive (Methane Possible)
- [X] Toxic (non-radiological) (H_2S Possible) (Cyanide Possible)
- [ ] Radioactive

Substance

This task will involve the reasonable possibility of exposure to the substances listed below at concentrations or in quantities which may be hazardous to the health of the site personnel.

Primary Hazard (Rate: low, med, high, ext)

Substance	Inhalation of Gases/ Vapors	Inhalation of Dusts/ Mists	Ingestion	Dermal Absorption of Solids/ Liquids and/or Skin Contam.	Dermal Absorption of Gases/ Vapors	Corrosive/ Irritant	Ignit-ability	Reactivity/ Explosion
	Methane H_2S Cyanide	Drill cuttings		Solid waste residue		H_2S		Methane

Substance	Exposure Limit	IDLH Level	Health Effects
Methane	NA	<19.5% O_2 or >5% Methane (LEL)	Inert asphyxiant Displaces O_2
H_2S	10 ppm	300 ppm	Respiratory irritant, eye irritant, chemical asphyxiant
Solid Waste Residue	-	-	-
Dust from air rotary drill cuttings	-	-	Respiratory irritation
HCN	4.7 ppm-10 min. ceiling	50 ppm	Chemical asphyxiant CNS toxin

11. Ambient Air/Site Monitoring Procedures

The following instruments shall be used to monitor the work environment and workers' breathing zones prior to site entry and at the specified intervals.

	Instrument	Monitoring Frequency					
X	PID (HNU, OVM) w/10 eV lamp	Cont.	15min.	30min.	hourly	other	_____
_____	OVA	Cont.	15min.	30min.	hourly	other	_____
X	Combustible Gas Indicator	Cont.	15min.	30min.	hourly	other	_____
X	H2S Detector	Cont.	15min.	30min.	hourly	other	_____
X	Colorimetric Detector Tubes (HCN)	Cont.	15min.	30min.	hourly	other	If any unusual odor detected
_____	Other (describe below)	Cont.	15min.	30min.	hourly	other	_____

Description/Other: Colorimetric dector tubes will be used to determine the presence of HCN at least hourly while drilling more frequently if there is evidence of actively venting gases.

12. Action Levels

Task personnel shall observe the following Action Levels:

Instrument	Action Level	Specific Action
Combustible gas MSA-361	>25% LEL in work zone >25% LEL in excavation	Evacuate area Perform continuous monitoring
H_2S detect MSA-361	2 ppm in breathing zone	Stop work; approach and monitor area from upwind
Colorimetric tubes for cyanide	≥5 ppm at the mouth of the borehole ≥1 ppm in breathing zone	Monitor breathing zone Stop work; move to clean air upwind; approach from upwind; monitoring
PID	any 3.75 minute average above the established background in the breathing zone or any peak reading >5 ppm in the breathing zone.	Temporarily stop work - contact Golder H&S officer

13. Personal Monitoring

___ Passive Dosimeter ___ Personal Air Sampling ___ Other

Description/Other:

N/A

14. Biological Monitoring/Medical Surveillance

_____ This project requires medical surveillance or biological monitoring procedures beyond the provisions of the routine medical surveillance program, see description below

Description: N/A

15. Onsite Control

Control boundaries have been established, and the Exclusion Zone (the contaminated area), Hotline, Decontamination Line, Contamination Control Zone and Support Zone (clean area) have been designated and are identified as follows:

Establish control boundary ~ 25 feet around rill rig.

(Name)_____ has been designated to coordinate access control on the work site during this task. No unauthorized person shall be allowed beyond the Contamination Control line.

16. Personal Protective Equipment

Location	Job Function/Task	Initial Level of Protection
Controlled Zone	Logging Drill Cuttings	B C D 1 2 3 other
		B C D 1 2 3 other
	Observe/document well installation	B C D 1 2 3 other
	If unforeseen conditions occur, consult a Golder H&S Officer	B C D 1 2 3 other
	about upgrade to C-2.	B C D 1 2 3 other
Decontamination Zone		B C D 1 2 3 other
	Access/egress	B C D 1 2 3 other
		B C D 1 2 3 other

List the specific protective equipment and material (where applicable) for each of the Levels of Protection identified above

Level B _____

___ Pressure demand airline
___ Pressure demand airline with escape provisions
___ Pressure demand SCBA

Level C 2

X Half face Air Purifying Respirator
___ Full face Air Purifying Respirator
___ Full face canister Air Purifying Respirator
X Standard work clothes
X Hard hat, steel toed boots, safety glasses
X Ear protection during drill rig operation
X Inner latex gloves
X Outer NBR (Nitrile Butyl Rubber) gloves

Level D 3

X Standard work clothes
X Hard hat, steel toed boots, safety glasses
X Ear protection during drill rig operation
___ Inner latex gloves
___ Outer NBR gloves

Level _____ _____

Where air purifying respirators are authorized, acid/gas are the appropriate canisters/cartridges for use with the specific substances and concentrations anticipated. Cartridges shall be replaced at the start of each work day.

NO CHANGES TO THE SPECIFIED LEVELS OF PROTECTION SHALL BE MADE WITHOUT THE KNOWLEDGE AND APPROVAL OF THE HEALTH AND SAFETY OFFICER AND THE PROJECT MANAGER

17. Decontamination

Personnel and equipment leaving the Controlled Zone shall proceed through the following decontamination stations and procedures from the decontamination zone:

Personnel Decontamination

Station	Procedure
Wash station	Wash hands thoroughly prior to eating or drinking.

Personnel to shower at home as soon as possible after leaving work site.

Equipment Decontamination

Station	Procedure
N/A	

The following decontamination equipment is required: Water, soap.

Emergency decontamination procedures:

18. Confined Entry Procedures ___X___ Not Applicable

Yes	N/A		Yes	N/A	
___	___	Provide Forced Ventilation	___	___	Refer to Personal Protective Equip. (#16)
___	___	Test Atmosphere For:	___	___	Refer to Emergency Procedures (#29)
___	___	(a) $\%O_2$	___	___	Other Special Procedures
___	___	(b) %LEL			
___	___	(c) Other			

Descriptions/Other:

19. Cutting/Welding Procedure ___X___ Not Applicable

Yes	N/A	
___	___	Relocate or Protect Combustibles
___	___	Wet Down or Cover Combustible Floor
___	___	Check Flammable Gas Concentrations (%LEL) in air
___	___	Cover Wall, Floor, Duct and Tank Openings
___	___	Provide Fire Extinguisher

Other Special Instructions:

20. Onsite Organizationand Coordination

Project Manager: John Velimesis
Field Team Leader: John Velimesis
Site Safety Officer: ~~Cindy Yates~~ Maggie Fairhurst

Field Team	Name	Job Function
	Maggie Fairhurst	Log borehole from drill cuttings; observe/document well installation

21. Special Instructions

22. SanitationRequirements

Potable water supply available on work site? ___ Yes
_X_ No

Portable toilets required on work site? ___ Yes If Yes, how many? _____
_X_ No

Temporary washing/shower facilities required at work site? ___ Yes If yes, describe below.
_X_ No If no, state location existing facilities.

Description: N/A

23. FieldProcedures Change Authorization

Instruction Number to be changed

Duration of Authorization Requested
___ Today only
___ Duration of Task

Date:_____

Description of Procedures Modification:

Justification:

Person Requesting Change:

Name

Title

Signature

Verbal Authorization Received From:

Name

Time

Title

Approved By
(Signature of person named above to be obtained within 48 hours of verbal authorization)

24. Emergency Procedures This page is to be posted at prominent location on site.

Yes No
____ __X__ On-site Communications Required? Emergency Channel N/A

Nearest Telephone Please locate upon arrival at site.

Fireand Explosion

In the event of a fire or explosion, if the situation can be readily controlled with available resources without jeopardizing the health and safety of yourself, the public, or other site personnel, take immediate action to do so, otherwise:

1. Notify emergency personnel by calling 911.
2. If possible, isolate the fire to prevent spreading.
3. Evacuate the area

Chemical Exposure

Site workers must notify the site health and safety officer immediately in the event of any injury or any of the signs or symptoms of overexposure to hazardous substances identified below:

Substances Present	Symptoms of Acute Exposure	First Aid
Methane	Unconsciousness	Move to clean air; seek medical attention
H_2S	Initial rotten egg smell; respiratory irritation, unconsciousness	Move to clean air; seek medical attention if symptomatic
H. Cyanide	Weakness, headache, nausea, increased respiratory rate and depth of breathing	Move to clean air, seek medical attention

24. Emergency Procedures - Cont'd

On Site Injury Or Illness

In the event of an injury requiring more than minor first aid, or any employee reporting any sign or symptom of exposure to hazardous substances, immediately take the victim to Cascade Valley Hospital located at 330 S. Stillaguamish, Arlington, WA, phone 435-2133 or 1-800-272-0115. In the event of life-threatening or traumatic injury, implement appropriate first-aid and immediately call for emergency medical assistance at 911. The nearest designated trauma center is Cascade Valley Hospital located at 330 S. Stillaguamish, Arlington, WA, phone 435-2133 or 1-800-272-0115.

Designated Personnel Current in First Aid/CPR (Names)

Designated Back-Up Personnel (Names)	Function

Required Emergency Back-Up Equipment

Emergency Response Authority

John Velimesis is the designated site emergency coordinator and has final authority for first response to on-site emergency situations.

Upon arrival of the appropriate emergency response personnel, the site emergency coordinator shall defer all authority but shall remain on the scene if necessary to provide any and all possible assistance. At the earliest opportunity, the site safety officer or the site emergency coordinator shall contact the project coordinator or health and safety officer.

Project Coordinator John Velimesis Phone (w) 883-0777 (h) 1-668-7549

Health and Safety Officer Same Phone (w) " (h) "

25. Safety Briefing

The following personnel were present at pre-job safety briefing conducted at 08:15 (time) on 7-23-91 (date) at LAKE GEORGE LANDFILL (ON-SITE) (location), and have read the above plan and are familiar with its provisions:

Name	Signature
JOHN VELMESIS	John A Velmesis
MARGARET FAIRHURST	Margaret F. Fairhurst

Fully charged ABC Class fire extinguisher available on site?	YES ✓
Fully stocked First Aid Kit available on site?	YES ✓
All project personnel advised of location of nearest phone?	YES ✓
All project personnel advised of location of designated medical facility or facilities?	YES ✓

JOHN VELMESIS
Printed Name of Field Team Leader or Site Safety Officer

John A Velmesis 7-23-91
Signature Date

APPENDIX B

ENVIRONMENTAL LABORATORY TEST RESULTS

CHAIN OF CUSTODY RECORD

DATE 29 July 91 PAGE 1 OF 1

Laucks
Testing Laboratories, Inc.
940 South Harney St. Seattle Washington 98108 (206)767-5060

THIS INFORMATION WILL BE USED FOR REPORTING

NAME: FAIRHURST, MARGARET M.
ADDRESS: 4104-148th Ave. N.E. Redmond, WA 98052
ATTENTION: Margaret Fairhurst
PROJECT NAME: Snohomish Co., Goodwin Landfill
JOB/P.O. NO.:
SAMPLER (SIGNATURE): Margaret M. Fairhurst (PRINTED NAME): Margaret M. Fairhurst

LAB NO.	LAB SA #	SAMPLE NO.	DATE	TIME	LOCATION	TESTING PARAMETERS: Metals EPA 7000	VOA'S EPA 8240	Petroleum Hydrocarbons EPA418.1	Total Organic Carbon EPA 9060	NO. OF CONTAINERS	OBSERVATIONS, COMMENTS, SPECIAL INSTRUCTIONS
		9131178LG54MF	25Jul91	800	Goodwin Landfill		✓			1	
		9131178LG52MF	25Jul91	0805	Goodwin Landfill					1	Hold - use for Backup sample of
		9131178LG53MF	25Jul91	0820	Goodwin Landfill		✓	✓		1	VOA's 1st, then Petroleum Hydrocarbons
		9131178LG54MF	25Jul91	0820	Goodwin Landfill	✓			✓	1	
		9131178LG55MF	25Jul91	1615	Goodwin Landfill				✓	1	HOLD, use as Backup for EPA 7000's TOC
		9131178LG56MF	25Jul91	0500	Goodwin Landfill		✓	✓		1	VOA's 1st, then Petroleum Hydrocarbons
		9131178LG57MF	25Jul91	1615	Goodwin Landfill	✓			✓	1	
		9131178LG58MF	26Jul91	1025	Goodwin Landfill					1	HOLD, use for Backup for VOA's + PTH
		9131178LG59MF	26Jul91	10:25	Goodwin Landfill	✓			✓	1	
		9131178LG510MF	26Jul91	10:25	Goodwin Landfill		✓	✓		1	VOA's 1st, then Petroleum Hydrocarbons
		9131178LG511MF	26Jul91	10:25	Goodwin Landfill					1	HOLD, use for Backup for EPA 7000's TOC
		9131178LG512MF	25Jul91	[illegible]	LAUCKS		✓			1	FB
		14	25Jul91	[illegible]	Goodwin Landfill					1	HOLD, use for Backup

TOTAL NUMBER OF CONTAINERS: 13

SHIPMENT METHOD: Cornered

SPECIAL SHIPMENT, HANDLING OR STORAGE REQUIREMENTS: Keep cool

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE: Margaret M. Fairhurst	7/29/91	SIGNATURE:	
PRINTED NAME: Margaret M. Fairhurst	TIME: 13:25	PRINTED NAME:	TIME
COMPANY: Golder Associates		COMPANY:	
RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE:		SIGNATURE:	
PRINTED NAME:	TIME	PRINTED NAME: LAUCKS TESTING LABS	TIME
COMPANY:		COMPANY:	

INSTRUCTIONS:
1. Shaded areas for lab use only.
2. Complete in ballpoint pen. Draw one line through errors and initial.
3. Be specific in test requests.
4. Check off tests to be performed for each sample.
5. Retain final copy after signing.
6. Provide name and telephone of your contact person.

NAME: Margaret Fairhurst
TELEPHONE: ~~861-8485~~ 883-0777

BILLING INFORMATION, IF DIFFERENT
NAME: Snohomish County Dept. Public ~~Ken Miller~~ Works
ADDRESS: 2930 Wetmore Ave Everett WA 98201
ATTN: Ken Miller

SAMPLE INTEGRITY DATA SHEET

Plant/Site Goodwin Landfill Project No. 913-1178.200

Site Location Snohomish County, WA Sample ID

Sampling Location Borehole LG5, Goodwin Landfill

Technical Procedure Reference(s)

Type of Sampler California Split Spoon (DO)

Date 25 July 91 Time

Media SOIL Station LG5

Sample Type: (grab) time composite space composite

Sample Acquisition Measurements (depth, volume of static well water and purged water, etc.)

NA (during drilling)

Sample Description

Field Measurements on Sample (pH, conductivity, etc.)

Aliquot Amount	Container	Preservation/Amount
		None

Sampler (signature) Date

Supervisor (signature) Date

Golder Associates Inc.

413-1178.200

Lauck's 83 years
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063
Chemistry, Microbiology, and Technical Services

CLIENT: Snohomish County PUD
2930 Wetmore Ave.
Everett, WA. 98206

ATTN : Ken Miller

Work ID : Snoco., Goodwin Landfill
Taken By : Goulder Associates
Transported by: Hand Delivered
Type : Soil

Certificate of Analysis
Work Order# : 91-07-B66
DATE RECEIVED : 07/29/91
DATE OF REPORT: 09/11/91
CLIENT JOB ID : Prof Svc Contract 1420

SAMPLE IDENTIFICATION:

	Sample Description	Collection Date
01	9131178LG51/52MF	07/25/91 08:00
02	9131178LG53MF	07/25/91 08:20
03	9131178LG54MF	07/25/91 08:20
04	9131178LG55MF	07/25/91 16:15
05	9131178LG56MF	07/25/91 15:00
06	9131178LG57MF	07/25/91 16:15
07	9131178LG58MF	07/25/91 10:25
08	9131178LG59MF	07/29/91 10:25
09	9131178LG510MF	07/26/91 10:25
10	9131178LG511MF	07/26/91 10:25
11	9131178LG512MF (TB)	07/25/91
12	14	07/25/91
13	Method Blank	N/A

Samples 9107B66-04A, -07A, -10A, and -12A were not analyzed per clients request.

FLAGGING:

The flag "U" indicates the analyte of interest was not detected, to the limit of detection indicated.

The flag "J" indicates the analyte of interest was detected below the routine reporting limit. This value should be regarded as an estimate.

cc: Goulder Associates
4104 - 148th Ave. NE
Redmond, WA 98052
ATTN: Margaret Fairhurst

Laucks 83 years
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063

Chemistry, Microbiology, and Technical Services

CLIENT : Snohomish County PUD

Certificate of Analysis

Work Order# : 91-07-B66

Unless otherwise instructed all samples will be discarded on 10/03/91

Respectfully submitted,
Laucks Testing Laboratories, Inc.

J. M. Owens

Laucks 83 years
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063
Chemistry, Microbiology, and Technical Services

CLIENT : Snohomish County PUD

Certificate of Analysis

Work Order # 91-07-B66

TESTS PERFORMED AND RESULTS:

Analyte	Units	02	03	05	06
Arsenic (Method 7061)	mg/kg DB		2.6		1.8
Barium (Method 6010)	mg/kg DB		48.		35.
Cadmium (Method 6010)	mg/kg DB		1.1		1.2
Chromium (Method 6010)	mg/kg DB		65.		39.
Lead (Method 6010)	mg/kg DB		10. U		10. U
Mercury (Method 7471)	mg/kg DB		0.1 U		0.1 U
Selenium (Method 7741)	mg/kg DB		0.5 U		0.5 U
Silver (Method 6010)	mg/kg DB		1. U		1. U
TPH Oil & Grease	mg/kg DB	20. U		210.	
Total Organic Carbon	%, dry basis		0.3		0.1 U
Total Solids	%	93.8		90.8	
Total Solids	%		93.7		91.8

Analyte	Units	08	09
Arsenic (Method 7061)	mg/kg DB	0.9	
Barium (Method 6010)	mg/kg DB	37.	
Cadmium (Method 6010)	mg/kg DB	0.9	
Chromium (Method 6010)	mg/kg DB	32.	
Lead (Method 6010)	mg/kg DB	10. U	
Mercury (Method 7471)	mg/kg DB	0.1 U	

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Chemistry, Microbiology, and Technical Services

CLIENT : Snohomish County PUD

Certificate of Analysis

Work Order # 91-07-B66
Continued From Above

TESTS PERFORMED AND RESULTS:

Analyte	Units	08	09
Selenium (Method 7741)	mg/kg DB	0.5 U	
Silver (Method 6010)	mg/kg DB	1. U	
TPH Oil & Grease	mg/kg DB		20. U
Total Organic Carbon	%, dry basis	0.1 U	
Total Solids	%		82.8
Total Solids	%	80.8	

Lauck's 83 years
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Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9107B66-01A
Client Sample ID: 9131178LG51/52MF

Date Received : 07/29/91
Date Extracted : N/A
Test Code : LXTCVW

Collection Date : 07/25/91
Date Analyzed : 07/31/91
Test Method : SW 8240

Compound	Result (ug/L)	SDL (ug/L)	Compound	Result (ug/L)	SDL (ug/L)
Chloromethane	1 U	1	Bromodichloromethane	1 U	1
Bromomethane	1 U	1	1,2-Dichloropropane	1 U	1
Vinyl chloride	1 U	1	Trichloroethene	1 U	1
Chloroethane	3 U	3	Benzene	1 U	1
Methylene chloride	1 U	1	Dibromochloromethane	3 U	3
Acetone	5 U	5	1,1,2-Trichloroethane	1 U	1
Carbon disulfide	1 U	1	Bromoform	1 U	1
1,1-Dichloroethene	1 U	1	4-Methyl-2-pentanone	3 U	3
1,1-Dichloroethane	1 U	1	2-Hexanone	3 U	3
trans-1,2-Dichloroethene	1 U	1	1,1,2,2-Tetrachloroethane	3 U	3
cis-1,2-Dichloroethene	1 U	1	Tetrachloroethene	1 U	1
Total 1,2-Dichloroethene	1 U	1	Toluene	1 U	1
Chloroform	1 U	1	Chlorobenzene	3 U	3
2-Butanone	3 U	3	trans-1,3-Dichloropropene	3 U	3
1,2-Dichloroethane	1 U	1	Ethylbenzene	1 U	1
1,1,1-Trichloroethane	1 U	1	cis-1,3-Dichloropropene	3 U	3
Carbon tetrachloride	1 U	1	Styrene	1 U	1
Vinyl acetate	1 U	1	Total Xylene	1 U	1

Surrogate Recovery Report

Surrogate Compound	Percent Recovery	Limits: Min.	Max.
1,2-Dichloroethane d4	105	78	118
Toluene d8	105	83	117
p-Bromofluorobenzene	104	81	115

* Surrogate recovery is outside of control limits. See comments.

Laucks 83 years
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063
Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9107B66-11A
Client Sample ID: 9131178LG512MF (TB)

Date Received : 07/29/91
Date Extracted : N/A
Test Code : LXTCVW

Collection Date : 07/25/91
Date Analyzed : 08/02/91
Test Method : SW 8240

Compound	Result (ug/L)	SDL (ug/L)	Compound	Result (ug/L)	SDL (ug/L)
Chloromethane	1 U	1	Bromodichloromethane	1 U	1
Bromomethane	1 U	1	1,2-Dichloropropane	1 U	1
Vinyl chloride	1 U	1	Trichloroethene	1 U	1
Chloroethane	3 U	3	Benzene	1 U	1
Methylene chloride	1	1	Dibromochloromethane	3 U	3
Acetone	7	5	1,1,2-Trichloroethane	1 U	1
Carbon disulfide	1 U	1	Bromoform	1 U	1
1,1-Dichloroethene	1 U	1	4-Methyl-2-pentanone	3 U	3
1,1-Dichloroethane	1 U	1	2-Hexanone	3 U	3
trans-1,2-Dichloroethene	1 U	1	1,1,2,2-Tetrachloroethane	3 U	3
cis-1,2-Dichloroethene	1 U	1	Tetrachloroethene	1 U	1
Total 1,2-Dichloroethene	1 U	1	Toluene	1 U	1
Chloroform	1 U	1	Chlorobenzene	3 U	3
2-Butanone	3 U	3	trans-1,3-Dichloropropene	3 U	3
1,2-Dichloroethane	1 U	1	Ethylbenzene	1 U	1
1,1,1-Trichloroethane	1 U	1	cis-1,3-Dichloropropene	3 U	3
Carbon tetrachloride	1 U	1	Styrene	1 U	1
Vinyl acetate	1 U	1	Total Xylene	1 U	1

Surrogate Recovery Report

Surrogate Compound	Percent Recovery	Limits: Min.	Max.
1,2-Dichloroethane d4	106	78	118
Toluene d8	111	83	117
p-Bromofluorobenzene	110	81	115

* Surrogate recovery is outside of control limits. See comments.

Lucks 83 years
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Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9107B66-02A
Client Sample ID: 9131178LG53MF

Date Received : 07/29/91
Date Extracted : N/A
Test Code : LXTCVS

Collection Date : 07/25/91
Date Analyzed : 07/31/91
Test Method : SW8240

Compound	Result (ug/Kg DB)	SDL (ug/Kg DB)	Compound	Result (ug/Kg DB)	SDL (ug/Kg DB)
Chloromethane	2 U	2	Bromodichloromethane	2 U	2
Bromomethane	2 U	2	1,2-Dichloropropane	2 U	2
Vinyl chloride	2 U	2	Trichloroethene	2 U	2
Chloroethane	5 U	5	Benzene	2 U	2
Methylene chloride	5	2	Dibromochloromethane	5 U	5
Acetone	5 J	8	1,1,2-Trichloroethane	2 U	2
Carbon disulfide	2 U	2	Bromoform	2 U	2
1,1-Dichloroethene	2 U	2	4-Methyl-2-pentanone	5 U	5
1,1-Dichloroethane	2 U	2	2-Hexanone	5 U	5
trans-1,2-Dichloroethene	2 U	2	1,1,2,2-Tetrachloroethane	5 U	5
cis-1,2-Dichloroethene	2 U	2	Tetrachloroethene	2 U	2
Total 1,2-Dichloroethene	2 U	2	Toluene	2 U	2
Chloroform	2 U	2	Chlorobenzene	5 U	5
2-Butanone	5 U	5	trans-1,3-Dichloropropene	5 U	5
1,2-Dichloroethane	2 U	2	Ethylbenzene	2 U	2
1,1,1-Trichloroethane	2 U	2	cis-1,3-Dichloropropene	5 U	5
Carbon tetrachloride	2 U	2	Styrene	2 U	2
Vinyl acetate	2 U	2	Total Xylene	2 U	2

Surrogate Recovery Report

Surrogate Compound	Percent Recovery	Limits: Min.	Max.
1,2-Dichloroethane d4	91	76	121
Toluene d8	94	74	128
p-Bromofluorobenzene	90	72	118

* Surrogate recovery is outside of control limits. See comments.

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Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9107B66-05A
Client Sample ID: 9131178LG56MF

Date Received : 07/29/91
Date Extracted : N/A
Test Code : LXTCVS

Collection Date : 07/25/91
Date Analyzed : 07/31/91
Test Method : SW8240

Compound	Result (ug/Kg DB)	SDL (ug/Kg DB)	Compound	Result (ug/Kg DB)	SDL (ug/Kg DB)
Chloromethane	1 U	1	Bromodichloromethane	1 U	1
Bromomethane	1 U	1	1,2-Dichloropropane	1 U	1
Vinyl chloride	1 U	1	Trichloroethene	1 U	1
Chloroethane	4 U	4	Benzene	1 U	1
Methylene chloride	1 U	1	Dibromochloromethane	4 U	4
Acetone	7 U	7	1,1,2-Trichloroethane	1 U	1
Carbon disulfide	1 U	1	Bromoform	1 U	1
1,1-Dichloroethene	1 U	1	4-Methyl-2-pentanone	4 U	4
1,1-Dichloroethane	1 U	1	2-Hexanone	4 U	4
trans-1,2-Dichloroethene	1 U	1	1,1,2,2-Tetrachloroethane	4 U	4
cis-1,2-Dichloroethene	1 U	1	Tetrachloroethene	1 U	1
Total 1,2-Dichloroethene	1 U	1	Toluene	1 U	1
Chloroform	1 U	1	Chlorobenzene	4 U	4
2-Butanone	4 U	4	trans-1,3-Dichloropropene	4 U	4
1,2-Dichloroethane	1 U	1	Ethylbenzene	1 U	1
1,1,1-Trichloroethane	1 U	1	cis-1,3-Dichloropropene	4 U	4
Carbon tetrachloride	1 U	1	Styrene	1 U	1
Vinyl acetate	1 U	1	Total Xylene	1 U	1

Surrogate Recovery Report

Surrogate Compound	Percent Recovery	Limits: Min.	Max.
1,2-Dichloroethane d4	99	76	121
Toluene d8	98	74	128
p-Bromofluorobenzene	95	72	118

* Surrogate recovery is outside of control limits. See comments.

Laucks 83 years
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063
Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9107B66-09A
Client Sample ID: 9131178LG510MF

Date Received : 07/29/91
Date Extracted : N/A
Test Code : LXTCVS

Collection Date : 07/26/91
Date Analyzed : 07/31/91
Test Method : SW8240

Compound	Result (ug/Kg DB)	SDL (ug/Kg DB)	Compound	Result (ug/Kg DB)	SDL (ug/Kg DB)
Chloromethane	2 U	2	Bromodichloromethane	2 U	2
Bromomethane	2 U	2	1,2-Dichloropropane	2 U	2
Vinyl chloride	2 U	2	Trichloroethene	2 U	2
Chloroethane	5 U	5	Benzene	2 U	2
Methylene chloride	5	2	Dibromochloromethane	5 U	5
Acetone	8 U	8	1,1,2-Trichloroethane	2 U	2
Carbon disulfide	2 U	2	Bromoform	2 U	2
1,1-Dichloroethene	2 U	2	4-Methyl-2-pentanone	5 U	5
1,1-Dichloroethane	2 U	2	2-Hexanone	5 U	5
trans-1,2-Dichloroethene	2 U	2	1,1,2,2-Tetrachloroethane	5 U	5
cis-1,2-Dichloroethene	2 U	2	Tetrachloroethene	2 U	2
Total 1,2-Dichloroethene	2 U	2	Toluene	2 U	2
Chloroform	2 U	2	Chlorobenzene	5 U	5
2-Butanone	5 U	5	trans-1,3-Dichloropropene	5 U	5
1,2-Dichloroethane	2 U	2	Ethylbenzene	2 U	2
1,1,1-Trichloroethane	2 U	2	cis-1,3-Dichloropropene	5 U	5
Carbon tetrachloride	2 U	2	Styrene	2 U	2
Vinyl acetate	2 U	2	Total Xylene	2 U	2

Surrogate Recovery Report

Surrogate Compound	Percent Recovery	Limits: Min.	Max.
1,2-Dichloroethane d4	98	76	121
Toluene d8	101	74	128
p-Bromofluorobenzene	97	72	118

* Surrogate recovery is outside of control limits. See comments.

Laucks 83 years
Testing Laboratories, Inc.
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Chemistry, Microbiology, and Technical Services

APPENDIX A

Method Blank Report

Lauck's 83 years
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063
Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9107B66-13A
Client Sample ID: Method Blank

Date Received : 07/29/91
Date Extracted : N/A
Test Code : LXTCVW

Collection Date :
Date Analyzed : 07/31/91
Test Method : SW 8240

Compound	Result (ug/L)	SDL (ug/L)	Compound	Result (ug/L)	SDL (ug/L)
Chloromethane	1 U	1	Bromodichloromethane	1 U	1
Bromomethane	1 U	1	1,2-Dichloropropane	1 U	1
Vinyl chloride	1 U	1	Trichloroethene	1 U	1
Chloroethane	3 U	3	Benzene	1 U	1
Methylene chloride	1 U	1	Dibromochloromethane	3 U	3
Acetone	5 U	5	1,1,2-Trichloroethane	1 U	1
Carbon disulfide	1 U	1	Bromoform	1 U	1
1,1-Dichloroethene	1 U	1	4-Methyl-2-pentanone	3 U	3
1,1-Dichloroethane	1 U	1	2-Hexanone	3 U	3
trans-1,2-Dichloroethene	1 U	1	1,1,2,2-Tetrachloroethane	3 U	3
cis-1,2-Dichloroethene	1 U	1	Tetrachloroethene	1 U	1
Total 1,2-Dichloroethene	1 U	1	Toluene	1 U	1
Chloroform	1 U	1	Chlorobenzene	3 U	3
2-Butanone	3 U	3	trans-1,3-Dichloropropene	3 U	3
1,2-Dichloroethane	1 U	1	Ethylbenzene	1 U	1
1,1,1-Trichloroethane	1 U	1	cis-1,3-Dichloropropene	3 U	3
Carbon tetrachloride	1 U	1	Styrene	1 U	1
Vinyl acetate	1 U	1	Total Xylene	1 U	1

Surrogate Recovery Report

Surrogate Compound	Percent Recovery	Limits: Min.	Max.
1,2-Dichloroethane d4	101	78	118
Toluene d8	104	83	117
p-Bromofluorobenzene	104	81	115

* Surrogate recovery is outside of control limits. See comments.

Lucks 83 years
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063
Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9107B66-13A
Client Sample ID: Method Blank

Date Received : 07/29/91
Date Extracted : N/A
Test Code : LXTCVS

Collection Date :
Date Analyzed : 07/31/91
Test Method : SW8240

Compound	Result (ug/Kg DB)	SDL (ug/Kg DB)	Compound	Result (ug/Kg DB)	SDL (ug/Kg DB)
Chloromethane	1 U	1	Bromodichloromethane	1 U	1
Bromomethane	1 U	1	1,2-Dichloropropane	1 U	1
Vinyl chloride	1 U	1	Trichloroethene	1 U	1
Chloroethane	3 U	3	Benzene	1 U	1
Methylene chloride	1 U	1	Dibromochloromethane	3 U	3
Acetone	5 U	5	1,1,2-Trichloroethane	1 U	1
Carbon disulfide	1 U	1	Bromoform	1 U	1
1,1-Dichloroethene	1 U	1	4-Methyl-2-pentanone	3 U	3
1,1-Dichloroethane	1 U	1	2-Hexanone	3 U	3
trans-1,2-Dichloroethene	1 U	1	1,1,2,2-Tetrachloroethane	3 U	3
cis-1,2-Dichloroethene	1 U	1	Tetrachloroethene	1 U	1
Total 1,2-Dichloroethene	1 U	1	Toluene	1 U	1
Chloroform	1 U	1	Chlorobenzene	3 U	3
2-Butanone	3 U	3	trans-1,3-Dichloropropene	3 U	3
1,2-Dichloroethane	1 U	1	Ethylbenzene	1 U	1
1,1,1-Trichloroethane	1 U	1	cis-1,3-Dichloropropene	3 U	3
Carbon tetrachloride	1 U	1	Styrene	1 U	1
Vinyl acetate	1 U	1	Total Xylene	1 U	1

Surrogate Recovery Report

Surrogate Compound	Percent Recovery	Limits: Min.	Max.
1,2-Dichloroethane d4	94	76	121
Toluene d8	96	74	128
p-Bromofluorobenzene	93	72	118

* Surrogate recovery is outside of control limits. See comments.

Laucks 83 years
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Chemistry, Microbiology, and Technical Services

Quality Control Report
Method Blanks for Work Order 9107B66

Blank Name	Samples Verified	Test Description	Result		Units	Control Limit
B080191_ICP_S01	3,6,8	Chromium	1.0	U	mg/kg DB	2.0
		Lead	10	U	mg/kg DB	20
		Silver	1.0	U	mg/kg DB	2.0
		Barium	2.0	U	mg/kg DB	4.0
		Cadmium	0.50	U	mg/kg DB	1.0
B080691_HY_S01	3,6,8	Arsenic	0.50	U	mg/kg DB	1.0
B080691_HY_S02	3,6,8	Selenium	0.50	U	mg/kg DB	1.0
B080991_HG_S01	3,6,8	Mercury	0.10	U	mg/kg DB	0.20
B081391_OG_S01	2,5,9	IR Total Recoverable Oil and Grease	20	U	mg/kg DB	40
B081491_TOC_S02	3,6,8	Total Organic Carbon	0.10	U	percent	0.20

Method blank results for multi-analyte tests appear directly after this report.

A method blank can validate more than one analyte on more than one work order. The method blanks in this report may validate analytes not determined on this work order, but nonetheless determined in the associated blank.

Because they validate more than one work order, method blank results are not always reported in the same concentration units used for sample results.

blank exceeds control limit

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Chemistry, Microbiology, and Technical Services

APPENDIX B

Matrix Spike/Matrix Spike Duplicate Report

* In MS/MSD K080191_ICPS01 the Lead concentration was greater than 4 times the spiking level, so accurate recovery could not be determined.

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Quality Control Report
MS/MSD Report for Work Order 9107B66

MS/MSD Name	Sample Fractions Verified	MS/MSD Sample	Analyte	Percent Recovery MS	MSD	RPD	Cont. Limits LCL	UCL	RPD
K080191_ICPS01	3,6,8	9107A92-07	Barium	90	89	1	50	150	30
			Cadmium	99	100	1	60	117	22
			Chromium	90	113	23	50	142	24
			Lead	26*	151 *	141*	75	125	20
			Silver	96	95	1	50	150	30
K080991_HGS01	3,6,8	9107B66-08	Mercury	95	95	0	50	145	30

* = Value Exceeds Control Limit
RPD = Relative Percent Difference
LCL = Lower Control Limit
UCL = Upper Control Limit
-1 for recovery value indicates that recovery could not be calculated

An MS/MSD pair can validate the results for more than one work order. For this reason, results for analytes not requested on this work order may appear in this MS/MSD report.

APPENDIX C

SOILS LABORATORY TEST RESULTS

SCHEDULE OF LABORATORY TESTS

PROJECT SHORT TITLE SNOHOMISH CO. / LAKE GOODWIN LGS / WA DATE IN 08-19-91

PROJECT NUMBER 913-1178.200 ENGR. VOLMESUS DATE DUE 08-25-91

BORING	SAMPLE	Atterberg Limits	Moist. & Desc.	Wash Sieve	Mod. Proctor	Std. Proctor	Sieve & Hydro	Specific Grav.	Shelby Ext.	Consol.	UU	CU	Slake Dur.	CBR	Uncont. Com.	F.W. Perm.	R.W. Perm.	Recompact	pH	Min. Resistivity	Vane Shear			COMMENTS
			4	84																				* SAVE REMAINING SAMPLE VOLS. *
LG-S	1			■																				GRAIN SIZE ANALYSIS (WASH SIEVE W/ -200 FRACTION) ASTM D-1140 / C-136 (0-.5')
"	2			■																				(FOR ALL SAMPLES) (5-5.9)
"	3			X																				MINED
"	4			■																				(15-16)
"	5			■																				(20.0-21.5)
"	6			■																				(25.0-25.9)
"	7			■																				(30.0-30.9)
"	8			■																				(35.0-36.0)
"	9			■																				(40.0-41.0)
"	10			■																				(45.0-46.0)

■ Test Started

■ Test Completed

■ Engineer given copies

■ Billed

* Laboratory submits drafting only for CU,UU and consolidation tests. Drafting billed to project directly.

SCHEDULE OF LABORATORY TESTS

PROJECT SHORT TITLE SNOHOMISH G. / LK GOODWIN LGS / WA DATE IN 04-19-91

PROJECT NUMBER 913-1178 . 200 ENGR. Vanmeter DATE DUE 04-25-91

BORING	SAMPLE	Atterberg Limits	Moist. & Desc.	Wash Sieve	Mod. Proctor	Std. Proctor	Sieve & Hydro	Specific Grav.	Shelby Ext.	Consol.	UU	CU	Slake Dur.	CBR	Unconf. Com.	F.W. Perm.	R.W. Perm.	Recompact	pH	Min. Resistivity	Vane Shear			COMMENTS
LG-5	11			X																				(50.0 - 51.0)
"	12			X																				(55.0 - 55.9)
"	13			X																				(60.0 - 60.8)
"	14			X																				
"	15			X																				
"	16			X																				
"	17			X																				
"	18			X																				
"	19			X																				
"	20			X																				(80.0 - 80.3)

Test Started

Test Completed

Engineer given copies

Billed

Laboratory submits drafting only for CU,UU and consolidation tests. Drafting billed to project directly.

SCHEDULE OF LABORATORY TESTS

PROJECT SHORT TITLE SNOHOMISH CO / LK. GOODWIN / WA (LG5) DATE IN 04-19-91

PROJECT NUMBER 913-1178 . 200 ENGR. Voumvouris DATE DUE 04-25-91

BORING	SAMPLE	Atterberg Limits	Moist. & Desc.	Wash Sieve	Mod. Proctor	Std. Proctor	Sieve & Hydro	Specific Grav.	Shelby Ext.	Consol.	UU	CU	Slake Dur.	CBR	Uncont. Com.	F.W. Perm.	R.W. Perm.	Recompact	pH	Min. Resistivity	Vane Shear			COMMENTS
LG-5	21			■																				(85.0 - 85.8)
"	22			■																				(90.0 - 90.7)
"	23			x																				
"	24			■																				(100)
"	25			■																				(105)
"	26			■																				(110)
"	27			■																				(115)
"	28			■																				(120)
"	29			■																				(125)
"	30			■																				(130)

■ Test Started

■ Test Completed

■ Engineer given copies

■ Billed

Laboratory submits drafting only for CU,UU and consolidation tests. Drafting billed to project directly.

SCHEDULE OF LABORATORY TESTS

PROJECT SHORT TITLE Snohomish / Lk. Goodwin / WA DATE IN 08-19-91

PROJECT NUMBER 913-1178 . 200 ENGR. Vermeul DATE DUE 08-25-91

BORING	SAMPLE	Atterberg Limits	Moist. & Desc.	Wash Sieve	Mod. Proctor	Std. Proctor	Sieve & Hydro	Specific Grav.	Shelby Ext.	Consol.	UU	QU	Slake Dur.	CBR	Uncont. Com.	F.W. Perm.	R.W. Perm.	Recompact	pH	Min. Resistivity	Vane Shear			COMMENTS
LG-5	31			■																				(135)
"	32			■																				(140)
"	33			■																				(145)
"	34	■		■																				(150)
"	35			■																				(155)
"	36			■																				(160)
"	37			■																				(165)
"	38	■		■																				(170)
"	39			■																				(175)
"	40	■		■																				(180)

Test Started

Test Completed

Engineer given copies

Billed

Laboratory submits drafting only for CU,UU and consolidation tests. Drafting billed to project directly.

SCHEDULE OF LABORATORY TESTS

PROJECT SHORT TITLE Snohomish Co / Lake Goodwin / WA DATE IN 8-22-91

PROJECT NUMBER 913-1178.200 ENGR. Velimesis DATE DUE

BORING	SAMPLE	Atterberg Limits	Moist. & Desc.	Wash Sieve	Mod. Proctor	Std. Proctor	Sieve & Hydro	Specific Grav.	Shelby Ext.	Consol.	UU	CU	Slake Dur.	CBR	Unconf. Com.	F.W. Perm.	R.W. Perm.	Recompact	pH	Min. Resistivity	Vane Shear			COMMENTS
LG-5	41	■		■																				(185)
	42	■		■																				(190)

Test Started

Test Completed

Engineer given copies

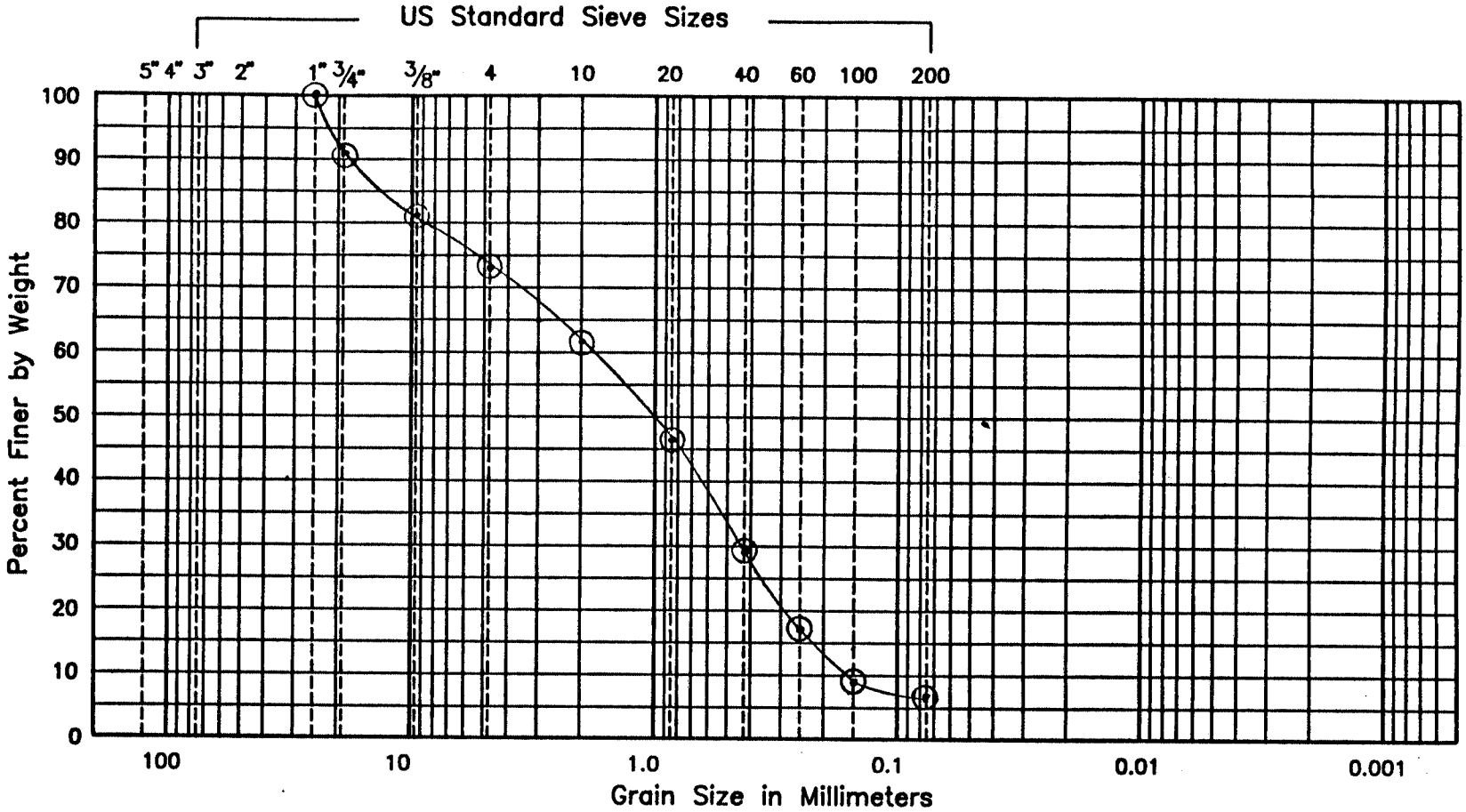
Billed

Laboratory submits drafting only for CU,UU and consolidation tests. Drafting billed to project directly.

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH / LAKE GOODWIN / WA
Project No. 913-1178,200 Date 8/27/91 Tested By MF Approved By

Golder Associates



Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 1	0-5	3.9				Light olive brown (5Y 5/6), c-f SAND, some c-f gravel, little silt, (SP-SM).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH / LAKE GOODWIN / WA
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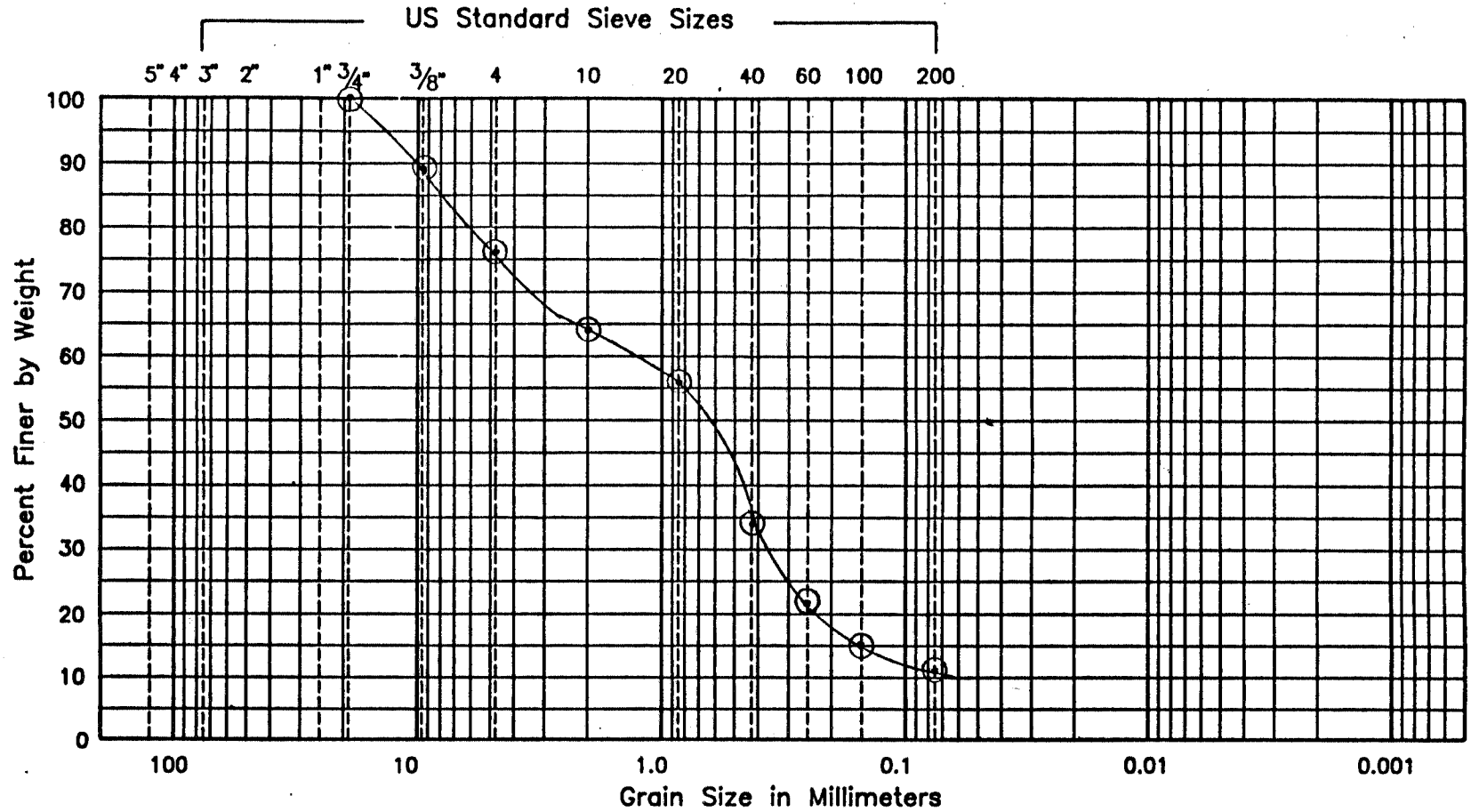

Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 2	5 - 5.9	6.0				Olive gray (5Y 3/2), c-f SAND, some c-f gravel, little silt, (SW-SM).

GRAIN SIZE DISTRIBUTION

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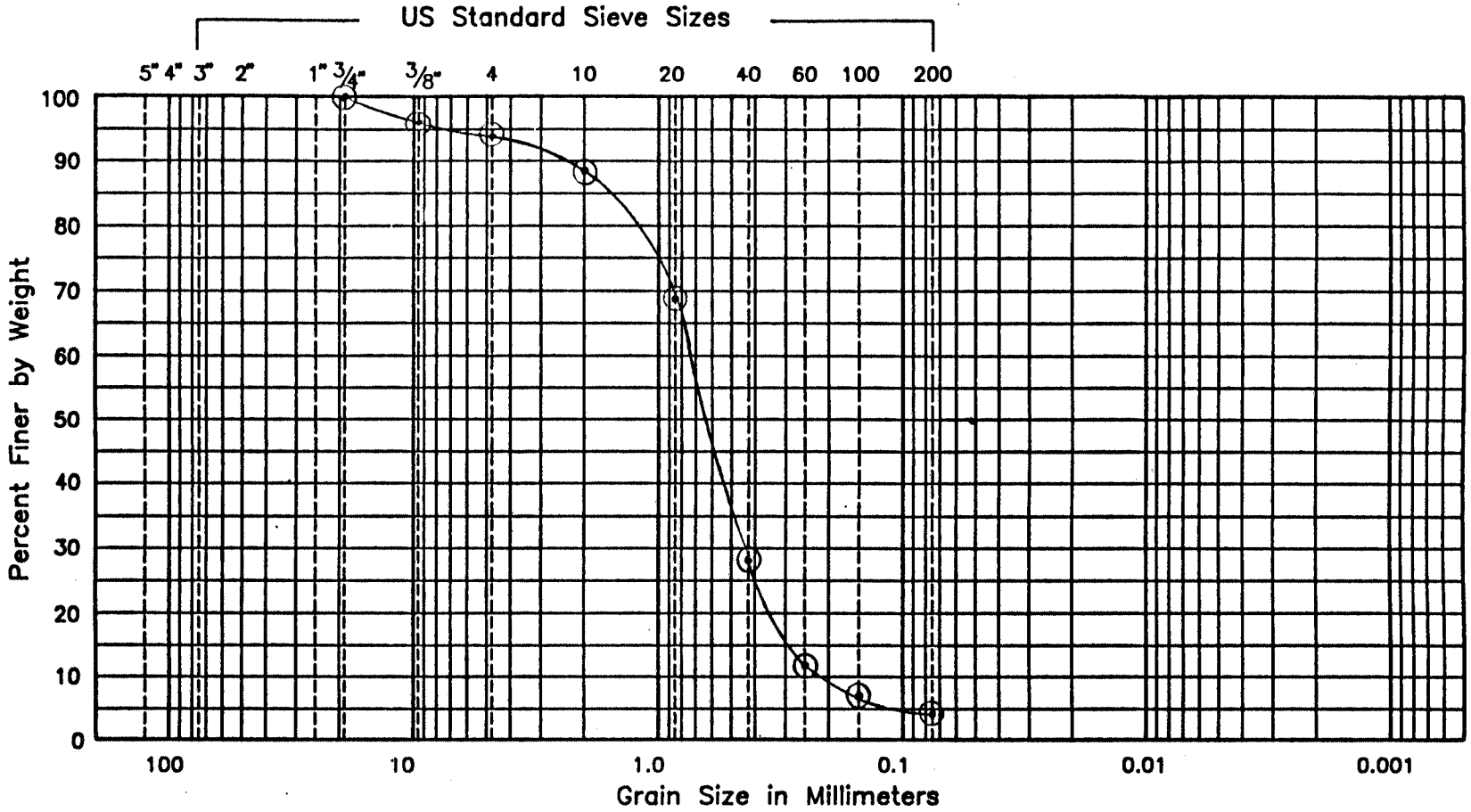

Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 4	15-16	6.2				Light olive gray (5 Y 5/2), m-f SAND, little f gravel, trace silt, (SP).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH / LAKE GOODWIN / WA
Project No. 913-1178,200 Date 8/27/91 Tested By MF Approved By

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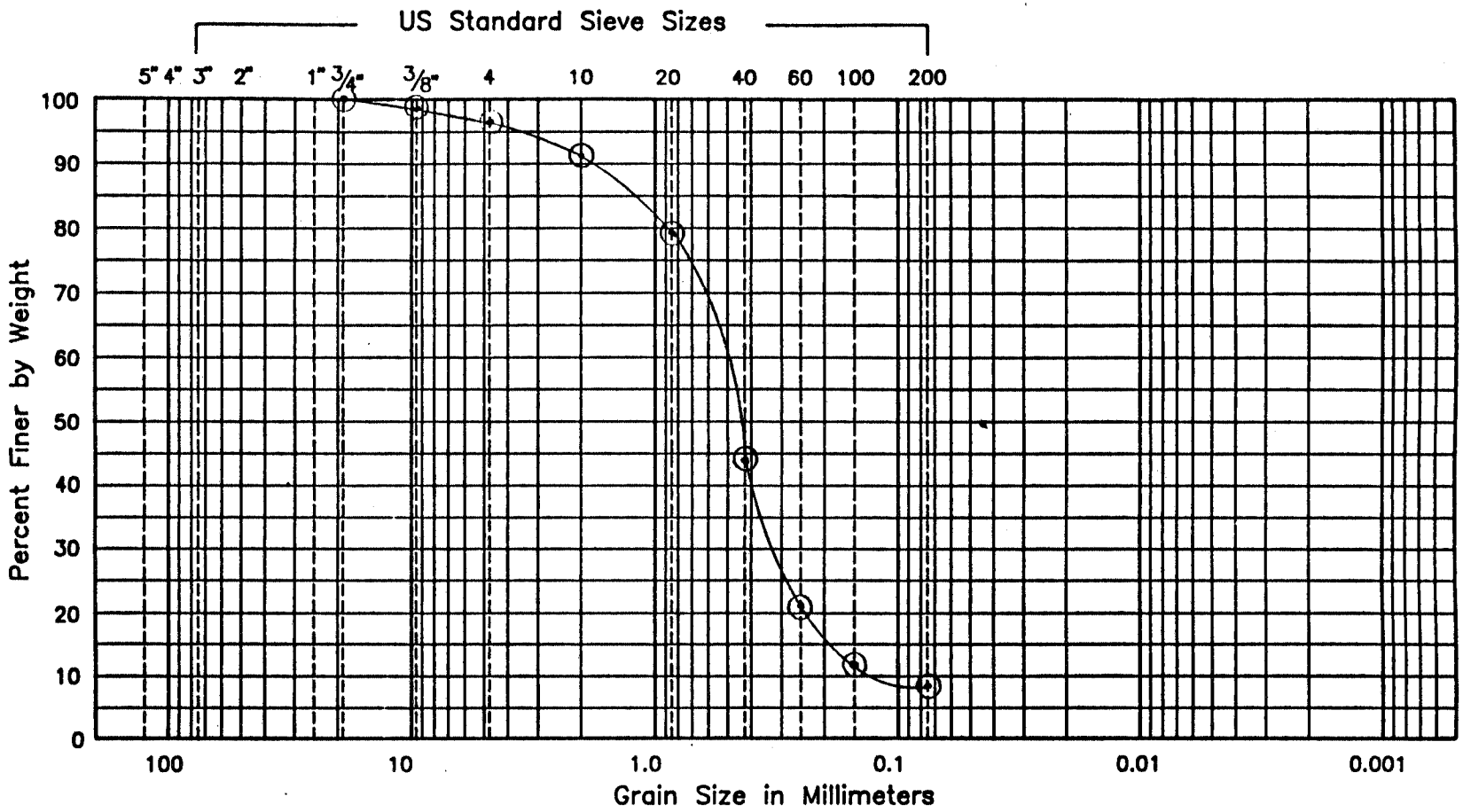

Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 5	20.0-21.5	5.6				Light olive brown (5Y 5/6), m-f SAND, little silt, trace f gravel, (SP-SM).

GRAIN SIZE DISTRIBUTION

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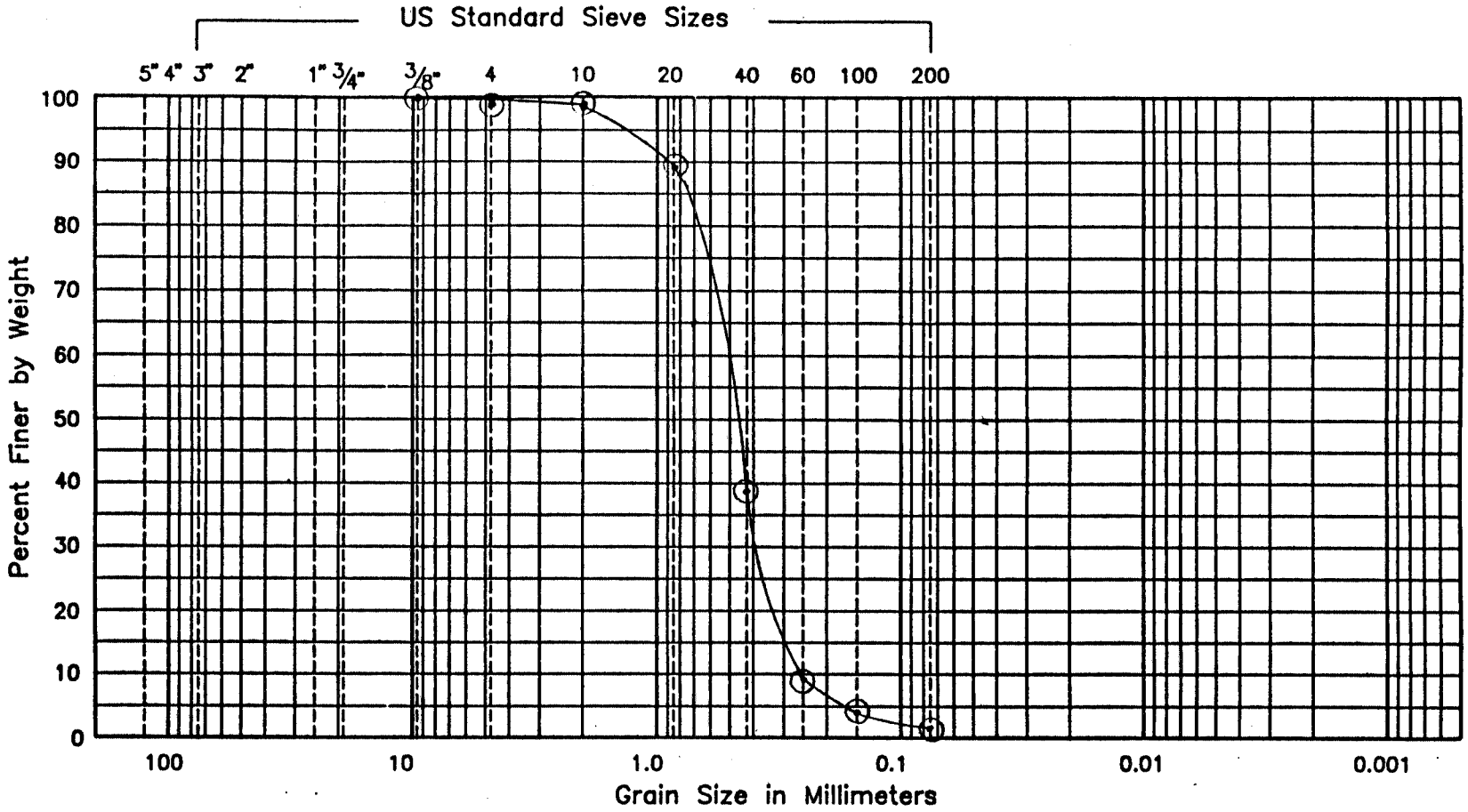

Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 6	25.0-25.3	4.6				Light olive gray (5Y 5/2) m-f SAND, trace silt, trace f gravel, (SP).

GRAIN SIZE DISTRIBUTION

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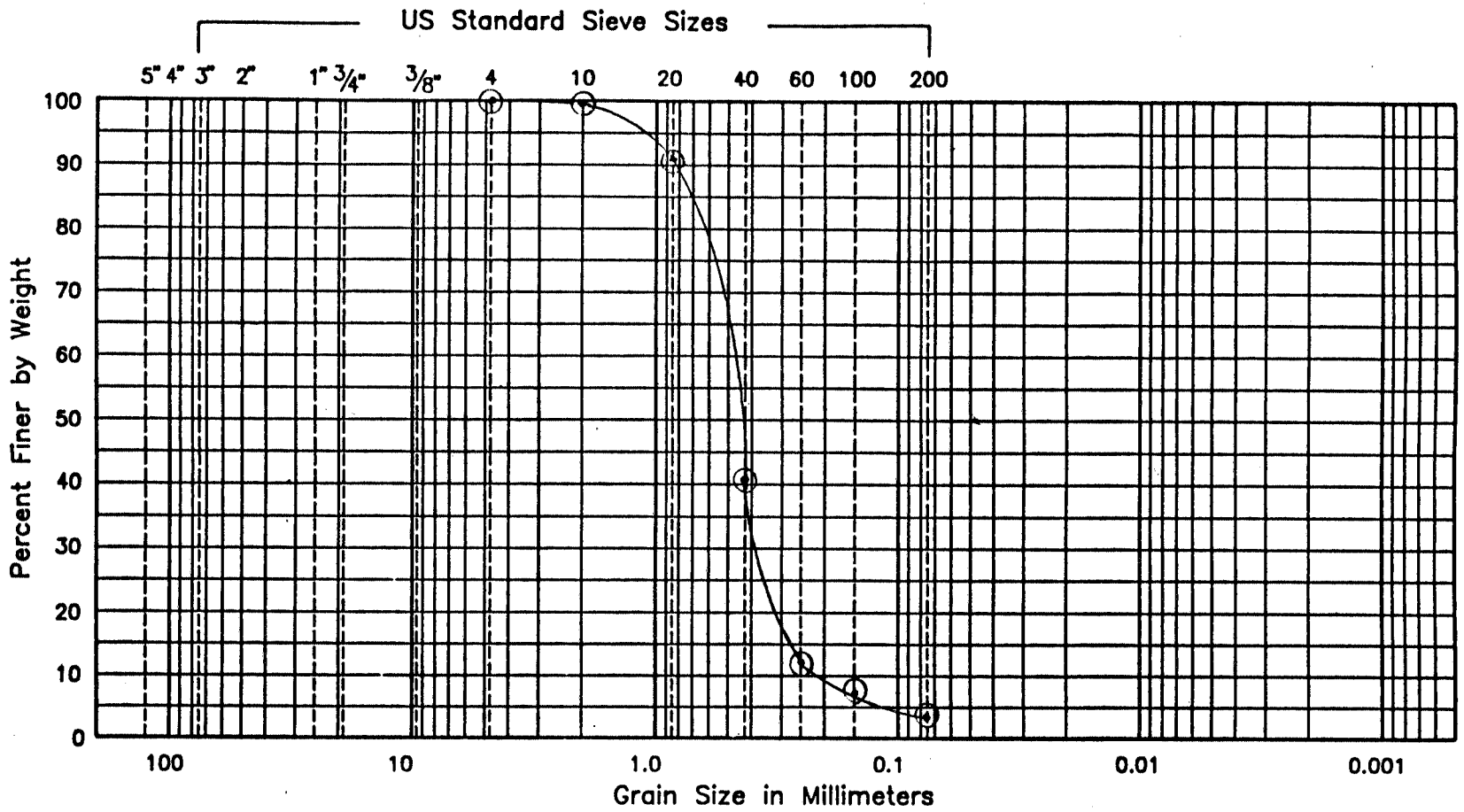


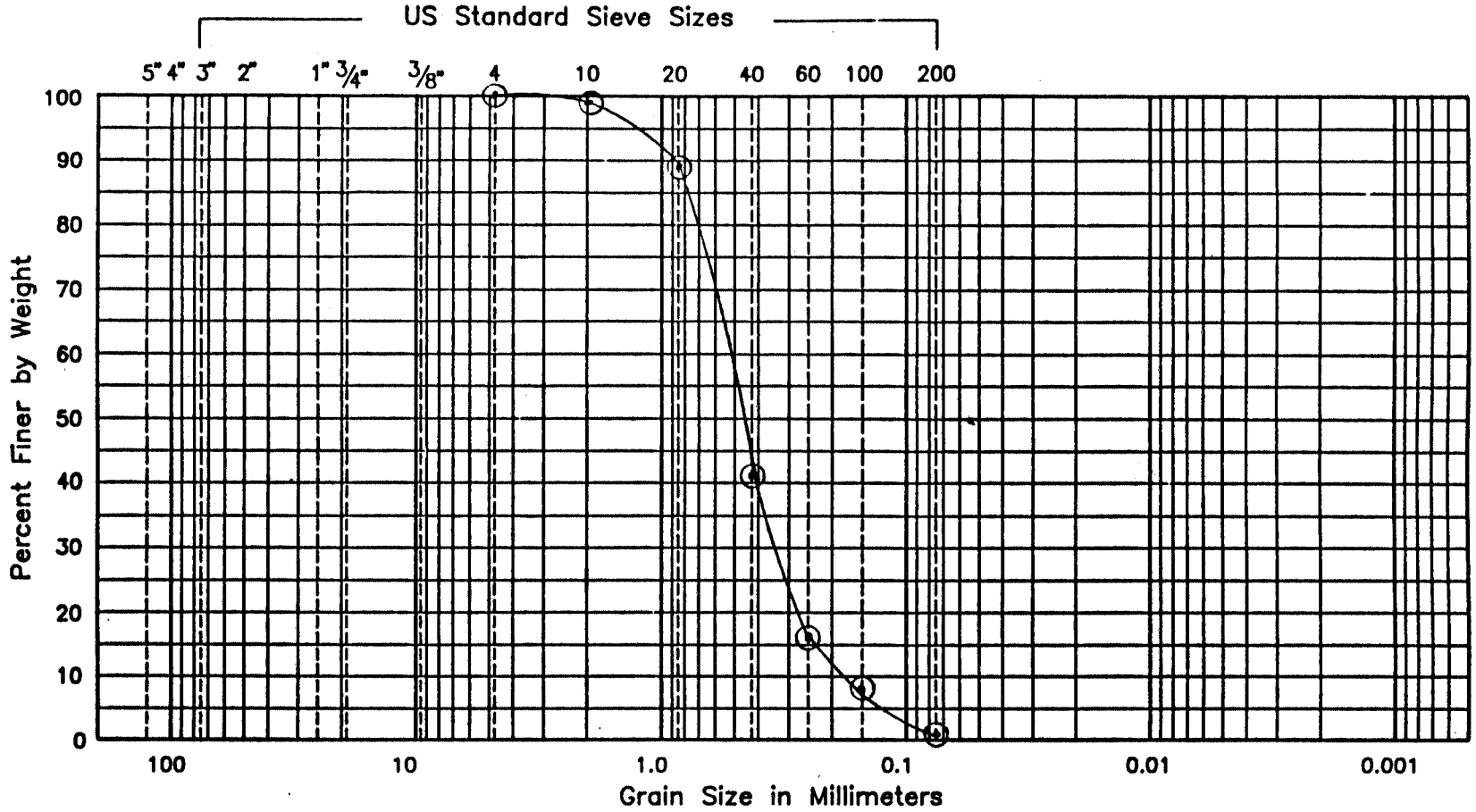
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 7	30.0-30.9	8.0				Light olive gray (5Y 5/2), m-f SAND, trace silt, (SP).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH / LAKE GOODWIN / WA
Project No. 913-1178.200 Date 8/27/91 Tested By MF Approved By

Golder Associates



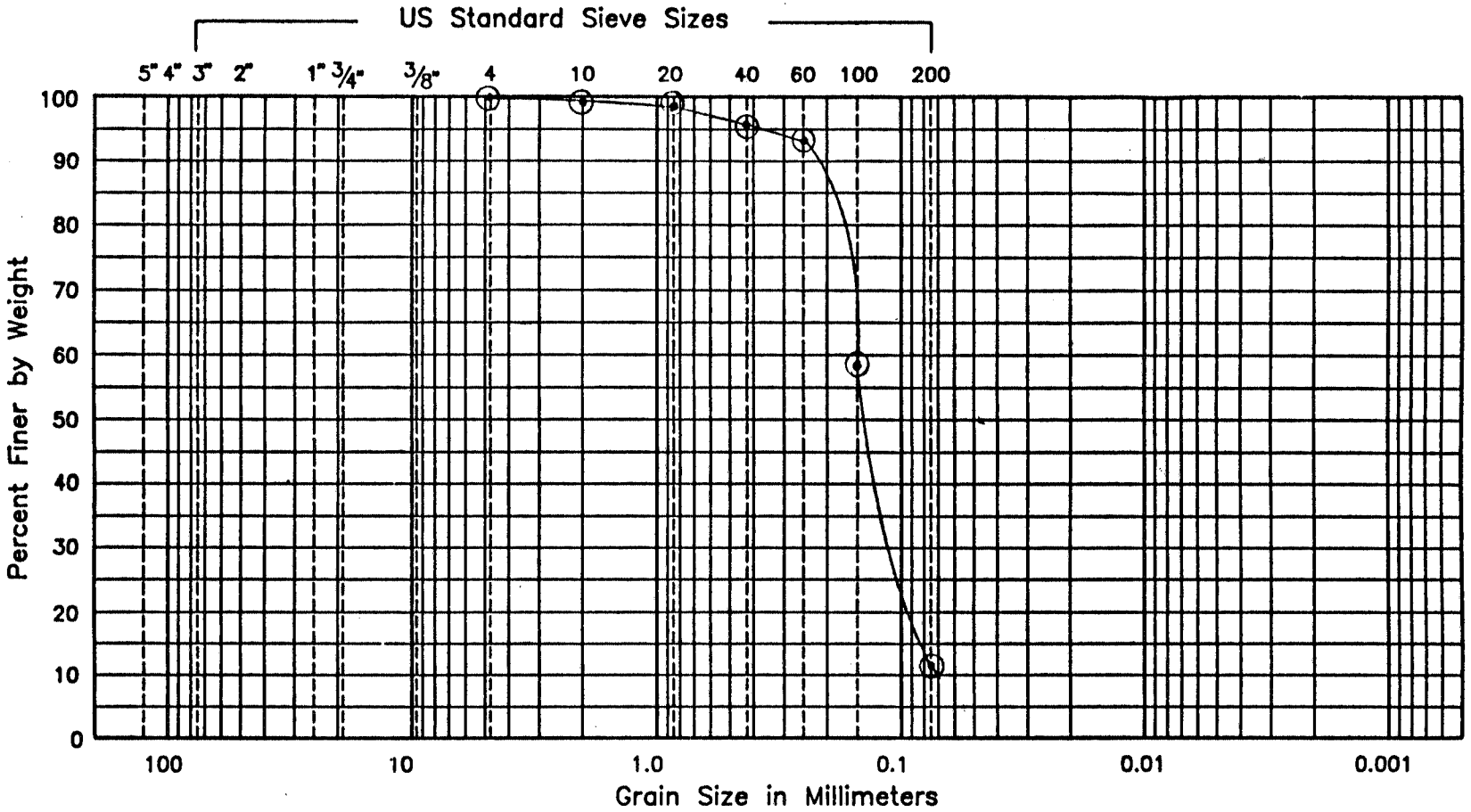
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 8	35.0 - 35.6	8.8				Light olive gray (5Y 5/2), m-f SAND, trace silt, (SP).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH / LAKE GOODWIN / WA
Project No. 913-1178.200 Date 8/27/91 Tested By M F Approved By

Golder Associates



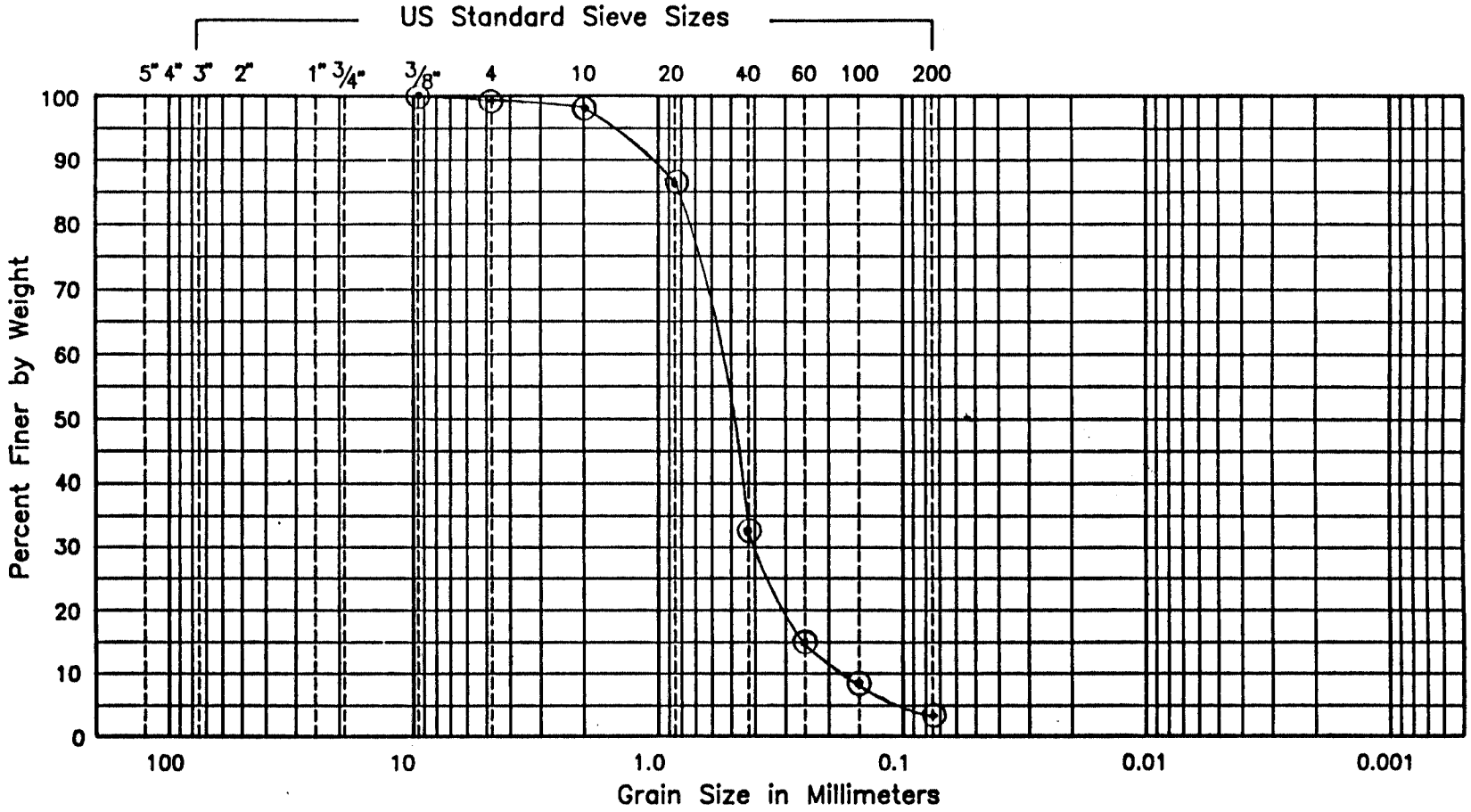
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 9	40.0-41.0	13.2				Light olive gray (5Y5/2) f SAND, little silt, (SP_SM).

GRAIN SIZE DISTRIBUTION

Project SNOHOMICH / LAKE GOODWIN / WA
Project No. 913-1178.200 Date 8/27/91 Tested By MF Approved By

Golder Associates



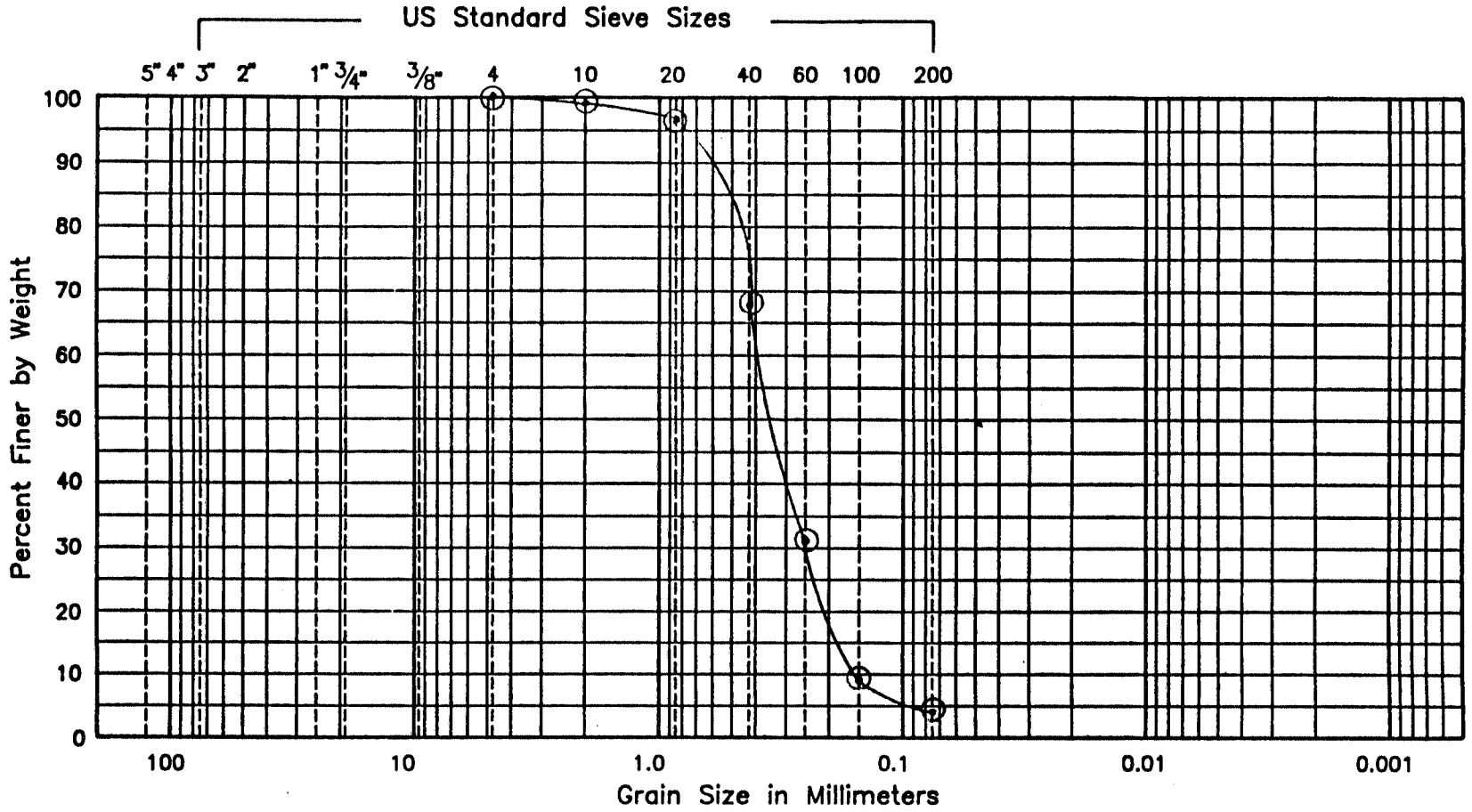
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 10	45.0-46.0	5.0				Light olive gray (5Y 5/2), m-f SAND, trace silt, trace f gravel, (SP).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH / LAKE GOODWIN / WA
Project No. 913-1178.200 Date 8/27/91 Tested By MF Approved By

Golder Associates



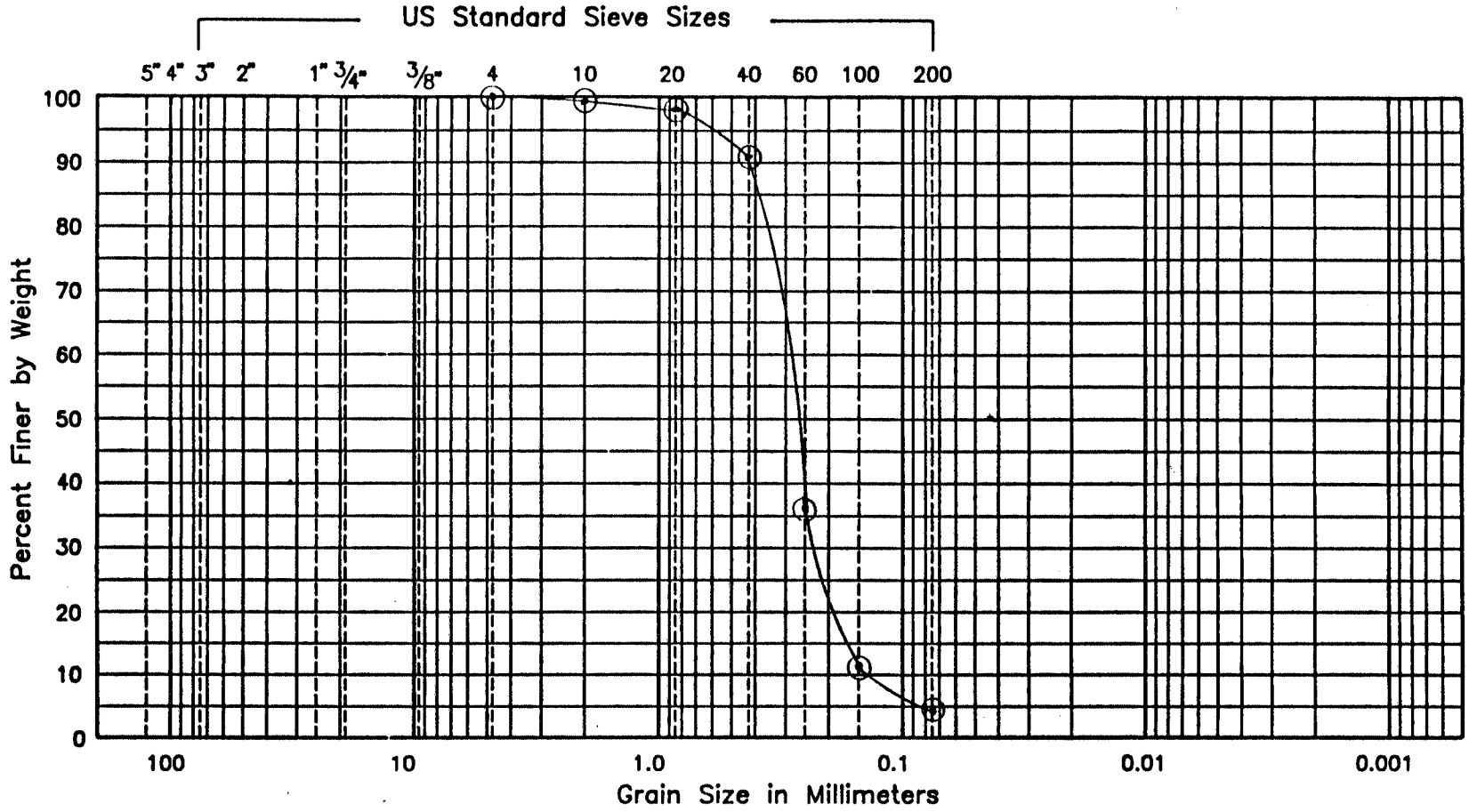
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 11	50.0-51.0	65				Light olive gray (5Y 5/2), m-f SAND, trace silt, (SP).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH / LAKE GOODWIN / WA
Project No. 913-1178.200 Date 8/27/91 Tested By MF Approved By

Golder Associates



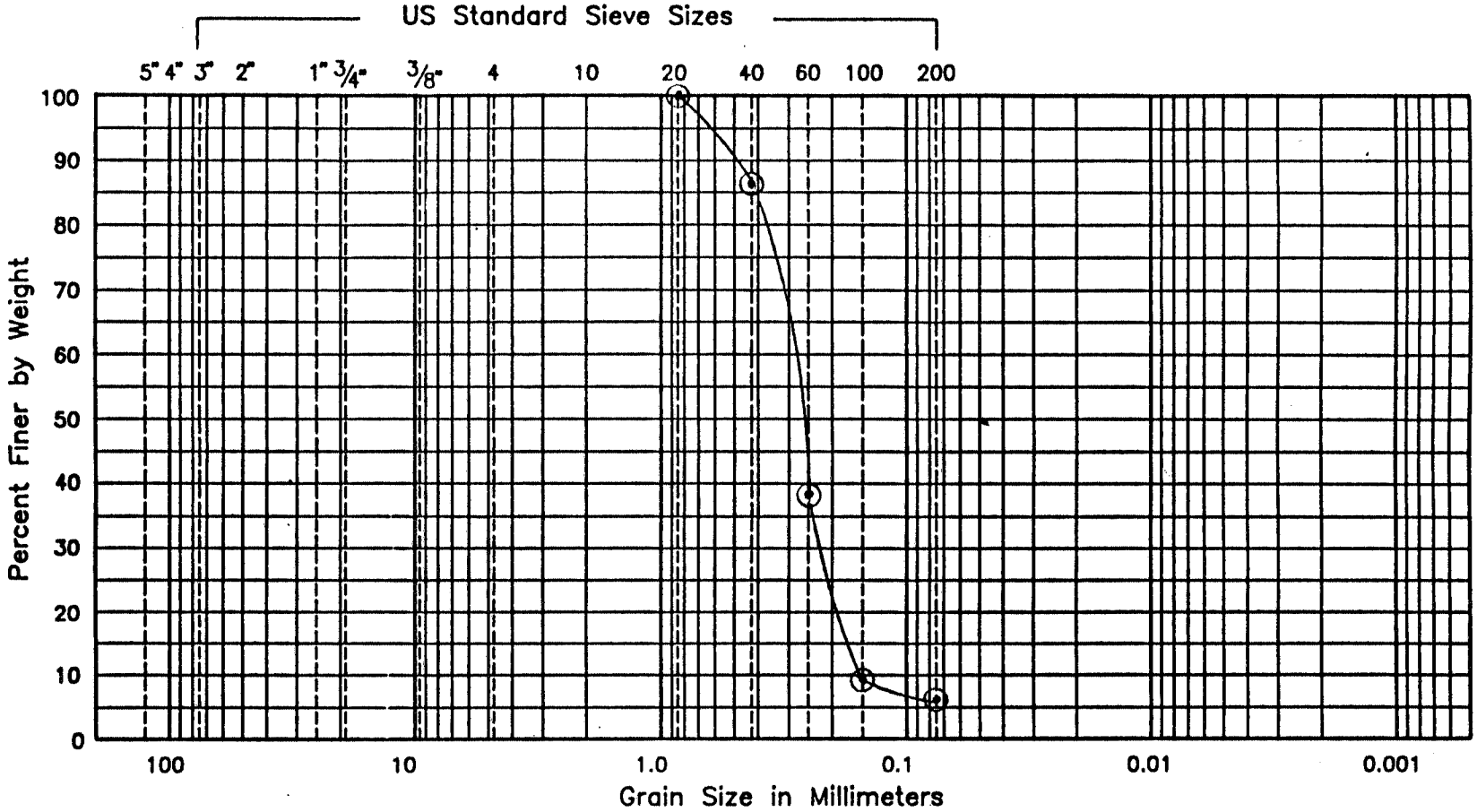
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 12	55.0-55.9	6.8				Light olive gray (5Y 5/2) f SAND, trace silt, (SP).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH / LAKE GOODWIN / WA
Project No. 913-1173.200 Date 8/27/91 Tested By M.F. Approved By

Golder Associates



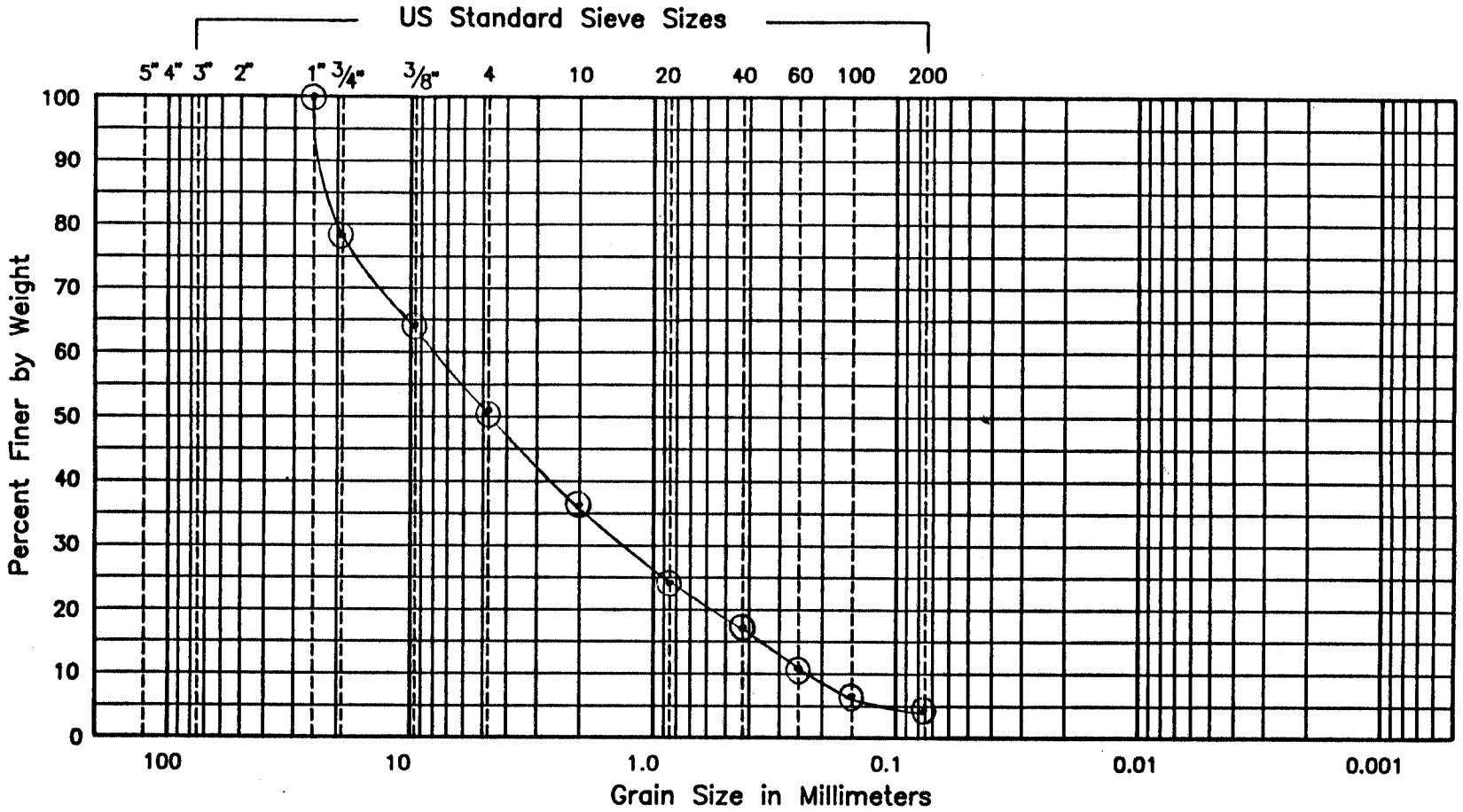
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 13	60.0 - 60.8	6.9				Light olive gray (5Y 5/2), m-f SAND, little silt, (SP-SM).

GRAIN SIZE DISTRIBUTION

Project: SNOHOMISH CO/LAKE GOODWIN/WA
Project No. 913-1178.200 Date 8/28/91 Tested By MF Approved By

Golder Associates



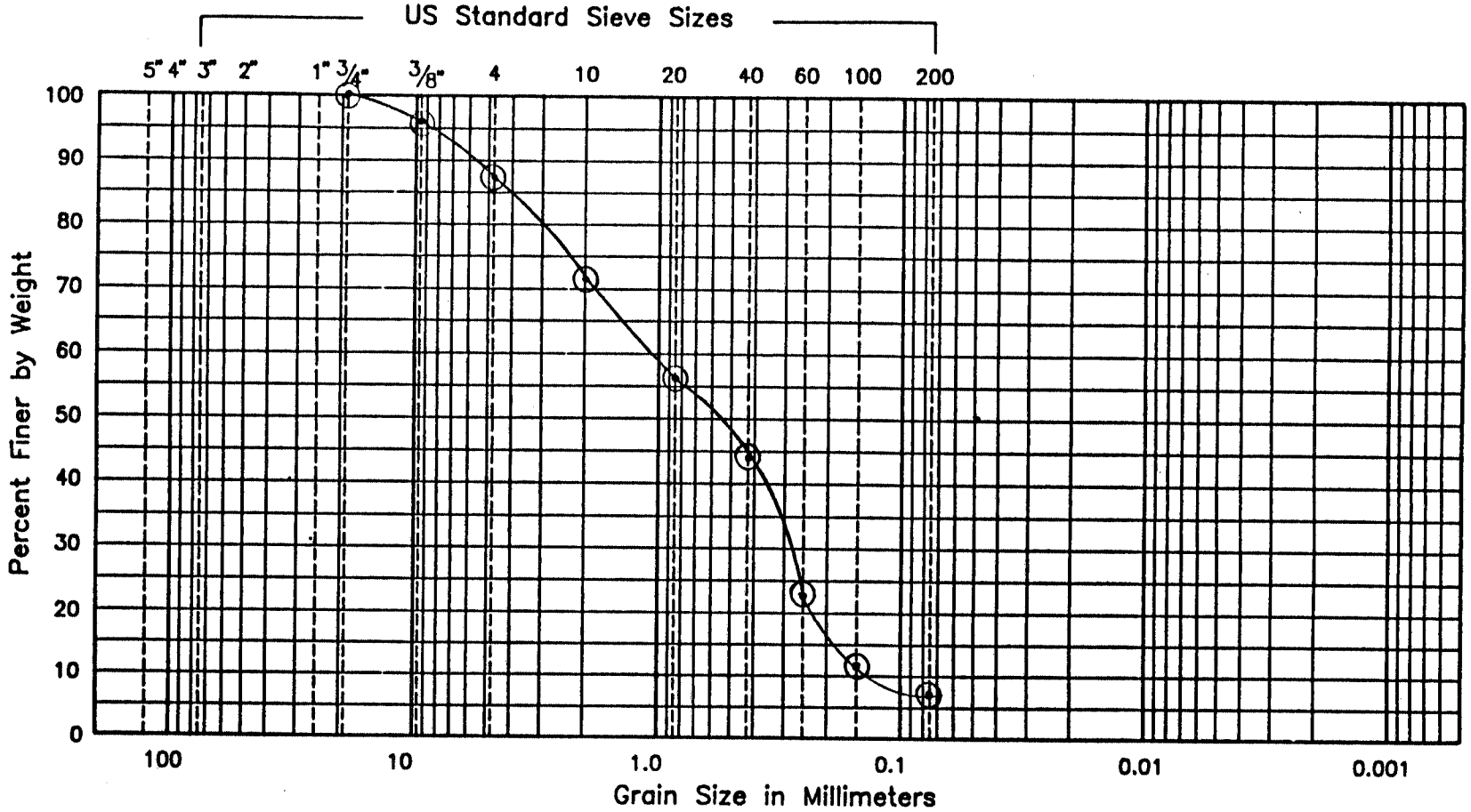
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 20	80.0-80.3	5.9				Medium gray (n 5), c-f GRAVEL and c-f SAND, trace silt, (GW).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO/LAKE GOODWIN/WA
Project No. 913-1178.200 Date 12/28/91 Tested By MF Approved By

Golder Associates



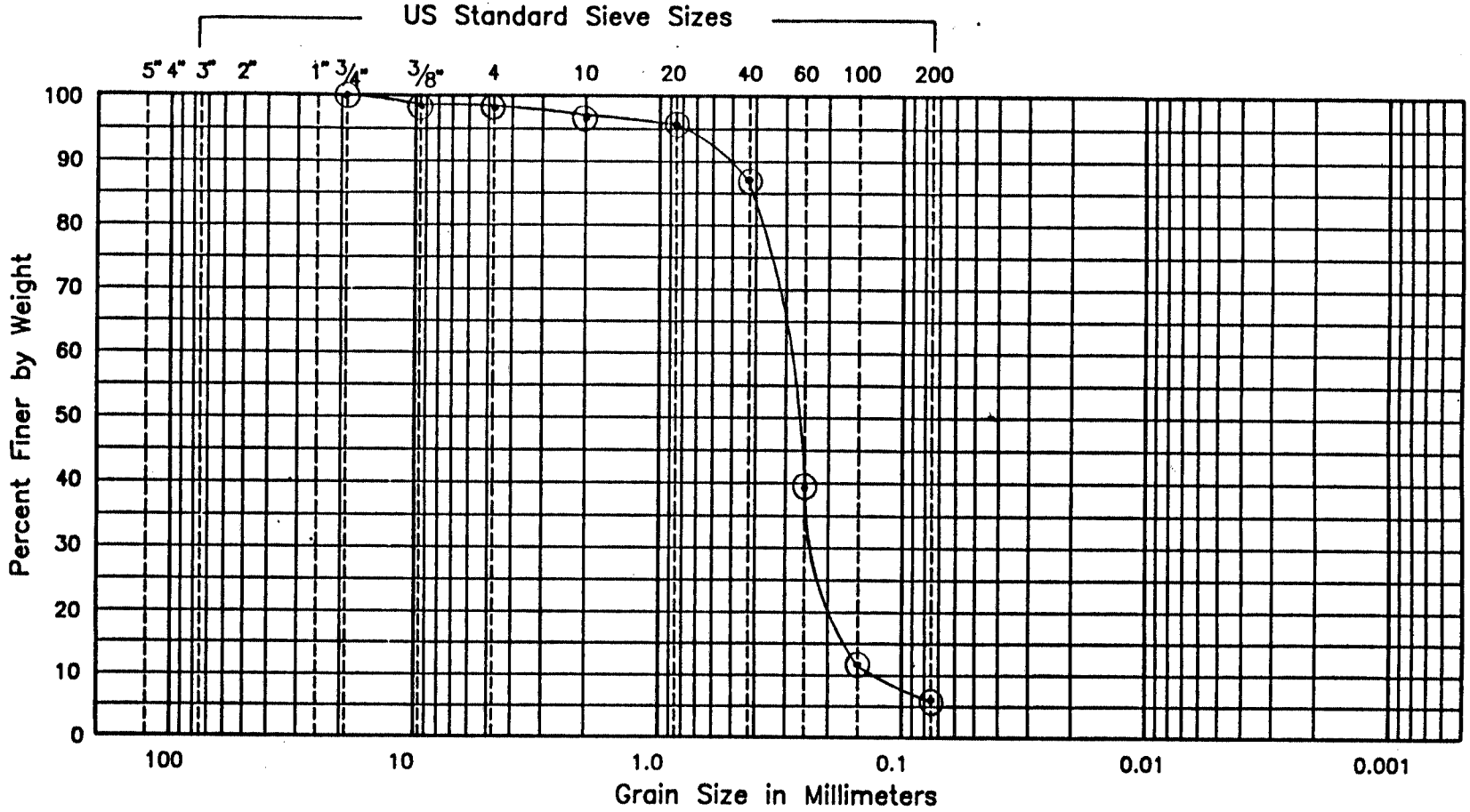
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 21	85.0-85.8	14.2				Dark greenish gray (5G 4/1), c-f SAND, some f gravel, little silt, (SP-SM).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO/LAKE GOODWIN/WA
Project No. 913-1178.200 Date 8/28/91 Tested By MF Approved By

Golder Associates



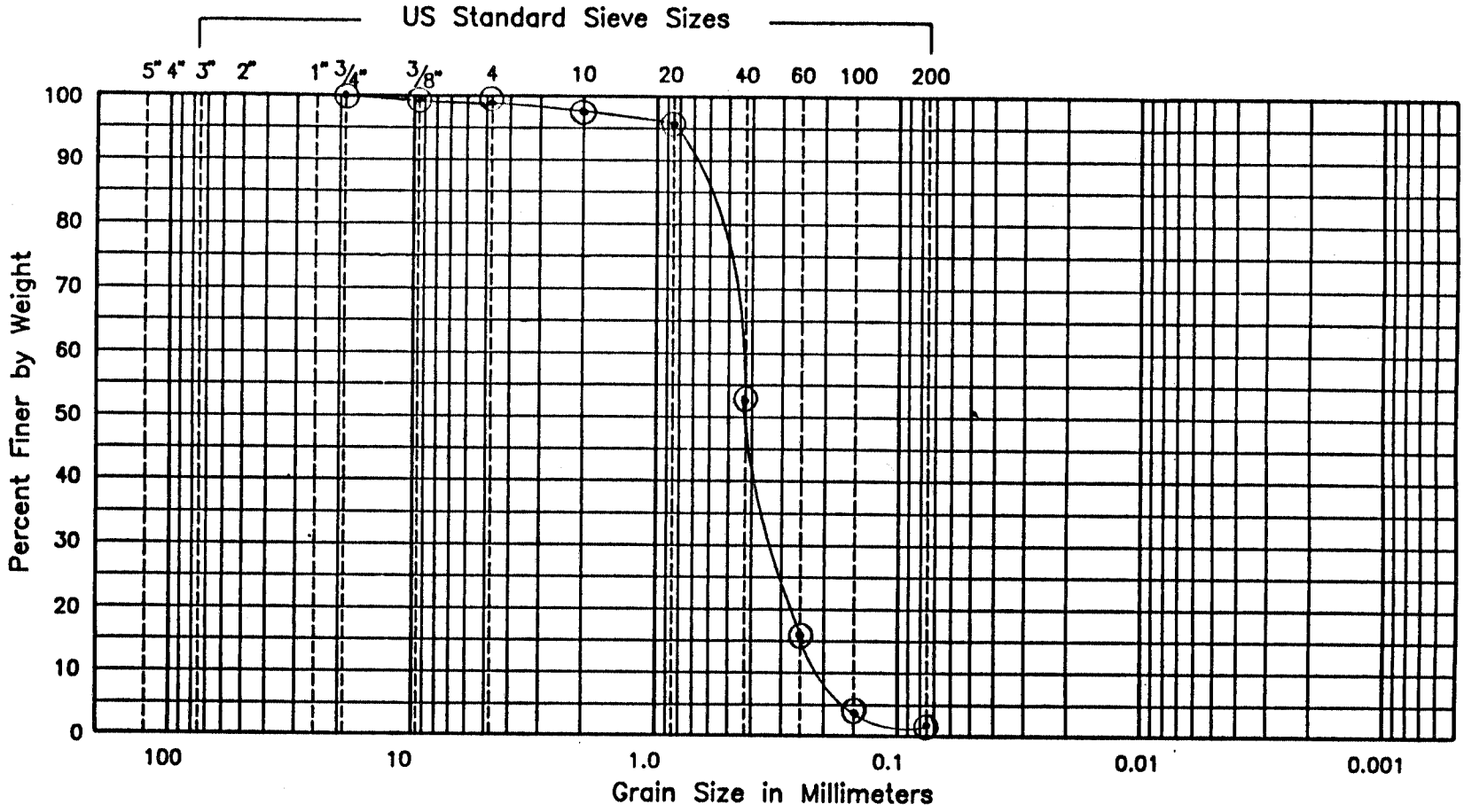
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 22	90.0-90.7	22.1				Medium gray (n5), m-f SAND, little silt, trace f gravel, (SP-SM).

GRAIN SIZE DISTRIBUTION

Project: SNOHOMISH CO / LAKE GOODWIN / WA
Project No. 913-1178.200 Date: 12/28/91 Tested By: MF Approved By:

Golder Associates



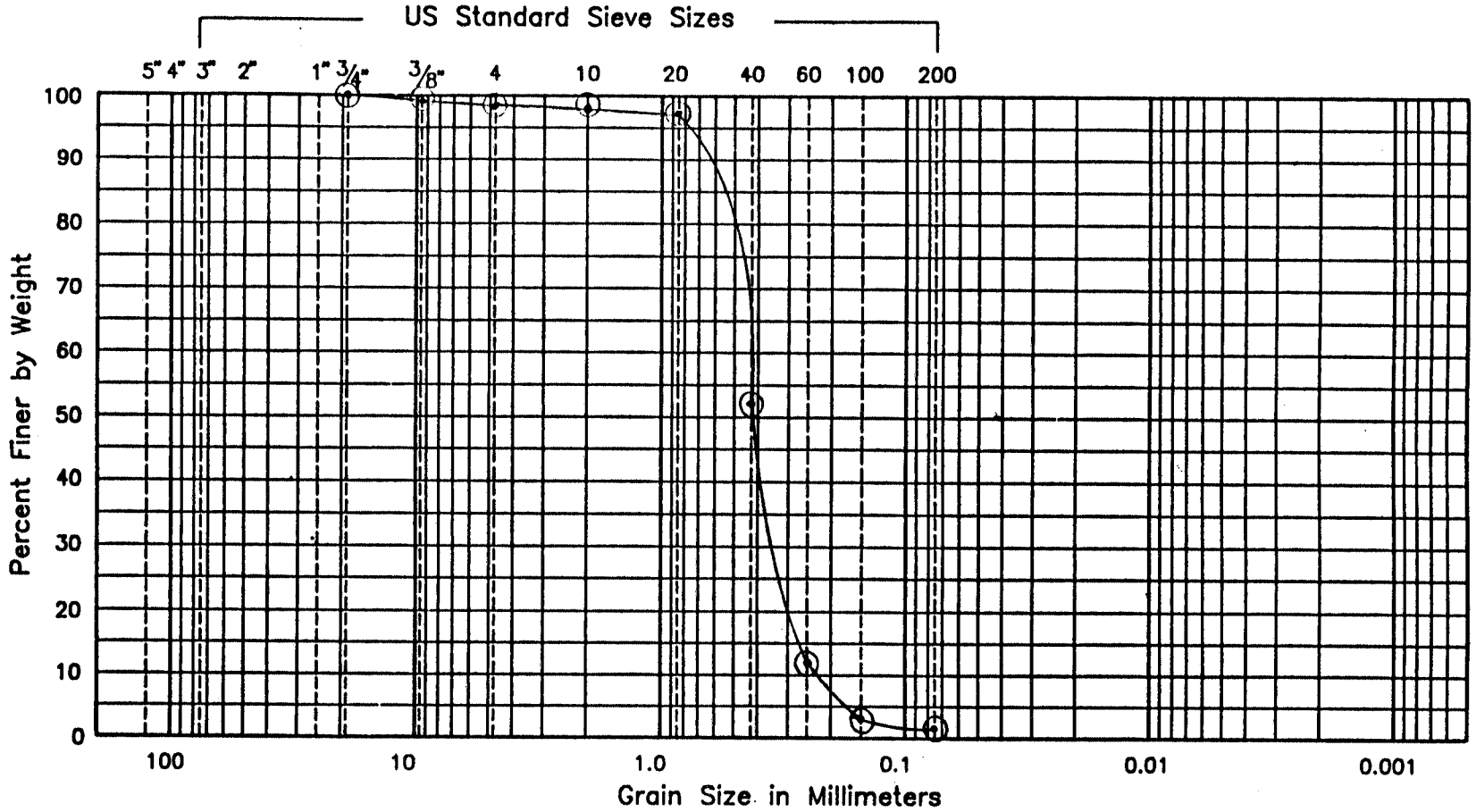
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 24	100	23.7				Olive gray (5Y 3/2), m-f SAND, trace f gravel, trace silt, (SP).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO/LAKE GOODWIN/WA
Project No. 913-1178.200 Date 10/28/91 Tested By MF Approved By

Golder Associates



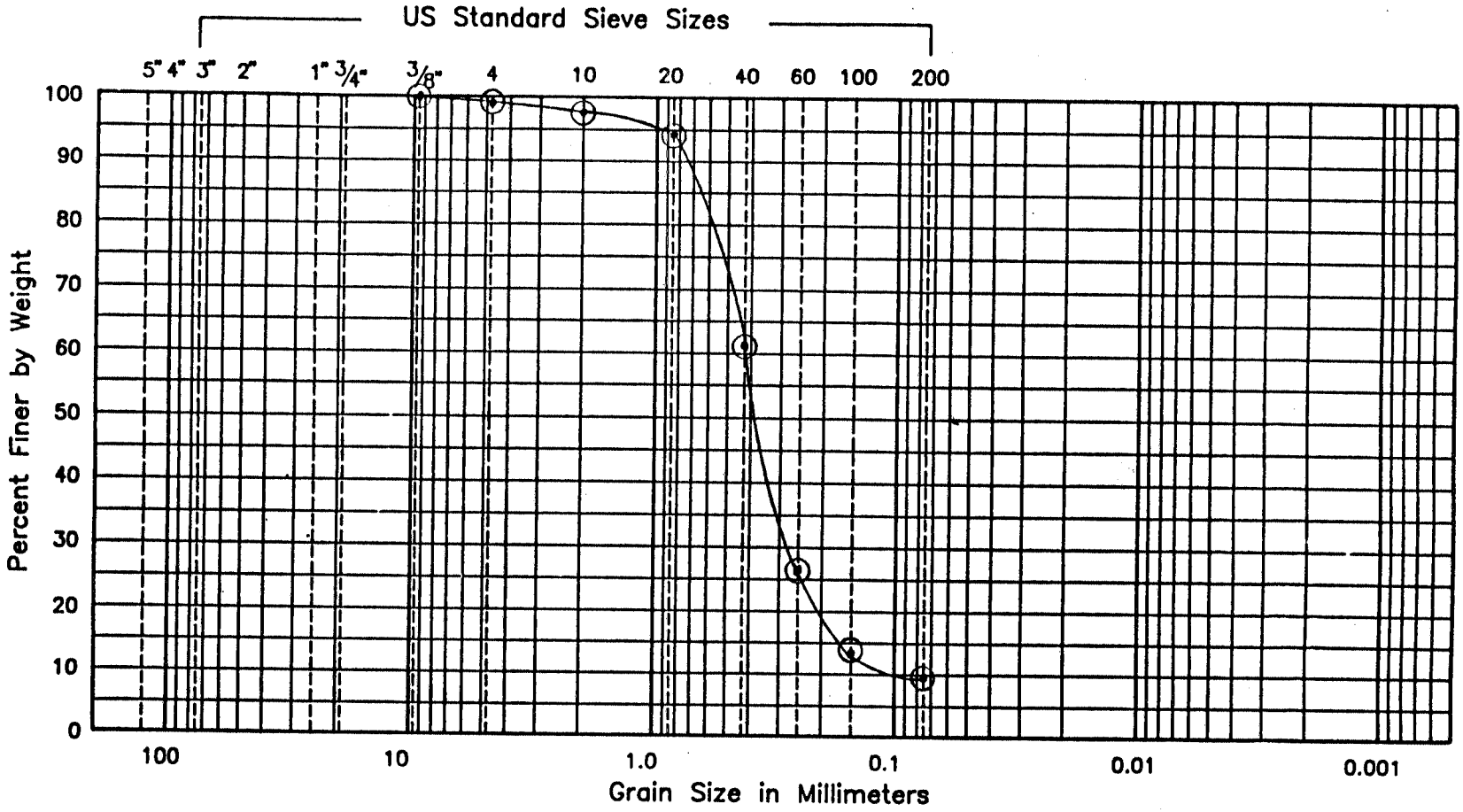
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 25	105	6.5				Moderate olive brown (5Y 4/4), m-f SAND, trace f gravel, trace silt, (SP).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO / LAKE GOODWIN / WA
Project No. 913-1178.200 Date 12/28/91 Tested By MF Approved By

Golder Associates



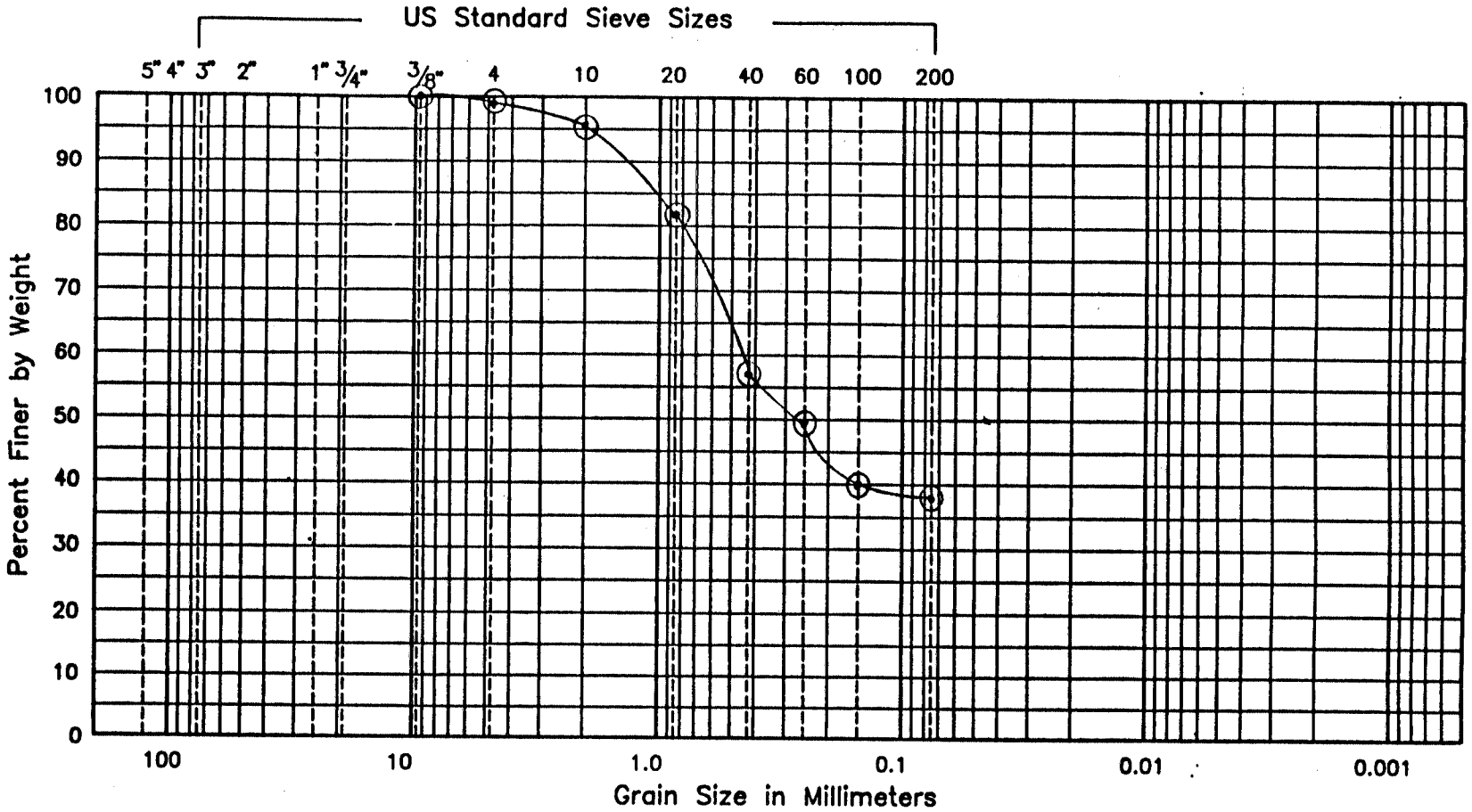
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 26	110	24.6				Light olive brown (5Y 5/6), m-f SAND, little silt, trace f gravel, (SP-SM).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO/LAKE GOODWIN/WA
Project No. 913-1178.200 Date 9/28/89 Tested By MF Approved By

Golder Associates



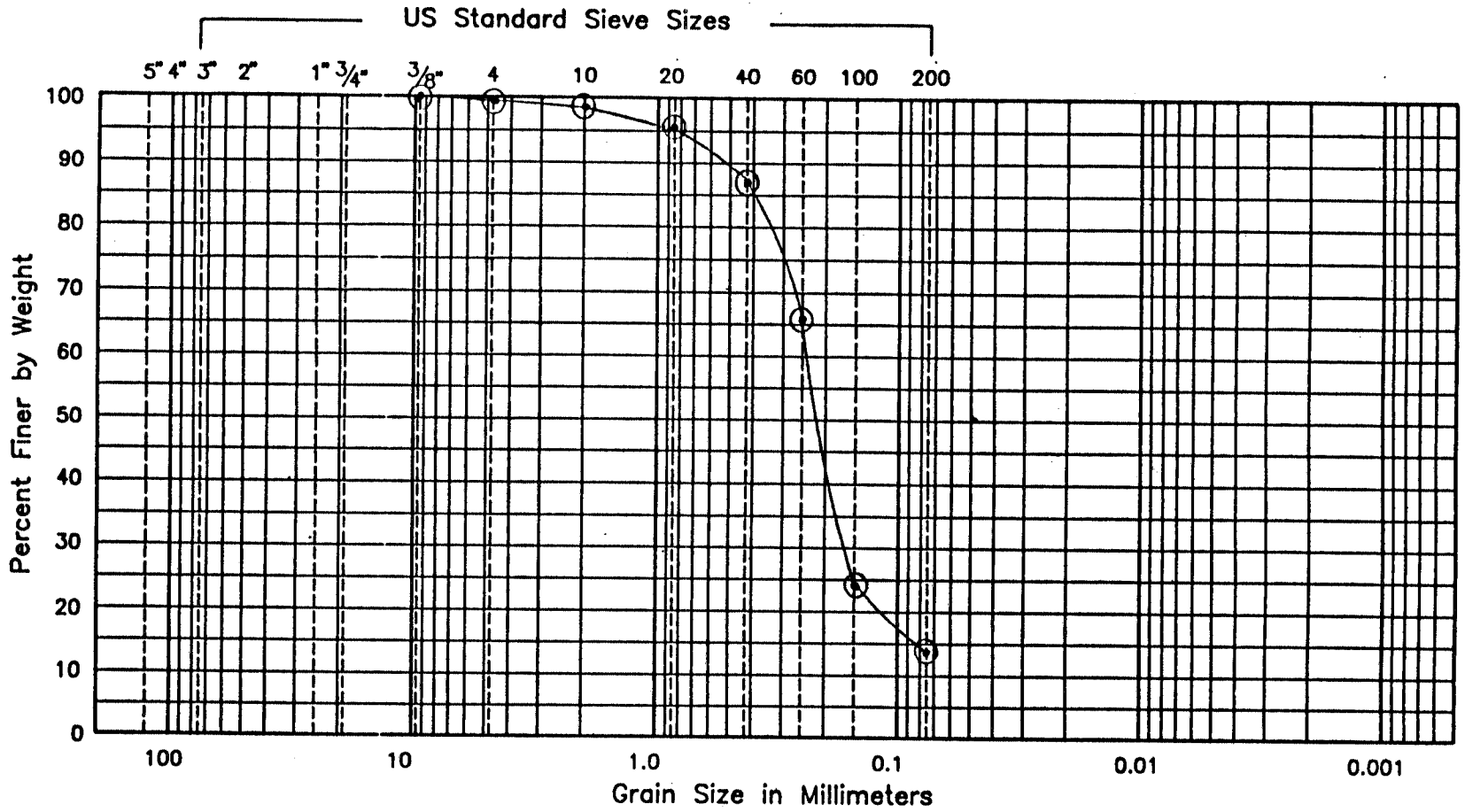
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 27	115	25.0				Light olive gray (5Y5/2), c-f SAND and CLAYEY SILT, trace f gravel, (SM).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO/LAKE GOODWIN/WA
Project No. 913-1178.200 Date 9/28/91 Tested By MF Approved By

Golder Associates



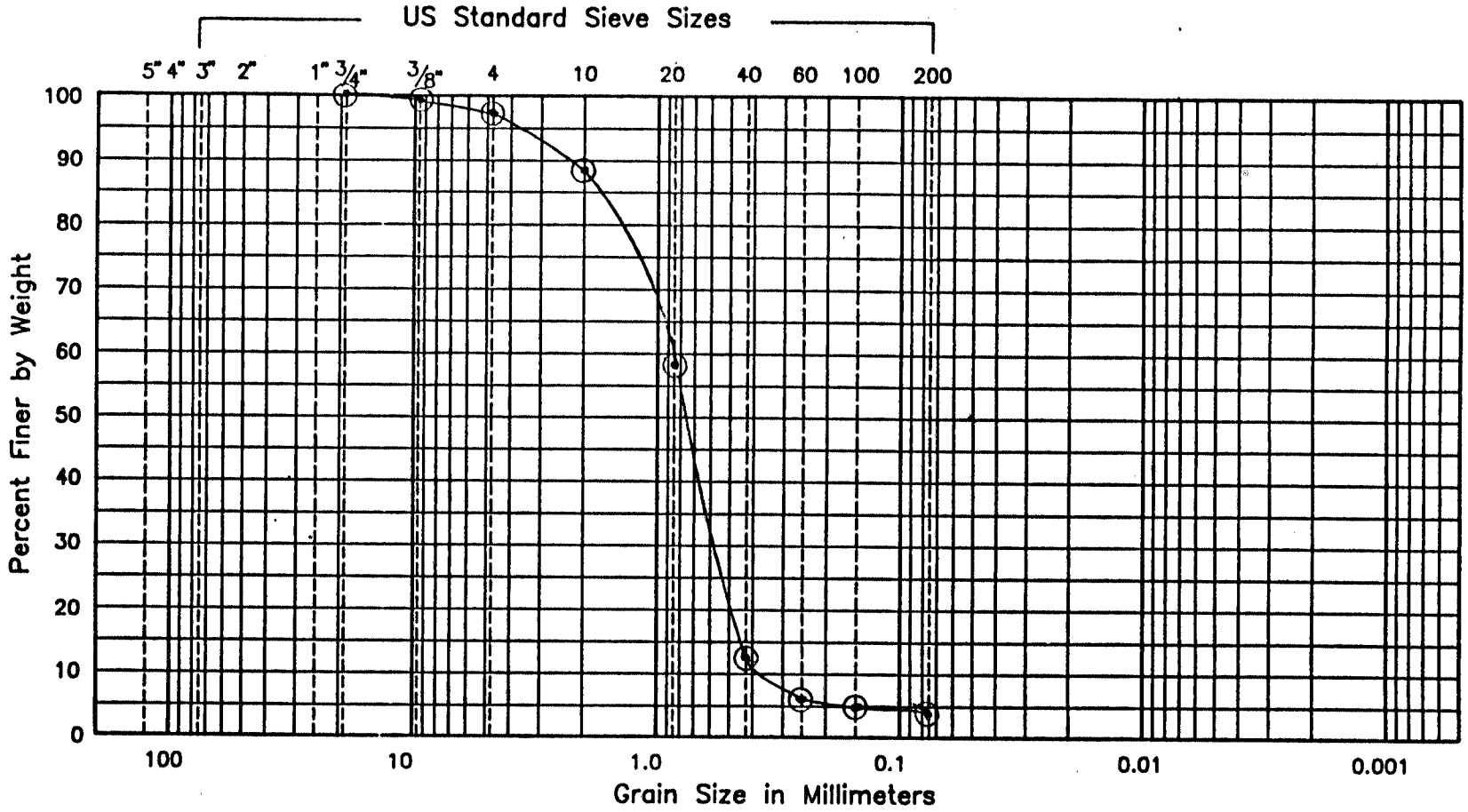
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 28	120	8.8				Moderate olive brown (5Y 4/4), m-f SAND, some silt, trace f gravel, (SM).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO/LAKE GOODWIN/WA
Project No. 913-1178.200 Date 8/28/91 Tested By MF Approved By

Golder Associates



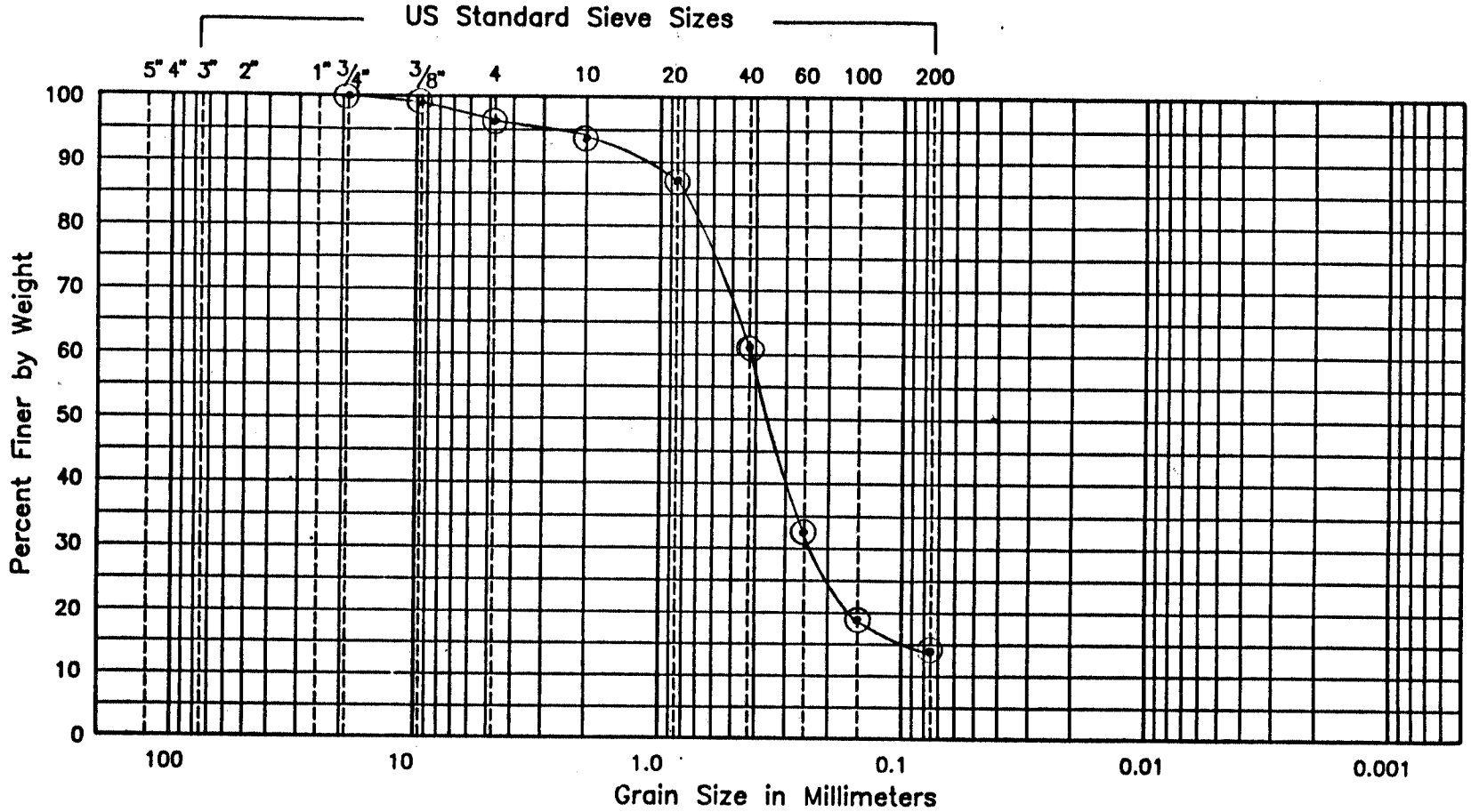
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 29	125	7.3				Olive gray (5Y 3/2), c-m SAND, trace f gravel, trace silt, (SP).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO/LAKE GOODWIN/WA
Project No. 913-1178.200 Date 9/28/91 Tested By MF Approved By

Golder Associates



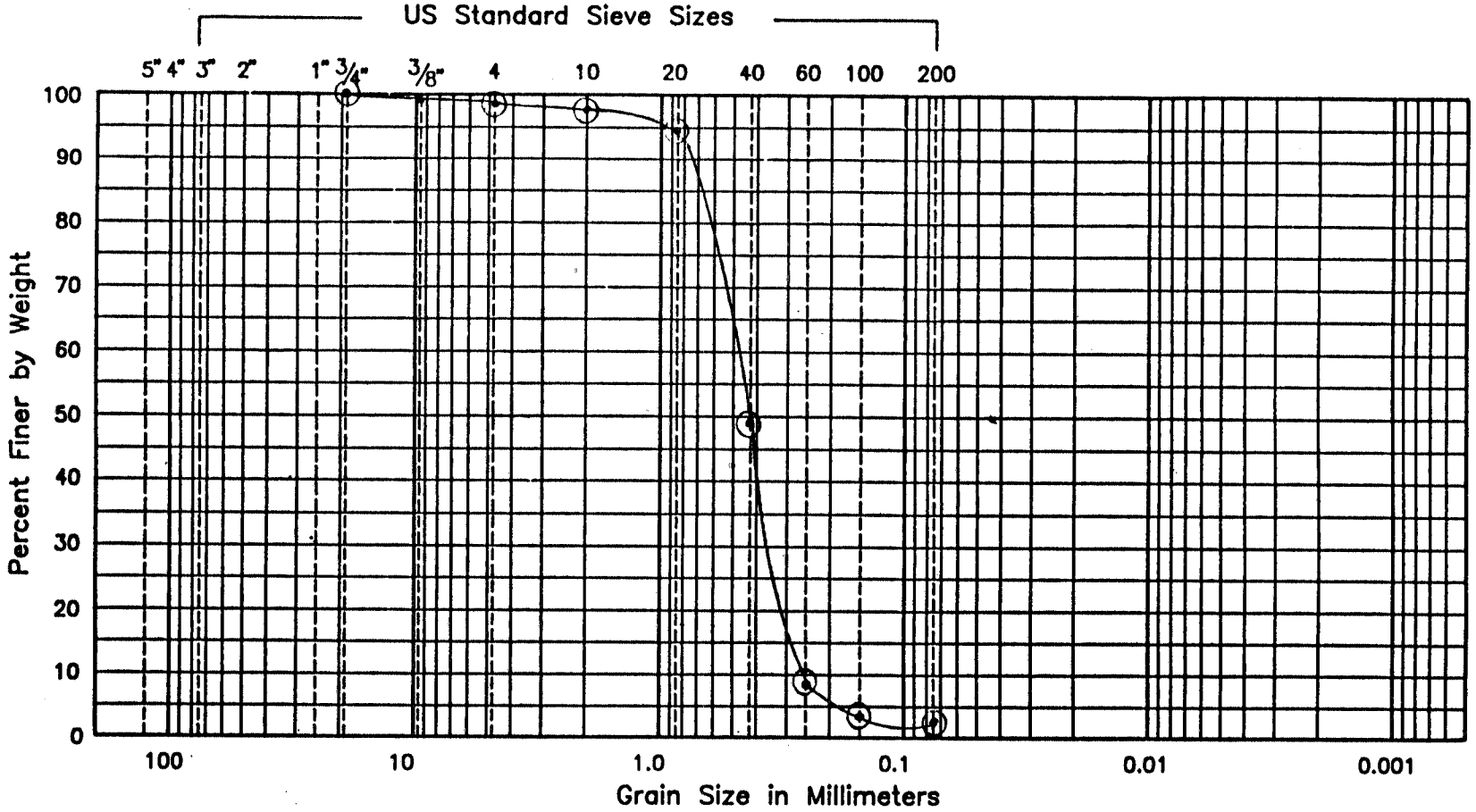
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 30	130	18.9				Moderate olive brown (5Y 4/4), m-f SAND, some silt, trace f gravel, (SM).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO/LAKE GOODWIN/WA
Project No. 913-1178.200 Date 9/28/91 Tested By MF Approved By

Golder Associates



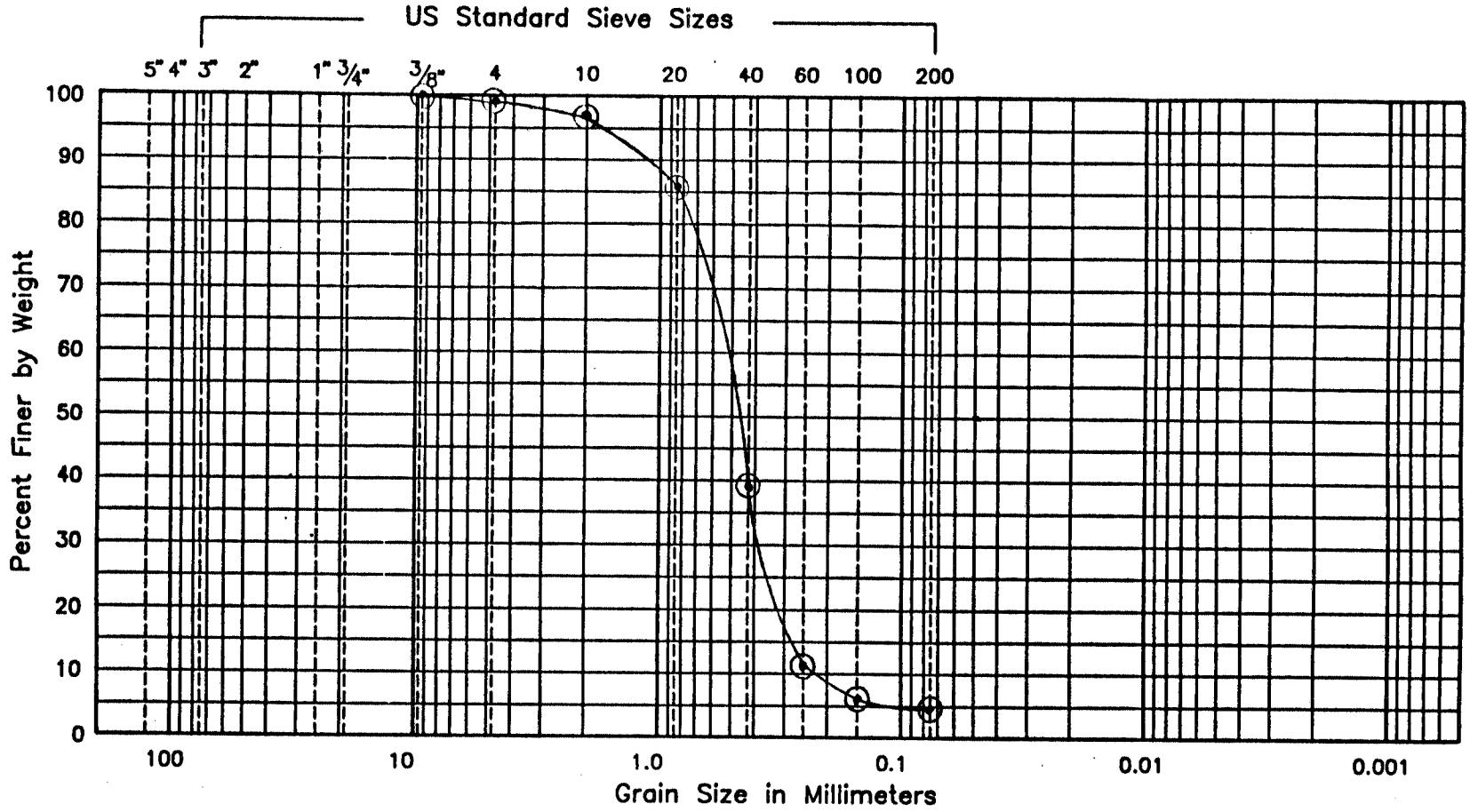
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 31	135	6.4				Olive gray (5Y 3/2), m-f SAND, trace f gravel, trace silt, (SP).

GRAIN SIZE DISTRIBUTION

Project: SNOHOMISH CO / LAKE GOODWIN / WA
Project No. 913-1178.200 Date 8/28/91 Tested By MF Approved By

Golder Associates



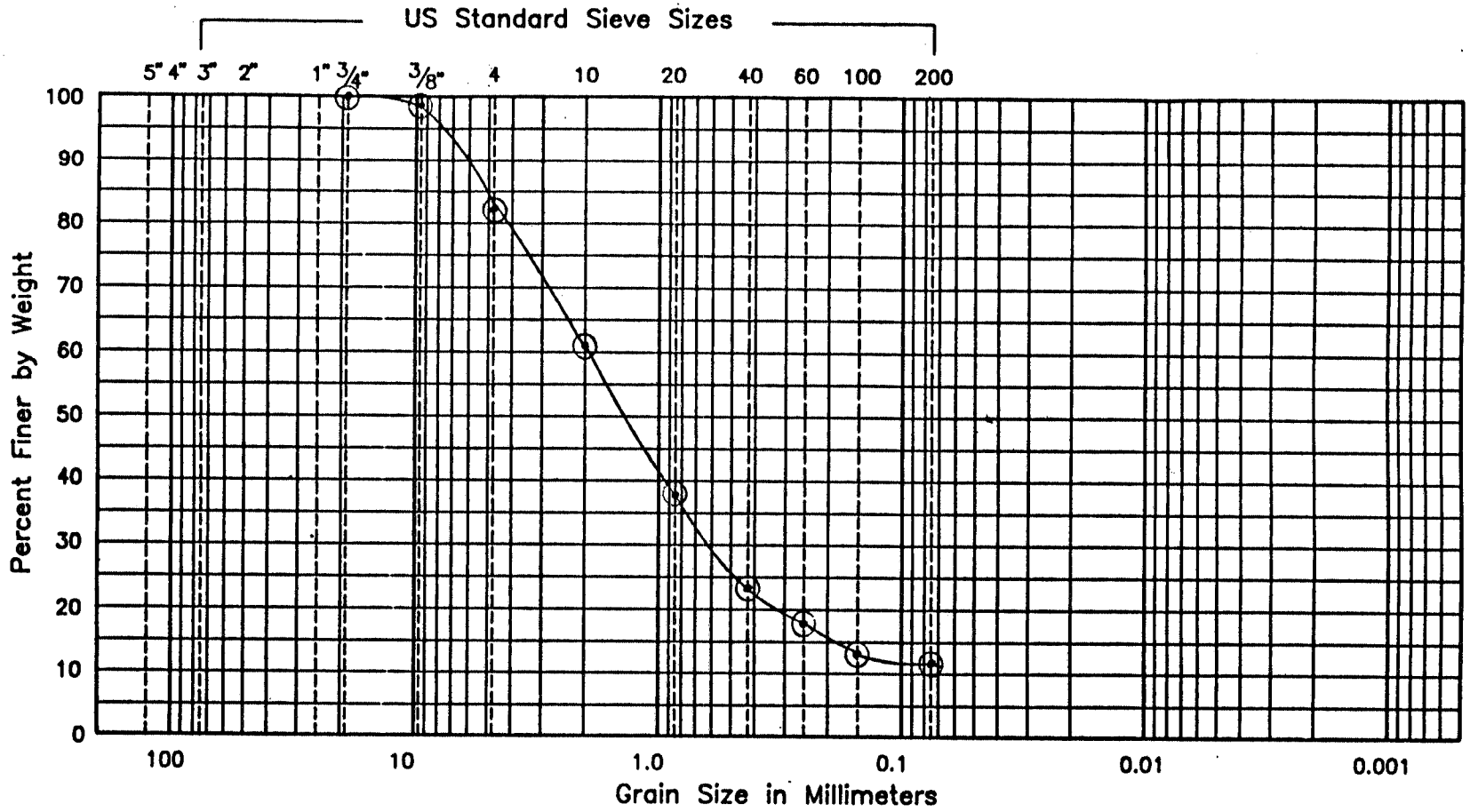
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 32	140	7.5				Olive gray (5 Y 3/2), m-f SAND, trace f gravel, trace silt, (SP).

GRAIN SIZE DISTRIBUTION

Project: SNOHOMISH CO / LAKE GOODWIN / WA
Project No. 913-1178.200 Date 8/28/91 Tested By MF Approved By

Golder Associates



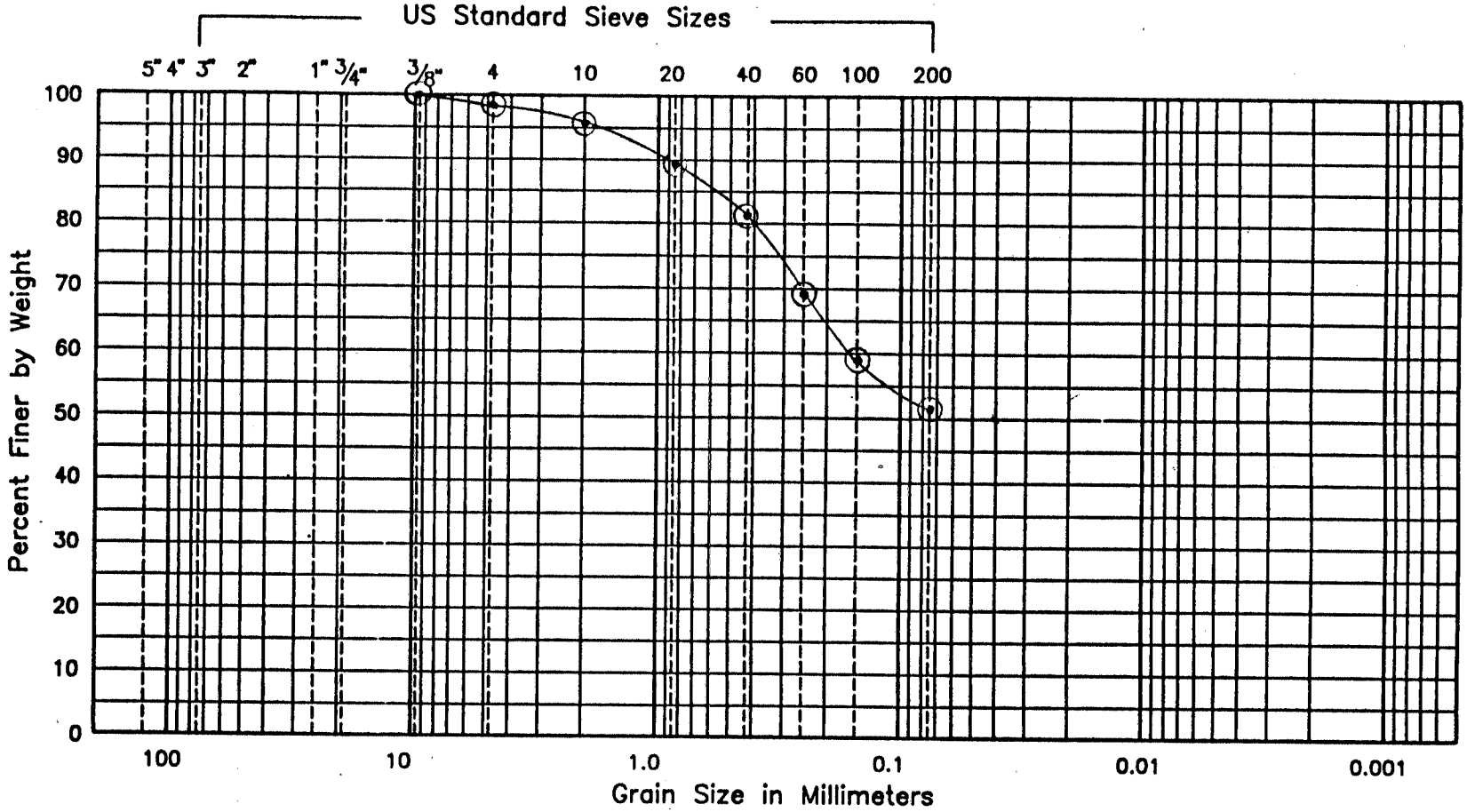
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 33	145	12.6				Olive gray (5 Y 3/2), c-f SAND, some f gravel, little silt, (SP-SM).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO / LAKE GOODWIN / WA
Project No. 913-1178.200 Date 12/28/91 Tested By MF Approved By

Golder Associates



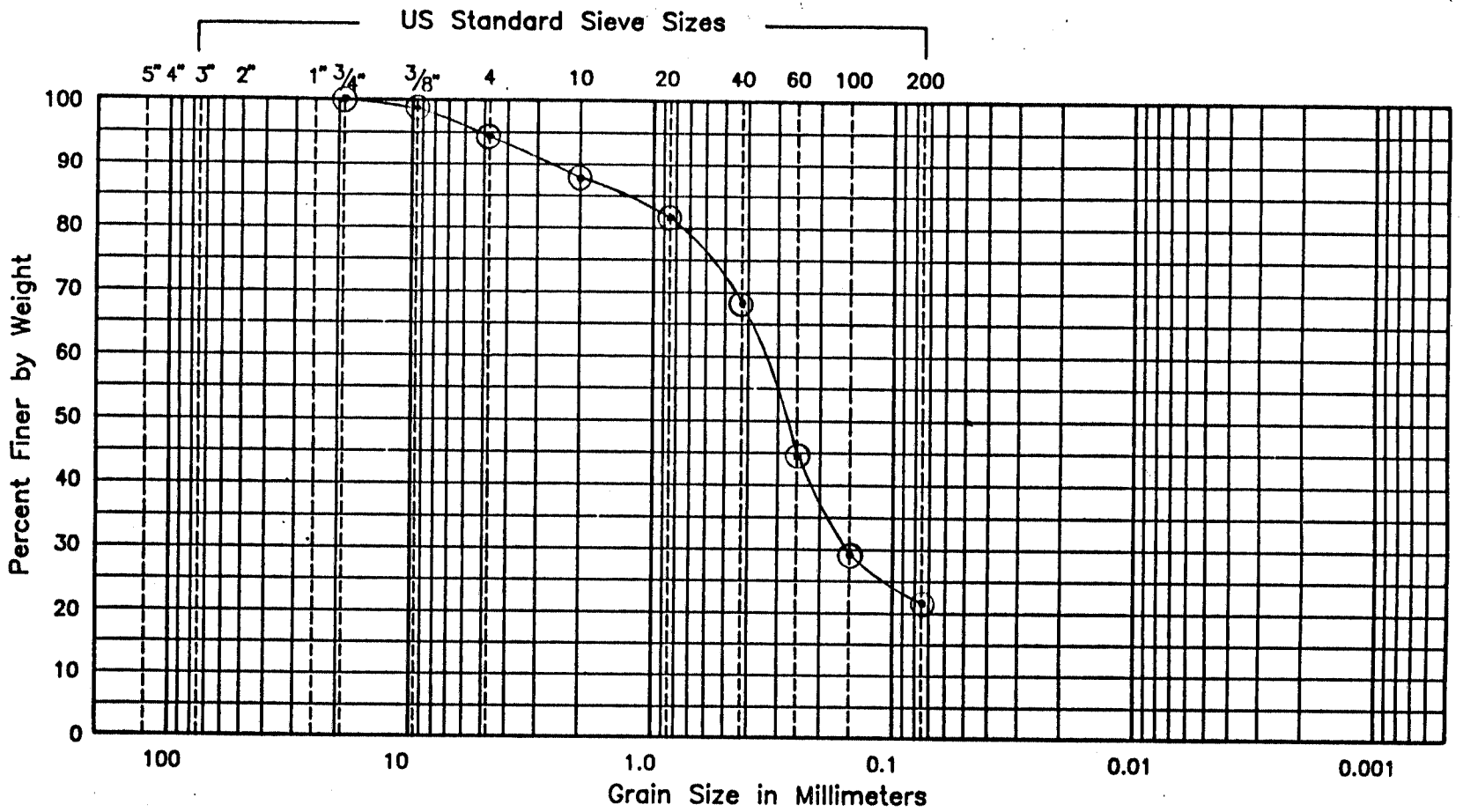
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 34	150	55.5	24	13	11	Olive gray (5Y 3/2), CLAYEY SILT and m-f SAND, trace f gravel, (CL).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO/LAKE GOODWIN/WA
Project No. 913-1178.200 Date 12/28/91 Tested By MF Approved By

Golder Associates



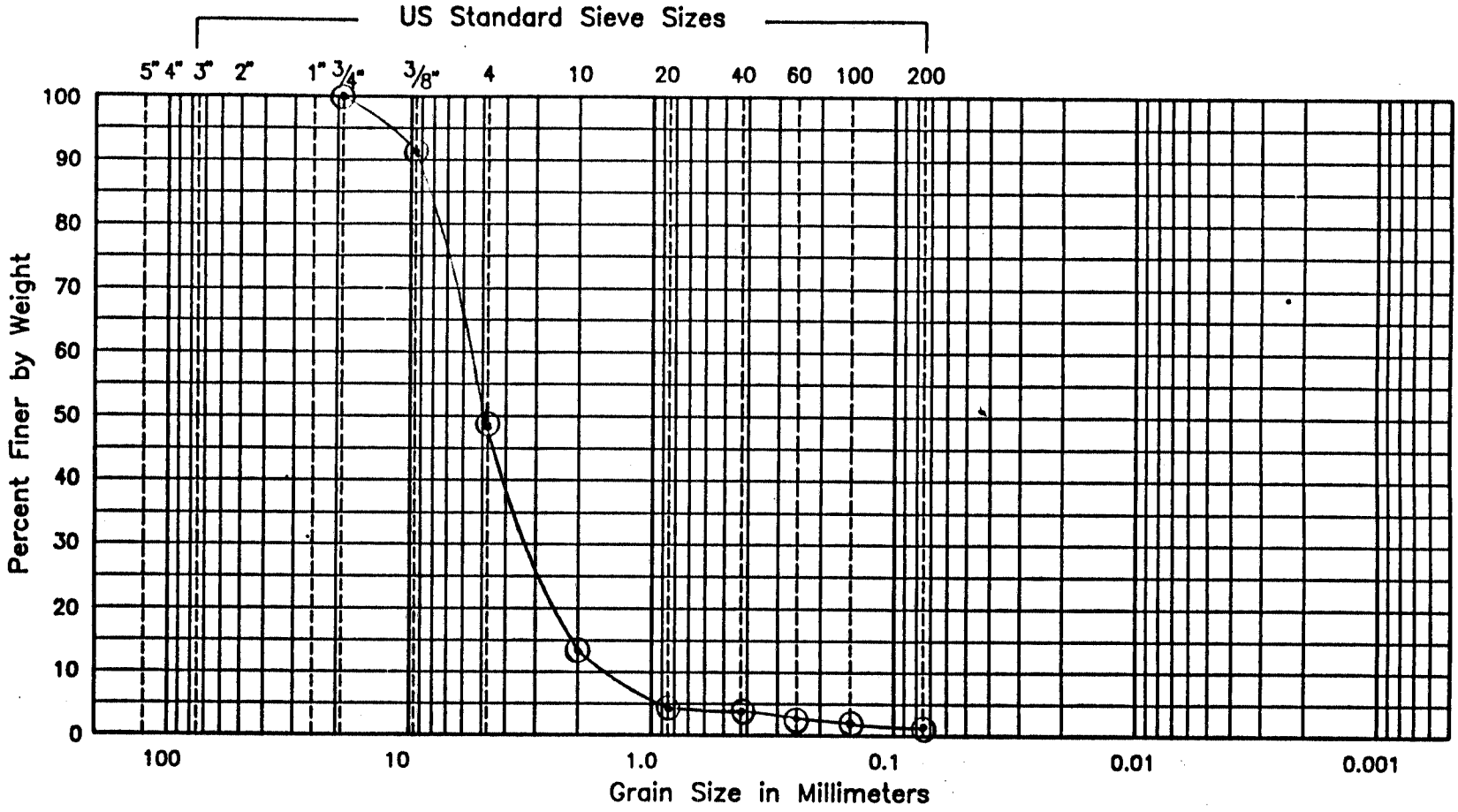
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 35	155	30.1				Olive gray (5Y 3/2), c-f SAND some clayey silt, little f gravel, (SM).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO / LAKE GOODWIN / WA
Project No. 913-1178.200 Date 9/28/91 Tested By NF Approved By

Golder Associates



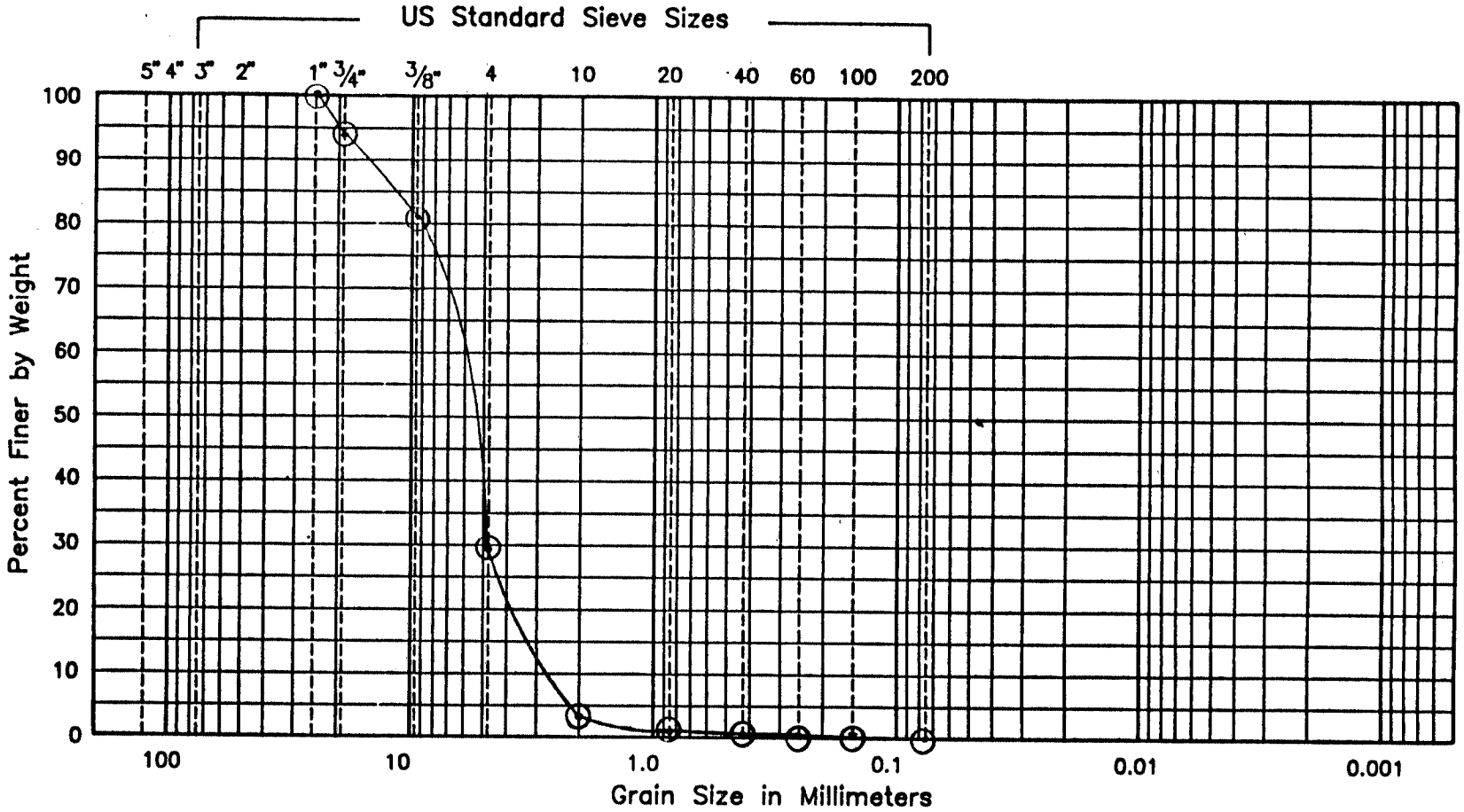
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 36	160	2.7				Olive gray (5Y3/2), f GRAVEL and c-m SAND, trace silt, (GW).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO/LAKE GOODWIN/WA
Project No. 913-1178.200 Date 12/28/91 Tested By MF Approved By

Golder Associates



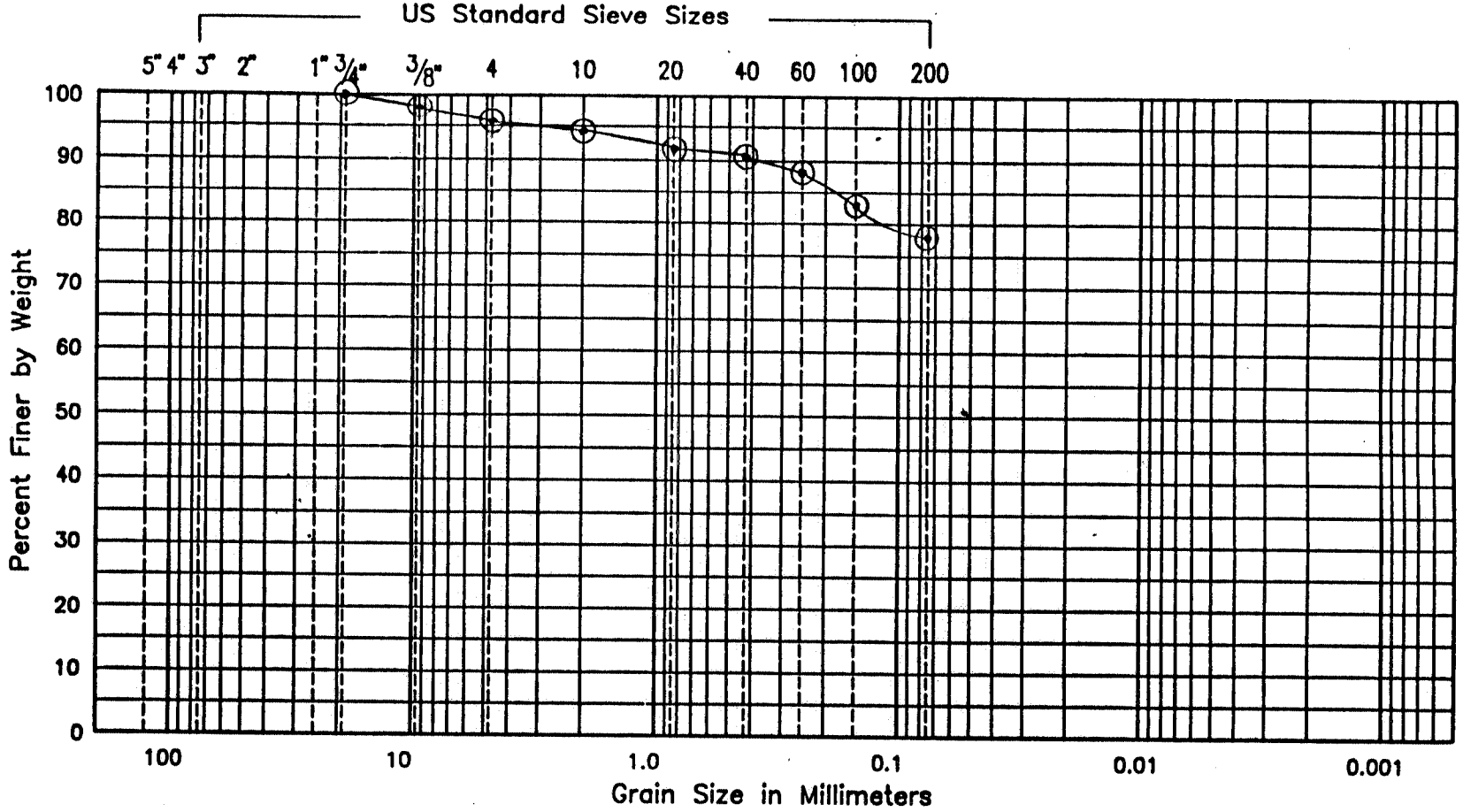
Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 37	165	3.2				Olive gray (5Y 3/2), c-f GRAVEL, some c. sand, trace silt, (GP).

GRAIN SIZE DISTRIBUTION

Project SNOHOMISH CO/LAKE GOODWIN/WA
Project No. 913-1178.200 Date 10/28/91 Tested By MF Approved By

Golder Associates



Cobbles	Gravel		Sand			Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

Boring No.	Elev. or Depth	W_n	W_L	W_p	I_p	Description
LG-5 38	170	103.2	49	16	33	Olive gray (5Y 3/2), SILTY CLAY, some m-f sand, trace f gravel, (CL).

GOLDER ASSOCIATES INC., REDMOND, WA

ASTM D-1140/C-136
SIEVE ANALYSIS

PROJECT	SNOHOMISH CO/LAKE GOODWIN/WA
PROJECT NUMBER	913-1178.200
ENGINEER	VELIMESIS
DATE	8/21/91
TECHNICIAN	MF
REVIEWER	DC

SIZE OF LARGEST PARTICLE	MINIMUM MASS OF SAMPLE REQUIRED
#10	200g
#4	500g
3/4"	1500g
1"	2000g
2"	4000g
3"	5000g

BOREHOLE NUMBER	LG-5	LG-5	LG-5	LG-5	LG-5	LG-5
SAMPLE NUMBER	27	28	29	30	31	32
DEPTH (ft)	115	120	125	130	135	140
TARE NUMBER	R	DH	SKY	J	W	Z
TARE WT (g)	107.24	223.73	207.98	107.17	108.56	114.84
WET WT + TARE (g)	353.29	1278.80	1483.60	909.60	942.40	1446.1
DRY WT + TARE (g)	304.02	1193.90	1396.70	781.86	892.10	1352.7
MOISTURE (%)	25.0%	8.8%	7.3%	18.9%	6.4%	7.5%

	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER
TARE (g)	107.33		224.87		207.96		107.22		108.45		114.79	
3"	107.33	100.0%	224.87	100.0%	207.96	100.0%	107.22	100.0%	108.45	100.0%	114.79	100.0%
2"	107.33	100.0%	224.87	100.0%	207.96	100.0%	107.22	100.0%	108.45	100.0%	114.79	100.0%
1"	107.33	100.0%	224.87	100.0%	207.96	100.0%	107.22	100.0%	108.45	100.0%	114.79	100.0%
3/4"	107.33	100.0%	224.87	100.0%	207.96	100.0%	107.22	100.0%	108.45	100.0%	114.79	100.0%
3/8"	107.33	100.0%	224.87	100.0%	214.64	99.4%	112.87	99.2%	109.78	99.8%	114.79	100.0%
#4	108.80	99.3%	226.14	99.9%	246.98	96.7%	131.27	96.4%	115.96	99.0%	117.46	99.8%
#10	116.65	95.3%	238.83	98.6%	351.61	87.9%	152.32	93.3%	125.94	97.8%	146.58	97.4%
#20	142.60	82.1%	265.35	95.8%	702.85	58.4%	191.65	87.5%	148.70	94.9%	299.52	85.1%
#40	190.76	57.6%	345.59	87.6%	1249.70	12.4%	375.95	60.2%	506.68	49.2%	869.90	39.0%
#60	206.32	49.7%	557.73	65.7%	1325.80	6.0%	565.45	32.1%	827.60	8.2%	1209.60	11.6%
#100	225.49	40.0%	961.20	24.1%	1338.96	4.9%	653.65	19.0%	866.50	3.3%	1287.90	5.2%
#200	230.36	37.5%	1061.80	13.7%	1353.40	3.6%	687.67	14.0%	870.90	2.7%	1301.50	4.1%
MEETS ASTM SAMPLE SIZE REQUIREMENT?	NO		YES		YES		NO		NO		YES	
D10	N/A		D10 N/A		D10 0.16		D10 N/A		D10 0.26		D10 0.23	
D30	N/A		D30 N/A		D30 0.59		D30 N/A		D30 0.38		D30 0.39	
D60	N/A		D60 N/A		D60 0.85		D60 N/A		D60 0.48		D60 0.51	
Cu	N/A		Cu N/A		Cu 5.31		Cu N/A		Cu 1.85		Cu 2.22	
Cz	N/A		Cz N/A		Cz 2.56		Cz N/A		Cz 1.16		Cz 1.30	

GOLDER ASSOCIATES INC., REDMOND, WA

ASTM D-1140/C-136
SIEVE ANALYSIS

PROJECT	SNOHOMISH CO/LAKE GOODWIN/WA
PROJECT NUMBER	913-1178.200
ENGINEER	VELIMESIS
DATE	8/21/91
TECHNICIAN	MF
REVIEWER	DPO

SIZE OF LARGEST PARTICLE	MINIMUM MASS OF SAMPLE REQUIRED
#10	200g
#4	500g
3/4"	1500g
1"	2000g
2"	4000g
3"	5000g

BOREHOLE NUMBER	LG-5	LG-5	LG-5	LG-5	LG-5	LG-5
SAMPLE NUMBER	33	34	35	36	37	38
DEPTH (ft)	145	150	155	160	165	170
TARE NUMBER	Y	M-2	DA	M-5	11	3A
TARE WT (g)	107.77	103.01	101.44	105.07	79.46	195.07
WET WT + TARE (g)	1221.30	1277.30	554.80	798.8	329.79	1071.60
DRY WT + TARE (g)	1096.80	858.40	449.98	780.47	322.03	626.38
MOISTURE (%)	12.6%	55.5%	30.1%	2.7%	3.2%	103.2%

	CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER	
TARE (g)	107.80			223.13			101.47			105.16			78.96			195.51		
3"	107.80	100.0%	3"	223.13	100.0%	3"	101.47	100.0%	3"	105.16	100.0%	3"	78.96	100.0%	3"	195.51	100.0%	
2"	107.80	100.0%	2"	223.13	100.0%	2"	101.47	100.0%	2"	105.16	100.0%	2"	78.96	100.0%	2"	195.51	100.0%	
1"	107.80	100.0%	1"	223.13	100.0%	1"	101.47	100.0%	1"	105.16	100.0%	1"	78.96	100.0%	1"	195.51	100.0%	
3/4"	107.80	100.0%	3/4"	223.13	100.0%	3/4"	101.47	100.0%	3/4"	105.16	100.0%	3/4"	93.32	94.1%	3/4"	195.51	100.0%	
3/8"	123.57	98.4%	3/8"	223.13	100.0%	3/8"	104.72	99.1%	3/8"	171.47	90.2%	3/8"	124.74	81.1%	3/8"	207.02	97.3%	
#4	283.39	82.2%	#4	231.06	99.0%	#4	120.92	94.4%	#4	452.50	48.6%	#4	249.11	29.9%	#4	215.70	95.3%	
#10	497.50	60.6%	#10	259.14	95.2%	#10	143.54	87.9%	#10	690.91	13.3%	#10	312.76	3.6%	#10	220.58	94.2%	
#20	728.94	37.2%	#20	300.86	89.7%	#20	164.61	81.9%	#20	753.53	4.0%	#20	319.34	0.9%	#20	226.60	92.8%	
#40	867.00	23.2%	#40	365.39	81.2%	#40	211.72	68.4%	#40	759.04	3.2%	#40	320.21	0.5%	#40	235.21	90.8%	
#60	920.40	17.8%	#60	450.40	69.9%	#60	293.66	44.9%	#60	765.22	2.3%	#60	320.57	0.4%	#60	247.36	88.0%	
#100	962.60	13.6%	#100	528.45	59.6%	#100	347.56	29.4%	#100	770.26	1.5%	#100	321.15	0.2%	#100	267.26	83.4%	
#200	987.30	11.1%	#200	590.39	51.4%	#200	371.08	22.6%	#200	772.59	1.2%	#200	321.48	0.0%	#200	291.01	77.9%	
MEETS ASTM SAMPLE SIZE REQUIREMENT?	YES			YES			NO			NO			NO			NO		
D10	0.054	D10	N/A	D10	N/A		D10	1.60		D10	2.80		D10	N/A				
D30	0.61	D30	N/A	D30	N/A		D30	3.30		D30	3.90		D30	N/A				
D60	1.90	D60	N/A	D60	N/A		D60	5.60		D60	6.00		D60	N/A				
Cu	35.19	Cu	N/A	Cu	N/A		Cu	3.50		Cu	2.14		Cu	N/A				
Cz	3.63	Cz	N/A	Cz	N/A		Cz	1.22		Cz	0.91		Cz	N/A				

GOODEAR ASSOCIATES Inc., REDMOND, WA

ASTM D-1140/C-136
SIEVE ANALYSIS

PROJECT	SNOHOMISH CO/LAKE GOODWIN/WA
PROJECT NUMBER	913-1178.200
ENGINEER	VELIMESIS
DATE	8/22/91
TECHNICIAN	MF
REVIEWER	DRC

SIZE OF LARGEST PARTICLE	MINIMUM MASS OF SAMPLE REQUIRED
#10	200g
#4	500g
3/4"	1500g
1"	2000g
2"	4000g
3"	5000g

BOREHOLE NUMBER	LG-5	LG-5	LG-5	LG-5
SAMPLE NUMBER	39	40	41	42
DEPTH (ft)	175	180	185	190
TARE NUMBER	2	SF	XX	13
TARE WT (g)	195.02	149.5	215.65	253.62
WET WT + TARE (g)	812.2	779.29	1044.6	892.50
DRY WT + TARE (g)	530.94	495.75	628.08	549.10
MOISTURE (%)	83.7%	81.9%	101.0%	116.2%

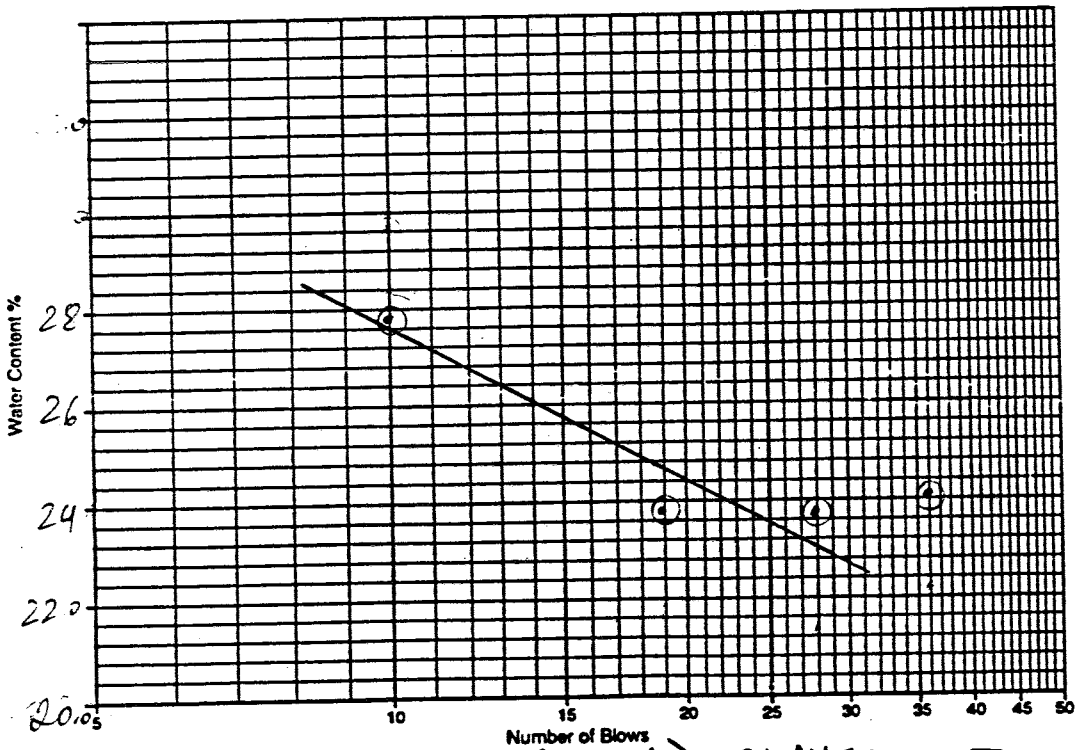
	CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER
TARE (g)	195.17			150.22			215.87			253.93	
3"	195.17	100.0%	3"	150.22	100.0%	3"	215.87	100.0%	3"	253.93	100.0%
2"	195.17	100.0%	2"	150.22	100.0%	2"	215.87	100.0%	2"	253.93	100.0%
1"	195.17	100.0%	1"	150.22	100.0%	1"	215.87	100.0%	1"	253.93	100.0%
3/4"	195.17	100.0%	3/4"	150.22	100.0%	3/4"	215.87	100.0%	3/4"	253.93	100.0%
3/8"	197.32	99.4%	3/8"	158.40	97.6%	3/8"	215.87	100.0%	3/8"	253.93	100.0%
#4	205.92	96.8%	#4	167.16	95.1%	#4	225.89	97.6%	#4	255.47	99.5%
#10	216.52	93.6%	#10	177.62	92.1%	#10	239.85	94.2%	#10	257.40	98.8%
#20	229.04	89.9%	#20	181.68	90.9%	#20	247.65	92.3%	#20	262.34	97.2%
#40	243.91	85.5%	#40	189.22	88.7%	#40	253.20	90.9%	#40	268.14	95.2%
#60	257.09	81.6%	#60	203.97	84.5%	#60	264.34	88.2%	#60	277.75	91.9%
#100	270.38	77.6%	#100	225.84	78.2%	#100	284.06	83.5%	#100	292.14	87.1%
#200	285.36	73.2%	#200	251.90	70.6%	#200	310.06	77.2%	#200	311.87	80.4%

MEETS ASTM SAMPLE SIZE REQUIREMENT?	NO	NO	NO	NO
D10	N/A	D10 N/A	D10 N/A	D10 N/A
D30	N/A	D30 N/A	D30 N/A	D30 N/A
D60	N/A	D60 N/A	D60 N/A	D60 N/A
Cu	N/A	Cu N/A	Cu N/A	Cu N/A
Cz	N/A	Cz N/A	Cz N/A	Cz N/A

Type of Test	LL	LL	LL	LL	Nat. MC
Container #	5	18	28	35	15
Number of blows	36	28	19	10	25
Weight of sample wet + tare	40.97	41.23	43.07	46.37	34.30
Weight of sample dry + tare	37.87	38.13	39.62	41.75	32.78
Weight of water					
Tare	25.03	25.07	25.10	25.11	25.20
Weight of dry soil					
Water content %	24.1	23.7	23.8	27.8	20.1

Type of Test	PL	PL
Container #	1/10	11/2
Weight of sample wet + tare	38.11	38.57
Weight of sample dry + tare	37.71	38.08
Weight of water		
Tare	34.51	34.21
Weight of dry soil		
Water content %	12.5	12.7

Borehole #	LG-5
Sample #	34
Depth	150'
Liquid Limit	24
Plastic Limit	13
Plasticity Index	11
Moisture Content	55.5
Liquidity Index	3.9



Sample Description Olive grey (5Y 3/2), CLAYEY SILT and m-f SAND, trace f. gravel, (CL).

ATTERBERG LIMITS, ASTM D4318

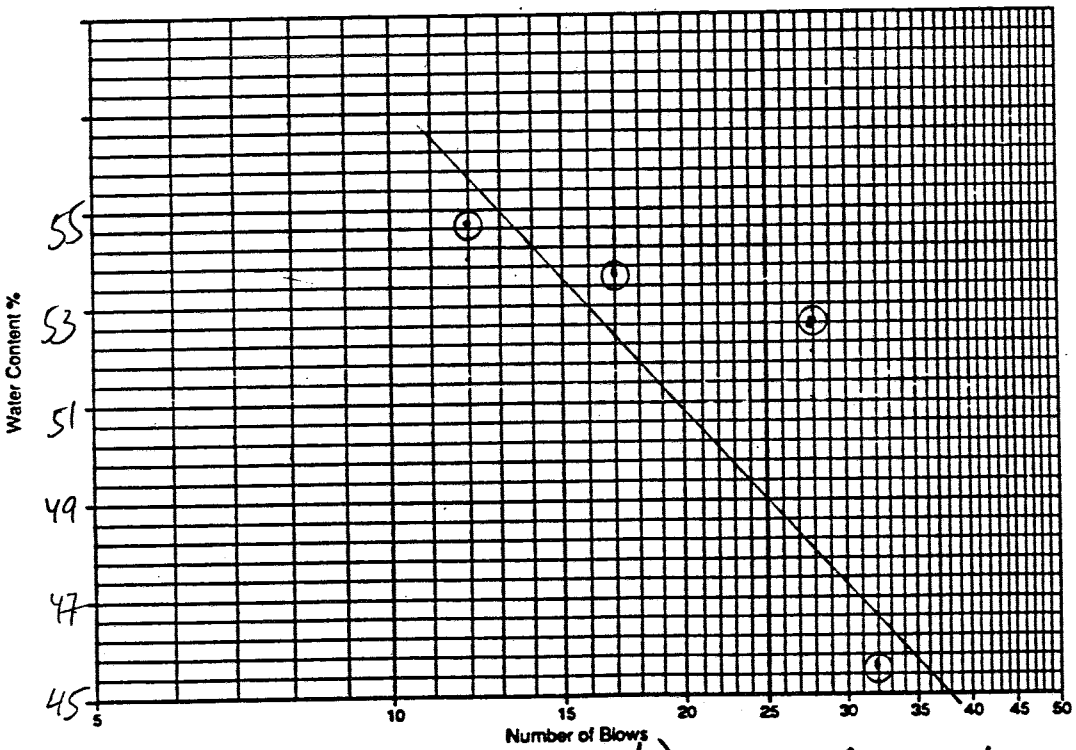
Project Snohomish Co / Lk Goodwin / LWA
Project No. 91-1178.200 Date 2/2/91 Tested By MF Checked By

Golder Associates

Type of Test	LL	LL	LL	LL	Nat. MC
Container #	26	27	29	33	
Number of blows	28	17	12	32	
Weight of sample wet + tare	37.83	38.45	39.70	43.06	
Weight of sample dry + tare	33.48	33.78	34.39	37.40	
Weight of water					
Tare	25.21	25.09	24.68	24.98	
Weight of dry soil					
Water content %	52.6	53.7	54.7	45.6	

Type of Test	PL	PL
Container #	17/36	12/34
Weight of sample wet + tare	41.33	41.54
Weight of sample dry + tare	40.40	40.61
Weight of water		
Tare	34.64	34.84
Weight of dry soil		
Water content %	16.1	16.1

Borehole #	LG-5
Sample #	38
Depth	170'
Liquid Limit	49
Plastic Limit	16
Plasticity Index	33
Moisture Content	103.2
Liquidity Index	2.6



Sample Description Olive grey (5Y 3/2), SILTY CLAY, some m-f sand, trace f gravel, (CL).

ATTERBERG LIMITS, ASTM D4318

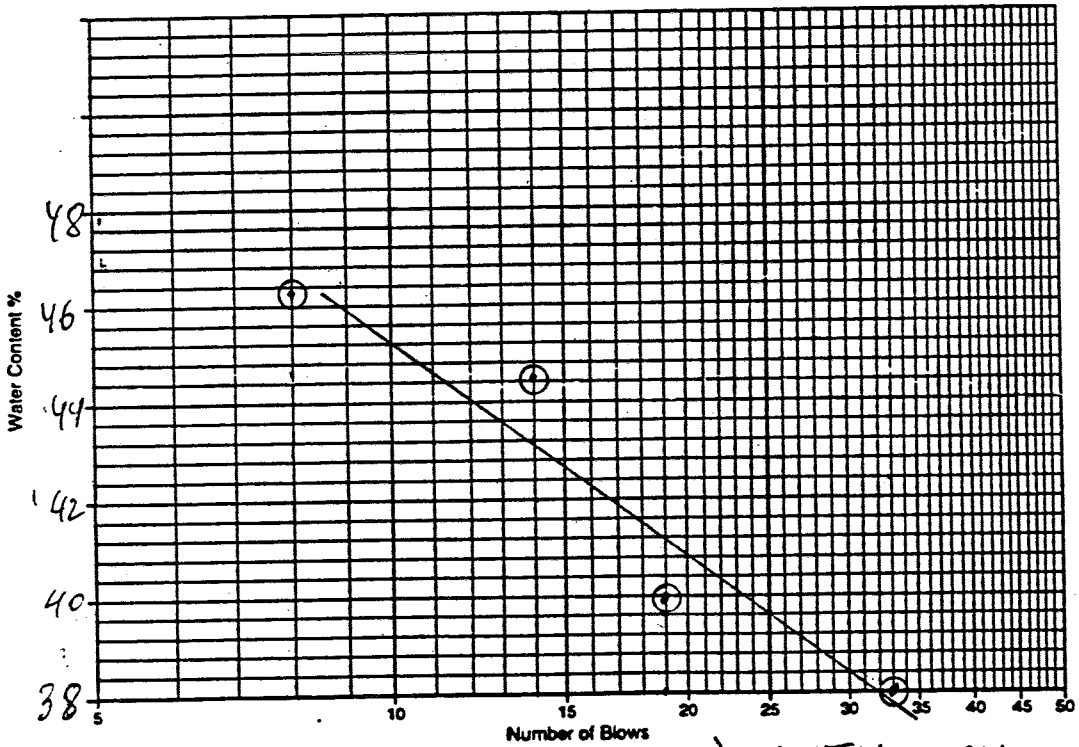
Project Snohomish Co / Lake Goodwin / WA
Project No. 913-1178.200 Date 8/29/91 Tested By MF Checked By DRD

Golder Associates

Type of Test	LL	LL	LL	LL	Nat. MC
Container #	2	10	11	12	
Number of blows	8	14	19	33	
Weight of sample wet + tare	42.27	43.42	40.52	44.63	
Weight of sample dry + tare	36.71	37.79	36.11	39.25	
Weight of water					
Tare	24.69	25.14	25.11	25.09	
Weight of dry soil	12.02	12.65	11	14.16	
Water content %	46.3	44.5	40	38	

Type of Test	PL	PL
Container #	5/24	1/31
Weight of sample wet + tare	46.52	41.03
Weight of sample dry + tare	39.76	40.21
Weight of water		
Tare	34.37	34.41
Weight of dry soil	5.39	5.8
Water content %	14.1	14.1

Borehole #	LG-5
Sample #	40
Depth	180
Liquid Limit	40
Plastic Limit	14
Plasticity Index	26
Moisture Content	81.9
Liquidity Index	2.6



Sample Description Medium gray (n 5), SILTY CLAY, some c-f sand, trace f gravel, (CL).

ATTERBERG LIMITS, ASTM D4318

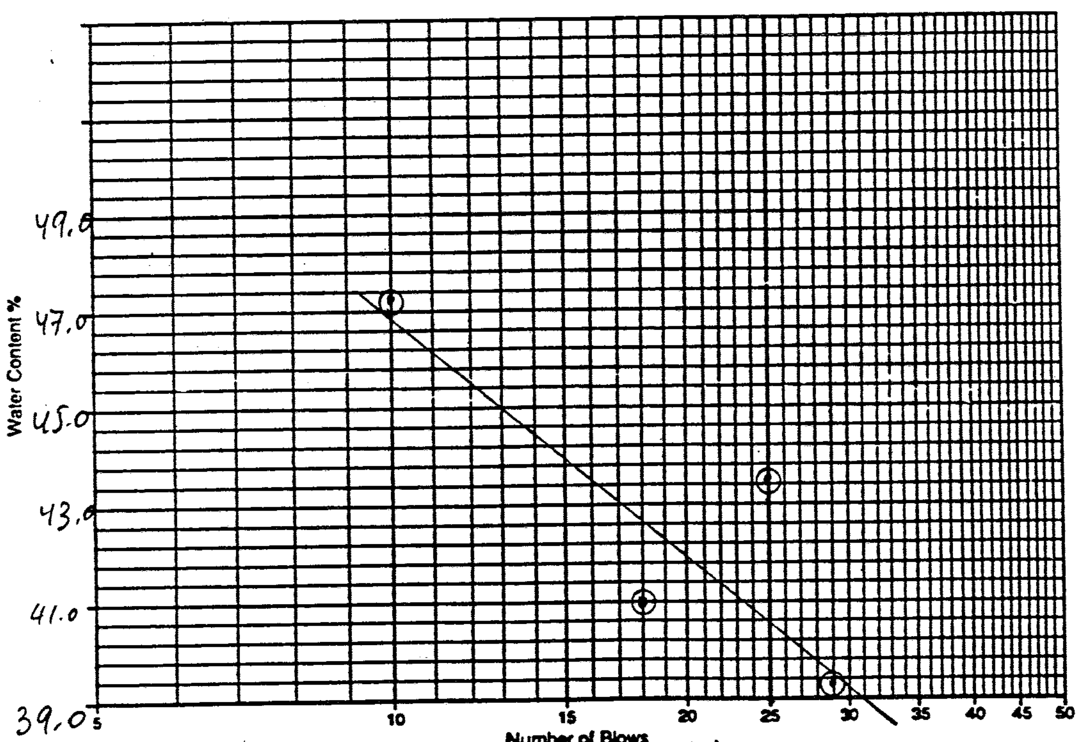
Project Snohomish Co/LG Goodwin/LGA
Project No. 913-1178 Date 8/28/91 Tested By ME Checked By DCO

Golder Associates

Type of Test	LL	LL	LL	LL	Nat. MC
Container #	10	27	29	33	
Number of blows	29	25	10	18	
Weight of sample wet + tare	39.59	40.21	38.35	39.83	
Weight of sample dry + tare	35.51	35.64	33.96	35.53	
Weight of water					
Tare	25.12	25.13	24.67	25.05	
Weight of dry soil					
Water content %	39.3	43.5	47.3	41.0	

Type of Test	PL	PL
Container #	1/36	17/26
Weight of sample wet + tare	39.89	41.42
Weight of sample dry + tare	39.18	40.64
Weight of water		
Tare	34.46	34.74
Weight of dry soil		
Water content %	15.0	13.2

Borehole #	LG-5
Sample #	41
Depth	185'
Liquid Limit	41
Plastic Limit	14
Plasticity Index	27
Moisture Content	101.0
Liquidity Index	3.2



Sample Description Olive grey (5Y 4/1), SILTY CLAY, some c-f sand, trace f gravel, (CL).

ATTERBERG LIMITS, ASTM D4318

Project Snohomish Co./LK Goodwin/WA
Project No. 503-1178 [illegible] Date 5/2/01 Tested By ML Checked By DPC

Golder Associates

LDER ASSOCIATES INC., REDMOND, WA

TM D-1140/C-136
IVE ANALYSIS

OJECT	Snohomish Co/Lake Goodwin/WA
OJECT NUMBER	913-1178-260
GINEER	Vaimesis
TE	8/20/91
CHNICIAN	M/E
VIEWER	RO

SIZE OF LARGEST PARTICLE	MINIMUM MASS OF SAMPLE REQUIRED
#10	200g
#4	500g
3/4"	1500g
1"	2000g
2"	4000g
3"	5000g

REHOLE NUMBER	LG-5	LG-5	LG-5	LG-5	LG-5	LG-5	LG-5
MPLE NUMBER	1	2	4	5	6	7	
PTH (ft)	0-.5'	5-5.9	15'-16'	20.0-21.5	25.0-25.9	30.0-30.9	
E NUMBER	X	S-3	S-8	S-2	BY	1A	
E WT (g)	106.83	133.69	135.35	133.21	161.55	152.23	
WT + TARE (g)	834.0	452.85	541.52	768.57	527.50	539.31	
WT + TARE (g)	806.6	434.89	517.71	734.61	511.54	510.48	
STURE (%)	ERR	ERR	ERR	ERR	ERR	ERR	

	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER
TARE (g)	106.73		133.35		152.24		151.32		161.56		152.26	
3"		ERR		ERR		ERR		ERR		ERR		ERR
2"		ERR		ERR		ERR		ERR		ERR		ERR
1"		ERR		ERR		ERR		ERR		ERR		ERR
3/4"	175.36	ERR		ERR		ERR		ERR		ERR		ERR
3/8"	239.45	ERR	163.68	ERR	165.27	ERR	158.01	ERR		ERR		ERR
#4	291.46	ERR	204.89	ERR	173.94	ERR	171.53	ERR	162.96	ERR		ERR
#10	373.78	ERR	241.79	ERR	197.32	ERR	203.85	ERR	169.10	ERR	154.46	ERR
#20	480.24	ERR	282.07	ERR	271.32	ERR	275.55	ERR	197.68	ERR	185.42	ERR
#40	601.35	ERR	333.18	ERR	428.16	ERR	488.52	ERR	376.97	ERR	366.57	ERR
#60	688.24	ERR	368.45	ERR	491.43	ERR	631.97	ERR	478.72	ERR	466.77	ERR
#100	743.24	ERR	389.40	ERR	509.42	ERR	680.76	ERR	497.28	ERR	485.59	ERR
#200	763.21	ERR	401.72	ERR	517.83	ERR	701.63	ERR	503.53	ERR	497.38	ERR
S ASTM SAMPLE REQUIREMENT?												
D10		ERR		ERR		ERR		ERR		ERR		ERR
D30		ERR		ERR		ERR		ERR		ERR		ERR
D60		ERR		ERR		ERR		ERR		ERR		ERR
Cu		ERR		ERR		ERR		ERR		ERR		ERR
Cz		ERR		ERR		ERR		ERR		ERR		ERR

BH S-2

LDER ASSOCIATES INC., REDMOND, WA

TM D-1140/C-136
EVE ANALYSIS

OJECT Snohomish Co/Lake Goodwin/WA
OJECT NUMBER 913-1178.200
GINEER Vaimeris
TE 8/20/91
CHNICIAN MF
VIEWER JRO

SIZE OF LARGEST PARTICLE	MINIMUM MASS OF SAMPLE REQUIRED
#10	200g
#4	500g
3/4"	1500g
1"	2000g
2"	4000g
3"	5000g

REHOLE NUMBER	LG-5	LG-5	LG-5	LG-5	LG-5	LG-5	LG-5
MPLE NUMBER	Q	9	10	11	12	13	
PTH (ft)	35.0-36.0	40.0-41.0	45.0-46.0	50.0-51.0	55.0-55.9	60.0-60.8	
NE NUMBER	3AB	B	2A	E	A2	B	
NE WT (g)	152.90	150.94	152.24	160.98	159.83	158.32	
T WT + TARE (g)	484.85	546.73	607.94	569.35	537.78	475.30	
T WT + TARE (g)	457.99	500.63	586.21	544.52	513.66	454.87	
STURE (%)	ERR	ERR	ERR	ERR	ERR	ERR	

	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER
TARE (g)	152.83		131.14		135.48		160.88		159.82		156.72	
3"		ERR		ERR		ERR		ERR		ERR		ERR
2"		ERR		ERR		ERR		ERR		ERR		ERR
1"		ERR		ERR		ERR		ERR		ERR		ERR
3/4"		ERR		ERR		ERR		ERR		ERR		ERR
3/8"		ERR		ERR		ERR		ERR		ERR		ERR
#4		ERR		ERR	136.73	ERR		ERR		ERR		ERR
#10	157.43	ERR	133.20	ERR	142.86	ERR	162.76	ERR	160.08	ERR		ERR
#20	185.66	ERR	134.54	ERR	145.47	ERR	171.73	ERR	165.86	ERR		ERR
#40	334.03	ERR	146.91	ERR	427.51	ERR	284.28	ERR	194.43	ERR	198.02	ERR
#60	407.65	ERR	155.51	ERR	504.54	ERR	425.70	ERR	383.20	ERR	338.94	ERR
#100	436.26	ERR	277.04	ERR	532.62	ERR	508.47	ERR	475.86	ERR	423.85	ERR
#200	466.65	ERR	439.07	ERR	554.62	ERR	526.45	ERR	496.77	ERR	436.12	ERR

S ASTM SAMPLE REQUIREMENT?												
D10		D10		D10		D10		D10		D10		
D30		D30		D30		D30		D30		D30		
D60		D60		D60		D60		D60		D60		
Cu	ERR	Cu	ERR	Cu	ERR	Cu	ERR	Cu	ERR	Cu	ERR	
Cz	ERR	Cz	ERR	Cz	ERR	Cz	ERR	Cz	ERR	Cz	ERR	

B.1 S-3

LDER ASSOCIATES INC., REDMOND, WA

TM D-1140/C-136
IVE ANALYSIS

JECT	Snohomish/Lake Goodwin/WA
JECT NUMBER	913-1178.200
INEER	Vaimenis
E	8/21/91
HNICIAN	ME
IEWER	DRC

SIZE OF LARGEST PARTICLE	MINIMUM MASS OF SAMPLE REQUIRED
#10	200g
#4	500g
3/4"	1500g
1"	2000g
2"	4000g
3"	5000g

EHOLE NUMBER	LG-5	LG-5	LG-5	LG-5	LG-5	LG-5	LG-5
PLE NUMBER	20	21	22	24	25	26	110
TH (ft)	80.0-80.3	85.0-85.8	90.0-90.7	100	105	110	
E NUMBER	S1	M	100	RR	CX	S-9	
E WT (g)	135.31	69.62	77.95	167.50	222.69	135.86	
WT + TARE (g)	309.56	397.94	403.92	1138.9	1865.3	707.95	
WT + TARE (g)	299.91	357.09	344.93	953.1	1764.9	594.98	
STURE (%)	ERR	ERR	ERR	ERR	ERR	ERR	

	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER
TARE (g)	167.69		69.61		77.88		135.34		103.03		136.09	
3"		ERR		ERR		ERR		ERR		ERR		ERR
2"		ERR		ERR		ERR		ERR		ERR		ERR
1"		ERR		ERR		ERR		ERR		ERR		ERR
3/4"	203.87	ERR		ERR		ERR		ERR		ERR		ERR
3/8"	226.14	ERR	83.77	ERR	82.57	ERR	137.40	ERR	107.78	ERR		ERR
#4	248.75	ERR	106.44	ERR	82.57	ERR	141.46	ERR	112.87	ERR	137.76	ERR
#10	272.80	ERR	152.66	ERR	85.71	ERR	146.07	ERR	116.44	ERR	145.39	ERR
#20	296.40	ERR	195.44	ERR	90.32	ERR	169.39	ERR	125.69	ERR	163.33	ERR
#40	304.04	ERR	229.76	ERR	111.56	ERR	508.96	ERR	846.0	ERR	314.75	ERR
#60	315.27	ERR	292.91	ERR	239.48	ERR	800.01	ERR	1448.7	ERR	473.14	ERR
#100	322.11	ERR	325.37	ERR	312.59	ERR	891.0	ERR	1600.2	ERR	532.91	ERR
#200	325.55	ERR	335.87	ERR	328.52	ERR	906.4	ERR	1612.6	ERR	549.84	ERR

S ASTM SAMPLE REQUIREMENT?	NO											
D10		D10		D10		D10		D10		D10		
D30		D30		D30		D30		D30		D30		
D60		D60		D60		D60		D60		D60		
Cu	ERR	Cu	ERR	Cu	ERR	Cu	ERR	Cu	ERR	Cu	ERR	
Cz	ERR	Cz	ERR	Cz	ERR	Cz	ERR	Cz	ERR	Cz	ERR	

D.1 5-4

HOLDER ASSOCIATES INC., REDMOND, WA

ASTM D-1140/C-136
SIEVE ANALYSIS

PROJECT Snohomish / Lake Goodwin / WA
PROJECT NUMBER 013-1178.200
ENGINEER Vaimens
DATE 8/21/91
TECHNICIAN ME
REVIEWER DRC

SIZE OF LARGEST PARTICLE	MINIMUM MASS OF SAMPLE REQUIRED
#10	200g
#4	500g
3/4"	1500g
1"	2000g
2"	4000g
3"	5000g

BOREHOLE NUMBER	LG-5		LG-5		LG-5		LG-5		LG-5		LG-5								
SAMPLE NUMBER	27		28		29		30		31		32								
DEPTH (ft)	115		120		125		130		135		140								
TARE NUMBER	R		DH		SKY		d		W		Z								
TARE WT (g)	107.24		223.73		207.98		107.17		108.56		114.84								
WET WT + TARE (g)	353.29		1279.8		1483.6		909.6		942.4		1446.1								
DRY WT + TARE (g)	304.02		1193.9		1396.7		781.86		892.1		1352.7								
MOISTURE (%)	ERR		ERR		ERR		ERR		ERR		ERR								
	CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER		CUMULATIVE WEIGHT (g)	PERCENT FINER		
TARE (g)	107.33			224.87			207.96			107.22			108.45			114.79			
3"		ERR	3"		ERR	3"		ERR	3"		ERR	3"		ERR	3"		ERR	3"		ERR
2"		ERR	2"		ERR	2"		ERR	2"		ERR	2"		ERR	2"		ERR	2"		ERR
1"		ERR	1"		ERR	1"		ERR	1"		ERR	1"		ERR	1"		ERR	1"		ERR
3/4"		ERR	3/4"		ERR	3/4"		ERR	3/4"		ERR	3/4"		ERR	3/4"		ERR	3/4"		ERR
3/8"		ERR	3/8"		ERR	3/8"	214.64	ERR	3/8"	112.87	ERR	3/8"	109.78	ERR	3/8"		ERR	3/8"		ERR
#4	108.80	ERR	#4	226.14	ERR	#4	246.98	ERR	#4	131.27	ERR	#4	115.96	ERR	#4	117.46	ERR	#4		ERR
#10	116.65	ERR	#10	238.83	ERR	#10	351.61	ERR	#10	152.32	ERR	#10	125.94	ERR	#10	146.58	ERR	#10		ERR
#20	142.60	ERR	#20	265.35	ERR	#20	702.85	ERR	#20	191.65	ERR	#20	148.70	ERR	#20	299.52	ERR	#20		ERR
#40	190.76	ERR	#40	345.59	ERR	#40	1249.70	ERR	#40	375.95	ERR	#40	506.68	ERR	#40	869.9	ERR	#40		ERR
#60	206.32	ERR	#60	557.73	ERR	#60	1325.80	ERR	#60	565.45	ERR	#60	827.6	ERR	#60	1209.6	ERR	#60		ERR
#100	225.49	ERR	#100	961.2	ERR	#100	1338.96	ERR	#100	653.65	ERR	#100	866.5	ERR	#100	1287.9	ERR	#100		ERR
#200	230.36	ERR	#200	1061.8	ERR	#200	1353.40	ERR	#200	687.67	ERR	#200	870.9	ERR	#200	1301.5	ERR	#200		ERR
MEETS ASTM SAMPLE SIZE REQUIREMENT?																				
D10			D10			D10			D10			D10			D10			D10		
D30			D30			D30			D30			D30			D30			D30		
D60			D60			D60			D60			D60			D60			D60		
Cu		ERR	Cu		ERR	Cu		ERR	Cu		ERR	Cu		ERR	Cu		ERR	Cu		ERR
Cz		ERR	Cz		ERR	Cz		ERR	Cz		ERR	Cz		ERR	Cz		ERR	Cz		ERR

15.1.1.2-5

OLDER ASSOCIATES INC., REDMOND, WA

STM D-1140/C-136
IEVE ANALYSIS

ROJECT	Snohomish / Lake Goodwin / WA
ROJECT NUMBER	913-1178.200
NGINEER	Vanmeris
ATE	8/21/91
ECHNICIAN	MC
EVIEWER	

SIZE OF LARGEST PARTICLE	MINIMUM MASS OF SAMPLE REQUIRED
#10	200g
#4	500g
3/4"	1500g
1"	2000g
2"	4000g
3"	5000g

OREHOLE NUMBER	LG5		LG5		LG5		LG-5		LG-5		LG-5	
AMPLE NUMBER	33		34		35		36		37		38	
EPTH (ft)	145		150		155		160		165		170	
ARE NUMBER	Y		M-2		DA		M5		11		3A	
ARE WT (g)	107.87		103.01		101.44		105.07		79.46		195.07	
ET WT + TARE (g)	1221.3		1277.5		554.80		798.80		329.79		1071.6	
RY WT + TARE (g)	1096.8		858.4		449.98		780.47		322.03		626.38	
OISTURE (%)	ERR		ERR		ERR		ERR		ERR		ERR	

	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER
TARE (g)	107.80		223.13		101.47		105.16		78.96		195.51	
3"		ERR		ERR		ERR		ERR		ERR		ERR
2"		ERR		ERR		ERR		ERR		ERR		ERR
1"		ERR		ERR		ERR		ERR		ERR		ERR
3/4"		ERR		ERR		ERR		ERR	93.32	ERR		ERR
3/8"	123.57	ERR		ERR	104.72	ERR	171.47	ERR	124.74	ERR	207.02	ERR
#4	283.39	ERR	231.06	ERR	120.92	ERR	452.50	ERR	249.11	ERR	215.70	ERR
#10	497.50	ERR	259.14	ERR	143.54	ERR	690.91	ERR	312.76	ERR	220.58	ERR
#20	728.94	ERR	300.86	ERR	164.61	ERR	753.53	ERR	319.34	ERR	226.60	ERR
#40	867.0	ERR	365.39	ERR	211.72	ERR	759.04	ERR	320.21	ERR	235.21	ERR
#60	920.4	ERR	450.40	ERR	293.66	ERR	765.22	ERR	320.57	ERR	247.36	ERR
#100	962.6	ERR	528.45	ERR	347.56	ERR	770.26	ERR	321.15	ERR	267.26	ERR
#200	987.3	ERR	540.39	ERR	371.08	ERR	772.59	ERR	321.48	ERR	291.01	ERR

ETS ASTM SAMPLE ZE REQUIREMENT?	—		—		—		—		—		—	
D10		D10		D10		D10		D10		D10		
D30		D30		D30		D30		D30		D30		
D60		D60		D60		D60		D60		D60		
Cu	ERR	Cu	ERR	Cu	ERR	Cu	ERR	Cu	ERR	Cu	ERR	
Cz	ERR	Cz	ERR	Cz	ERR	Cz	ERR	Cz	ERR	Cz	ERR	

GOLDER ASSOCIATES INC., REDMOND, WA

B-1 2-6

ASTM D-1140/C-136
SIEVE ANALYSIS

PROJECT: Snohomish Co/Lake Goodwin/WA
PROJECT NUMBER: 913-1178.200
ENGINEER: Valnesis
DATE: 8/22/91
TECHNICIAN: ML
REVIEWER: DO

SIZE OF LARGEST PARTICLE	MINIMUM MASS OF SAMPLE REQUIRED
#10	200g
#4	500g
3/4"	1500g
1"	2000g
2"	4000g
3"	5000g

BOREHOLE NUMBER	LG-5		LG-5		LG-5		LG-5												
SAMPLE NUMBER	39		40		41		42												
DEPTH (ft)	175		180		185		190												
TARE NUMBER	2		SE		XX		13												
TARE WT (g)	195.02		149.50		215.65		253.62												
WET WT + TARE (g)	812.2		779.29		1041.6		892.5												
DRY WT + TARE (g)	530.94		495.75		628.08		549.16												
MOISTURE (%)	ERR		ERR		ERR		ERR		ERR		ERR								

	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER	CUMULATIVE WEIGHT (g)	PERCENT FINER
TARE (g)	195.17		150.22		215.87		253.93					
3"		ERR		ERR		ERR		ERR		ERR		ERR
2"		ERR		ERR		ERR		ERR		ERR		ERR
1"		ERR		ERR		ERR		ERR		ERR		ERR
3/4"		ERR		ERR		ERR		ERR		ERR		ERR
3/8"	197.32	ERR	158.40	ERR		ERR		ERR		ERR		ERR
#4	205.92	ERR	167.16	ERR	225.89	ERR	255.47	ERR		ERR		ERR
#10	216.52	ERR	177.62	ERR	239.85	ERR	257.40	ERR		ERR		ERR
#20	229.04	ERR	181.68	ERR	247.65	ERR	262.34	ERR		ERR		ERR
#40	243.91	ERR	189.22	ERR	253.20	ERR	268.14	ERR		ERR		ERR
#60	257.09	ERR	203.97	ERR	264.34	ERR	277.75	ERR		ERR		ERR
#100	270.38	ERR	225.84	ERR	284.06	ERR	292.14	ERR		ERR		ERR
#200	285.36	ERR	251.9	ERR	310.06	ERR	311.87	ERR		ERR		ERR

METS ASTM SAMPLE SIZE REQUIREMENT?	No		NO									
D10		D10		D10		D10		D10		D10		
D30		D30		D30		D30		D30		D30		
D60		D60		D60		D60		D60		D60		
Cu	ERR	Cu	ERR	Cu	ERR	Cu	ERR	Cu	ERR	Cu	ERR	
Cz	ERR	Cz	ERR	Cz	ERR	Cz	ERR	Cz	ERR	Cz	ERR	

APPENDIX D

HISTORY OF HOLE FORMS AND FIELD NOTES

Golder Associates

HISTORY OF HOLE

Job No. 913-1187 Sheet 1 of 1

Geologist FAIRHURST Date 23 July 91 Boring No. 165B
Driller G. GAUF Surface Elevation ~230 Weather Sunny Temp. 80 °F
Contractor Mathes Drill Fluid NA Depth 0 to 0
Location Goodwin Landfill Type of Barrel NA Casing Size NA Core Size NA

BEGINNING OF SHIFT	END OF SHIFT
Time 0730 Depth of Hole NA	Time 1110 Hrs. Productive ___ Hrs. Delayed ___
Depth to WL NA Depth to Casing NA	Depth of Hole NA Depth of Casing NA Depth to WL NA

0730 Arrived on site, with John S. Velimesis — Drillers {Aaron Lagoie, Gary Gauf}

0920 Drillers arrived on site

1050 ~~?~~ Stop for day to relocate boring ~~two~~ site.

~~1100~~ ~~Left site~~
1110 Left site - mobe to Golder → Redmond.

END OF DAY IN FIELD

[signature]

Checked by:

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Golder Associates

HISTORY OF HOLE

Job No. 913-1178.200 Sheet 1 of 1

Geologist M. FAIRHURST Date 24 July 91 Boring No. L65A
Driller Gary GAUF Surface Elevation ~ 230 ft. Weather Ptly Cloudy / Sunny Temp. 70 °F
Contractor Mathes Drill Fluid NA Depth 0 to
Location Goodwin Landfill Type of Barrel NA Casing Size NA Core Size NA

BEGINNING OF SHIFT	END OF SHIFT
Time 0705 Depth of Hole 0	Time 1430 Hrs. Productive ___ Hrs. Delayed ___
Depth to WL NA Depth to Casing 0	Depth of Hole 0 (to 20 ft. - backfilled) Depth of Casing 0 Depth to WL NA

0705 arrived on site. Gary GAUF, Mathes's driller, already on site, ~~sand~~ since 600 A.M. indicated graders had been here & left.

0720 Gary left site for coffee — CLIENT KEN MILLER 388-3488
0740 J.S. Velmeris arrived on SITE — ENV. TECH DAVE SCHONHARD 666-3193
0750 Gary Gauf returned to site — DRILLER GARY GAUF 355-7367 hm
0800 Drillers Assistant, Aaron Lajoie, arrived on site
0815 Safety meeting with G. Gauf, A. Lajoie, J.S. Velmeris, M. Fairhurst
0840 End of safety meeting, signed Drillers check (safety) sheet
- General discussion of drill plan for day.
0900 Took 1st sample at 5' depth (Grab sample ~~@~~ SA#1).
0915 drillers ~~went~~ bored down another 5'. Garbage came up in cuttings, (~5' and below to 10'). J.S.V. instructed driller to go another 5' (to 15' depth) while he called Ken Miller to discuss situation of Garbage in hole. Ken Miller was out in field - unreachable
0930 Drillers, about to drive split spoon, realized missing attachement b/t rods & hammer. decide to bypass connectors & directly attach rods to hammer. drove sample (#2).
0940 checked borehole area w/ OVM & MSA - Clean air. ~~~~ all safe readings.
0945 J.S.V. halted work to try ~~~~ Ken Miller (Snohomish County) again. G. Gauf & J.S.V. discuss situation
0955 On Standby - shut down rig. Instructed by Dave Schonhard (Snohomish County) and Doug Morell to go on standby & wait for arriving Ken Miller.

1100 Ken Miller arrived on site. J.S.V. and M. Fairhurst discussed, planned relocation of borehole ~~~~. Walked perimeter ~~of~~ of landfill (or property line boundary) to decide on relocation. ~~~~ Concluded that area just S.E. of current borehole site, <50', is prime site. Also, need to blade out new ~~for~~ proposed site of blackberry bushes and growth. Drillers called their sup to come this afternoon if possible, to clear area and fill in for a new drill pad
1200 Ken Miller and J.S.V. left site. M. Fairhurst monitored backfill of 20' borehole. Used 6 bags of 'hole plug'.
1230 Completed backfilling of current hole. Left site for lunch
1315 Returned to site - observed blading of new proposed borehole site. Chose spot - field decision → No test pit necessary. began ~~~~ moving fill for new pad
1330 Called & transmitted information & decisions & overall moods of current situation to Doug Morell.
1430 Gary Gauf, driller, completed rig set up & left site. Checked by:

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Golder Associates

HISTORY OF HOLE

Job No. 913-1178.200 Sheet 1 of 2

Geologist M. FAIRHURST Date 25 July 91 Boring No. LGS
Driller G. GAUF Surface Elevation ~230 ft. Weather Drizzle Temp. 55-60 °F
Contractor MATHES Drill Fluid NA Depth 0 to 75.0 ft.
Location Snohom. Co. Goodwin Landfill Type of Barrel NA Casing Size 4¼" HSA Core Size NA

BEGINNING OF SHIFT	END OF SHIFT
Time 0730 Depth of Hole 0	Time 1730 Hrs. Productive ___ Hrs. Delayed ___
Depth to WL NA Depth to Casing 0	Depth of Hole 75.0' Depth of Casing 75.0' Depth to WL NA

0730 ON SITE - set up sampling station in field. Suited up for hazardous area (level
0750 Took grab sample from surface (0-5') soil, Checked site w/calibrated OVM & MSA - No Response
800 Took Environmental Sample blanks Golder Associates blanks (dripped distilled H_2O across sampler (splitspoon)) I.D.# 9131178LG51MF
805 Environmental GA sample blanks #2 (9131178LG52MF) - took second, backup, sample in same manner as 1st previous.
810 Drove 1st regular geotech soil sample at 5.0 feet.
820 Drove ~~Foote~~ Environmental sample in deconned split spoon at 10.0 feet (I.D.# 9131178 LG53MF and 9131178LG54MF).
830 Stopped due to rock in drill bit
840 resume drilling
845 Called Christina Jensen
855 Took Environmental Samples (drove at 820) from split spoon, logged them & put in correct jars and stored them in cooler.
915 Checked site and hole with OVM and MSA 361 - No Response
945 Checked site and hole with OVM and MSA 361 - No Response
1020 Checked site and hole with OVM and MSA 361 - No Response
1045 Dave Findley arrived on site
1050 Checked site and hole with OVM and MSA 361 - No response
1120 Ken Miller arrived on site
1140 Drillers left for lunch
1150 Ken Miller left site, Dave Findley and I left for lunch, (1st sealed sample containers w/ a signed seal) → locked in Truck.
1250 Back on site - drillers here & working to resume drilling - Checked seal on samples - no Tampering visible.
1255 resume logging samples
1415 at 70 feet - Notice samples are no longer damp but moist. Decide to continuous sample with deconned samplers - (note → this is 10 feet earlier than predicted continuous sampling.)
1500 Drove Environmental Sample - ~~to~~ very hard drilling. 3" for 50 blows; in a gravelly layer - sample just filled small VOA jar (I.D.# 91311178LG56MF)
Checked site with ~~MSA~~ 361 and OVM - No response (checked hole also).
Battery on MSA is low so Alarm will not stop - turned off machine - will recharge asap.
1515 Continuous sampling with deconned samples; decided to use this sample directly below previous sample (at 70.7 feet) 50 blows for 0.5 inch. Will use this for metals Sample. God
Called Christina Jensen at Golder ~~s~~ the soil at this point to get whatever best sample possible - stir
(15 min. Stand-by for driller w/ sampler phase.) a mix in deconned ~~&~~ bowl ~~for metal~~ soil for metals sample.
- Conferred with driller: he feels we are stuck on a rock. So we should drill beyond to 74 feet & try again - Agreed
1530 resumed drilling
1600 Called Ken Miller & discussed driller time and more about, Explained roughly the situation at hand with the attempt to take Environmental Sample combined with the hard drilling.
Also, check drillers Washington state drilling license - Valid until 10/10/91 when it expires

— CONTINUED —

Checked by:

Golder Associates

HISTORY OF HOLE

Job No. 913-1178 Sheet 2 of 2

Geologist M. FAIRHURST Date 25 July 91 Boring No. LG5
Driller GARY GAUF Surface Elevation ~230 ft. Weather drizzle Temp 55-60 °F
Contractor MATHES Drill Fluid NA Depth 0 to 75.0 ft.
Location GOODWIN LANDFILL / SNOHOMISH CO. Type of Barrel NA Casing Size 4½" HSA Core Size NA

BEGINNING OF SHIFT	END OF SHIFT
Time 0730 Depth of Hole 0	Time 730 Hrs. Productive ____ Hrs. Delayed ____
Depth to WL NA Depth to Casing 0	Depth of Hole 75.0' Depth of Casing 75.0' Depth to WL NA

1615 Called Dan Morrell, explained difficult drilling at environmental sample depth situation (therefore small sample recovery). Dan recommended the following:
- Take and cool store sample from 65.0ft to 66.0ft. even though not in a deconned sampler - to be used as a backup (sampler washed) for metals. This was sample #14.
- Take and transfer and cool store sample #15 (70.0ft-70.5 ft.) and use as a metals analysis (Also, not in a deconned spoon sample, but washed). SA #15 became* 913178LG55MF
- SA #16 from 70.5 to 70.7 ft was in a deconned sampler → got 3" of sample and immediately placed into a VOA's sample jar and labeled #913178LG56MF
- SA #17 and SA #18 are both deconned samplers & were both placed in the same jar to be tested for metals #913178LG57MF
- then drill to 75.0 ft attempt to take 3rd environmental sample if in water table. If not, try at 80 ft.
- Take water level measurement at 75.0 ft; wait 5 min. and take again

I Completed & carried out these suggestions as best as possible in situation.

1620 checked site with OVM and MSA 361 → No response
1650 drillers decide to shut down for the day
1700 Attempted to take a water level reading. Appears (by dropping small rock in hole) NO water in hole. Instruments buzzer/alarm went of several times (eg ~3x's) while decanning and went off continuously as it brought instrument to surface. Probe was dry when resurfaced.
1710 Began cleem up for day
1730 Left the Site.

Reached 75.0 ft. for day.
No water in hole

Checked by:

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No. 602

J. VELIMESIS

07-23-91 913-1178.200 SNO-CTY/LAKE GOODWIN/WA PG 1 of 38

07:35 J. VELIMESIS & M. FAIRHURST ON SITE @ LAKE GOODWIN LANDFILL; CLEAR, SUNNY, TEMP 67°F — GOING TO 90-95°F THIS AFTERNOON.

07:45 DAVE SCHONHARD (SNO-CTY) SHOWS UP ON SITE w/ GAS BUBBLER GAUGE FOR WELL MEASUREMENT. HE DEMONSTRATED USE OF GAUGE ON WELL LG-3. (ALSO UNLOCKED LANDFILL GATE).

READING #1 - 71.8 INCHES H_2O (5.98 FT)

#2 - 71.1 INCHES H_2O

(MAGGIE BRINGING GAI TRUCK ON-SITE)

08:05 MAGGIE CALIBRATING OVM + MSA 361

08:36 SMALL DOZER ARRIVES & BEGINS GRADING WORK NEAR LANDFILL ENTRANCE - NOT ASSOCIATED w/ THIS PROJECT

- KEN SCHONHARD LEAVES SITE

08:40 JSV TAKES BUBBLER GAUGE READING AT LG-2: 2 ATTEMPTS YIELD VALUE OF 00.00; ASSUME NO WATER IN WELL.

09:05 AT LG-4 w/ BUBBLER GAUGE

READING #1 = 66.8 INCHES H_2O —

#2 = 60.2 ? VOID

#3 = 67.0 " —

} 5.5 FT

JSV

J.L. DARLING CORP
TACOMA, WA 98421

J Voulmosis

09:15 MATHES DRILL CREW ARRIVES ON-SITE w/
BRUTE-22R RIG;
DRILLER: GARY GAUF
HELPER: ERIN LANOYE

09:20 DISCUSS DRILLING OBJECTIVES w/ DRILLER
1. AVOID GARBAGE: RIG & PAD NOT WELL PLACED; BLADING BLACKBERRY'S EXPOSED SURFACE GARBAGE
2. ENCR SAMPLES EVERY 5 FT; 3 ENVT. SAMPLES
3. 4-5 DAY SCHEDULE IS ABOUT RIGHT
4. AIR ROTARY SETTING AUGERS (TO WATER TABLE) OR CASING.

09:45 @ LG-1 w/ BUBBLER GAUGE
READINGS #1 = 65.6
#2 = 65.8 ✓

09:50 DRILL RIG ATTEMPTING TO SET UP & GET LEVEL; DRILL PAD FILL ENDS IN SWALE → BANK FALLING OUT FROM UNDER RIG SUPPORTS.
JSV + DRILLER CALL MATHES OFFICE & SNOHOMISH CTY (KEN MILLER) FOR INSTRUCTIONS. REQUEST OTHER DOZER OR CHANGE TO FILL SWALE. THIS WILL:
1- GIVE SOLID PAD FOUNDATION
2- ALLOW MOVING HOLE BACK FROM WHAT MAY NOW BE THE ACTIVE EDGE OF LANDFILL.

10:30 CALL BACK FM KEN MILLER & TOM FUCHS - MATHES DRILLING CAN HAVE CLEAN FILL, ROCK + DOZER ON SITE 6AM TOMORROW.

JSV

J. Voulmosis

10:40 KEN MILLER CONFIRMS w/ 6:00 AM DOZER + FILL AND REGRADE.

11:00 ALL PARTIES DEMOB FROM SITE.

07-24-91

07:45 JSV ON-SITE; MACKIE FAIRHURST ALREADY HERE (7:03 AM)
WEATHER PTLY CLOUDY, WARM 70±°; EXPECTED HIGH = 85°F

07:50 DRILLER BACK FROM COFFEE BREAK
DRILL PAD COMPLETE + SWALE FILLED WITH CLEAN FILL; DRILL RIG SET UP ~15 FT BACK FROM PREVIOUS STAKE, PAST BOTTOM OF SWALE, ~~DUG~~ HOPEFULLY BEYOND LANDFILL PERIMETER.

07:55 COMPUTE G.W. ELEVATIONS TAKEN YESTERDAY.

	G.S. ELEV.	TOTAL DEPTH	ELEV BOTTOM	ELEV BUBBLER TUBE	H2O COL (FT)	ELEV H2O
LG-1	239.6	97.0	142.6		5.48	148.1
LG-2	269.4	127.0	142.4		ϕ	142.4
LG-3	241.7	103.0	138.7		5.98	144.7
LG-4	207.4	75.5	131.9		5.58	137.5

08:00 DRILL HELPER ARRIVES ON SITE.

JSV

J.L. DARLING CORP TACOMA, WA 98421
No. 602

J. VELIMESIS

7-24-91 913-1178 SNO-CTY / LK. GOODMAN / WA 1G 4 of 38

08:15 SAFETY MTG. W/ DRILLER
- APPROACH RIG FROM DRILLER'S SIDE
- NOTE LOCATION OF AIR ROTARY PRESSURE RELEASE
- DETAIL LOCATION OF CUTTING DISCHARGE
- OVM & [illegible] LOCATIONS
- PPE = C3 for SAMPLING CREW ; EAR PROT.
- PRIMARY HAZARDS.
CH4, OVA, AIR PRESS, DISCHARGE LINE, OVERHEAD,
COMPLICATED BY CONFINED WORKING AREA ON
PAD PINNED IN WITH TOPOGRAPHY & RIG.

08:30 - MAGGIE SETS UP SAMPLING & DECON STATION
- DRILLERS CHECKING EQUIP
08:45 - DRILLERS START DIESEL RIG & BEGIN WORK
IN EARNEST - SET AUGER FLIGHTS ON AIR R RIG
09:00 - TAKE 1ST CORE SAMPLE @ ~ 5.0 FEET BELOW
TOP OF PAD FILL.
09:15 - 2ND 5FT AUGER FLIGHT BRINGS LANDFILL WASTE
TO SURFACE
09:20 - ATTEMPT TO CALL KEN MILLER - NOT IN
09:25 - 3RD 5FT AUGER FLIGHT - STILL IN WASTE.
09:30 - DRILLER CALLS OFFICE FOR PROTS (5 min)
09:40 - DRIVE 1ST 24 INCH SPLIT SPOON FOR COMPOSITE
15'-17' BGS. MAGGIE COLLS SAMPLE.

JAV

No. 602

J. VELIMESIS

7-24-91 913-1178 SNO-CTY / LK GOODMAN / WA 1G 5 of 38

10:00 - DRILLER GOES ON STAND-BY @ CAE DIRECTION
- CALL TO D. SCHONHARD @ CATHCART INDICATES
KEN MILLER ENROUTE TO LAKE GOODMAN SITE
10:50 - KEN MILLER ON SITE
KEN, JSV, MAGGIE TO FIELD RECON OF
PPTY BOUNDARY, ADJ. PROPERTY, HILLSIDE TO
EAST (B/T LANDFILL & ROAD).
- PLAN IS TO REQUEST DOZER OPERATOR
(DOZER STILL ONSITE) TO CLEAR 30-50 FT
OF VEG. TO EAST ALONG OLD TRACKS
TO LOCATE BETTER LOCATION ON KNOWN EDGE
OF LANDFILL
- EXISTING LOCATION IN POSSIBLE DRAINAGE
RAVINE (NATURAL) WHICH ~~MAY~~ HAVE BEEN BACKFILLED
W/ WASTE
11:35 - BREAK DOWN CAE EQUIP
EXISTING. LOCAT
- DRILLER INSTRUCTED TO BACKFILL HOLE
W/ BENTONITE CHIPS. (TO SURFACE)
12:00 - K. MILLER OFF SITE
- DRILLERS BEGIN BACKFILLING HOLE
MAGGIE LOGGING ACTIVITY
12:05 JSV OFF SITE

JAV

J. Velimirsis

SAT

08-03-91 913-1178.200 SNO-CTY/LK GOODMAN/WA PG 6 OF 38

06:55 JSV ARRIVES @ SITE GATE- DRILLER NOT THERE.
GATE LOCKED.
WEATHER CALM, WIND 0-3 KT, SKY CLOUDY, SUNNY, TEMP ~ 50°F

07:03 ERIN & ANDIE (DRILL HELPER) ARRIVE, UNLOCKS GATE.
VEHICLE IS 1/2 TON PICKUP W/ 200 GAL WATER TANK & AIR COMPRESSOR & PRESSURE WASHER. DRILL RIG (REPLACEMENT RIG - CME 75?) NOT YET HERE
ERIN BEGINS SITE INSP & MINOR CLEAN UP.

ANTICIPATE TODAY'S ACTIVITIES TO BE:
1. DRILL ANGLE ROPE (115 FT. IN GROUND)
2. BACKFILL W/ BENTONITE TO 97 FT. BGS.
3. INSTALL WELL; SCREENED INTERVAL 75-95 FT BGS.

07:30 NO DRILL RIG YET
ERIN POSITIONING SAND &
FOR EASE OF WELL INSTALLATION
- JSV ARRIVES ON SITE
WELL MONUMENT, 40 FT (8" x 0 FT RISER) 2 INCH I.D.
STAINLESS STEEL WELL CASING, 20 FT (4" x 5 FT SECTIONS)
STAINLESS STEEL SLOTTED SCREEN, END CAP (STAINLESS STEEL).
ALL O-RINGS SEEMS LOOKS TO BE IN GOOD CONDITION
- ALSO: 1300 LBS SILICA SAND, 11 x 50 LB BAGS HOLE PLUG (3/8 SIZE, "WYOMING BENTONITE")
- 1ST ATTEMPT BOREHOLE NOW LOCATED W/ 3/4" SCHEDULE STAKE ~40' FROM FINAL BOREHOLE.

JSV

No. 602

J. L. DARLING CORP TACOMA, WA 98421

J. Velimirsis

SAT

8-3-91 913-1178.200 SNO-CTY/LK GOODMAN/WA PG 7 OF 38

07:45 ERIN INDICATES THAT WELL CASING & SCREEN LEFT-OVER FROM PREVIOUS ACTIVITIES ON THIS JOB SITE (INVENTORIED FOR SNO-CTY?) AND HENCE IS IDENTICAL TO MATERIALS USED IN LOCAL TEMP LOG-H.
- ALSO NOTE 8 - 60 LB BAGS OF CONCRETE MIX & ~20 BAGS ACC "PURE GRAY" CEMENT @ 50 LB EA.

07:48 DRILL RIG ARRIVES ON-SITE = CME 75.
DRILLER: CARY GAMP

08:00 CARY SETTING UP DRILL RIG
ERIN PRESSURE WASHING WELL CASING & SCREEN

08:20 DRILL RIG SETUP & LEVEL COMPLETE

08:25 DRILLER'S REMARK THEY ARE MISSING CORRECT SIZE AUGER ALWAYS ON THE RIG TO MATE TO AUGERS IN GROUND.

08:45 DRILLER DEMOB - TO DRIVE TO CENTRALIA TO GET ADAPTER & 2 INCH CASING LINE (ON SITE 4 INCH LINE; NEW RIG PUMP 2 INCH).
THEY WILL CALL JSV @ HOME WHEN READY TO DEPART CENTRALIA THIS PM TO RETURN TO SITE TODAY TO FINISH WELL INSTAL.

08:50 GATE LOCKED, RIG SECURE; OFF SITE.

GW

15:00 JSU BACK ON SITE. SUNNY, CLEAR, 80+ °F, WIND 0-5 KT
DRILLER ALREADY HERE (SINCE ~13:00) HE LOST MY HOME # & LEFT MESSAGE AT OFFICE; OFFICE DID NOT CALL ME. I WAS AWAITING CALL.

DRILLER'S SUMMARY OF ACTIVITY:

- DROP TAPE DOWN TO 113.5 BGS, IMPLIES 1.5 FT BENTONITE DOWN AT BOTTOM OF AUGERS (113.5 TO 115) BGS
- TWIST AUGERS LOOSE, PULL BACK 10 FT (1 FLIGHT = 5 FT OUT, REMAINING FLIGHT W/ 5 FT STICKUP)
- FILL WITH WATER IN ATTEMPT TO USE WEIGHT TO FORCE PLUG OUT BOTTOM. FAILED.
- RUN A-ROD TO BOTTOM, PUMP WATER DOWN & SPIN AUGERS — STILL PLUG IS CAUGHT;
- AS WATER PRESSURE BUILDS, TOP PORTION OF PLUG BEGINS TO RISE TO (65) ± BGS, ON WATER PRESSURE, TAPE NOW STICKING TO SIDES OF AUGERS, INDICATING BENTONITE SLURRY STICKING TO INSIDE OF AUGER FLIGHTS DUE TO MIXING ACTION OF PUMPED WATER. DRILLER NOW ALMOST OUT OF WATER.

NOTE: DRILLER APPEARS TO BE VERY TIRED.

15:15 BEGIN PULLING A-ROD OUT OF HOLE.
15:30 — 100 FT A-ROD PULLED FROM HOLE
LAST 10 FT SECTION FALLS INTO HOLE JUST AS 20 FT

JSU

SECTION WAS REMOVED. (CLAMPS SLIPPED, WINCH PULLED BACKWARDS, DRILLER'S RATTLER WRONG; & DOES NOT STOP ROD).

~100 FT FREE FALL; TOP OF HOLE CLEAR.

15:35 BEGIN FISHING FOR A-ROD; RUN ADD'L 110 FT A-ROD DOWN
15:50 — CANNOT FIND MISSING SECTION OF ROD. POSSIBLY IMBEDDED IN BENTONITE BELOW 110 FT LEVEL.
BOTTOM OF AUGERS NOW @ 105 FT BGS, WITH ADD'L 5 FT STICKUP FOR 110 FT AUGER TTL.
- SOUND HOLE W/ WEIGHTED TAPE. TAPE HANGS UP AT (72.6 − 5) FT BGS IN REMAINING GROUT IN AUGERS.
- DECLARE 10 FT A-ROD LOST. SINCE 2 A-RODS ARE A SNUG FIT IN AUGERS, MOST PROBABLE THAT MISSING 10 FT SECTION IS BELOW 105 FT BGS LEVEL.
- JSU APPROVES LEAVING IT IN; NOW GET RID OF BENTONITE PLUG IN AUGERS; THEN COMPLETE WELL.

16:00 — DRILLERS BEGIN PULLING 110 FT OF A-ROD OUT OF HOLE.
16:15 — 110 FT OF A-ROD OUT OF HOLE. TOP OF HOLE CLEAN.
- TAPE STILL STICKS @ ABOUT 70± FT.
- WEIGHTED TAPE UNDER FREEFALL GOES TO (108.8 − 5) OR JUST TO BOTTOM OF AUGERS.

JSU

16:20 - RUN CENTER PUNCH DOWN HOLE IN ATTEMPT TO CLEAN BENTONITE FROM ANCHOR (@ 70 + 105 FT LEVELS)
- USE PLUG ON 5 FT SECTION OF A-ROD + 110 FT ROD.

16:30 - AT BOTTOM OF ANCHOR, 115 FT ROD ON STRING, w/ 12 FT STICKUP; ROD SINKS SLOWLY INTO PLUG & SLACK IN CABLE FOULS WINCH. PAUSE TO RECHARGE.

16:35 - WINCH FIXED; ANCHOR STILL PLUGGED
- DISCUSS OPTIONS

16:45 - CENTER PLUG RESTING ON BENTONITE PLUG.
- DRILLER REMOVES TOP 5 FT OF A-ROD, LAYING DRILL STRING STAND ON PLUG.
- ATTEMPT TO ATTACH DRIVE FITTING TO A-RODS & SPIN A-ROD & CENTER PLUG ASSEMBLY TO DISLODGE BENTONITE PLUG. - FOUND FITTING PROBLEM - DRIVE FITTINGS FOR A-ROD ARE MIS-MATCHED, & NO GO
- REMOVE NEXT 5 FT A-ROD SECTION, TOP OF A-ROD 5 FT BELOW TOP ANCHOR FLIGHT
- LIFT & SPIN ANCHOR w/ A-ROD ASSEMBLY INSIDE. Δ VERTICAL ~ 18 INCHES
- ADD 10 FT A-ROD & TRY FISHING FOR STRING. GOT-IT! CENTER PLUG JUST BELOW BOTTOM FLIGHT
- PLUG APPARENTLY OUT, BUT STRING HANGS UP ON (BENTONITE?) STILL INSIDE ANCHOR FLIGHTS.
- WINCH CABLE FOULS AGAIN - 5 MIN FIX

17:00 BEGIN PULLING 115 FT OF A-RODS + CENTER PLUG.
- SOME DIFFICULTY, CENTER PLUG PROBABLY HAS BENTONITE / SAND AROUND IT.
- w/ 40 FT A-ROD OUT, CLAMPS SLIP & 75 FT + CENTER BIT FALLS DOWN HOLE

17:10 - DRILLERS TAKE A BREAK!

17:25 - UNWIND & NEARLY REWIND TROUBLESOME WINCH CABLE.

17:30 - GO FISHING FOR 75 FT OF DRILL STRING.
- DO NOT ENCOUNTER TOP OF 75 FT. SECTION USING ANOTHER 40 FT SECTION.

17:45 - DRILLERS OUT OF THREADED PINS FOR REMAINING A-ROD
- TRY TO CANNIBALIZE PINS ON CENTER PLUG
- FIND 75 FT SECTION USING TAPE - HAD COME FAST w/ A-ROD 1ST TIME
- PULL UP & FISH AGAIN - GOT IT THIS TIME!
- PULL ENTIRE DRILL STRING.

17:57 - FULL STRING CLEAR OF HOLE; CENTER PLUG HAS ~ 0.8 FT OF BENTONITE + SAND MIX ON TOP OF ANNULUS.
- WEIGHTED TAPE FINDS "BOTTOM" @ (95 FT) OR @ ~ 90 FT BGS → HEAVY FM SOFT BOTTOM OF ANCHORS @ 105 FT BGS.; UNKNOWN FM 105 TO 115 FT.

18:05 DISCUSS OPTIONS; DRILLER TO CALL HIS OFFICE TONIGHT; WILL CALL ME TOMORROW AM - HE HAS MY PHONE #.

18:05 OFFSITE

J.L. DARLING CORP TACOMA, WA 98421

SW J VERHOEVEN'S

WEATHER: CLEAR, WARM, WIND 0-5KT, TEMP HI = 80's

07:55 AT HOME - REC'D CALL FROM DRILLER GARY GAGE THAT THEY WILL BE ON SITE SHORTLY AFTER 9:00

08:30 ARRIVE ON-SITE - DRILLER HAS JUST ARRIVED, TRUCK IS 1/2 WAY UP ENTRANCE ROAD

- GARY HAS SPOKEN WITH TOM FURNHOP ABOUT OPTIONS.
- GARY HAS A PLAN: 1) PULL AUGERS BACK AFTER LOADING HOLE WITH WATER TO FLUSH HEAVE OUT & KEEP HOLE OPEN. 2) THEN RUN A-RODS DOWN w/ SMALL TRI-CONE BIT & TURN AUGERS BACK DOWN TO 115 FT w/ STRONG HEAD OF WATER. 3) PULL BACK TRI-CONE & A-ROD w/ WATER THRU BIT TO MINIMIZE HEAVE.
- ONLY ANNOYING PBLM - DRILL RIG HAS NO DRIVE ADAPTER TO SPIN TRICONE ON AROD; SO TRICONE IS STATIC - NOT DYNAMIC AS NO WAY TO SPIN A-RODS. (JSV NOTE: HORSEPLAY NOT A FULLY LIMITING PROBLEM)
- JSV DISCUSSES USING CENTER PLUG w/ FULL HEAD OF WATER & TURNING AUGERS DOWN TO 115 w/O FIRST PULLING BACK. DRILLER RESPONDS THAT CENTER PLUG FITS TIGHTLY ENOUGH TO "SUCK HEAVE" INTO AUGERS AS IT IS WITHDRAWN. SO USE TRICONE. PULL AUGERS BACK IN ATTEMPT TO FLUSH THEM. JSV SKEPTICAL.

JSV

No. 602

J. VERHOEVEN'S

SW

9:40 DRILLERS SET UP

09:50 FIRE UP DRILL RIG & PUMP HOLE FULL OF WATER

09:55 AUGERS FULL OF WATER - PULL AUGERS BACK APPROX 5 FT. IN SHORT STEPPING MOTIONS.

- REMOVE TOP 5 FT. AUGER FLIGHT (NOW 105 FT. AUGER DOWN HOLE)

10:00 - RUN TAPE DOWN HOLE TO CHECK HEAVE -

- TAPE STICKS BADLY TO SIDES OF AUGERS AT DEPTH.
- FINAL TAPE READING IS 90 FT +/- BELOW TOP OF AUGER = STILL 15 FT. HEAVE.

10:10 - GARY & JSV HOLD STRATEGY MTG.

- NOT CONVINCED THAT STATIC TRICONE ON A-ROD WILL CLEAR HEAVE
- BEST SOLUTION IS AIR ROTARY RIG
- OPTIONS w/ AUGER RIG ARE TO:
  - DRILL NEW HOLE - BUT CAN'T CLEAR THIS ONE TO GROUT.
  - GET PARTS TO SPIN TRICONE - BUT WATER LEAKS PAST AUGER JOINTS & NEED MUD TO CARRY HEAVE OUT TO SURFACE.
- SO REALLY NEED AN AIR RIG - AUGER IS NOW JUST DAMAGING HOLE, CAVING & NOT ALLOWING FOR BENTONITE CHIPS OR GROUT TO SEAL.

10:30 - DECIDE THAT OPTIMUM IS TO LEAVE THIS HOLE w/ AS MANY OPTIONS IN PLACE WHILE FREEING UP THE RIG. →

JSV

J.L. DARLING CORP TACOMA, WA 98421

J VELLMOSIS

SU

8-4-91 913-1178.200 SNO. CTY / LK GOODMAN / WA PG 14 OF 38

10:40 - DECIDE TO RUN AUGERS DOWN TO 115 FT, LEAVING HEAVE IN PLACE FOR OPTION TO CLEAR W/ AIR ROTARY OR ABANDON & GROUT - ALSO W/ AIR ROTARY.

- GARY DECIDES TO USE A-ROD & TRICONE ON THE OFF CHANCE OF CLEARING AUGERS IN THE PROCESS.

- JCN & GARY BOTH WRITE-UP NOTES TO DOCUMENT THE DECISION.

10:50 - BEGIN RUNNING TRICON BIT (8 INCH LONG) & 115 FT OF A-ROD DOWN HOLE.

11:00 - TRICONE RESTS ON TOP OF HEAVE ~ 89 FT BELOW TOP OF AUGER = 94!

- STILL 25 FT A-ROD AVAIL.

11:05 - REMOVE TOP 5 FT - A-ROD TO ALLOW TURNING AUGERS DOWN TO 115 FT; NOW 85 FT A-ROD DOWN

- ADD 5 FT AUGER & TURN DOWN TO ~ 105 FT BGS.; NOW 110 FT AUGER DOWNHOLE.

11:10 - FISH FOR A-ROD TO ADD NEXT A-ROD SECTION.

11:18 - GOT IT, ADD 5 FT A-ROD; Σ = 90 FT DOWN.

11:20 - ADD 5 FT AUGER SECTION; Σ = 115 FT AUGER DOWN HOLE TO 110 FT BGS.

JCN

No. 612

J. VELLMOSIS

SU

8-4-91 913-1178.200 SNO. CTY / LK GOODMAN / WA PG 15 OF 38

11:25 - ADD 5 FT A-ROD; Σ = 95 FT

- FLOOD AUGERS W/ WATER

11:30 - ADD TOP "DEAD" AUGER FLIGHT FOR USE AS DRIVE EXTENSION TO ALLOW TURNING DOWN TO 115 FT BGS.

- EVEN W/ BIG DRILL RIG PUMP, WATER NEVER OVER TOPPED AUGER FLIGHTS.

11:32 - TURN AUGERS DOWN TO 115 FT BGS. & REMOVE TOP EXTENSION AUGER FLIGHT.

∴ Σ = 115 AUGER DOWN HOLE, FLUSH TO G.S.

- VIEW A-ROD INDICATES 14 FT OF HEAVE; TOP OF 100 FT OF A-ROD + 0.75 FT BIT IS ~ 1 FT BELOW G.S.

- WEIGHT OF A-ROD + WATER DID NOT CLEAR HEAVE FROM AUGERS BUT NO ADDITIONAL HEAVE EITHER.

11:45 - BEGIN TO SECURE SUPPLIES ON SITE UNDER PLASTIC.

- BEGIN TO REMOVE 100 FT A-ROD FROM HOLE.

12:00 - ALL A-ROD OUT; AUGER SHOE PLATE IN PLACE. AUGER EXTENSION & RIG LEFT (ATTACHED TO RIG) IN PLACE TO SEAL HOLE.

- DRILLER'S SECURE SITE.

12:25 - ALL OFF - SITE.

JCN

J.L. DARLING CORP TACOMA, WA 98421

DURA Lite

J. VERHEUL

WED 8-7-91	913-1178.200	SNO-CTY / LK GOODWIN / WA	PG 16 OF 38
06:55	ARR @ SITE CLOUDY, WIND 0-7KT, TEMP ~65°F		
	POSSIBLE SHOWERS LATER		
07:00	ERIN LABOIE ARRIVES W/ F350 ACCESSORY PICKUP TRUCK		
	W/ WATER TANK (750 GAL)		
07:05	GARY CRAFT ARRIVES IN PERSONAL PICKUP TRUCK		
	ERIN UNLOADING ADDITIONAL DRILL ROD & MOBIL LOCK ROD		
07:10	TOM FURTOP ARRIVES IN MATTOS F250 PICKUP.		
	ALL 3 MATTOS PERSONNEL NOW HERE.		
07:15	- MOBIL LOCK (ML) ROD INVENTORY		
	= 12 x 10 FT SECTIONS = 120 FT + 0.8 FT BIT W/ 3 BLADES (BAGS)		
	ML OD = $2\frac{5}{8}$ & $2\frac{3}{4}$ INCHES. BIT OD = ~$3\frac{1}{4}$ INCH		
	- ERIN CLEANS ALL ROD W/ HOT PRESSURE WASHER, (100 LOS & OUT OF ALIGNMENT)		
	- GARY + TOM ATTACH WATER SWIVEL TO DRIVE HEAD ASSEMBLY		
07:30	- TOM LEAVES SITE - TO ANSWER PAGER.		
	- GARY HAVING TROUBLE W/ BOLTS ATTACHING WATER SWIVEL		
	TRIP TO LOCAL HARDWARE MAY BE NECESSARY		
	- ERIN DECONS OTHER ROD FITTINGS, CLAMPS, ETC W/ HOT		
	PRESSURE WASHER		
07:35	- GARY LEAVES TO GET BOLTS @ HARDWARE STORE		
07:50	- ERIN ORGANIZING DRILLING PARTS & TOOLS		
08:05	- ERIN DECONS STAINLESS WELL CASING & SCREEN		
08:35	- GARY BACK ON-SITE W/ BOLTS.		

No. 612

J. VERHEUL

WED 8-7-91	913-1178.200	SNO-CTY / LK GOODWIN / WA	PG 17 OF 38
09:00	BEGIN RUNNING ML ROD DOWN INSIDE AUGER		
	FLIGHTS, W/ DRAG BIT ON BOTTOM END.		
	(FIRST REMOVE TOP 5 FT EXTENSION SECTION OF AUGER;		
	NOW 115 FT AUGER IN GROUND, TOP IS ~0.5 FT		
	ABOVE G.S.). (5 FT SECTIONS OLD AW ROD 1.34 INCH OD)		
	- ERIN USING 100% VEGETABLE CRISCO ON ML THREADS.		
	- W/ 90 FT ML ROD DOWN HOLE, SWIVEL WENT BEGINS		
	TO SLIP.		
09:25	- REACH 100 FT BGS & ENCOUNTER HEAVE. ADD 10FT MORE ML SECTION & BEGIN TO ATTACH TO DRIVE		
	HEAD, & HOSE WATER LINES TO WATER SWIVEL.		
09:35	- BEGIN TURNING DRAG BIT " " "		
09:40	- ADD WATER PRESSURE & ADVANCE SIT ~ 5 FT. (105 FT DOWN HOLE)		
	BENTONITE, SAND & SILT ARE FORCED TO THE		
	SURFACE INSIDE AUGER CASING (5 FT STICKUP)		
09:55	- PAGE TO RE-RIG WATER SWIVEL		
	- TOM RETURNS BACK ON SITE W/ 2-5 FT		
	SECTIONS OF ML ROD. (NOT DECONNED ON-SITE)		
	- ADD 5 FT ML SECTION TO DRILL STRING		
	- ADVANCE ~ 3.5 FT WHEN WATER BEGINS TO		
	BY-PASS PLASTIC SEALING THE HOLE & WASH		
	BACK DOWN THE OUTSIDE OF AUGER FLIGHTS,		
	CAUSING & ENLARGING BOREHOLE.		
	- RETURNS TO SURFACE PLASTIC W/ SLURRY ARE MADE.		

J.L. DARLING CORP. TACOMA, WA 98421

J. VERIMOSU

WES
8-7-91 | 913-1178-200 | SNO-CTY / LK GOODWIN / LUL | PG 18 OF 38

10:15 - ADVANCE ANOTHER 1.5 FT TO 110 FT BGS.
- RUNNING LOW ON WATER.
10:20 - CONTINUE FLUSHING AT 110 FT LEVEL, USING REMAINING WATER
- ERIN TAKES F350 w/ WATER TANK TO GET MORE H_2O
10:25 - GARY + TOM REMOVE 5 FT ML ROD TOP SECTION, & REPLACE IT w/ 1ST 10 FT SECTION.
- WATER SOURCE: SMOKEY PT FIRE STATION
  - TOM REPORTS THIS SOURCE USED BEFORE; TESTED BY CONVERSE CONSULTANTS PREVIOUSLY
10:35 - CHANGE A GASKET ON WATER SWIVEL TO MIN. LEAKAGE.
10:45 - WATER ARRIVES - ADVANCE TOWARD 115 FT BGS.
- BREAK THRU BOTTOM OF AUGERS - MOMENTARILY LOSS OF CIRCULATION
- MATERIAL CARRIED TO SURFACE IS NOW CLEAN COARSE SAND.
10:55 - BACK OFF 2-FT & ATTEMPT TO MEASURE SETTLEMENT OF SUSPENDED MATERIAL.
- LITTLE ADD'L SETTLEMENT. RODS STAND FREE w/ BIT @ 115 FT BGS.
- BEGIN TO PULL ROD OUT OF HOLE.
11:00 - ERIN TRANSFERS WATER FM F350 TANK TO DRILL RIG TANK
11:10 - ERIN LEAVES SITE TO REFILL F350 WATER TANK.

No. 612

J. VERIMOSU

WES
8-7-91 | 913-1178-200 | SNO-CTY / LK GOODWIN / LUL | PG 19 OF 38

11:25 - ALL 120 FT ML ROD OUT OF HOLE
- SOUND w/ TAPE: BOTTOM OF HOLE TO TOP OF AUGER CASING = 115.0 FT. AMAZING!
- ERIN ARRIVES BACK w/ 750 GAL H_2O.
11:30 - CONVENIENT POINT TO STOP & BREAK FOR LUNCH.
12:10 - RIGGING FOR WELL INSTALLATION
12:15 - ATTEMPT TO PULL AUGERS BACK 1.2 FT - V. DIFFICULT; MAY HAVE TO SPIN TO LOOSEN
12:20 - ROD HEAD CONNECTOR DRIVING AUGERS 4.25 x 1 5/8" BREAKS UNDER THE LOAD. TOM DEPARTS FOR OFFICE TO GET 2" DIAM REPLACEMENT (APPROX 2 HR ROUND TRIP TIME.)
- CHECK BOREHOLE w/ TAPE: STILL CLOSE TO 115.0 FT BGS.
13:15 - GARY & ERIN GO INTO LAKE GOODWIN TO PHONE OFFICE
13:35 - GARY & ERIN BACK ON SITE.
14:55 - TOM ARRIVES BACK ON SITE w/ PARTS.
15:10 - FIRE UP & TRY AGAIN - CAN'T PULL UP & WON'T SPIN!
15:15 - KEN MILLER ARRIVES ON SITE - JSV BRINGS KEN UP TO DATE.
15:25 - PAUSE TO ALLOW OVERHEATING CLUTCH TO COOL DOWN.
- KEN MILLER OUT OF TOWN TILL NEXT MONDAY.
- TALK TO KEN MOSER RE COUNTY INPUT [illegible].
15:35 - MUCH MANEUVERING RAISES AUGERS 5 FT; REMOVE TOP FLIGHT.
15:45 - AGAIN MUCH WORK TO PULL BACK ANOTHER 5 FT; REMOVE 2ND 5 FT AUGER FLIGHT.

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15:45 - USE TAPE - HOLE HAS STAYED OPEN FOLLOWING REMOVAL OF 5 FT. OF AUGER; BEGIN TO BACKFILL WITH HOLEPLUG BENTONITE CHIPS.

15:50 - TAPE INDICATES HOLEPLUG TO (108-3) FT BGS WITH SOME PROBABLY STILL IN WATER COLUMN.

- PULL UP & TWIST & BREAK AUGERS TO TAKE A TAPE MEASUREMENT W/ ~3.5 FT. STICKUP.
- TAPE INDICATES "BOTTOM" @ (107-3.5) = 103.5 FT BGS

15:55 - ADD SLOWLY MORE HOLEPLUG CHIPS.

15:58 - TAPE INDICATES BOTTOM AT (105.5-3.5) = 102 FT BGS.

- CONTINUE TRYING TO BREAK AUGERS FREE.
- REMOVE 3RD 5-FT. AUGER FLIGHT.

16:02 - PAUSE TO TAPE CHECK W/ 1.5 FT STICKUP

BOTTOM IS NOW (TAPE STUCK IN AUGER BIT) FT BGS

(100 - 1.5) = 98.5

∴ HEAVING IN SOME. BEHIND AUGERS; BUT HEAVE IS APPARENTLY "SAND"

- BOTTOM OF AUGERS NOW AT 98 FT BGS

16:10 - DECIDED TO PULL BACK ADDITIONAL 2.3 FT & BEGIN PLACING SAND BASE (OST 3 FT TO 95 FT BGS)

- UP SEVERAL FT & REMOVE 4TH 5 FT AUGER FLIGHT
- TAPE CHECK: (99.6 - 3.6) = 96.0

HEAVE NOW CLOSING IN BEHIND AUGERS.

16:15 - MANAGE TO PULL AUGERS STRAIGHT UP ~ 4 FT.

- TAPE CHECK W/ 0.5 FT STICKUP. INDICATES BOTTOM @ (94.5 - .5) = 94.0)

WHERE DRILLERS FEEL "BOTTOM" IS SANDY HEAVE INSIDE (0.5 FT) AUGER BIT.

- JSV AGREES W/ HOLE CLOSING & AUGERS V. TIGHT TO PUT SAND IN NOW + HEAD OF WATER & BEGIN TO SET WELL. HEAVING BACK WILL ALLOW SLIGHT SUBSIDENCE TO PUT WELL ON SEVERAL INCHES CLEAN SAND @ ~95 FT.

16:30 - DRILLERS GO ON CLOCK FOR WELL INSTALL.

ADD ~3 INCH SAND TO AUGER FLIGHTS.

- TAPE INDICATE SAND IN AUGER TO 93.5 FT BGS.
- NOW BEGIN TO INSTALL STAINLESS

* - JSV AUTHORIZES LEAVING OUT CENTRALIZER AT TOP OF WELL SCREEN. CENTRALIZER IN AUGER HOLE MAKES NO SENSE & PRECLUDES PRECISE TAPING OF SAND PACK. JSV OKS FOR PRECISE MEASUREMENT. AUGER WILL HELP POSITION WELL SCREEN & WEIGHT OF SCREEN WILL PREVENT SCREWING DURING AUGER WITHDRAWAL.

16:35 - INSTALL SCREEN & CASING SECTIONS, USING CLEAN WRENCH TO SNUG O-RING SEALS AT EACH SECTION JOINT.

16:35 - 4 - 5 FT Screen sections are followed by 10 FT sections of casing.

16:45 - 2 sections (10 FT) of casing would not thread. Removed temporarily = BAD; 60 FT casing + 20 FT screen now in well.

- 2 additional 10 FT sections in packages & decon'd w/ hot pressure washer.

16:55 - Continue install: 8 x 10 FT casing + 20 FT screen.

- (95.0 - 1.7 FT) to bottom of stainless well (From sand in bottom of augers to top of auger casing)

∴ bottom of stainless is 93.3 FT BGS. (???)

17:00 - Pull up on augers - still stuck, but stainless well casing drops some distance.

- Fill augers w/ water for static (head).
- Corn cleaning & breaking. Aw rod & decon.
- Water does not overflow augers.
- Continue trying to pull augers; 95 FT mark on stainless now at top of augers, 0.5 FT above G.S.

17:05 - Reattach augers to drive head over top of stainless - tape top of stainless first to keep interior clean.

- Attempt to pull augers straight up. = no way!
- Tape measurement: stickup = 6.3 FT
- cannot get good measurement.

17:20 - Remove top auger flight & try tape again. (Stickup = 1.3 FT)

- Tape sticking to augers; add water to auger casing: Tape = 95.3 - 1.3 = 94.0
- Now is 95 FT. auger in ground;

∴ Time to add + water sand (~ 6 in inside augers).

- New tape meas: 94.8 - 1.3 = 93.5

Add more sand + water; approx now 94.3 - 1.3 = 93.0

- Replace auger flight to attempt to pull augers back ~ 3 inches.
- Recheck to see how sand is falling past augers into borehole. Tape = 94.7 - 1.6 = 93.1

17:30 - Add sand & repeat process

17:50 - Measurement tape is not giving good results in remaining annulus. Tape sticking to auger, wasting much time ∴ get some poly pipe overnight to make reusable stage gauge. Continue w/ sand pack tomorrow AM.

- Secure augers over exposed well casing
- Secure site.

18:15 - Everyone off site!

[signature]

J. VELIMOSIS

THU 8-8-91	913-1178-200 SND-CITY / UK GROUNDWATER	PG 24 OF 38
07:00	JSV - ON SITE	
	FULL OVERCAST, BREEZY, TEMP ~ 60°F ; 40% CHANCE OF RAIN TODAY	
	- ERIN LAJOIE ON-SITE JUST ARRIVED OF JSV	
7:05	- ERIN DEPARTS TO GET 750 GAL WATER	
7:10	- TOM FULTOP ARRIVES ON SITE	
	- GARY GAGE ARRIVES ON SITE.	
7:20	- START RIG, ENCOUNTER WATER, USE TAPE TO MEASURE BOTTOM SAND LEVEL W/ TAPE - NO GO - TAPE STICKS TO BOREHOLE.	
	- BREAK OUT 100 FT 3/4 IN DIAM POLY PIPE ; USE AS MEASUREMENT STAFF. ; MEASURE AS 91.9 IF LOWER; MARK IN 5 FT INCREMENTS W/ TAPE 100 - 70 FT.	
	- SAND IS AT BOTTOM OF AUGERS @ (95-1.6) = 93.4 FT BGS.	
	- BOTTOM OF SCREEN IS AT EL (100 - 5.5) = 94.5 FT BGS	
7:45	- ADD SAND & WATER USING POLY PIPE AS TREMIE TUBE.	
	- WHEN FILLING SAND DOWN ; WHEN WATER OVERFLOWS, SAND IS UP TO TREMIE AUGERS LEV. ~ 6 IN FROM PREVIOUS BOTTOM LEV.	
	- ATTEMPT TO PULL AUGERS BACK ; TWISTING SLIGHTLY ~ 0.3 FT	
	- MEASURE SAND ELEV W/ POLY PIPE = 94.3 = JUST INSIDE BOTTOM OF AUGER; AUGER NOW AT 95-1.9 = 93.9 FT BGS	
	- REPEAT ENTIRE PROCEDURE.	

No. 612

J. VELIMOSIS

THU 8-8-91	913-1178-200 SND-CITY / UK GROUNDWATER	PG 25 OF 38
08:00	- AUGERS AT (95-2.3) = 92.7 ; SAND AT (95-2.9) = 92.1	
	- REPEAT PROCESS	
08:10	- TOM LEAVES SITE TO MAKE MORNING PHONE CALLS.	
	- AUGERS AT (95-2.9) = 92.1 ; SAND AT (95-3.4) = 91.6	
08:25	- AUGERS AT (95-3.2) = 91.8 ; SAND AT (95-3.9) = 91.1	
	- AT LIMIT OF DRIVE HEAD TRAVEL - NOW MUST TRIM STAINLESS CASING TO CONTINUE. (YUCK!)	
	CUT 1.72 FT STAINLESS FROM 100.00 AT TOP. - TRIM POLY PIPE 1.0 FT.	
08:35	- CONTINUE ADDING SAND + PULLING AUGERS ; AUGERS, SAND SCREW.	
	- REMOVE TOP EXTENSION, AUGER FLIGHT ; REDUCE ASSEMBLY TO 95 FT AUGER.	
	- AUGERS AT (95-3.7) = 91.3 ; SAND AT (95-3.6) = 91.4	
09:05	- AUGERS AT (95-4.1) = 91.0 ; SAND AT (95-4.1) = 90.9	
9:10	- TAKE BREAK TO LET CLUTCH COOL OFF	
	- TOM FULTOP BACK ON SITE.	
	- RUN TAPE DOWN ANNULUS OUTSIDE AUGERS TO REACH WATER AT 10 FT BGS. =	
09:25	- TOM & GARY LEAVE SITE TO CALL OFFICE FOR ADVICE OPTIONS +	
	- ERIN CONTINUES SITE CLEANUP ; DISCONNECTS 4TH AUGER FLIGHT ; UNLOADS EXTRA CASING & PREPARES FOR EVENTUAL GROUTING OPERATIONS.	
10:00	- GARY + ERIN BACK ON SITE	
	- WEATHER NOW PARTLY SUNNY, 70°F ; WINDS TO 12 KT	

J. Voumotis

TIME 8-8-91	913-1178.200	SND-CTY/LK GOODWIN/LUL	PG 26 of 38

"ON ADVICE FM COMPANY V.P.":

10:00 - REMOVE POLY PIPE MEASURING STAFF FM HOLE

- REMOVE RED-HEAD 4-WAY SWIVEL (WATER LINE w/ 2" DIAM CONNECTOR)

- ADD BACK 4TH AUGER FLIGHT (10 FT TOTAL AUGER)

- USE FULL POWER TO TRY TO BREAK AUGERS FREE

10:10 - AUGERS NOW AT (95-4.1) = 90.9 = Δ OF 0.1

= NOT MUCH PROGRESS ; TRY AGAIN

10:20 - CLUTCH VERY HOT & BEGINNING SMOKE

- AUGERS AT (95-5.0) = 90.0

- NOW CAN REMOVE 4TH AUGER FLIGHT AGAIN & ∴ REACH REMAINING AUGER w/ DRIVE HEAD.

- ALSO ATTEMPT TO USE TRUCK'S HYDRAULIC JACKS TO FORM FOLCRUM w/ TRUCK WEIGHT TO ... ADD TO UPWARD FORCE

10:35 - AUGERS NOW HAVE 85 FT SECTION FLUSH w/ G.S.

REMOVE 5TH AUGER FLIGHT → 9.5 FT STICKUP

- USE POLY PIPE TO CHECK SAND DEPTH @ 89.1 ≈ 1 FT HEAVE.

- TOP OF STAINLESS STICKUP NOW 4.5 - 0.8 = 3.3 FT

ELEV OF BOTTOM STAINLESS = 100 - 1.7 - 3.3 = 95.0

- AUGERS FREE ! PULL UP ~ 6 INCH

- REMOVE 6TH AUGER FLIGHT

11:00 - USE PUMP & WATER SWIVEL TO PUMP WATER INTO AUGERS.

- PULL AUGERS BACK ~ 5.0 FT

No. 612

J. Voumotis

TIME 8-8-91	913-1178.200	SND-CTY/LK GOODWIN/LUL	PG 27 of 38

11:00 - ~80 FT AUGERS IN GROUND TO G.S. w/ 10 FT STICKUP (2 FLIGHTS)

- REMOVE 7TH AUGER FLIGHT = NOW ~5 FT STICKUP. w/ STICKUP INCLUDED = 85 TOTAL AUGER.

- USE POLY PIPE TO CHECK SAND DEPTH: (80 FT TAPE MARK - 0.9 FT POLY PIPE STICKUP) = 79.1 FT BGS.

*** NATURAL SANDS HEAVE IN TO SCREEN FM 90.9 TO 79.1 BGS = 11.8 FT.

- BOTTOM OF AUGERS = 80 - 0.5 FT AUGER STICKUP = 79.5 FT BGS.

- RUN TAPE DOWN INSIDE STAINLESS = 97.8 FT TO BOTTOM; BUT IF CLEAN SHOULD BE 100 - 1.7 = 98.3

∴ 0.5 FT SILT IN BOTTOM OF STAINLESS.

- ELEV. BOTTOM OF STAINLESS IS NOW (100 - 1.7) - 3.75 STICKUP

= 98.3 - 3.75 = 95.3 - .75 = 94.65 FT BGS.

11:15 - SLOWLY CONTINUE ADDING SAND ; NOW ABOVE WATER TABLE ; TL ~ 1 FT ADD'L SAND.

- JSV CONSULTS FORMATION SAND PACKING WELL FROM 90.9 FT TO 79.1 FT BGS = 11.8 FT

11:25 - PULL AUGERS BACK ~ 1 FT & CHECK SAND LEVEL - LOOKS OK. ; ADD MORE SAND.

11:35 - BREAK FOR LUNCH WHILE JSV CONTACTS w/ D. MORRELL

12:35 - FIRE UP RIG - CONTINUE PLACING SAND.

PULL BACK & ADD SAND IN 0.5 FT INCREMENTS.

- TOM FURLUP DEPARTS SITE FOR TODAY.

- JSV HAS CALLED A. MORELL & K. MILLER (SND-CTY) CONCERNING 11.8 FT NATURAL MAT'L AROUND SCREEN.

J.L. DARLING CORP TACOMA WA 98421

DURA-Rite

12:35 - CONT'D: JSV LEFT MESSAGE TO CALL CORMAN #. JSV WAITING FOR CALL FM KEN MILLER (CANCELLED VACATION TODAY) ON HIS WILLINGNESS TO GIVE VARIANCE ON DRILLING CONTRACT SPECS FOR SAND PACK

13:20 - H&S INCIDENT:

DRILLER CUTS MIDDLE & LITTLE FINGERS OF RIGHT HAND ON STRAY WIRE OF WINCH CABLE. MIDDLE FINGER REQUIRES BAND-AIDE; LITTLE FINGER REQUIRES ALTERNAL PRESSURE TO STOP BLEEDING FROM JAGGED 1 INCH CUT. CUTS WASHED W/ SURGICAL SOAP & NEOSPORIN; LITTLE FINGER WRAPPED W/ GAUZE PAD & 2 INCH GAUSE; TIED OFF OVER WOUND. DRILLER DECLINES FURTHER MEDICAL TREATMENT NOW; JSV ADVISED IMMEDIATE VIEW BY DOCTOR & PROBABLY TETANUS SHOT!

13:45 DRILLERS CONTINUING TO PLACE SAND PACK. AT ~75 FT. BGS (EOL)

14:01 ATTEMPT TO CALL KEN MILLER. STILL NOT IN.
- ~73 FT SAND

14:30 - 15 MIN BREAK

14:45 - FINISHING SAND PACK FM 71.5 TO ~70.0 FT BGS

15:00 - PULL AUGERS BACK TO 69.0 FT; MEASURE SAND W/ POLY PIPE @ 70.0 FT BGS.
TOTAL SAND = 6 x 100 LBS BAGS = 600 LBS.

15:00 - BEGIN ADDING 2 BUCKETS 1/4 INCH VOLCLAY PELLETS ON TOP OF SAND. (50 LB EACH BUCKET)

15:10 - TAKE STATIC WATER LEVEL READING WITH ACTEST 150 WATER LEVEL PROBE, EAF SERIAL # H1D3
85.0' - 3.85 FT STAINLESS STICKUP = 81.15 FT BGS.
- CONTINUE ADDING DRY PELLETS SLOWLY, W/ POLY PIPE & FUNNEL. AUGERS SLOWLY TO PREVENT BRIDGING.

15:15 - FINISH 1ST BUCKET OF PELLETS; HYDRATE BY RUNNING WATER DOWN POLY-PIPE AS TREMIE TUBE.
- USING 75 FT PRAIRIE POLY PIPE, BOTTOM OF PIPE = TOP OF PELLETS = 70 - 2.7 + 1.7 = 75 - 1 = 69 FT BGS

15:21 - START ADDING 2ND BUCKET OF PELLETS.
SOUNDS LIKE THEY ARE FALLING INTO WATER.
- PULL AUGERS BACK AGAIN TO 70 - 3.95 = 66.05 FT BGS
- FINISH W/ 2ND BUCKET; PULL AUGER'S BACK; MEASURE TOP OF PELLETS AS 70 - 3.3 = 66.7 FT (?)
AUGERS AT 70 - 4.3 = 65.7 FT BGS.
- HYDRATE PELLETS BY ADDING WATER DOWN TREMIE (POLY PIPE).

15:30 - FINAL CALL TO KEN MILLER - NOT IN

15:40 - PULL AUGERS BACK ~1 FT; REMOVING AUGER TO 65 FT AUGER BGS INCL. W/ ~ 0.4 FT STICKUP
AUGER BOTTOM @ ~ 65 - 0.4 = 64.6
PELLETS AT 70 - 5.65 POLY STICKUP = 64.35 FT BGS
∴ PELLETS (HYDRATING) IN AUGER; ∴ PULL BACK!

J. Velimesis

THU
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15:50 BEGIN ADDING 3-RD BUCKET PELLETS
* THE BUCKET IS 1/2" VOLCLAY TABLETS. (50 LBS)
GO SLOWLY TO AVOID BRIDGING

16:00 - LARGER TABLETS QUICKLY BRIDGING AUGER BIT;
MOSTLY DRY; POLY PIPE NOT STRONG ENOUGH
TO PUNCH THRU; TRY RIGID WITH 1" DIAM PVC
(REAL TREMY PIPE)
- NOTE: WITH 2 BUCKETS PELLETS AT 64 FT →
5.4 FT PELLETS = ENOUGH FOR GOOD SEAL
& MEETS WA STATE SPECS.
- 1" PVC PUNCHES OUT PLUG, GO DOWN TO
TOP OF EXISTING PELLETS:
(6x 9' [5.4'] FT) + 6 FT + 6.2 FT - 3.3 FT =
66.2 - 3.3 = 62.9 FT (?)
= PLENTY OF PELLETS.

16:30 SECURE SITE.
16:50 EVERYONE OFF SITE. [signature]

No. 612

J.L. DARLING CORP TACOMA WA 98421

DURA

J. Velimesis

FRI
8-9-91 913-1170.200 SNO-CTY / LK GOODWIN / WA PG 31 OF 38

07:00 JSU ON-SITE JUST AFTER ERIN & JOE ARRIVED
- WEATHER: RAIN, HEAVY AT TIMES W/ ROLLING THUNDER
07:05 - GARY GRAFF ARRIVES ON-SITE.
- JSU INDICATES THAT IF GROUTING BEGINS BEFORE
COUNTY APPROVES WELL - IT IS DRILLER'S RISK.
- DONUTS TILL 7:30
7:30 - JSU & GARY RECONCILE PAPERWORK
8:00 - JSU ATTEMPTS TO CALL KEN MILLER / KEN MOSER @ SNO CTY
08:20 - JSU FINALLY TALKS W/ KEN MOSER - MOSER SPOKE W/
MILLER LAST EVENING. IF GOLDER ADVISES GO, &
THERE ARE NO CONCERNS ABOUT QUALITY, GROUT
& ABANDON. JUST DOCUMENT CAREFULLY.
- JSU ACKNOWLEDGES
- DRILLERS WORKING ON RIG TO PUMP GROUT.
08:30 - MEASURE TOP OF PELLETS @ 66.3 - 4.1 STICKUP = 62.2 FT BGS
IMPLIES 8.2 FT PELLETS IN PLACE
08:50 - MIXING PURE GOLD GROUT. BAG INSTRUCTIONS
RECOMMEND 14 GAL H_2O / 50 LB BAG; GROUT
VERY THICK W/ 5 BAGS PER 100 GAL (5x14 = 70 GAL; 7x14 = 98)
09:07 - BEGIN PUMPING GROUT DOWN AUGERS - MIX IS
4.5 BAGS / 100 GAL OR 20+ GAL / BAG; GROUT IS
VERY THICK; NOT TOTALLY UNIFORM.
09:15 PULL AUGERS BACK ~ 15 FT & SOUND HOLE.

9:30 - JSV suggests using tremie pipe - Gary responds that he can't pull auger & tremie back simultaneously; using augers as tremie & maintaining head of grout in augers to prevent caving of formation & avoid gaps (bridges) in grout sealing borehole.

- Driller's calcs show 4.29 gal/ft w/ 10" hole & 2" well casing; so uses 100 gal every 20 ft to be safe.

:00 - Drillers mixing 2nd batch grout.
100+ gal w/ 5 bags Purogel; mixed more slowly is nice & uniform; not as thick as 1st batch.

- Pump 100 gal down augers.
- Flood to top of augers @ ~75 gal; pull augers back another 5 ft & shut off grout pump. Still ~15 gal grout remaining in tank.
- Remove the top auger flight & pump remaining grout down hole w/ splash & overflow at surface.

1:15 - Pull augers back 5 ft → 5 ft stickup.
Pump next batch from here to give drilling head; displacing annular water to surface.

10:20 - Mixing 3rd batch grout.
Gary changes his mind - now pulling augers back to 35 ft bgs & running 1" rigid PVC tremie pipe down; will grout to surface.

10:25 - Tremie pipe snaps at critical joint -
"Back to Plan 'A'? No, on to Plan 'C'"
- use new roll of 1" diam black poly pipe
- trim to 40 ft & use as tremie tube

11:15 - Tremie tube in place; 5 bags grout in 100 gal H_2O mixed & uniform; consistency in between last 2 batches - thick.

- Pump ~100 gal grout down tremie tube. Grout rises to ground surface outside augers and out top of 1.5 ft stickup inside augers.
- Drillers remove poly pipe & prepare to remove augers.

11:30 - Jeff Colon from the Snohomish Health District arrives. We give him a tour & bring him up to date on grouting methods used. He would like to observe well abandonment. JSV informs Jeff about natural sand over 1 ft of screen.

11:45 - Jeff Colon departs site.

FMI — J. Volimesis

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11:45 - All Auger's out of hole.
- Grout has fallen ~ 2 ft BGS.
- Stainless standing in center of borehole.
- JJV checks stainless stickup
"G.S." is now muddy mess.
Estimate top of stainless ~ 3.5 to 3.6' AGS.
∴ 100 - 3.6 - 1.7 = 94.7 ft BGS = bottom of well

12:00 - Cleaning up site; augers & equip.

12:30 - Lunch break: Gary & crew offsite; JJV stays

12:40 - Snohomish County Deputy Sheriff on site -
Saw open site gate & stopped to check it out;
Left site after 3 min chat w/ JJV

13:30 - Crew & Gary back on site

13:40 - Crew offsite to tank up w/ Diesel, Gas + H_2O.
- Gary cleaning tools & prepping to demob
CME 75 drill rig this P.M.
- Will set surface casing later today
- Specs say -3.0 ft to + 1+ ft. ; use
Bentonite chips to form foundation on top
of grout to set casing.

14:15 - Add 1 bag Hole Plug to water standing on
top of grout; top of hole plug 1.5 ft
below G.S.

FMI — J. Volimesis — No. 612

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14:35 Begin to mix Lone-Star Tru-Mix concrete mix
to set well monument.

14:40 - Measure top of stainless casing to
Level Rod @ G.S. = 3.60 ft; ∴ bottom well = 100 - 1.72 - 3.60 = 100 - 5.32 = 94.68 ft BGS
- Trim stainless to specs:
Monument -3 ft BGS s.t. top of monument
is +13 inch above stainless casing. Since
Monument = 60 inch:
60 - 36 - 13 = 11 inches above G.S.
is top of stainless.
- Trim stainless to +11" A.G.S. = (using pipe cutter)
Trim: 2.690 ft of casing.
∴ Total cut fm stainless = 1.715 + 2.690 = 4.405 ft
∴ Total length stainless = 100 - 4.405 = 95.595 ft.
- Gary files inner edge of stainless casing.

14:50 - 1 bag concrete mix in hole; set surface casing (monument)

15:05 - 9 bags concrete mix in hole:
Concrete feathered to G.S.
Monument pushed down into concrete &
plumbed; well casing ~ in center.
Top monument to outside GS = 2.05 ft
" to inside concrete = 1.85 ft

16:00 Lower mast; clean rig; pull off hole

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J. VELIMOSS

FRI
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16:10 MATERIAL SUMMARY
14 SACKS GROUT
9 SACKS CONCRETE M.A
16:30 CLEANUP STILL IN PROGRESS; DIVIDING TOOLS B/T TRUCKS
16:40 - MOVE DRILL RIG TO POSITION JUST INSIDE GATE,
FOR PICKUP LATER TONIGHT.
- ERIN DRIVES GARY BACK ON SITE TO PICK UP
GARY'S TRUCK; DRILLERS LEAVING DIRECTLY.
16:40 - JSV OFF-SITE.

JV

No. 612

J. VELIMOSIS

WED
8-14-91 | 913-1178.200 | SNO-CTY / LK GOODWIN / LWA | PG 37 of 38

07:50 J. VELIMOSIS + JOE SCIANCE (GAI) AT GATE
08:10 MATHES PERSONNEL ARRIVE: TOM FARROP + ERIN LASOO
(SMALL + LARGE PICK UP TRUCKS w/ PUMP ASSEMBLY)
WEATHER: COOL & FOGGY TURNING TO PTLY CLOUDY;
TEMP ~ 55°F ~~RAISED~~ FOR 75-80°F TODAY.
08:20 MEASUREMENTS INDICATE MONUMENT SETTLED ~ 0.25 INCH.
NOW TOP OF MONUMENT TO CONCRETE = 2.045 FT
TOP OF WELL CASING TO TOP OF MONUMENT = 1.06 FT
- DRILLERS UNLOAD 100 FT 1¼" PVC SOLID PIPE
& 100 FT ¾" PVC SOLID PIPE
TO BAIL & DEVELOP WELL.
08:25 - JOE TAKES W.L. MEASUREMENT AS
TO TOP OF STAINLESS CASING = 82.45 FT
- JOE TAKES DEPTH TO BOTTOM OF WELL
= SILT INSIDE WELL CASING AS
95.0 FT TO TOP OF STAINLESS CASING
TOTAL LENGTH OF CASING + SCREEN = 95.595
∴ 0.6 FT SILT IN BOTTOM OF WELL
08:30 - TOM & ERIN LOWER 1¼" PVC INTO WELL w/
CHECK VALVE IN BOTTOM.
- LOWER ¾" PIPE WITH ORIFICE / BAILER AT BOTTOM.
- ALL PIPE STEAM CLEANED THIS MORNING AT
MATHES OFFICE.

J.L. DARLING CORP TACOMA, WA 98421

J. V[illegible]

[illegible] 8-14-91	913-1178.200	SHO-CTY / [illegible]	Groundwater / [illegible]		PG 38 of 38
08:45	Begin Development				
	1st 5 Gal is Dirty!				
	1st Turbidity meas. is from 2nd 5 Gal & is				
	1' OFF THE 100 NTU scale!				
09:00	- Tom unpacks Hydrostar Pump -				
	Rods in 2, 5 + 10 FT Lengths.				
09:10	- Tom, [illegible] + Joe working together;				
	Development continues; looks Good.				
	Joe to Document Pump Install.				
09:10	- JSV off site				

[signature]

Golder Associates

HISTORY OF HOLE

Job No. 913-1178.200 Sheet 1 of 2

Geologist Joe SAMER Date 8/14/91 Boring No. Monitoring Well
Driller [redacted] Surface Elevation — Weather Sunny Temp. 70 °F
Contractor Mathes Drill Fluid — Depth — to —
Location Lake Goodwin, WA Type of Barrel — Casing Size — Core Size —

BEGINNING OF SHIFT	END OF SHIFT
Time 8:00 Depth of Hole 95.0	Time 2:30 Hrs. Productive 6 Hrs. Delayed .5
Depth to WL 82.45 Depth to Casing —	Depth of Hole 95.0 Depth of Casing — Depth to WL 82.45

7:45 Arrived on Site. Joe Samer, John Velemeis, Aaron and Tom.

8:15 Casing Settled .25 inch since last measurement. Preparing PVC tubing for bailing (development)
Water level Measurement = 82.45 feet
Depth of hole (inc. Silt) = 95.0
∴ .6 feet of Silt at bottom of hole Assuming bottom of well without silt is 95.6 feet down

8:30 begin Stringing down bailing device (PVC) (100) (50)
set up Turbidometer

8:45 bailing begins — Number of 5 Gallons Buckets

Turbidity	Sample	Cumulative Gallons
Approximately 100 ntu	1	(7.5 gallons)
>100 ntu	2	(22.5 gallons)
>100 NTU	3	(100.5 gallons)
>100 NTU	4	(150 gallons)
>100 NTU	5	(135 gallons)
55 ~~NTU~~	6	(195 gals)
35 NTU	7	(225 gals)
35 NTU	8	(275 gals)
35 NTU	9	(300 gals)
35 NTU	10	(325 gals)

John Velemeis departs @ approx 9:15.

Volume of Standing Casing = .3 ft³ = 2.25 gallons

10:45 We did not have any appreciable change in Clarity in the Last three turbidity Measurements and at ≈ 20 gals per well volume, we have removed 15 well volumes. Stop pumping now and take a water level measurement.

11:00 Bailing pump is removed and a water level measurement taken.

11:30 Depth to water = 82.5 feet @ 11:30
Now the Drillers are laying out the gear for the Hydrostar pump.

11:35 I took a depth of hole measurement.
Depth to bottom of well = 94.95 feet @ 1135

11:35 Break for lunch.

Checked by:

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Golder Associates

HISTORY OF HOLE

Job No. 913-1178.200 Sheet 2 of 2

Geologist Joe Sawyer Date 8/14/91 Boring No. Monitoring Well
Driller _____ Surface Elevation _____ Weather _____ Temp. _____ °F
Contractor Mathes Drill Fluid — Depth — to —
Location Lake Goodwin, WA Type of Barrel _____ Casing Size — Core Size —

BEGINNING OF SHIFT	END OF SHIFT
Time 8:00 Depth of Hole 95.0	Time 2:30 Hrs. Productive 5.5 Hrs. Delayed .5
Depth to WL 92.45 Depth to Casing —	Depth of Hole — Depth of Casing — Depth to WL —

12:00 back to work.
12:15 water level = 92.45 feet
beginning to lower in Pump.

the bubbler tube is located 2.5 feet from bottom End of pump.

Pump and Rod Down Hole @ 12:26	(12.4)	12.4
Rod and Coupler attached	(10.2)	10.2-.2
Rod and Coupler attached	(10.2)	10.2-.2
Rod and coupler attached	(10.2)	10.2-.2
Rod and Coupler attached	(10.2)	10.2-.2
Rod and Coupler attached	(10.2)	10.2-.2
Rod and Coupler attached	(10.2)	10.2-.2
Rod and Coupler attached	(10.2)	10.2-.2
6.095' Rod Attached	(6.095)	6.095-.2
1:50 Rod Assembly Attached	(5.45)	5.45-.2
		Total = 93.545

Now we are installing the pump head seal.
Note: Can't install the pump head motor attachment until the cavity brings out the fitting.
Also, I checked with the driller and Aaron has a key. #214.

I attempted to pump water out by hand. Pumping became increasingly heavy until I could no longer pump.
Finished cleaning up and prepared to leave.
I tried one more time to pump the well. Some water trickled out the fitting when the clear tube came in. It was evident that the pump was working but I was not strong enough to get water out.
Drillers departed and I left the site at 2:30.

Checked by:

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