

PREPARED FOR: Mercury Marine
PREPARED BY: Laura Peterson/CH2M HILL
DATE: March 29, 1993
SUBJECT: Former Mercury Marine Plant No. 1 Site Investigation
Soil Boring, Well Installation, and Soil Sampling
PROJECT: GLO33316.A0.00

Introduction

This technical memorandum summarizes the soil boring, well installation, and soil sampling procedures used during the site investigation at the former Mercury Marine Plant No. 1 in Cedarburg, Wisconsin. Work commenced on January 13, 1993, and was completed on January 27, 1993.

Drilling services were provided by Layne-Northwest Co. of Pewaukee, Wisconsin. Analytical services were provided by Precision Analytical Laboratory (PAL) of Milwaukee, Wisconsin.

Personnel

The personnel onsite to perform the groundwater and soil sampling and to oversee the soil borings are listed below.

Team Member	Responsibilities
Laura Peterson	Project Hydrogeologist, Site Safety Coordinator
Aaron Petri	Sample Team Member, Surveying
Jeff Lamont	Sample Team Member, Logging Rock Cores
Dan Chatfield	Surveying

Soil Borings

Twelve borings were drilled to provide stratigraphic and hydrogeologic information as well as physical and chemical soil characteristics. The borings were advanced to bedrock using 4.25-inch hollow stem augers and were continuously sampled at 2-foot intervals

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using 3-inch split spoon samplers. Soil samples were logged by the onsite CH2M HILL hydrogeologist. A USCS field classification was recorded for each soil type observed. Soil properties such as relative moisture content, color, density or consistency, soil structure, and mineralogy were also recorded. Copies of the soil boring logs are in Attachment 1. Cuttings were placed in U.S. DOT-approved 55-gallon drums. Each drum was marked with its borehole location and moved to a central location onsite pending disposal.

Soil samples were collected for chemical analyses from boring MSB8, MSB9, MSB10, MSB11, and MSB12 (see Figure 2-1). A 3-inch split-spoon sampler was driven at 2-foot intervals. Immediately after the spoon was opened, the soil sample was screened for VOCs using an HNu photoionization detector. At least one soil sample was collected from each stratigraphic unit present in the unconsolidated formation. Two 4-ounce VOA jars were filled first, followed by two 4-ounce jars for TOC analysis. The filled jars were placed on ice in a cooler pending delivery to the laboratory. Soil samples were submitted for VOC and TOC analyses based on field screening results or visual appearance. Samples not submitted for analyses were disposed of in a 55-gallon drum. Table TM1-1 lists the soil samples submitted for chemical analyses. VOC analyses was done using the U.S. EPA's SW-846 method SW-8241.

The stainless steel sampling trowel was decontaminated after each sample's collection using a TSP and water solution followed by a 10-percent methanol and water rinse and a final distilled water rinse. The rinsate was collected and stored in 55-gallon drums pending disposal.

For those boreholes not chemically sampled, HNu screenings were done on the split-spoon sample immediately following opening of the spoon. Readings were recorded on the soil boring logs.

The work plan stated that four soil samples would be collected from borings inside the building for physical characterization and that samples from the clay would be collected using Shelby tube samplers. Because of the stiff, often gravelly till encountered in the subsurface and the size of the electric rig used for drilling, it was not possible to push a Shelby tube to collect soil samples for physical analyses. However, a total of three Shelby tube samples were obtained from two borings (MSB7 and MSB11) just outside of the west side of the building. Soil samples were immediately sealed in the tubes using sealing wax provided by the drilling contractor. Physical samples were submitted to PAL for grain size, moisture content, and porosity analyses. The boring location and depth interval of the samples submitted are listed in Table TM1-1.

Table TM1-1
Soil Samples Collected for Physical and Chemical Analysis
Mercury Marine Plant No. 1
Cedarburg, Wisconsin

Boring No.	Depth, ft.	Soil	Date	Parameters
MSB07	3 to 5	Clayey Silt	1/22/93	Grain Size, Porosity, % Moisture
	5 to 6	Clay	1/22/93	VOC, TOC
	6 to 7	Clay	1/22/93	VOC, TOC
	7 to 9	Gravelly Sand	1/22/93	VOC, TOC
	9 to 11	Sandy Silt	1/22/93	Grain Size, Porosity, % Moisture
MSB08	8 to 10	Clay	1/20/93	VOC, TOC
	10 to 12	Clay	1/20/93	VOC, TOC
MSB09	3 to 5	Clay/Fine Sand	1/21/93	VOC, TOC
	9 to 11	Gravelly Sand	1/21/93	VOC, TOC
MSB10	1 to 3	Clayey Sand/Clay	1/22/93	VOC, TOC
	3 to 5	Clay	1/22/93	VOC, TOC
	9 to 11	Well-Graded Sand	1/22/93	VOC, TOC
MSB11	1 to 3	Clay/Silty Sand	1/25/93	VOC, TOC
	3 to 5	Sandy Silt	1/25/93	Grain Size, Porosity, % Moisture
	5 to 7	Silty Clay/Silty Sand	1/25/93	VOC, TOC
	9 to 11	Silty Clay	1/25/93	VOC, TOC
	13 to 15	Sandy Gravel	1/25/93	VOC, TOC

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Mercury Marine Plant No. 1
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	5 to 6	Clay	1/22/93	VOC, TOC
	6 to 7	Clay	1/22/93	VOC, TOC
	7 to 9	Gravelly Sand	1/22/93	VOC, TOC
	9 to 11	Sandy Silt	1/22/93	Grain Size, Porosity, % Moisture
MSB08	8 to 10	Clay	1/20/93	VOC, TOC
	10 to 12	Clay	1/20/93	VOC, TOC
MSB09	3 to 5	Clay/Fine Sand	1/21/93	VOC, TOC
	9 to 11	Gravelly Sand	1/21/93	VOC, TOC
MSB10	1 to 3	Clayey Sand/Clay	1/22/93	VOC, TOC
	3 to 5	Clay	1/22/93	VOC, TOC
	9 to 11	Well-Graded Sand	1/22/93	VOC, TOC
MSB11	1 to 3	Clay/Silty Sand	1/25/93	VOC, TOC
	3 to 5	Sandy Silt	1/25/93	Grain Size, Porosity, % Moisture
	5 to 7	Silty Clay/Silty Sand	1/25/93	VOC, TOC
	9 to 11	Silty Clay	1/25/93	VOC, TOC
	13 to 15	Sandy Gravel	1/25/93	VOC, TOC

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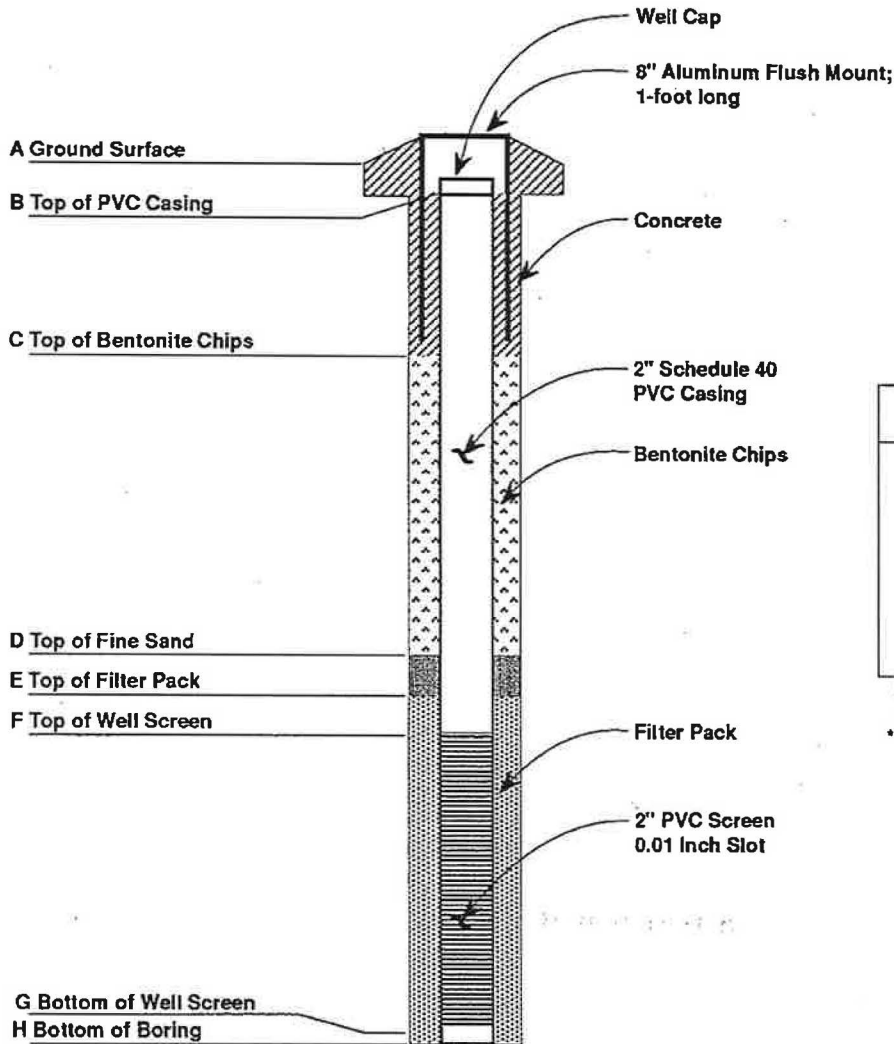
In 4 of the 12 borings, drilling continued 10 feet into competent bedrock using air rotary drilling methods. A 10-foot long rock core was obtained from the bedrock surface at borings MSB7, MSB10, and MSB11. At boring MSB6, rock cores were collected from 20 to 60 feet below grade. A 1.78-inch core barrel was used to obtain the cores. Each core was placed in a core box labeled with the site name, borehole location, sample interval, and date. The cores were logged by a CH2M HILL hydrogeologist. Copies of the rock core logs are included in Attachment 1.

For borings in which monitoring wells were not installed, the borehole was abandoned using either bentonite chips or bentonite-cement grout. Bentonite-cement grout was used to abandon the borings inside the plant building.

Monitoring Well Installation

Five monitoring wells were installed to provide information about the groundwater flow direction in both the glacial till and bedrock. The wells were constructed with 2-inch Schedule 40 PVC riser and 0.010-inch factory-slotted screen. Wells MW-1, MW-3, and MW-5 were fitted with 5-foot screens and MW-4 with a 10-foot screen. The bedrock well, MW-2, was fitted with a 15-foot screen. The riser pipes and screens were steam cleaned before use. Following screen and riser installation, a medium-grained sand pack was placed in the annulus of the borehole to a height of about 2 feet above the top of the screen. A 2-foot layer of fine-grained silica sand was placed above the filter pack. For the wells screened in the unconsolidated formation, bentonite chips were placed above the sand pack to a height of about 4 feet below the ground surface. For the bedrock well, a 5-foot layer of chips were placed above the fine sand. The remainder of the annulus was filled with bentonite slurry to about 4 feet below grade. The wells were completed with a concrete surface seal and 1-foot-long aluminum flush mounts. A locking, expanding well cap was placed on the riser pipes. The completed well was developed using a bailer to surge and purge the well.

Monitoring well construction details are shown in Figure TM1-1. Monitoring well construction and development forms were completed for each well and submitted to the Wisconsin DNR per Chapter NR 141 of the Wisconsin Administrative Code. Copies of those forms are in Attachment 2.



Monitoring Well	A	B	C	D	E	F	G	H
MW-1	787.37	787.02	783.37	781.37	779.37	777.37	772.37	772.37
MW-2*	786.52	786.27	750.52	745.52	743.52	741.52	726.52	726.52
MW-3	799.58	799.18	795.58	773.58	771.58	769.58	764.58	755.58
MW-4	786.06	785.84	783.56	783.06	782.06	781.06	771.06	758.06
MW-5	793.43	793.20	789.43	781.93	780.93	778.93	773.93	773.93

Elevations are in feet and are referenced to MSL.

*For MW-2, bentonite slurry was used to fill the annulus from 750.52 feet to 782.52 feet.

GL03316-A0.00 Const. Detail 2-22-93 [m]

FIGURE TM1-1
Monitoring Well
Construction Details
 Former Mercury Marine Plant No. 1
 Cedarburg, Wisconsin



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Health and Safety

Drilling, groundwater grab sampling, and soil sampling were performed in Level D personal health and safety protection. CH2M HILL personnel were responsible for ambient air monitoring during drilling and sampling activities and for enforcing the provisions outlined in CH2M HILL's Health and Safety Plan. Ambient air monitoring was conducted using either an HNu photoionizer or an OVA. There were no positive readings for ambient air throughout the field investigation. The HNu and OVA were calibrated at the start of each day.

Surveying

The soil borings and monitoring wells were located by CH2M HILL personnel. Horizontal locations were surveyed to the nearest 0.1 foot. Ground elevations for the borings and the top of well casings were surveyed to the nearest 0.01 foot. The horizontal and vertical locations for the borings and wells are listed in Table TM1-2.

Table TM1-2 Survey Results Mercury Marine Plant No. 1 Cedarburg, Wisconsin			
Boring No.	X-Coord.	Y-Coord.	Elevation
MSB01	2,535,313	477,928	785.42
MSB02	2,535,376	477,714	787.37
MSB03	2,535,671	477,464	786.42
MSB04	2,535,680	477,296	786.64
MSB05	2,535,484	477,005	799.58
MSB06	2,535,677	477,317	786.52
MSB07	2,535,312	477,586	787.28
MSB08	2,535,307	477,443	786.38
MSB09	2,535,300	477,587	786.49
MSB10	2,535,305	477,719	788.57
MSB11	2,535,318	477,433	786.06
MSB12	2,535,210	477,680	793.43

Note: X and Y coordinates are based on Wisconsin state plane coordinate system grid, South Zone

Elevations are in feet and are referenced to mean sea level, 1929 Adjustment

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Documentation

Field measurements and descriptions made during the field work were recorded in the field log book (see Attachment 3).

Chain-of-custody forms (see Attachment 4) were kept from the point of sample origin to delivery to the laboratory. Specific laboratory chain-of-custody procedures as described in Section 5 of the Quality Assurance Project Plan were followed with the exception that the laboratory's own chain-of-custody form was used. In addition, the sample coolers were not locked and sealed because either the courier from the laboratory picked up the samples at the site, or the samples were delivered directly to the lab by a CH2M HILL team member.

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PREPARED FOR: Mercury Marine
PREPARED BY: Laura Peterson/CH2M HILL
DATE: March 26, 1993
SUBJECT: Former Mercury Marine Plant No. 1 Site Investigation
Groundwater Grab Sampling
PROJECT: GLO33316.A0.00

Introduction

This technical memorandum summarizes the procedures and field measurements taken during groundwater grab sampling at the former Mercury Marine Plant No. 1 in Cedarburg, Wisconsin. Work commenced on January 13, 1993, and was completed on January 27, 1993. Analytical services were provided by Precision Analytical Laboratory (PAL) of Milwaukee, Wisconsin. Water level measurement activities are also documented in this memorandum.

Personnel

The personnel onsite to perform the groundwater sampling are listed below.

Team Member	Responsibilities
Laura Peterson	Project Hydrogeologist, Site Safety Coordinator
Aaron Petri	Sample Team Member
Jeff Lamont	Sample Team Member and Hydrogeologist

Field Work Activities

Soil Boring

Groundwater grab samples were collected from the glacial till at borings MSB2, MSB5, MSB7, MSB9, MSB11, and MSB12. Grab samples were also collected from the dolomite at borings MSB6, MSB7, MSB10, and MSB11. After a boring was advanced to the top of bedrock, the augers were pulled back about 3 feet and a PVC screen and riser were dropped down inside the augers to the bottom of the borehole. Where drilling

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continued into the dolomite, the water sample was collected from within the borehole casing.

Water Level Measurement

Before sampling, water levels were measured with an electronic water level indicator to the nearest 0.01 foot from the northernmost point of the well riser. Water level measurements were also made from the monitoring wells during both the site investigation and the pump test. The measurements are listed in Table TM2-1.

Well Purging

After measuring the water level, the depth to the bottom of each borehole was sounded with the water level indicator to determine the total depth of the well. The volume of water in the casing was calculated using the equation

$$V_{\text{gal}} = 7.48\pi r^2 h$$

where:

h = height of the water column in feet

r = radius of the well in feet

A stainless steel bailer was used to purge at least three well volumes. Boreholes went dry after a limited amount of purging were allowed to recover before sampling began. Purge water was collected in 5-gallon buckets and emptied into 55-gallon drums at a central plant location pending disposal.

Sample Collection

After purging the well, water samples were collected with a stainless steel bailer. Samples for VOC analysis were collected first. The sample bottles were labeled with the sample designation and the date and time of collection. The filled bottles were placed in a cooler on ice pending shipment to the laboratory. Samples were submitted to PAL for analysis of VOCs, alkalinity, hardness, TOC, COD, and iron. The CH2M HILL hydrogeologist documented sample collection activities in the field log book, a copy of which is in Attachment 3.

**Table TM2-1
Groundwater Elevations
Mercury Marine Plant No. 1
Cedarburg, Wisconsin**

Well No.	X-Coord.	Y-Coord.	TOC Elevation	Groundwater Elevation									
				2/2/93	2/9/93	2/10/93	2/15/93	2/18/93	2/24/93	2/24/93	2/25/93	2/26/93	3/3/93
MW-1	5376.33	7713.70	787.02	776.84	776.81	776.78	776.72	776.76	776.56	776.59	--	--	776.50
MW-2	5677.22	7317.34	786.27	766.04	766.08	766.02	766.06	--	765.84	765.84	765.87	765.82	765.83
MW-3	5483.59	7004.67	799.18	766.72	766.78	766.95	--	--	--	--	--	--	766.75
MW-4	5317.50	7432.94	785.84	775.82	775.44	775.73	775.67	775.63	--	--	--	775.50	775.49
MW-5	5209.60	7679.82	793.20	777.43	777.39	777.95	--	--	777.13	777.28	777.26	777.12	777.07
MW-6	5307.01	7600.86	787.19	776.87	776.84	776.79	776.71	776.69	776.59	776.59	776.58	776.58	776.54
P-6	5307.87	7590.98	787.16	753.54	753.63	753.77	754.26	754.06	754.44	754.05	753.57	753.92	752.84

Note: Units are in feet.
Elevations referenced to mean sea level.
TOC = Top of Casing.
-- indicates water level not measured.

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Decontamination Procedures

The bailers were decontaminated between sampling locations. Bailers were washed with a TSP and tap water mixture followed by a distilled water rinse, 10 percent methanol rinse, and a final distilled water rinse.

Chain of Custody

Chain-of-custody forms (Attachment 4) were kept from the point of sample origin to delivery to the laboratory. Specific laboratory chain-of-custody procedures as described in Section 5 of the Quality Assurance Project Plan were followed with the exception that the laboratory's own chain-of-custody form was used. In addition, the sample coolers were not locked and sealed because either the courier from the lab picked up the samples at the site, or the samples were delivered directly to the lab by a CH2M HILL team member.

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ATTACHMENT 1
SOIL BORING AND ROCK CORE LOGS

10011AA6 GLO-3



PROJECT NUMBER GLO33316.A000	BORING NUMBER (MW-1) MSB2 SHEET 1 OF 1
SOIL BORING LOG	

PROJECT Mercury Marine Plant No. 1 LOCATION In front of garage door "K"
 ELEVATION _____ DRILLING CONTRACTOR Layne-NW
 DRILLING METHOD AND EQUIPMENT Brat-22R
 WATER LEVELS _____ START 1/13/93 FINISH 1/13/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
1					Asphalt. Sandy Gravel Fill.	OVA BG = Oppm Begin drilling @ 1349
3	1-3		1		Silty Clay (CL). DK brown-Black. moist stiff. Some clay.	OVA = BG
5	3-5		1		2'6" Silty Sand (SM). Lt. Brown. Moist. med. Dense. Some black clay. Same (SM). Dense. Trace fine gravel. Some orange mottling. Trace rock fragments	OVA = BG
7	5-7		2		Same (SM). Some black clay. Somewhat more clayey than above. Some gravel. Some larger gravel (2-in ϕ) in bottom 8".	OVA = BG
9	7-9		2		Clayey SILT (CL-ML). Brown. Moist. Very dense. Some fine sand. Some rounded gravel.	OVA = BG
11	9-11		0.8		Same as above (CL-ML).	OVA = BG OVA breathing zone = BG t=1435
13	11-13		0.9		Silty, well-graded SAND (SW). Brown. Wet. Med. dense. Some gravel.	OVA = BG $\frac{17}{2}$
15	13-15		1.4		Clayey, well-graded SAND (). Brown. Wet. Some silt and gravel. Dense. Some gravel angular. 14'4" Silty CLAY (ML-CL). Lt gray. Moist. Hard. Some sand and gravel.	OVA = BG Hit rock @ 15.5'



PROJECT NUMBER GL033316 A & B	BORING NUMBER MSB3	SHEET 1	OF 1
SOIL BORING LOG			

PROJECT Mercury Marine Plant No 1 LOCATION East of bldg near Door # 4
 ELEVATION _____ DRILLING CONTRACTOR Layne - NW
 DRILLING METHOD AND EQUIPMENT Brat-22R, 4.25" HSA, 3" split spoon
 WATER LEVELS _____ START 1/14/93 FINISH 1/14/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
1					Asphalt. Sand & Gravel Fill (GW)	H _{Nu} BG = 0.25 ppm Begin. boring @ 0931.
1-3		1.5			Sandy gravel (GW). Black & brown. Moist. Some silt. Trace asphalt Trace clay. 2'	H _{Nu} = BG H _{Nu} breathing zone = BG
3					Poorly-graded fine silty Sand (SP-sm) Brown. Slightly moist med. dense.	
3-5		1.8			Same (SP). Grading to a silt with some clay. 3'6" Clayey SILT (ML). Brown. Moist Dense Trace fine sand. Trace orange mottling	H _{Nu} deflected slightly above BG.
5					Clayey silt (ML-CL). Somewhat more Clayey than above Brown. Moist. Dense. Some fine sand Trace gravel Rock fragments 4" from tip.	H _{Nu} = BG
7					Same (ML-CL). More moist than above Some fine sand seams.	H _{Nu} = BG
9					Poorly-graded, fine, silty sand (SM-SP) 3'10" Brown. Moist loose.	H _{Nu} = BG.
9-11		1.8			Clayey SILT (ML-CL) Brown. Moist. Dense. Trace gravel. Fine sand seams Rock fragment about 1" from tip	
11					3 inch sand lens at tip. Clayey silt 10'6" in spoon tip. EOB @ 10.5' t = 1040	Hit bedrock @ 10.5' No water.



PROJECT NUMBER GLO 33316. A.P. ØØ	BORING NUMBER (MW-2) MSB4 + MSB6 SHEET 1 OF 1
SOIL BORING LOG	

PROJECT Mercury Marine Plant No. 1 LOCATION East of bldg. near dock
 ELEVATION _____ DRILLING CONTRACTOR Layne-NW
 DRILLING METHOD AND EQUIPMENT Brat-22R, 4.25" HSA, 3" split spoon
 WATER LEVELS _____ START 1/14/93 FINISH 1/14/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
1	Blind Drilled				Silty sand and gravel fill. Fine roots in upper 2 inches.	H _{Nu} BG = 0.25 ppm Start drilling @ 1150
1-3			1.3		Clayey SILT (CL-ML). Brown. slightly moist. Very dense. Trace gravel. Some fine sand. Much orange mottling.	H _{Nu} = BG
3-5			1.5		SILT (ML). Brown. Slightly moist. Very dense. Some fine sand. Trace clay and gravel. Some fine sand seams. Much rust mottling.	H _{Nu} = BG
5-7			0.3		Clayey silt (ML-CL). Brown. moist. Dense. Some fine sand. Trace gravel. Fine rock fragments in tip.	Couldnt drive spoon past 6 1/2' Hit rock. Rock fragments in cuttings from 5-7 ft.
7-9			0		Some clayey silt in tip of spoon. Rock fragments in tip	
9-11			1		Silty, very fine, poorly-graded sand (SM-SPT). Brown moist loose. Trace rock fragments 9 1/4" Clayey SILT (CL-ML). Brown. Moist Very dense. Some sand seams. Trace orange mottling. Bottom 3" sandier.	H _{Nu} = BG
11-13			0.3		Clayey Sand (SC). Brown. Very moist. Med. dense. Some gravel. Sand is coarser than above.	H _{Nu} = BG
13-15			0.7		Clayey Silt (CL-ML). Brown. Very moist. Dense. Clayier than above. Trace gravel. Some fine sand seams	H _{Nu} = BG



PROJECT NUMBER GLO33316.A7.00	BORING NUMBER MSB5 (mw-3) SHEET 1 OF 3
SOIL BORING LOG	

PROJECT Mercury Marine Plant No. 1 LOCATION South Parking lot
 ELEVATION _____ DRILLING CONTRACTOR Layne-NW
 DRILLING METHOD AND EQUIPMENT Beat. 22R; 4.25" HSA; 3" split spoon
 WATER LEVELS _____ START 1/14/93 FINISH 1/15/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
1					Asphalt Silty, sandy, clayey gravel fill.	H ₂ O BG = 0.25 ppm Start drilling @ 1500
3	1-3		1-3		Clayey silt (CL-ML). Brown. Moist. Hard. Some fine sand.	H ₂ O = BG
5	3-5		1.1		Same (CL-ML). Lower 6" softer. Trace gravel.	H ₂ O = BG
7	5-7		1.2		Same (CL-ML). Trace orange mottling. Bottom 8" is a lighter brown than above. Trace small gravel.	H ₂ O = BG
9	7-9		1.4		Clayey silt (CL-ML). Brown. Slightly moist very dense. Some fine sand. Trace gravel. Some orange mottling.	H ₂ O = BG
11	9-11		1.5		Same (CL-ML). Not as clayey as above. One fine sand seam fracture.	H ₂ O = BG
13	11-13		2		Same (CL-ML). Some 1 1/2" gravel. Some orange mottling. Dense.	H ₂ O = BG
15	13-15		2		Same (CL-ML). Very dense. Rock fragment 1' from bottom.	H ₂ O = BG



PROJECT NUMBER	BORING NUMBER MS B5	SHEET 2 OF 3
SOIL BORING LOG		

PROJECT _____ LOCATION South Parking Lot
 ELEVATION _____ DRILLING CONTRACTOR _____
 DRILLING METHOD AND EQUIPMENT _____
 WATER LEVELS _____ START 1/14/93 FINISH 1/15/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6" x 6" x 6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
17	15-17		0		Rock and clayey silt in tip	
19	17-19		0.8		Same (CL-ML). Some rock fragments.	H _{Nu} = BG
21	19-21		1.8		Same (CL-ML). Dense. Some gravel and rocks.	H _{Nu} = BG
23	21-23		2		Same (CL-ML) silty clay (CL). Gray. Moist. 2.2' stiff. Trace gravel.	Stop drilling @ 1655
25	23-25		0.3		Silty Clay (CL). Brown. Wet. Soft. Trace gravel. Some fine sand.	Begin drilling @ 0720 on 1/15 H _{Nu} BG = 0.3 ppm
27	25-27		0.3		Same (CL). Wet 2" fine-medium clayey sand lense in tip.	
29	27-29		1.5		Same (CL). Clayey sand and rock fragments in tip	H _{Nu} = BG
29	29-3		0.7		Same (CL). 4" sandy gravel in tip. Brown. Dry loose.	H _{Nu} = BG



PROJECT NUMBER

BORING NUMBER

MSB5

SHEET

3

OF 3

SOIL BORING LOG

PROJECT

LOCATION South Parking Lot

ELEVATION

DRILLING CONTRACTOR

DRILLING METHOD AND EQUIPMENT

WATER LEVELS

START 1/14/93

FINISH 1/15/93

LOGGER L Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
31	31-33		1.1		Same (). Two inches of orange mottling about 6" from tip (right above fine sand). 32'6"	H ₂ O = BG
33					Fine, poorly-graded sand (SP). Brown. moist. loose. Some silt.	
	33-35		1.1		Same (SM-SP). Wet. Trace small rounded gravel.	H ₂ O deflected slightly Ya ppm.
35	35-37		1.2		Clayey sand (SC). Wet. Some gravel. 36'	H ₂ O = BG
37	37-39		0.7		Silty Clay (CL). Gray-brown. Moist. Hard. Trace sand and gravel. Some rock fragments.	H ₂ O = BG
39	39-41		0		Same (CL). Rock 6" from tip.	No Recovery. Spoon probably pushing rock.
41	41-43		0		No Recovery.	Rock in tip. cuttings are the silty clay.
43	43-45		0.3		Silty clay (CL). Same as above. Weathered bedrock in bottom inch. Sandy rock fragments. Lt. brown. EOB @ 44'	EOB @ 1015 AM
45						



PROJECT NUMBER G-033316 A & B	BORING NUMBER MSB7	SHEET 1 OF 2
SOIL BORING LOG		

PROJECT Mercury Marine Plant No. 1 LOCATION West of bldg.
 ELEVATION _____ DRILLING CONTRACTOR Layne - NW
 DRILLING METHOD AND EQUIPMENT Brat. 22R, 4.25" HSA, 3" split-spoon
 WATER LEVELS _____ START 1/22/93 FINISH 1/22/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
1					Asphalt Concrete	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION H _{Nu} BG = 0.4 ppm start boring @ 0808
3	1-3		1.8		Gravelly sand (sw). Black & Brown. Moist. Loose. Black cinders throughout. Clay (CL). Brown & Lt. gray. Moist medium. Some silt. Trace fine gravel. Much orange mottling.	H _{Nu} = BG
3	3-5				Pushed Shelby Tube.	Same silty clay in tip of Shelby Tube.
5	5-7		2		Clay (CL). Lt. Gray. Moist. Soft. Some black discoloration. Trace orange mottling.	(Oily odor from 5-6') H _{Nu} deflected slightly (0.1 ppm)
7	7-9		1		Silty Clay (CL). Brown & Lt. gray. Moist. Medium. Trace fine gravel. More gravelly in lower 4 inches.	Two fractures in lower foot. (Some fine-med. grained sand in fractures & slight discoloration greenish black)
9	9-11				Well-graded gravelly sand (SW). Orangish-brown. Moist. Loose	H _{Nu} = BG
9	9-11				Pushed Shelby Tube	
11	11-13		0.5		Same (SW). Lower 4" wet	H _{Nu} = BG ∇ Getting into weathered rock.
13	13-15		0.8		Silty Clay (CL). Gray. Moist. Very stiff. Much gravel, large dolomite fragments.	In weathered bedrock. Tough drilling.
15						



PROJECT NUMBER GL033316-A0.00	BORING NUMBER MSB7	SHEET 2 OF 2
SOIL BORING LOG		

PROJECT Mercury Marine Plant No. 1 LOCATION west side of bldg
 ELEVATION _____ DRILLING CONTRACTOR _____
 DRILLING METHOD AND EQUIPMENT _____
 WATER LEVELS _____ START 1/22/93 FINISH 1/22/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
	15-16		0.3		Sandy, silty clay (CL). Gray. Wet. Soft. Much gravel. 2-inch rock 16'	Met refusal @ 16'
					EOB	Will collect 10' rock core. Reamed down thru weathered bedrock to 18'. Will try to core from 18-28'.



PROJECT NUMBER GL033316-Aφ.φφ	BORING NUMBER MSB8	SHEET 1 OF 1
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SOIL BORING LOG

PROJECT Mercury Marine Plant No.1 LOCATION Inside bldg @ south end
 ELEVATION _____ DRILLING CONTRACTOR Layne-Nw
 DRILLING METHOD AND EQUIPMENT Simco Electric Rig, 4.25" HSA, 3" split-spoon
 WATER LEVELS _____ START 1/20/93 FINISH 1/20/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
1					Concrete Gravel Concrete	H _{Nu} BG = 0.35 ppm Abandoned pit
2					Sand + gravel fill	2'3"
3	2-4	1			Very fine silty sand (SP-SM). Brown. Moist. Med. dense. Large rock 8" from tip.	H _{Nu} = BG Collect soil sample 2-4'
4						
5	4-6	0.8			Silty Clay (CL). Brown. Moist. Stiff. Some fine sand. Trace gravel. Some rust mottling.	H _{Nu} = BG Collect soil sample 4-6'
6						
7	6-8	2			Silty Clay (CL). Brown. Moist. Stiff. Some sand. Much gravel. Trace rust mottling. About 1 ft from tip some sand discolored - greenish black	H _{Nu} = BG
8						
9	8-10	1.3			Same (CL). Some greenish-black sand about 8" from tip where there was a fracture. Some rock fragments in lower 6".	H _{Nu} of sand fracture = 3ppm Collect soil sample 8-10' Driller says it feels like we're getting into weathered bedrock
10						
11	10-12	1.8			Silty Clay (CL). Gray-brown. Slightly moist. Very stiff. Some sand. Trace fine gravel. Two fractures in lower foot.	H _{Nu} = 2.6 ppm Collected soil sample from 10-12'
12						
13	12-13	1			Clay (CL). Dk. gray. Slightly moist. Hard. Some silt. Trace sand and fine gravel. Trace hair-line fractures.	H _{Nu} = 2 ppm Met resistance @ 13' 3". Weathered bedrock in spoon tip
14					EOB	



PROJECT NUMBER GLO 33316. A Ø Ø Ø	BORING NUMBER MSB9	SHEET 1 OF 1
SOIL BORING LOG		

PROJECT Mercury Marine Plant No. 1 LOCATION Inside Bldg - NW Corner
 ELEVATION _____ DRILLING CONTRACTOR Layne - NW
 DRILLING METHOD AND EQUIPMENT Simpeco Electric Rig, 4.25" HSA, 3" split-spoon
 WATER LEVELS _____ START 1/21/93 FINISH 1/21/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
1	(Blind drilled)				Concrete upper 7". Then 5" of Sandy, silty clay.	HNu BG = 0.35 ppm Start boring @ 1200
1-3			1.8		Silty, gravelly sand (sm-sw). Brown. Slightly moist Dense. Lower foot more silty. Trace rust mottling.	Slight deflection of needle on HNu (0.1 ppm) Encountering much resistance while augering from 1-3 Feet Collected sample from 1-3'
3-5			1.7		Silty clay (CL). Lt. brown. Moist. Medium, much sand. Trace small gravel. 4" Silty fine sand (sm-sp). Brown. Moist. Loose. Trace clay. 4'8"	Collected sample from 3-5' HNu = 0.3 ppm Slight discoloration of sand base Some sand greenish black
5-7			0		Silty clay (CL). Lt. brown. Moist. med. stiff. Trace fine gravel. No Recovery.	Hitting a lot of rocks.
7-9			1.2		Gravelly sand (sw). Brown. Dry. 7'11" Dolomite Rock, Lt. Gray 8'4"	Collected sample from 7-9' HNu = 0.4 ppm
9-11			1.2		Gravelly sand (sw). Brown. Dry. Loose. Some orange coloring. Same (sw). Very moist. Some 2" subangular gravel. One dolomite rock fragment at top. Some discolored sand (greenish-black).	Weathered bedrock in spoon tip HNu = 6 ppm Collected sample from 9-11' HNu of cuttings = 4 ppm
11					11'6" EOB	Resistance due to bedrock
13						



PROJECT NUMBER GLO33316-A0.00	BORING NUMBER MSB10	SHEET 1 OF 1
SOIL BORING LOG		

PROJECT Mercury Marine Plant No 1 LOCATION Outside Bldg - NW Corner
 ELEVATION _____ DRILLING CONTRACTOR Layne - NW
 DRILLING METHOD AND EQUIPMENT Brat. 22R, 4.25" HSA 3-inch split spoon
 WATER LEVELS _____ START 1/22/93 FINISH 1/22/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
1					Asphalt. Concrete. Sand + Gravel fill.	
1-3	1-3	2			Clayey sand + Gravel (GC). Blackish brown. Moist. Very stiff. Bits of coal. Some thin wires. Silty Clay (CL). Brown + Lt. gray. Moist. Stiff. Some bit of coal. A few thin wires.	At about 1 ft depth, some copper wires in cutting - HNU = BG Sample collected from 1-3'
3-5	3-5	2			Same (CL). Some black discoloration in upper foot. A 3" silty sand lense (med-coarse) about 4" from tip. Some greenish-black discoloration of sand.	Collected sample from 3-5' HNU = BG
5-7	5-7	1.7			Same (CL). 2-inch rocks 1' from tip. Drier than above. Trace coarse sand. Trace stones. Trace orange mottling.	HNU = BG.
7-9	7-9	2			Same (CL). Trace gravel.	HNU = BG
9-11	9-11	1			Well-graded sand + gravel (SW). Orange-brown. Moist. Loose. Rock fragments in spoon tip. Same (SW). Three dk. rust horizontal bands	HNU = BG Collected sample from 9-11'
11					Pushed Shelby Tube.	Only recovered about 4". Tip of tube bent up. Wet, sand + gravel (SW) in tip.
13	13-13.5	0				Hitting pretty competent bedrock at about 13.5 ft. Stop drilling @ 1610 Will rock core on Monday



PROJECT NUMBER GLO 33316.AP DP	BORING NUMBER MSB11 (MW-4) SHEET 1 OF 1
SOIL BORING LOG	

PROJECT Mercury Marine Plant No. 1 LOCATION SW Corner of bldg
 ELEVATION _____ DRILLING CONTRACTOR Layne - NW
 DRILLING METHOD AND EQUIPMENT Brat-22R, 4.25" HSA, 3-inch split-spoon
 WATER LEVELS _____ START 1/25/93 FINISH 1/25/93 LOGGER L Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
1					Asphalt - 6" Concrete - 6"	H _{Nu} BG = 0.3 ppm Start drilling @ 1352
3			1.5		Sandy, silty clay (CL). Brown-Black. Moist. Stiff. Much black ashes. Some 1/6" gravel. Very fine silty sand (SM-SP). Brown. Moist. Trace black cinders. Some gravel. Much gravel in tip.	H _{Nu} = BG Collected sample + depth from 1-3'
5					Pushed Shelby Tube	Silt and med-grained sand in tip.
7			1		Silty clay. Lt. Brown. Moist. Medium	5'6" Collected sample from 5-7'
9			1.6		Silty, med. grained sand (SM-SP). Brown. Wet. Loose. Some greenish-black discoloration. Silty clay (CL-ML). Lt. brown. Moist. Medium. Some gravel and rock fragments.	H _{Nu} = BG some green discoloration of sand
11			2		med-grained sand (SP). Brown. Wet. Loose. Trace gravel. Rocks in lower 3". Silty clay (CL). Upper foot very moist with much sand. Some sand green. Lower foot drier and siltier. Two horizontal fractures. Some gravel throughout.	H _{Nu} = BG Collected sample + MS-MSD from 9-11'
13					Pushed shalby tube	Tried pushing shalby Tube from 11-13'. No recovery. Just rock in tip.
15			1.1		Rock. Lt. tan. Very weathered. Sandy gravel (GW). Gray. Wet. Loose. Rock fragments. Some sand is green.	H _{Nu} = BG Collected sample from 13-15'
					15'	Resistance @ 15' L=1510



PROJECT NUMBER GL033316-Aφ.06	BORING NUMBER MSB12 (MW-5) SHEET 1 OF 2
SOIL BORING LOG	

PROJECT Mercury Marine Plant No. 1 LOCATION Near City well No. 3 (inside fence)
 ELEVATION _____ DRILLING CONTRACTOR Layne - NW
 DRILLING METHOD AND EQUIPMENT Brat. 22R, 4.25" HSA, 3-inch split spoon
 WATER LEVELS _____ START 1/26/93 FINISH 1/26/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
1					Topsoil	H _{Nu} BG = 0.25 ppm Start drilling @ 1333
1	1-3		1.5		Clayey SILT (ML). DK. brown. Moist. Very dense. Much fine sand. Some fine roots in upper 8". Lower 6" has some gravel. Some horizontal fractures.	H _{Nu} = BG
3	3-5		2		Silty Clay (CL). DK. brown - Black. Moist. Stiff. 3'6"	H _{Nu} = BG
3	3-5		2		Silty Clay (CL). Lt. brown. Slightly moist. Very stiff. Some gravel. Trace coarse sand. Trace orange mottling. Trace Lt. gray mottling.	About 8" from tip, some coarser black sand (green-black?) along side of sample.
5	5-7		1.5		Same CCL. A couple of 2" rocks in lower foot.	H _{Nu} = BG
7	7-9		1.7		Same CCL. 7'8"	H _{Nu} = BG
7	7-9		1.7		Silt (ML). Lt. Brown. Moist. Dense. 2" Coarse sand seam with gravel at lower end - very moist. 8'4"	2" rock about 1.1 ft. from tip
9	9-11		1.7		Silty Clay (CL). Lt. brown. Moist. Stiff. Much gravel. Some coarse sand.	
9	9-11		1.7		Same CCL. Slightly moist. Hard. Rock in tip. Much orange mottling. Some black speckles.	H _{Nu} = BG.
11	11-13		0.2		Clay (CL). Lt. Brown. Very moist. Medium. Some silt. Much gravel.	
13	13-15		2		Same (CL). Grades into a gray Clay. 13'6"	H _{Nu} = BG
13	13-15		2		Clay (CL). Gray. Dry. Hard. Some silt. A couple of hairline horizontal fractures.	
15						



PROJECT NUMBER	BORING NUMBER	SHEET	2	OF 2
	MSB12			
SOIL BORING LOG				

PROJECT _____ LOCATION Near city well no. 3 (inside fence)
 ELEVATION _____ DRILLING CONTRACTOR _____
 DRILLING METHOD AND EQUIPMENT _____
 WATER LEVELS _____ START 1/26/93 FINISH 1/26/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)			
	17	15-17				
17	17-19		1		Same (CL). Clay (CL). Gray. Moist. Very stiff. Some silt and sand. Much gravel. Some weathered rock fragments - (yellowish tan in color)	17'3" H _N = BG A well-graded sand seam about 8" from tip - WET
19	19-19.5		0.3		Sandy Clay (CL). Gray. Wet. Medium. Some gravel. Dolomite rocks in tip.	19.5' H _N = BG Met resistance @ 19.5' Stop drilling @ 14.55' EOB @ 19.5'



PROJECT NUMBER

GLO 33316.A0.00

BORING NUMBER (mw-a)

MSB6

SHEET 1 OF 3

ROCK CORE LOG

PROJECT Mercury Marine Plant No. 1 LOCATION East side of bldg.
 ELEVATION _____ DRILLING CONTRACTOR Layne - NW
 DRILLING METHOD AND EQUIPMENT Brat - 22 R, Air Rotary ORIENTATION _____
 WATER LEVEL AND DATE _____ START 1/19/93 FINISH 1/20/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES		GRAPHIC LOG	LITHOLOGY	COMMENTS	
		RQD (%)	FRACTURES PER FOOT				DESCRIPTION
							DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS
16					Unconsolidated, Gravel (up to 3" ϕ) Gray clay. Fine silty sands.		
17							
18							
19							
20							
21	10' / 10' = 100%	60			Dolomite. Lt. gray to Lt. tan. Fine-grained. Hard. Slightly weathered. Massive bedding.		
22			RQD = Fair. Fracturing - Vertical (0°) Jointing - 80° Some vugs - filled with calcite.				
23			Small solution cavities (up to 1/2" ϕ)				
24			Some secondary jointing at 90°.				
25			Jointing is moderately close (1-3 ft).				
26							
27							
28							
29							
30							



PROJECT NUMBER

GLD 33316-AD-00

BORING NUMBER

MSB6

SHEET 2 OF 3

ROCK CORE LOG

PROJECT Mercury Marine Plant No. 1 LOCATION _____

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____ ORIENTATION _____

WATER LEVEL AND DATE _____ START 1/19/93 FINISH 1/20/93 LOGGER _____

DEPTH BELOW SURFACE (FT)	CORE RUN LENGTH, AND RECOVERY (%)	ROD (%)	FRACTURES PER FOOT	DISCONTINUITIES		GRAPHIC LOG	LITHOLOGY	COMMENTS
				DESCRIPTION				
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			ROCK TYPE, COLOR, MINERALOGY, TEXTURE, WEATHERING, HARDNESS, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
31	10' 10'	80		RQD = Good Fracturing at 0° + 45°. One large solution cavity (1.5') @ 35' filled with calcite.			Dolomite - Lt. gray. Fine-grained. Hard. Massive bedding.	
32				Not as much FeOx staining, fracturing, jointing, or vugs as above.				
33								
34								
35								
36								
37								
38								
39								
40								
41	10' 10'	82		RQD = Good. Fractures nearly vertical. Little FeOx staining. Few vugs. Little to no solution cavities.			Dolomite - Lt. gray. Fine-grained. Hard. Slightly weathered. Massive bedding.	
42								
43				Some secondary jointing @ 90°.				
44				Joint spacing moderately close.				
45								



PROJECT NUMBER

GLO 33316-A0.00

BORING NUMBER

MSB6

SHEET

3 OF 3

ROCK CORE LOG

PROJECT Mercury Marine Plant No. 1 LOCATION _____

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____ ORIENTATION _____

WATER LEVEL AND DATE _____ START 1/19/93 FINISH 1/20/93 LOGGER _____

DEPTH BELOW SURFACE (FT)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES		GRAPHIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT			
46						
47						
48						
49						
50						
51	10/10	91				
52						
53						
54						
55						
56						
57						
58						
59						
60						

RQD = Excellent. No solution cavities increase. (up to 1" ϕ)
 Fracturing - 0°, 40°, 90°.
 Highly vesicular, more fractured than above.
 Joint spacing - close.
 much Fe Ox staining.

Dolomite. Lt. gray.
 Fine-grained Hard.
 Moderate weathering.
 Massive bedding.

EOB @ 60'



PROJECT NUMBER

GL0 33316-Aφ.φφ

BORING NUMBER

MSB7

SHEET 1 OF 1

ROCK CORE LOG

PROJECT Mercury Marine Plant No. 1 LOCATION West side of bldg.
 ELEVATION _____ DRILLING CONTRACTOR Layne - NW
 DRILLING METHOD AND EQUIPMENT Brat-22R, Air Rotary ORIENTATION _____
 WATER LEVEL AND DATE _____ START 1/22/93 FINISH 1/22/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	CORE RUN, LENGTH, AND RECOVERY (%)	R Q D (%)	FRACTURES PER FOOT	DISCONTINUITIES		GRAPHIC LOG	LITHOLOGY	COMMENTS
				DESCRIPTION				
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS				
19	10/10 =100%	50		RQD = Poor. Some solution cavities Fractures - 20°, 35°. Some secondary jointing @ 90°. Very little Fe Ox staining			Dolomite. Lt-gray. Slightly weathered/fresh. Fine-grained. Hard. Bedding Massive	
20								
21								
22								
23								
24								
25								
26								
27								
28								



PROJECT NUMBER GLO 33316-AD.00 BORING NUMBER MSB10 SHEET 1 OF 1

ROCK CORE LOG

PROJECT Mercury Marine Plant No. 1 LOCATION NW corner of bldg.
 ELEVATION _____ DRILLING CONTRACTOR Leys - NW
 DRILLING METHOD AND EQUIPMENT Brat-22R, Air Rotary ORIENTATION _____
 WATER LEVEL AND DATE _____ START 1/25/93 FINISH 1/25/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	CORE RUN, LENGTH, AND RECOVERY (%)	R O D (%)	FRACTURES PER FOOT	DISCONTINUITIES	GRAPHIC LOG	LITHOLOGY	COMMENTS
				DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, WEATHERING, HARDNESS, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
14.5	10% =100%	52		RQD = Fair Jointing - moderately close Fractures - 0° & 90° Some solution cavities. Somewhat vesicular. Some Fe Ox staining.		Dolomite, Lt-gray Fine-grained slightly weathered. Hard. Bedding - massive.	
15.5							
16.5							
17.5							
18.5							
19.5							
20.5							
21.5							
22.5							
23.5							



PROJECT NUMBER GL033316.A000	BORING NUMBER MSB11 (mw-4)	SHEET 1 OF 1
ROCK CORE LOG		

PROJECT Mercury Marine Plant No. 1 LOCATION SW corner of bldg.
 ELEVATION _____ DRILLING CONTRACTOR Layne - NW
 DRILLING METHOD AND EQUIPMENT Brat-22 R, Air Rotary ORIENTATION _____
 WATER LEVEL AND DATE _____ START 1/26/93 FINISH 1/26/93 LOGGER L. Peterson

DEPTH BELOW SURFACE (FT)	CORE RUN, LENGTH, AND RECOVERY (%)	ROD (%)	FRACTURES PER FOOT	DISCONTINUITIES		GRAPHIC LOG	LITHOLOGY	COMMENTS
				DESCRIPTION				
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS				
19	10' / 10' = 100%	57		RQD = Fair Fracturing - 0°, 90° A few vugs. Some FeOx staining.			Dolomite. Lt. gray. Fine grained Hard. Slightly weathered. Bedding Massive.	
20								
21								
22								
23								
24								
25								
26								
27								
28								

ATTACHMENT 2
MONITORING WELL CONSTRUCTION
DEVELOPMENT FORMS

Facility/Project Name <u>Mercury Marine</u>	Grid Location <u>477 714</u> ft. <input checked="" type="checkbox"/> N. <input type="checkbox"/> S.	Well Name <u>MW-1</u>
Facility License, Permit or Monitoring Number <u>2 535, 376</u>	<u>2 535, 376</u> ft. <input checked="" type="checkbox"/> E. <input type="checkbox"/> W.	Wis. Unique Well Number _____ DNR Well Number _____
Type of Well Water Table Observation Well <input checked="" type="checkbox"/> 11 Piezometer <input type="checkbox"/> 12	Section Location <u>NW 1/4 of SE 1/4 of Section 34</u>	Date Well Installed <u>01/13/93</u> m m . d d / y y
Distance Well Is From Waste/Source Boundary <u>unknown</u> ft.	T <u>10</u> N, R <u>21</u> <input checked="" type="checkbox"/> E <input type="checkbox"/> W	Well Installed By: (Person's Name and Firm) <u>Vince Meindel</u>
Is Well A Point of Enforcement Std. Application? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Location of Well Relative to Waste/Source <input type="checkbox"/> Upgradient <input type="checkbox"/> Sidegradient <input type="checkbox"/> Downgradient <input checked="" type="checkbox"/> Not Known	<u>Layne - Northwest</u>

A. Protective pipe, top elevation <u>787.37</u> ft. MSL	1. Cap and lock? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
B. Well casing, top elevation <u>782.02</u> ft. MSL	2. Protective cover pipe: <u>Flush Mount</u> a. Inside diameter: <u>8.0</u> in. b. Length: <u>1.0</u> ft. c. Material: Steel <input checked="" type="checkbox"/> 04 Other <input type="checkbox"/>
C. Land surface elevation <u>787.4</u> ft. MSL	d. Additional protection? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, describe: _____
D. Surface seal, bottom ft. MSL or <u>4.0</u> ft.	3. Surface seal: Bentonite <input type="checkbox"/> 30 Concrete <input checked="" type="checkbox"/> 01 Other <input type="checkbox"/>
2. USCS classification of soil near screen: <input type="checkbox"/> GP <input type="checkbox"/> GM <input type="checkbox"/> GC <input type="checkbox"/> GW <input checked="" type="checkbox"/> SW <input type="checkbox"/> SP <input type="checkbox"/> SM <input checked="" type="checkbox"/> SC <input type="checkbox"/> ML <input type="checkbox"/> MH <input checked="" type="checkbox"/> CL <input type="checkbox"/> CH <input type="checkbox"/> Bedrock	4. Material between well casing and protective pipe: Bentonite <input type="checkbox"/> 30 Annular space seal <input checked="" type="checkbox"/>
3. Sieve analysis attached? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	5. Annular space seal: <u>Chipped Granular Bentonite</u> <input checked="" type="checkbox"/> 33 ____ Lbs/gal mud weight ... Bentonite-sand slurry <input type="checkbox"/> 35 ____ Lbs/gal mud weight ... Bentonite slurry <input type="checkbox"/> 31 ____ % Bentonite ... Bentonite-cement grout <input type="checkbox"/> 50 <u>0.33</u> Ft ³ volume added for any of the above
14. Drilling method used: Rotary <input type="checkbox"/> 50 Hollow Stem Auger <input checked="" type="checkbox"/> 41 Other <input type="checkbox"/>	How installed: Tremie <input type="checkbox"/> 01 Tremie pumped <input type="checkbox"/> 02 Gravity <input checked="" type="checkbox"/> 08
15. Drilling fluid used: Water <input type="checkbox"/> 02 Air <input type="checkbox"/> 01 Drilling Mud <input type="checkbox"/> 03 None <input checked="" type="checkbox"/> 99	6. Bentonite seal: Bentonite granules <input type="checkbox"/> 33 <input type="checkbox"/> 1/4 in. <input type="checkbox"/> 3/8 in. <input type="checkbox"/> 1/2 in. Bentonite pellets <input type="checkbox"/> 32 <u>None</u> Other <input checked="" type="checkbox"/>
16. Drilling additives used? <input type="checkbox"/> Yes <input type="checkbox"/> No Describe _____	7. Fine sand material: Manufacturer, product name and mesh size <u>U.S. Silica; Fine sand; 0.2-0.3</u> Volume added <u>0.33</u> ft ³
17. Source of water (attach analysis): _____	8. Filter pack material: Manufacturer, product name and mesh size <u>American Materials; 0.35-0.45</u> Volume added <u>1.16</u> ft ³
Bentonite seal, top _____ ft. MSL or <u>NA</u> ft.	9. Well casing: Flush threaded PVC schedule 40 <input checked="" type="checkbox"/> 23 Flush threaded PVC schedule 80 <input type="checkbox"/> 24 Other <input type="checkbox"/>
Fine sand, top _____ ft. MSL or <u>6.0</u> ft.	10. Screen material: <u>same</u> Screen type: Factory cut <input checked="" type="checkbox"/> 11 Continuous slot <input type="checkbox"/> 01 Other <input type="checkbox"/>
Filter pack, top _____ ft. MSL or <u>8.0</u> ft.	Manufacturer <u>Monoflex</u> Slot size: <u>0.010</u> in. Slotted length: <u>5.0</u> ft.
Well screen, top _____ ft. MSL or <u>10.0</u> ft.	11. Backfill material (below filter pack): None <input checked="" type="checkbox"/> Other <input type="checkbox"/>
Well screen, bottom _____ ft. MSL or <u>15.0</u> ft.	
Filter pack, bottom _____ ft. MSL or <u>15.0</u> ft.	
Borehole, bottom _____ ft. MSL or <u>15.0</u> ft.	
Borehole, diameter <u>6.0</u> in.	
O.D. well casing <u>2.38</u> in.	
I.D. well casing <u>2.05</u> in.	

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Dawn Peterson Firm: CHAM HILL

Please complete and return both sides of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with 144, Wis. Stats., failure to file this form may result in a forfeiture of not less than \$10, nor more than \$5,000 for each day of violation. In accordance

Facility/Project Name <u>Mercury Marine</u>	Well Name <u>MW-1</u>
License, Permit or Monitoring Number _____	Wis. Unique Well Number: _____ DNR Well Number: _____

1. Can this well be purged dry? Yes No

2. Well development method
- surged with bailer and bailed 4 1
 - surged with bailer and pumped 6 1
 - surged with block and bailed 4 2
 - surged with block and pumped 6 2
 - surged with block, bailed and pumped 7 0
 - compressed air 2 0
 - bailed only 1 0
 - pumped only 5 1
 - pumped slowly 5 0
 - Other

3. Time spent developing well 30 min.

4. Depth of well (from top of well casing) 14.5 ft.

5. Inside diameter of well 2.05 in.

6. Volume of water in filter pack and well casing 2.1 gal.

7. Volume of water removed from well 30.0 gal.

8. Volume of water added (if any) 0 gal.

9. Source of water added _____

10. Analysis performed on water added? Yes No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	<u>10.05</u> ft.	<u>10.10</u> ft.
Date	<u>01/26/93</u> m m d d y y	<u>01/26/93</u> m m d d y y
Time	<u>7:30</u> <input checked="" type="checkbox"/> a.m. <input type="checkbox"/> p.m.	<u>4:37</u> <input type="checkbox"/> a.m. <input checked="" type="checkbox"/> p.m.
12. Sediment in well bottom	<u>1.5</u> inches	<u>0.5</u> inches
13. Water clarity	Clear <input type="checkbox"/> 10 Turbid <input checked="" type="checkbox"/> 15 (Describe)	Clear <input type="checkbox"/> 20 Turbid <input checked="" type="checkbox"/> 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	_____ mg/l	_____ mg/l
15. COD	_____ mg/l	_____ mg/l

Additional comments on development:

Well developed by: Person's Name and Firm	I hereby certify that the above information is true and correct to the best of my knowledge.
Name: <u>Mike Santas</u>	Signature: <u>[Signature]</u>
Firm: <u>Layne - Northwest</u>	Firm: <u>C Ham Hill</u>

NOTE: Shaded areas are for DNR use only. See instructions for more information.

Facility/Project Name <u>Mercury Marine</u>	Grid Location <u>477, 317</u> ft. <input checked="" type="checkbox"/> N. <input type="checkbox"/> S.	Well Name <u>MW-2</u>
Facility License, Permit or Monitoring Number <u>2,535,677</u>	ft. <input checked="" type="checkbox"/> E. <input type="checkbox"/> W.	Wis. Unique Well Number _____ DNR Well Number _____
Type of Well Water Table Observation Well <input checked="" type="checkbox"/> 11 Piezometer <input type="checkbox"/> 12	Section Location <u>NW 1/4 of SE 1/4 of Section 34</u>	Date Well Installed <u>01/21/93</u> m m . d d . y y
Distance Well Is From Waste/Source Boundary <u>unknown</u> ft.	T <u>10</u> N. R. <u>21</u> <input checked="" type="checkbox"/> E <input type="checkbox"/> W	Well Installed By: (Person's Name and Firm) <u>Vince Meindel</u> <u>Layne-Northwest</u>
Is Well A Point of Enforcement Std. Application? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Location of Well Relative to Waste/Source <input type="checkbox"/> Upgradient <input type="checkbox"/> Sidegradient <input type="checkbox"/> Downgradient <input checked="" type="checkbox"/> Not Known	

A. Protective pipe, top elevation <u>786.52</u> ft. MSL	1. Cap and lock? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
B. Well casing, top elevation <u>786.27</u> ft. MSL	2. Protective cover pipe: <u>Flush Mount</u> a. Inside diameter: <u>8.0</u> in. b. Length: <u>1.0</u> ft. c. Material: Steel <input checked="" type="checkbox"/> 04 Other <input type="checkbox"/>
C. Land surface elevation <u>786.4</u> ft. MSL	d. Additional protection? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, describe: _____
D. Surface seal, bottom _____ ft. MSL or <u>4.0</u> ft.	3. Surface seal: Bentonite <input type="checkbox"/> 30 Concrete <input checked="" type="checkbox"/> 01 Other <input type="checkbox"/>
12. USCS classification of soil near screen: <input type="checkbox"/> GP <input type="checkbox"/> GM <input type="checkbox"/> GC <input type="checkbox"/> GW <input type="checkbox"/> SW <input type="checkbox"/> SP <input type="checkbox"/> SM <input type="checkbox"/> SC <input type="checkbox"/> ML <input type="checkbox"/> MH <input type="checkbox"/> CL <input type="checkbox"/> CH <input checked="" type="checkbox"/> Bedrock	4. Material between well casing and protective pipe: Bentonite <input checked="" type="checkbox"/> 30 Annular space seal <input type="checkbox"/>
13. Sieve analysis attached? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	5. Annular space seal: Granular Bentonite <input type="checkbox"/> 33 Lbs/gal mud weight ... Bentonite-sand slurry <input type="checkbox"/> 35 <u>9.4</u> Lbs/gal mud weight ... Bentonite slurry <input checked="" type="checkbox"/> 31 % Bentonite ... Bentonite-cement grout <input type="checkbox"/> 50 <u>5.71</u> Ft ³ volume added for any of the above
14. Drilling method used: Rotary <input checked="" type="checkbox"/> 50 Hollow Stem Auger <input checked="" type="checkbox"/> 41 Other <input type="checkbox"/>	How installed: Tremie <input type="checkbox"/> 01 Tremie pumped <input checked="" type="checkbox"/> 02 Gravity <input type="checkbox"/> 08
15. Drilling fluid used: Water <input checked="" type="checkbox"/> 02 Air <input type="checkbox"/> 01 Drilling Mud <input type="checkbox"/> 03 None <input type="checkbox"/> 99	6. Bentonite seal: Bentonite granules <input type="checkbox"/> 33 <input type="checkbox"/> 1/4 in. <input type="checkbox"/> 3/8 in. <input type="checkbox"/> 1/2 in. Bentonite pellets <input type="checkbox"/> 32 <u>Bentonite Chips (< 3/8")</u> Other <input checked="" type="checkbox"/>
16. Drilling additives used? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	7. Fine sand material: Manufacturer, product name and mesh size <u>U.S. Silica; 0.2-0.3</u> Volume added <u>0.33</u> ft ³
Describe _____	8. Filter pack material: Manufacturer, product name and mesh size <u>American Materials; 0.35-0.45</u> Volume added <u>2.81</u> ft ³
17. Source of water (attach analysis): <u>Water tap inside building (west side)</u>	9. Well casing: Flush threaded PVC schedule 40 <input checked="" type="checkbox"/> 23 Flush threaded PVC schedule 80 <input type="checkbox"/> 24 Other <input type="checkbox"/>
E. Bentonite seal, top _____ ft. MSL or <u>38.5</u> ft.	10. Screen material: <u>Same</u> Screen type: Factory cut <input checked="" type="checkbox"/> 11 Continuous slot <input type="checkbox"/> 01 Other <input type="checkbox"/>
F. Fine sand, top _____ ft. MSL or <u>41.0</u> ft.	Manufacturer <u>Monoflex</u> Slot size: <u>0.010</u> in. Slotted length: <u>15.0</u> ft.
G. Filter pack, top _____ ft. MSL or <u>43.0</u> ft.	11. Backfill material (below filter pack): None <input checked="" type="checkbox"/> Other <input type="checkbox"/>
H. Well screen, top _____ ft. MSL or <u>45.0</u> ft.	
I. Well screen, bottom _____ ft. MSL or <u>60.0</u> ft.	
J. Filter pack, bottom _____ ft. MSL or <u>60.0</u> ft.	
K. Borehole, bottom _____ ft. MSL or <u>60.0</u> ft.	
L. Borehole, diameter <u>6.0</u> in.	
M. O.D. well casing <u>2.38</u> in.	
N. I.D. well casing <u>2.05</u> in.	

I hereby certify that the information on this form is true and correct to the best of my knowledge.
Signature Sam Peterson Firm CHAM HILL

Please complete and return both sides of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with ch. 144, Wis. Stats., failure to file this form may result in a forfeiture of not less than \$10, nor more than \$5,000 for each day of violation. In accordance

Facility/Project Name <u>Mercury Marine</u>	Well Name <u>MW-2</u>				
License, Permit or Monitoring Number _____	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="width:50%; padding: 2px;">Wis. Unique Well Number</th> <th style="width:50%; padding: 2px;">DNR Well Number</th> </tr> <tr> <td style="height: 20px;"> </td> <td style="height: 20px;"> </td> </tr> </table>	Wis. Unique Well Number	DNR Well Number		
Wis. Unique Well Number	DNR Well Number				

1. Can this well be purged dry? Yes No

2. Well development method
- surged with bailer and bailed 4 1
 - surged with bailer and pumped 6 1
 - surged with block and bailed 4 2
 - surged with block and pumped 6 2
 - surged with block, bailed and pumped 7 0
 - compressed air 2 0
 - bailed only 1 0
 - pumped only 5 1
 - pumped slowly 5 0
 - Other _____

3. Time spent developing well 45 min.

4. Depth of well (from top of well casing) 59.8 ft.

5. Inside diameter of well 2.05 in.

6. Volume of water in filter pack and well casing 12.7 gal.

7. Volume of water removed from well 115.0 gal.

8. Volume of water added (if any) 0 gal.

9. Source of water added _____

10. Analysis performed on water added? Yes No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	<u>19.87</u> ft.	<u>20.60</u> ft.
Date	<u>01/26/93</u> m m d d y y	<u>01/26/93</u> m m d d y y
Time	<u>7:44</u> <input checked="" type="checkbox"/> a.m. <input type="checkbox"/> p.m.	<u>12:15</u> <input type="checkbox"/> a.m. <input checked="" type="checkbox"/> p.m.
12. Sediment in well bottom	<u>1.0</u> inches	<u>0.2</u> inches
13. Water clarity	Clear <input type="checkbox"/> 10 Turbid <input checked="" type="checkbox"/> 15 (Describe) <u>Lt. brown</u>	Clear <input type="checkbox"/> 20 Turbid <input checked="" type="checkbox"/> 25 (Describe) <u>Lt. brown</u>

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	_____ mg/l	_____ mg/l
15. COD	_____ mg/l	_____ mg/l

Additional comments on development:

Borehole gained water during drilling of the last 10-15 feet. Driller blew out 70 gal. water following completion of drilling and prior to development.

Well developed by: Person's Name and Firm	I hereby certify that the above information is true and correct to the best of my knowledge.
Name: <u>Gene</u>	Signature: <u>Gene Peterson</u>
Firm: <u>Layne - Northwest</u>	Firm: <u>CHam Hill</u>

NOTE: Shaded areas are for DNR use only. See instructions for more information.