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PROJECT FILE

TECHNICAL MEMORANDUM

R45-0009

TO: Charles Pitz, Department of Ecology

FROM: Lawrence D. Beard, P.E., and Dan McCormack

DATE: April 22, 1997

RE: SHORELINE AREA INVESTIGATION
CASCADE POLE SITE
OLYMPIA, WASHINGTON

At the request of Mr. Don Bache from the Port of Olympia, we are providing Ecology this technical memorandum that describes the findings of the subsurface investigation along the shoreline area near the sheet pile cutoff wall at the Cascade Pole site (Site) in Olympia, Washington. The purpose of the investigation was to determine the extent of nonaqueous phase liquids (NAPL) in the narrow strip of upland between the sheet pile wall and the East Bay of Budd Inlet. The investigation consisted of using a hollow-stem auger drill rig to collect soil samples that were field screened for the presence of NAPL. The goal of this investigation was to better define the distribution of NAPL in the shoreline area to determine the extent of remediation required during the final cleanup action for the site. The scope of work for this investigation is described in Landau Associates' January 14, 1997 technical memorandum, which was submitted to Ecology for review and approval prior to implementing the investigation.

BACKGROUND

NAPL has been observed in previous sediment explorations north and east of the shoreline area, as shown on Figure 1. The source of this NAPL is believed to be the former Cascade Pole wood treatment plant southwest of the shoreline area. Releases of wood treatment products (primarily creosote compounds and pentacholoraphenol with associated carrier oils) resulted in both light nonaqueous phase liquid (LNAPL) and dense nonaqueous phase liquid (DNAPL) contamination of the soil and groundwater. Previous investigations in the uplands area of the site identified DNAPL in the vicinity of the shoreline area but little or no LNAPL.

The migration of DNAPL appears to be primarily controlled by the shape and slope of the aquitard surface. Soil borings in the uplands area and sediment cores in the East Bay of Budd Inlet indicate that the aquitard generally slopes to the east-northeast but has irregularities that cause DNAPL to accumulate, or pond, in aquitard depressions. Previous explorations in the vicinity of

the sheet pile wall show a rise, or lip, in the aquitard under the southwest part of the shoreline area that has caused DNAPL to accumulate in the vicinity of the cutoff wall.

There may be one or more channel-like depressions in the aquitard surface under the shoreline area through which the DNAPL has preferentially migrated to the sediments. Before 1965, a log pond, or channel, extended from the former wood treatment area to the shoreline area connecting the former wood treatment plant to Budd Inlet (Figure 1). The shoreline area was built in the early 1980s when the peninsula was enlarged to its present configuration by filling. It is unclear if there is a depression, or trough, in the aquitard corresponding to the former log pond that serves as a preferential pathway for the migration of DNAPL to the sediments and therefore limits the lateral distribution of NAPL along the shoreline.

Another potential pathway for the migration of NAPL may be the backfill around the decommissioned NPDES pipeline that discharged at the northwest end of the shoreline area. Although NAPL has been observed in the sediments around the former NPDES pipe (Figure 1) it is unclear which transport mechanism was responsible for migration of NAPL to this location.

FIELD EXPLORATIONS

Subsurface conditions were explored by 12 borings (SI-1 through SI-12) at the locations indicated on the Site Plan (Figure 1) between January 29 and January 31, 1997. Borings were drilled with a truck-mounted hollow-stem auger drill rig to depths ranging from 19.5 to 41.5 ft below ground surface (BGS). The field explorations were coordinated and monitored by a geologist from Landau Associates who maintained detailed records of encountered subsurface conditions, obtained representative soil samples, described the soil by using visual and textural examination, and screened the soil for presence of NAPL. All soil encountered was described using the Soil Classification System described in Appendix A (Figure A-1), in general accordance with ASTM D2488, *Standard Recommended Practice for Description of Soils (Visual-Manual Procedures)*.

Logs of the explorations are presented on Figures A-2 through A-13. These logs represent our interpretation of subsurface conditions identified during the explorations. The boring elevations and locations were surveyed by Southwest Surveying Inc., Olympia, Washington.

Soil samples were collected from each boring at approximately 5-ft intervals in the upper 10 ft of each boring and at 2½-ft intervals or continuously below 10 ft. Samples were collected by driving a standard split-spoon sampler ahead of the auger. Borings SI-2 through SI-12 were terminated at the top of the aquitard (Figure 2), which ranged from 17.5 to 24.0 ft BGS or elevations

of +0.5 to -7.0 MLLW. Boring SI-1 was advanced through a thin remnant of the aquitard and into the underlying soil. The aquitard remnant in SI-1 was encountered at a depth of 32.0 ft BGS (-13.0 MLLW) and was approximately 2.5 ft thick. All borings were backfilled with bentonite chips. Boring SI-8 was located along the alignment of the NPDES pipeline and sampled at 5.0 to 7.0 ft BGS (the depth that corresponds to the backfill around the pipeline) in addition to continuous sampling in the aquitard vicinity.

Soil samples were evaluated for presence of NAPL by a combination of field screening methods including visual observations of product and sheen, and response to ultraviolet light. No chemical analysis was planned or conducted. All sampling and downhole drilling equipment was decontaminated between uses. Drill cuttings were moved to the disposal cell in the uplands portion of the site.

SUBSURFACE CONDITIONS

Geologic Conditions

The subsurface conditions in the shoreline area consist of fill over native tidal flat sediments. The native tidal flat sediments act as an aquitard between the overlying fill soil and underlying "lower aquifer." The subsurface conditions are summarized in a cross section developed from the investigation borings (Figure 2). Additional detailed geologic and environmental information is presented in the boring logs in Appendix A.

The fill soil is primarily dredge spoils, consisting of gray sand with varied amounts of silt, gravel, and shells with occasional silt lenses. There is an increasing amount of gravel in the fill in southeast part of the shoreline area. The upper 2 to 3 ft of material in the shoreline area contains varied amounts of gravel, cobbles, and debris (concrete, wood). The intertidal portion of the shoreline area is mostly covered with riprap consisting of large cobbles, boulders, and concrete debris.

The gravel in the southeast portion of the shoreline area (Borings SI-1, SI-2, SI-11, and SI-12) is interpreted to be fill placed to build a dike in the early 1980's for dredge spoils containment. The location of the dike in aerial photographs taken during the construction corresponds to the southeast end of the shoreline area where gravel was encountered (SI-1 and SI-2).

The aquitard encountered in borings SI-2 through SI-12 consisted of an olive gray-colored silty clay or clayey silt with a trace of wood, fine sand, and (often whole) shells. This is similar to what was encountered in explorations during previous site investigation. Thin sand lenses and

pockets were observed in the upper few inches of the aquitard in some of the borings, which are likely sand filled burrows of benthic organisms. The remnant of the aquitard encountered at SI-1 was a sandy silt with clay and shell fragments; this area may have been dredged during construction of the small boat harbor and part of the aquitard stripped away. As illustrated on Figure 2, a subtle depression is present in the top of the aquitard between borings SI-7 and SI-12 , which generally corresponds to the former log pond channel location.

Construction of the slurry wall along the southeast edge of the shoreline area required an excavation into the top of the aquitard. Landau Associates' geologist monitoring the construction of the slurry wall observed a sand and gravel fill (dike material) that overlies the aquitard near boring SI-1, SI-2 and SI-3. The aquitard encountered while excavating for the slurry wall approximately 25 ft south of SI-1 was also at elevation -13.0 ft MLLW, consisted of similar material (olive gray silt with clay, fine sand, and shell fragments), and was at least 4 ft thick.

NAPL Occurrence

Samples for the borings were carefully screened for presence of NAPL using three techniques: visual observation, sheen testing in a jar with distilled water, and observation for fluorescence under an ultraviolet light. Results of the screening is presented on the boring logs in Appendix A and is summarized on the cross section shown on Figure 2.

No evidence of NAPL was encountered in the three northwestern-most borings (SI-4, SI-5, and SI- 7) or the southeastern most boring (SI-1). Trace amounts of product and/or sheen was observed in three other eastern borings (SI-2, SI-3, and SI-10). The middle portion of the shoreline area has a shallow depression in the aquitard surface that generally corresponds to the location of the former log pond channel. The borings in this area (SI-6, SI-8, SI-9, SI-11, and SI-12) had significant occurrences of NAPL, sheen, and a strong response to ultraviolet light.

NAPL (i.e., DNAPL) was typically encountered only in the bottom 0.5 to 2.0 ft of fill that overlies the aquitard, as shown in Figure 2. In boring SI-2, the only evidence of NAPL observed was a small droplet of product about 1/10-inch in diameter and a slight sheen associated with a wood fragment in the top of the aquitard. DNAPL was not observed in soil excavated from the slurry wall in the area south of borings SI-1 and SI-2. In boring SI-3, there was a small amount of DNAPL observed in the 0.5 ft of soil immediately above the aquitard and a sheen associated with occasional sand lenses in the very top of the aquitard.

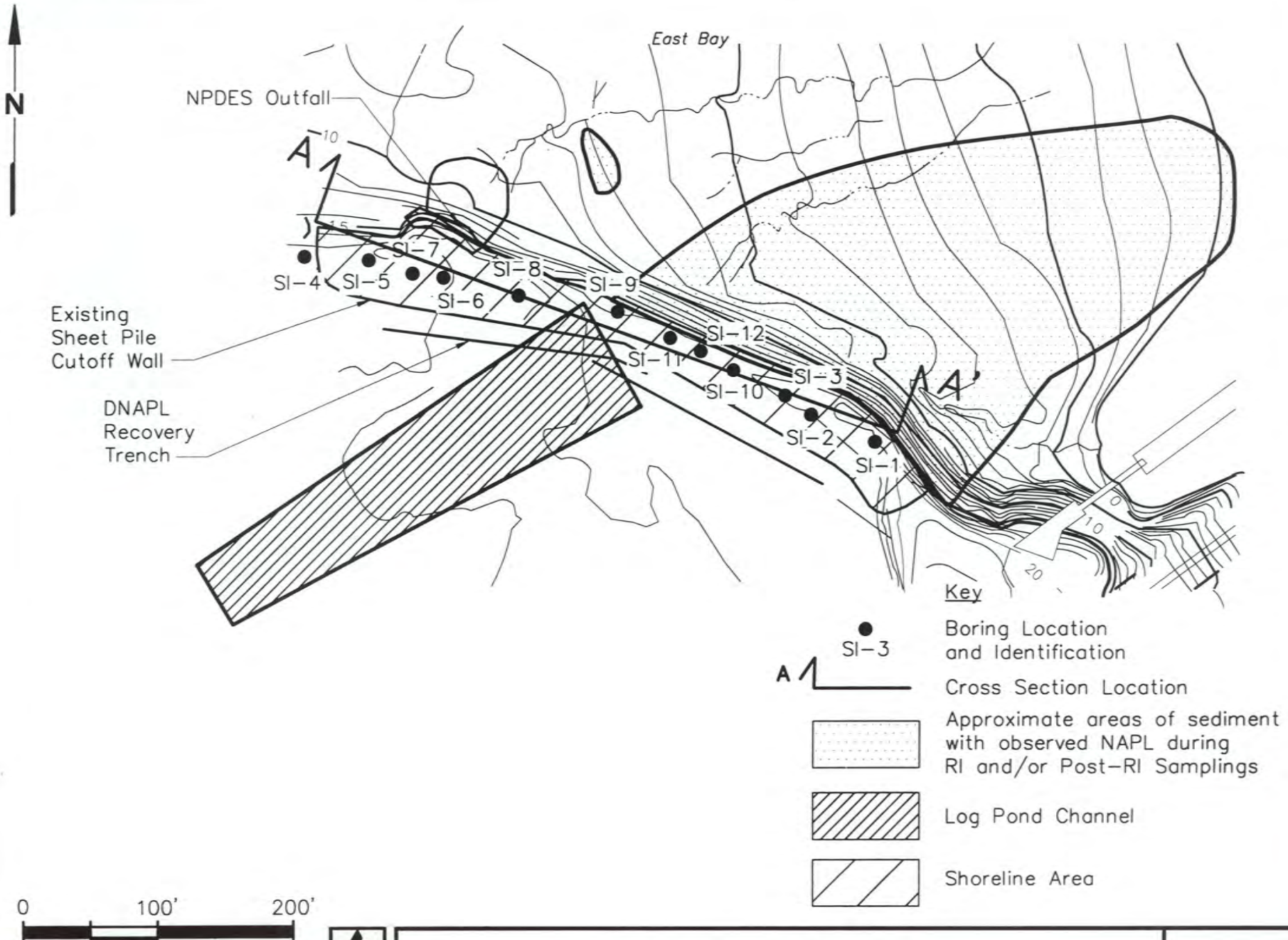
In boring SI-9, DNAPL was observed in the bottom 2.5 ft of soil above the aquitard (-3.0 to -5.5 MLLW), and a small amount of product was also observed just above a silt lense about 15 ft BGS (+5.0 MLLW). This was the only occurrence of NAPL (beyond a slight sheen) that was not in the immediate vicinity of the aquitard.

No definitive evidence of LNAPL was observed in any of the borings. Boring SI-8 was located along the alignment of the NPDES pipeline; however, no evidence of NAPL was encountered in the depth corresponding to the pipeline backfill (5.0-7.0 ft BGS). Product (SI-9) and sheen (SI-12) were observed at about elevation 6 ft, which could be within an LNAPL smear zone near the shoreline; however, these occurrences could also be associated with DNAPL migrating along geologic contacts.

CONCLUSIONS

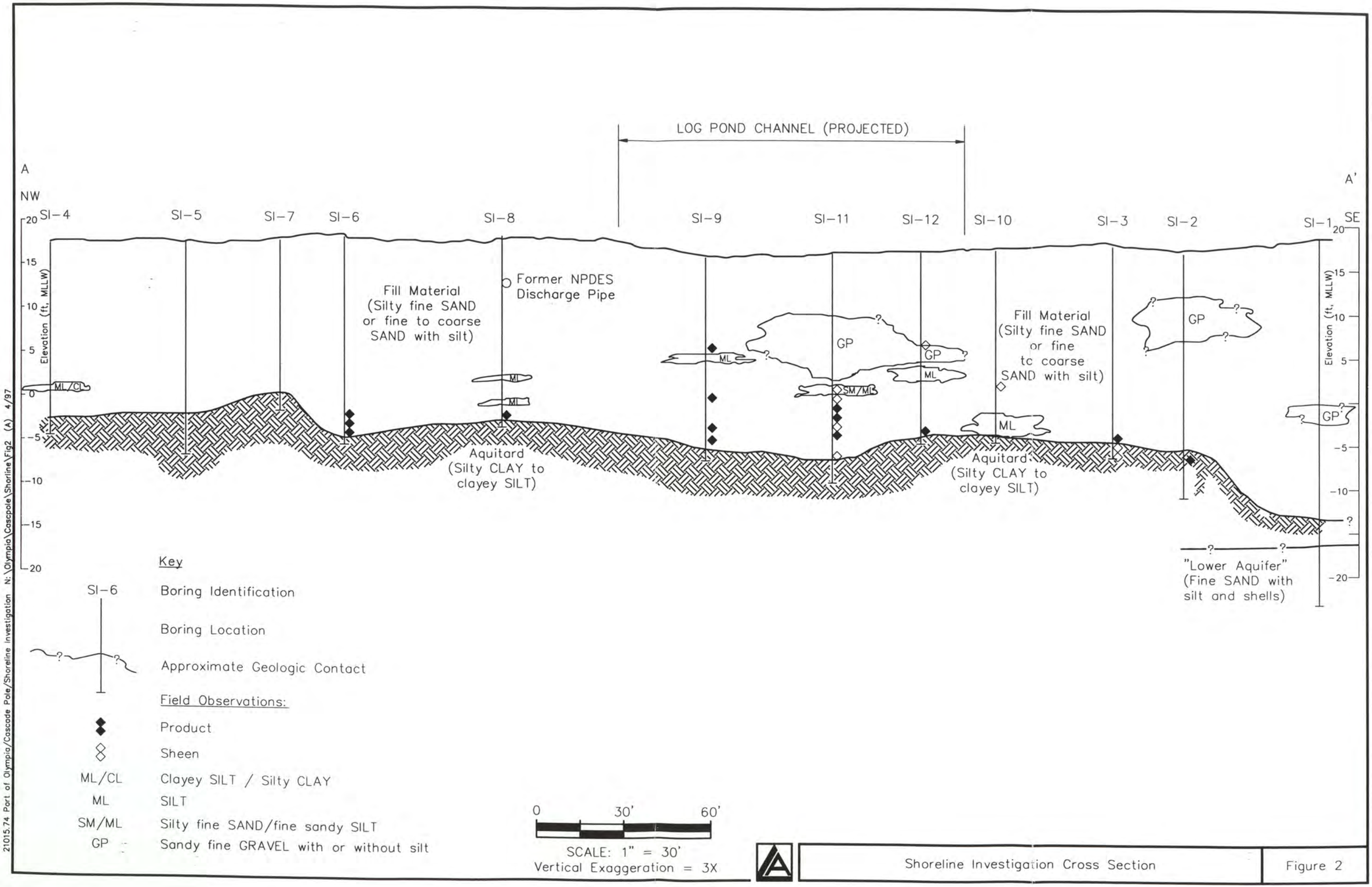
Geologic data collected during the investigation indicate the presence of a subtle depression in the top of the aquitard between borings SI-7 and SI-12 that is about 200 ft wide. NAPL occurrence observed during the investigation indicates that NAPL, primarily or exclusively in the form of DNAPL, is largely limited to the depression area. However, minor amounts of NAPL were observed to the southeast of the depression area. No LNAPL was observed in association with the NPDES outfall pipe backfill, which suggest that the NAPL present in the vicinity of the outfall is likely the result of historic discharge from the outfall and not caused by NAPL migration through the pipeline backfill.

We hope this memorandum meets your current needs. Please call us if you have any questions or wish to discuss the results of the investigation further.



Shoreline Investigation Site Plan

Figure 1



Shoreline Investigation Cross Section

Figure 2

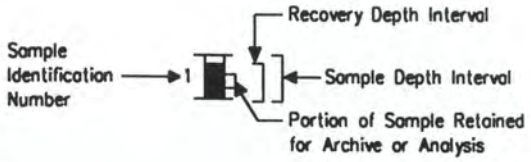
Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL (1)	TYPICAL DESCRIPTIONS (2)(3)
COARSE-GRAINED SOIL (More than 50% of material is larger than No.200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No.4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No.4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No.200 sieve size)	SILT AND CLAY (Liquid Limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid Limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand or silty soil
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content
	OTHER			AC/PC	Pavement; Asphalt or Concrete

Notes:
1. USCS letter symbols correspond to the symbols used by the Unified Soil Classification System and ASTM Classification methods. Dual letter symbols (e.g., SM-SP) for a sand or gravel indicate a soil with an estimated 5-15% fines. Multiple letter symbols (e.g.,ML/CL) indicate borderline or multiple soil classifications.
2. Soil classifications are based on the general approach presented in the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, as outlined in ASTM D2488. Where laboratory index testing has been conducted, soil classifications are based on the *Standard Test Method for Classification of Soils for Engineering Purposes*, as outlined in ASTM D2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:
   - Primary Constituent: >50% – "GRAVEL," "SAND," "SILT," "CLAY," etc.
   - Secondary Constituents: >30% and ≤50% – "very gravelly," "very sandy," "very silty," etc.
   - >15% and ≤30% – "gravelly," "sandy," "silty," etc.
   - Additional Constituents: >5% and ≤15% – "with gravel," "with sand," "with silt," etc.
   - ≤5% – "trace gravel," "trace sand," "trace silt," etc., or not noted.

Key

SAMPLE NUMBER & INTERVAL



TEST DATA

Code	Description

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon Sampler
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon Sampler
c	Shelby Tube
d	Grab Sample
e	3.00-inch I.D. Core Barrel Sampler
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	350-lb. Hammer, 30-inch Drop

OTHER

▽ ATD	Approximate Water Elevation At Time of Drilling (ATD) or On Date Noted

SI-1

SAMPLE DATA				SOIL PROFILE		
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol

Drilling Method: HSA Auger

Ground Elevation (ft): 17.9 (MLLW)

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	USCS Symbol	
0				SP-SM	Brown, fine to coarse SAND with silt (wet, medium dense) (fill) (no UV response, sheen, or product)
	1	a2	22		
	2	a2	22		
10					
	3	a2	27		
	4	a2	18		(Less silty from 14 ft to 18 ft)
	5	a2	25		
				GP	Brown, sandy GRAVEL with trace silt (wet, medium dense) (fill) (dike) (no UV response, sheen, or product)
20	6	a2	23	SW	
	7	a2	27		Brown, medium to coarse SAND with gravel and trace silt (wet, medium dense) (fill) (dike) (no UV response, sheen, or product)
	8	a2	31		
	9	a2	26		
30	10	a2	28		Becomes gray
	11	a2	32	ML	Gray, sandy SILT with clay and shell fragments (moist, very stiff) (aquitard remnant) (no UV response, sheen, or product) Grades sandier at 34.0 ft
	12	a2	38	SM	Gray, silty, fine SAND with trace shell fragments (wet, dense) (no UV response, sheen, or product)
	13	a2	46	SP	Brown, fine SAND with trace silt (moist to wet, medium dense) (no UV response, sheen, or product)
40	14	a2	48	SP SM	Gray and brown, fine SAND with silt (moist to wet, dense) (no UV response, sheen, or product)
50					
60					

Boring Completed 01/29/97
Total Depth = 41.5 ft.
Backfilled with bentonite chips

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. UV = Ultraviolet

21015.74 Port of Olympia/Cascade Pole Site/Shoreline Investigation N:\Olympia\Cascpole\Shorline\Borings\FigA-2 (A) 4/97

Boring SI-1 | Figure A-2

SI-2

SAMPLE DATA					SOIL PROFILE		
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	
0							Drilling Method: HSA Auger Ground Elevation (ft): 16.9 (MLLW)
	1	a2	60			SM	Brown, silty fine to coarse SAND with gravel and shell fragments (moist, dense)(fill) (no UV response, sheen, or product)
	2	a2	33			GP	Brown, sandy, fine GRAVEL (wet, medium dense, fill) (no UV response, sheen, or product)
10	3	a2	25			SP	Brown, gravelly, medium to coarse SAND, with trace silt (wet, medium dense) (fill) (no UV response, sheen, or product)
	4	a2	19				
	5	a2	13				Becomes gray
20	6	a2	19				
	7	a2	25			ML	Gray to blue green, clayey SILT/silty CLAY with shell fragments (moist, stiff) (aquitard) (trace product around wood fragment at 23.5 ft)
	8	a2	70/1"				
	9	a2	123				
30							
40							
50							
60							

Boring Completed 01/29/97
Total Depth = 28.0 ft.
Backfilled with bentonite chips

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. UV = Ultraviolet

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Boring SI-2

Figure A-3

SI-3

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	SOIL PROFILE
							Drilling Method: HSA Auger Ground Elevation (ft): 17.3 (MLLW)
0						SP	Brown fine to coarse SAND with gravel and trace silt (moist, loose to medium dense) (fill) (no UV response, sheen, or product)
	1	a2	37				
	2	a2	38				
10							Becomes gray and wet
	3	a2	19				Becomes loose
20	4	a2	22				Moderate ultraviolet response, sheen and trace product just above aquitard
	5	a2	16			ML	Gray clayey SILT/silty CLAY (moist, stiff) (aquitard) (moderate UV response and slight sheen associated with occasional 1/8-in. thick sand lenses. No product).
30							
40							
50							
60							

Boring Completed 01/29/97
Total Depth = 24.0 ft.
Backfilled with bentonite chips

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. UV = Ultraviolet

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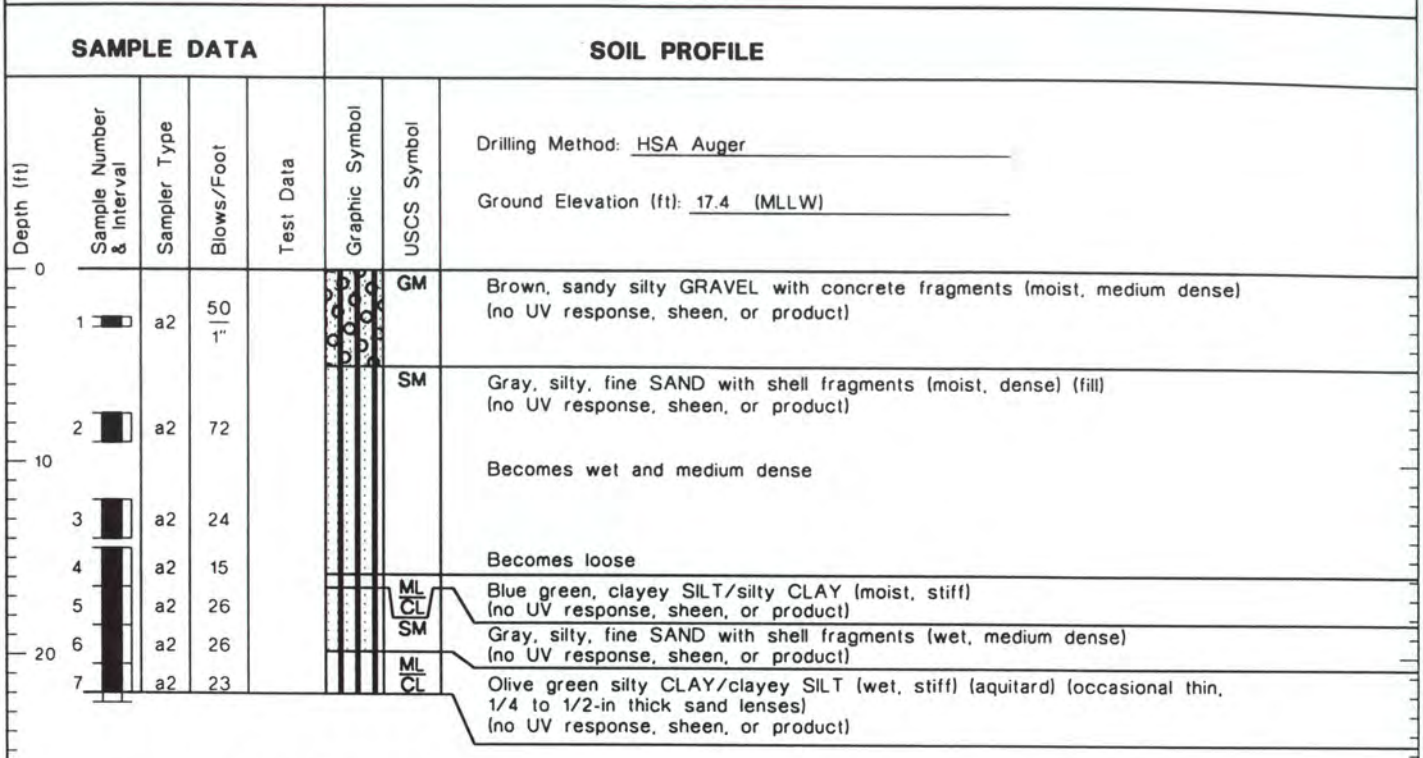
Boring SI-3 | Figure A-4

SI-4



Boring Completed 01/30/97
Total Depth = 22.0 ft.
Backfilled with bentonite chips

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. UV = Ultraviolet

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Boring SI-4

Figure A-5

SI-5

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	SOIL PROFILE
							Drilling Method: HSA Auger Ground Elevation (ft): 17.5 (MLLW)
0	1	a2	17			SM	Brown, silty SAND (moist, medium dense) (fill) (no UV response, sheen, or product) (with concrete debris and gravel in upper 4 ft)
	2	a2	46				Becomes gray and wet with occasional interbedded clayey silt lenses and shell fragments
10	3	a2	30				
	4	a2	15				
	5	a2	40				Becomes blue gray
20	6	a2	24			CL/ML	Olive green, silty CLAY/clayey SILT (moist, stiff to very stiff) (aquitard) (with occasional 1/8-in thick sand lenses) (no UV response, sheen or product)
	7	a2	27				

Boring Completed 01/30/97
Total Depth = 24.0 ft.
Backfilled with bentonite chips

30

40

50

60

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. UV = Ultraviolet

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Boring SI-5

Figure A-6

SI-6

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	SOIL PROFILE
							Drilling Method: HSA Auger Ground Elevation (ft): 17.9 (MLLW)
0	1	a2	37			SM/GM	Brown, sandy GRAVEL/gravelly SAND with silt and debris (moist, medium dense) (fill) (no UV response, sheen, or product)
10	2	a2	41			SM	Gray, silty fine SAND with shell fragments (moist, medium dense) (fill) (no UV response, sheen, or product)
	3	a2	17				Becomes wet and loose with occasional 1/2 to 3/4-in thick clayey silt lens
	4	a2	19				
	5	a2	18				
20	6	a2	16				Occasional wood fragments Strong ultraviolet response, sheen and product from 20.0 to 22.5 ft)
	7	a2	17			ML/CL	Olive green clayey SILT/silty CLAY with trace shell fragments (moist, stiff) (aquitard) (no UV response, sheen, or product)

Boring Completed 01/30/97
Total Depth = 23.5 ft.
Backfilled with bentonite chips

30

40

50

60

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. UV = Ultraviolet

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Boring SI-6

Figure A-7

SI-7

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	SOIL PROFILE
							Drilling Method: HSA Auger Ground Elevation (ft): 17.7 (MLLW)
0						SM	Brown, silty SAND with wood debris (moist, medium dense) (fill) (no UV response, sheen, or product)
	1	a2	50/4"				Becomes gray with shell fragments
10	2	a2	26				Becomes wet with occasional silty clay lenses, no UV response sheen, or product associated with clay lenses)
	3	a2	21				
	4	a2	9			CL	Olive green, silty CLAY (moist, medium stiff) (aquitard) (no UV response, sheen, or product)
20							

Boring Completed 01/30/97
Total Depth = 19.5 ft.
Backfilled with bentonite chips

30

40

50

60

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. UV = Ultraviolet

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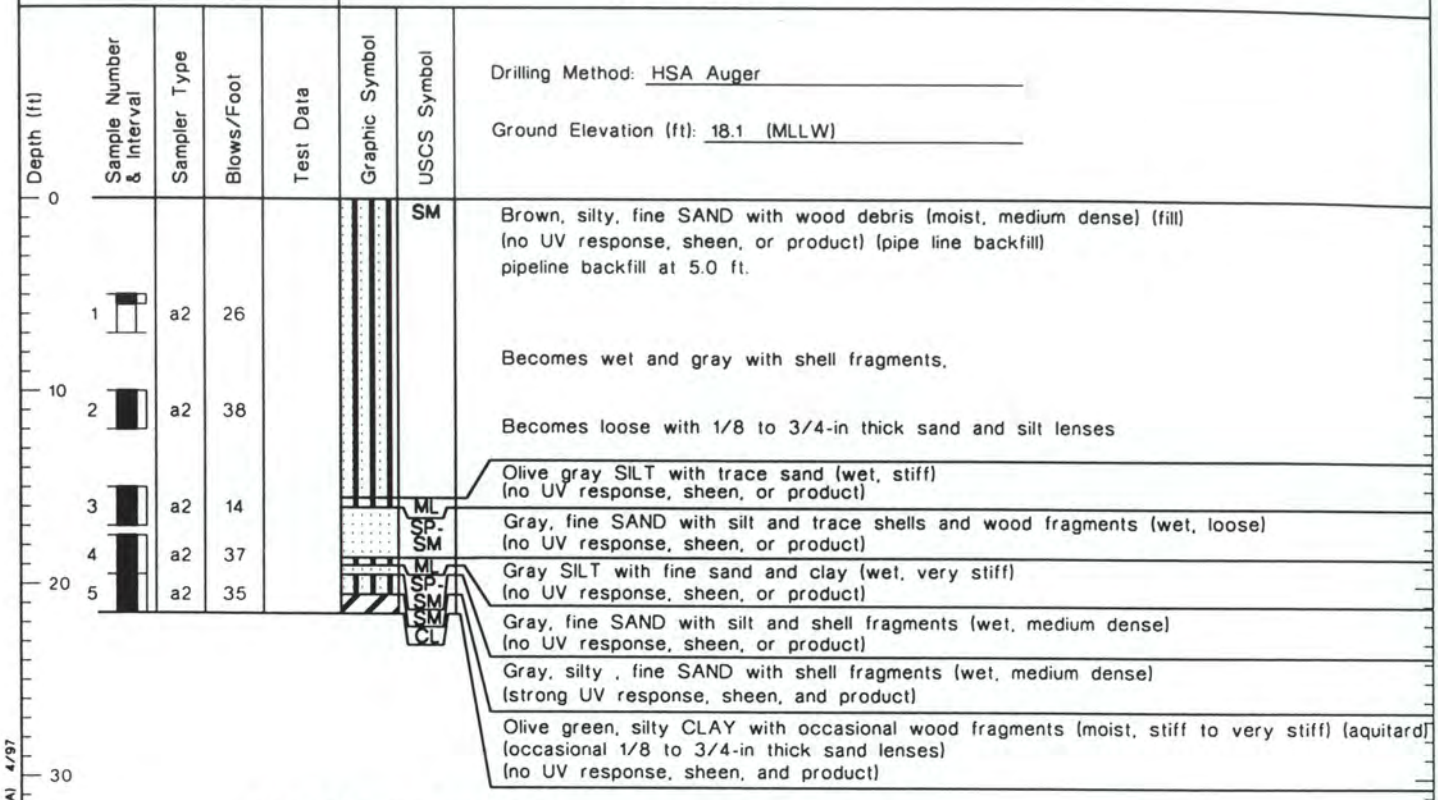
Boring SI-7

Figure A-8

SI-8



Boring Completed 01/30/97
Total Depth = 21.5 ft.
Backfilled with bentonite chips

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. UV = Ultraviolet

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Boring SI-8 | Figure A-9

SI-9

SAMPLE DATA | **SOIL PROFILE**

Drilling Method: HSA Auger

Ground Elevation (ft): 15.7 (MLLW)

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	
0						SM	Brown silty, fine SAND with gravel (wet, dense to very dense) (fill) (no UV response, sheen, or product)
	1	a2	50/3"				
10							Becomes gray, wet (strong UV response, sheen, and product0
	2	a2	17			ML	Gray SILT with wood debris (wet, stiff) (fill) (wood debris with slight to moderate UV reponse 11.4 to 12.0 ft, no sheen, or product)
						SM	Gray, silty, fine SAND with shell fragments (wet, medium dense) (fill) (strong UV response, sheen, and product from 15.0 to 16.0 ft.) Less silty 16.0 to 16.5 ft
	3	a2	37				
	4	a2	26			SM/CL	Gray, silty, fine SAND with shell fragments interlayered with olive green, silty CLAY (wet, loose/stiff) (strong UV response, sheen, and product)
20	5	a2	22				
	6	a2	19			CL	Olive green, silty CLAY with shells (moist, stiff) (aquitard) (no UV response, sheen, or product from 19.0 to 21.5 ft.)

Boring Completed 01/31/97
Total Depth = 23.0 ft.
Backfilled with bentonite chips

30

40

50

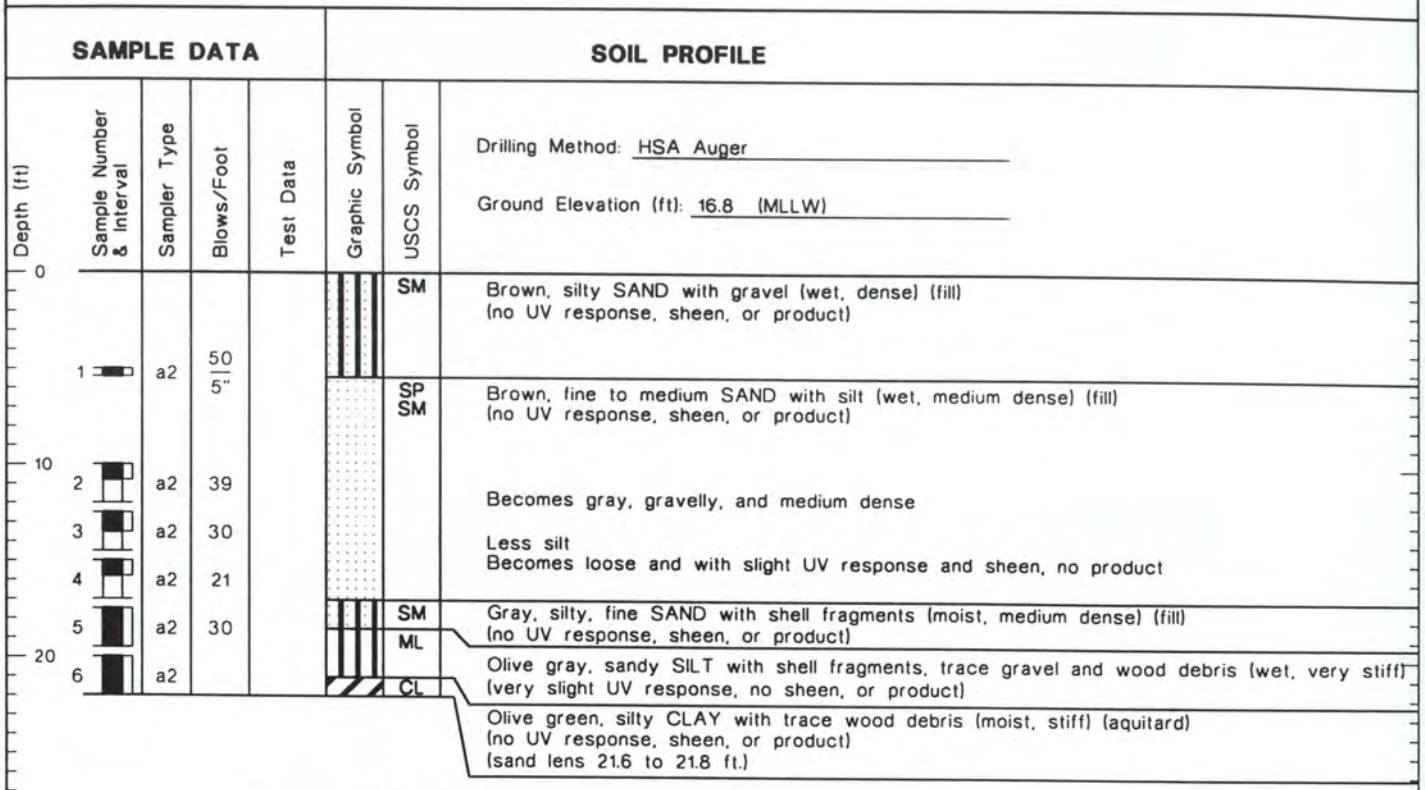
60

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. UV = Ultraviolet

21015.74 Port of Olympia/Cascade Pole Site/Shoreline Investigation N:\Olympia\Cascpole\Shoreline\Borings\FigA-10 (A) 4/97

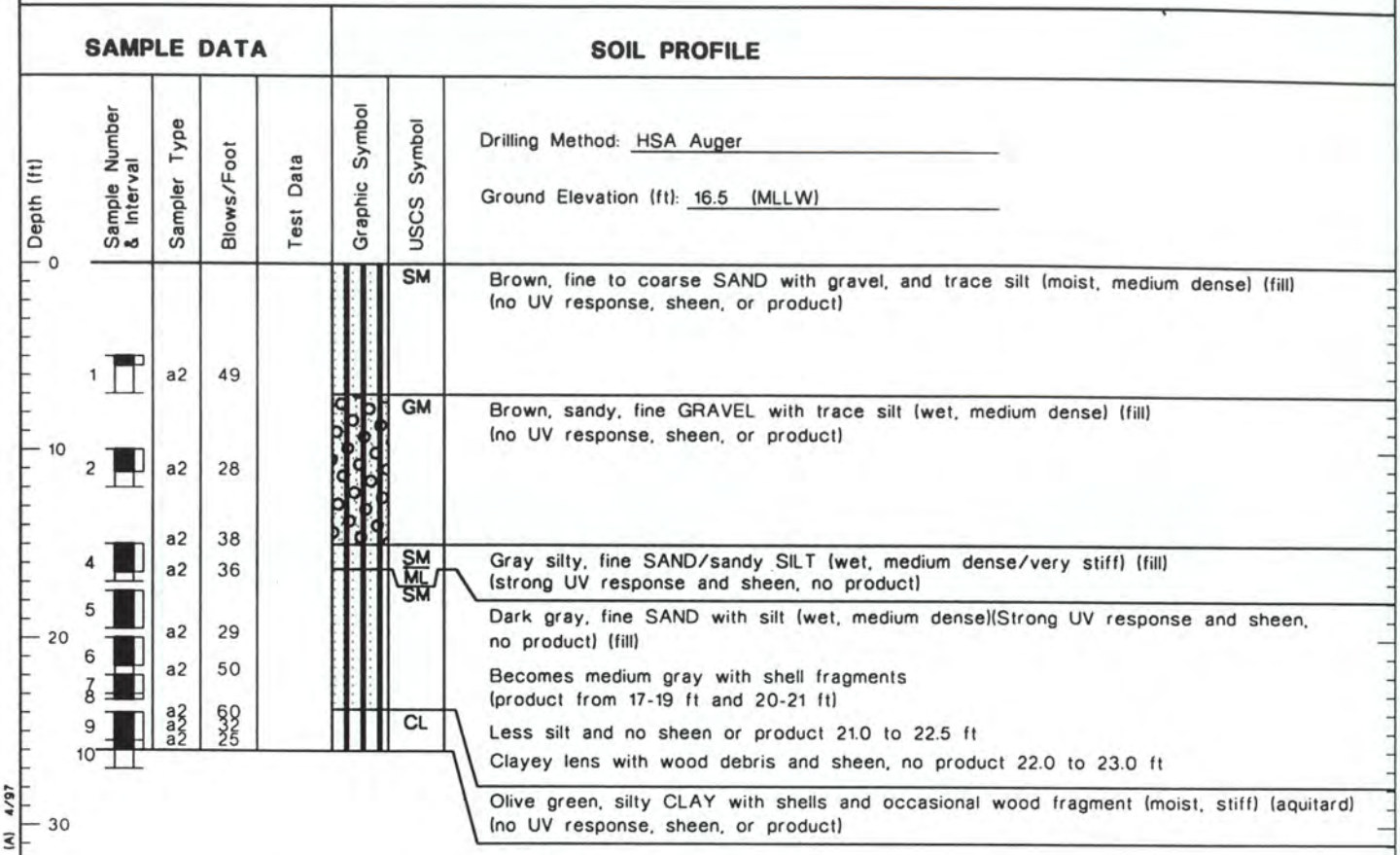
Boring SI-9 | Figure A-10

SI-10



Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. UV = Ultraviolet

SI-11



Boring Completed 01/31/97
Total Depth = 26.0 ft.
Backfilled with bentonite chips

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. UV = Ultraviolet

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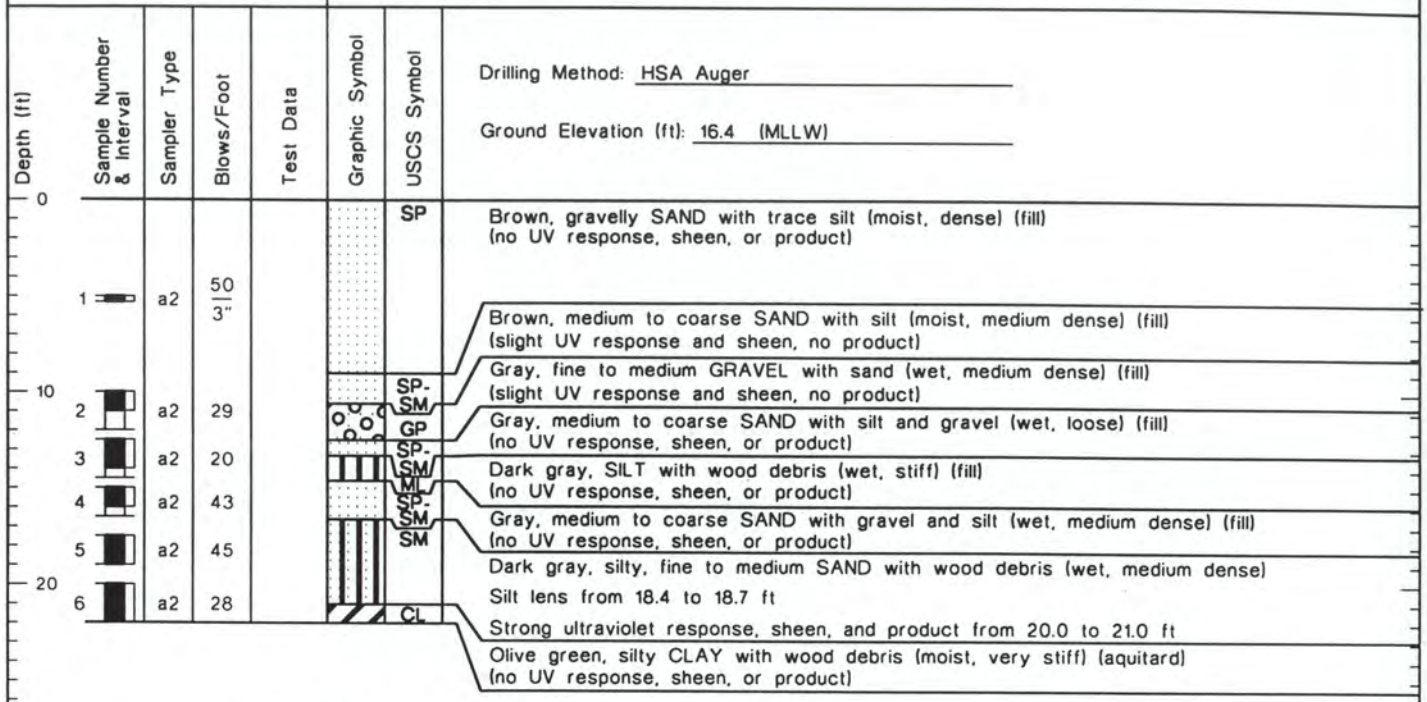
Boring SI-11 | Figure A-12

SI-12



Boring Completed 01/31/97
Total Depth = 22.0 ft.
Backfilled with bentonite chips

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. UV = Ultraviolet

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Boring SI-12 | Figure A-13