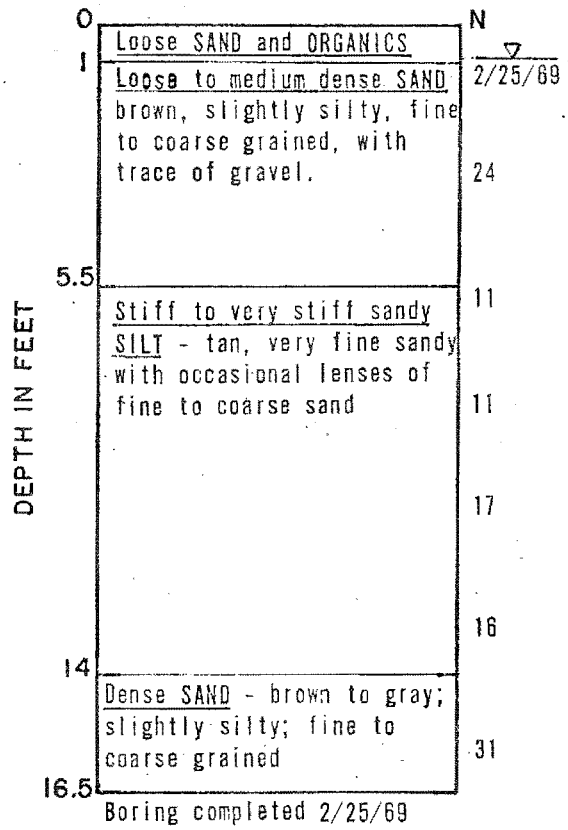
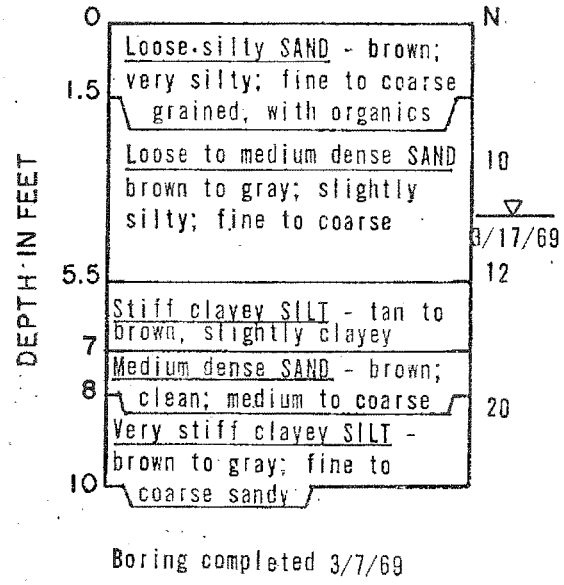
B-20



B-22

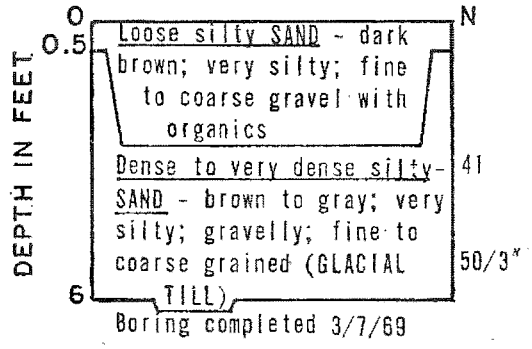


LEGEND

▽ Water level

N Standard Penetration Resistance (blows/foot)

B-21



THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

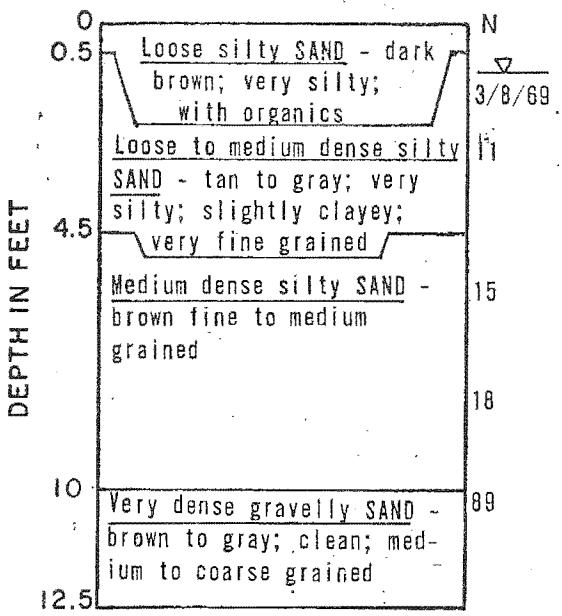
LOGS OF BORINGS B-20, B-21 & B-22

APRIL 1, 1969 W-1509-2

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

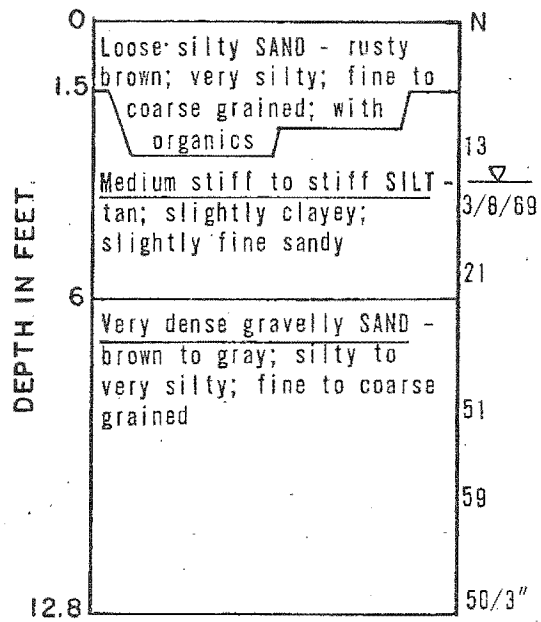
FIG. A-15

B-23



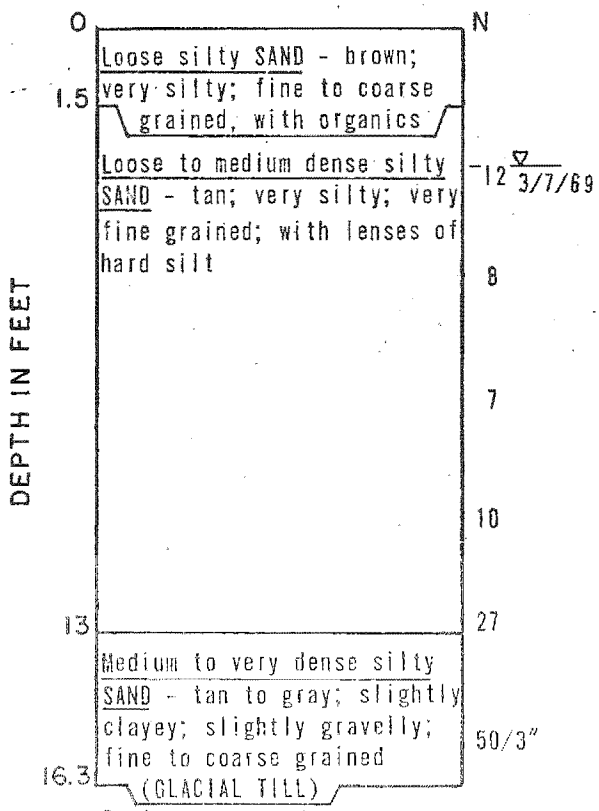
Boring completed 3/8/69

B-25



Boring completed 3/8/69

B-24



Boring completed 3/7/69

LEGEND

▽ Water level

N Standard Penetration Resistance (blows/foot)

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOGS OF BORINGS
B-23, B-24 & B-25

APRIL 1, 1969 W-1509-2

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-16

USC	SOIL DESCRIPTION Surface Elevation: Approx. 178 ft.	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet	STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) △ Blows per foot (0 – 50 – 100)
SM	Very loose, brown, silty, gravelly SAND with organics		1			
		4.5	2	▽ 5/5/69 dry		
SM	Dense, light brown, silty, gravelly SAND (Weathered Glacial Till)	7.0	3			
CL	Hard, blue-gray, silty CLAY with lenses of tan, sandy silt	10.7	4		10	
SM	Very dense, tan to blue-gray, silty, gravelly SAND (Glacial Till)		5			50/5"
			6			50/6"
		18.0	7			50/6"
SP	Very dense, gray, fine to medium SAND with scattered coarse sand and gravel		8		20	50/5.5"
			9			50/6"
			10			50/5"
			11			50/4"
SW	Very dense, gray, gravelly, fine to coarse SAND	29.0			30	
		31.5	12			50/5"
SP	Very dense, gray, fine SAND	33.5	13			50/6"
	Bottom of Boring Completed 5/5/69				40	

0 – 20 – 40 ○ % Water content

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✱ Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- ▽ Perched Water Level

PROPOSED LIBRARY BUILDING
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-26

JUNE 4, 1969 W-1785

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-17

USC	SOIL DESCRIPTION Surface Elevation: Approx. 177 ft.	DEPTH, feet	SAMPLES
SM	Dense, light brown, silty, gravelly SAND (Weathered Glacial Till)		1
CL	Hard, blue-gray, silty CLAY with lenses of tan, sandy silt	5.7	2, 3
SM	Very dense, tan to blue-gray, silty, gravelly SAND (Glacial Till)	10.9	4, 5
SM	Very dense, light brown, silty, fine SAND	15.7	6
SP	Very dense, gray, fine to medium SAND with scattered coarse sand and gravel	17.7	7, 8, 9, 10, 11, 12
	Bottom of Boring Completed 5/5/69	33.5	13

GROUND WATER: 5/5/69 ▼ dry

DEPTH, feet: 10, 20, 30, 40

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot

0 50 100

50/6"
50/3"
50/4"
50/5"
50/5"
50/5"
50/6"
50/6"

0 20 40
⊙ % Water content

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✳ Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- ▽ Perched Water Level

PROPOSED LIBRARY BUILDING
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-27

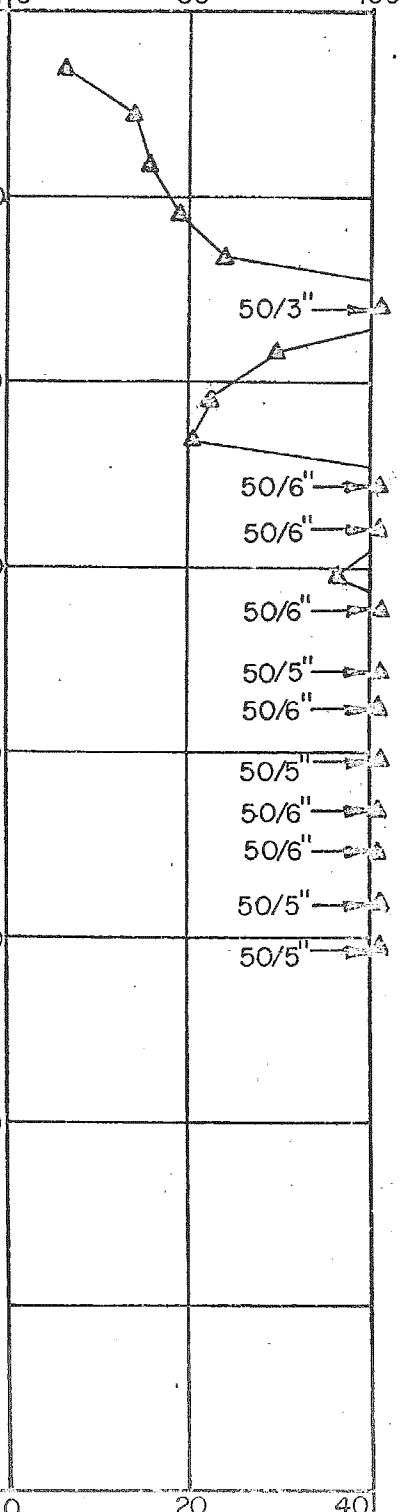
JUNE 4, 1969 W-1785

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-10

USC	SOIL DESCRIPTION Surface Elevation: Approx. 188 ft.	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet
SM	Loose, brown, silty SAND and GRAVEL				
SP	Medium to dense, gray, fine to medium SAND with scattered coarse sand and gravel	2.0	1, 2	5/7/69	
SM	Very dense, tan, silty, gravelly SAND (Glacial Till with erratic granite boulders	7.0 8.5	3		
SP-SM	Very dense, light brown, slightly silty to silty, medium to coarse SAND and GRAVEL		4, 5, 6		10
ML	Very dense, light brown to tan SILT with 4" layer of silty, coarse sand and fine gravel	16.5	7		
CL	Hard, blue-gray, silty CLAY	19.5	8, 9	dry	20
SP	Very dense, gray, clean, fine SAND with seam of tan SILT	25.5 26.0	10		
SM	Very dense, tan, silty, gravelly SAND (Glacial Till)	29.0	11		
SM	Very dense, tan to light brown, slightly silty, fine SAND with layers of very fine sandy silt	31.2	12, 13		30
SP	Very dense, gray, fine to medium SAND with trace of coarse sand and gravel		14, 15, 16, 17, 18, 19	5/7/69	40
		50.9	20		50
					60

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



Bottom of Boring
Completed 5/7/69

(Composite log of 4 borings, first three borings met refusal on granite boulders at 9.5 to 12 feet)

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Atterberg limits: L Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

PROPOSED LIBRARY BUILDING
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

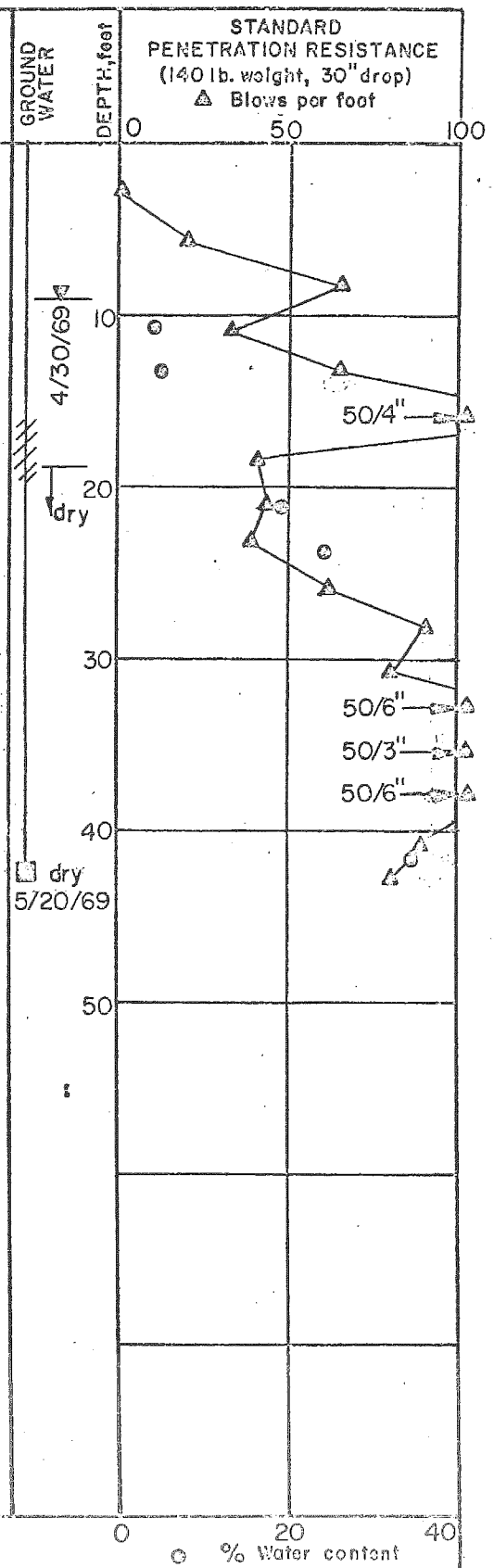
LOG OF BORING NO. B-28

JUNE 4, 1969 W-1785

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-19

USC	SOIL DESCRIPTION Surface Elevation: Approx. 187 ft.	DEPTH, feet	SAMPLES
SM	Very loose, brown, silty SAND and GRAVEL with some organics		1
SP-SM	Very dense, gray, slightly silty, fine to medium SAND with scattered coarse sand and gravel	4.5	2, 3, 4
ML	Very dense, tan to blue-gray, silty, gravelly SAND (Glacial Till)	12.0	5, 6
SP	Dense, gray, fine to medium SAND with scattered coarse sand and gravel	17.0 19.0	7
CL	Hard, blue-gray, silty CLAY		8, 9
SP	Very dense, gray, clean, fine SAND	24.5 26.2	10
SM	Very dense, tan, silty, gravelly SAND (Glacial Till) with layers of tan, very fine, sandy SILT above and below till		11
SP	Very dense, gray, fine SAND with scattered coarse sand and gravel	30.7	12, 13, 14, 15, 16, 17
	Bottom of Boring Completed 4/30/69	44.0	



LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

PROPOSED LIBRARY BUILDING
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

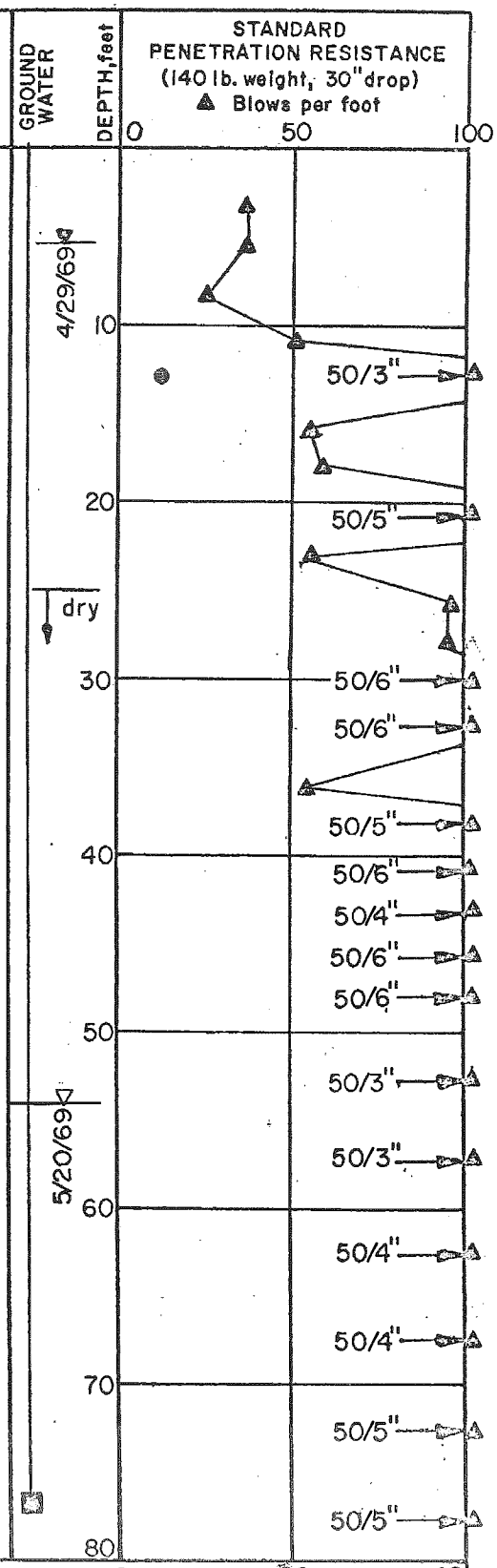
LOG OF BORING NO. B-29

JUNE 4, 1969 W-1785

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-20

USC	SOIL DESCRIPTION Surface Elevation: Approx. 192 ft.	DEPTH, feet
SM	Loose, brown, silty SAND with roots & organics	2.5
SW-SM	Medium to dense, gray, slightly silty, gravelly, fine to coarse SAND	9.0
SP-SM	Very dense, gray to light brown, slightly silty, medium to coarse SAND with scattered gravel	18.5
SP	Very dense, light brown, slightly silty, fine SAND with an 18" layer of slightly silty, medium to coarse sand and gravel	25.0
CL	Hard, blue-gray, silty CLAY	28.7
SM	Very dense, tan, silty SAND (Glacial Till)	31.5
SM	Very dense, blue-gray, silty, gravelly SAND (Glacial Till)	34.0
SP	Very dense, tan to gray, fine SAND with fine sandy silt lenses	37.0
SP	Very dense, gray, clean, fine SAND with trace of coarse sand and gravel	50.0
ML	Very dense, light brown, silty, very fine SAND	55.0
SP	Very dense, gray, medium to coarse SAND with gravel	63.0
SP	Very dense, gray, fine to medium SAND	75.0
SP	Very dense, gray, medium to coarse SAND with gravel	78.4
	Bottom of Boring Completed 4/29/69	



LEGEND

- I — 2.0" O.D. split spoon sample
- II — 3.0" O.D. thin-wall sample
- * — Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P — Sampler pushed
- USC — Unified Soil Classification
- Perched Water Level

PROPOSED LIBRARY BUILDING
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

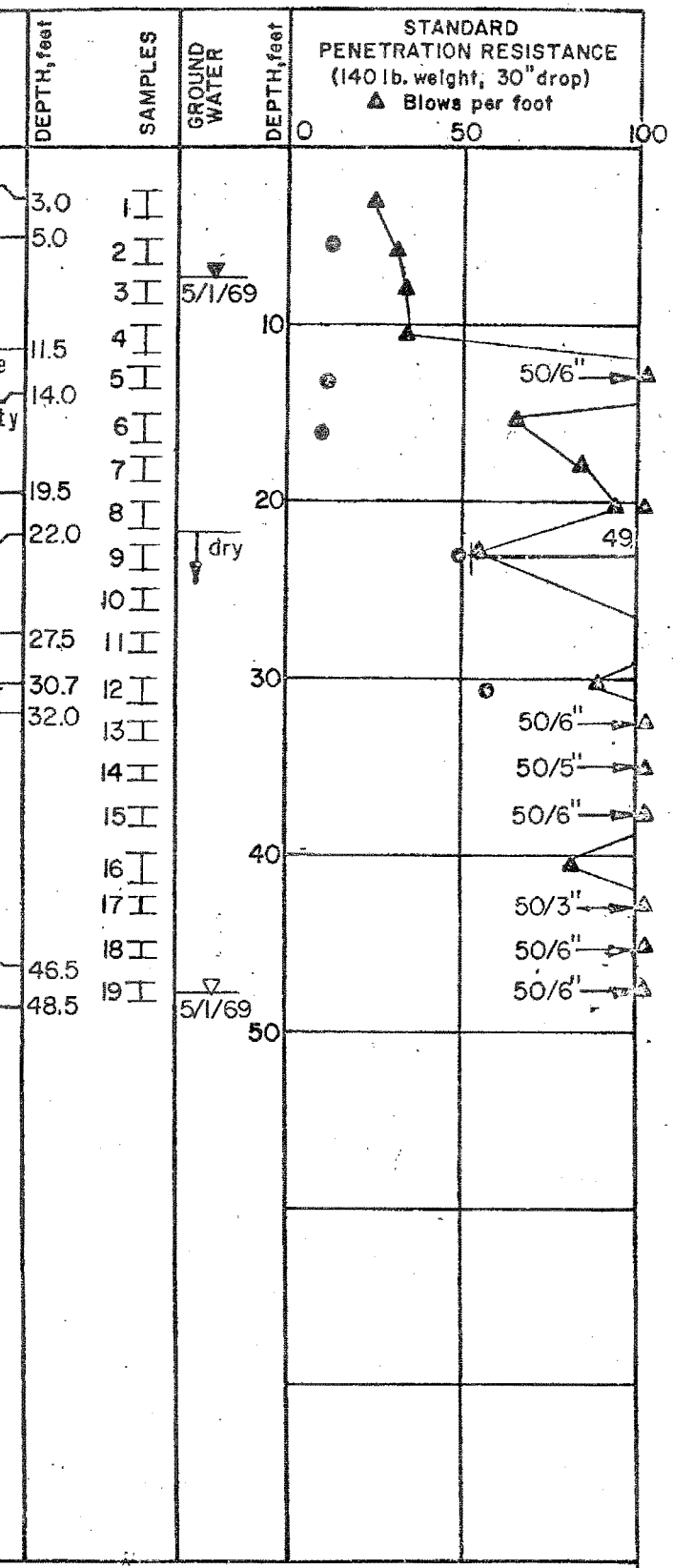
LOG OF BORING NO. B-30

JUNE 4, 1969 W-1785

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-21

USC	SOIL DESCRIPTION Surface Elevation: Approx. 189 ft.	DEPTH, feet
SM	Loose, brown, silty SAND, with organics	
SM	Medium dense, tan, silty, fine to medium SAND with gravel	3.0
SP-SM	Dense, tan to gray, slightly silty, fine to medium SAND with scattered coarse sand and fine gravel	5.0
SM	Very dense, tan to gray, silty, gravelly, fine to coarse SAND	11.5
SP-SM	Very dense, light brown to gray, slightly silty gravelly, medium to coarse SAND	14.0
SP	Very dense, gray, fine to medium SAND with scattered coarse sand and gravel	19.5
CL	Hard, blue-gray, silty CLAY	22.0
SM	Very dense, tan, silty, gravelly SAND (Glacial Till)	27.5
ML	Very dense, light brown, very fine, sandy SILT	30.7
SP	Very dense, gray, fine SAND with trace of coarse sand and gravel	32.0
SP	Very dense, gray, fine to medium SAND with scattered coarse sand	46.5
	Bottom of Boring Completed 5/1/69	48.5



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered

Atterberg limits:
- L Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

PROPOSED LIBRARY BUILDING
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

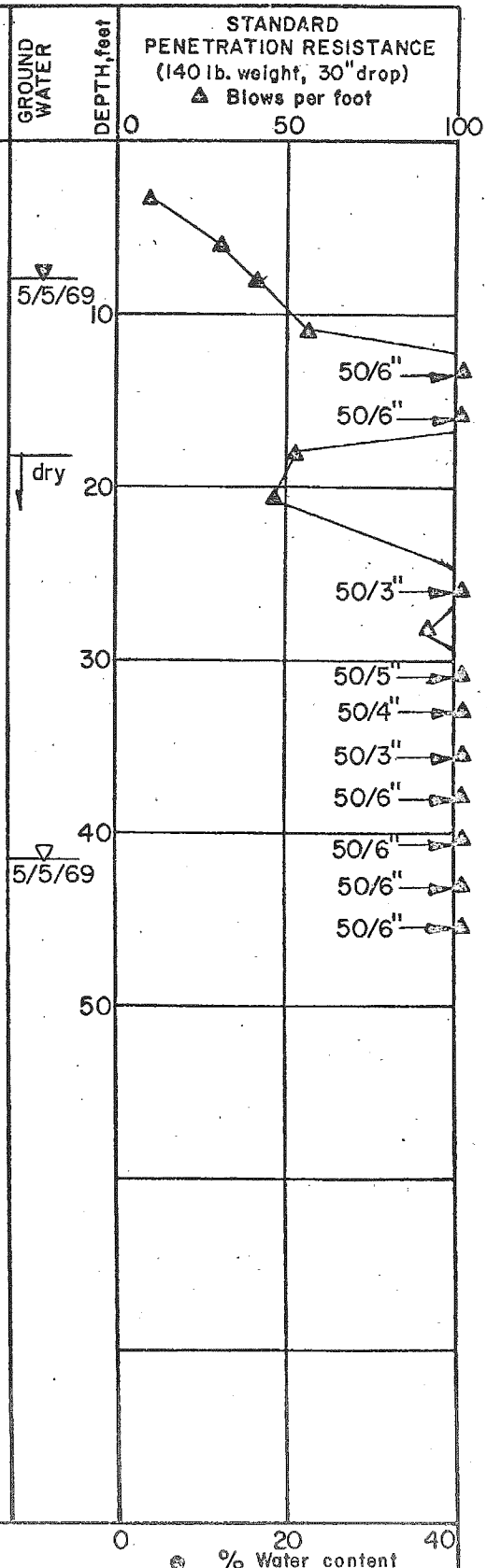
LOG OF BORING NO. B-31

JUNE 4, 1969 W-1785

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-22

USC	SOIL DESCRIPTION Surface Elevation: Approx. 184 ft.	DEPTH, feet
SM	Medium dense, brown, silty, gravelly SAND with organics	4.0
SP-SM	Dense to very dense, gray to light brown, slightly silty, fine to medium SAND with trace of coarse sand and gravel	12.0
SM	Very dense, tan, silty, gravelly SAND (Glacial Till)	16.0
SM	Very dense, blue-gray, silty, gravelly SAND (Glacial Till)	18.2
CL	Hard, blue-gray, silty CLAY	23.5
ML	Very dense, tan SILT	24.0
SM	Very dense, tan, silty, fine SAND, with lenses of tan-gray, fine SAND and a 12" layer of tan, silty SAND (Glacial Till)	28.8
SP	Very dense, gray, fine SAND with scattered medium to coarse sand and trace of gravel	41.0
SP	Very dense, gray, fine to medium SAND with trace of coarse sand	45.5
SW	Very dense, gray, gravelly, fine to coarse SAND	46.0
	Bottom of Boring Completed 5/5/69	



LEGEND

- I — 2.0" O.D. split spoon sample
- II — 3.0" O.D. thin-wall sample
- * — Sample not recovered

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P — Sampler pushed
- USC — Unified Soil Classification
- Perched Water Level

PROPOSED LIBRARY BUILDING
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

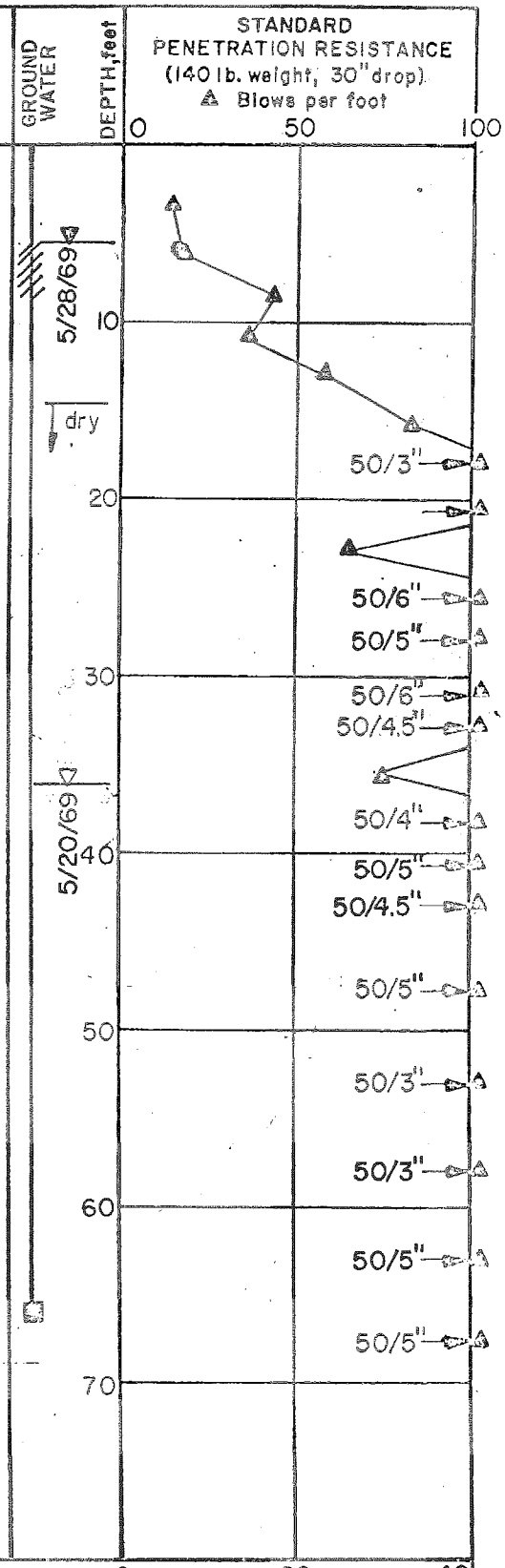
LOG OF BORING NO. B-32

JUNE 4, 1969 W-1785

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-23

USC	SOIL DESCRIPTION Surface Elevation: Approx. 179 ft.	DEPTH, feet
SM	Loose, brown, silty SAND with roots and organics	2.0
SP-SM	Medium dense to dense, gray, slightly silty, fine to medium SAND with scattered coarse sand and gravel	
SM	Very dense, tan to blue-gray, silty, gravelly SAND (Glacial Till)	13.5
CL	Very dense, tan to blue-gray, sandy, silty CLAY	15.8 17.0
SM	Very dense, tan to blue-gray, silty, gravelly SAND (Glacial Till)	21.5
ML	Very dense, light brown, silty, very fine SAND	24.5
SP	Very dense, gray, fine to medium SAND with scattered coarse sand and gravel	29.0
SP	Very dense, gray, fine SAND with trace of coarse sand and gravel	36.5
SP	Very dense, gray, fine to medium SAND with some coarse sand and trace of gravel	45.0
SP	Very dense, gray, fine SAND	57.5
SW	Very dense, gray, gravelly, fine to coarse SAND	67.9
	Bottom of Boring Completed 4/28/69	



LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

PROPOSED LIBRARY BUILDING
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

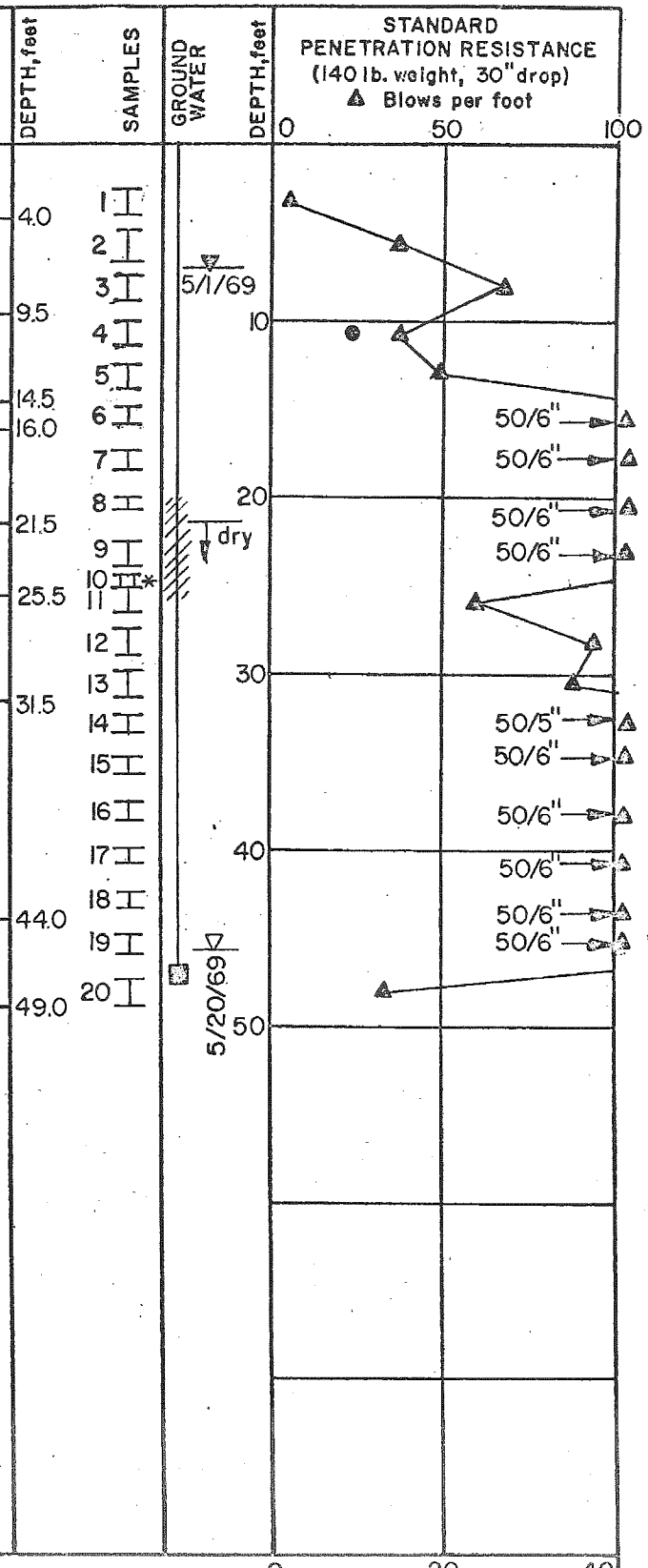
LOG OF BORING NO. B-33

JUNE 4, 1969 W-1785

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-24

USC	SOIL DESCRIPTION Surface Elevation: Approx. 188 ft.	DEPTH, feet
SM	Loose, brown, silty, gravelly SAND with some organics	4.0
SP	Dense to very dense, gray, fine to medium SAND with scattered coarse sand and gravel.	9.5
ML	Dense, light brown, sandy SILT, with gray, slightly silty, fine sand	14.5
ML	Very dense, blue-gray, silty, clayey SAND with gravel	16.0
SW-SM	Very dense, gray, slightly silty, fine to coarse SAND with scattered gravel	21.5
CL	Hard, blue-gray, silty CLAY	25.5
SM	Very dense, tan, silty, gravelly SAND (Glacial Till) with layers of silty, very fine SAND	31.5
SP	Very dense, gray, fine SAND, with scattered coarse sand and gravel	44.0
SP	Very dense, gray, fine to medium SAND with scattered coarse sand and gravel	49.0
	Bottom of Boring Completed 5/1/69	



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

PROPOSED LIBRARY BUILDING
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

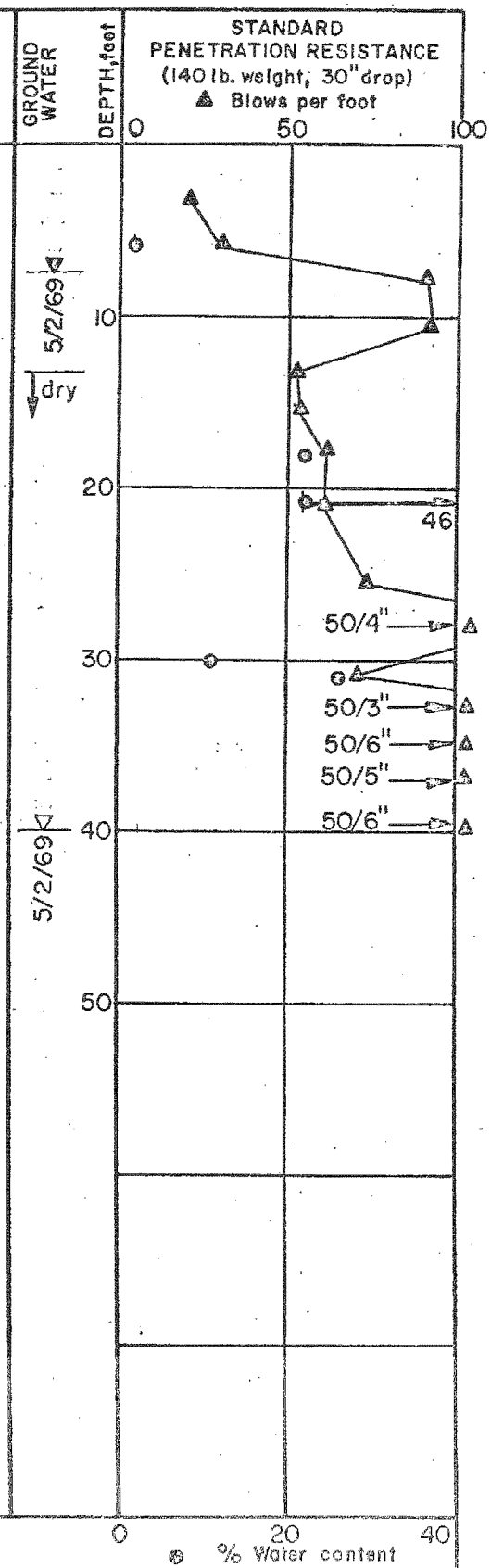
LOG OF BORING NO. B-34

JUNE 4, 1969 W-1785

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-25

USC	SOIL DESCRIPTION Surface Elevation: Approx. 182 ft.	DEPTH, feet
SM	Loose, brown, silty, gravelly SAND	2.0
SP-SM	Medium dense, gray, slightly silty, fine to medium SAND with trace of coarse sand and gravel	7.0
SP	Very dense, gray, fine to medium SAND with scattered coarse sand and gravel	11.5
ML	Very dense, light brown SILT	13.2
CL	Hard, blue-gray, silty CLAY	27.0
SM	Very dense, blue-gray, silty, gravelly SAND (Glacial Till)	29.0
SM	Very dense, tan, silty, gravelly SAND (Glacial Till)	30.8
ML	Very dense, light brown, silty, very fine SAND	31.3
SP	Very dense, gray, fine to medium SAND with scattered coarse sand and gravel	37.0
SW	Very dense, gray, fine to coarse SAND with gravel	39.0
SP	Very dense, gray, fine to medium SAND	41.0
	Bottom of Boring Completed 5/2/69	



LEGEND

- I — 2.0" O.D. split spoon sample
- II — 3.0" O.D. thin-wall sample
- ✱ — Sample not recovered

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P — Sampler pushed
- USC — Unified Soil Classification
- Perched Water Level

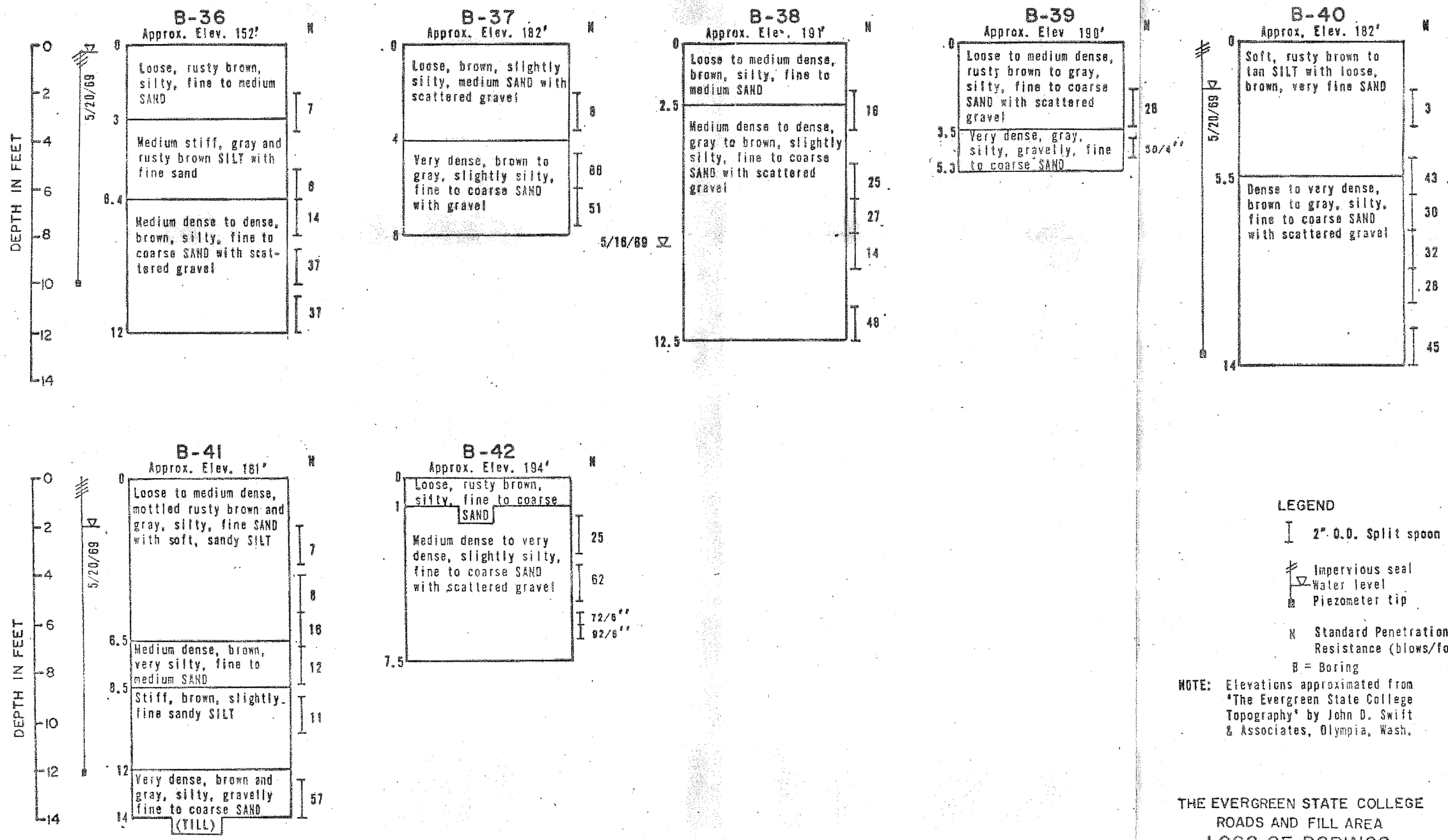
PROPOSED LIBRARY BUILDING
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-35

JUNE 4, 1969 W-1785

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-26



THE EVERGREEN STATE COLLEGE
ROADS AND FILL AREA
LOGS OF BORINGS
B-36 THROUGH B-42
JUNE 6, 1969 W-1509-3

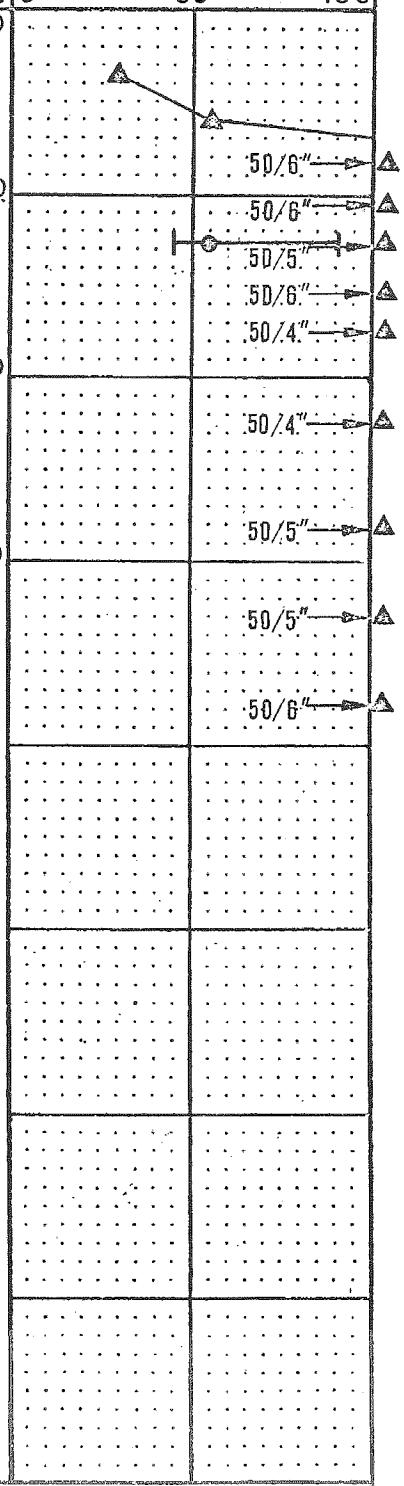
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-27

USC	SOIL DESCRIPTION Surface Elevation: Approx. 187'	DEPTH, feet	SAMPLES
	Forest Duff	0	
SM	Medium dense, rusty tan to gray, very silty fine to medium SAND	2.0	1 I
SP	Very dense, dark gray, fine to medium SAND with scattered coarse sand and fine gravel	4.5	2 I 3 I
CL	Hard, dark gray, fine sandy, silty CLAY	9.0	4 I 5 I 6 I
SP	Very dense, dark gray and brown, fine to medium SAND with scattered coarse sand and gravel	18.0	7 I 8 I 9 I 10 I
	Boring Completed 7/14/69	37.5	11 I

GROUND WATER: 7/14/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
▲ Blows per foot



LEGEND

I 2.0" O.D. split spoon sample
II 3.0" O.D. thin-wall sample
✳ Sample not recovered

Atterberg limits:
Liquid limit
Natural water content
Plastic limit

Impervious seal
Water level
Piezometer tip
P Sampler pushed
USC Unified Soil Classification
Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-43

AUGUST 6, 1969 W-1509-4

SHANNON & WILSON,
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG A-28

USC	SOIL DESCRIPTION **Surface Elevation:** Approx. 201'	DEPTH, feet	SAMPLES
	Forest Duff	1.5	
SM	Dense to very dense, brown to gray, slightly silty to silty, fine to coarse SAND with scattered gravel		1, 2, 3, 4, 5
ML	Hard, brown, sandy SILT	14.5	
SW SP	Very dense, brown, slightly silty, fine to coarse SAND with scattered gravel	15.5	6, 7, 8, 9, 10, 11
CL	Hard, dark gray, silty CLAY	30.0	12
SC	Very dense, dark gray, slightly silty, clayey SAND with scattered gravel	36.0	13, 14
SP	Very dense, brown, slightly silty to medium SAND (dry)	45.0	15
	Boring Completed 7/15/69	53.0	16

GROUND WATER 8/22/69

DEPTH, feet: 0, 10, 20, 30, 40, 50

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
▲ Blows per foot
0 50 100

50/4", 50/6", 50/5", 50/5", 50/5", 50/5", 50/6", 50/6", 50/6", 50/6", 50/6", 50/6"

0 25 50
⊙ % Water content

LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-44

AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG A-29

USC	SOIL DESCRIPTION Surface Elevation: Approx. 207'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet	STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) ▲ Blows per foot (0 — 50 — 100)
SM	Forest Duff	0.5			0	
	Medium dense, rusty brown, very silty, gravelly SAND with roots and organics	2.0	1 I			50/3" (rock)
SP SM	Very dense, brown to gray, slightly silty to silty, fine to coarse SAND with scattered gravel		2 I 3 II 4 II 5 II 6 I 7 II 8 II	7/15/69	10 20	50/3" 50/5" 50/5" 50/6" 50/4" 50/4"
SP	Very dense, brown, fine to medium SAND with trace of silt	21.0	9 I 10 I 11 II		30	50/6" 50/4"
CL	Hard, dark gray, silty CLAY	35.0	12 I 13 I		40	50/6"
ML	Hard, dark gray, clayey, sandy SILT with scattered gravel	46.0	14 I 15 I		50	50/5" 50/4"
SP	Very dense, brown, fine to medium SAND with scattered coarse sand and fine gravel (moist)	55.0 57.9	16 II		60	50/5"
	Boring Completed 7/16/69					

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- ● % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-45

AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-30

USC	SOIL DESCRIPTION Surface Elevation: Approx. 203'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet	STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) △ Blows per foot (0 – 50 – 100)
SM	Forest Duff	0.5				
	Loose, rusty brown, silty, gravelly SAND	2.1				
SM SP	Very dense, brown, silty, fine to coarse SAND with scattered gravel becoming slightly silty below 7.5 ft.		1 I 2 II 3 II 4 II 5 II 6 I 7 I 8 I 9 II	7/16/69	0 10 20	50/6" 50/6" 50/6" 50/4" 50/4" 50/5" 50/4"
SW	Very dense, dark gray, slightly silty, fine to coarse SAND	25.0	10 II		30	50/6"
SM	Very dense, dark gray, silty, fine SAND	29.0	11 I			50/3"
CL	Hard, dark gray, silty CLAY	34.0	12 I		40	50/4"
ML	Hard, dark gray, clayey SILT with sand and gravel	42.0	13 I			50/4"
SP	Very dense, brown, slightly silty, fine to medium SAND with scattered coarse sand and gravel	46.0	14 II 15 II 16 * 17		50	50/4" 50/5" 50/0.5" (rock)
			18 I	8/22/69	60 70	50/3" 50/3"
	Boring Completed 7/16/69	68.2				

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- ● % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-46

AUGUST 6, 1969 W - 1509 - 4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-31

USC	SOIL DESCRIPTION Surface Elevation: Approx. 198'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet	STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) ▲ Blows per foot (0 – 50 – 100)
SM	Forest Duff	1.0			0	
	Loose, rusty brown, silty, gravelly SAND with roots and organics	2.5	1 I			
SP	Medium dense, brown, slightly silty, fine to medium SAND	7.0	2 I 3 I			
SP SM	Dense to very dense, slightly silty to silty, fine to medium SAND with scattered coarse sand		4 I 5 I	7/17/69	10	50/6"
GM	Very dense, brown, silty, sandy GRAVEL (Waterbearing)	14.0	6 I			50/6"
SW	Very dense, brown to gray, fine to coarse SAND with traces of gravel and silt	17.0	7 II 8 I 9 II		20	50/6" 50/6" 50/5"
			10 II			81/6"
CL	Hard, dark gray, silty CLAY with joints and slickensides	30.0	11 I 12 I 13 I		30 40	50/5" 55/6" 50/6"
ML	Hard, dark gray, slightly clayey, sandy SILT with scattered gravel	45.0	14 I			50/4"
	Boring Completed 7/17/69	48.4			50	

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- ⊙ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-47

AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-32

USC	SOIL DESCRIPTION Surface Elevation: Approx. 202'	DEPTH, feet	SAMPLES
	Forest Duff	0.5	
SM	Loose, rusty brown, silty SAND with roots and organics	2.2	1 I
SM	Very dense, brown, very silty, fine to medium SAND with scattered coarse sand	7.0	2 I 3 I
SP	Very dense, gray, fine to medium SAND with trace of silt	9.5	4 II
SM	Very dense, brown, silty to very silty, fine to coarse SAND with scattered gravel	14.0	5 II
SM ML	Very dense, brown, silty, fine SAND becoming fine sandy SILT below 18 ft.	21.0	6 I 7 I
SP	Very dense, brown to gray, slightly silty, fine to medium SAND, locally medium to coarse sand below 27.5 ft.	36.0	8 I 9 II 10 I
CL	Hard, dark gray, silty CLAY	38.5	11 I
	Boring Completed 7/17/69		

GROUND WATER — 8/22/69

DEPTH, feet: 0, 10, 20, 30, 40

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot
0 — 50 — 100

56/6" △
50/6" △
50/4" △
50/6" △
50/5" △
50/5" △
50/5" △
61/6" △

0

LEGEND

I 2.0" O.D. split spoon sample
II 3.0" O.D. thin-wall sample
* Sample not recovered

Atterberg limits:
Liquid limit
Natural water content
Plastic limit

Impervious seal
Water level
Piezometer tip
P Sampler pushed
USC Unified Soil Classification
Perched Water Level

© % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-48

AUGUST 6, 1969 W - 1509 - 4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-33

USC	SOIL DESCRIPTION Surface Elevation: Approx. 196'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet	STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) ▲ Blows per foot (0 – 50 – 100)
	Forest Duff	1.0			0	
SM	Medium dense, rusty brown, silty, slightly gravelly SAND with roots, and organics	3.0	1 II			50/4" (rock) ▲
			2 I			50/6" ▲
GM SM	Very dense, brown, silty fine to coarse SAND and GRAVEL		3 I			50/6" ▲
			4 II		10	50/3" ▲
SM	Very dense, brown, silty, fine to medium SAND with scattered coarse sand and trace of gravel to 1"	11.0	5 I			50/6" ▲
			6 I			50/6" ▲
			7 I	7/18/69	20	50/5" ▲
			8 I			50/6" ▲
SP	Very dense, gray, fine to medium SAND with scattered coarse sand and gravel	27.0	9 II		30	50/6" (rock) ▲
			10 II			50/4" ▲
			11 II		40	50/5" ▲
CL	Hard, dark gray, silty CLAY	42.0 43.3	12 I			50/5" ▲
	Boring Completed 7/18/69				50	
					0	

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✱ Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

⊗ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

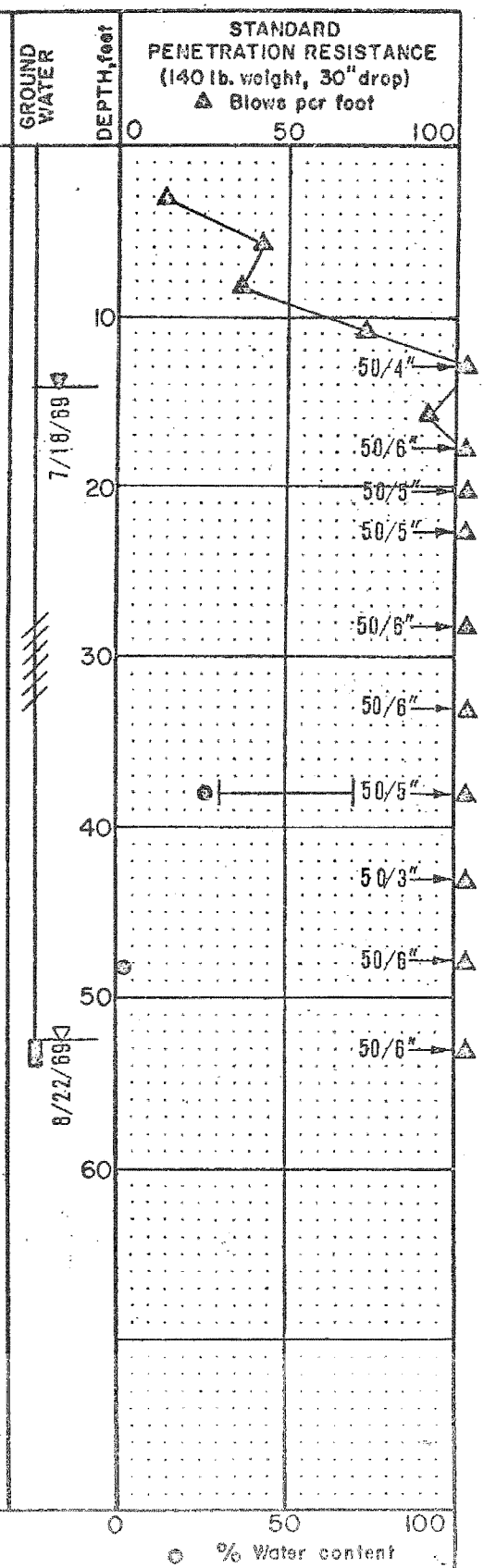
LOG OF BORING NO. B-49

AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-34

USC	SOIL DESCRIPTION Surface Elevation: Approx. 195'	DEPTH, feet	SAMPLES
	Forest Duff	0	
ML	Stiff, tan to brown, sandy, slightly gravelly SILT	1.5	1
SM	Dense, brown to gray, silty, fine to medium SAND	4.5	2
ML	Hard, brown, sandy SILT	7.0	3
SM	Very dense, brown, silty to very silty, fine to coarse SAND with scattered gravel to 1"	9.5	4, 5, 6, 7, 8, 9
CH	Hard, dark gray, silty CLAY (highly plastic)	29.0	10, 11, 12
SP	Very dense, brown, slightly silty, fine SAND	42.0	13
SP	Very dense, gray, slightly silty, fine to medium SAND	44.0	14, 15
	Boring Completed 7/18/69	53	



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-50

AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-35

USC	SOIL DESCRIPTION Surface Elevation: Approx. 183'	DEPTH, feet	SAMPLES
	Forest Duff	0.5	
SM	Loose to medium dense, brown, silty, fine to medium SAND with roots and organics	3.5	1 I, 2 I
ML	Hard, light brown, sandy SILT	6.0	
SP SM	Dense to very dense, brown to gray, slightly silty to silty, fine to medium SAND with scattered coarse sand and gravel	14.5	3 I, 4 I, 5 I, 6 II
CL	Hard, dark gray, silty CLAY	20.0	7 I
ML	Hard, dark gray, clayey SILT with sand and scattered gravel	24.0	8 I
SP	Very dense, brown to gray, fine to medium SAND with trace of silt (dry to 37 ft.)	42.0	9 II, 10 II, 11 I, 12 II
	Boring Completed 7/21/69		

GROUND WATER: 8/22/69

DEPTH, feet: 0, 10, 20, 30, 40, 50

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
▲ Blows per foot
0 50 100

50/6" ▲ (depth 20)
50/6" ▲ (depth 25)
50/6" ▲ (depth 30)
50/6" ▲ (depth 35)
50/6" ▲ (depth 40)

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✳ Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- ⊗ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-51

AUGUST 6, 1969 W-1509-4

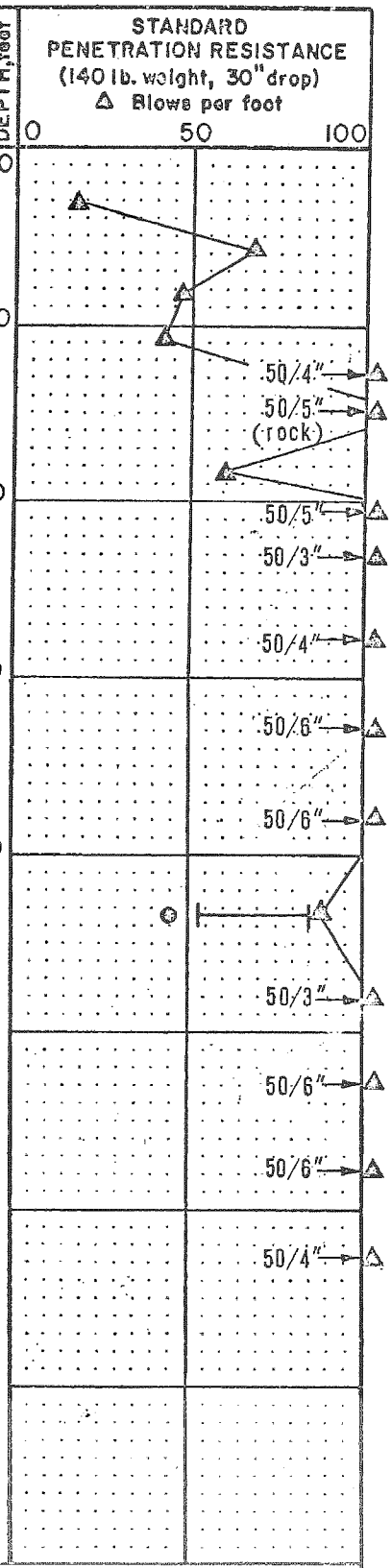
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG A-36

USC	SOIL DESCRIPTION Surface Elevation: Approx. 195'	DEPTH, feet	SAMPLES
	Forest Duff	0.5	
SM	Medium dense, brown, very silty SAND with roots and organics	4.0	
SM	Dense to very dense, brown, silty, fine to coarse SAND with gravel to ¾"		1, 2, 3, 4, 5, 6
SP	Very dense, brown, slightly silty, fine to medium SAND	17.0	7, 8
CL	Hard, dark gray, silty CLAY	22.8	9
SM	Very dense, brown, silty, fine SAND becoming silty fine to coarse sand below 30'	26.0	10, 11
ML	Hard, dark gray, slightly sandy, clayey SILT with a few horizontal partings of fine to medium sand (dry)	36.0	12, 13, 14, 15
SM	Very dense, gray to brown, silty, fine to medium SAND with traces of coarse sand and gravel to ¾"	55.0	16
SP	Very dense, gray, fine to medium SAND with trace of coarse sand and fine gravel	62.0 62.8	17

Boring Completed 7/22/69

GROUND WATER: 7/21/69



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✳ Sample not recovered

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-52

AUGUST 6, 1969 W-1509-4

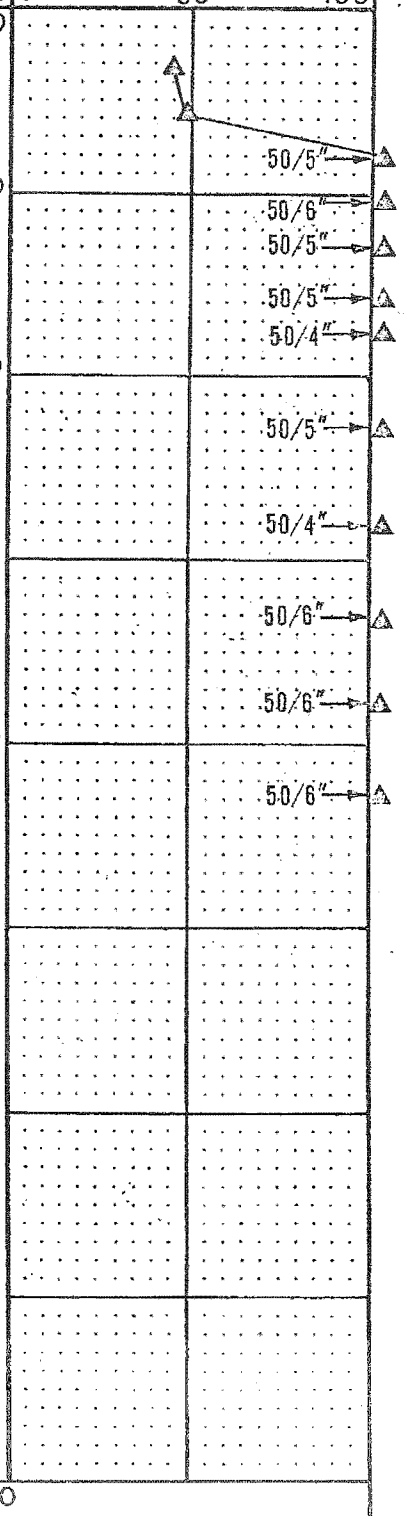
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-37

USC	SOIL DESCRIPTION Surface Elevation: Approx. 180'	DEPTH, feet	SAMPLES
SM	Medium dense, rusty brown, silty, fine to medium SAND with scattered gravel	0 1.9	1
SP	Dense, gray, fine to medium SAND with trace of fine gravel, becoming fine to coarse sand below 5.0' (dry)	7.0	2
SW	Very dense, brown, slightly silty, fine gravelly, fine to coarse SAND (Water-bearing)	7.5	3
SM	Very dense, brown, very silty, fine SAND with scattered fine gravel (dry)	9.5	4
SW	Very dense, brown, slightly silty, fine to coarse SAND with scattered fine gravel (Waterbearing)		5, 6, 7, 8
CL	Hard, dark gray, silty CLAY (dry)	26.0	9, 10, 11
SW	Very dense, fine to coarse SAND with gravel to ¾"	38.0	12
	Boring Completed 7/23/69	43.0	

GROUND WATER: 7/22/69, 7/23/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) ▲ Blows per foot



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- ○ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-53

AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-38

USC	SOIL DESCRIPTION Surface Elevation: Approx. 184'	DEPTH, feet	SAMPLES
SM	Forest Duff	0.5	
SM	Medium dense, rusty brown, very silty, fine to medium SAND with roots	2.0	1
SM	Medium dense, brown, silty, fine to medium SAND	9.5	2, 3
SM	Very dense, brown, silty to very silty, fine to coarse SAND with fine gravel	14.0	4, 5
SM SW	Very dense, brown to gray, slightly silty, fine to coarse SAND with scattered gravel	29.0	6, 7, 8, 9
CL	Hard, dark gray, slightly sandy, silty CLAY	36.0	10
SP	Very dense, dark gray, fine to medium SAND with trace of silt and coarse sand	58.0	11, 12, 13, 14, 15
SM	Very dense, brown, silty, fine to coarse SAND with gravel	62.9	16
	Boring Completed 7/23/69		

GROUND WATER: 7/23/69; 8/22/69

DEPTH, feet: 0, 10, 20, 30, 40, 50, 60, 70

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
▲ Blows per foot
0 50 100

(rock)
50/4"
50/5"
50/2"
50/4"
50/6"
50/4"
50/5"
50/6"
50/6"
50/6"
50/5"

0

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

● % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

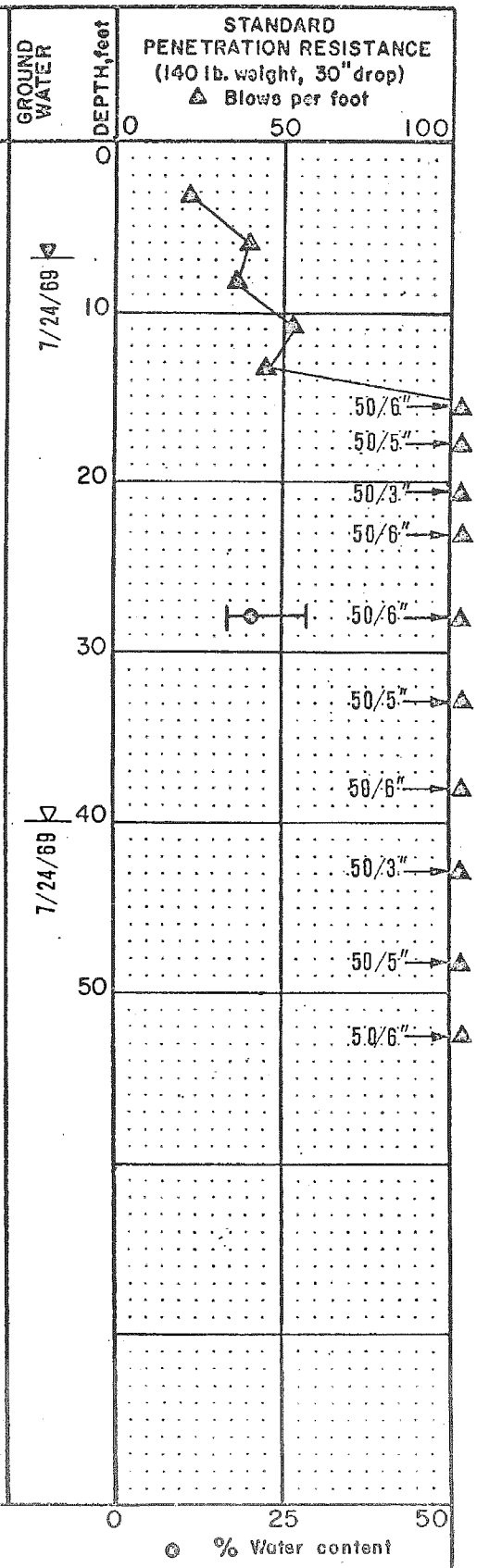
LOG OF BORING NO. B-54

AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-39

USC	SOIL DESCRIPTION Surface Elevation: Approx. 172'	DEPTH, feet	SAMPLES
SM	Loose to medium dense, rusty brown, very silty, fine to medium SAND		1
SP	Dense to very dense, brown to gray, slightly silty, fine to medium SAND with scattered coarse sand and gravel below 8.0'	4.5	2, 3, 4, 5, 6, 7
ML	Hard, dark gray, sandy, slightly clayey SILT with scattered gravel	19.5	8, 9, 10
SW	Very dense, brown, fine to coarse SAND with scattered gravel and trace of silt	31.5	11, 12
SP	Very dense, dark gray, fine to medium SAND	42.0	13, 14
	Boring Completed 7/24/69	53.0	15



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-55

AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-40

USC	SOIL DESCRIPTION Surface Elevation: Approx. 173'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet	STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) ▲ Blows per foot (0 – 50 – 100)
	Forest Duff	0.5			0	
SM	Medium dense, rusty brown, slightly gravelly, silty, fine to medium SAND with roots and organics	4.5	1			
SM	Dense to very dense, brown to gray, silty to very silty, fine to medium SAND with scattered coarse sand and fine gravel		2			50/6"
			3			50/5"
			4		10	50/5"
			5			
			6	7/24/69		
CL	Hard, dark gray, slightly fine sandy, silty CLAY	17.0	7			50/6"
			8		20	50/5"
			9			50/5"
			10			50/6"
ML	Hard, dark gray, slightly clayey, sandy SILT with scattered gravel	29.0			30	
			11			50/2"
SP	Very dense, brown to gray, fine to medium SAND with scattered coarse sand and gravel	35.0		8/22/69		
			12		40	50/3"
			13			50/4"
	Boring Completed 7/25/69	47.0	14		50	50/4"
					0	

LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

● % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-56

AUGUST 6, 1969 W-1509-4

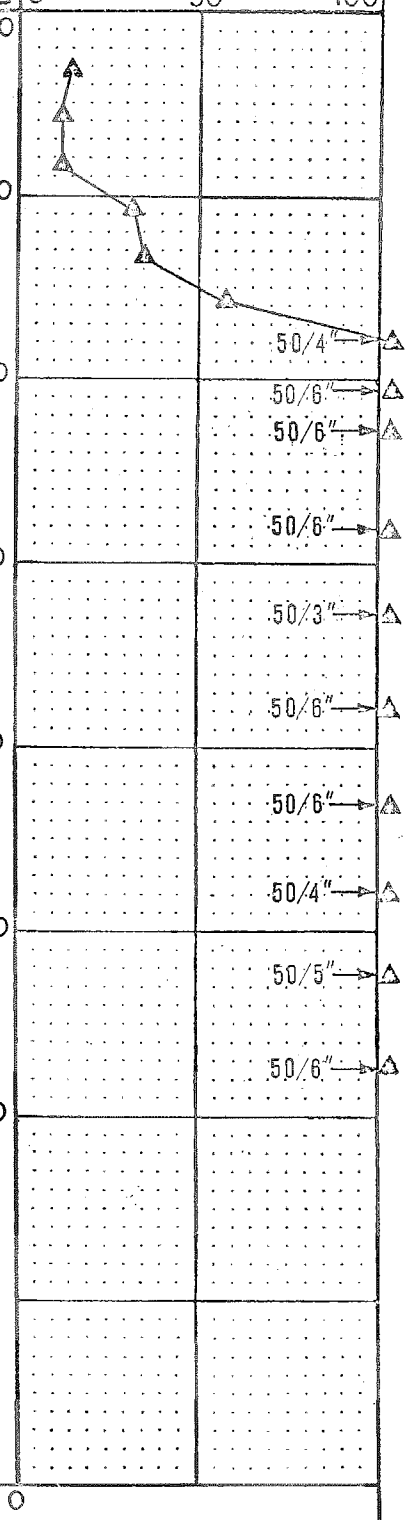
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-41

USC	SOIL DESCRIPTION Surface Elevation: Approx. 164'	DEPTH, feet	SAMPLES
	Forest Duff	1.0	
ML	Stiff, dark brown, slightly gravelly, sandy SILT with roots and organics	4.5	1 I
ML	Stiff, tan, slightly clayey, sandy SILT		2 I 3 I 4 I
SM	Dense to very dense, dark gray, very silty SAND with scattered gravel	13.0 15.5	5 I 6 I
SW	Very dense, brown to gray, fine to coarse SAND with scattered fine gravel and trace of silt		7 I 8 I 9 II 10 I
SP	Very dense, dark gray, slightly silty, fine to medium SAND with scattered coarse sand and fine gravel	33.0	11 II 12 II 13 I 14 II 15 I 16 I
	Boring Completed 7/25/68	58.0	

GROUND WATER DEPTH, feet: 7/25/69 (10); 7/25/69 (40)

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Imparvious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

● % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-57

AUGUST 6, 1969 W-1509-4

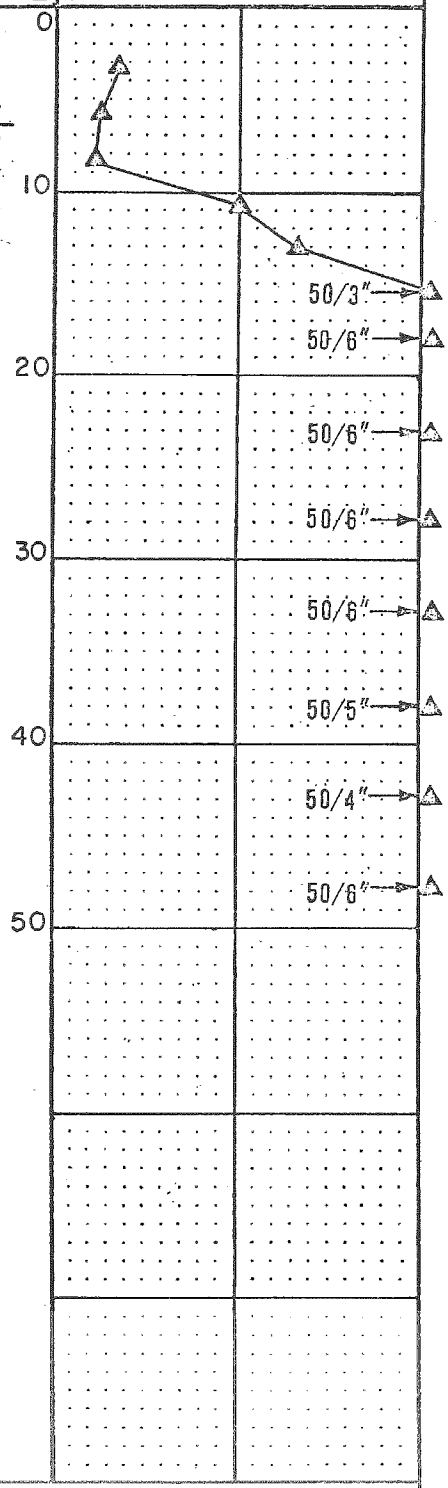
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-42

USC	SOIL DESCRIPTION Surface Elevation: Approx. 167'	DEPTH, feet	SAMPLES
	Forest Duff	2.0	
ML	Very stiff, tan, slightly clayey, sandy SILT	3.5	1
SM SC	Medium dense, tan, slightly clayey, silty, fine to coarse SAND with scattered gravel		2 3
SM	Very dense, brown, very silty, fine SAND with scattered fine gravel	10.5 12.0	4 5
SM	Very dense, dark gray, silty fine to medium SAND		6 7
ML	Hard, dark gray, sandy SILT with scattered gravel (Glacial TILL)	21.0	8
SM	Very dense, brown, silty, fine to coarse SAND with scattered fine gravel	26.0	9
SW	Very dense, brown, fine to coarse SAND with scattered gravel and trace of silt (Waterbearing)	32.0	10 11 12
	Boring Completed 7/28/69	48.0	13

GROUND WATER: 8/22/69; 7/28/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
Δ Blows per foot



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

o % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-58

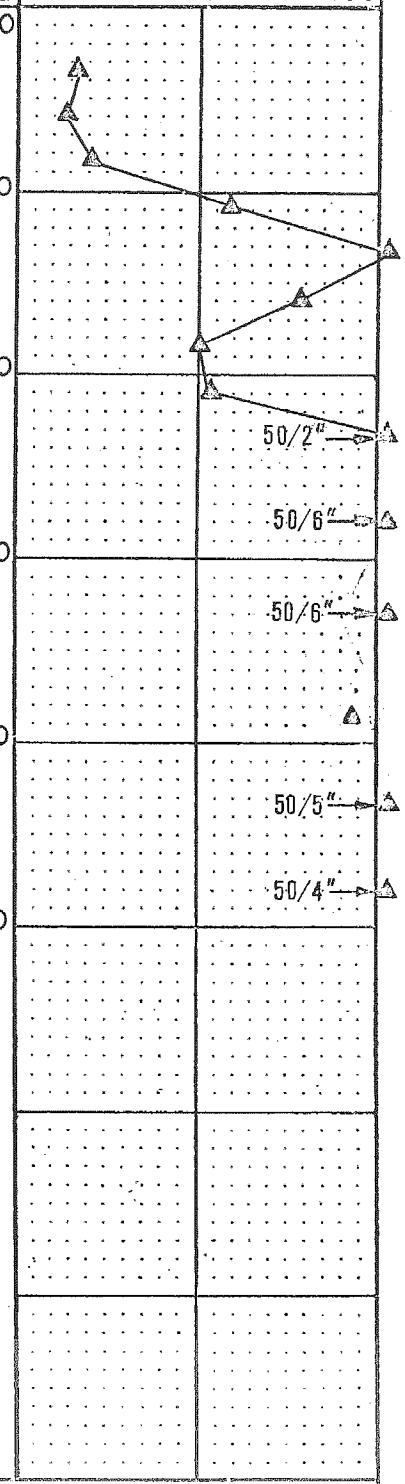
AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-43

USC	SOIL DESCRIPTION Surface Elevation: Approx. 168'	DEPTH, feet	SAMPLES
	Forest Duff	1.0	
ML	Stiff, dark brown, sandy SILT with roots and organics	3.0	1, 2
SM	Medium dense, tan, very silty, fine to medium SAND with fine gravel below 8.0'	10.5	3, 4
ML	Hard, brown, sandy, slightly gravelly SILT	14.0	5
CL	Hard, dark gray, silty CLAY	20.5	6, 7, 8
SP	Very dense, dark gray, slightly silty fine to medium SAND	22.0	9
ML	Hard, brown to gray, sandy SILT with scattered gravel	26.0	10
SW	Very dense, brown, fine to coarse SAND with gravel and trace of silt	36.0	11, 12
SP	Very dense, dark gray fine to medium SAND with scattered coarse sand and fine gravel	48.3	13, 14
	Boring Completed 7/29/69		

GROUND WATER: 8/22/69



LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-59

AUGUST 6, 1969 W-1509-4

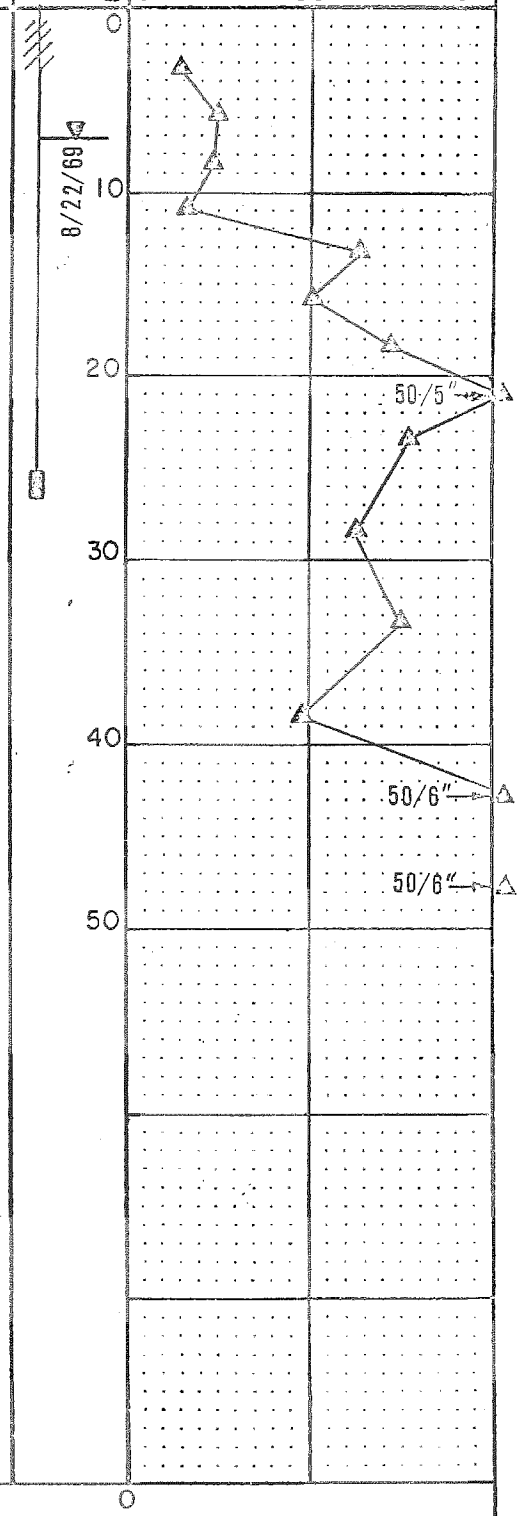
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-44

USC	SOIL DESCRIPTION Surface Elevation: Approx. 183'	DEPTH, feet	SAMPLES
	Forest Duff	1.0	
SM GM	Medium dense, tan to brown, very silty SAND and GRAVEL with roots and organics	4.5	1
SM	Medium dense, brown, silty, fine to coarse SAND with scattered gravel to ¾" (Waterbearing)	12.0	2, 3, 4
SM	Very dense, brown, silty, fine to medium SAND with scattered coarse sand and fine gravel	20.0	5, 6, 7
SP	Very dense, brown, slightly silty, fine to medium SAND	26.0	8, 9
CL	Hard, dark gray, silty CLAY	37.0	10, 11
SM	Dense, dark gray, very silty, fine to medium SAND	40.0	12
SP	Very dense, brown, slightly silty, fine to medium SAND with scattered coarse sand and fine gravel	48.0	13 ±, 14 ±
	Boring Completed 7/29/69		

GROUND WATER: 8/22/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- ⊙ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-60
AUGUST 6, 1969 W-1509-4

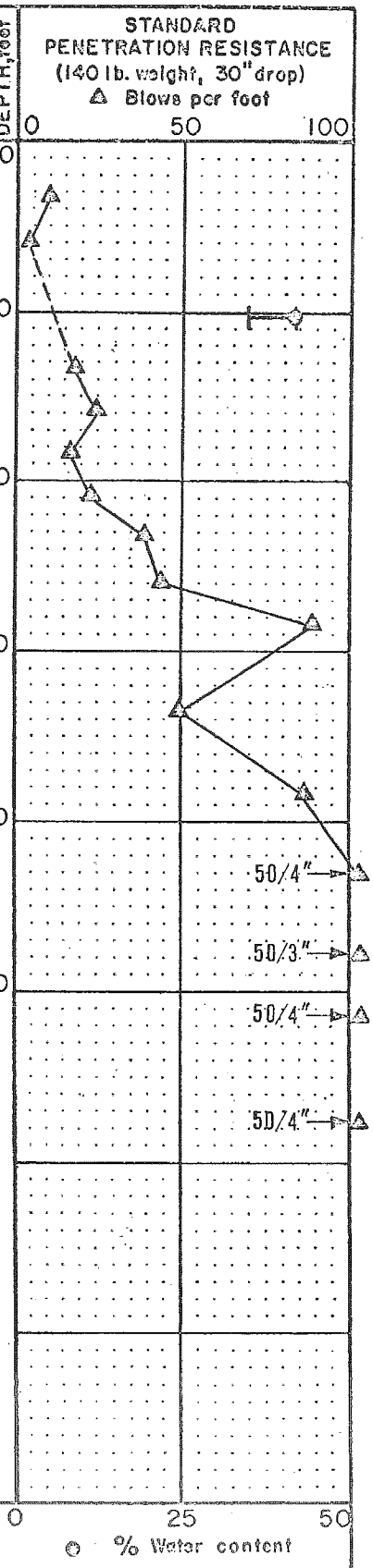
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-45

USC	SOIL DESCRIPTION Surface Elevation: Approx. 161'	DEPTH, feet
ML	Stiff, tan to rusty brown, fine sandy SILT with organics	0 2.0
ML	Soft to medium stiff, tan to rusty brown, slightly clayey SILT with seams to 4" of fine to medium sand	11.5
SM	Medium dense, gray to brown, silty fine to medium SAND with trace of coarse sand and gravel	22.0
SP	Dense to very dense, brown, slightly silty, fine to medium SAND	36.0
SM	Very dense, brown, very silty fine SAND	40.0
ML	Hard, dark gray, sandy SILT with scattered gravel	46.0
SP	Very dense, gray, fine to medium SAND with scattered coarse sand and fine gravel and a trace of silt (Waterbearing)	57.8
	Boring Completed 7/30/69	

SAMPLES: 1 I, 2 I, 3 II P, 4 II P, 5 I, 6 I, 7 I, 8 I, 9 I, 10 I, 11 I, 12 I, 13 I, 14 I, 15 I, 16 I, 17 I

GROUND WATER: 8/22/69



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-61

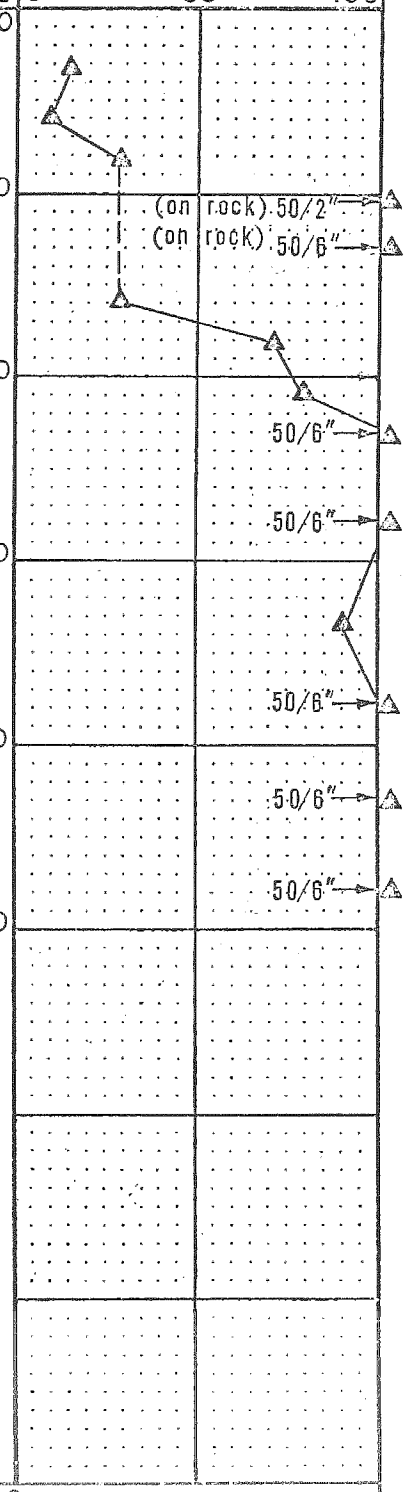
AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-46

USC	SOIL DESCRIPTION Surface Elevation: Approx. 165'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet
ML	Forest Duff	1.0			0
ML SM	Soft, brown, sandy SILT with roots and organics	2.0	I 1		
	Stiff, tan to gray, sandy SILT becoming loose brown, very silty fine SAND below 6'	7.0	I 2		
SM	Medium dense to dense, brown, very silty, fine to coarse SAND with scattered gravel		I 3	7/30/69	10
			I 4		
			I 5		
			I 6		
SM ML	Very dense, brown, very silty, fine to coarse SAND to hard sandy SILT with scattered gravel	17.0	I 7		20
			I 8		
ML	Hard, gray, slightly clayey SILT	22.0	I 9		
SW SP	Very dense, brown to gray, fine to coarse SAND with scattered gravel and trace of silt (Waterbearing below 35.0')	25.0	I 10		30
			I 11		
			I 12		40
			I 13		
		48.0	I 14		50
	Boring Completed 7/30/69				

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) △ Blows per foot



LEGEND

I 2.0" O.D. split spoon sample
II 3.0" O.D. thin-wall sample
✱ Sample not recovered

Atterberg limits:
Liquid limit
Natural water content
Plastic limit

Impervious seal
Water level
Piezometer tip
P Sampler pushed
USC Unified Soil Classification
Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-62
AUGUST 6, 1969 W-1509-4

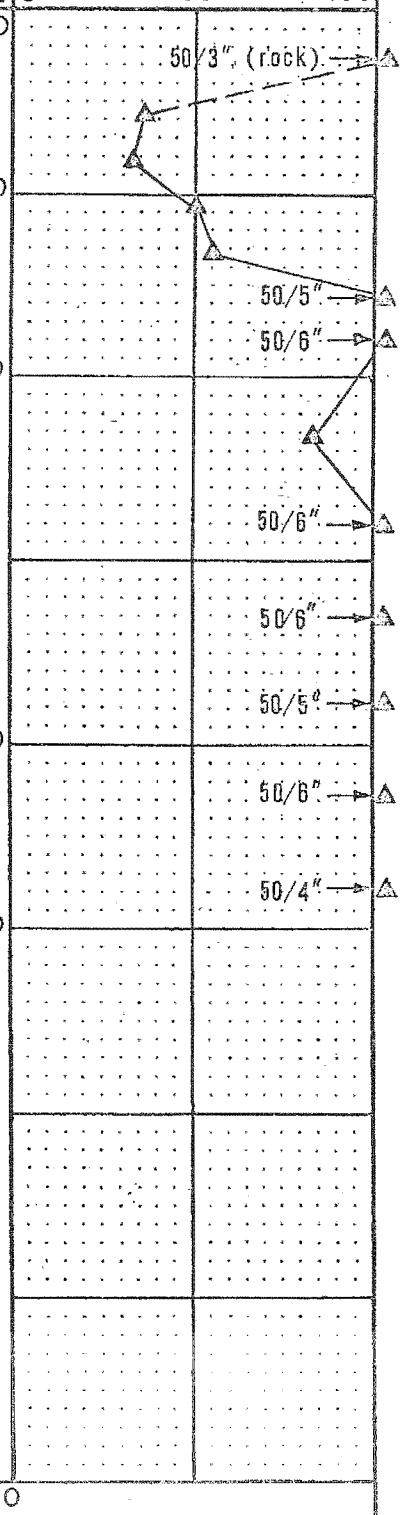
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-47

USC	SOIL DESCRIPTION Surface Elevation: Approx. 170'	DEPTH, feet	SAMPLES
SM	Forest Duff	0.5	1
	Loose to medium dense, rusty brown, very silty, slightly gravelly SAND with roots and organics	3.0	2
SM	Dense, brown, very silty, fine to coarse SAND with scattered gravel		3, 4
SP	Very dense, brown, fine to medium SAND with scattered coarse sand and fine gravel and a trace of silt	12.0	5, 6, 7
ML CL	Hard, dark gray, slightly sandy, clayey SILT to silty CLAY	20.0	8, 9, 10
SP	Very dense, brown to gray, fine to medium SAND with scattered coarse SAND and GRAVEL (Waterbearing)	36.0	11, 12
	Boring Completed 7/30/69	47.8	13

GROUND WATER: 7/30/69, 8/22/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✲ Sample not recovered
- Atterberg limits: L Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- ⊙ % Water content

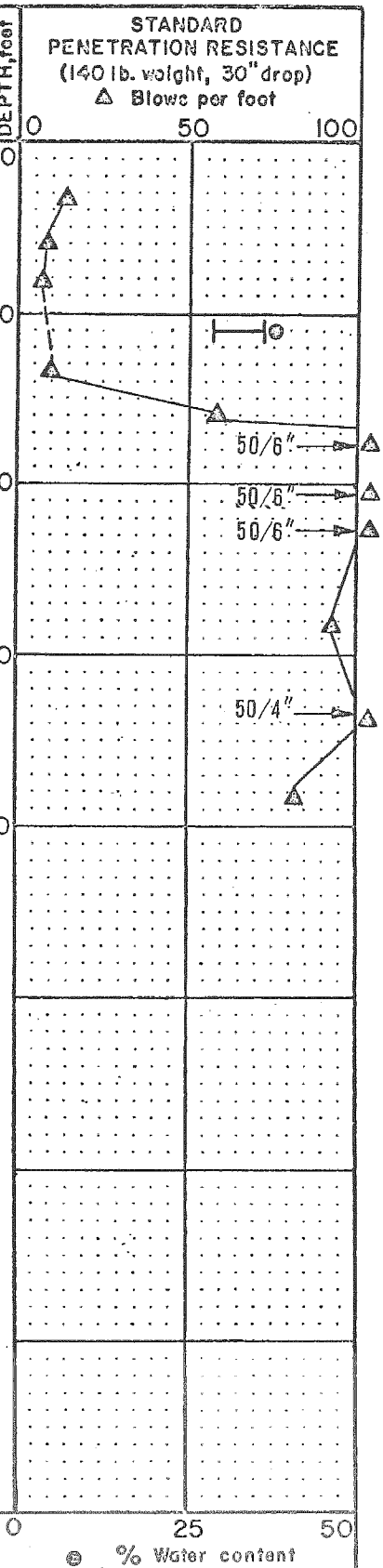
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-63
AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-48

USC	SOIL DESCRIPTION Surface Elevation: Approx. 181'	DEPTH, feet	SAMPLES	GROUND WATER
	Forest Duff	1.0		
SM	Medium dense, brown, silty, fine to coarse SAND with gravel	3.0	1 I	
SM ML	Loose, tan to brown, silty, very fine SAND to medium stiff, slightly clayey SILT with horizontal sand partings		2 I 3 I 4 II 5 I	7/31/69
ML	Hard, mottled tan and gray, clayey SILT	15.5 16.5	6 I	
ML	Hard, dark gray, clayey SILT with scattered sand and gravel	18.4	7 I 8 I	
SP	Very dense, brown, fine to medium SAND with scattered coarse sand and gravel and a trace of silt (dry)		9 I 10 I 11 I 12 I	
	Boring Completed 7/31/69	39.0		



LEGEND

I 2.0" O.D. split spoon sample
II 3.0" O.D. thin-wall sample
✳ Sample not recovered

Atterberg limits:
Liquid limit
Natural water content
Plastic limit

Impervious seal
Water level
Piezometer tip
P Sampler pushed
USC Unified Soil Classification
Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

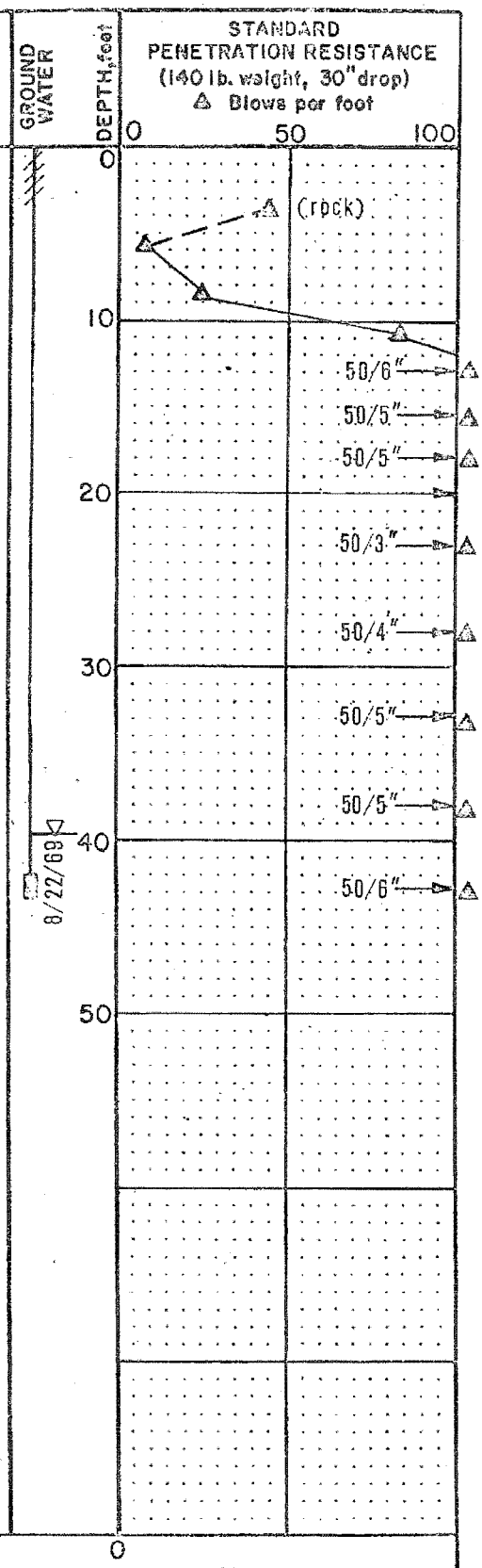
LOG OF BORING NO. B-64

AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-49

USC	SOIL DESCRIPTION Surface Elevation: Approx. 178'	DEPTH, feet	SAMPLES
	Forest Duff	0.5	
SM	Loose to medium dense, rusty brown, silty, gravelly SAND with roots and organics	4.5	1 I 2 I
ML SM	Medium stiff, tan, clayey SILT and loose to medium dense, fine to medium SAND (layered)	10.5	3 I 4 I
ML	Hard, brown, very sandy SILT with scattered gravel	13.0	5 I 6 I
SP	Very dense, brown, fine to medium SAND with scattered coarse sand and trace silt		7 I 8 I 9 I 10 I 11 I
	Boring Completed 7/31/69	43.0	12 I



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered

Atterberg limits:
- L Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

e, % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-65

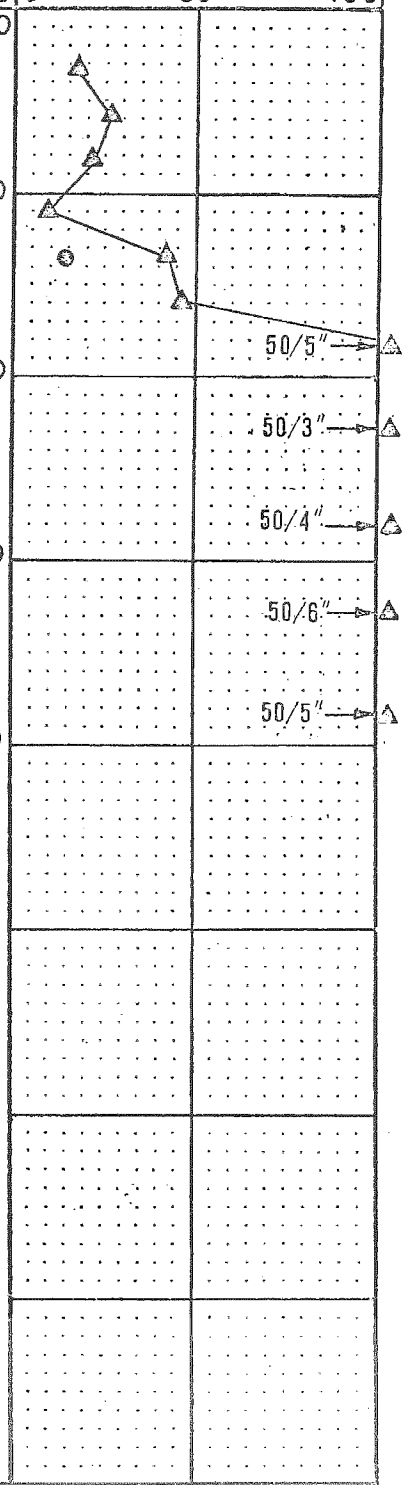
AUGUST 6, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-50

USC	SOIL DESCRIPTION Surface Elevation: Approx. 145'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet
	Forest Duff	1.0			0
SM	Loose, brown, very silty SAND with roots and organics	3.0	1		
SM	Medium dense, tan to brown, silty fine SAND	4.5	2		
SW	Medium dense, brown to gray, slightly silty, fine to coarse SAND with scattered fine gravel		3	7/31/69	10
SM	Loose, light brown, very silty, fine SAND	10.5	4		
SM	Dense, tan, very silty, fine to coarse SAND with scattered fine gravel (weathered TILL)	13.0	5 6		
SM	Very dense, brown, silty, fine to medium SAND	17.0	7		20
ML	Hard, dark gray, sandy, slightly gravelly, clayey SILT	22.0	8		
SP SM	Very dense, brown to gray, slightly silty to silty, fine to medium SAND (Waterbearing)	26.0	9		30
			10	7/31/69	
		38.9	11		40
	Boring Completed 7/31/69				

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✳ Sample not recovered

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

● % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-66
JANUARY 15, 1970 W-1509-4

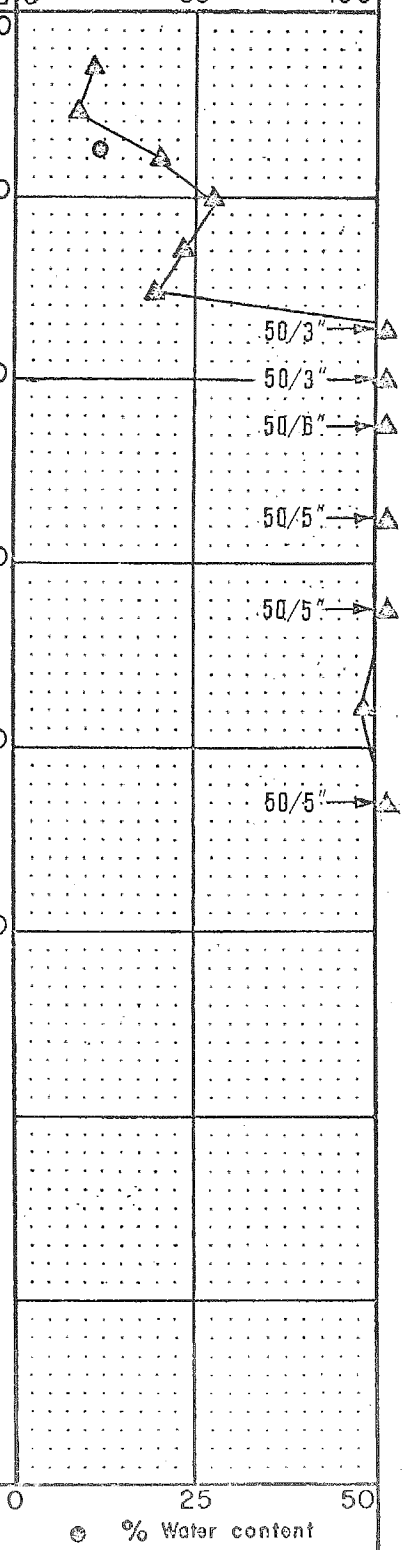
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-51

USC	SOIL DESCRIPTION Surface Elevation: Approx. 152'	DEPTH, feet	SAMPLES
	Forest Duff	0.5	
SM	Medium dense, rusty brown, very silty, fine to coarse SAND with gravel and roots	4.0	1 I, 2 I
SM	Medium dense to dense, brown, very silty, fine to medium SAND with scattered coarse sand (weathered Glacial TILL)	9.0	3 I, 4 I
SM	Dense to very dense, brown, silty, fine to coarse SAND with scattered fine gravel	15.0	5 I, 6 I, 7 II
SW	Very dense, gray, slightly silty, fine to coarse SAND with scattered fine gravel	21.5	8 I, 9 I
ML	Hard, dark gray, slightly clayey, sandy SILT	30.0	10 I, 11 I
SP	Very dense, brown, slightly silty, fine to medium SAND with scattered coarse sand and fine gravel (Waterbearing at 36 ft.)	43.5	12 I, 13 I
	Boring Completed 8/1/69		

GROUND WATER: 8/22/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✳ Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-67
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-52

USC	SOIL DESCRIPTION **Surface Elevation:** Approx. 163'	DEPTH, feet	SAMPLES
	Forest Duff	0.5	
SM	Loose, dark brown, very silty SAND with roots and organics	2.0	1
ML	Stiff, tan, sandy SILT	4.5	2
SM	Very dense, brown to gray, very silty, fine SAND with scattered medium to coarse sand (Glacial TILL)		3, 4
SM	Very dense, brown to gray, very silty, fine to coarse SAND with scattered fine gravel (Glacial TILL)	11.5	5, 6
SP	Very dense, brown, fine to medium SAND with a trace of silt	17.0	7
SM	Very dense, gray, silty, fine SAND	22.0	8
SP SM	Very dense, gray, slightly silty to silty, fine to medium SAND	26.0	9, 10
SM	Very dense, brown, silty, fine to medium SAND with scattered coarse sand (Waterbearing)	36.0	11, 12
	Boring Completed 8/1/69	48.4	13

GROUND WATER: 8/1/69

DEPTH, feet: 0, 10, 20, 30, 40, 50

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot
0 50 100

50/6", 50/2", 50/4", 50/5", 50/5", 50/4", 50/4", 50/6", 50/5"

0 25 50
⊙ % Water content

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✳ Sample not recovered

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-68

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-53

USC	SOIL DESCRIPTION Surface Elevation: Approx. 166'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet	STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) △ Blows per foot (0 – 50 – 100)
SM	Medium dense, light brown, fine to coarse SAND with scattered fine gravel	0	1		0	
ML	Stiff, brown SILT	4.5 5.5	2			50/5"
			3			50/6"
SM	Very dense, brown, silty to very silty, fine to coarse SAND with fine gravel (Glacial TILL)		4		10	50/5"
			5			
			6			50/5"
SP SM	Very dense, brown, fine to coarse SAND with seams to 3 inches of silty fine sand (Waterbearing)	17.0	7	8/4/69	20	50/5"
ML	Hard, brown, clayey SILT (dry)	23.0	8			
ML	Hard, dark gray, clayey SILT with seams to 1 inch of silty, waterbearing, fine to coarse SAND	26.0	9	8/22/69	30	50/4"
			10			50/5"
SM	Very dense, dark gray, very silty, fine gravelly, fine to coarse SAND	36.0	11		40	50/3.5"
SW SM	Very dense, gray, locally silty, fine to coarse SAND with fine gravel (Waterbearing)	40.0	12			50/5"
		48.3	13		50	50/4"
	Boring Completed 8/4/69					

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✳ Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- ⊙ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-69

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-54

USC	SOIL DESCRIPTION Surface Elevation: Approx. 163'	DEPTH, feet	SAMPLES
SM	Medium dense, tan, silty, fine to medium SAND	0	
ML	Hard, tan, fine sandy SILT	2.0 3.0	1
SM	Very dense, light gray to brown, silty, fine to coarse SAND with fine gravel (weathered Glacial TILL)		2 3
SW	Very dense, gray, fine gravelly, fine to coarse SAND (Waterbearing)	10.5	4
SP	Dense to very dense, light brown, slightly silty, fine to medium SAND (Waterbearing)	12.5	5 6
SP	Very dense, gray, fine SAND	16.5 18.0	7
ML CL	Hard, dark gray, clayey SILT to silty CLAY with a few seams to 6 inches of fine to coarse waterbearing SAND (boulder at 21.5 ft.)		8 9 10
SW	Very dense, gray, slightly silty, fine to coarse SAND with scattered fine gravel	36.0	11 12
	Boring Completed 8/4/69	48.8	13

GROUND WATER: 8/4/69

DEPTH, feet: 0, 10, 20, 30, 40, 50

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot
0 50 100

50/6"
50/3.5"
50/4"
50/5"
50/5.5"
50/6"
50/4.5"

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- Sample not recovered
- Attorberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- ○ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-70

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-55

USC	SOIL DESCRIPTION Surface Elevation: Approx. 151'	DEPTH, feet	SAMPLES
SM	Loose, rusty brown, silty SAND with gravel	0 1.5	
SM	Very dense, light to dark brown, very silty, fine to coarse SAND with scattered fine gravel (highly weathered Glacial TILL)	14.5	1 I 2 II 3 I 4 I 5 I 6 I 7 I
SP SW	Very dense, brown to gray, slightly silty, fine to coarse SAND with fine gravel (Waterbearing)		8 II 9 I 10 II
ML	Hard, dark gray, sandy, clayey SILT with scattered gravel	36.0 37.9	11 II

Boring Completed 8/5/69

GROUND WATER: 8/22/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) △ Blows per foot

DEPTH, feet: 0, 10, 20, 30, 40, 50

0 50 100

50/6" 50/3.5" 50/6" 50/5" 50/6" 50/6" 50/2.5" 50/5" 50/5.5" 50/5"

0 25 50

⊙ % Water content

LEGEND

I 2.0" O.D. split spoon sample
II 3.0" O.D. thin-wall sample
✲ Sample not recovered

Atterberg limits:
Liquid limit
Natural water content
Plastic limit

Impervious seal
Water level
Piezometer tip
P Sampler pushed
USC Unified Soil Classification
Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-71

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-56

USC	SOIL DESCRIPTION Surface Elevation: Approx. 155'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet	STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) △ Blows per foot (0 – 50 – 100)
SM	Loose, tan, silty, fine to coarse SAND with scattered gravel	1.0			0	
SM	Very dense, brown, very silty, fine to coarse SAND with fine gravel (weathered Glacial TILL)	17.0	1, 2, 3, 4, 5, 6, 7	8/5/69	10, 20	50/5", 50/4", 50/4.5", 50/2.5", 50/0.5"
SM SW	Very dense, brown, slightly silty to silty, fine to coarse SAND with scattered fine gravel and seams of fine to medium sand (Waterbearing)	37.6	8, 9, 10, 11	8/5/69	30	50/6", 50/3"
ML	Hard, dark gray, clayey SILT with scattered sand and gravel (Waterbearing)	47.6	12, 13		40, 50	50/4.5", 50/3.5"
	Boring Completed 8/5/69					

LEGEND

- I — 2.0" O.D. split spoon sample
- II — 3.0" O.D. thin-wall sample
- ✳ — Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P — Sampler pushed
- USC — Unified Soil Classification
- Perched Water Level
- o — % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-72

JANUARY 15, 1970 W-1509-4

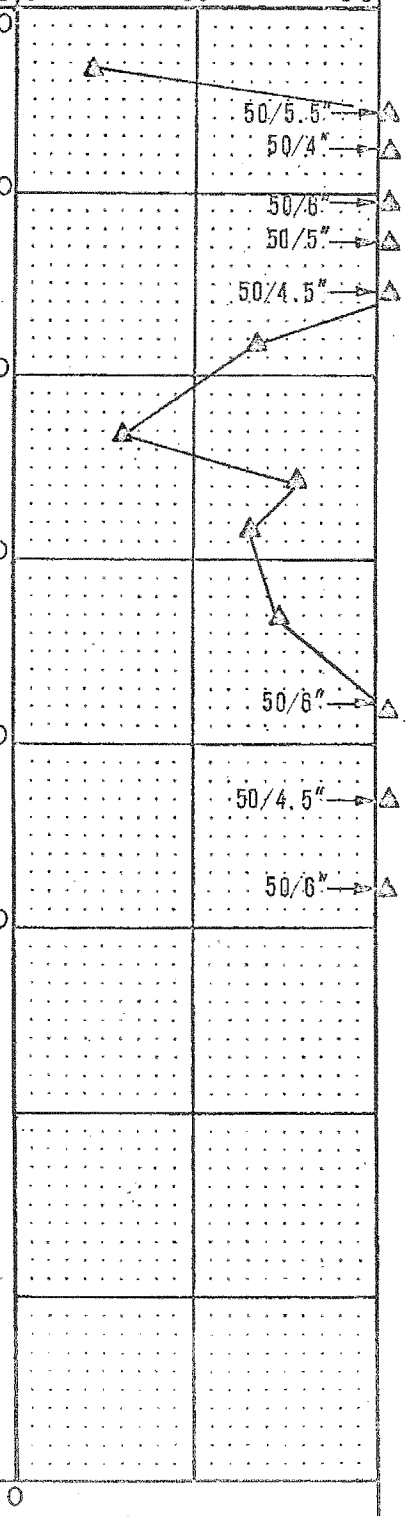
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-57

USC	SOIL DESCRIPTION Surface Elevation: Approx. 169'	DEPTH, foot	SAMPLES
SM	Loose, tan, silty, fine to coarse SAND with scattered gravel	0 2.0	
ML	Stiff, tan, clayey SILT (highly weathered)	3.5	1
SM	Medium dense, light brown, very silty, fine to coarse SAND	5.0	2 3
SM	Very dense, brown to gray, very silty, fine SAND with scattered medium to coarse sand and fine gravel (weathered Glacial TILL)		4 5 6 7
	Soft decomposed log	23.5 24.0	8
SW	Very dense, brown, fine to coarse SAND with a trace of silt (Waterbearing)		9 10
ML	Hard, light brown, fine sandy SILT	33.0 35.0	11
SM	Very dense, dark gray, very silty, fine to coarse SAND with scattered gravel		12 13
	Boring Completed 8/15/69	48.0	14

GROUND WATER: 8/22/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered
- Afterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-73
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-5C

USC	SOIL DESCRIPTION Surface Elevation: Approx. 162'	DEPTH, feet	SAMPLES
SM	Loose, tan, very silty, fine to coarse SAND	0	
ML	Hard, tan, sandy SILT (highly weathered)	2.5	1
		3.4	2
SM	Very dense, light brown, silty, fine to coarse SAND with fine gravel (Glacial TILL)		3, 4, 5, 6
ML	Hard, light brown, fine sandy SILT	17.0	
		18.0	7
SM	Dense to very dense, brown, silty, fine to medium SAND (Waterbearing)		8, 9
CL	Hard, dark gray, slightly fine sandy, silty CLAY	34.0	10
		38.4	11
	Boring Completed 8/6/69		

GROUND WATER: 8/6/69

DEPTH, feet: 0, 10, 20, 30, 40

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot
0 50 100

50/6"
50/6"
50/5.5"
50/5"
50/5"

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Atterberg limits: L Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- ○ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-74

JANUARY 15, 1970 W-1509-4

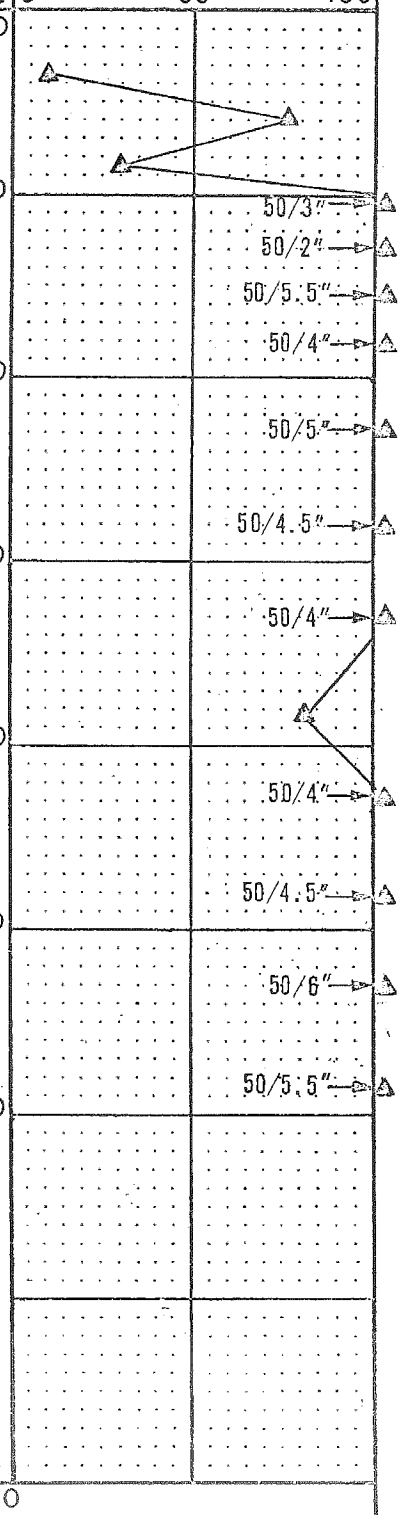
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-59

USC	SOIL DESCRIPTION Surface Elevation: Approx. 159'	DEPTH, feet	SAMPLES
SW	Loose, rusty tan, slightly silty, fine to coarse SAND with scattered gravel	0	1
SM	Very dense, tan to brown, very silty, fine to coarse SAND with scattered gravel	4.5	2
ML	Very stiff, tan SILT with seams of fine to coarse SAND	7.0	3
SM	Very dense, light brown, very silty, fine to coarse SAND with fine gravel (Glacial TILL)	9.5	4, 5, 6, 7, 8, 9
SW	Very dense, brown, slightly silty, fine to coarse SAND with fine gravel	30.0	10, 11, 12, 13, 14
CL	Hard, dark gray, silty CLAY	57.7	15
	Boring Completed 8/6/69	58.9	

GROUND WATER 6/22/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

% Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-75

JANUARY 15, 1970 W-1509-4

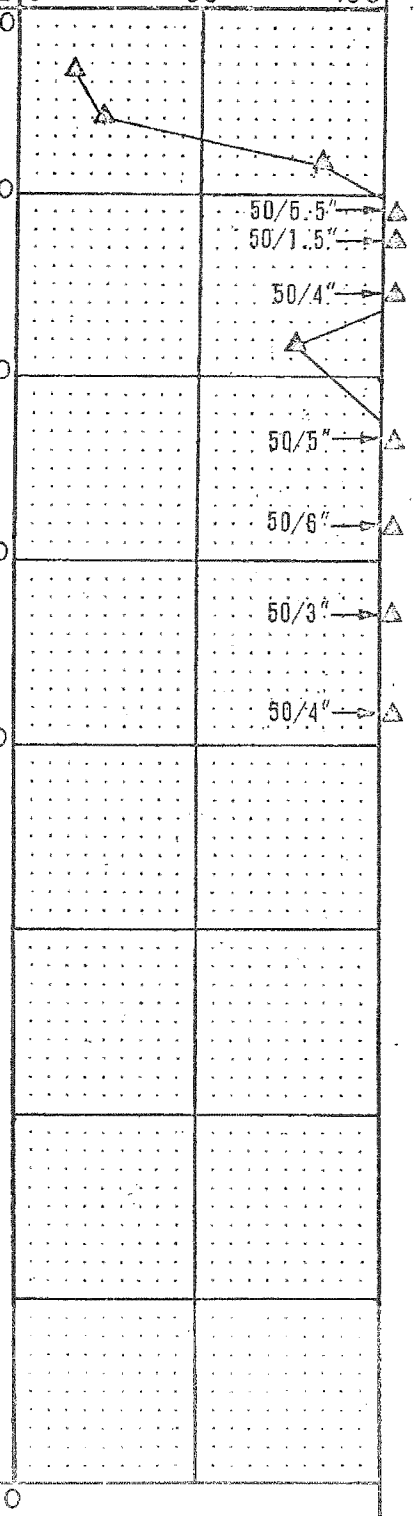
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-60

USC	SOIL DESCRIPTION Surface Elevation: Approx. 159'	DEPTH, feet	SAMPLES
SM	Loose, tan, very silty, fine to coarse sand with fine gravel	0 1.5	
ML	Stiff, tan, clayey SILT (highly weathered)	3.5	I
SP	Medium dense, tan, fine SAND	4.5	
SM	Medium dense, tan to brown, very silty, fine to coarse SAND with scattered fine gravel (highly weathered Glacial TILL)	7.0	2 I 3 I
SM	Very dense, brown, silty to very silty, fine to coarse SAND with scattered fine gravel (Glacial TILL)		4 I 5 – 6 I
SM	Very dense, brown, silty, fine to coarse SAND with fine gravel (Waterbearing)	16.5	7 I 8 I 9 I
SP	Very dense, brown to gray, slightly silty, fine to medium SAND with scattered coarse SAND	32.0	10 I
	Boring Completed 8/6/69	38.8	11 I

GROUND WATER

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



LEGEND

I 2.0" O.D. split spoon sample
II 3.0" O.D. thin-wall sample
Sample not recovered

Attorberg limits:
Liquid limit
Natural water content
Plastic limit

Impervious seal
Water level
Piezometer tip
P Sampler pushed
USC Unified Soil Classification
Perched Water Level

% Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

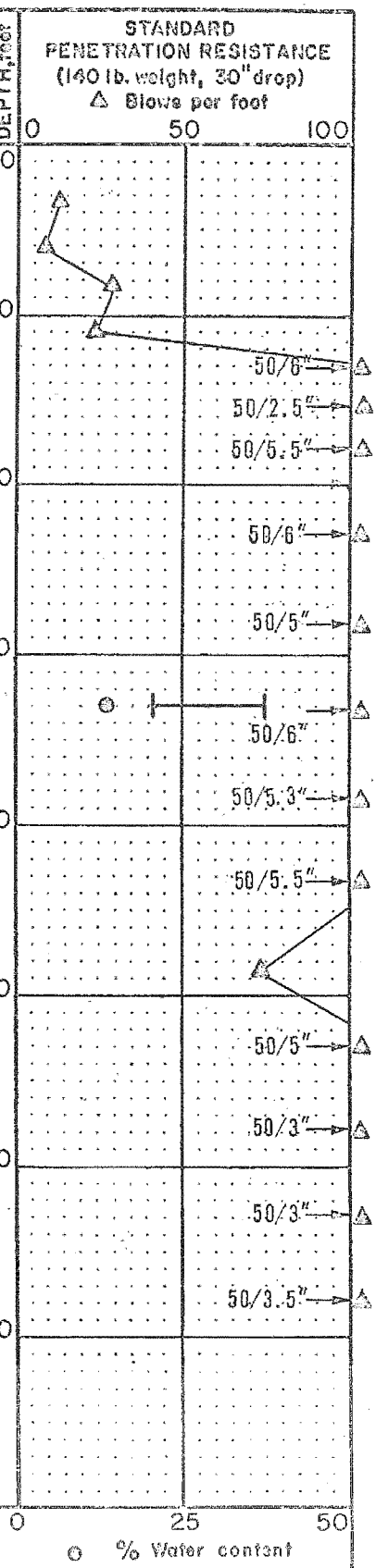
LOG OF BORING NO. B-76
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-61

USC	SOIL DESCRIPTION Surface Elevation: Approx. 158'	DEPTH, feet	SAMPLES
SM	Loose, rusty brown, very silty, fine to coarse SAND with scattered fine gravel	0 2.0	1
ML	Stiff, tan, clayey SILT with a few seams of fine sand (highly weathered)		2
SM	Medium dense, light brown, very silty, fine fine to coarse SAND (Weathered Glacial TILL)	7.0	3 4
SM	Very dense, brown, very silty, fine gravelly, fine to coarse SAND (Glacial TILL)	12.0	5 6 7 8 9
CL	Hard, dark gray, silty, locally fine sandy CLAY (dry)	30.0	10 11 12
SW SP	Very dense, gray, fine to coarse SAND with seams of coarse sand and fine gravel (Waterbearing)	43.4	13 14
SW SM	Very dense, gray, slightly gravelly, fine to coarse SAND with seams of very silty, fine to medium SAND (Waterbearing)	56.0	15 16
	Boring Completed 8/7/69	67.7	17

GROUND WATER: 8/22/69



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

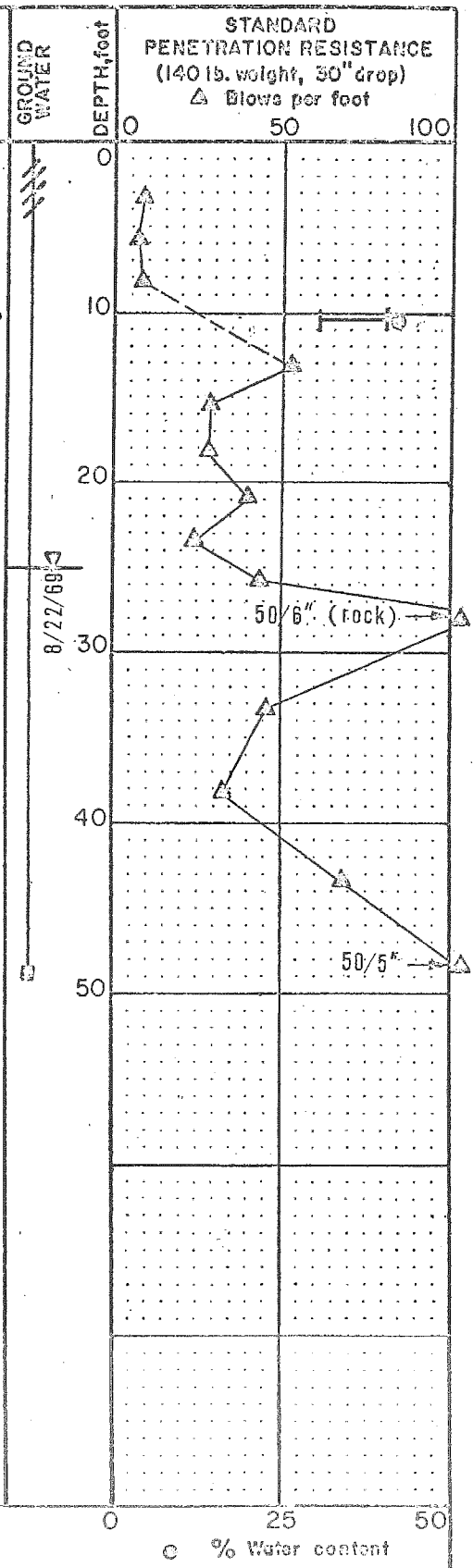
LOG OF BORING NO. B-77

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-62

USC	SOIL DESCRIPTION Surface Elevation: Approx. 162'	DEPTH, feet
SM	Loose, tan, very silty, fine to coarse SAND	0 2.0
ML	Medium stiff to stiff, tan, clayey SILT with partings of loose, fine to coarse sand (weathered)	
SP	Very dense, brown, slightly silty, fine to medium SAND with partings of fine to coarse sand	11.0 14.0
SM	Medium dense to dense, brown to gray, silty to very silty, fine to coarse SAND with scattered fine gravel (highly weathered Glacial TILL)	29.0
SP	Dense to very dense, brown, slightly silty, fine to medium SAND with seams of slightly gravelly, fine to coarse sand	48.8
	Boring Completed 8/7/69	



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✲ Sample not recovered

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-78

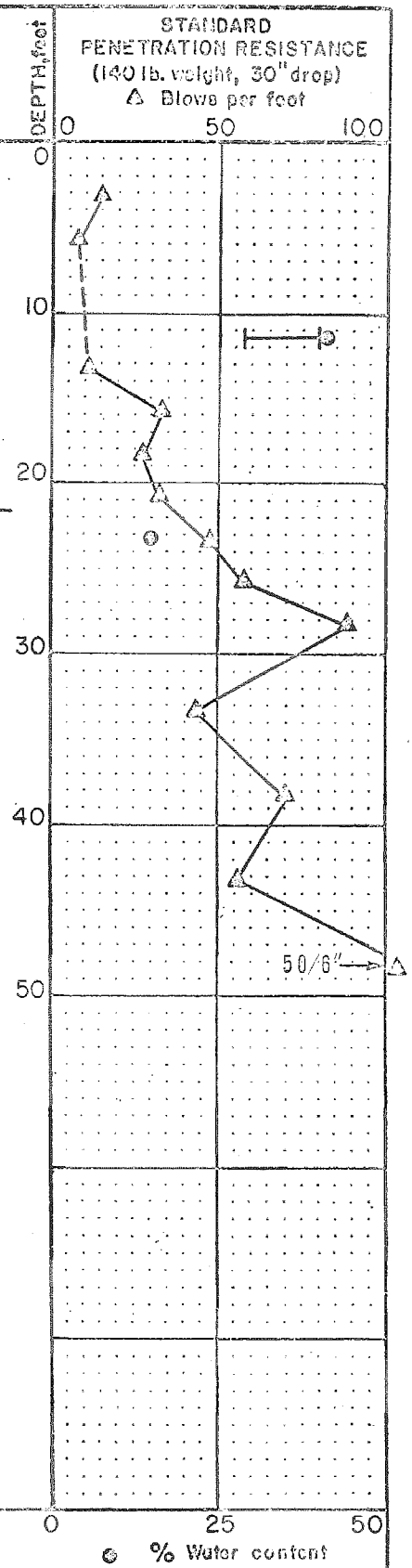
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG A-C

USC	SOIL DESCRIPTION Surface Elevation: Approx. 161'	DEPTH, feet	SAMPLES
SM	Loose, tan, very silty, fine gravelly, fine to coarse SAND with roots and organics	0	
ML	Medium stiff, tan, clayey SILT (weathered)	2.0	1
SM	Medium dense, gray, slightly fine gravelly, very silty, fine to coarse SAND (weathered TILL)	3.0	2
ML	Medium stiff, tan, clayey SILT (weathered and oxidized)	4.0	3 P, 4 P
ML	Medium stiff to stiff, tan, clayey SILT with seams to 1 inch of fine to coarse sand	12.5	5
SW	Dense, brown, fine to coarse SAND	15.5	6
SM	Medium dense to dense, light brown to gray, very silty, fine to coarse SAND with fine gravel (Glacial TILL)	17.0	7, 8
SM	Dense to very dense, brown, silty, fine to coarse SAND with scattered gravel (waterbearing)	24.0	9, 10, 11, 12, 13, 14
	Boring Completed 8/8/69	48.5	15

GROUND WATER: 8/22/69



LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

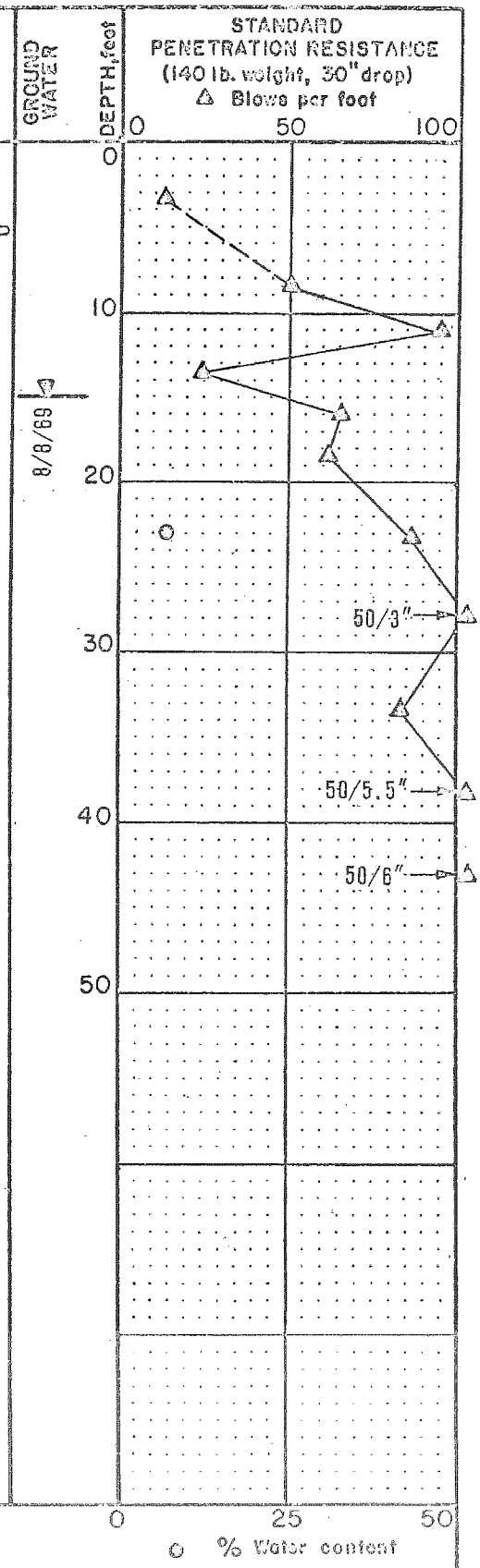
LOG OF BORING NO. B-79

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-64

USC	SOIL DESCRIPTION Surface Elevation: Approx. 163'	DEPTH, feet	SAMPLES
SM	Loose, tan, very silty, fine to coarse SAND with scattered fine gravel	0 2.0	
ML	Stiff to hard, tan, slightly fine sandy SILT		1 I 2 II P
SW	Very dense, brown, slightly silty, fine to coarse SAND with scattered gravel	7.0	3 I 4 I
SM	Medium dense to very dense, brown, silty to very silty, fine to coarse SAND (water-bearing)	12.0	5 I 6 I
ML	Hard, dark gray, clayey SILT with seams to 4 inches of waterbearing fine to medium SAND	18.1	7 I 8 I
SW	Very dense, brown, slightly silty, fine to coarse SAND with gravel (Waterbearing)	26.0 29.0	9 II
SP	Very dense, brown, slightly silty, fine to medium SAND with scattered coarse sand and fine gravel (waterbearing)		10 I 11 I
	Boring Completed 8/8/69	43.0	12 II



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-80

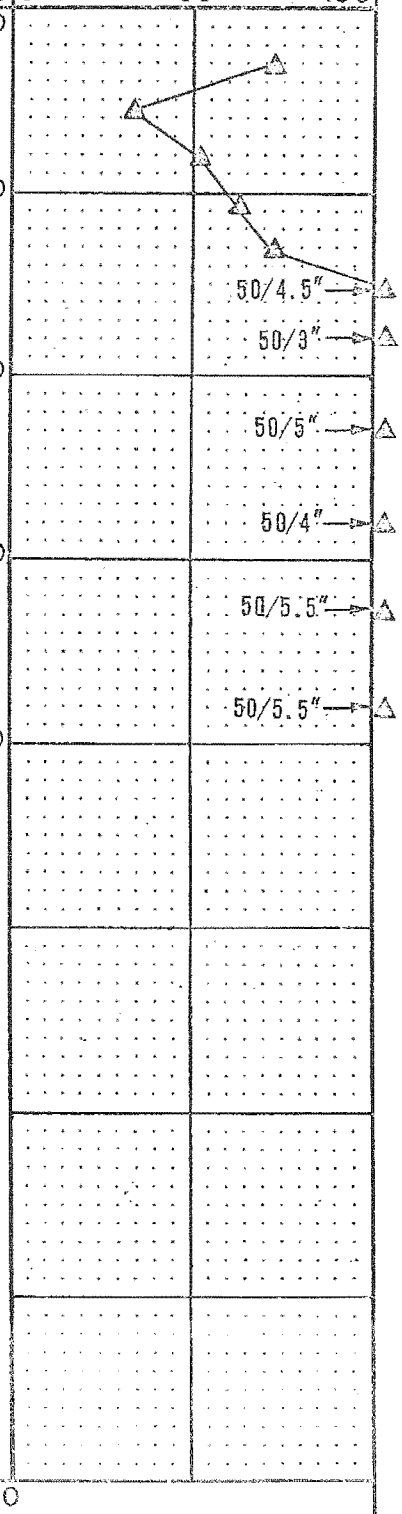
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-65

USC	SOIL DESCRIPTION Surface Elevation: Approx. 161'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet
SM	Loose, tan, very silty, fine to coarse SAND with scattered fine gravel	0 2.0	I		0
SM	Very dense, light brown, very silty, fine to medium SAND with scattered fine gravel	4.5	I		
SP	Dense, light brown, fine to medium SAND	7.0	I		
SM	Very dense, brown, silty, fine to coarse SAND with fine gravel and irregular zones of clean sand (Waterbearing)		I I	8/11/69	10
		13.9	I		
SM CL	Alternating seams to 1.0 ft. of very dense, dark gray, very silty, fine to coarse SAND and hard, dark gray, silty CLAY		I I I I	8/22/69	20 30
		30.0			
SW SP	Very dense, gray, fine gravelly, fine to coarse SAND with seams of waterbearing fine sand		H I		40
		38.4			
	Bottom of Boring 8/11/69				

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



○ % Water content

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✱ Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-81

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG A-66

USC	SOIL DESCRIPTION Surface Elevation: Approx. 164'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet	STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) △ Blows per foot (0 – 50 – 100)
SM SP	Loose, tan, very silty, fine to coarse SAND with scattered fine gravel Dense to very dense, fine to medium SAND with scattered coarse sand and fine gravel (dry)	0 1.5	1 2		0	
SW SP	Dense to very dense, brown, fine to coarse SAND with fine gravel and seams of fine sand	7.5	3 4 5 6	8/11/69	10	
ML SM	Hard, tan, slightly clayey SILT Very dense, brown to gray, very silty, fine to coarse SAND with fine gravel (Glacial TILL)	16.0 17.0	7 8		20	50/2"
SM ML SW	Alternating seams to 6 inches of: Very dense, gray, very silty, fine gravelly, fine to coarse SAND; hard gray clayey SILT; and very dense, gray, waterbearing, fine to coarse SAND	22.0	9 10 11	8/22/69	30	50/4" 50/5.5" 50/5"
SW	Very dense, gray, fine to coarse SAND with fine gravel (Waterbearing)	35.0	12 13		40	50/2.5" 50/3.5"
	Boring Completed 8/11/69	47.7	14		50	50/3"

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level
- o % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-82

JANUARY 15, 1970 W-1509-4

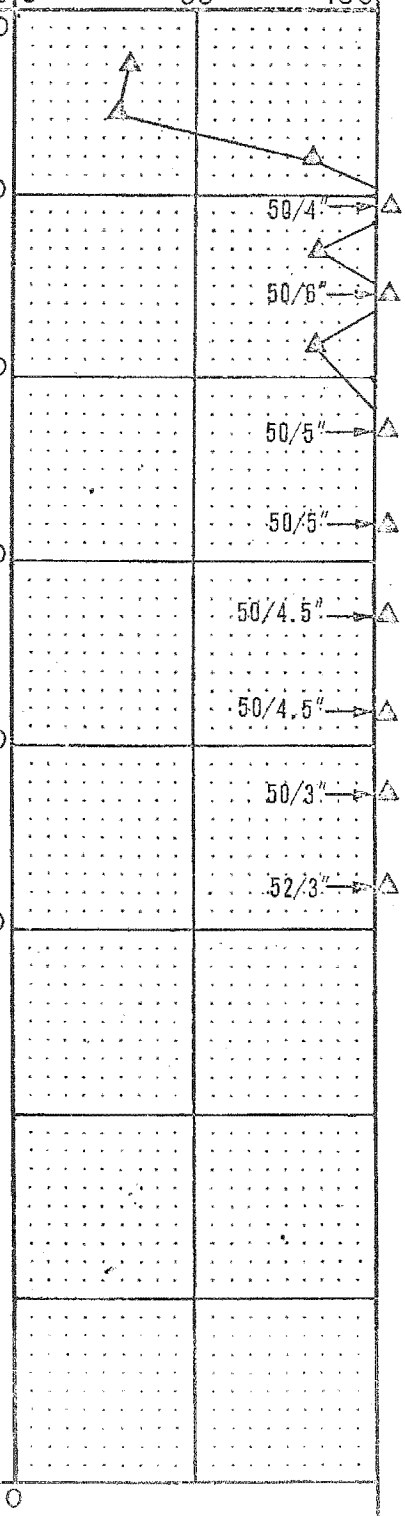
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-67

USC	SOIL DESCRIPTION Surface Elevation: Approx. 160'	DEPTH, feet	SAMPLES
SM	Loose, tan, very silty, fine to coarse SAND with scattered fine gravel	0 2.0	1
SP	Medium dense to dense, light brown, slightly silty, fine to medium SAND		2
SW	Very dense, brown, slightly silty, fine to coarse SAND (Waterbearing)	7.0 8.9	3
ML	Hard, dark gray, clayey SILT with inclusions of fine to coarse sand and gravel		4
SM	Very dense, brown, silty, fine to coarse SAND (Waterbearing)	12.0 13.9	5 6
ML	Hard, dark gray, clayey, locally very fine sandy, SILT with scattered fine to coarse sand		7 8
CL	Hard, dark gray, silty CLAY	24.0	9
SM	Very dense, dark gray, very silty, fine SAND	29.0	10
SW	Very dense, gray, slightly silty, fine to coarse SAND with fine gravel (Waterbearing)	35.0	11 12
	Boring Completed 8/12/69	47.9	13

GROUND WATER: 8/22/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P — Sampler pushed
- USC — Unified Soil Classification
- Perched Water Level
- % Water content

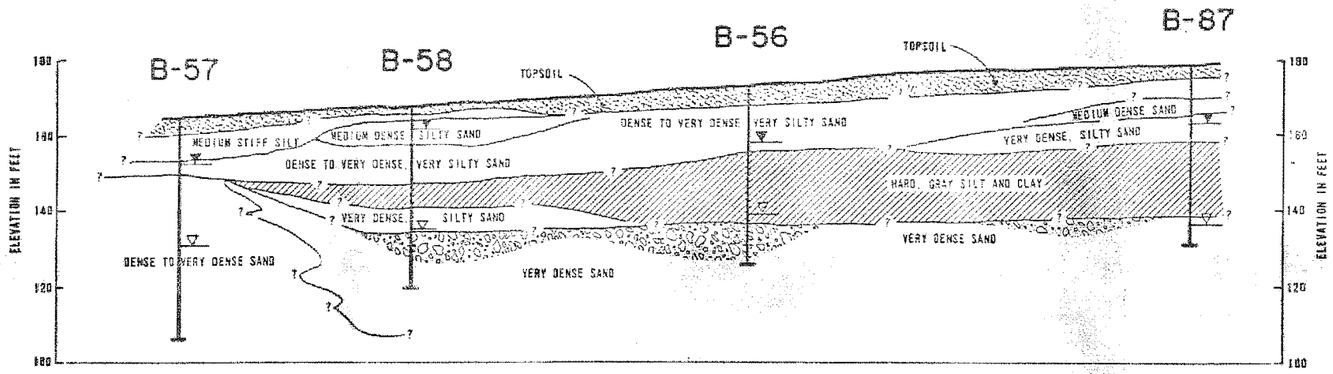
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-83

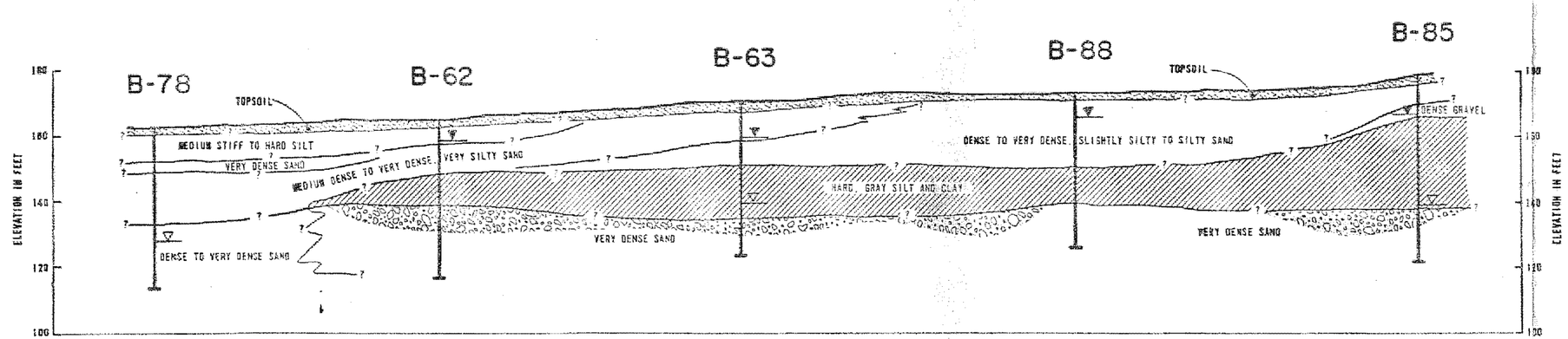
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-68



PROFILE 8-8



PROFILE 9-9

NOTES

1. These profiles are generalized from materials encountered in the borings and variations between the profiles and actual conditions may exist.
2. Ground surface elevations were obtained from drawing titled 'Clearing and Grubbing, The Evergreen State College, Olympia, Washington' 1"=40' scale by Quinton-Bedlong Inc. dated May 16, 1969.
3. Elevation Datum; Mean Low Low Water.

LEGEND

Soil Group

1 — Loose to medium dense, rusty brown to tan, silty, gravelly SAND or medium stiff, sandy SILT with roots and organics (Residual Topsoil Development)

1 — Soft to hard, tan, sandy, locally clayey SILT (Lacustrine Sediments)

2 — Medium dense to very dense SAND, slightly silty to to very silty sand with localized lenses of SILT or CLAY (Lenticular elements of Vashon Drift, i.e. recessional outwash, ablation till, till, and advance outwash)

3 — Hard, dark gray, silty CLAY to clayey SILT, locally underlain by dense to very dense, dark gray, very silty SAND (Glaciolacustrine Sediments)

4 — Very dense, brown to gray, slightly silty SAND with scattered gravel (Undifferentiated Intergiacial Sediments)

Perched Waterlevel
Groundwater Level
} Dates water levels observed noted on boring logs

0 20 40 60 80
VERTICAL SCALE IN FEET

0 40 80 120 160
HORIZONTAL SCALE IN FEET

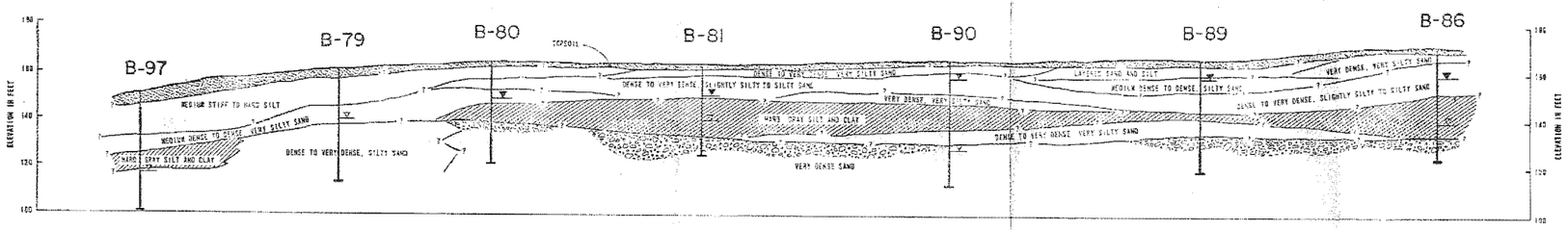
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

SUBSURFACE PROFILES 8-8 & 9-9

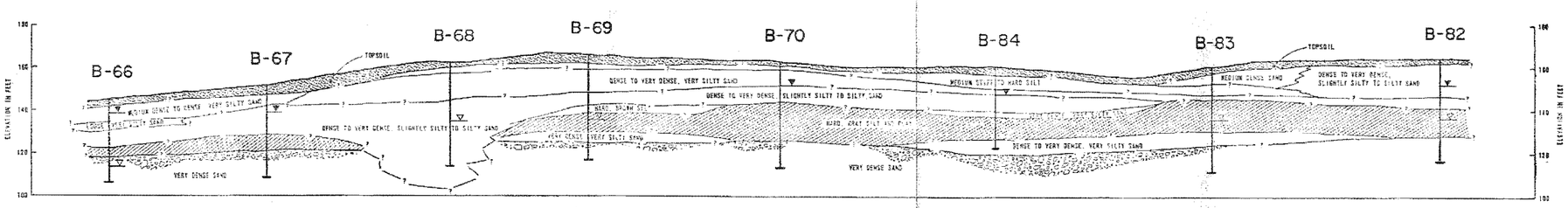
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG 5



PROFILE 10-10



PROFILE 11-11

NOTES

1. These profiles are generalized from materials encountered in the borings and variations between the profiles and actual conditions may exist.
2. Ground surface elevations were obtained from drawing titled "Clearing and Grubbing, The Evergreen State College, Olympia, Washington" 1"=40' scale by Durdon-Dalong Inc. dated May 16, 1969.
3. Elevation Datum: Mean Low Low Water.

LEGEND

Soil Group

1 — Loose to medium dense, rusty brown to tan, silty, gravelly SAND or medium stiff, sandy SILT with roots and organics (Residual Topsoil Development)

1 — Soft to hard, tan, sandy, locally clayey SILT (Lacustrine Sediments)

2 — Medium dense to very dense SAND, slightly silty to to very silty, sand with horizontal lenses of SILT or CLAY (Lenticular elements of Vashon Drift, i.e. recessional outwash, ablation till, till, and advance outwash)

3 — Hard dark gray, silty CLAY to clayey SILT, locally underlain by dense to very dense, dark gray, very silty SAND (Glaciolacustrine Sediments)

4 — Very dense, brown to gray, slightly silty SAND with scattered gravel (Undifferentiated Interglacial Sediments)

Perched Water level } Dates water levels observed noted on boring logs

Groundwater level }

0 20 40 60 80
VERTICAL SCALE IN FEET

0 40 80 120 160
HORIZONTAL SCALE IN FEET

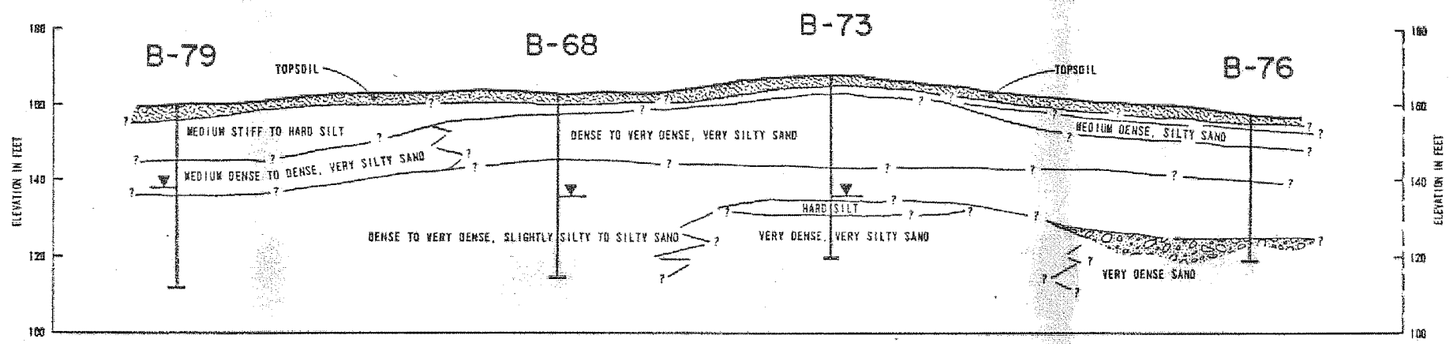
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

SUBSURFACE PROFILES 10-10 & 11-11

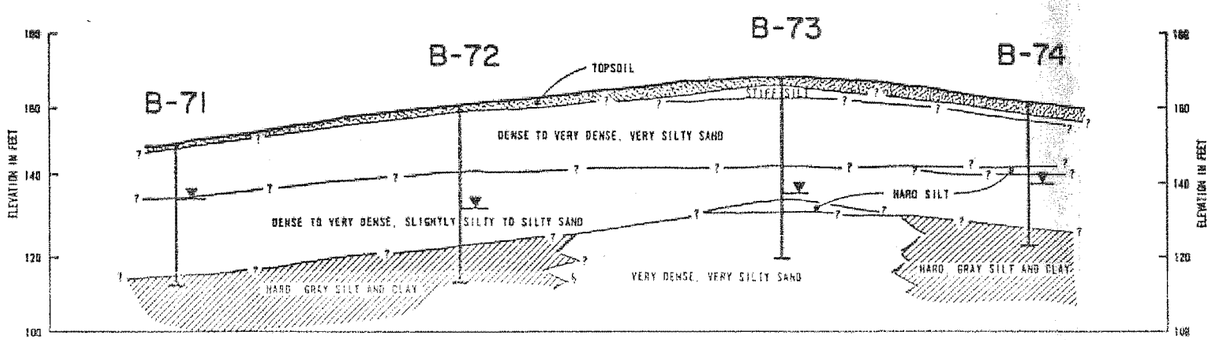
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 6



PROFILE C-C



PROFILE 12-12

NOTES

1. These profiles are generalized from materials encountered in the borings and variations between the profiles and actual conditions may exist.
2. Ground surface elevations were obtained from drawing titled 'Clearing and Grubbing, The Evergreen State College, Olympia, Washington' 1"=40' scale by Quinton-Budlong Inc. dated May 18, 1969.
3. Elevation Datum; Mean Low Low Water.

LEGEND

Soil Group

1 — Loose to medium dense, rusty brown to tan, silty, gravelly SAND or medium stiff, sandy SILT with roots and organics (Residual Topsoil Development)

1 — Soft to hard, tan, sandy, locally clayey SILT (Lacustrine Sediments)

2 — Medium dense to very dense SAND, slightly silty to to very silty sand with localized lenses of SILT or CLAY (Lenticular elements of Vashon Drift, i.e. recessional outwash, ablation till, till, and advance outwash)

3 — Hard, dark gray, silty CLAY to clayey SILT, locally underlain by dense to very dense, dark gray, very silty SAND (Glaciolacustrine Sediments)

4 — Very dense, brown to gray, slightly silty SAND with scattered gravel (Undifferentiated Interglacial Sediments)

Perched Waterlevel
Groundwater Level
} Dates water levels observed noted on boring logs

0 20 40 60 80
VERTICAL SCALE IN FEET

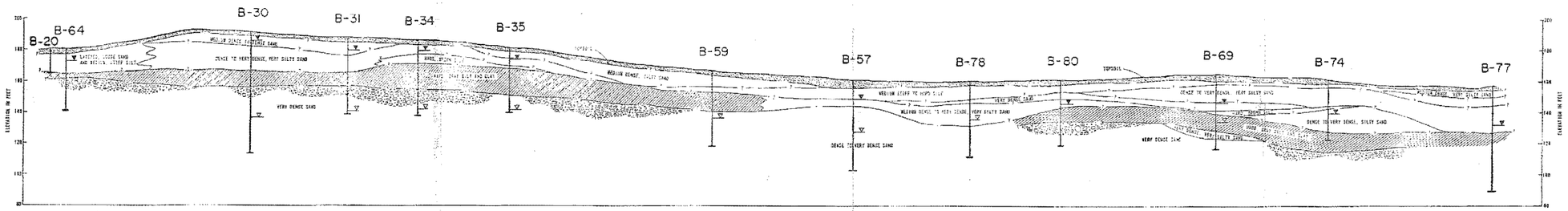
0 40 80 120 160
HORIZONTAL SCALE IN FEET

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

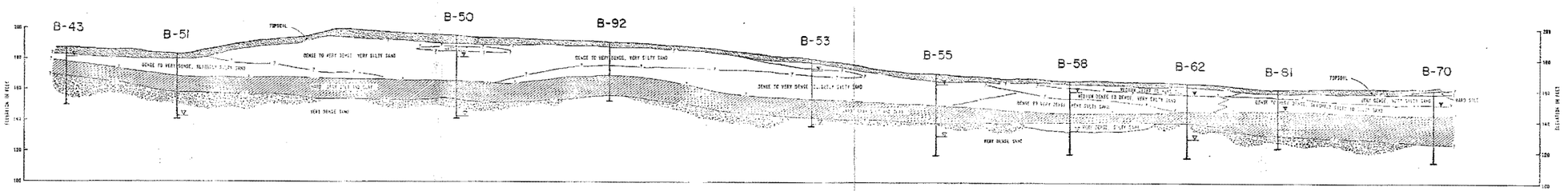
SUBSURFACE PROFILES C-C & 12-12

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS



PROFILE D-D



PROFILE E-E

NOTES

1. These profiles are generated from information measured in the borings and represent interpretations of the boring data between boring strips.
2. Ground surface elevations were obtained from drawing titled "Grading and Grubbing, The Evergreen State College, Olympia, Washington" sheet 1 of 2 prepared by Hamilton-Bolling Inc. dated May 13, 1968.
3. Elevation datum: Mean Low Low Water.

LEGEND

Unit Group

1 — Loose to medium dense, ruddy brown, tan, silty, gravelly, SAND or medium stiff, sandy SILT with roots and organics (Residual Topsoil Development)

2 — Soft to hard, dark, sandy, locally clayey SILT (Alluvial-Marsh Deposits)

3 — Medium dense to very dense SAND, slightly silty to very silty SAND with fine-grained lenses of silt and clay (Continental Deposits of Vashon Stade, Pleistocene Period) with minor SILT, GRAVEL, and organic materials

5 — Hard, dark gray, silty CLAY to clayey SILT, locally interbedded by dense to very dense, dark gray, very silty SAND (Glaciomarine Deposits)

4 — Very dense, brown to gray, slightly silty SAND with interbedded gravel (Consolidated Glaciofluvial Sediments)

Piezometer Observed Groundwater Level } Dates water levels observed and noted on boring logs

0 20 40 60 80
VERTICAL SCALE IN FEET

0 40 80 120 160
HORIZONTAL SCALE IN FEET

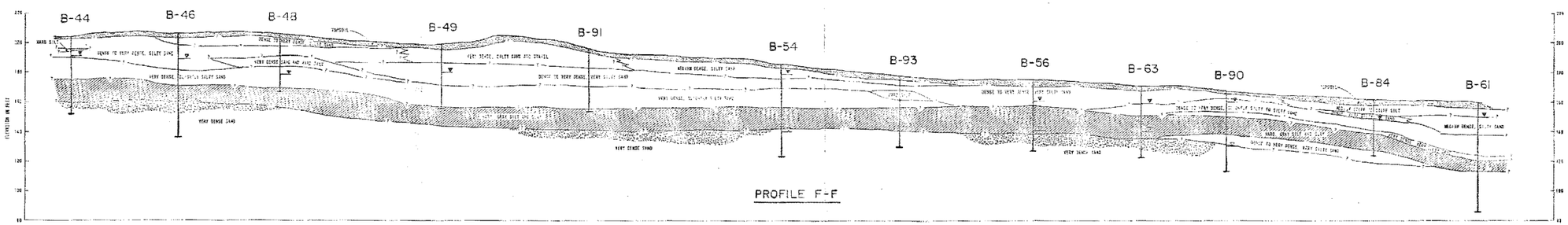
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

SUBSURFACE PROFILES D-D & E-E

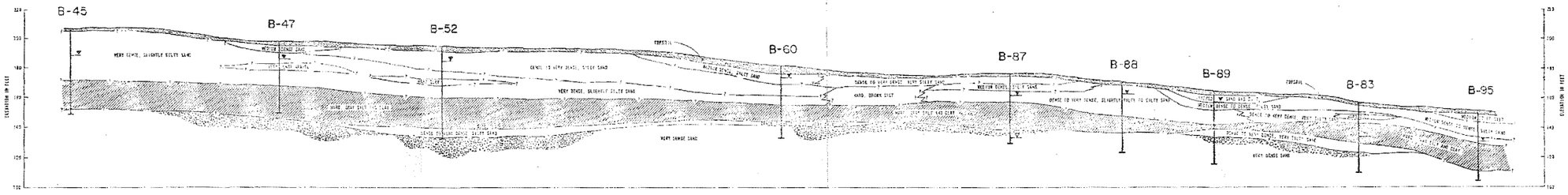
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG.8



PROFILE F-F



PROFILE G-G

NOTES

1. These profiles are generalized from materials encountered in the borings and extrapolated between the profiles as certain conditions may exist.
2. Ground surface elevations were obtained from drawing Entitled "Grading and Clearing, The Evergreen State College, Olympia, Washington" Final scale by Coleman-Bulling Inc. dated May 15, 1968.
3. Elevation datum: Mean Low Low Water.

LEGEND

Soil Group

1. Dense to medium dense (very dense in low, silty gravelly SAND or medium stiff, sandy SILT with rootlets and organics (Residual Topsoil Development)
2. Soft to hard, lean, sandy, locally clayey SILT (Lacustrine Sediments)
3. Medium dense to very dense silty to slightly silty to very silty sand, sometimes gravelly, mixture of SILT or CLAY (Glaciofluvial Deposits of Vashon Drift, i.e., Fraser Lobe: Medium, coarse, fine, and advance outwash)
4. Hard, stiff, gray, silty CLAY to clayey SILT, locally weathered to brown to very stiff, dark gray, very silty SILT (Glaciolacustrine Sediments)

Very dense, brown to gray, slightly silty SAND with rootlets present (Glaciofluvial or Glaciolacustrine Sediments)

Perched Water Level
Groundwater Level } Water levels observed and noted on boring logs

0 20 40 80
VERTICAL SCALE IN FEET

0 40 80 120 160
HORIZONTAL SCALE IN FEET

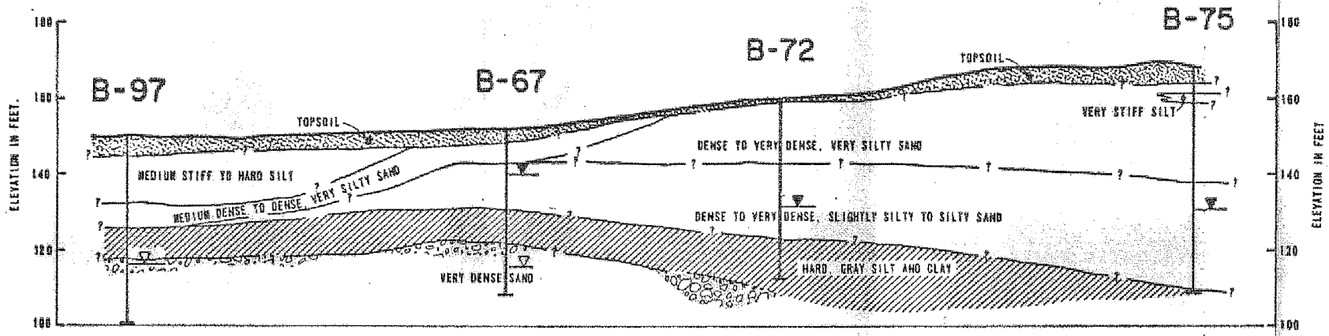
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

SUBSURFACE PROFILES F-F & G-G

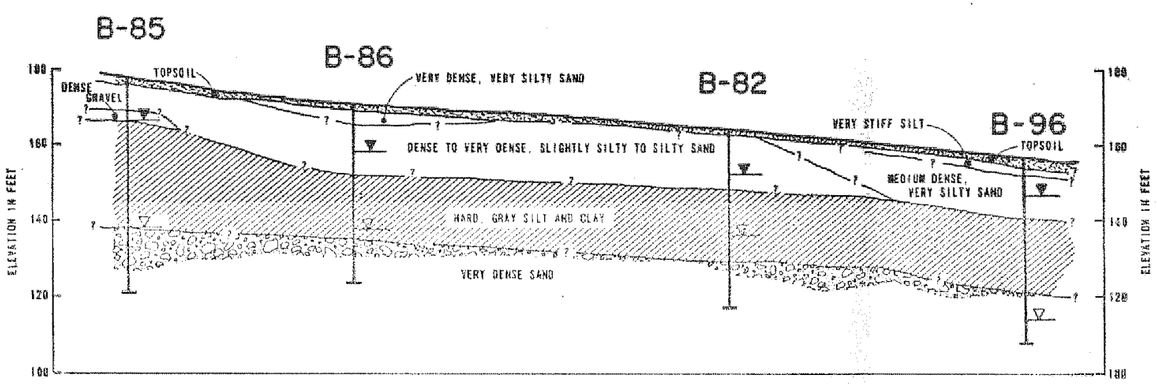
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG 9



PROFILE B-B



PROFILE H-H

NOTES

1. These profiles are generalized from materials encountered in the borings and variations between the profiles and actual conditions may exist.
2. Ground surface elevations were obtained from drawing titled 'Clearing and Grubbing, The Evergreen State College, Olympia, Washington' 1"=40' scale by Quinton-Budlong Inc. dated May 16, 1969.
3. Elevation Datum: Mean Low Low Water.

LEGEND

Soil Group	
1	Loose to medium dense, rusty brown to tan, silty, gravelly SAND or medium stiff, sandy SILT with roots and organics (Residual Topsoil Development)
	Soft to hard, tan, sandy, locally clayey SILT (Lacustrine Sediments)
2	Medium dense to very dense SAND, slightly silty to to very silty sand with localized lenses of SILT or CLAY (Lenticular elements of Vashon Drift, i.e. recessional outwash, ablation till, till, and advance outwash)
3	Hard, dark gray, silty CLAY to clayey SILT, locally underlain by dense to very dense, dark gray, very silty SAND (Glaciolacustrine Sediments)
4	Very dense, brown to gray, slightly silty SAND with scattered gravel (Undifferentiated Interglacial Sediments)
	Perched Waterlevel } Dates water levels observed noted on boring logs
	Groundwater Level } Dates water levels observed noted on boring logs

0 20 40 60 80
VERTICAL SCALE IN FEET

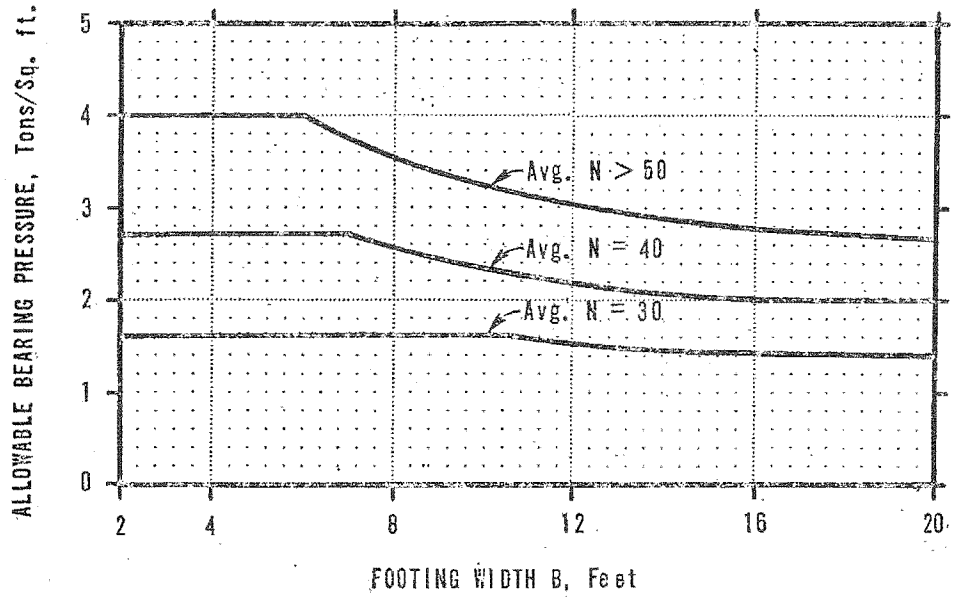
0 40 80 120 160
HORIZONTAL SCALE IN FEET

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

SUBSURFACE PROFILES B-B & H-H

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS



ALLOWABLE BEARING PRESSURE ON SAND SOILS

NOTES

1. To determine appropriate value of N to use in the above curve:
   a. Average N values within a depth of 2B below the base of the footing in all borings within the immediate vicinity of the structure.
   b. Footing width B in the above chart is the least dimension of any particular footing.
   c. Use lowest average value of N thus determined.
2. Direct interpolation can be used between curves.
3. Footings should be founded in soils with average values of N at least equal to 30.
4. The maximum total and differential settlements of footings designed according to these curves are estimated to be about 1" and ½", respectively. The majority of the settlement will occur during construction.

THE EVERGREEN STATE COLLEGE

OLYMPIA, WASHINGTON

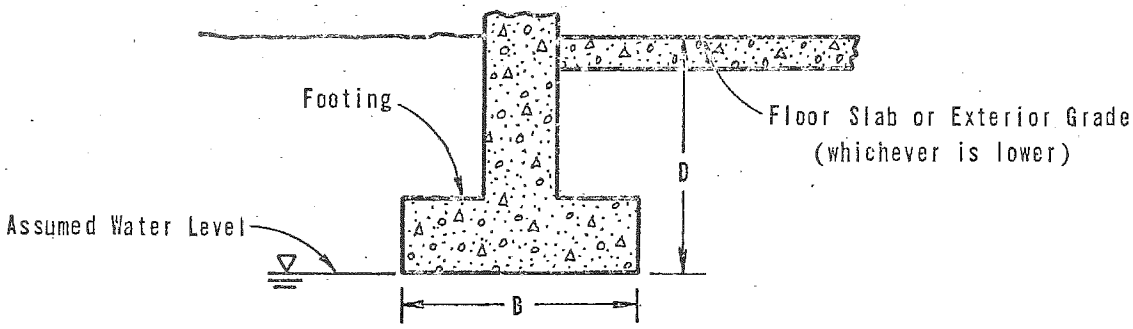
BEARING PRESSURES

NOVEMBER 17, 1969 W-1509-4

SHANNON & WILSON

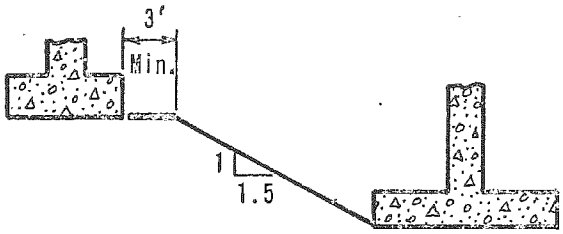
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 11



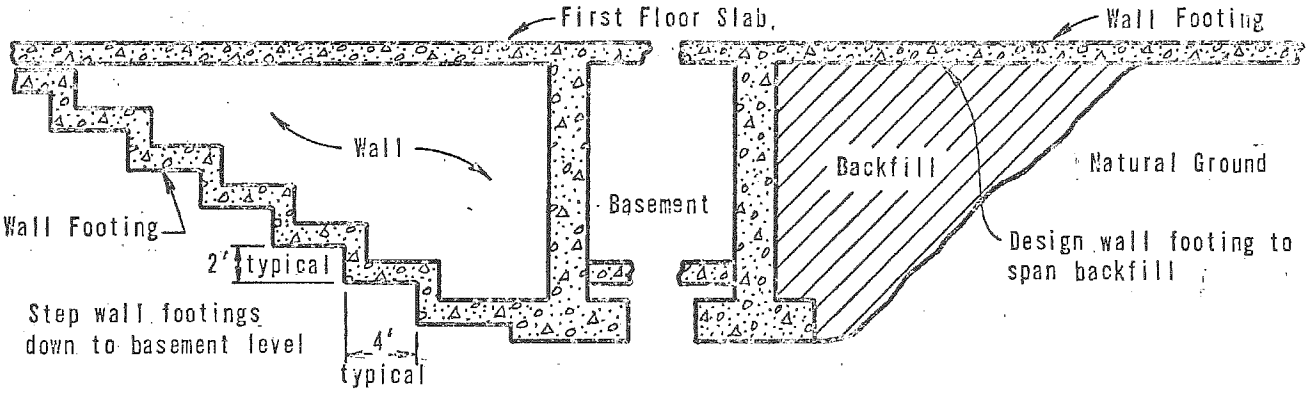
Minimum Dimensions B & D = 2 feet

A. ASSUMED CONDITIONS & MINIMUM FOOTING SIZE

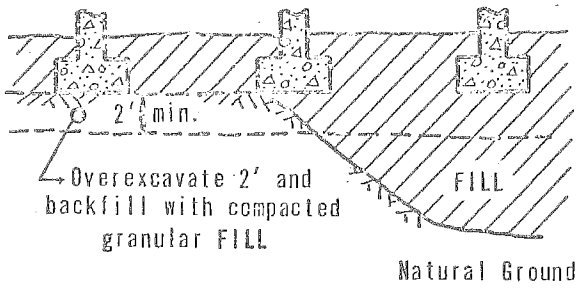


Adjacent footings should not be constructed at such different levels that construction of the lower footing would disturb soil supporting the upper footing and that the pressure from the upper footing would add undue additional stress to the soil beneath the lower footing. This difficulty can generally be avoided by positioning the footings as shown.

B. SPREAD FOOTINGS AT DIFFERENT LEVELS



C. WALL FOOTINGS AT DIFFERENT LEVELS



D. FOOTINGS ON STRUCTURAL FILL AND NATURAL GROUND

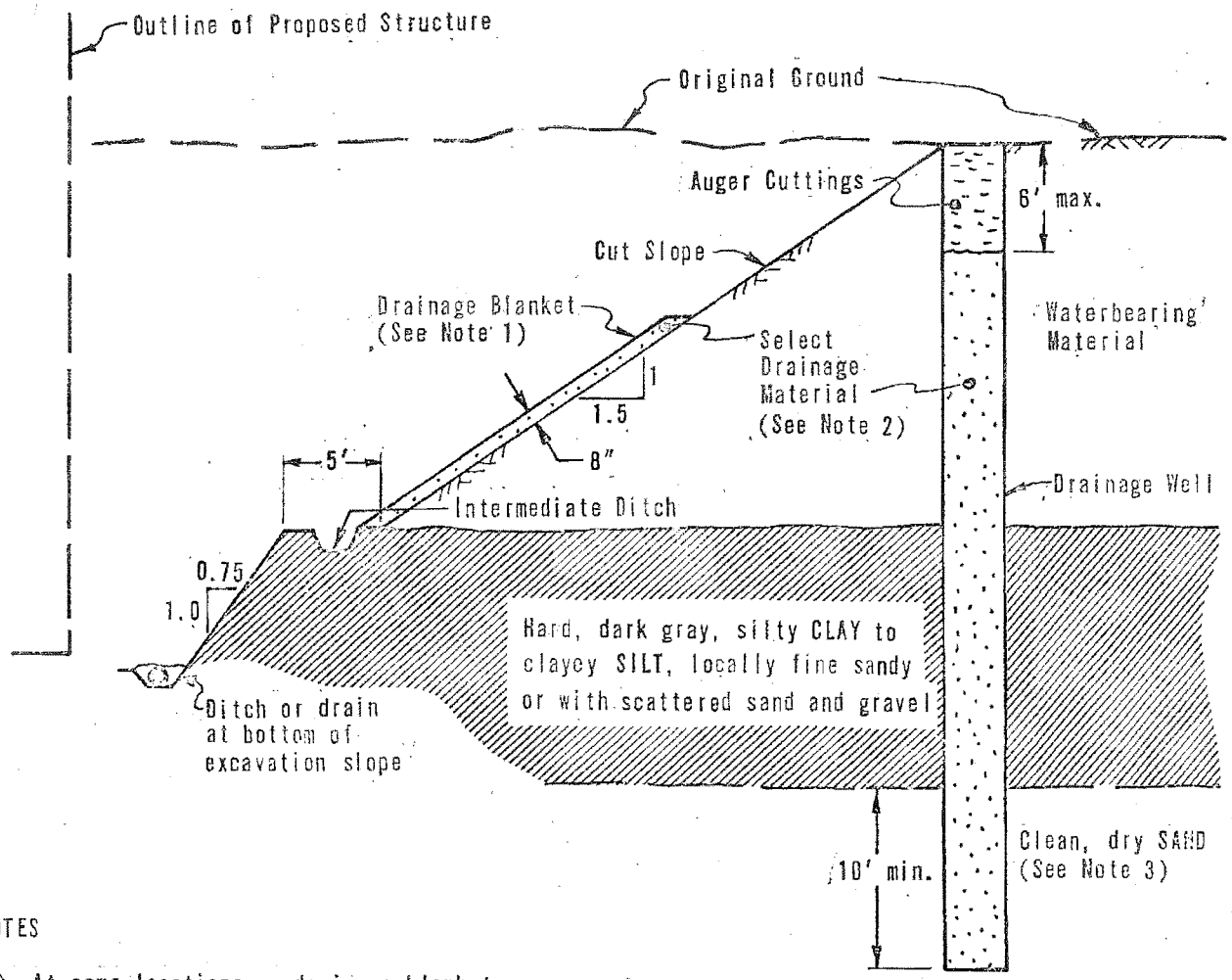
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

DESIGN CRITERIA
FOOTING FOUNDATIONS

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG 12



NOTES

1) At some locations, a drainage blanket may be required to prevent slope erosion by water draining into excavation between the vertical sand drains.

2) Granular drainage material to conform with the gradation requirements of 'Gravel Backfill for Drains', Division 9-03.12(4), Washington State Highway Commission Standard Specifications for Road and Bridge Construction, 1969.

3) When lower water table is at or very near the bottom of the silty clay to clayey silt, install high capacity deep well turbine pumps in selected sand drains to aid in dewatering.

APPROXIMATE SCALE: 1" = 20'

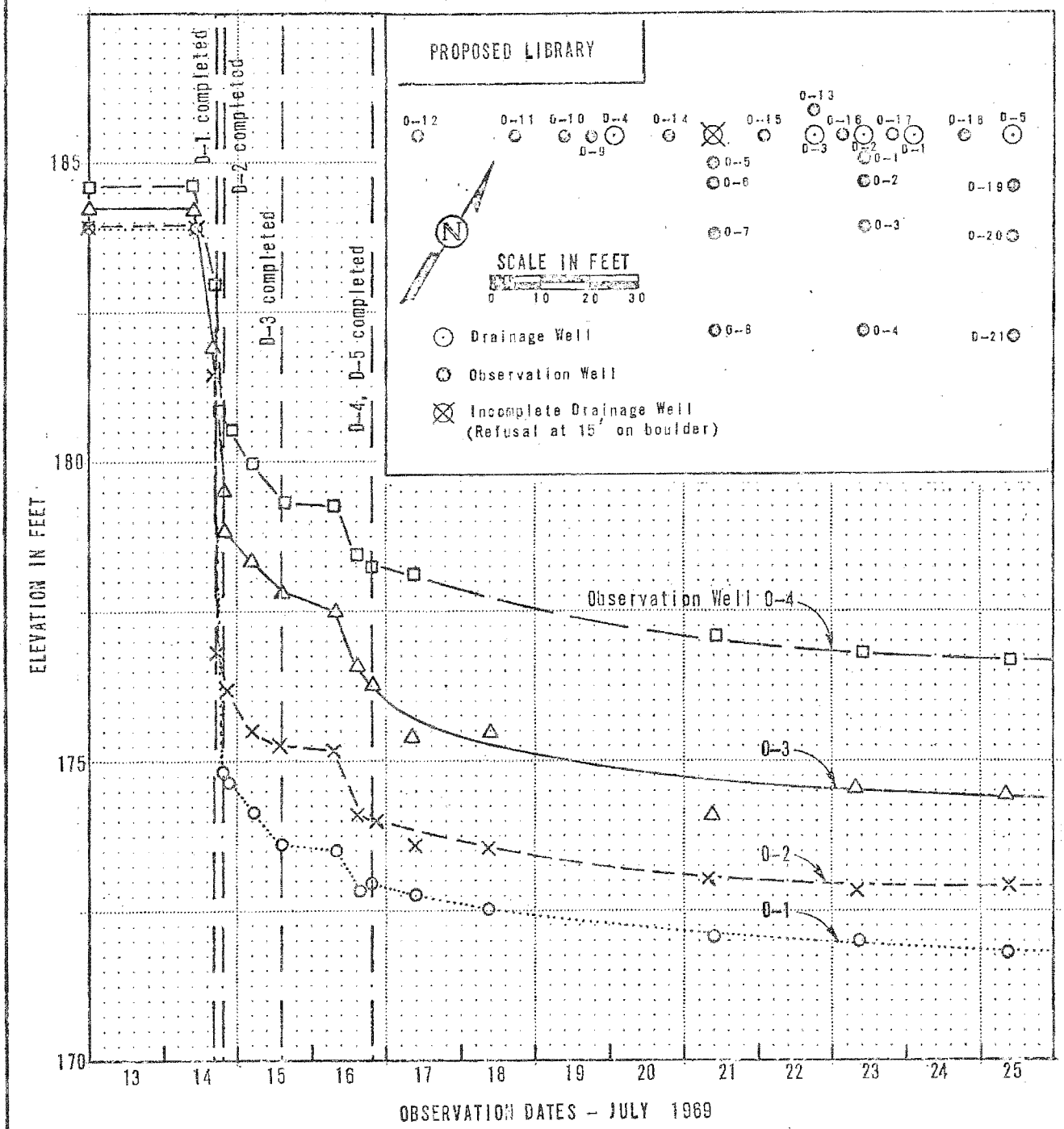
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

EXCAVATION
SLOPE DRAINAGE DETAILS

NOVEMBER 17, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 13



NOTE

This drawing based on Figs. 2 and 7, Shannon & Wilson, Inc. report, "Test of Vertical Drainage Wells, The Evergreen State College, Olympia, Washington", dated August 18, 1969.

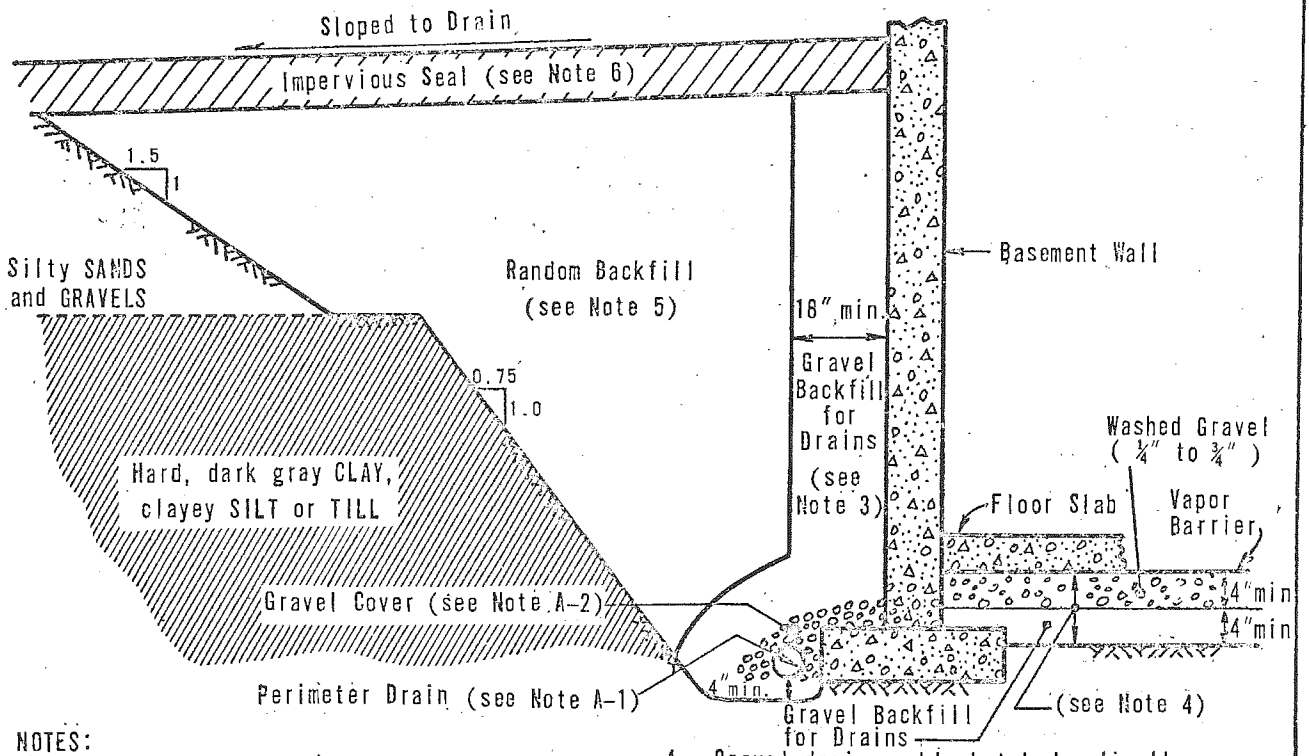
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

DRAWDOWN - TIME CURVES
VERTICAL SAND DRAINS

NOVEMBER 17, 1969 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 14



NOTES:

1. 6" or larger diameter bell and spigot with bottom half of joint sealed, top open or perforated metal or plastic pipe with perforations on top, sloped to drain.

2. 6" cover or envelope of ¼" to ¾" washed gravel placed over open joints or perforations.

3. Gravel Backfill for Drains conforming with Division 9-03.12 (4) of the Washington State Highway Commission, Standard Specifications for Road and Bridge Construction, 1969.

4. Gravel drainage blanket hydraulically connected to sump or storm drain, but not to perimeter drain.

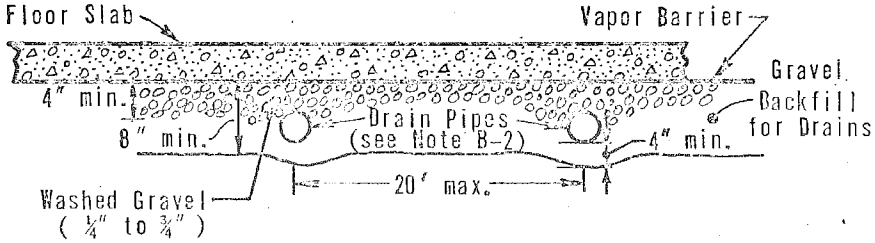
5. During wet weather, backfill should be reasonably well-graded sand and gravel with not more than 5% by weight passing No. 200 sieve. (Based on ¾" minus fraction).

6. Impervious Seal, pavement or minimum of 2' of impervious materials in unpaved areas.

7. All backfill should be compacted to 95% Modified Proctor maximum dry density (ASTMD ; 1557-667).

A. BASEMENT FOUNDED IN IMPERVIOUS SOILS

B. BASEMENT FOUNDED IN WATERBEARING SOILS



NOTES:

1. Foundation drainage details similar to those shown in Drawing (A) with under-floor drains installed in gravel as shown.

2. 4" minimum diameter open joint tile or perforated pipe under-floor drains on 20' centers, hydraulically connected to perimeter drains. or directly to storm drain system.

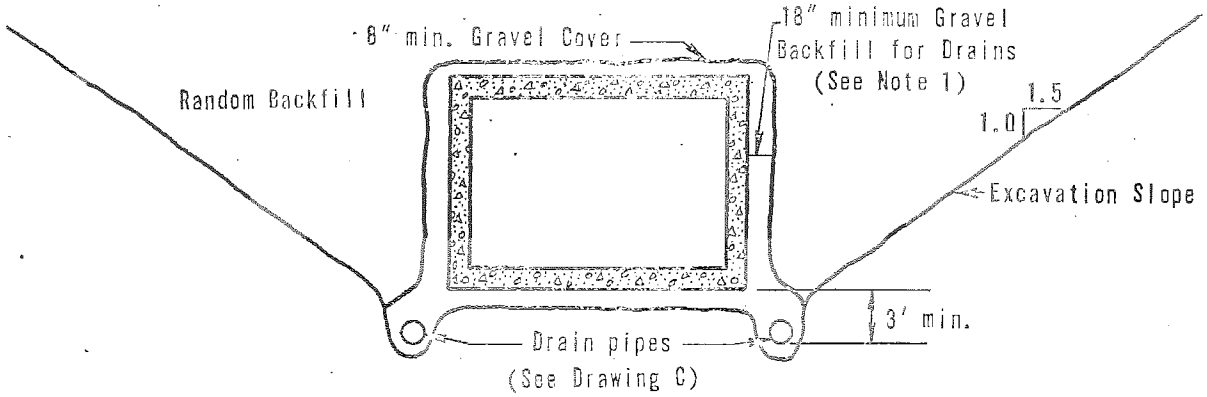
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

FOUNDATION DRAINAGE DETAILS

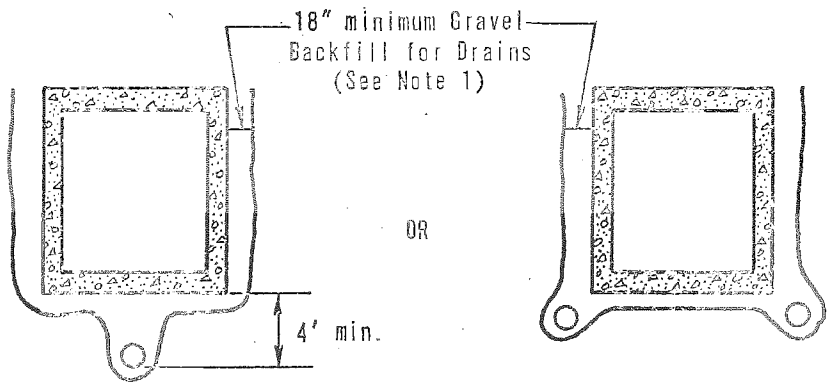
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 15



A. MAIN UTILITY TUNNEL



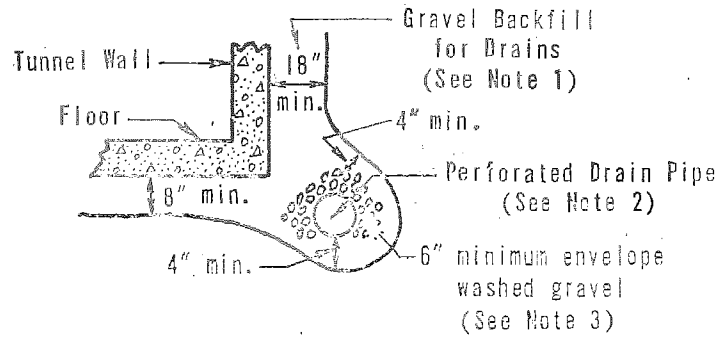
B. BRANCH UTILITY TUNNEL

NOTES

1. Gravel backfill for drains conforming with Division 9-03.12 (4) of the Washington State Highway Commission Standard Specifications for Road and Bridge Construction, 1969.

2. Perforated drain pipe placed with perforations up.

3. 6" minimum envelope of 1/4" to 3/4" washed gravel.



C. DRAIN INSTALLATION DETAIL

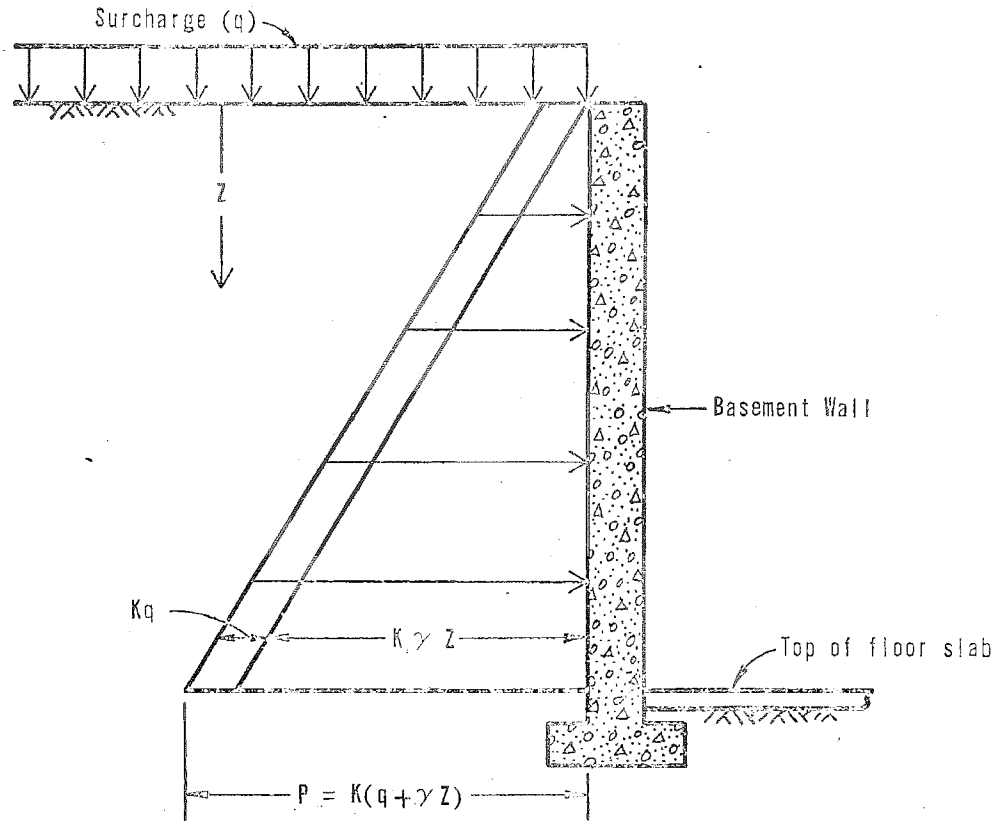
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

UTILITY TUNNEL
DRAINAGE DETAILS

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 16



P = Lateral pressure at depth Z (lbs./ ft.^{2}) per foot of wall
γ = Wet density of the backfill material (lbs./ft.^{3}) = 135 pcf
q = Surcharge on surface (lbs./ft.^{2})
K = Coefficient of lateral earth pressure (dimensionless)

K VALUES

Yielding Wall	K = Ka = 0.3	(top is allowed to deflect)
Non-Yielding Wall	K = Ko = 0.5	(top is restrained)

NOTE

Above values assume fully drained condition with no water pressure on wall.

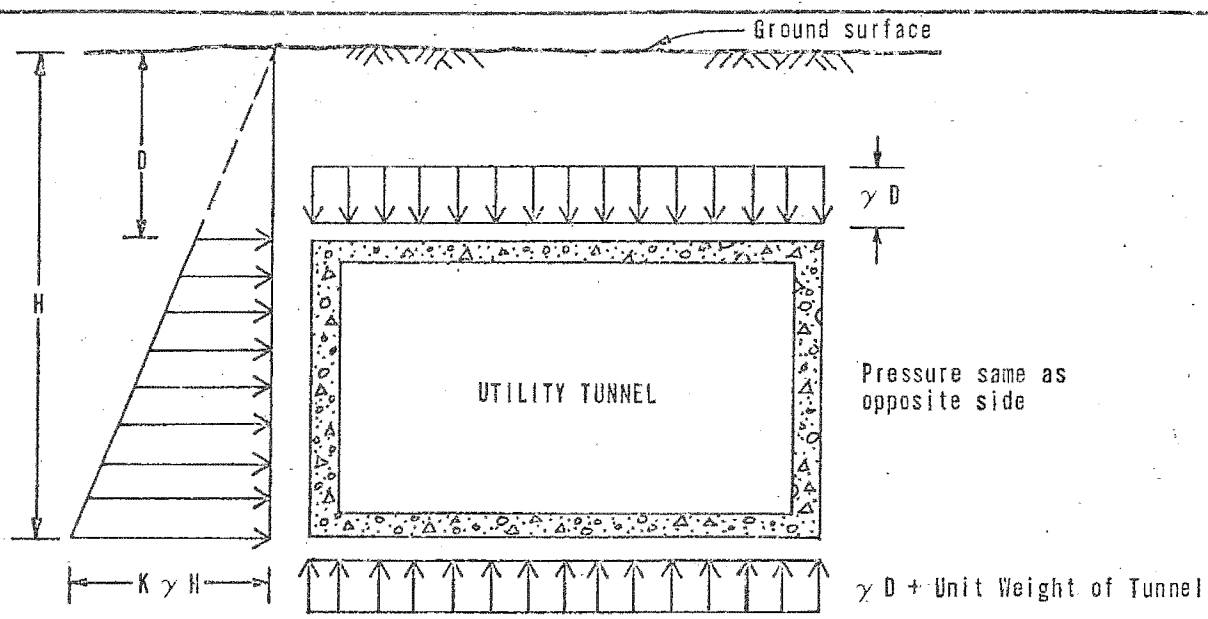
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LATERAL EARTH PRESSURES

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG 17



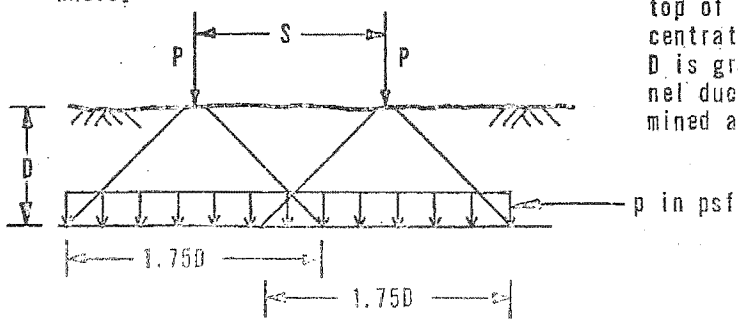
Lateral Pressure = $K \gamma H$ per lineal foot of tunnel
Vertical Pressure = γD per lineal foot of tunnel

where K = Coeff of Lateral Earth Pressure = 0.6
γ = Unit Weight of Soil = 135 pcf
D = Depth from ground surface to top of tunnel
H = Depth from ground surface to base of tunnel

NOTES

1) In this analysis it is assumed that a subdrain system will prevent hydrostatic pressures from acting on the conveyer tunnel.
2) Surcharge loads, if any should be added to the tunnel walls according to the procedure shown in Fig. 22.
3) Live loads induced by vehicular traffic on the top of the tunnel should be considered as concentrated loads if D is less than 2 feet. Where D is greater than 2 feet the stress on the tunnel due to vehicular traffic, p may be determined as follows: (See illustration)

Where:



$$p = \frac{2P}{(1.75D + S)\,(1.75D)}$$

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

EARTH PRESSURES
ON UTILITY TUNNELS

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 19

PART III. ROADS, PARKING AREAS AND ANCILLARY STRUCTURES

This portion of the report pertains to the subsurface conditions and engineering studies and recommendations for Road "A", Parking Lots "B" and "C" and ancillary structures at The Evergreen State College site. The investigation for Road "A" included in this report pertains to the two one-way thoroughfares, Road "AN" and Road "AS", located between Overhulse and Kaiser Road. The ancillary structures investigated included the Water Storage Tanks west of Overhulse Road and south of Road "A", the Pump Station east of Overhulse and south of Road "A", and the Sanitary Sewer line running parallel to Overhulse Road between Road "A" and the central plant. A plan showing the location of these structures and the borings and test pits advanced for this study is presented on Fig. 19.

A. WATER STORAGE TANKS

Two water storage tanks located side by side are proposed west of Overhulse Road and south of the proposed Road "A" as shown on Figs. 19 and 20. Description of the subsurface conditions and engineering studies and recommendations pertaining to the construction of these tanks are presented in the following sections.

The tanks are approximately 92 feet in diameter and 25 feet in depth and are to be constructed of steel plate. The bottom elevation is 153 feet and the top 178 feet. The present ground surface slopes from approximate elevation 181 feet at the west extremity of the tanks to about elevation 157 feet at the east extremity. An earth berm is to be placed around the portion of the tanks not below the present ground surface, to about elevation 178 feet.

Three borings were drilled at the site, to depths of 30, 40 and 50 feet. The bottom of the borings corresponds to approximate elevation 130 feet. The location of the three borings,

numbered B-108, B-109 and B-110, are shown on Figs. 19 and 20. The boring logs are presented in Appendix A, Figs. A-93 through A-95. Observation wells were installed in all three borings to observe the depth to groundwater.

Laboratory tests consisted of visual classification of each sample and grain-size analysis on six selected samples. The six grain-size distribution curves are presented in Figs. A-127 and A-128.

1. Subsurface Conditions

Based on our interpretation of the boring information, the general subsurface soil profile is shown on Fig. 21. The location of this section is shown on Fig. 20. The predominant materials encountered at the site, below the thin top soil mantle, are listed in descending order as follows:

(1) Dense to very dense light brown slightly silty sand and gravel,
(2) Hard, blue-gray, silty clay with lenses of tan silt to sandy silt and
(3) Very dense, gray, fine to medium sand.

The topsoil mantle, which varies from about 1.5 to 2.0 feet in thickness, generally consists of a medium stiff, dark brown, organic, sandy, gravelly silt. Generally below this topsoil mantle lies a layer of dense to very dense, light brown, slightly silty to silty, gravelly, fine to coarse sand to depths ranging from about 20 to 26.5 feet below the present ground surface. Underlying the sand layer is a stratum of very dense silty fine sand, varying from 1.5 to 3.5 feet in thickness. Directly below the silty fine sand is the impermeable dry, hard, blue-gray, silty clay which was encountered generally throughout The Evergreen State College site. In boring B-108 lenses of tan silt and silty gravelly sand are present within the clay stratum. Below the clay layer, a 4-foot layer of very dense, gray, fine to medium sand was encountered at boring B-108 below which a hard, tan, sandy silt was encountered.

Groundwater measurements recorded in the borings are shown on the logs of borings. A gradient of approximately 9 feet over a distance of 160 feet between the outer borings was measured on November 5, 1969 at which time the water level readings were at elevation 157, 152, and 148 feet for borings B-108, B-109 and B-110, respectively.

2. Engineering Studies and Recommendations

Engineering studies were directed towards foundations, allowable bearing pressure, estimated settlements, lateral earth pressures, excavations, drainage, and structural fill. The results and recommendations pertaining to these studies are presented in the following sections.

Foundations. The proposed tanks are approximately 25 feet in height and will be placed below ground surface. It is our understanding, that the two proposed water storage tanks will be placed upon a base of oiled sand. This oiled-sand base will serve as a leveling course to provide uniform support for the steel plate tanks. Where concentrated loads are transmitted to the tank bottom, such as the tank periphery or at interior column locations, we recommend that these be supported on spread footings. To provide an adequate factor of safety against bearing failure, and to minimize the total and differential settlements, we recommend that allowable bearing pressures of 4 tsf (tons per square foot) and 2.5 tsf be used for the west and east tanks respectively, for the design of spread footings. Alternatively, if spread footings under the east tank are placed in the very dense sand and gravel encountered at a depth of 10 to 13 feet below the original ground surface, a value of 4 tsf may be used for both tanks. We recommend that an experienced soils engineer or technician be retained to inspect footing excavations if the footings are to be located in the very dense sand and gravel. We also recommend that the base of the spread footings be located a minimum distance of 2 feet below the bottom of the tanks and further, that the footings be not less than 18 inches wide.

Where the depth of the excavation is about 15 feet, the weight of the excavated material will be greater than the weight of the tanks fully loaded. Because of this condition and the existence of very competent foundation soils, the total and differential settlements for the west tank and total settlement of the west portion of the east tank would be negligible, in our opinion. The maximum total settlement in the east tank, resulting from the recommended allowable bearing pressures will be less than or equal to 1 inch, in our opinion. However, the differential settlement may also be 1 inch over a distance of about 50 feet since the uphill end of the tank should have negligible settlements. The major portion of the total and differential settlement should occur when the tanks are first filled.

The magnitude of lateral earth pressures on the storage tank walls will depend upon the type of backfill, surcharge loading, and amount of lateral movement permitted along the wall during backfilling operations. It is our understanding that the tank walls will be rigidly supported by steel, wide flange stiffeners, spaced about 4 to 5 feet apart. However, the steel plate walls would be somewhat flexible between the stiffeners. Where the walls are rigid and non-yielding, a coefficient of lateral earth pressure (K) equal to 0.5 should be used to determine the lateral earth pressure. Where the walls are flexible or free to yield an amount equal to about two thousandth of the distance between stiffeners, the K value may be reduced to 0.3. For example, if approximately 25 percent of the wall is considered non-yielding, we recommend that the K value be adjusted proportionately between 0.3 to 0.5, which in this case yields a K value of 0.35. Depending on the wall rigidity, an appropriate K value should be selected and applied to the diagram on Fig. 17 for determining the lateral earth pressure. Figure 17 has been prepared for lateral earth pressures against basement walls, however, the same conditions are applicable for the flexible storage tank walls. The resulting lateral earth pressures are for the critical condition

of an empty tank. The values in Fig. 17 are based on the assumption that a drainage system will be provided and buildup of hydrostatic pressure will not occur. Overcompaction of backfill material may induce increased lateral earth pressure, therefore, we recommend that only moderate compactive effort be applied in close proximity to the walls. It is also recommended that the backfill be brought up uniformly around the tank. In no case should large dozers or heavy equipment be used for compaction near the walls.

Excavation. The two storage tanks are to be buried into the hillside as shown on Fig. 21. The required depth of excavation below the existing ground surface ranges from about 31 feet to 6 feet. Below a depth of 10 to 12 feet from the present ground surface, standard penetration values were 100 blows per foot and greater. Thus, excavation of these very dense materials may require ripping.

The borings revealed that groundwater is present above the proposed bottom of the excavation at the west end as shown on subsurface profile on Fig. 21. To provide stability of the excavation slopes below the water table, avoid hazards due to slides and sloughing, and to provide a suitable working surface at the bottom of the excavation, dewatering should be accomplished. One possible method, in our opinion, to dewater this zone would be to install an intercepter drain around the perimeter of the excavation and utilize local ditching if necessary. This could be accomplished by first excavating down to within 1 or 2 feet of the groundwater and then constructing an intercepter drain around the perimeter of the excavation before continuing to the final depth. This drain could consist of a perforated pipe placed in an excavated trench about 2 feet below the final excavation depth and backfilled with free draining material conforming with "Gravel Backfill for Drains", Section 9-03.12(4) of the State of Washington, Standard Specification for Road and Bridge Construction, 1969. As an alternative, the permanent periphery drain described in

the following section could be installed and tied in with the drainage layer outside and beneath the proposed tank. Because the trench and drain will be excavated and placed below the groundwater table it may be necessary to utilize a steel-strutted trench box as a means of supporting the trench sides. Regardless of the construction methods used, all trenching should be accomplished in compliance with the applicable provisions of the "Safety standards for construction work," State of Washington, Department of Labor and Industries, Division of Safety.

We recommend that all unbraced excavation slopes be excavated no steeper than 1 vertical on 1.5 horizontal (1V on 1.5H), provided dewatering is accomplished prior to excavation into the waterbearing zone. If heavy surface runoff occurs or groundwater inflow exists even after dewatering, then it may be necessary to protect the slopes from erosion with a gravel blanket or equivalent.

If the final construction is carried out in late fall or winter, i.e., during the wet season, or if the excavation becomes excessively wet due to groundwater inflow, the foundation soils, particularly the clay and silty materials, may become soft and loose, making them unsuitable for foundation support. Thus, for wet weather construction, we recommend that provisions be made to protect footing excavations by placing a working mat of lean concrete immediately after the footing excavation. Provisions should also be made to remove all soft or loose materials before construction of the footings or placement of the granular bedding material and the oiled-sand base. Furthermore, we recommend that the clean gravel base which is beneath the oiled-sand base be placed as soon as practicable after the excavation is complete and all soft or loose material is removed.

Drainage Requirements. To prevent a hydrostatic uplift pressure which could force the tanks off their foundations when they are empty, a perimeter drainage system is recommended. The recommended drainage system is described below and the details are shown on Fig. 22.

Open joint bell and spigot pipe or perforated pipe drains should be placed around the periphery of the two storage tanks and as a cross drain between the tanks as shown on Fig. 22. The perforated drains should be placed with the perforations on top and the open joint drains should be placed with the lower half of the joint sealed with cement mortar. The drains should be 6 inches in diameter and sloped to drain. An envelope of at least 6 inches of washed gravel (1/4" to 3/4") surrounded by a minimum of 6 inches of clean reasonably well-graded sand and gravel should be provided above the perforations or the open joints. The two materials serve as a graded filter between adjacent soils and the drain pipe and prevent fine grained soils from entering the pipe.

The proposed oiled-sand base below the bottom of the tanks should be underlain by at least 8 inches of clean gravel base which conforms to the requirements of "Gravel Backfill for Drains" as specified in Section 9-03.12(4) of the State of Washington, Standard Specifications for Road and Bridge Construction, 1969. This will serve as a drainage layer beneath the tanks and should be connected hydraulically to the peripheral as well as cross drains. The drainage system should be provided with clean-out and rod-out accesses for periodical clearing.

A free-draining granular backfill such as clean sand or the material conforming to the requirements of "Gravel Backfill for Drains", should be provided behind the storage tank walls. This backfill should consist of a minimum thickness of 18 inches as recommended on Fig. 22. The remainder of the backfill (random backfill on Fig. 22) may consist of on-site materials provided they are placed and compacted as described subsequently, during dry weather. However, in our opinion the materials below the water table will be wet of optimum and thus require drying prior to placement. During wet weather the random backfill should consist of reasonably well-graded granular material containing less than 5 percent fines, (material finer than the No. 200 mesh sieve) based on that portion of the material finer than 3/4 inch. The fines should be non-plastic. The backfill should be sealed at

the surface with at least 2 feet of impervious silt or clay material in unpaved areas to prevent infiltration of surface water. Impervious materials as such are available at the waste areas of the site. The finished ground surface should be sloped to drain away from the structures.

Structural Fill. Material placed for construction of the berm around the east storage tank, in our opinion, should be a controlled, structural fill to assure stability. The fill material should be placed after removal of all unsuitable material (material from the surface to a depth 1.5 to 2.5 feet containing organic matter) and after the excavated surface has been proof-rolled with a roller or other suitable compaction equipment. The structural fill should be placed in thin lifts not exceeding 12 inches and compacted to a density equal to or greater than 90 percent of the modified Proctor maximum dry density as determined by ASTM D 1557 test procedure. The suitability of material from the excavation as compacted fill will depend upon the gradation of the material, and the moisture content when it is placed and compacted. The slightly silty fine to coarse sand and gravel from the proposed excavation contains from 8 to 12 percent fines. The materials excavated from below the groundwater table will probably require drying. The top soil, clay and silts should be wasted. Selective excavation should be accomplished so that the granular soils suitable for backfill will not be contaminated with unsuitable fine-grained soils.

Backfill behind the storage tank walls or fill within the berm area, which will support pavement or other structures, should be compacted to a density equal to at least 95 percent of the modified Proctor maximum dry density as previously defined. For such structural fill, the material should be placed in loose lifts 8 inches or less in thickness. Backfill behind the storage tank walls or fill within the berm area which do not support structures or pavement should be compacted to a density of 90 percent modified.

If over excavation below the tank is necessary to remove soft or loosened materials, the area should be backfilled with a

reasonably well-graded sand and gravel containing less than 5 percent of non-plastic fines. This fill should also be placed in lifts not exceeding 8 inches and thoroughly compacted to a density equal to at least 95 percent of the modified Proctor maximum dry density as defined in the preceeding paragraph. We recommend that all earthwork be inspected by a qualified soils engineer or technician who would observe the excavation, groundwater and drainage installation and test the quality of fill material and compaction at frequent intervals.

B. PUMP STATION

The proposed pump station is located about 150 feet northeast of the proposed water storage tanks on the east side of Overhulse Road as shown on Figs. 19 and 20. It is to be a one story, 35 by 50 foot concrete structure with a finished floor elevation of 151 feet. The present ground surface slopes from west to east from approximate elevation 147 feet to 144 feet.

Four borings were advanced at the site on December 11 and 12, 1969 using a truck-mounted hollow stem auger. Borings B-111,B-112 and B-114 were drilled at the location of the proposed pump house and boring B-113 about 100 feet north of the proposed structure, as shown on Fig. 20. The four borings ranged from 35.8 to 38.7 feet in depth, extending to elevation 107 to 113 feet. The logs of the borings are presented in Appendix A, Figs. A-96 through A-99. Observation wells were located in borings B-111 and B-114 to observe the depth to groundwater, the results of which are recorded on the logs of borings.

Laboratory tests conducted on the soils included visual classification of all samples, and determination of natural water content and Atterberg limits of selected undisturbed samples. In addition, a series of shear tests were performed on the silty soils, using the Torvane, a small portable torsion vane shear device, to evaluate the strength characteristics.

The results of the visual classifications have been used to supplement the field classifications, both of which are combined

in the boring logs on Figs. A-96 through A-99. The plots of the natural water contents and Atterberg limits are shown on the boring logs, together with results of the Torvane strengths which are presented in terms of shear strength in tons per square foot (tsf). Results of the laboratory tests, together with a description of the subsurface conditions, and engineering studies and recommendations pertaining to foundation design are presented in the following sections.

1. Subsurface Conditions

Based on our interpretation of the boring information, the general subsurface conditions are shown by the subsurface profile on Fig. 21. The location of this section is shown on Fig. 20. The location of this section is shown on Fig. 20. Basically, the site of the proposed pump station is underlain by silt and sand materials which generally are divided into three predominant strata. These strata, excluding the top soil mantle, are listed in descending order as follows:

(1) Medium dense, tan to gray, silty, very fine SAND to stiff, clayey, sandy SILT,

(2) Medium dense to very dense, gray to tan, slightly silty to silty, fine gravelly SAND,

(3) Hard, blue-gray, clayey SILT, with partings and seams of fine to coarse sand, fine sandy silt, and random fine gravel.

The top soil mantle which varies from about 1.0 to 2.0 feet in thickness, generally consists of a soft,brown, organic sandy clayey silt. This soft material was saturated to the degree of being unstable at the time of our subsurface exploration. The unstable condition was due to the prevailing wet weather conditions and the disturbance caused by clearing operations. The drill rig produced ruts up to 2 feet in depth when moving from one boring location to another at the site.

Generally below this surface material, a stratum of medium dense silty sands and stiff sandy silts was encountered

above elevation 130 feet. These soils were generally encountered in relatively thin layers and lenses. The sandy silt was generally clayey near the base of this stratum. The natural water content in these soils varies from about 22 to 38 percent. The standard penetration resistance values ranged from 8 to 15 and averaged 13 blows per foot. The shear strength of the silt, as determined by the Torvane shear device, ranged from 0.20 to 0.35 tsf and averaged 0.30 tsf.

Underlying the sand-silt stratum is a layer of gray to tan, slightly silty to silty, fine gravelly SAND, ranging from about 4 to 11 feet in thickness. The silty and slightly silty SANDS were generally encountered in alternating seams with the latter being waterbearing. The relative density of these materials varies from medium dense to very dense as determined by the standard penetration resistance, which ranges from 18 to 63 blows per foot under the building area.

Underlying the sand layer is an impermeable dry, hard, blue gray, clayey SILT. This soil stratum is similar to the typical silty clay which has characterized The Evergreen State College site, except, that it contains partings and seams of fine to coarse sand, fine sandy silt, and scattered fine gravel.

Groundwater measurements recorded in borings B-111 and B-114 are presented on the logs of borings. The water level readings recorded on December 15, 1969, were at approximate elevation 142 and 137 feet for B-111 and B-114 respectively.

2. Engineering Studies and Recommendations

Engineering studies were directed towards preload, structural fill, foundations, allowable bearing pressure and estimated settlements. The results and recommendations pertaining to these studies are given in the following sections.

Preload Fill. The upper 15 to 20 feet of subsurface soils consist of medium dense silty very fine SAND and SILT with clayey material towards the bottom of the stratum. The finished floor

elevation is approximately 2 to 4 feet above the present ground surface. Because of the potential settlements of the fine grained soils beneath the site of the proposed Pump Station due to the weight of the proposed fill and structure, we have recommended, in a conference with the structural engineer, that a preload fill be placed on the site to reduce future total and differential settlements. Placement of the preload fill started on January 5, 1970, and is presently at an average elevation of 156 feet, about 8 feet above the design floor elevation. To monitor the amount and rate of settlement due to the preload fill, five settlement plates were recommended in the area of the Pump Station. Four plates were recommended about 20 feet in from each corner of the fill and one at approximately the center of the fill area. The settlement plates were to consist of a 2-foot square by 1/4-inch steel plate placed below the existing topsoil. Directly below the plate, a sand blanket with a central gravel pocket to allow water to come up into the riser pipe was to be placed. The riser pipe, was to consist of 2-inch diameter steel pipe which extends up through subsequently placed fill. Details of the recommended settlement plate are shown on Fig. 23. The settlement readings were made by others and were to be performed by first determining the elevation of each plate at the time of installation, before any filling was accomplished. The fill elevation was to be recorded, each time settlement readings were made. Readings were then to be taken upon completion of filling and at weekly intervals for a period of one month. The interval between readings may then be increased to once every two weeks. At the time settlement readings are made, the water level within the riser pipe should be measured. These water level readings are useful in determining the degree of consolidation under the preload fill.

The total time required for the preload fill to be left in place will be dependent upon the rate of settlement as determined by the settlement plate readings. It is our opinion that approximately 4 to 6 months will be required to produce the desired consolidation of the underlying materials. We recommend

that we be retained to review the settlement data to determine when the preload fill can be removed.

Upon completion of the preloading program, the preload fill materials should be removed. In addition, all original unsuitable material below the fill (material containing organic matter) should be removed to provide a firm surface upon which to place the structural fill. It is a normal practice to strip the organic topsoil and place the structural fill and then place the preload fill. However, for this particular case, the preload fill placement was accomplished in January, 1970, during the wet weather season when the ground was too wet and soft for equipment traverse over the area to accomplish stripping. In addition, the site was located ideally close to Road "A", where it was necessary to strip Road "A" to obtain fill material for the Overhulse crossing. Thus, the unsuitable materials from Road "A" were wasted on the pump station site where it could serve as a preload fill. Thus, it is necessary to remove all materials, including the original top soil, prior to placement of the structural fill.

Prior to removal of the preload fill, it is recommended that shallow holes be dug around the site to assure that the water level is at least 2 feet below the proposed excavation level and, if necessary, ditching or some other means should be accomplished to maintain drainage of water below this level. After removal of the preload fill and the original unsuitable organic materials, the site should be inspected by an experienced soils engineer to assure that all of the unsuitable soft materials have been removed. The stripped surface should then be allowed to dry by scarifying the upper 6 to 8 inches. When the water content is at optimum for compaction, it should be proof-rolled with six complete coverages of the wheels of a loaded dump truck to provide a firm base upon which to place the structural fill. We recommend that an experienced soils engineer or technician be present at the site during this proof-rolling and to inspect the ground surface and detect the presence of pockets of soft

material, which if encountered should be removed and backfilled with competent material before placement of structural fill.

Structural Fill. All fill within the building area and beneath paved surfaces should be placed as structural fill. The structural fill should be placed after removal of all unsuitable material, and after the excavated surface has been proof-rolled, as discussed in the preceeding section (Preload). The structural fill should be placed in lifts not exceeding 8 inches and thoroughly compacted to at least 95 percent of the Modified AASHO maximum dry density, as determined by ASTM D1557-66T test procedure. The structural fill should extend out from the outside edge of the footings a minimum distance of 2 feet plus the thickness of structural fill beneath the bottom of the footing.

The structural fill should consist of a fairly well-graded sand and gravel. The fines (material finer than the No. 200 mesh sieve) should be limited to less than 5 percent and non-plastic, when placed during wet weather. The fines content may be as much as 15 percent when placed during dry weather, provided its moisture content is not greater than its optimum water content. The optimum water content is that which allows the best compaction of the soil under a given amount of compactive effort.

The first 2 feet of the structural fill, regardless of weather conditions, should consist of clean, fairly well-graded sand and gravel with less than 5 percent of non-plastic fines.

Foundations. The proposed building site will have approximately 6 feet of structural fill, assuming about 2 feet of the original unsuitable material is removed. Thus, it is recommended that the structure be supported on individual and continuous spread footings and that the pump units be supported on individual foundation blocks, founded in the structural fill. We recommend that spread footings and pump foundations be designed for an allowable bearing pressure of 1,500 psf with a minimum of 3 feet of structural fill provided for beneath the foundation.

Since the site is being preloaded with approximately 8 feet of fill, which exceeds the weight of the structural fill, settlement due to the weight of the structural fill should be negligible. However, since we understand that the continuous footings will be approximately 3 feet in width with a burial of 2.5 feet into the structural fill, the stress on the stripped surface would be about 300 to 500 psf over that by the preload fill under the footings. This stress increase will dissipate rapidly with depth. Thus, we estimate the total settlement to be about one-half inch and the differential settlement about three-fourths of the total. We estimate most of the settlement would occur during construction. However, some additional settlement may occur due to vibrations from the pump units.

Settlement from vibratory loads are accentuated if imposed vibrations are resonant with the natural frequency of the foundation-soil system. When the vibrations are at resonance even compact cohesionless soils may be densified with accompanying settlement. The resonance of the soil foundation system is a function of the operating speed of the equipment and the size and weight of the supporting foundation block. It is our understanding, that the operating speed and frequency of the proposed pump units are 17,500 r.p.m. (revolutions per minute) and 500 c.p.s. (cycles per second) respectively. The most critical resonant vibration occurs with equipment operating at speeds less than 1000 r.p.m. The tolerable vibration amplitude decreases as frequency increases. To avoid high frequency and resonance with the vibrating pump equipment, we recommend that the resonant frequency of the foundation block soil system be less than one-half the equipment operating frequency. To decrease the foundation soil system resonant frequency to this value, we recommend that the weight of each foundation block be equal to or greater than the weight of the corresponding pump unit.

We recommend that the minimum width of spread footings be limited to 2 feet for spread footings and 16 inches for continuous footings. The base of the footings or foundation blocks

should be located not less than 18 inches below the surface of the interior floor slab or exterior grade, whichever is lower.

A trench extends the full length of the center of the building to accommodate the pipe lines. The bottom of this trench is approximately 6 feet 9 inches below the finished floor level or is at approximately the bottom of the structural fill. Thus, it is recommended that the trench wall footing and floor be supported on at least 2 feet of clean structural fill material with less than 5 percent of non-plastic fines to provide a firm working surface and base upon which to construct the trench.

The trench walls should be designed for lateral earth pressures presented in Fig. 17 of the main text. Overcompaction of backfill material may induce increased lateral earth pressure, therefore, we recommend that only moderate compactive effort be applied in close proximity to the walls. In no case should large dozers or heavy equipment be used for compaction near the walls, unless special bracing is provided and the wall is designed for the increased lateral loads induced by such large and heavy equipment. Drains should be provided for beneath the trench floor. If it is not possible to place such drains, then the trench should be designed as a water-tight structure and the lateral earth pressure should include the water pressure. The trench should also be designed to counteract bouyancy in this case.

Weather Limitation. The preload fill material consists of unsuitable road fill materials obtained from the Road "A" excavation west of Overhulse Road during the month of January when wet weather generally prevailed. Furthermore, the surface material was saturated and very soft when the preload was placed. It is our opinion that any earthwork activities such as removal of preload fill and construction of the structural fill would be very difficult to accomplish during wet season. Therefore, we recommend that earthwork activity be accomplished only during the dry summer months. It is further recommended that if the construction of the foundation is to be accomplished during the fall and winter months, the structural fill material beneath the building and where

excavations are proposed consists of clean fairly well-graded sand and gravel with less than 5 percent of non-plastic fines. The excavation should be accomplished in such a manner that the foundation soils would not be disturbed and become soft.

C. SANITARY SEWER

Borings B-115 through B-117 were advanced to determine the subsurface conditions along the proposed sanitary sewer line east of Overhulse Road. The invert of the proposed line varies from elevation 141 feet, at the intersection with Road A to 143 feet east of the proposed Central Plant along Overhulse Road. The present ground surface along Overhulse varies from about elevation 149 feet to 152 feet, from south to north. The borings were located along the east shoulder of Overhulse Road.

The three borings were drilled with a truck-mounted hollow stem auger at the locations shown on Fig. 10, on December 15, 1969, and ranged in depth from 16.0 to 18.5 feet from the ground surface. The logs of the borings are presented in Appendix A, Figures A-100 through A-102. Observation wells were located in all three borings to observe the depth to groundwater, the results of which are recorded on the logs of borings.

Laboratory tests conducted on the soils included visual classification of all samples, and determination of natural water content and Atterberg limits of selected undisturbed samples. In addition, a series of strength tests were performed on the silt and clay soils, using the Torvane, a small portable torsion vane shear device to evaluate the strength characteristics.

The visual classifications of samples have been used to supplement the field classifications, both of which are combined in the boring logs on Figs. A-100 through A-102. The plots of the natural water contents in percent and Atterberg limits are shown on the boring logs, together with results of the Torvane strengths, in tons per square foot. Results of the laboratory

tests, together with description of the subsurface conditions and general construction recommendations are presented in the following sections.

1. Subsurface Conditions

The subsurface conditions encountered in the three borings advanced along the proposed sewer route are presented below. Because of the large distance between borings, a generalized profile of materials encountered between these borings is not practical. The soils encountered in the three borings generally consist of fine sand, silt, and clay mixtures to a depth of 14.0 to 17.5 feet below the surface.

In the southern most boring, B-116, the predominate soil encountered within the depth of the proposed sewer trench excavation, approximate elevation 141 feet, was loose, silty, very fine SAND to very fine sandy SILT. Between elevation 139 to 135 feet a layer of stiff, clayey SILT was encountered and below this material lies a dense silty, gravelly SAND or glacial till. The natural water content of the silt materials ranged from about 30 to 34 percent and the shear strength of these materials varied between 0.20 and 0.45 tsf.

The soils encountered in Boring B-115 are generally a medium dense, silty, fine SAND above elevation 143 feet and a stiff fine, sandy SILT to silty CLAY from elevation 143 feet to the bottom of the boring. The natural water contents ranged from 23 to 36 percent while the shear strength varied between 0.16 and 0.39 tsf. The Atterberg limits on the fine sandy silt are shown on the boring log.

The soils in Boring B-117 from about elevation 148 to 133 consist of clayey, very fine SAND and SILT mixtures, with seams of waterbearing, fine SAND existing below elevation 143 feet. Standard penetration resistances indicate that above elevation 143 feet these soils are very loose to soft and below

this elevation are medium dense to stiff. Torvane shear test results in the clayey silt materials yielded shear strength values ranging between 0.27 and 0.32 tsf, as shown on the boring log. Natural water content measurements varied between 30 and 37 percent for the silt materials. The Atterberg limits of the slightly clayey, silghtly fine sandy silt are shown on the boring log. Below approximate elevation 133 feet a dense to very dense, slightly clayey, silty, gravelly SAND, classified as glacial till was encountered.

2. Construction Recommendations

The recommendations presented in this section are based upon the subsurface condition encountered in the three borings, B-115 through B-117. Variations between the materials encountered in the borings and actual conditions may exist. If such variations are encountered at the time of construction, we should be notified so that we can reconsider our recommendations where necessary.

The grade of the sewer line will require excavations which range from about 9 to 12 feet in depth below the existing ground surface. Where Road "A" crosses the sewer line, an additional 6 to 8 feet of roadway fill has been placed, which will require a total excavation depth of 17 to 18 feet. If construction is accomplished during the dry season, conventional equipment should be able to operate along the entire alignment. During the past winter, we observed ponded water along the alignment of the proposed sewer line. Thus, surface drainage and special access provisions would be required.

Trenching in soils such as those encountered in the three borings along the alignment could be accomplished by open cut methods provided the sides are sloped back sufficiently to establish stability and protect workmen. In our opinion for cuts up to 10 feet in depth, temporary slopes in the medium dense to stiff sand and silt soils could range from about 1V (vertical) on 1H (horizontal) to 1V on 1.25H and slopes in the structural fill at Road "A" could be about 1V on 1.5H. Where excavations exceed

10 feet, flatter slopes should be required. Cuts in soft silt or loose sand, or where abundant seepage is encountered, will require flatter slopes in order to provide stability, or should be shored.

The above slope values should be used only as a guide and should not be shown on plans, as sloping should be made the responsibility of the contractor who is continuously present at the job site to observe the nature and occurrence of subsurface conditions encountered, including groundwater. Regardless of the construction methods used, all trenching should be accomplished in compliance with the applicable provisions of the "Safety Standards of Construction Work", State of Washington, Department of Labor and Industries, Division of Safety.

Excavation could be accomplished with vertical trench sides if sheeting and bracing is used to resist the lateral earth pressures. We recommend that lateral pressures for braced vertical cuts be designed using a rectangular pressure distribution equal to 40H (psf/lineal foot of trench) where H equals the height of the trench. An alternative for braced excavations is the use of a steel-strutted trench box. This method is commonly used in sewer line installations and consists of pulling a steel-strutted trench box through the trench to take the place of shoring as a means of protecting the workmen. The box should be capable of withstanding the lateral pressures presented above. Any portion of the excavation extending above the box should be sloped back to prevent soil from falling into the box.

The groundwater level in the three borings ranged from 2.3 to 3.6 feet in depth from the present ground surface (shoulder of Overhulse Road) on February 10, 1970, as recorded on the boring logs. Because of zones of impermeable material encountered in the three borings, the extent and capacity of water in these materials is expected to vary considerably. To minimize seepage and thus reduce the instability of the slope, all excavation should be carried out during the dry season, generally June to mid-October, if possible. Collector trenches with local sumps should be utilized during construction to control any seepage or runoff as

well as to prevent the bottom of the excavation from becoming soft, quick and/or spongy due to wet conditions. Further, it may be necessary to dewater the materials along the sewer line to a depth of about 18 inches below the trench bottom, if trenching and local sumps cannot control the water inflow which causes slope instability. We recommend that excavation of the line commence from the low end (south end) of the invert and progress uphill. This would enable the in-place line to drain the excavation. If excavation operations are carried out during the wet season this may be a necessity.

The sanitary sewer lines should be founded upon a clean bedding material. The trench should be carefully excavated to provide an undisturbed, firm base on which to place the bedding material. Pockets of wet, soft and spongy material should be removed and replaced with a select granular material. The granular bedding material should be fairly clean sand or sand and gravel with a maximum size of 3/4 inch. The granular bedding should have a minimum thickness of 6 inches below the bottom of the pipe and should extend half way up the pipe barrel at the sides. The remainder of the side fill and a minimum depth of 24 inches over the top of the pipe should be backfilled with select granular material carefully compacted so as not to damage the pipe. This material should be limited to a maximum size of 1 inch so as not to damage the pipe during compaction.

The backfill above the bedding material may consist of on-site material or select granular material depending upon the amount of backfill settlement that can be tolerated and the season of construction. Materials used below areas which will support future roads, buildings or other structural members should be compacted to at least 95 percent of the Modified Proctor maximum dry density. Onsite materials may be used below these structural areas provided the above compaction requirements are satisfied. To achieve this degree of compaction the materials will probably require drying to reduce the water content to optimum. Wet on-site materials may be used for trench backfill

where considerable settlement can be tolerated. If this material is used below structural areas differential settlements of several inches across the trench should be anticipated.

Where on-site material is not suitable, a select imported granular material should be used. During wet weather this granular material should not contain more than 5 percent of material passing the No. 200 mesh sieve, based upon the material passing the 1 inch sieve. Material used in structural support areas should be placed in maximum 8-inch loose lifts and compacted to at least 95 percent of Modified Proctor maximum dry density.

D. PARKING AREAS "B" AND "C"

Presented within this section of the report are the subsurface conditions and recommendations pertaining to the two proposed parking areas "B" and "C", adjacent to access Road "B". The configuration of these parking areas and their location on the site are shown on Fig. 19. Parking Lot "B", which is west of Road "B", will be relatively flat and vary approximately from elevation 170 to 200 feet. The final elevation of Lot "B" will generally be within ±2 feet of original ground surface with isolated cut and fill areas no greater than 4 and 6 feet respectively. Parking Lot "C", located east of Road "B", will range from elevation 183 to 188 feet, while the present ground surface varies from elevation 182 to 193 feet.

Sixteen test pits, numbered TP-8 through TP-13 and TP-15 through TP-25A were dug on August 26 and 27, 1969, with a rubber-tire mounted hydraulic backhoe. The locations of these test pits are shown on Fig. 19 and the test pit logs are presented in Appendix A, Figs. A-105 through A-109.

Laboratory tests conducted on materials encountered in the two parking areas included visual classification, grain-size analysis and CBR (California Bearing Ratio) tests. The grain-size distribution curves are presented on Fig. A-103 and the series of CBR tests are presented on Figs. A-133 and A-134. The CBR tests were conducted on 4 representative materials using a

modified AASHO compactive effort of 55 blows with a 10-pound hammer dropped 18 inches on each of 5 layers using a 6-inch diameter steel mold as explained in Section C of Appendix A. Additional CBR tests were conducted on one of the representative materials using a lesser compactive effort by reducing the number of blows per layer to 25 and 10. The results of these latter tests together with the 55 blow tests on the same materials are presented by a series of curbes in Fig. A-134.

1. Subsurface Conditions

The subsurface conditions present in the two parking areas indicate that adequate bearing soils will generally be encountered below the topsoil. The layer of topsoil varies between 0.8 to 3.0 feet in thickness and is generally classified as a medium stiff, rusty brown, gravelly, sandy silt with roots and organics. The materials encountered below the topsoil layer vary from a medium stiff silt to a very dense sand and gravel as shown in the test pit logs. Generally, those test pits in the lower areas (TP-9, 10, 16, 23 and 24), encountered a layer of medium stiff to stiff, mottled, gray and tan, clayey silt ranging from about 0.8 to 4.5 feet in thickness. Also, those test pits on the southwest side of Road "B" generally encountered a layer of medium stiff to stiff, mottled, rust and tan silt ranging from about 2.0 to 4.2 feet in thickness. This latter silt layer was encountered directly below the topsoil and extended to about 3.5 to 6.0 feet below the ground surface. Where both the silt and clayey silt materials were encountered, the rust and tan silt was above the gray and tan clayey silt as noted on the test pit logs. The remainder of the material generally varies from a stiff, fine sandy silt to a dense to very dense sand and gravel.

Groundwater was encountered in six of the test pits during excavation as recorded on the test pit logs. The elevation of the groundwater encountered varied from 169 to 188 feet. This groundwater may be similar to that present in other areas at The Evergreen State College site where water bearing zones are perched above local impervious layers. The presence of these

water bearing zones and the reservoir quantity of the water they control are expected to be highly variable. Groundwater was at least 6 feet below the ground surface in all the test pits except test pit 22 where the water level was recorded as being 4 feet below the ground surface.

2. Construction Recommendations

The subsurface exploration and laboratory test results indicate that the materials, in the two parking areas, below the organic topsoil are adequate bearing soils for supporting a pavement, provided the natural water content of the silty soils is near optimum for compaction at the time of construction. The natural water content of the subgrade soils, even though determined in late August, was still above optimum and thus will require drying out for compaction.

Stripping and Proofrolling. In order to prepare a suitable surface on which to construct the subbase and asphaltic concrete pavement, stripping is recommended. Beneath the main access roads and perimeter roads, and other pavements subjected to continual traffic, removal of all topsoil and contaminated material such as that mixed with organics during clearing operations, is recommended. In local areas containing deep tree roots and other organics, this depth may be as much as 3 feet below the existing ground surface. Within the parking areas, where the pavement will not be subjected to continual traffic, the surface should be stripped of forest duff, highly organic topsoil and contaminated materials. The stripped area should be proofrolled with a heavy rubber-tired roller or other suitable compaction equipment to provide a firm compact surface upon which to construct the compacted fill or pavement subbase. We recommend that the top 6 inches of in situ material be compacted to a dry density of at least 95 percent of the modified AASHO maximum dry density (AASHO T-180) when proofrolled. It is recommended that the top 12-inches be scarified and if necessary, dried to optimum water content prior to proofrolling to obtain the 95 percent

compaction. Pockets of soft spongy material encountered during proofrolling should be either dried to optimum and recompacted or removed and replaced with other suitable fill material. We recommend that an experienced soils engineer or technician be present during stripping operations to observe behavior of the in situ materials during proofrolling and inspect all stripped areas before placement of compacted fill or subbase materials.

We recommend that earthwork be accomplished only during the dry summer months as on site materials will become wet and difficult to work with and impossible to compact during wet weather. Even during summer months, rainfall will cause the saturation of the surface layer which must be either removed and replaced with other suitable material or allowed to dry and be compacted prior to placing of additional fill or subbase material. During and following periods of heavy rainfall, earthwork construction should be halted entirely. Where the stripped surface is excessively wet, and if the time required for drying and proofrolling is not feasible due to construction schedule or other reasons, it is recommended that an 18-inch minimum layer thickness of select granular fill material be placed over the wet areas to provide an adequate working surface upon which to place subsequent fill or subbase material. This select material should consist of a reasonably well graded sand and gravel with not more than 5 percent of fines (material finer then the No. 200 mesh sieve) by dry weight, on the portion of the material finer than one-inch. The fines should be non-plastic and the maximum gravel size should not exceed 3 inches. We further recommend that during periods of rain, only this select material be used for compacted fills. The select material should be placed in maximum 8-inch loose lifts and compacted to a density equal to at least 90 percent of the modified AASHO maximum dry density.

Compacted Fill. We recommend that the granular materials encountered in test pits TP-8, TP-11, TP-12, and TP-13 be used for compacted fill in the two parking lots. This material should be

placed in maximum 8-inch thick loose lifts and compacted to 90% of modified AASHO maximum dry density (AASHO T-180). If it is necessary to use silty materials located in other cut areas within the parking lots, for compacted fill, we recommend that it be placed in maximum 8-inch thick loose lifts and compacted to 90% of modified AASHO maximum dry density. These materials are generally sensitive to changes in moisture content during compaction and therefore should be at optimum moisture content when placed. The last 6-inch layer of either subgrade materials should be compacted to 95 percent density. An experienced soils engineer or technician should be present during construction to monitor the fill placement and periodically take field density tests on the compacted fill to assure that it has been properly placed.

Pavement Design. We recommend that paved surfaces in the two parking areas be designed on the basis of the following CBR (California Bearing Ratio) values. These values were determined from laboratory test results in conjunction with the preceeding compaction recommendations on in situ and fill materials. The recommended CBR value for the silt material corresponds to the curve of optimum moisture content at a dry density equal to 95 percent of the maximum as shown on Fig. A-134. We recommend that a CBR value not greater than 8 be used for pavement design of Parking Lot "B". This value is recommended on the assumption that the stripped surface if proofrolled to 95 percent of modified maximum dry density and the natural moisture content is at optimum as previously recommended in the stripping and proofrolling section. We recommend that a CBR value of 30 be used for design of pavement constructed on in situ sand and gravels located on the southeast portion of Parking Lot "C". For the brown to tan silt; brown, silty fine sand; and brown silt with trace of sand and organics, which generally covers the remainder of Parking Lot "C" we recommend a CBR value no greater than 8 be used for pavement design. The CBR value of 8 is recommended on the assumption of 95 percent modified maximum dry density following

proofrolling at optimum moisture content as previously specified for stripping and proofrolling. In our opinion, in cut areas in Parking Lot "C", where excavation is greater than 3 feet in depth the dense sand and gravel would be encountered. We recommend this criteria be used as a boundary for selecting CBR values of 8 and 30 for the pavement design. We further recommend that a transistion zone of about 30 feet in width, located within the sand and gravel boundary, be required to insure and adequate pavement section at the transistion. This zone should be designed using a CBR value of 8. The boundary between the two CBR values should be varified in the field during construction.

The moisture content-density relationship of the brown silt used in determining the lower CBR value is shown on Fig. A-134. If it is desired to lower the density requirements or broaden the limits of the recommended moisture content, a corresponding lower CBR value should be determined from these curves.

Slope and Drainage Requirements. Maximum cuts and fills along the perimeter of the parking areas are expected to average between 5 and 6 feet. Based on the materials encountered, it is our opinion that permanent cut and fill slopes will be stable on 1 vertical on 2 horizontal slopes. Sloughing or erosion of these slopes possibly due to surface runoff should be minimized by seeding the slope with rye, clover or other types of deep rooted grasses.

Water levels recorded during test pit excavation indicate that cut areas should be above the upper water zone, thus only drainage provisions for surface water should be necessary. The pavement surface should be sloped to drain into a system of catch basins and storm drains.

E. ROAD "A"

The subsurface conditions and construction recommendation

pertaining to the section of Road "A", between Overhulse and Kaiser Road, is presented within this section of the report. Between Overhulse and Kaiser Road, Road "A" is divided into two one-way thoroughfares designated "AN" and "AS" for the north and south roadways, respectively, as shown on Fig. 19. Each roadway is about 4,700 feet long and the pavement sections are generally 25 feet in width. The elevation of the two roadways is about 164 feet at the west end and 133 feet at the east end. The maximum grade is 5 percent at the Overhulse crossing. It is our understanding that the two roadways have been maintained as close to the original ground surface as possible with resulting maximum cut and fills prior to stripping of about 5 and 8 feet, respectively.

On the north side of roadway "AN", a large open drainage channel is to be constructed. This channel varies from 5 to 14 feet in depth and maintains a grade of 0.2 to 1.3 percent. The bottom of the channel ranges from 8 to 15 feet in width and the side slopes are generally 1 vertical on 2 horizontal (1V on 2H) and 1V on 3H on the north and south faces, respectively. The purpose of the channel is to provide surface drainage for the main campus area in addition to the roadways.

Field explorations consisted of nine subsurface borings, numbered B-98 through B-106, and 19 backhoe test pits numbered TP-25 through TP-43. The borings were drilled with portable drilling equipment on September 24 and 25, and October 6 and 7, 1969. The test pits were dug with a track-mounted backhoe on February 25 and 26, 1970. The location of all the borings and test pits advanced along Road "A" is shown on Fig. 19. The logs of the borings and test pits are presented in Appendix A, Figs. A-83 through A-91 and Figs. A-110 through A-114, respectively. In addition, the location of the borings and test pits together with simplified logs is shown on roadway profiles presented on Figs. 24 through 28.

Field investigations included determination of the standard penetration resistance and visual classification of the boring samples and visual examination and probing of the test pit walls.

In addition, the groundwater level and/or seepage inflow was noted. The groundwater levels recorded on the boring logs in Appendix A are measurements of the depth at which water was encountered during drilling. The water levels recorded on the test pit logs are the depths at which inflow of water was noted in the open pits.

Laboratory tests conducted on materials encountered in Road "A" included visual classification, water content determinations, grain-size analysis and CBR (California Bearing Ratio) tests. Water contents were determined on the samples obtained from the test pits, the results of which are presented on the test pit logs, Figs. A-110 to A-114. The results of the CBR tests are presented on Fig. A-135 and a grain-size distribution curve for the soil used in the CBR test is presented on Fig. A-130. The CBR tests were conducted using three different compactive efforts consisting of 55, 25 and 10 blows with a 10-pound hammer dropped 18 inches on each of five layers as explained in Section C of Appendix A.

1. Subsurface Conditions

The subsurface conditions along Road "A", between Overhulse and Kaiser Road, are generalized by the six subsurface borings and 19 test pits, the logs of which are presented in Appendix A, Figs. A-83 through A-91 and A-110 through A-114, respectively, and on the five roadway cross sections in Figs. 24 through 28. Since the borings and test pits are spaced wide apart and since, generally, the stratigraphy and soils encountered in the upper 10 to 15 feet along this section of Road "A" are highly erratic, a soil profile was not developed. The soils, below the top soil mantle, are predominantly fine grained, consisting of fine sand, silt and clay.

The top soil mantle generally consists of soft, dark brown, organic SILT or forest duff with the exception of the flat open area between approximate stations 75 to 88, where the top soil is black and highly organic. The forest duff and highly organic silt generally varies from 0.5 to 1.8 feet in thickness. However, local

pockets of soft, brown to reddish brown, organic silt was encountered to depths up to 2.5 feet. The maximum thickness of 2.5 feet was encountered in TP-41.

Generally, between approximate stationing 55 to 75 and 88 to 99, below the top soil mantle to a depth of 10 to 15 feet below the present ground surface, erratic layers and lenses of silty fine sand to silty clay were encountered with some local pockets of sand and gravel. The silty fine sand was generally loose to medium dense. The clay and silt were soft to stiff. The natural water content of these soils was wet of optimum at the time of our field exploration.

In the open flat area between approximate stationing 75 to 88, the subsurface soil conditions were less erratic and can be generalized into the following soil layers.

(1) Soft, dark brown, highly organic silt (top soil) ranging from 1.0 to 1.5 feet in thickness
(2) Stiff, light gray, silty clay to a depth of 4.0 to 8.0 feet below the present ground surface
(3) Medium dense, gray, silty to clean, fine sand, ranging from about 2 to 4 feet in thickness and generally extending to a depth of 6.5 to 8.5 feet below the present ground surface
(4) Stiff, blue gray, slightly plastic silt, generally below a depth of 7.0 to 8.5 feet and extending throughout the depth of the test pits and borings.

The natural water content of these soils was also wet of optimum at the time of our field exploration.

The groundwater levels measured in the borings and test pits at the time of our field explorations were below the proposed alignment of both roadways with the exception of the water level recorded in test pit TP-32 which was 1.0 feet above grade. The measured water levels ranged from about 1.0 to 5.0 feet above the proposed open channel from approximate stationing 55 to 75 and

from about 3.5 to 7.0 feet from stationing 90 to 99. In addition, several local areas along the alignments contain ponded water as noted on the roadway profiles, Figs. 24 to 28. The largest of these areas is the flat open field between approximate stationing 75 to 88.

2. Construction Recommendations

The near surface soils along the route of Road "A", at the time of our test pit exploration on February 26, 1970, were very wet and soft creating a nearly non-trafficable condition. In addition, ponded water existed in several locations along the proposed alignment indicating poor drainage conditions. Further, the subsurface exploration and laboratory test results indicate that the underlying soils, which are generally fine-grained, were well above their optimum water content at the time of our field explorations. Thus, the on-site soils would be difficult to work and will require drying. Based on these conditions, we recommend that construction of Road "A" be accomplished only during dry weather, preferably during the summer months of June to mid-October, in order to improve equipment mobility and to properly place structural fill. We also recommend that areas containing ponded water be drained by local ditching as soon as practical in order to dry the area as much as possible before construction commences.

Stripping and Subgrade Preparation. In order to prepare a suitable surface on which to construct the pavement and place structural fill, stripping of the upper loose and organic material is necessary. Removal of all forest duff, organic top soil, soft and/or contaminated material, such as that mixed with organics during clearing operations, is recommended. In local areas containing deep tree roots and other organics, this depth may be as much as 3 feet or more below the existing ground surface.

The subgrade materials below stripped surfaces and in cut areas should be prepared in such a manner to provide a firm non-yielding working surface upon which to place the asphalt pavement section. Two possible methods to provide such a working surface

are (1) improve the subgrade soils by prerolling or (2) place a layer of select granular fill material over the subgrade soils following stripping operations.

1.) Improved Subgrade. To improve the in situ soils in order to provide a firm, unyielding subgrade to place the asphaltic pavement section, the stripped surface should be prerolled with a heavy rubber-tired roller or other suitable compaction equipment and the top 6 inches compacted to 95 percent of modified AASHO maximum dry density (AASHO T-180). Because of the wet conditions at the site and the high natural water content of the soils at the time of our field exploration, it is our opinion, that the in situ soils would be wet of optimum at the time of construction, even during the summer months. Thus, in our opinion, the silty and clayey in situ soils should be scarified and allowed to dry to optimum water content prior to prerolling. Because of the anticipated shaded conditions along most of the road alignment due to the surrounding trees, it is difficult to predict the amount of time it may take to dry the soils to their optimum water content. This drying period may be a week or even more under the most favorable weather conditions. During this period the loosened soils should be re-scarified periodically to accelerate drying. As an alternative to the natural drying process, it may be possible, to accelerate the drying by applying chemical agents such as lime to the west soils. If such chemicals are used to speed the drying time, we recommend that a test section be established first to determine the feasibility of such methods.

During compaction of the dried scarified soils, water may be "pumped" up from the underlying wet soils. If this condition occurs, the materials may become soft and spongy during prerolling and drying would again be necessary. Therefore, it is recommended that a test section be established at an early stage to determine the most feasible method and equipment to accomplish the work. Vibratory rollers should not, in our opinion, be used to compact the fine-grained site materials.

2.) Select Granular Subgrade. An alternate to prerolling the in situ soils is to place a layer of select granular fill material over the stripped or cut surface. We recommend that this layer be placed in three lifts of 12, 6 and 6 inches for a total thickness of 24 inches. We also recommend that excavation for stripping and in cut areas be accomplished in such a manner that the underlying in situ soils will be as undisturbed as possible. The excavated surface should then be allowed to dry. The select granular material should contain less than 5 percent fines (materials finer than the No. 200 mesh sieve) by weight, based on 1-inch minus fraction of the material. The fines should be non-plastic and the maximum gravel size should not exceed 3 inches. Compaction should be accomplished in such a manner that the underlying materials would not be disturbed and softened. Thus, it is recommended that the best compaction procedure be established in the field. In our opinion, the first 12-inch layer should receive four coverages of the treads of a small dozer, rubber-tired roller or other suitable equipment. The subsequent two 6-inch layers should be compacted to 90 and 95 percent of the modified AASHO maximum dry density, respectively.

Structural Fill. Generally, materials containing more than 5 percent fines cannot be compacted to a non-yielding surface and achieve a density equal to the recommended compaction when the water content is greater than the optimum. Thus, wet soils would require drying. The time required for drying is greater for materials with greater amount of fines. Where fines are plastic, even the material with less than 5 percent fines could become spongy and difficult to achieve the recommended density. Thus, on-site materials which could be used as structural fill for the embankment section are placed into three categories based on the amount of fines present, as follows:

(1) select granular materials containing less than 5 percent fines,

(2) moisture sensitive materials containing from 5 to 12 percent fines and

(3) highly moisture sensitive materials containing from 12 to 50 percent fines.

Materials containing greater than 50 percent fines such as silts and clays and organic soils should be wasted and not used as structural fill. The on-site materials generally containing greater than 5 percent fines are considered moisture sensitive. The select granular materials that are present at the site are contained in local pockets and selective excavation of these materials would be difficult to achieve, in our opinion. The moisture sensitive materials may be used as structural fill provided their water content is at optimum at the time of placement. In our opinion, these soils will be above optimum water content when excavated, even during the dry summer months, and thus drying would be required. Drying can best be accomplished by spreading the materials in thin lifts and reworking them periodically by discing. Time requirements and economics may prove drying of on-site materials impractical. If such is the case, imported borrow material should be used. If imported material is necessary, we recommend that an investigation of available borrow sources be made to determine the quality and quantity of such sources.

Embankments should be placed in maximum 8-inch thick, loose lifts and compacted to 90 percent of modified AASHO (T-180) maximum dry density. The top 6-inches should be compacted to 95 percent. The top 12-inches of the embankment section should consist of select granular material on which the asphalt treated base could be placed. An experienced soils engineer or technician should be present during construction to monitor the fill placement and periodically take field density tests on the compacted fill to assure that it has been properly placed.

Pavement Design. Pavement design for the two roadways will be dependent upon the bearing value of the subgrade materials. If the improved subgrade is constructed by prerolling the top 6 inches of in situ soils to a dry density of 95 percent of the modified AASHO maximum density, we recommend that a CBR value of

5 be used for pavement design. This value is selected from laboratory CBR test results (Fig. A-135) assuming the subgrade would be prepared to meet the preceeding compaction recommendations on in situ and fill materials. That is, the recommended CBR value corresponds to the value when the material is compacted at optimum water content to a dry density equal to 95 percent of the maximum as shown on Fig. A-135.

If the 24-inch select granular layer is placed and compacted as previously recommended, the pavement section should be designed on the basis of an in situ CBR value of the soils directly below the granular layer. We recommend that a CBR value of 2 be used for this design.

Presented below for comparison, are two typical pavement sections using the two recommended subgrades and CBR values.

Improved Subgrade		Select Granular Subgrade	
Thickness	Material	Thickness	Material
3"	asphaltic concrete	3"	asphaltic concrete
3"	asphalt treated base	4"	asphalt treated base
3"	5/8" minus crushed rock or gravel		
6"	1-1/4" minus crushed surfacing base coarse (Section 23, APWA)	24"	select granular subgrade

The pavement design for these two typical sections are based on design criteria from the Asphalt Institute manual series No. 1 (MS-1) "Thickness Design", using a traffic index number of 500.

The asphalt treated base may be placed on top of the 24-inch select granular base. The 3-inch layer of 5/8 inch minus crushed rock or gravel should be compacted with at least six

complete coverages of a vibrating plate compactor or a 10-ton steel wheel roller. In addition, the crushed rock should be moist when compacted to prevent the fines from shifting to the bottom of the layer.

Drainage Provisions. The large open channel north of roadway "AN" will provide drainage of the surface waters and intercept the flow of near surface groundwater north of that roadway. In addition, it is our understanding that longitudinal subdrains are to be provided beneath the south shoulder of roadway "AN" and the north and south shoulders of roadway "AS", and transverse subdrains are to be provided at transition zones between cut and fill areas where groundwater seepage is encountered.

We recommend that longitudinal subdrains be installed along the roadway cut or shallow fill sections. The subdrains should be located a minimum depth of 3.5 feet below the asphalt treated base, in order to provide an adequate drawdown beneath the pavement section. The exact location of the subdrains, in particular the transverse subdrains, should be determined in the field after the excavations have been completed. In addition, it is desirable to design subsurface drains with liberal water-removing capacities to allow for adverse conditions that may not have been discovered during the subsurface investigation or be encountered during construction. The subdrains could consist of perforated or open-joint pipe. The perforations should be placed up and the lower half of the open joints should be sealed with cement mortar. A 6-inch layer of 1/4-inch to 3/4-inch washed gravel should be placed over the perforations or open joints. The trench should be backfilled with a clean granular material conforming with "Gravel Backfill for Drains" Section 9-03.12(4) of the State of Washington, Standard Specifications for Road and Bridge Construction, 1969. The gravel backfill should be connected hydraulically to the 3-inch layer of 5/8-inch minus crushed rock in order to provide drainage beneath the asphalt treated base.

It is our understanding that open ditches are not planned along the roadways in the cut sections. Therefore, it is recom-

mended that paved shoulders and gutters be used to collect storm water into a system of catch basins and tight drains. Alternatively, the subdrains could be designed not only to collect the groundwater but also the stormwater collected in the catch basins. If subdrains are used for stormwater drainage they should be designed to flow half full at peak runoff to prevent recharging of the surrounding soils and plugging of perforations or open joints with fine grained soils and debris carried by the stormwater. Surface water should not be allowed to enter the subdrainage system by means other than direct connection from catch basins. Surface water often contains soil particles in suspension, which tend to deposit as the water percolates through the granular material of the subdrain, causing it to "silt up".

Because of the wet conditions which are expected to be encountered during construction operations, we recommend that the longitudinal subdrains and the open channel be constructed prior to making the final excavation of the deeper cut areas. The in-place drains and open channel will provide drainage of the more permeable in situ soils and serve to intercept additional seepage that may flow into the excavations, thus improving equipment mobility during construction.

Trenching in soils such as those encountered in the field explorations along the alignment could be accomplished by open cut methods provided the sides are sloped back sufficiently to establish stability and protect workmen. We recommend that sloping be made the responsibility of the contractor who is continuously present at the job site to observe the nature and occurrence of subsurface conditions encountered, including groundwater. Regardless of the construction methods used, all trenching should be accomplished in compliance with the applicable provisions of the "Safety Standards for Construction Work", State of Washington, Department of Labor and Industries, Division of Safety.

All trenching and the excavation of the open channel should be carried out during the dry season. We recommend that

excavation of the subdrain trenches and the open channel commence from the low end of the invert and progress uphill. This would enable the in-place line or channel to drain the trench excavation. In addition, local sumps may be required to control seepage or runoff not carried away by the in place line. Drainage as such should be provided in order to prevent the bottom of the excavation from becoming soft and spongy.

In our opinion the design slopes of 1V on 2H and 1V on 3H for the open drainage channel would remain stable above the groundwater level. However, where seepage or water inflow is present undermining of the slopes may occur and thus requiring flatter side slopes. Alternatively, a minimum 12-inch thick blanket of free draining clean sand and gravel could be placed on the sides and bottom of the channel from about 18 inches above the water inflow level to serve as a filter and prevent undermining of the side slopes.

GEORGE YAMANE
STATE OF WASHINGTON
REGISTERED
PROFESSIONAL ENGINEER

EARL A. SIBLEY
STATE OF WASHINGTON
REGISTERED
PROFESSIONAL ENGINEER

SHANNON & WILSON, INC.

By George Yamane
George Yamane, P.E.

By Earl A. Sibley
Earl A. Sibley, P.E.

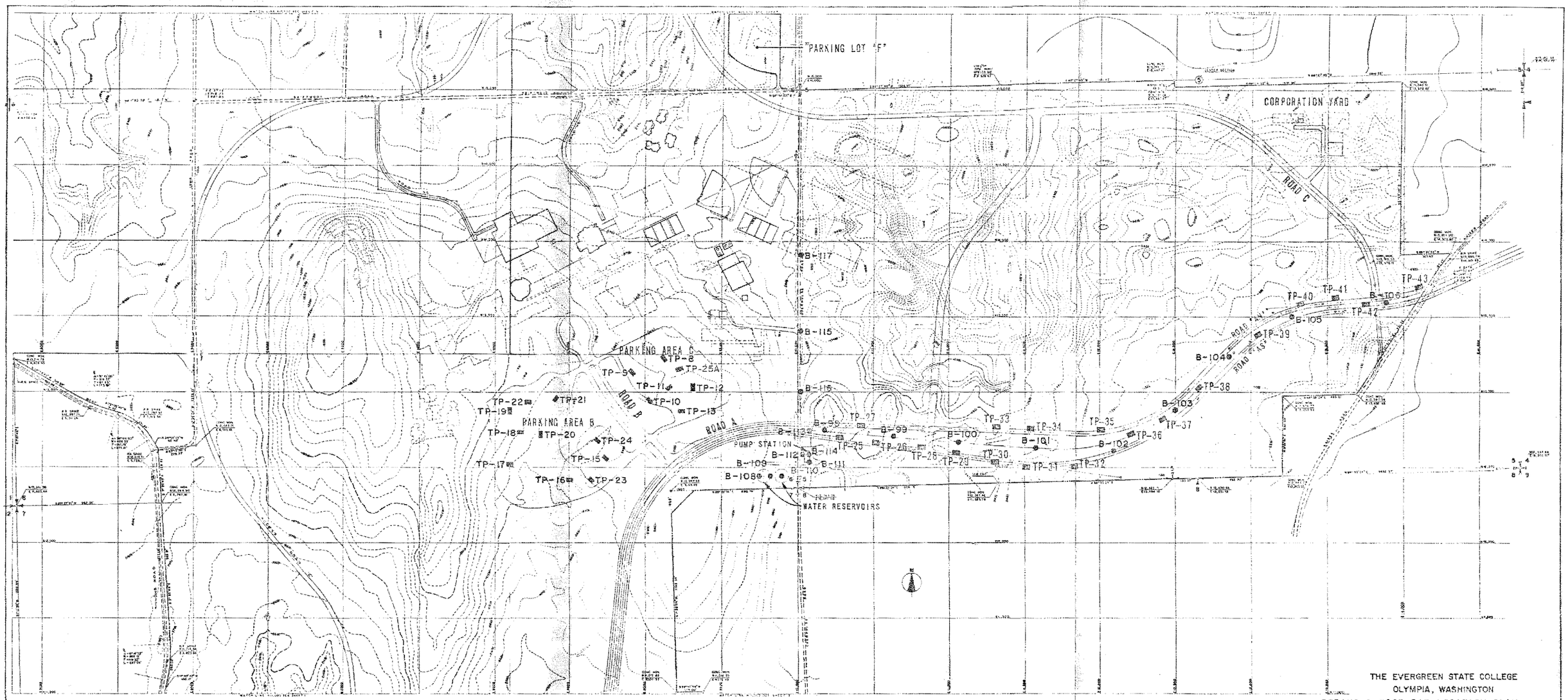
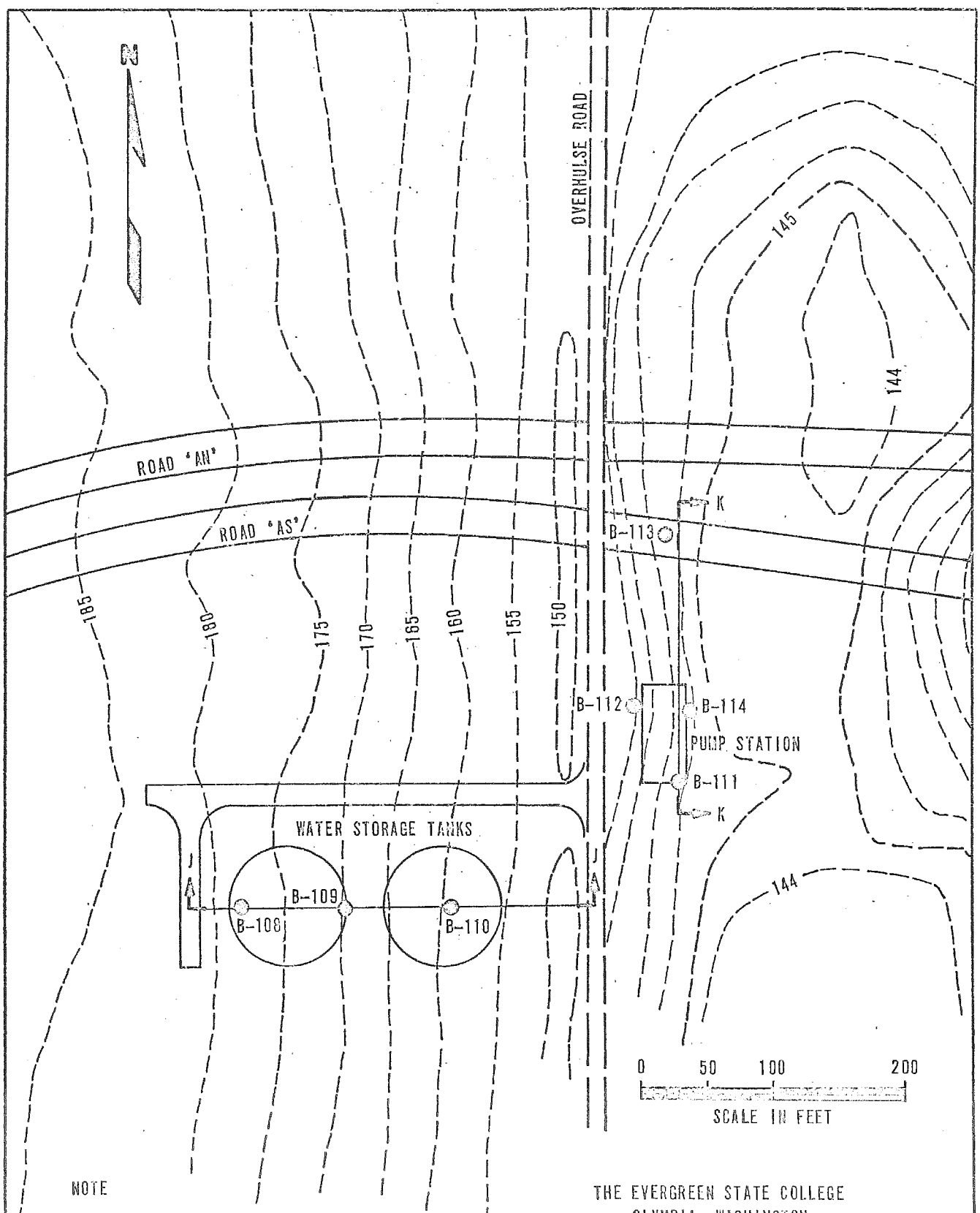

PARKING LOT "F"
CORPORATION YARD
ROAD C
ROAD A
ROAD B
ROAD D
ROAD E
PARKING AREA C
PARKING AREA B
PUMP STATION
WATER RESERVOIRS
B-117
B-115
B-105
B-104
B-103
B-102
B-101
B-100
B-99
B-98
B-113
B-112
B-114
B-111
B-110
B-109
B-108
TP-2
TP-25A
TP-9
TP-11
TP-12
TP-10
TP-13
TP-22
TP-21
TP-19
TP-18
TP-20
TP-24
TP-15
TP-17
TP-16
TP-23
TP-27
TP-25
TP-26
TP-28
TP-29
TP-30
TP-31
TP-32
TP-33
TP-34
TP-35
TP-36
TP-37
TP-38
TP-39
TP-40
TP-41
TP-42
TP-43
0 200 400 600 800 1000
SCALE IN FEET
LEGEND
B-20 Location of boring (and number)
TP-40 Location of test pit (and number)
NOTE
Drawing based on Quinton - Sudlong Inc. drawing titled "Site Plan, Roads and Utilities, The Evergreen State College, Olympia, Washington" dated November 3, 1969.
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON
BORING & TEST PIT LOCATION PLAN
ROADS, PARKING AREAS & ANCILLARY STRUCTURES
MARCH 27, 1970
W-1509-4
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 19



NOTE

Drawing based on Quinton-Budlong Inc. drawing titled "Additional Clearing & Grading Sheet No. 2, The Evergreen State College, Olympia, Washington", dated 10/23/69.

LEGEND

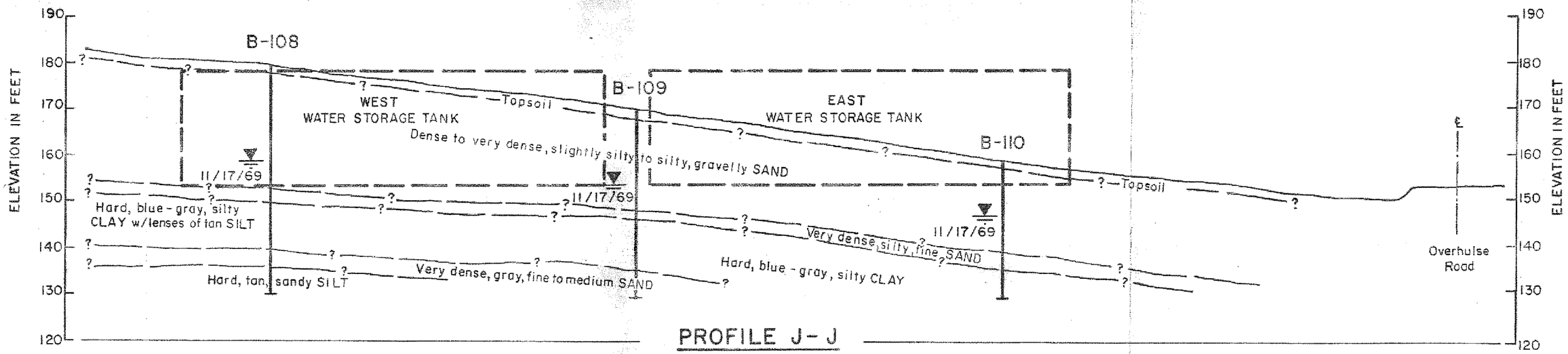
B-108 ○ Location of boring (and number).

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

BORING AND SUBSURFACE PROFILE LOCATION
WATER STORAGE TANKS AND PUMP STATION

MARCH 27, 1970 W-1509-4

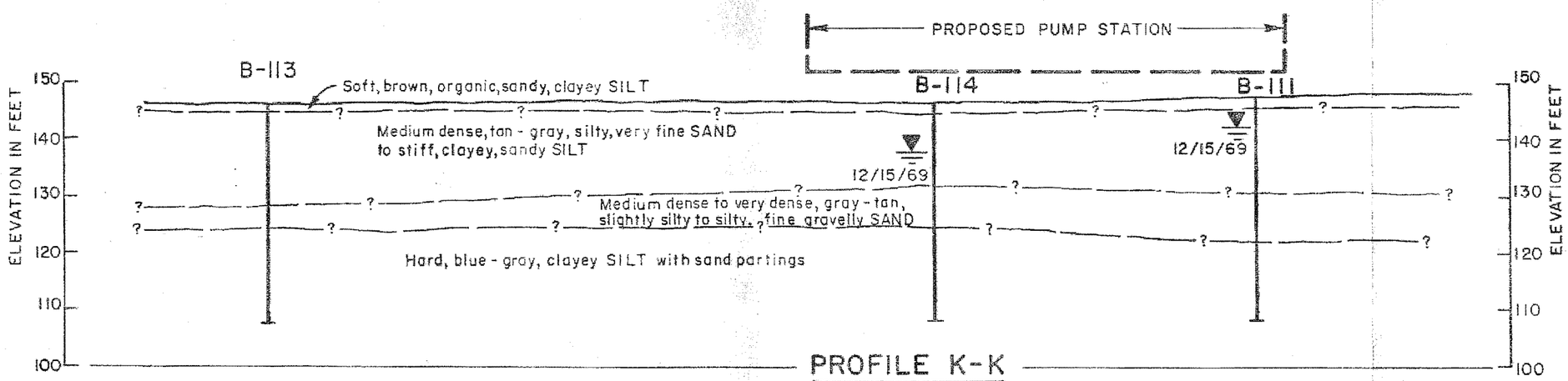
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS



PROFILE J-J

WATER STORAGE TANK

LOOKING NORTH



PROFILE K-K

PUMP STATION

LOOKING EAST

SCALE IN FEET

0 20 40 60 80 100

NOTES:

1) These profiles are generalized from materials encountered in the borings and variations between the profiles and actual conditions may exist.

2) Ground surface elevations were obtained from drawing titled "Pump Station & Reservoir, The Evergreen State College, Olympia, Washington", prepared by Quinton-Budlong Inc., undated.

LEGEND:

Water level

11/17/69 Date measured

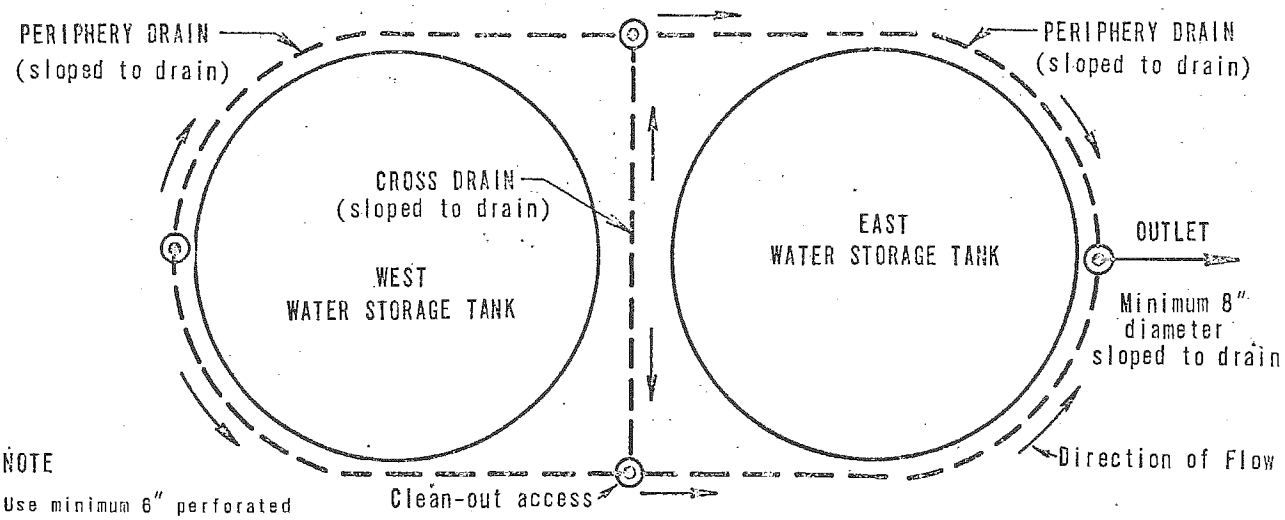
WATER STORAGE TANKS AND PUMP STATION
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

SUBSURFACE PROFILES
J-J & K-K

FEBRUARY 2, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

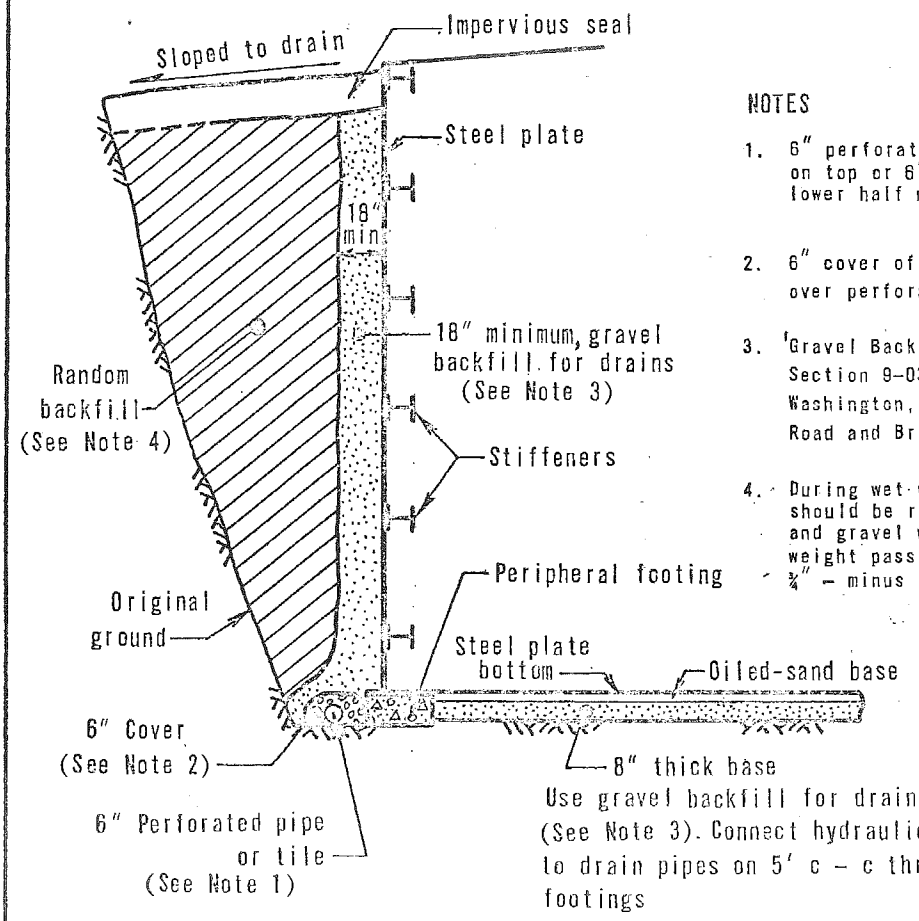
FIG 21



NOTE

Use minimum 6" perforated metal pipe or open joint tiles for periphery and cross drains.

PLAN VIEW



NOTES

1. 6" perforated metal pipe with perforation on top or 6" tiles laid open joint with lower half mortared, sloped to drain.

2. 6" cover of ¼" to ¾" washed gravel placed over perforations or open joints.

3. 'Gravel Backfill for Drains' to conform with Section 9-03.12 (4) of the State of Washington, Standard Specifications for Road and Bridge Construction, 1969.

4. During wet weather, random backfill should be reasonably well-graded sand and gravel with not more than 5% by weight passing No 200 sieve. (Based on ¾" – minus fraction.)

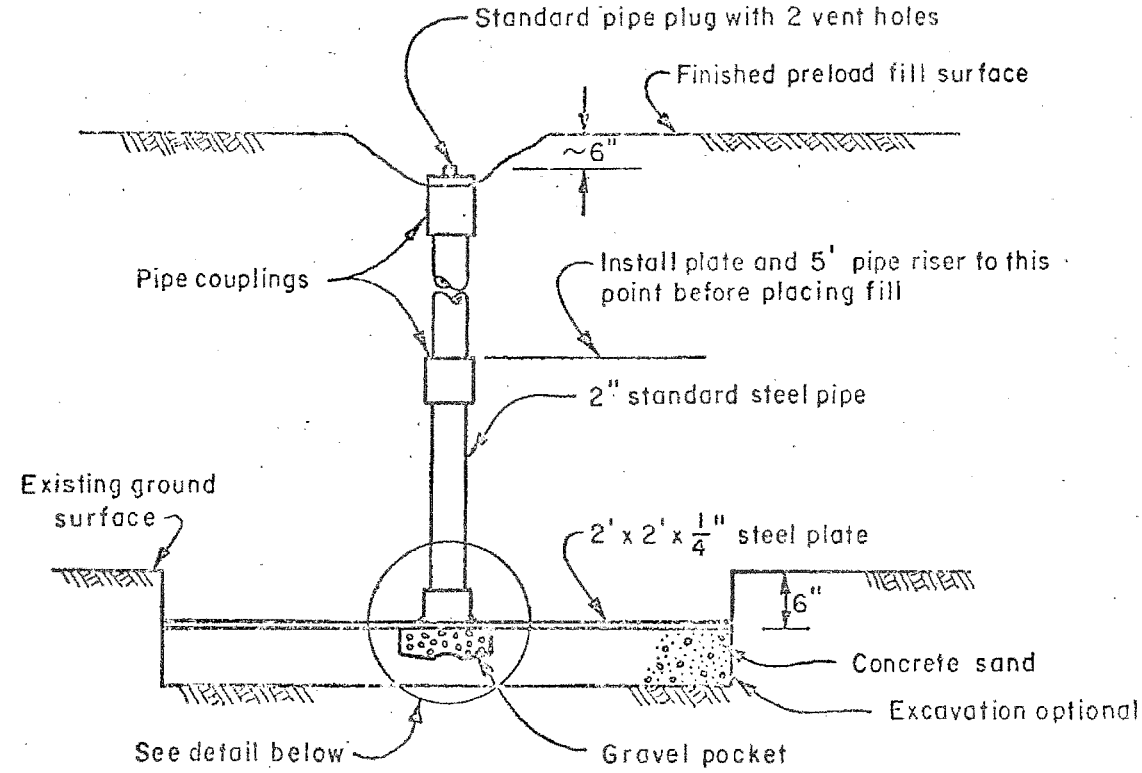
TYPICAL SECTION

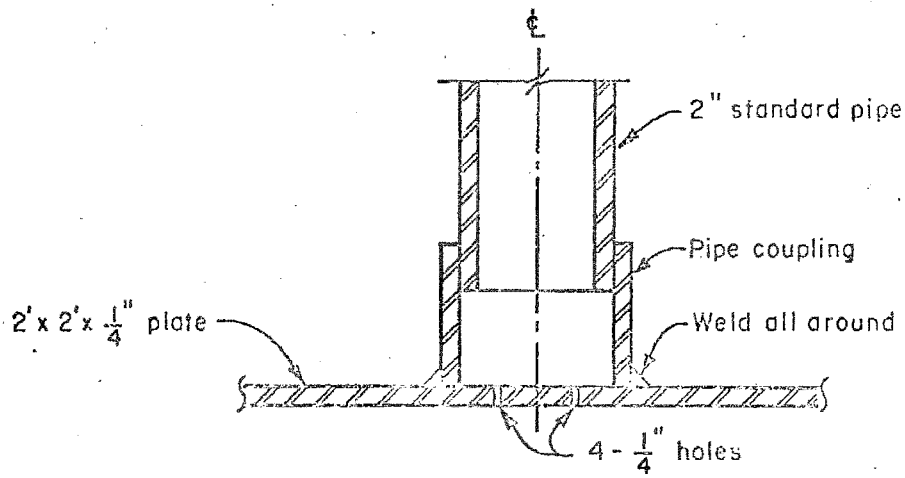
WATER STORAGE TANKS
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

DRAINAGE AND BACKFILL DETAIL

FEBRUARY 2, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS





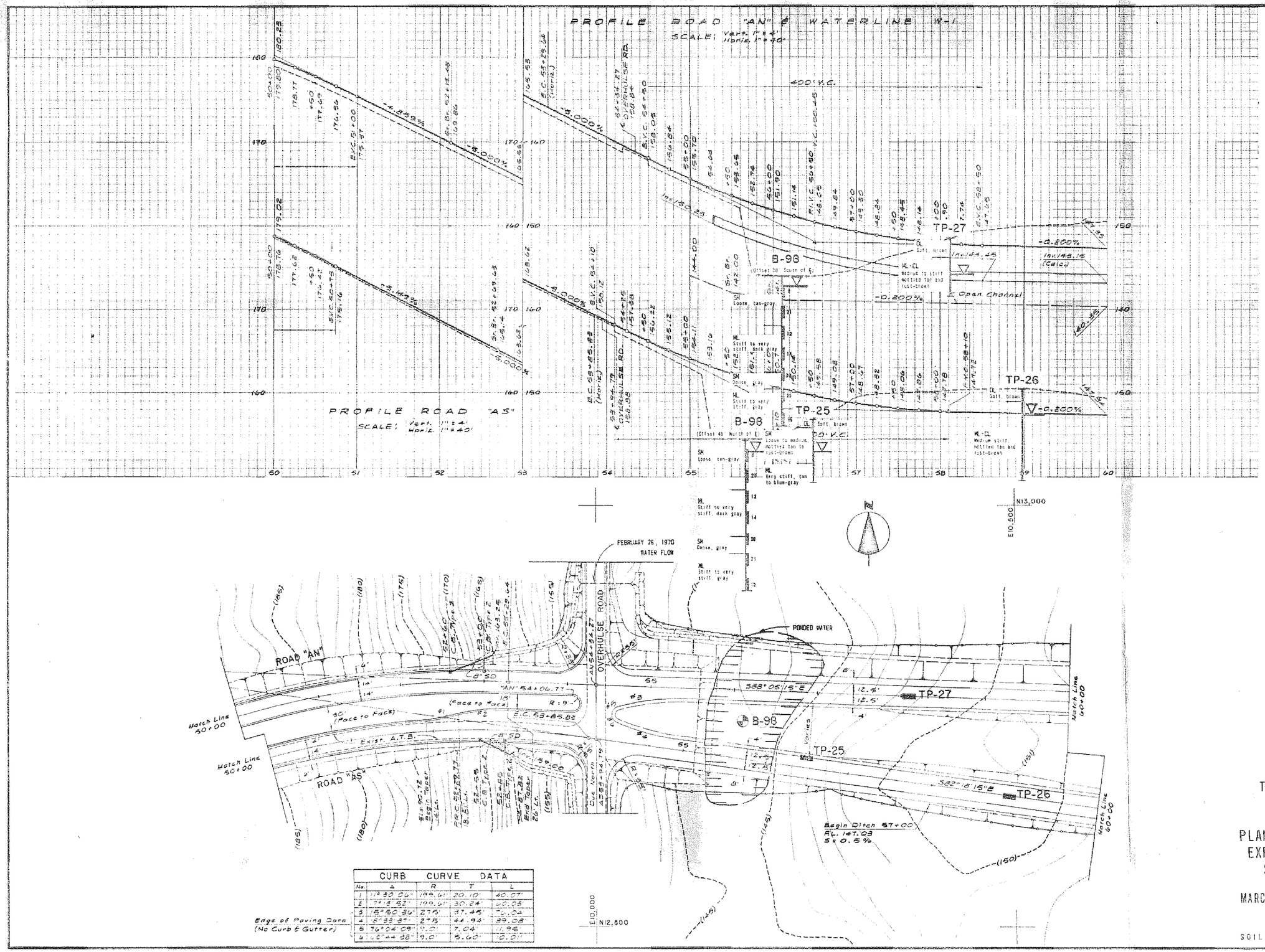
PUMP STATION
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

RECOMMENDED SETTLEMENT PLATE DETAILS

MARCH 27, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG 23



CURB CURVE DATA				
No.	Δ	R	T	L
1	11°30'06"	199.61'	20.10'	40.07'
2	79°18'52"	199.61'	30.24'	60.05
3	159°50'30"	275'	37.45'	76.04
4	8°33'37"	275'	44.94'	89.08
5	76°06'09"	9.0'	7.04	11.95
6	63°24'36"	9.0'	5.60'	10.01'

Edge of Paving Data (No Curb & Gutter)

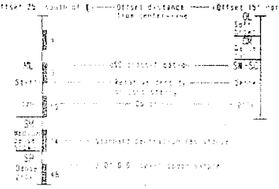
LEGEND

B-102 — Location of boring and number

TP-30 — Location of test pit and number

B-102 — Boring or test pit number — TP-30

(Offset 75' South of ℄) — Offset distance — (Offset 15' North of ℄)
(Top centerline)



UNIFIED SOIL CLASSIFICATION - USCS
(Group symbols and typical names)

GROUP SYMBOL	TYPICAL NAME
GW	Well graded gravels, gravel-sand mixtures little or no fines
GP	Poorly graded gravels, gravel-sand mixtures little or no fines
GM	Silty gravels, poorly graded gravel-sand-silt mixtures
GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
SW	Well graded sands, gravelly sands little or no fines
SP	Poorly graded sands, gravelly sands little or no fines
SM	Silty sands, poorly graded sand-silt mixtures
SC	Clayey sands, poorly graded sand-clay mixtures
ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silt-clays of low plasticity

Boundary classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC well graded gravel-sand mixture with clay binder.

0 5 10 15
VERTICAL SCALE IN FEET

0 50 100 150
HORIZONTAL SCALE IN FEET

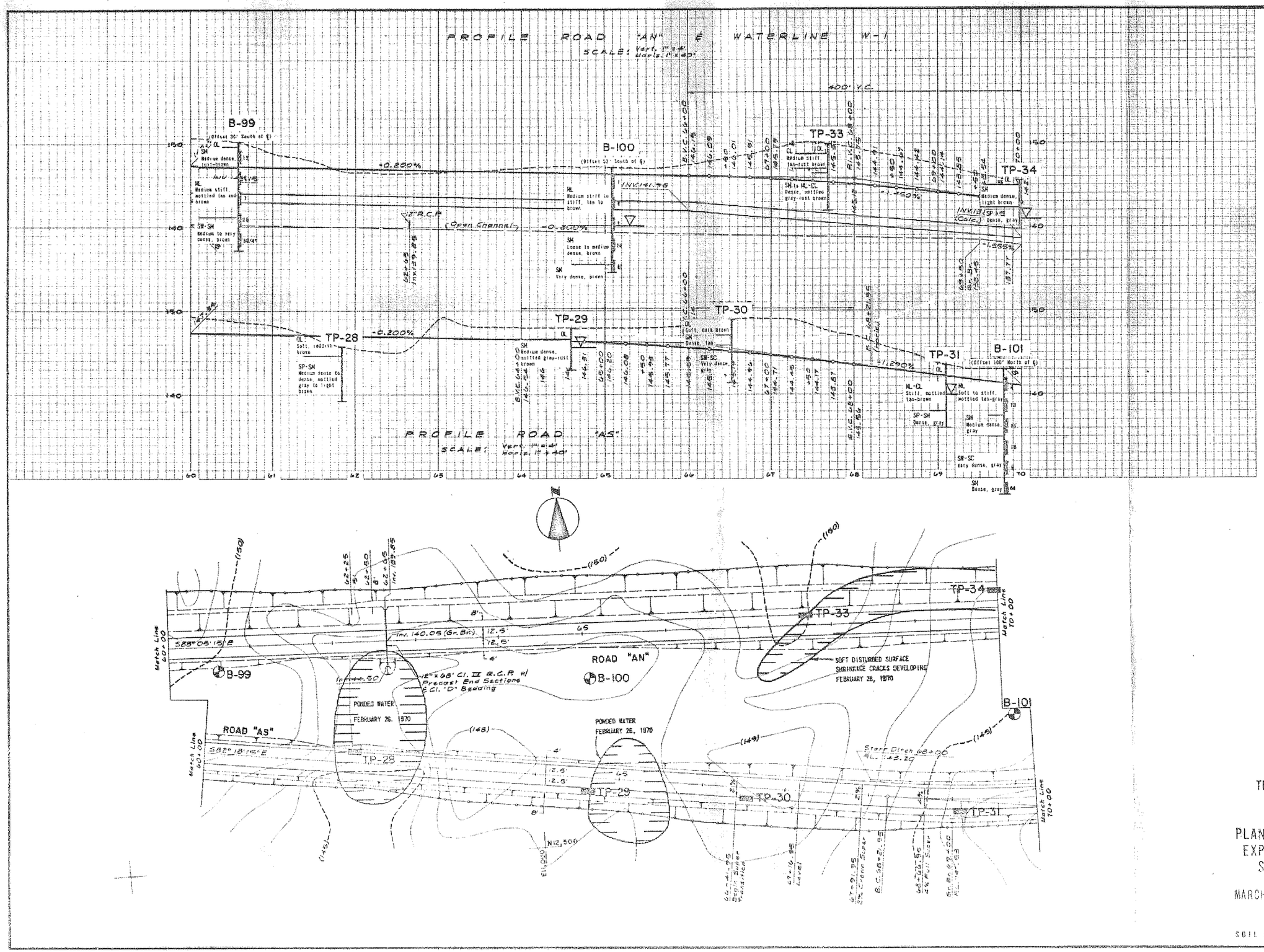
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

PLAN, PROFILE AND SUBSURFACE EXPLORATION DATA, ROAD 'A' STATION 50+00 TO 60+00

MARCH 27, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 24



LEGEND

B-102 — Location of boring (and number)

TP-30 — Location of test pit (and number)

B-102 — Boring or Test Pit number — TP-30

(Offset 25' South of ℄) — Offset distance from centerline — (Offset 15' North of ℄)

NL — USC classification — SM-SC

Stiff — Relative density or consistency — Dense

Tan — Color — Gray

SC Medium dense Gray — 14 — Standard penetration resistance

SP Dense Gray — 46 — 2.0" O.D. split spoon sample

UNIFIED SOIL CLASSIFICATION (USC)
(Group symbols and typical names)

GROUP SYMBOL	TYPICAL NAME
GW	Well graded gravels, gravel-sand mixtures little or no fines
GP	Poorly graded gravels, gravel-sand mixtures little or no fines
GM	Silty gravels, poorly graded gravel-sand-silt mixtures
GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
SW	Well graded sands, gravelly sands, little or no fines
SP	Poorly graded sands, gravelly sands, little or no fines
SM	Silty sands, poorly graded sand-silt mixtures
SC	Clayey sands, poorly graded sand-clay mixtures
ML	Inorganic silts and very fine sands, rock flour, silts or clayey fine sands with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silt-clays of low plasticity

Boundary classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC well graded gravel-sand mixture with clay binder.

0 5 10 15
VERTICAL SCALE IN FEET

0 50 100 150
HORIZONTAL SCALE IN FEET

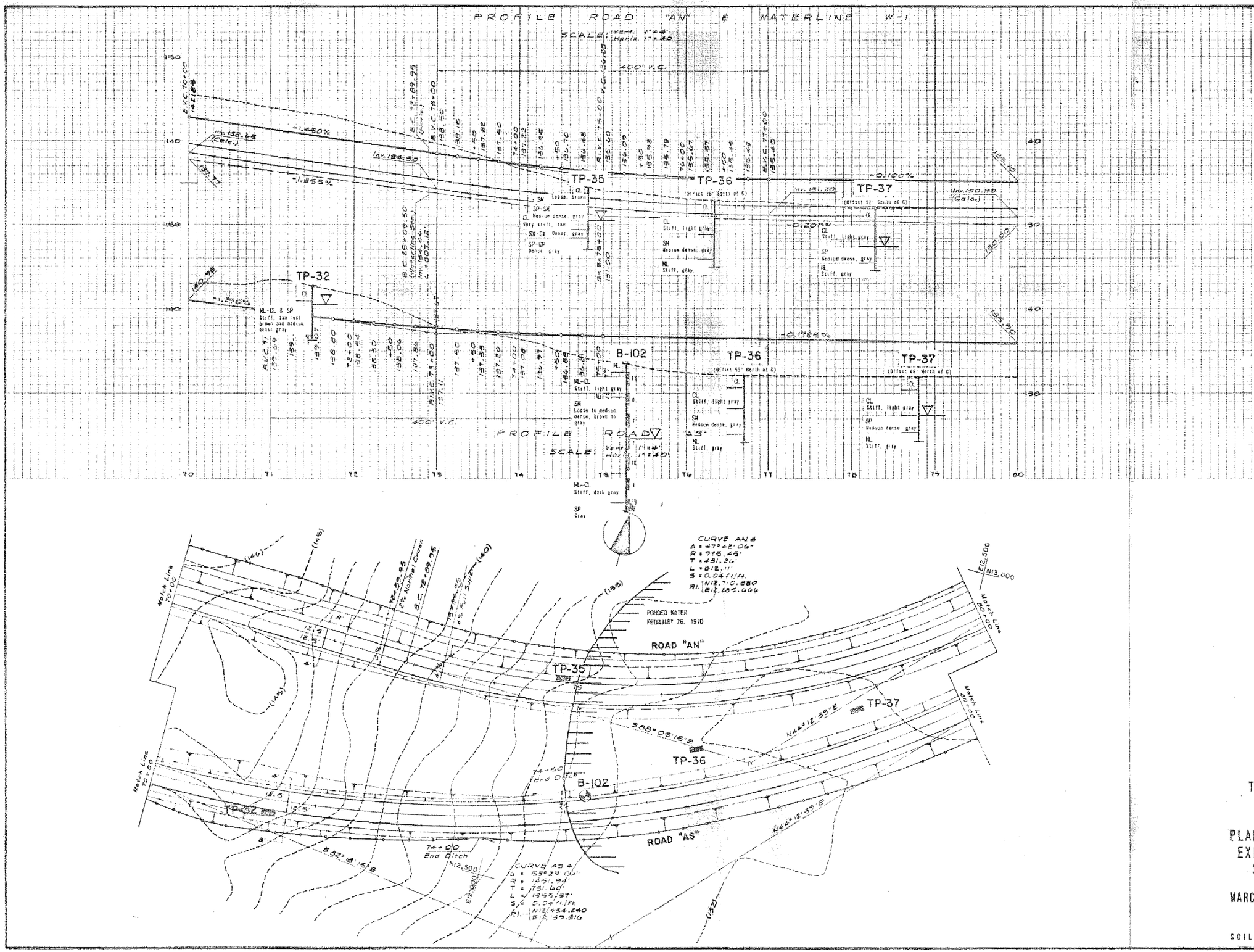
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

PLAN, PROFILE AND SUBSURFACE EXPLORATION DATA, ROAD 'A' STATION 60+00 TO 70+00

MARCH 27, 1970 W-1599-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 25



LEGEND

B-102 — Location of boring (and number)

TP-30 — Location of test pit (and number)

B-102 — Boring or Test Pit number — TP-30

(Offset 75' South of ℄) — Offset distance from center-line — (Offset 85' North of ℄)

Soft — Stiff — Very stiff — Medium dense — Dense — Very dense — Loose — Medium dense — Dense

Consistency or relative density

Medium stiff — Stiff — Very stiff — Medium dense — Dense — Very dense

Consistency or relative density

SM — Color — (Gray)

18 — Standard penetration resistance

18 — 2.0" O.D. split spoon sample

UNIFIED SOIL CLASSIFICATION USED:
(Group symbols and typical names)

GROUP SYMBOL	TYPICAL NAME
GW	Well graded gravels, gravel-sand mixtures little or no fines
GP	Poorly graded gravels, gravel-sand mixtures little or no fines
GM	Silty gravels, poorly graded gravel-sand-clay mixtures
GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
SW	Well graded sands, gravelly sands, little or no fines
SP	Poorly graded sands, gravelly sands little or no fines
SM	Silty sands, poorly graded sand-silt mixtures
SC	Clayey sands, poorly graded sand-clay mixtures
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silty clays of low plasticity

Boundary classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well graded gravel-sand mixture with clay binder.

0 5 10 15
VERTICAL SCALE IN FEET

0 50 100 150
HORIZONTAL SCALE IN FEET

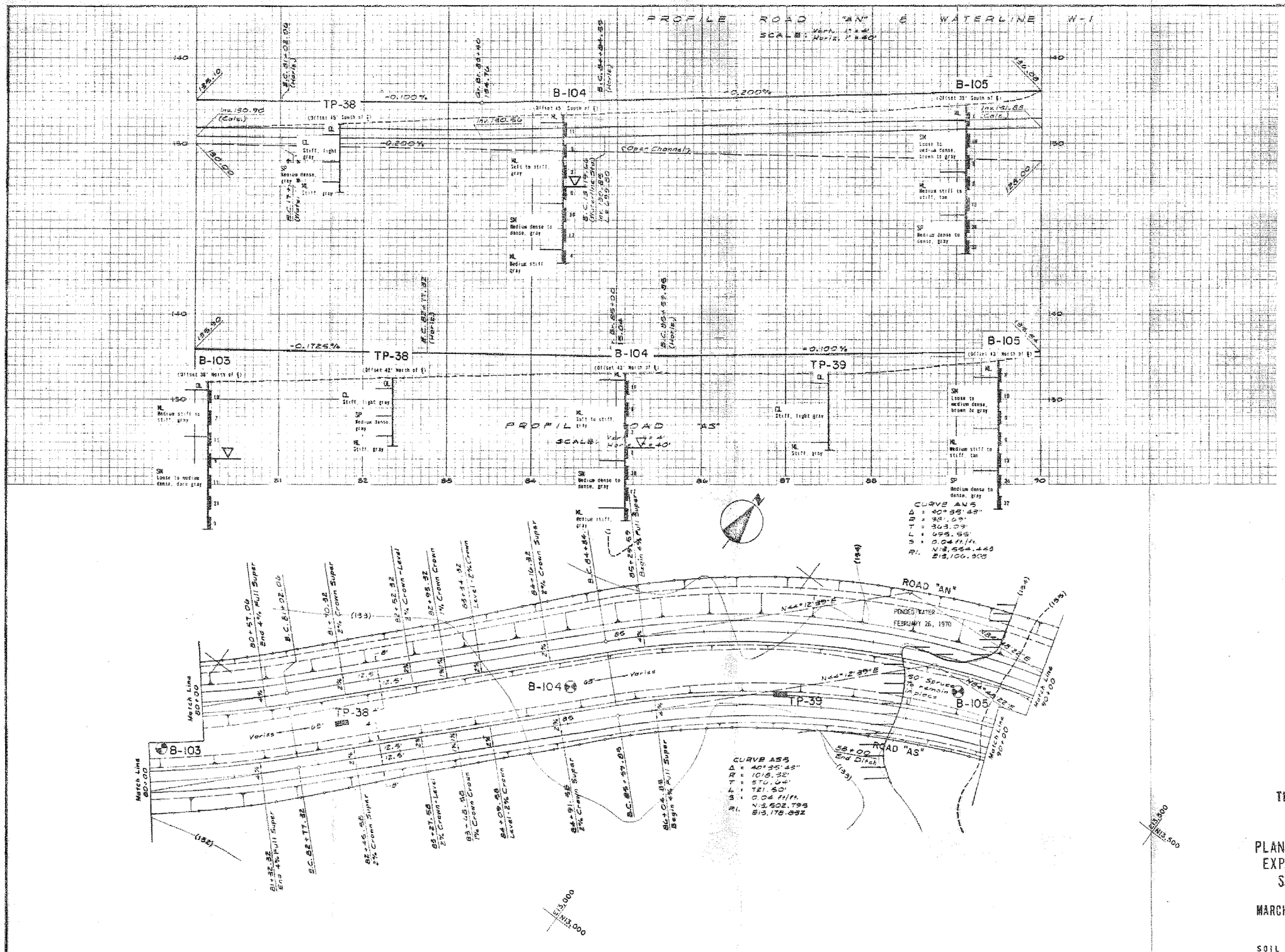
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

PLAN, PROFILE AND SUBSURFACE EXPLORATION DATA, ROAD 'A' STATION 70+00 TO 80+00

MARCH 27, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 26



LEGEND

B-102 — Location of boring and number

TP-30 — Location of test pit and number

B-102 — Boring or Test Pit Number — TP-30

Offset 25' South of ℄ — Offset distance from centerline — Offset 15' North of ℄

USC classification

Relative density or consistency

Color

Standard penetration resistance

2.0" O.D. sphere sample

UNIFIED SOIL CLASSIFICATION (USC)
(Group symbols and typical names)

GROUP SYMBOL	TYPICAL NAME
GW	Well graded gravels, gravel-sand mixtures little or no fines
GP	Poorly graded gravels, gravel-sand mixtures little or no fines
GM	Silty gravels, poorly graded gravel-sand-clay mixtures
GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
SW	Well graded sands, gravelly sands, little or no fines
SP	Poorly graded sands, gravelly sands, little or no fines
SM	Silty sands, poorly graded sand-silt mixtures
SC	Clayey sands, poorly graded sand-clay mixtures
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silt-clays of low plasticity

Boundary classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC well graded gravel-sand mixture with clay binder.

0 5 10 15
VERTICAL SCALE IN FEET

0 50 100 150
HORIZONTAL SCALE IN FEET

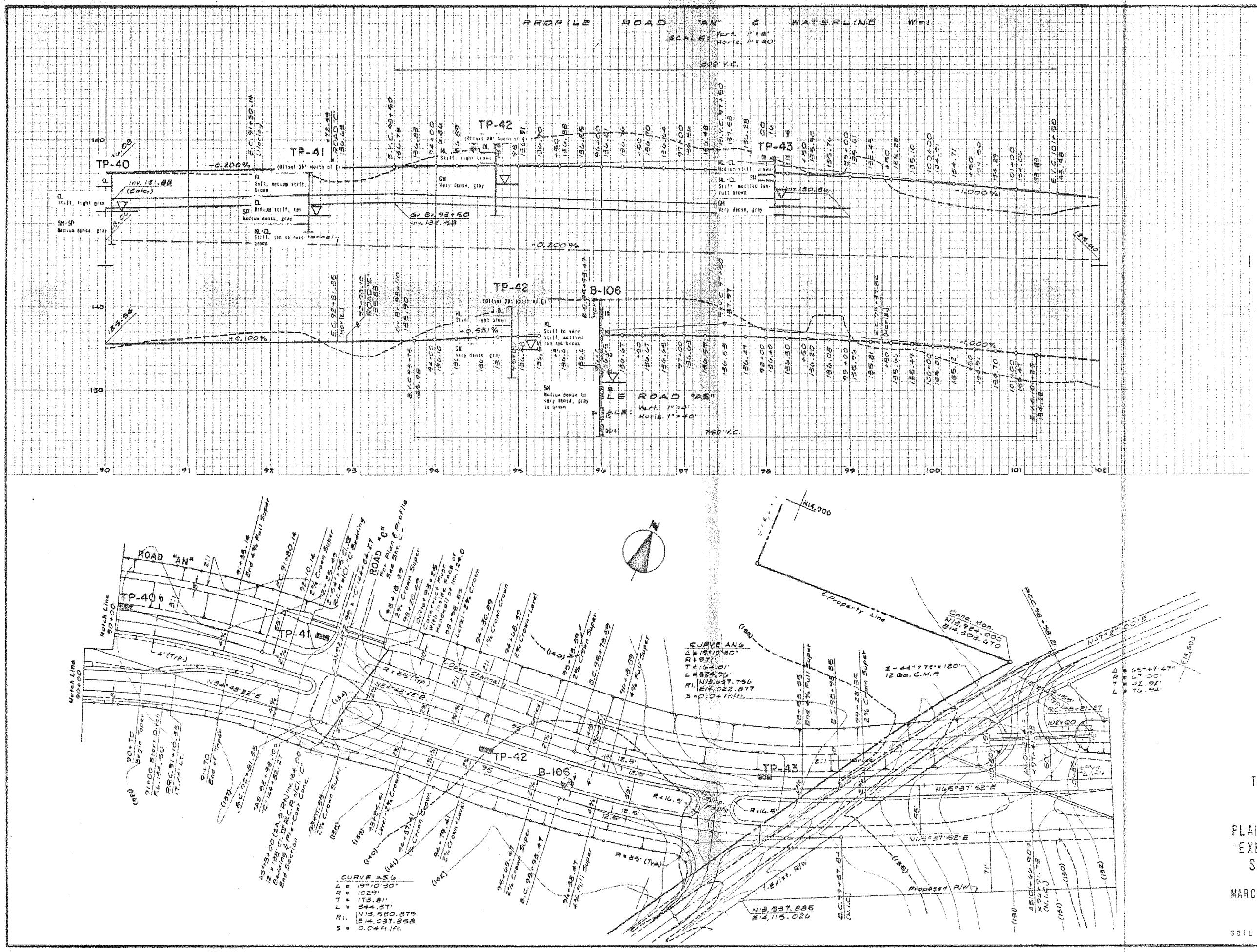
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

PLAN, PROFILE AND SUBSURFACE EXPLORATION DATA, ROAD 'A' STATION 80+00 TO 90+00

MARCH 27, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 27



LEGEND

B-102 — Location of boring (and number)

TP-30 — Location of test pit (and number)

B-102 — Boring or test pit number — TP-30

(Offset 29' south of ℄) — Offset distance — (Offset 15' north of ℄)
from centerline

Surface — Soil classification

Stiff — Relative density or consistency

Tan — Color — Gray

SM — Standard penetration resistance

Gray — 2 6" O.D. split spoon sampler

UNIFIED SOIL CLASSIFICATION (USC)
(Group symbols and typical names)

GROUP SYMBOL	TYPICAL NAME
GW	Well graded gravels, gravel-sand mixtures little or no fines
GP	Poorly graded gravels, gravel sand mixtures little or no fines
GM	Silty gravels, poorly graded gravel-sand-clay mixtures
GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
SW	Well graded sands, gravelly sands, little or no fines
SP	Poorly graded sands, gravelly sands, little or no fines
SM	Silty sands, poorly graded sand-silt mixtures
SC	Clayey sands, poorly graded sand-clay mixtures
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silty clays of low plasticity

Boundary classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example SW-SC well graded gravel-sand mixture with clay binder.

VERTICAL SCALE IN FEET

HORIZONTAL SCALE IN FEET

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

PLAN, PROFILE AND SUBSURFACE EXPLORATION DATA, ROAD 'A' STATION 90+00 TO 102+00

MARCH 27, 1970 W-1599-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. 28

APPENDIX

FIELD EXPLORATIONS

AND

LABORATORY TEST RESULTS

TABLE OF CONTENTS

		Page
A.	INTRODUCTION	A-1
B.	FIELD EXPLORATIONS	A-1
	Borings	A-1
	Groundwater Measurements	A-4
	Test Pits	A-5
	Hand Probes	A-5
C.	LABORATORY TESTS	A-6
	Natural Water Content	A-6
	Grain-size Analyses	A-6
	Atterberg Limit Tests	A-7
	California Bearing Ratio (CBR) Tests	A-7

LIST OF FIGURES

FIG. NO.	
A-1	COMPREHENSIVE SUBSURFACE EXPLORATION PLAN
A-2 - A-3	LOGS OF PHASE I BORINGS (B-1 THRU B-6)
A-4 - A-16	LOGS OF PHASE II BORINGS (B-7 THRU B-25)
A-17 - A-26	LOGS OF BORINGS AT LIBRARY SITE (B-26 THRU B-35)
A-27	LOGS OF BORINGS FOR ROADS AND FILL AREA (B-36 THRU B-42)
A-28 - A-82	LOGS OF BORINGS FOR MAIN BUILDING AREA (B-43 THRU B-97)
A-83 - A-102	LOGS OF BORINGS FOR ROADS AND ANCILLARY STRUCTURES (B-98 THRU B-117)

LIST OF FIGURES
(Continued)

FIG. NO.	
A-103 - A-114	LOGS OF TEST PITS
A-115	PROBE LOCATION PLAN
A-116 - A-130	GRAIN SIZE CLASSIFICATION
A-131 - A-132	PLASTICITY CHART
A-133 - A-135	CBR CURVES

PLATE

PLATE 1 COMPREHENSIVE SUBSURFACE EXPLORATION PLAN

(Located in pocket on back cover)

APPENDIX

FIELD EXPLORATIONS

AND

LABORATORY TEST RESULTS

A. INTRODUCTION

This appendix contains a description of, and the results obtained from the field explorations and the laboratory tests which were performed for this comprehensive foundation investigation at The Evergreen State College, Olympia, Washington. Included in this Appendix are the logs of borings and test pits as well as the laboratory test results obtained from the present investigation, together with those obtained in all previous investigations at the site.

B. FIELD EXPLORATIONS

The field explorations conducted at the site consisted of borings, test pits, hand probes, and groundwater measurements. The combined information obtained from these explorations provides an overall picture of the subsurface conditions at the site. A description of the methods used to accomplish and to interpret these explorations are contained in the following paragraphs.

Borings. A total of 117 borings were made at The Evergreen State College campus between early November, 1968, and mid-December, 1969. The locations of all of these borings are shown on Fig. A-1, Comprehensive Subsurface Exploration, and on Plate 1, which is the same drawing, but at a larger scale. This plate is contained in a pocket inside of the back cover of this report. The locations of these borings, by coordinates, are given in Table A-1 at the end of this text. The basis of the horizontal coordinate system at the campus was established

by Quinton-Budlong, Inc. as the centerline intersection of Overhulse and Driftwood Roads, having a coordinate of N 15,000 and E 10,000; and the north-south section line along Overhulse Road having a campus bearing of due north. A consecutive numbering system for identifying the borings made at the site was adopted early in the investigation of the campus.

Borings B-1 through B-42 were made in conjunction with previous studies at the site. The subsurface explorations in the main building area for the present investigation consisted of 55 additional borings numbered B-43 through B-97, and comprising 2,614.5 lineal feet of drilling. These borings were laid out in a grid system in order to provide maximum coverage of the main building area with fewer borings than would be required if the site was explored on a building-by-building basis. The locations of the borings within the main building area and the grid system are shown in Fig. 2 of the basic report. Twenty-four borings, numbered B-98 through B-117, and comprising 451 lineal feet, were made for the roads and ancillary structures. The locations of these borings are shown on both Fig. A-1, and Plate 1. The logs of the borings are given in Figs. A-2 through A-102.

The drilling of the borings in the main building area and those for the water storage and pumping facilities were subcontracted to Soil Sampling Service of Puyallup, Washington, and their work was continuously monitored by an experienced engineer or geologist from our firm.

A truck-mounted drilling rig with a 3-3/8 inch I.D. hollow-stem, continuous-flight auger was used to advance these borings, which ranged in depth from 37.5 feet to 67.5 feet. The average depth of the borings was on the order of 48 feet. Disturbed 2-inch O.D. split-spoon samples, and relatively undisturbed 3-inch O.D. thin-wall steel tube samples of the subsoils were obtained from the undisturbed soils beneath the lower end of

the advancing auger. Standard Penetration Tests were performed in conjunction with the split-spoon sampling. This test consists of driving the standard split-spoon sampler into the soil with a 140-pound hammer falling 30 inches. The number of blows required to produce 1 foot of penetration is defined as the Standard Penetration Resistance, N, and provides a measure of the compactness or relative density of granular soils, or the consistency of cohesive soils. The Standard Penetration values (blows per foot) are plotted on the boring logs. In several sampling attempts, 50 blows of the hammer produced a penetration of 6 inches or less. When such difficult sampling was encountered, the driving was stopped at 50 blows and the resulting penetration was recorded. The relatively undisturbed samples of the softer, fine grained soils were obtained by pushing the 3-inch O.D. steel tubes into the undisturbed soil beneath the auger with the hydraulic system of the drill rig.

The sampling interval during the first half of the boring program was 2.5 feet in the upper 25 feet and 5 feet at depths below 25 feet. During the latter portion of the boring program, in cases where the Standard Penetration values of the materials above 20 feet was greater than 50 blows per foot, the depth of sampling at an interval of 2.5 feet was decreased from 25 feet to 20 feet. There are, of course, exceptions to this general rule due to variations in subsurface conditions.

The borings for Road "A" between Overhulse and Kaiser Roads were accomplished by a drilling crew from the office of Shannon & Wilson, Inc., using portable drilling equipment, as timber clearing to permit access for the truck-mounted equipment had not been completed. These borings were advanced with a 3-inch diameter, power-operated auger, and split-spoon samples were obtained at 2.5 foot intervals in conjunction with the Standard Penetration Test. The borings advanced with the portable drilling equipment ranged in depth from 12.5 feet to 18 feet, and averaged approximately 16 feet in depth.

All split-spoon samples were visually classified in the field by our inspector. The split-spoon samples were sealed in air-tight jars and the ends of the tube samples were sealed with wax. All samples were returned to our laboratory for further classification and testing.

Groundwater Measurements. To determine the position of the groundwater surface, observation wells were installed in 42 of the 75 borings made during this comprehensive investigation. Of the 42 observation wells, 33 were installed in the main building area; the remaining nine were installed in borings made for the roads and ancillary facilities. Each observation well consisted of a special tip which was connected to a length of 1/2-inch diameter plastic riser pipe. In 33 of the observation wells, the tip consisted of a Norton porous stone 1.5 inches in diameter and 6 inches long; in the remaining 9 observation wells, a "hydro-tip" which consists of an 18-inch long section of 1-1/2 inch I.D. polyvinylchloride pipe with slotted openings 0.01 of an inch in width was used.

Each tip was seated in several feet of free draining sand and gravel which permits free access of groundwater to the well. In 12 of the observation wells in the main building area, seals of impervious auger cuttings or bentonite were placed within the impervious soils of the glaciolacustrine unit so that the observation well would read the groundwater level below this seal. In the remaining observation wells, seals of impervious material were placed near the top of each boring to prevent surface water from entering the well.

The depth to groundwater is measured by lowering an electrically activated probe down the plastic riser pipe of the observation well or piezometer. When the probe contacts the water, an electrical circuit is completed which activates an indicator needle or light at the ground surface. The water levels measured in the observation wells and/or piezometers are shown on the logs of the borings. Water levels observed during the drilling and

sampling operations are shown on the logs of the borings in which groundwater observation wells or piezometers were not installed.

Test Pits. A total of 19 test pits were excavated in parking areas "B" and "C" which are located adjacent to Road "B" and a total of 18 test pits were excavated for the section of Road "A" located between Overhulse and Kaiser Roads. These test pits were made so that the subgrade materials could be visually examined and so that bag samples could be obtained for laboratory testing. The locations of these test pits, which are numbered TP-7 through TP-25A in parking areas "B" and "C" and TP-25 throughTP-43 along Road A are shown on Fig. A-1, Comprehensive Subsurface Exploration Plan, and also on Fig. 19 of the basic text. Test pit logs are presented in Figs. A-103 through A-114.

The excavation of the test pits in parking areas "B" and "C" was subcontracted to W.E. McInnis, Excavating Contractor, of Olympia, Washington. These test pits were excavated to depths ranging from 9 to 12 feet with a backhoe mounted on a rubber tired tractor. The excavation of the test pits along Road "A: was accomplished by a track-mounted backhoe provided by J. D. Dutton Inc., contractor, Olympia, Washington. The depth of these test pits ranged from 5 to 11 feet. These test pits were sampled and logged by an experienced inspector from our firm who continuously monitored the excavation and backfilling of the test pits. Bag samples of the materials encountered in the test pits were obtained and returned to our laboratory for further classification and testing.

Hand Probes. A potential fill area, located adjacent to Overhulse Road, was explored and probed to determine the approximate depth of soft materials that are visibly apparent at the ground surface. Probing was accomplished with a 15-foot long 1-inch I.D. jointed steel rod containing a hard steel sampling shoe at the end. The probe was pushed into the soft soil by hand until a significant change in soil density occurred. The results

of the 46 hand probes, conducted in the area, including a plan of the area explored,are shown in Fig. A-115. In the boggy area east of Overhulse Road, the depth of soft material was found to exceed 15 feet, the length of the probe rod.

C. LABORATORY TESTS

Because of the nature of the materials encountered in the borings, a large part of the physical testing of the soil was accomplished in conjunction with the field sampling operation, via the Standard Penetration Test. For this investigation the laboratory testing consisted largely of tests performed on representative samples to determine the index properties and aid in classifying the materials. These tests included natural water content determinations, Atterberg limit tests, and grain-size analysis. California Bearing Ratio (CBR) tests were also performed to determine the suitability of soils for compacted fills and for subgrade materials in the roads and parking areas. The results of these tests, with the exception of the grain size analyses, and CBR tests are summarized on the boring logs.

Natural Water Content. The natural water content is defined as the weight of water in a soil expressed as a percentage of the dry soil weight. Natural water contents of the subsurface materials were determined for selected soil samples obtained from the borings. The oven temperatures for drying of the samples was approximately 105°C.

Grain Size Analyses. The quantitative determination of the distribution of particle sizes in selected soil samples was performed in accordance with the Standard Method for Grain Size Analysis of Soils, ASTM Designation: D 422-63. The distribution of particle sizes retained on the No. 200 sieve (greater than 0.074 mm) was determined by sieving, while the distribution of particle sizes passing the No. 200 sieve was determined by a sedimentation process, in which a hydrometer was used to secure

the necessary data. The results of the grain size analyses performed for this investigation as well as previous investigations at the site are contained in the Appendix Figs. A-116 through A-130. These grain size curves are presented in generally consecutive order by boring number.

Atterberg Limit Tests. Standard Atterberg Limit Tests were performed on representative samples of soil in accordance with ASTM Designation: D423-61T and ASTM Designation: D424-59. The liquid limit was determined using the "one-point method" in accordance with the following formula developed by the Corps of Engineers.[1]:

$$W = W_n \left(\frac{N}{25}\right)^{0.121}$$

where:

w_n = the water content of the soil which closes in N blows in the standard liquid limit device

In all cases, two separate water content determinations were made at identical blow counts. The plastic limit was also determined as the average water content of two separate test threads. The results of all of the Atterberg limit tests performed on samples obtained from the site are summarized on the Plasticity Charts, Figs. A-131 and A-132.

California Bearing Ratio (CBR) Tests. In order to determine the suitability of soils for compacted fills and for subgrade materials, compaction tests and California Bearing Ratio determinations were performed on the samples obtained from the test pits in the roads and parking areas, in addition to the classification tests listed above. The results of the compaction tests are presented in the form of moisture versus density

[1] "Simplification of Liquid Limit Tests", WES Technical Memorandum No. 3-286, Report No. 1, Waterways Experiment Station, Vicksburg, Miss., June, 1949.

curves and the results of the California Bearing Ratio determinations are presented in Figs. A-133 through A-135.

The California Bearing Ratio (CBR) test, used to obtain the results presented in this report, is a penetration test wherein a standardized piston, with an end-area of 3 square inches is used to penetrate the soil at a standard rate of 0.05 inch per minute. The unit load at each 0.1-inch penetration, up to 0.5 inch, was recorded; and the CBR was computed as the ratio of an arbitrarily selected unit load to that of a standard. The standard values obtained by testing a high-quality crushed-stone material are as follows:

0.1 inch penetration	1000 psi
0.2 inch penetration	1500 psi

The soil specimens were compacted in a cylindrical mold 6 inches in diameter, and about 7 inches high. Material passing the 3/4-inch sieve was mixed with varying amounts of water, and compacted in the mold with the desired compactive effort to a height of 4.58 inches. The modified compactive hammer, with a height of fall of 18 inches and weighing 10 pounds, was used. The soil was compacted in five equal layers with blows of 55, 25, or 10 per layer, depending upon the compactive effort desired. Each sample was soaked for a period of up to 4 days after compacting, depending upon the amount of swelling that occurred. A surcharge weight of 10 pounds was placed on the samples during the soaking period.

The samples were next removed from the soaking tank and allowed to drain for a period of 15 minutes and then the penetration test was performed. A surcharge weight equal to that used for the soaking period was used during the penetration tests. For each test, the piston was firmly seated and all dials were set at zero. The load was then applied at the uniform rate of 0.05 inch per minute, and readings were taken every 0.1 inch penetration. The stress-strain curve obtained from each penetration test was plotted. If the load-penetration curve was concave

upward for low readings, due to an inexact piston seating, the curve was corrected by moving it to the left so that it would pass through the origin. From these curves, corrected if necessary, the values at 0.1 inch and 0.2 inch penetration were compared with the standards. These values were then used to plot the curves shown in the text.

TABLE A-1

BORING LOCATIONS
BY
COORDINATES

Boring No.	Coordinates North	East	Boring No.	Coordinates North	East	Boring No.	Coordinates North	East
B-1	13,250	7,250	B-41	13,040	8,725	B-81	14,212	9,095
B-2	13,300	7,150	B-42	13,430	8,575	B-82	13,770	9,535
B-3	13,050	7,450	B-43	13,526	7,680	B-83	13,955	9,445
B-4	13,190	7,450	B-44	13,355	7,765	B-84	14,130	9,362
B-5	13,095	7,250	B-45	13,175	7,855	B-85	13,628	9,250
B-6	13,150	7,350	B-46	13,420	7,895	B-86	13,685	9,350
B-7	14,550	8,360	B-47	13,306	8,115	B-87	13,740	9,026
B-8	13,250	8,400	B-48	13,485	8,025	B-88	13,820	9,154
B-9	14,850	7,170	B-49	13,585	8,227	B-89	13,860	9,274
B-10	13,750	6,320	B-50	13,755	8,145	B-90	14,056	9,180
B-11	13,470	9,440	B-51	13,595	7,815	B-91	13,830	8,320
B-12	11,940	9,050	B-52	13,395	8,320	B-92	13,660	8,400
B-13	14,360	9,110	B-53	13,955	8,550	B-93	13,853	8,780
B-14	14,300	7,480	B-54	13,785	8,635	B-94	13,655	8,853
B-15	14,440	6,800	B-55	14,025	8,694	B-95	14,023	9,590
B-16	12,600	7,550	B-56	13,950	8,930	B-96	13,840	9,680
B-17	14,120	8,280	B-57	14,220	8,796	B-97	14,650	8,883
B-18	13,250	7,950	B-58	14,110	8,852	B-98	12,740	10,175
B-19	14,300	7,800	B-59	14,180	8,617	B-99	12,705	10,625
B-20	13,800	7,880	B-60	13,595	8,725	B-100	12,700	11,070
B-21	13,750	7,300	B-61	14,135	9,350	B-101	12,620	11,570
B-22	13,800	8,800	B-62	14,175	8,995	B-102	12,620	12,095
B-23	13,870	9,200	B-63	13,985	9,082	B-103	12,875	12,500
B-24	14,450	9,900	B-64	13,810	7,865	B-104	13,230	12,850
B-25	10,820	9,050	B-65	13,925	7,805	B-105	13,495	13,220
B-26	14,128	8,013	B-66	14,870	9,010	B-106	13,585	13,865
B-27	14,167	8,093	B-67	14,740	9,065	B-107	14,060	10,200
B-28	13,996	8,051	B-68	14,590	9,140	B-108	12,448	9,742
B-29	14,067	8,142	B-69	14,470	9,200	B-109	12,446	9,822
B-30	13,918	8,076	B-70	14,300	9,280	B-110	12,445	9,900
B-31	13,985	8,182	B-71	14,936	9,127	B-111	12,535	10,067
B-32	14,126	8,238	B-72	14,805	9,196	B-112	12,590	10,030
B-33	14,171	8,329	B-73	14,653	9,270	B-113	12,710	10,060
B-34	14,045	8,253	B-74	14,536	9,328	B-114	12,590	10,075
B-35	14,089	8,369	B-75	14,895	9,390	B-115	13,400	10,010
B-36	12,770	9,980	B-76	14,750	9,465	B-116	13,000	10,010
B-37	12,750	9,700	B-77	14,634	9,525	B-117	13,900	10,010
B-38	12,660	9,410	B-78	14,329	8,915			
B-39	12,500	9,190	B-79	14,490	8,965			
B-40	12,720	8,970	B-80	14,382	9,020			

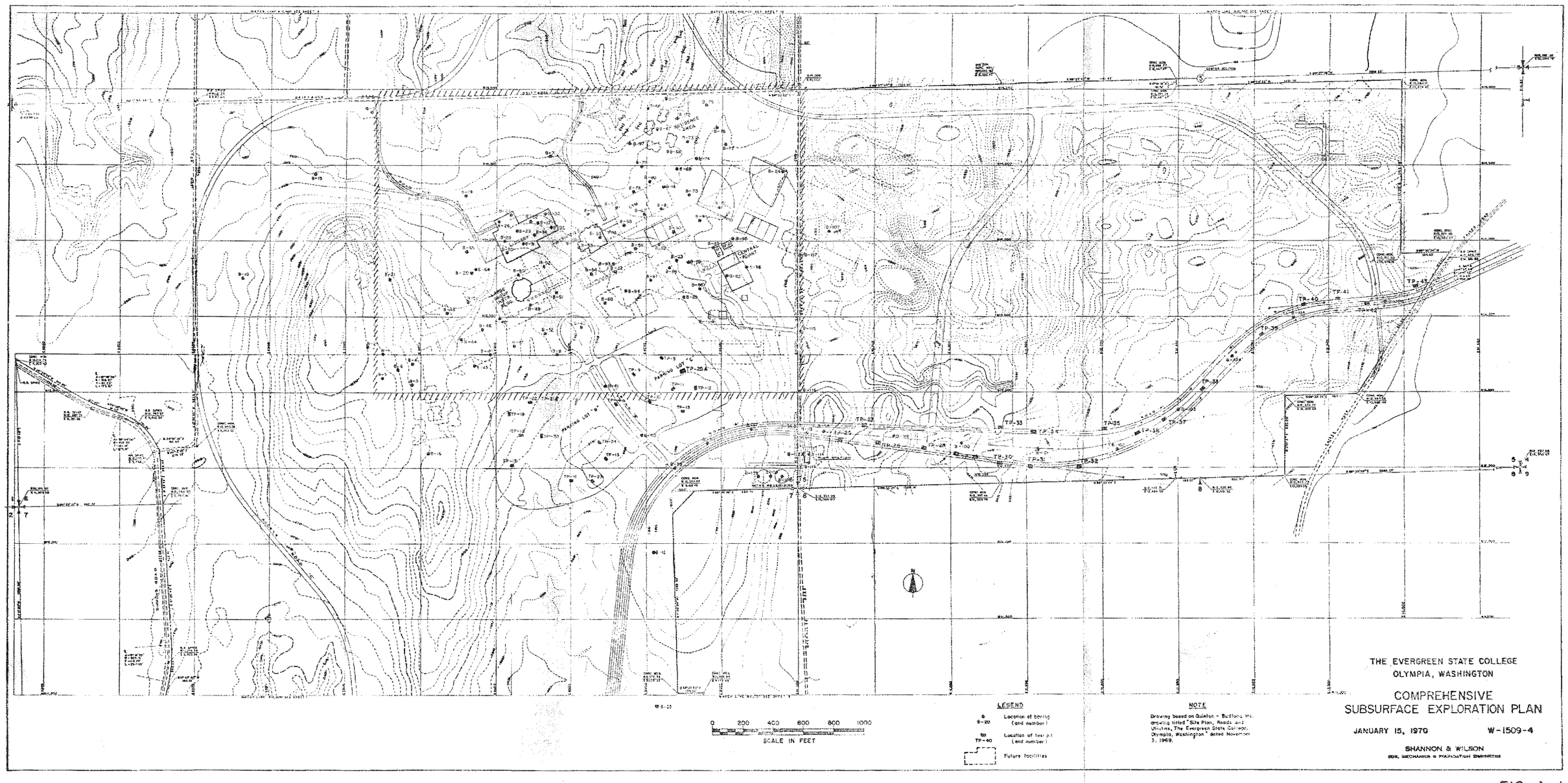
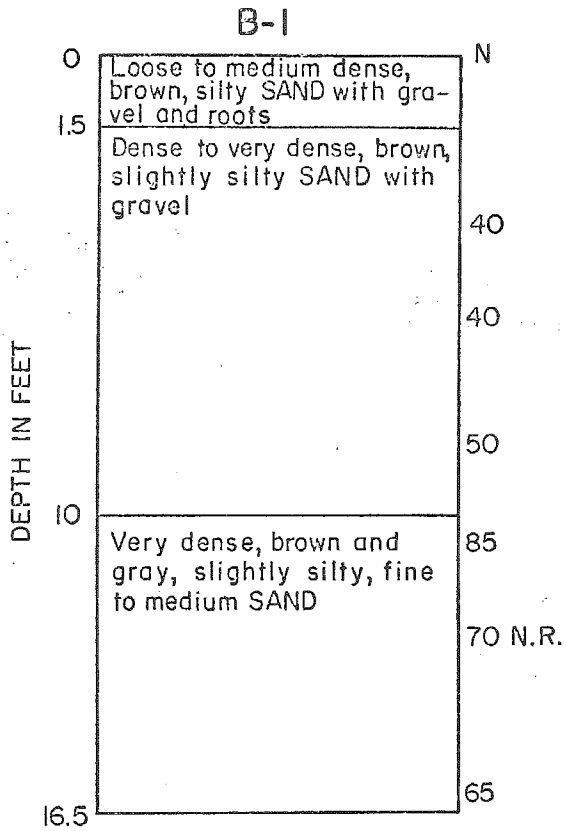
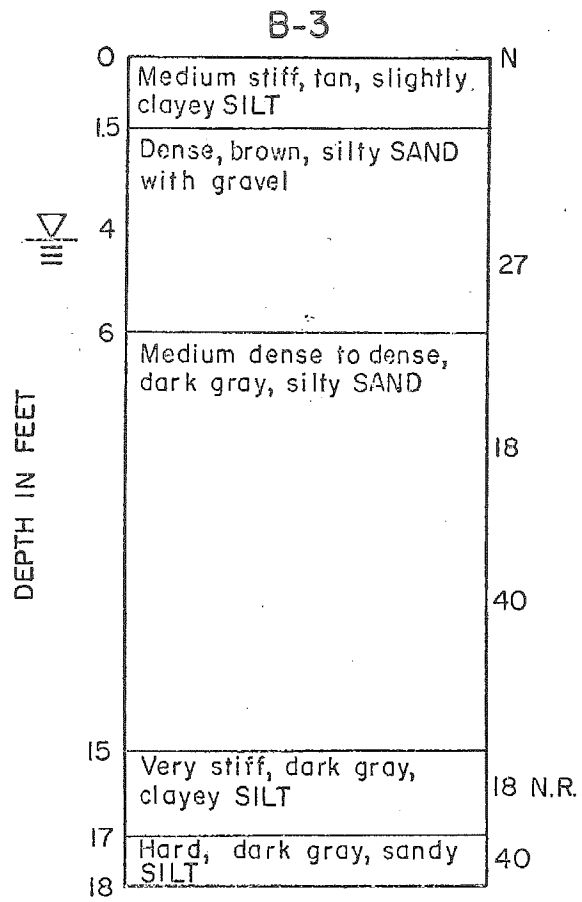
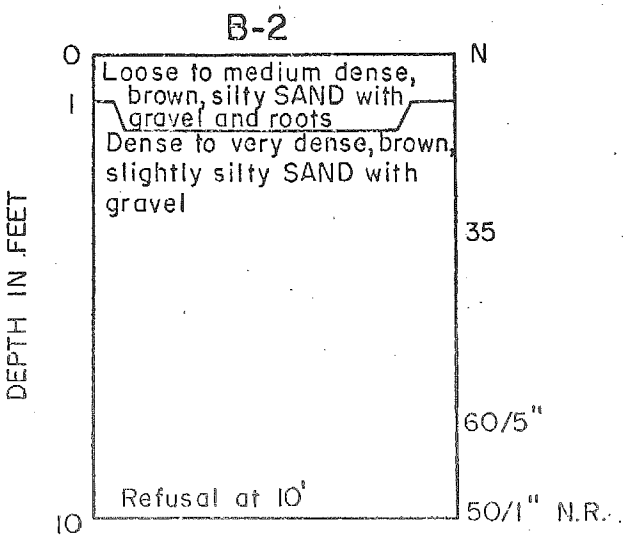

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON
COMPREHENSIVE
SUBSURFACE EXPLORATION PLAN
JANUARY 15, 1970
W-1509-4
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS
LEGEND
Location of boring (and number)
Location of test pit (and number)
Future facilities
NOTE
Drawing based on Quinton - Buttling Inc. drawing titled "Site Plan, Roads and Utilities, The Evergreen State College, Olympia, Washington" dated November 3, 1969.
SCALE IN FEET
0 200 400 600 800 1000
CENTRAL PLANT
PARKING LOT "C"
PARKING LOT "B"
TP-25A
TP-41
TP-40
TP-39
TP-33
TP-34
TP-35
TP-37
TP-36
TP-32
TP-31
TP-30
TP-28
TP-27
TP-26
TP-25
TP-13
TP-12
TP-19
TP-20
TP-21
TP-22
TP-23
TP-24
TP-2
TP-9
TP-10
TP-11
TP-14
TP-15
TP-16
TP-17
TP-18
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
B-12
B-13
B-14
B-15
B-16
B-17
B-18
B-19
B-20
B-21
B-22
B-23
B-24
B-25
B-26
B-27
B-28
B-29
B-30
B-31
B-32
B-33
B-34
B-35
B-36
B-37
B-38
B-39
B-40
B-41
B-42
B-43
B-44
B-45
B-46
B-47
B-48
B-49
B-50
B-51
B-52
B-53
B-54
B-55
B-56
B-57
B-58
B-59
B-60
B-61
B-62
B-63
B-64
B-65
B-66
B-67
B-68
B-69
B-70
B-71
B-72
B-73
B-74
B-75
B-76
B-77
B-78
B-79
B-80
B-81
B-82
B-83
B-84
B-85
B-86
B-87
B-88
B-89
B-90
B-91
B-92
B-93
B-94
B-95
B-96
B-97
B-98
B-99
B-100
B-101
B-102
B-103
B-104
B-105
B-106
B-107
B-108
B-109
B-110
B-111
B-112
B-113
B-114
B-115
B-116
B-117
B-118
B-119
B-120
B-121
B-122
B-123
B-124
B-125
B-126
B-127
B-128
B-129
B-130
B-131
B-132
B-133
B-134
B-135
B-136
B-137
B-138
B-139
B-140
B-141
B-142
B-143
B-144
B-145
B-146
B-147
B-148
B-149
B-150
B-151
B-152
B-153
B-154
B-155
B-156
B-157
B-158
B-159
B-160
B-161
B-162
B-163
B-164
B-165
B-166
B-167
B-168
B-169
B-170
B-171
B-172
B-173
B-174
B-175
B-176
B-177
B-178
B-179
B-180
B-181
B-182
B-183
B-184
B-185
B-186
B-187
B-188
B-189
B-190
B-191
B-192
B-193
B-194
B-195
B-196
B-197
B-198
B-199
B-200
B-201
B-202
B-203
B-204
B-205
B-206
B-207
B-208
B-209
B-210
B-211
B-212
B-213
B-214
B-215
B-216
B-217
B-218
B-219
B-220
B-221
B-222
B-223
B-224
B-225
B-226
B-227
B-228
B-229
B-230
B-231
B-232
B-233
B-234
B-235
B-236
B-237
B-238
B-239
B-240
B-241
B-242
B-243
B-244
B-245
B-246
B-247
B-248
B-249
B-250
B-251
B-252
B-253
B-254
B-255
B-256
B-257
B-258
B-259
B-260
B-261
B-262
B-263
B-264
B-265
B-266
B-267
B-268
B-269
B-270
B-271
B-272
B-273
B-274
B-275
B-276
B-277
B-278
B-279
B-280
B-281
B-282
B-283
B-284
B-285
B-286
B-287
B-288
B-289
B-290
B-291
B-292
B-293
B-294
B-295
B-296
B-297
B-298
B-299
B-300
B-301
B-302
B-303
B-304
B-305
B-306
B-307
B-308
B-309
B-310
B-311
B-312
B-313
B-314
B-315
B-316
B-317
B-318
B-319
B-320
B-321
B-322
B-323
B-324
B-325
B-326
B-327
B-328
B-329
B-330
B-331
B-332
B-333
B-334
B-335
B-336
B-337
B-338
B-339
B-340
B-341
B-342
B-343
B-344
B-345
B-346
B-347
B-348
B-349
B-350
B-351
B-352
B-353
B-354
B-355
B-356
B-357
B-358
B-359
B-360
B-361
B-362
B-363
B-364
B-365
B-366
B-367
B-368
B-369
B-370
B-371
B-372
B-373
B-374
B-375
B-376
B-377
B-378
B-379
B-380
B-381
B-382
B-383
B-384
B-385
B-386
B-387
B-388
B-389
B-390
B-391
B-392
B-393
B-394
B-395
B-396
B-397
B-398
B-399
B-400
B-401
B-402
B-403
B-404
B-405
B-406
B-407
B-408
B-409
B-410
B-411
B-412
B-413
B-414
B-415
B-416
B-417
B-418
B-419
B-420
B-421
B-422
B-423
B-424
B-425
B-426
B-427
B-428
B-429
B-430
B-431
B-432
B-433
B-434
B-435
B-436
B-437
B-438
B-439
B-440
B-441
B-442
B-443
B-444
B-445
B-446
B-447
B-448
B-449
B-450
B-451
B-452
B-453
B-454
B-455
B-456
B-457
B-458
B-459
B-460
B-461
B-462
B-463
B-464
B-465
B-466
B-467
B-468
B-469
B-470
B-471
B-472
B-473
B-474
B-475
B-476
B-477
B-478
B-479
B-480
B-481
B-482
B-483
B-484
B-485
B-486
B-487
B-488
B-489
B-490
B-491
B-492
B-493
B-494
B-495
B-496
B-497
B-498
B-499
B-500
B-501
B-502
B-503
B-504
B-505
B-506
B-507
B-508
B-509
B-510
B-511
B-512
B-513
B-514
B-515
B-516
B-517
B-518
B-519
B-520
B-521
B-522
B-523
B-524
B-525
B-526
B-527
B-528
B-529
B-530
B-531
B-532
B-533
B-534
B-535
B-536
B-537
B-538
B-539
B-540
B-541
B-542
B-543
B-544
B-545
B-546
B-547
B-548
B-549
B-550
B-551
B-552
B-553
B-554
B-555
B-556
B-557
B-558
B-559
B-560
B-561
B-562
B-563
B-564
B-565
B-566
B-567
B-568
B-569
B-570
B-571
B-572
B-573
B-574
B-575
B-576
B-577
B-578
B-579
B-580
B-581
B-582
B-583
B-584
B-585
B-586
B-587
B-588
B-589
B-590
B-591
B-592
B-593
B-594
B-595
B-596
B-597
B-598
B-599
B-600
B-601
B-602
B-603
B-604
B-605
B-606
B-607
B-608
B-609
B-610
B-611
B-612
B-613
B-614
B-615
B-616
B-617
B-618
B-619
B-620
B-621
B-622
B-623
B-624
B-625
B-626
B-627
B-628
B-629
B-630
B-631
B-632
B-633
B-634
B-635
B-636
B-637
B-638
B-639
B-640
B-641
B-642
B-643
B-644
B-645
B-646
B-647
B-648
B-649
B-650
B-651
B-652
B-653
B-654
B-655
B-656
B-657
B-658
B-659
B-660
B-661
B-662
B-663
B-664
B-665
B-666
B-667
B-668
B-669
B-670
B-671
B-672
B-673
B-674
B-675
B-676
B-677
B-678
B-679
B-680
B-681
B-682
B-683
B-684
B-685
B-686
B-687
B-688
B-689
B-690
B-691
B-692
B-693
B-694
B-695
B-696
B-697
B-698
B-699
B-700
B-701
B-702
B-703
B-704
B-705
B-706
B-707
B-708
B-709
B-710
B-711
B-712
B-713
B-714
B-715
B-716
B-717
B-718
B-719
B-720
B-721
B-722
B-723
B-724
B-725
B-726
B-727
B-728
B-729
B-730
B-731
B-732
B-733
B-734
B-735
B-736
B-737
B-738
B-739
B-740
B-741
B-742
B-743
B-744
B-745
B-746
B-747
B-748
B-749
B-750
B-751
B-752
B-753
B-754
B-755
B-756
B-757
B-758
B-759
B-760
B-761
B-762
B-763
B-764
B-765
B-766
B-767
B-768
B-769
B-770
B-771
B-772
B-773
B-774
B-775
B-776
B-777
B-778
B-779
B-780
B-781
B-782
B-783
B-784
B-785
B-786
B-787
B-788
B-789
B-790
B-791
B-792
B-793
B-794
B-795
B-796
B-797
B-798
B-799
B-800
B-801
B-802
B-803
B-804
B-805
B-806
B-807
B-808
B-809
B-810
B-811
B-812
B-813
B-814
B-815
B-816
B-817
B-818
B-819
B-820
B-821
B-822
B-823
B-824
B-825
B-826
B-827
B-828
B-829
B-830
B-831
B-832
B-833
B-834
B-835
B-836
B-837
B-838
B-839
B-840
B-841
B-842
B-843
B-844
B-845
B-846
B-847
B-848
B-849
B-850
B-851
B-852
B-853
B-854
B-855
B-856
B-857
B-858
B-859
B-860
B-861
B-862
B-863
B-864
B-865
B-866
B-867
B-868
B-869
B-870
B-871
B-872
B-873
B-874
B-875
B-876
B-877
B-878
B-879
B-880
B-881
B-882
B-883
B-884
B-885
B-886
B-887
B-888
B-889
B-890
B-891
B-892
B-893
B-894
B-895
B-896
B-897
B-898
B-899
B-900
B-901
B-902
B-903
B-904
B-905
B-906
B-907
B-908
B-909
B-910
B-911
B-912
B-913
B-914
B-915
B-916
B-917
B-918
B-919
B-920
B-921
B-922
B-923
B-924
B-925
B-926
B-927
B-928
B-929
B-930
B-931
B-932
B-933
B-934
B-935
B-936
B-937
B-938
B-939
B-940
B-941
B-942
B-943
B-944
B-945
B-946
B-947
B-948
B-949
B-950
B-951
B-952
B-953
B-954
B-955
B-956
B-957
B-958
B-959
B-960
B-961
B-962
B-963
B-964
B-965
B-966
B-967
B-968
B-969
B-970
B-971
B-972
B-973
B-974
B-975
B-976
B-977
B-978
B-979
B-980
B-981
B-982
B-983
B-984
B-985
B-986
B-987
B-988
B-989
B-990
B-991
B-992
B-993
B-994
B-995
B-996
B-997
B-998
B-999
B-1000

FIG. A-1







NOTES

N = number of blows required to produce a penetration of 6" or as noted; these values are approximately equivalent to the Standard Penetration Resistance.

▽ Water table

N.R. No Recovery

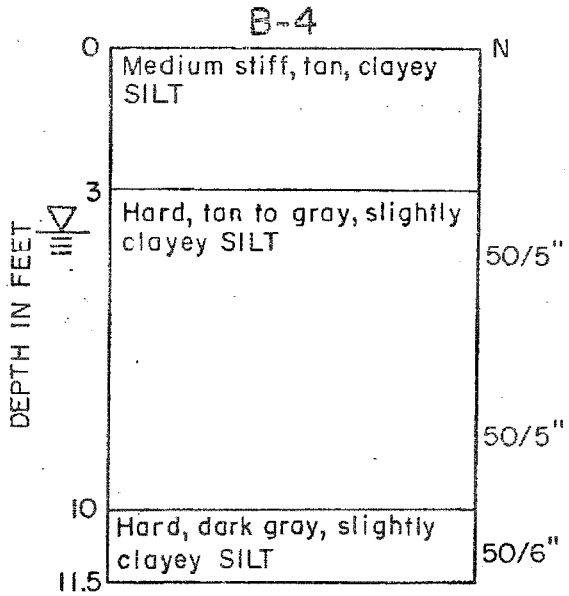
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

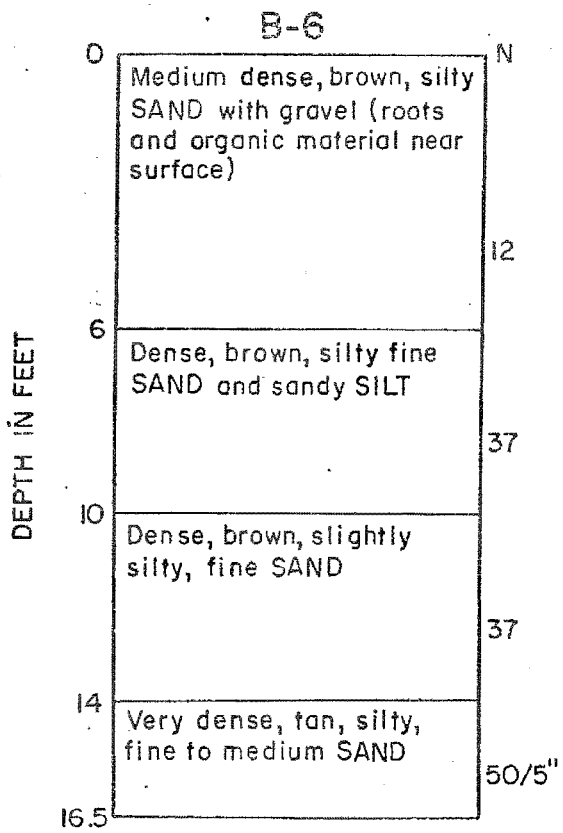
LOGS OF BORINGS 1, 2 & 3

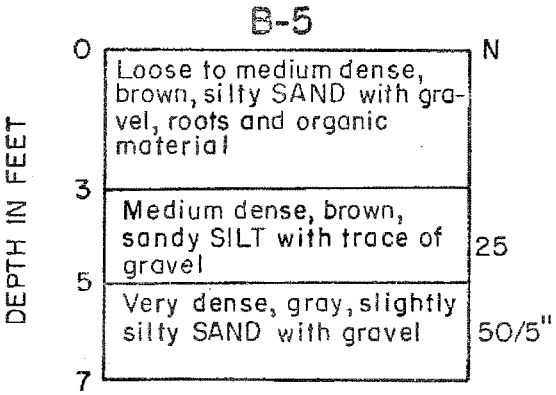
NOVEMBER 19, 1968 W-1509-1

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-2







NOTES

N = number of blows required to produce a penetration of 6" or as noted; these values are approximately equivalent to the Standard Penetration Resistance.

Water table

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOGS OF BORINGS 4, 5 & 6

NOVEMBER 19, 1968 W-1509-1

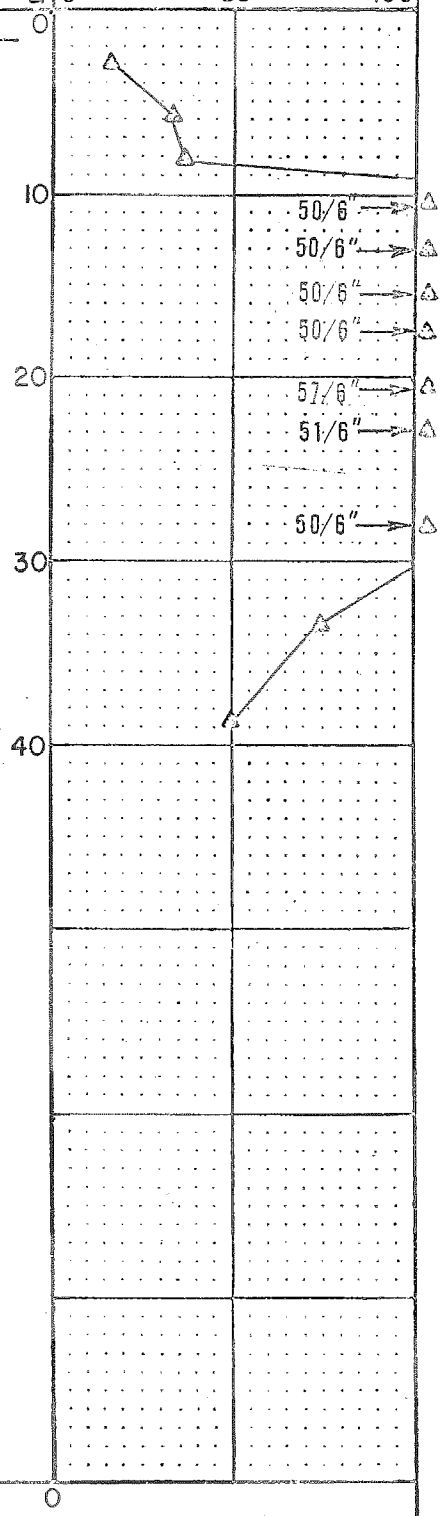
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG A

USC	SOIL DESCRIPTION Surface Elevation:	DEPTH, feet	SAMPLES
SW	Medium dense to dense, brown, slightly silty, fine to coarse SAND		
		7.0	
SM	Dense to very dense, brown, silty, fine SAND		
		12.0	
SM	Very dense, gray, silty, slightly gravelly, fine to coarse SAND		
		14.5	
SP	Very dense, brown, slightly silty, fine SAND		
		17.0	
SW SP	Very dense, brown to gray, gravelly, slightly silty, fine to coarse SAND		
		32.0	
SP	Very dense, gray, slightly silty, fine to medium SAND		
		39.0	
	Boring Completed 1/7/69		

GROUND WATER: 3/29/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification

Atterberg limits: Liquid limit; Natural water content; Plastic limit

⊙ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-7

APRIL 1, 1969 W-1509-2

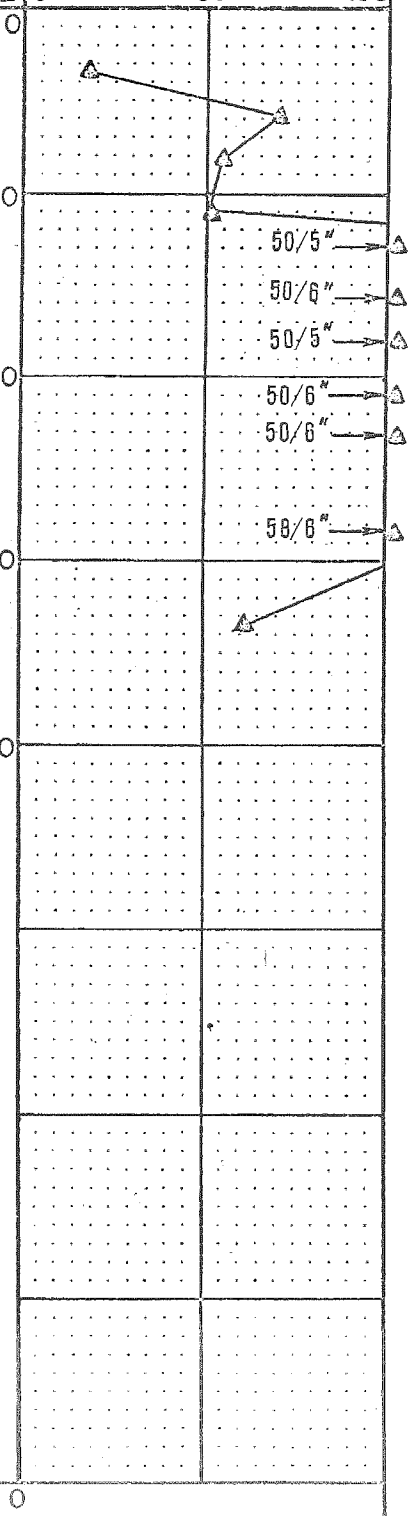
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-4

USC	SOIL DESCRIPTION Surface Elevation:	DEPTH, feet	SAMPLES
SM	Medium dense, tan, silty, slightly gravelly, fine SAND		1
SM	Very dense, brown to gray, silty, slightly gravelly, fine to coarse SAND	5.0	2, 3, 4
GP	Very dense, gray, sandy GRAVEL to 1 inch	12.0	5
SW SP	Very dense, gray to brown, gravelly, slightly silty, fine to coarse SAND	14.0	6, 7, 8, 9, 10
SM	Very dense, gray, silty, fine to medium SAND	33.0	11
	Boring Completed 1/7/69	34.0	

GROUND WATER: 3/29/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) △ Blows per foot



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Atterberg limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- o % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-8

APRIL 1, 1969 W-1509-2

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-5

USC	SOIL DESCRIPTION Surface Elevation:	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet	STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) ▲ Blows per foot 0 50 100
SM	Very dense, gray, silty, slightly gravelly fine to coarse SAND		1 I 2 I 3 I 4 I 5 I 6 II	3/29/69	0 10	50/6" 50/6" 50/6"
SW-GW	Very dense, gray, slightly silty, fine to coarse SAND & GRAVEL	17.0	7 I 8 I 9 I 10 I		20 30	51/6" 57/6" 57/6" 73/6"
	Boring Completed 1/8/69	33.0	11 II		40	53/6"

LEGEND

I 2.0" O.D. split spoon sample
II 3.0" O.D. thin-wall sample
✱ Sample not recovered

Atterberg limits:
Liquid limit
Natural water content
Plastic limit

Impervious seal
Water level
Piezometer tip
P Sampler pushed
USC Unified Soil Classification

o % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-9

APRIL 1, 1969 W-1509-2

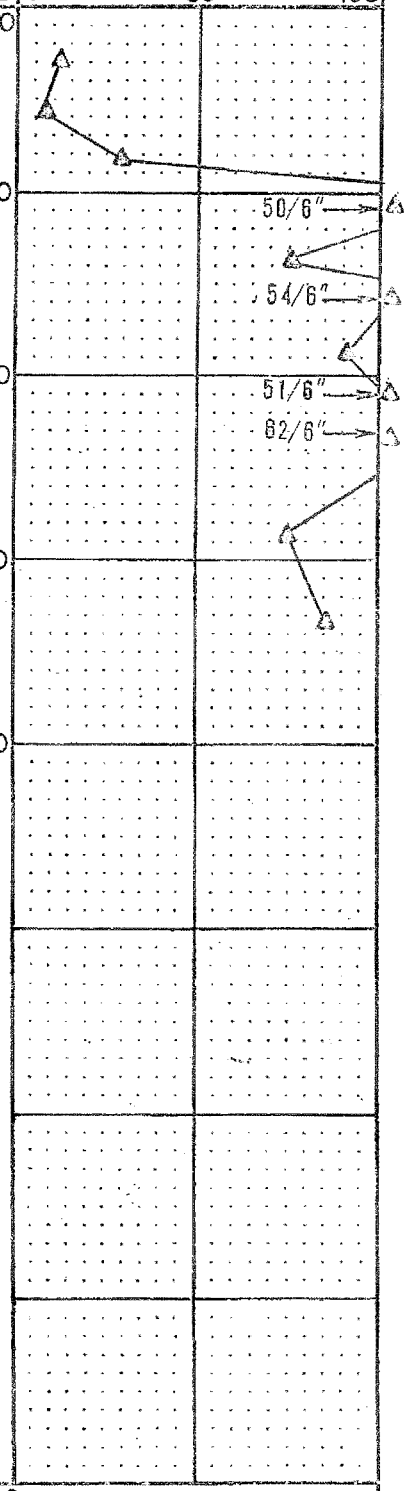
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-6

USC	SOIL DESCRIPTION Surface Elevation:	DEPTH, feet	SAMPLES
ML	Stiff, tan, slightly fine sandy SILT		1, 2
		7.0	
SM	Dense to very dense, gray, silty, slightly gravelly, fine to coarse SAND		3, 4
		13.0	
SM, ML	Very dense, gray, slightly silty SAND and hard, tan SILT (layered)		5, 6
		16.0	
SM	Very dense, gray, silty to slightly silty, slightly gravelly, fine to coarse SAND		7, 8, 9
		24.0	
SM	Very dense, gray, silty to slightly silty, fine SAND		10, 11
		34.0	
	Boring Completed 1/8/69		

GROUND WATER: 3/29/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification

o % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-10

APRIL 1, 1969 W-1509-2

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-7

USC	SOIL DESCRIPTION Surface Elevation:	DEPTH, feet
SM	Loose, brown, very silty, slightly gravelly, fine to coarse SAND with roots	0 – 2.0
SC	Loose, tan to light gray, clayey, slightly silty, fine to coarse SAND with scattered gravel	2.0 – 5.0
ML	Hard, tan to light gray, clayey SILT, dry in place	5.0 – 7.0
SM	Dense to very dense, brown to gray, gravelly, fine to coarse, silty SAND with trace of clay	7.0 – 11.5
SW GW	Very dense, gray, fine to coarse SAND and GRAVEL	11.5 – 14.0
ML	Hard, dark gray, slightly fine sandy, clayey SILT	14.0 – 17.5
SM	Very dense, dark gray, slightly gravelly, silty, fine to coarse SAND with layers of hard, clayey silt to 6"	17.5 – 20.6
ML	Hard, dark gray, clayey SILT, dry in place, with a few seams of dry, silty sand	20.6 – 36.0
	Boring completed 3/3/69	36.0

SAMPLES: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

GROUND WATER: 3/29/69

DEPTH, feet: 0, 10, 20, 30, 40

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot
0 50 100

50/0.5"
50/4"
50/6"

0 % Water content

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✳ Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-11

APRIL 1, 1969 W-1509-2

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-8

USC	SOIL DESCRIPTION Surface Elevation:	DEPTH, feet
ML	Very soft, tan to brown, slightly fine sandy, clayey SILT with roots and decomposed wood	3.0
ML	Medium stiff, tan, clayey SILT	4.5
SM	Loose, brown, very fine silty SAND (waterbearing)	7.0
ML	Medium stiff, tan, clayey SILT with partings of fine sand	13.0
SW SP	Medium dense to very dense, brown to gray, slightly silty, fine to coarse SAND with subrounded gravel to 1 inch (waterbearing)	28.0
GM	Very dense, gray, very silty, sandy GRAVEL	32.0
SW	Very dense, gray, clean, fine to medium SAND	35.6
	Boring Completed 3/3/69	

SAMPLES: 1, 2, 3, 4, 5 (P), 6, 7, 8, 9, 10, 11, 12

GROUND WATER: 3/29/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot

DEPTH, feet: 0, 10, 20, 30, 40

0 50 100

50/6" 50/6" 50/6" 50/3" 50/1.5"

LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

○ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

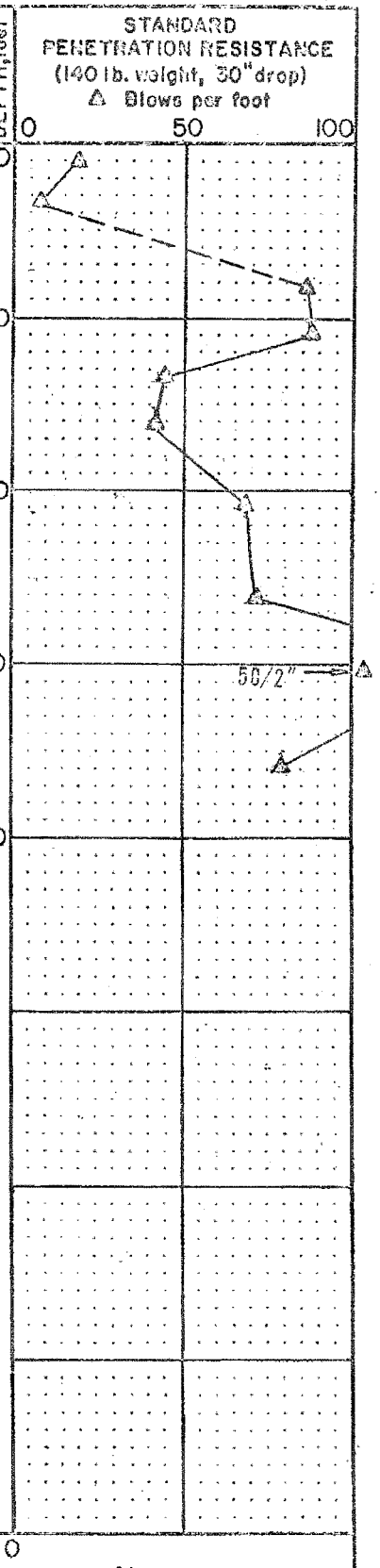
LOG OF BORING NO. B-12

APRIL 1, 1969 W-1509-2

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-9

USC	SOIL DESCRIPTION Surface Elevation:	DEPTH, feet	SAMPLES	GROUND WATER
	Forest Duff	0.5	1	
SM	Loose to medium dense, rusty brown to tan, slightly silty, gravelly, fine to coarse SAND	3.5	2	
ML	Stiff, tan, clayey SILT	5.9	3 P	
SM	Dense to very dense, tan to gray, silty to very silty, slightly gravelly, fine to medium SAND (waterbearing below 12.5 feet)		4 5 6 7	
ML	Hard, tan to dark gray, slightly sandy, clayey SILT (dry in place)	18.0	8	
SP	Very dense, gray to brown, clean, fine SAND (waterbearing)	23.0		
SM	Very dense, brown to dark gray, very silty, clayey, fine SAND, becoming coarser and less silty below 30 feet	25.4	9 10	3/29/69
	Boring Completed 3/4/69	36.0	11	



LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

○ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-13

APRIL 1, 1969 W-1509-2

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

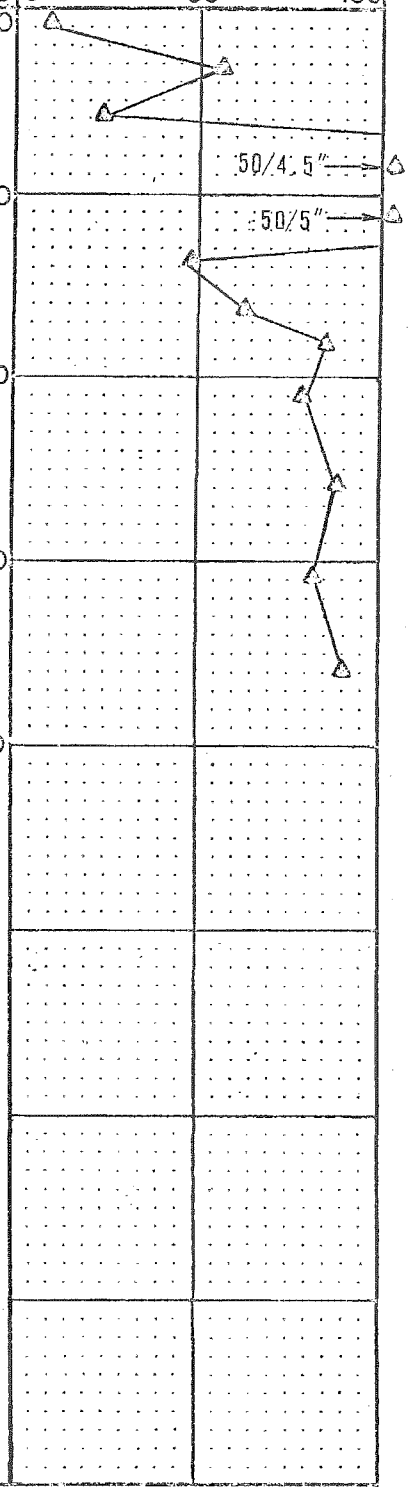
FIG. A-10

USC	SOIL DESCRIPTION Surface Elevation:	DEPTH, feet	SAMPLES
	Forest Duff	0.5	1
SP	Loose, tan, slightly silty, gravelly SAND	2.0	2
SM	Medium dense to very dense, tan to gray, very silty, fine gravelly, fine to coarse SAND (waterbearing below 12 feet)	12.0	3, 4, 5
SW SP	Dense to very dense, gray, slightly silty, fine to coarse SAND with trace of fine gravel (waterbearing)	36.4	6, 7, 8, 9, 10, 11, 12
	Boring Completed 3/4/69		

GROUND WATER

DEPTH, feet: 0, 10, 20, 30, 40

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



○ % Water content

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-14

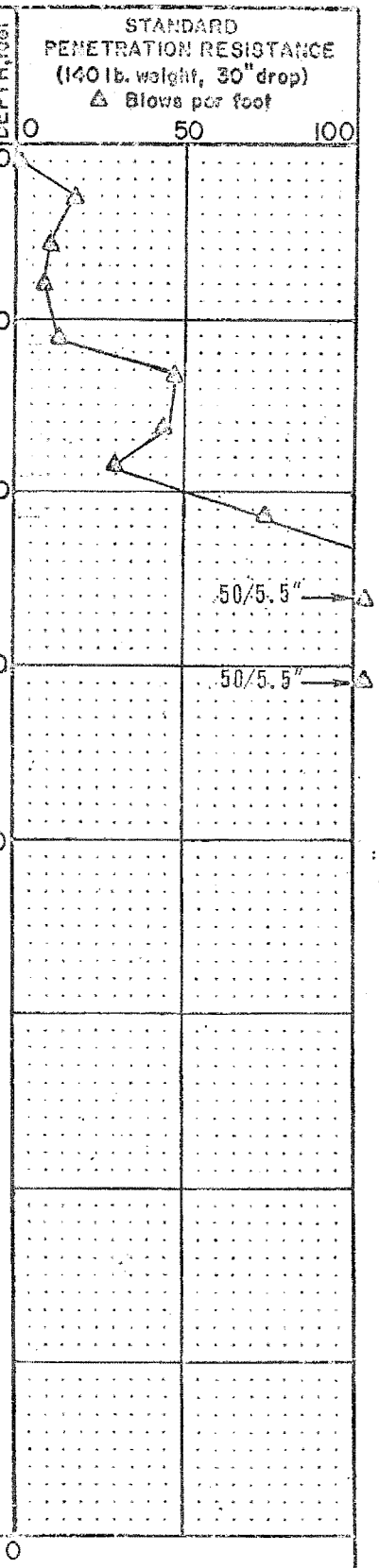
APRIL 1, 1969 W-1509-2

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-11

USC	SOIL DESCRIPTION Surface Elevation:	DEPTH, foot	SAMPLES
	Forest Duff	1.0	1
SM	Very loose, rusty brown, slightly gravelly, silty, fine to coarse SAND	2.5	2
SM	Medium dense, brown to gray, silty, very fine SAND	7.0	3
ML	Medium stiff, gray, slightly sandy, clayey SILT	8.5	4
SM	Loose to medium dense, tan to gray, very silty, slightly gravelly, fine to coarse SAND	13.0	5, 6
SM	Dense to very dense, brown to gray, silty to to slightly silty, fine SAND	26.0	7, 8, 9, 10
SW	Very dense, brown to gray, slightly silty, fine gravelly, fine to coarse SAND	35.4	11, 12
	Boring Completed 3/5/69		

GROUND WATER 3/28/69



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification

Atterberg limits: Liquid limit; Natural water content; Plastic limit

o % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-15

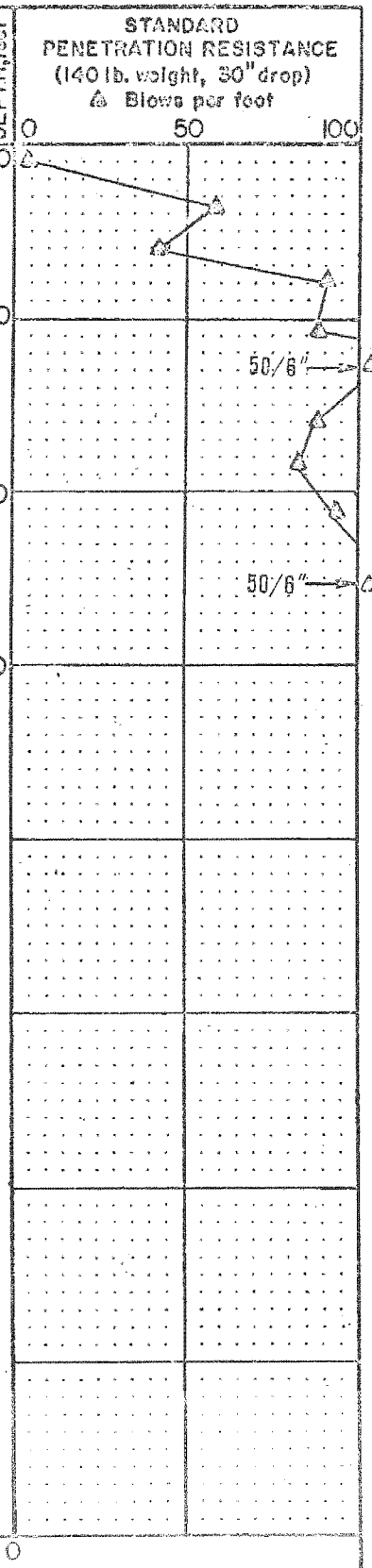
APRIL 1, 1969 W-1509-2

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-12

USC	SOIL DESCRIPTION Surface Elevation:	DEPTH, feet	SAMPLES
	Forest Duff	0.5	1
SM	Loose, rusty brown, very silty, slightly gravelly, fine to coarse SAND	2.0	2
SM	Dense to very dense, gray, silty, slightly gravelly, fine to coarse SAND		3, 4, 5, 6
SW	Very dense, gray, fine to coarse SAND (waterbearing)	15.5	7
SM	Very dense, gray, very silty, slightly gravelly, fine to coarse SAND	18.0	8, 9, 10
	Boring Completed 3/5/69	27.0	

GROUND WATER: 3/29/69



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification

Atterberg limits: Liquid limit; Natural water content; Plastic limit

○ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

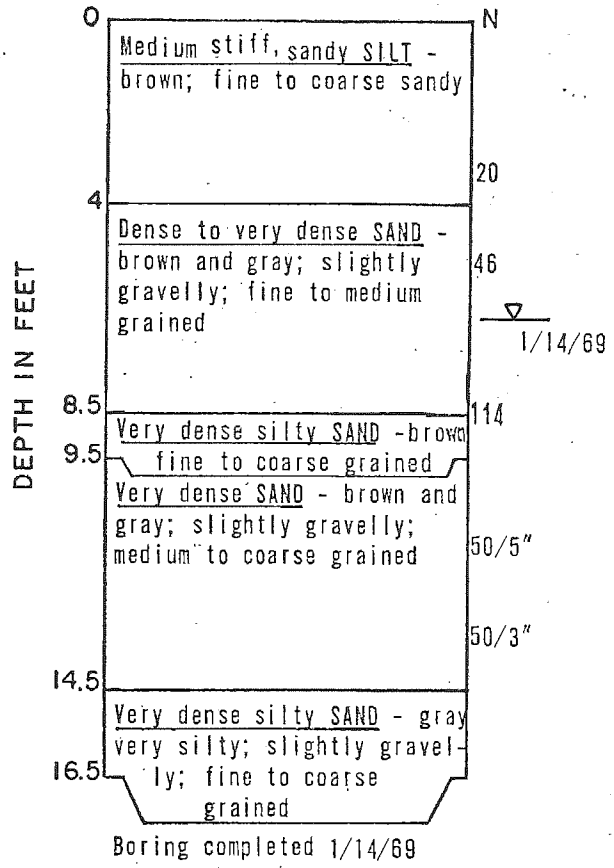
LOG OF BORING NO. B-16

APRIL 1, 1969 W-1509-2

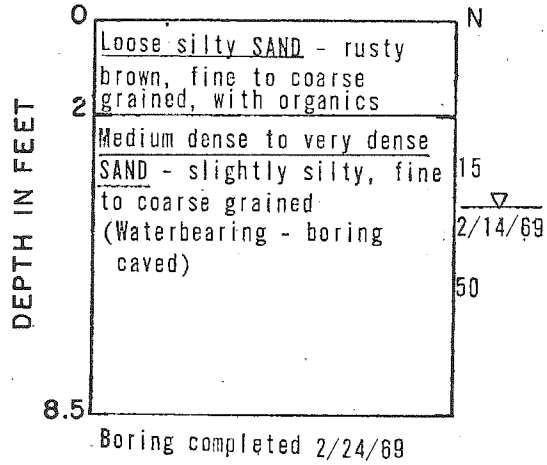
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-13

B-17



B-19

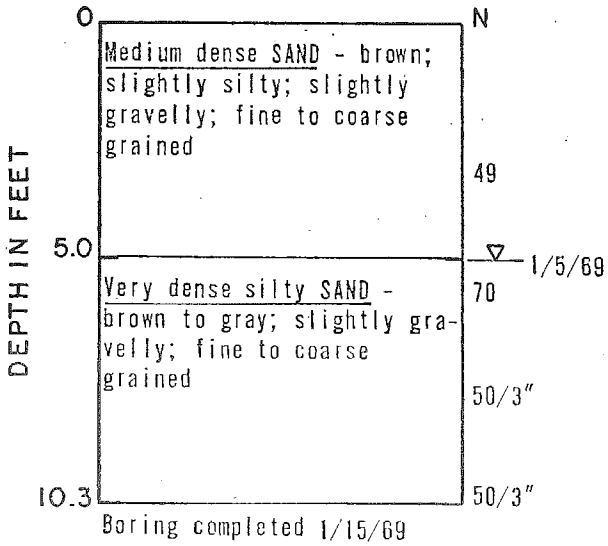


LEGEND

▽ Water level

N Standard Penetration Resistance (blows/foot)

B-18



THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

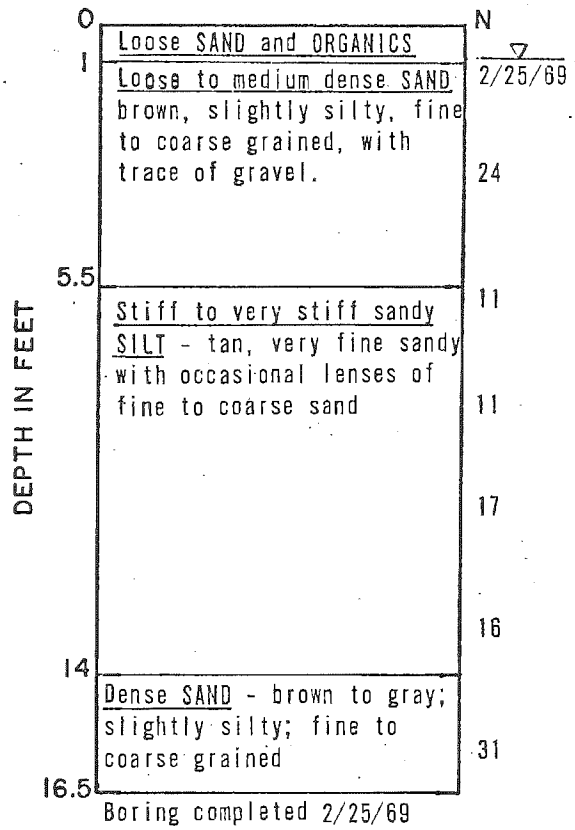
LOGS OF BORINGS
B-17, B-18 & B-19

APRIL 1, 1969 W-1509-2

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

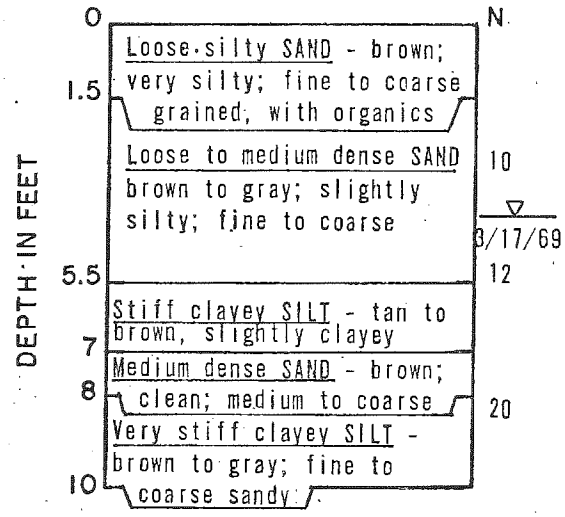
FIG. A-12

B-20



Boring completed 2/25/69

B-22



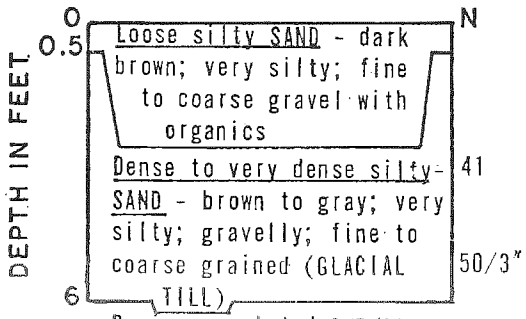
Boring completed 3/7/69

LEGEND

▽ Water level

N Standard Penetration Resistance (blows/foot)

B-21



Boring completed 3/7/69

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOGS OF BORINGS B-20, B-21 & B-22

APRIL 1, 1969 W-1509-2

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-15

USC	SOIL DESCRIPTION Surface Elevation: Approx. 161'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet	STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) △ Blows per foot (0 — 50 — 100)
SM	Loose, tan, very silty, fine to coarse SAND	0			0	
ML	Stiff, rusty brown SILT with wood inclusions	2.0 3.1	1 I			
ML	Stiff, tan, clayey SILT with seams to 4 inches of slightly silty, fine to medium SAND		2 II P 3 II P			
SM	Dense, brown to gray, very silty, fine to coarse SAND with scattered gravel (Glacial TILL)	9.7 12.0	4 I 5 I		10	
SP	Dense to very dense, brown, fine to medium SAND with scattered fine gravel grading to fine to coarse sand below 17.5 ft.		6 I 7 I	8/12/69	20	
SM	Very dense, brown to gray, very silty, fine to coarse SAND	20.4 22.0	8 I 9 I			50/6" △ 50/6" △
ML	Hard, dark gray, locally fine to medium sandy, clayey SILT with seams to 1 inch of clean sand		10 I		30	50/6" △
SP	Very dense, brown to gray, slightly silty, fine to medium SAND (Waterbearing)	32.5 34.0	11 I			50/6" △
SM	Very dense, gray, very silty, fine to coarse SAND (dry)	38.2	12 I		40	50/3.5" △
	Boring Completed 8/12/69					

LEGEND

- I — 2.0" O.D. split spoon sample
- II — 3.0" O.D. thin-wall sample
- Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P — Sampler pushed
- USC — Unified Soil Classification
- Perched Water Level

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

% Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-84

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-[illegible]

USC	SOIL DESCRIPTION Surface Elevation: Approx. 178'	DEPTH, feet	SAMPLES
SM	Loose, tan, very silty, fine gravelly, fine to coarse SAND with roots and organics	0 2.0	1
SP	Dense to very dense, light brown to gray, slightly silty, fine to medium SAND with scattered coarse sand and fine gravel		2 3
GP	Dense, brown, silty, very sandy, fine GRAVEL (Waterbearing)	9.0 12.0	4
CL	Hard, dark gray, silty CLAY (dry)		5 6 7 8 9
SM ML	Very dense, gray, silty, fine to coarse SAND with seams to 6 inches of hard, dark gray, clayey SILT	28.5	10 11
SW	Very dense, gray, fine to coarse SAND with scattered fine gravel	40.0	12
SP	Very dense, gray, fine to medium SAND with scattered fine gravel	45.0	13 14
	Boring Completed 8/12/69	57.7	15

GROUND WATER: 8/12/69; 8/22/69

DEPTH, feet: 0, 10, 20, 30, 40, 50, 60

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot
0 50 100

50/5"; 50/5"; 56/5"; 50/4"; 50/5"; 50/4"; 50/3"

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- ✱ Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

⊙ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-85

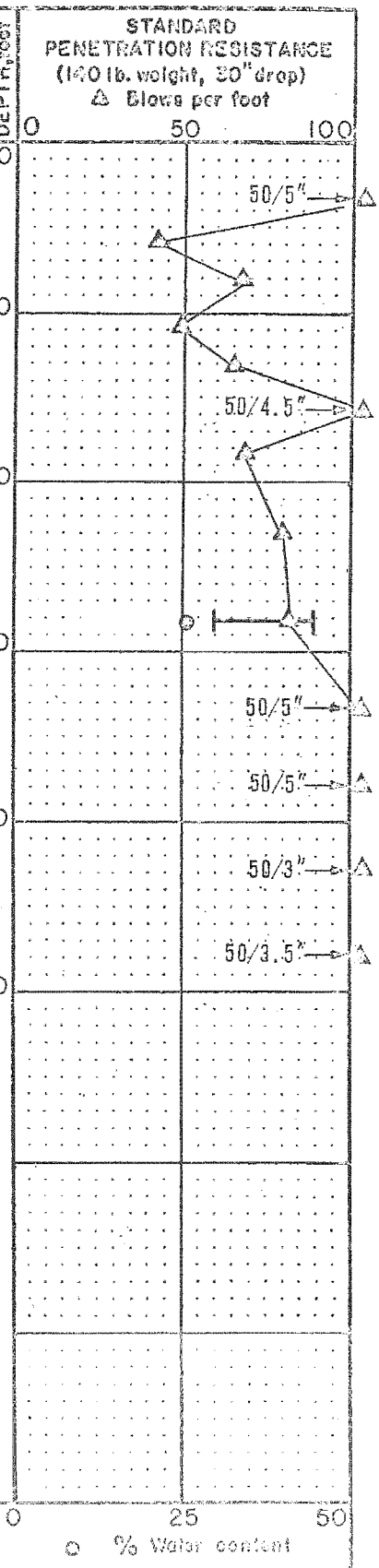
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-70

USC	SOIL DESCRIPTION Surface Elevation: Approx. 171'	DEPTH, feet	SAMPLES
SM	Loose, tan, very silty, fine to coarse SAND with scattered fine gravel	1.5	1
SM	Very dense, light brown, very silty, fine to coarse SAND with scattered gravel (weathered Glacial TILL)	4.5	2
SM	Dense, light brown, silty, fine to coarse SAND (waterbearing)	7.0	3, 4
SW SM	Very dense, light brown, slightly silty to silty, fine to coarse SAND with fine gravel	18.9	5, 6, 7
ML	Hard, dark gray, clayey SILT with partings of fine sand below 33.0 ft.	36.0	8, 9, 10
SW SM	Very dense, gray, fine gravelly, fine to coarse SAND with seams of silty sand (Waterbearing)	47.7	11, 12, 13
	Boring Completed 8/13/69		

GROUND WATER: 8/12/69, 8/22/69



LEGEND

- 2.0" O.D. split spoon sample
- 3.0" O.D. thin-wall sample
- Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-86

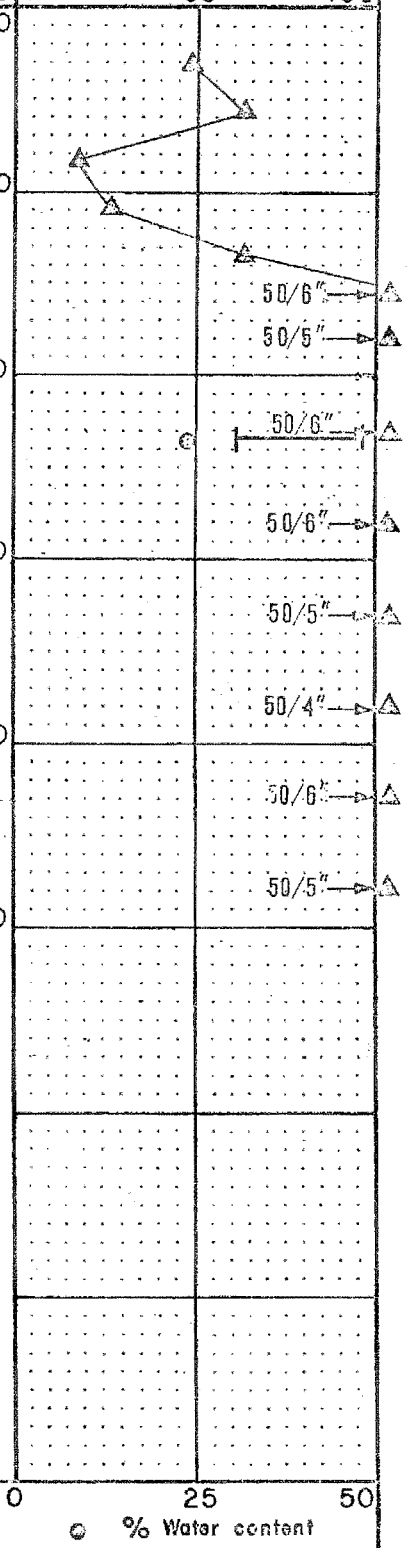
JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

USC	SOIL DESCRIPTION Surface Elevation: Approx. 178'	DEPTH, feet	SAMPLES
SM	Loose, tan, very silty, fine to coarse SAND	0 2.0	
ML	Stiff, tan, clayey SILT	2.8	1
SP	Dense to very dense, gray, slightly gravelly, fine to medium SAND	4.5	2
SM	Very dense, brown, very silty, fine to coarse SAND with fine gravel (weathered Glacial TILL)	7.0	3
SM	Medium dense, light brown, silty, fine to coarse SAND with fine gravel (Waterbearing)	12.0	4 5
SW	Very dense, brown, slightly silty, fine to coarse SAND with scattered fine gravel		6 7
ML	Hard, dark gray, clayey SILT with a few seams to 4 inches of very dense, fine to medium SAND	19.0	8 9
ML	Hard, dark gray, clayey SILT with scattered sand and gravel	30.0	10 11
SW	Very dense, brown to gray, slightly silty, fine to coarse SAND with scattered gravel (Waterbearing)	39.0	12
	Boring Completed 8/13/69	47.9	13

GROUND WATER: 8/13/69 (DEPTH, feet: 20); 8/13/69 (DEPTH, feet: 40)

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop)
△ Blows per foot



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-87

JANUARY 15, 1970 W - 1509 - 4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-72

USC	SOIL DESCRIPTION Surface Elevation: Approx. 172'	DEPTH, feet	SAMPLES
SM	Loose, rusty brown, very silty, fine to coarse SAND	0 2.0	1
SP	Very dense, brown, slightly silty, fine to medium SAND		2 3
SM	Very dense, tan to brown, silty, fine to coarse SAND	8.2 10.5	4
SW SM	Very dense, brown, slightly silty to silty, fine to coarse SAND with scattered fine gravel		5 6 7
SM	Very dense, dark gray, silty, fine to medium SAND	19.0	
CL ML	Hard, dark gray, silty CLAY grading to very fine sandy SILT below 30 ft.	23.0	8 9
SW SP	Very dense, gray, slightly silty, fine to coarse SAND with fine gravel	33.5	10 11 12 13
	Boring Completed 8/14/69	47.8	

GROUND WATER: 8/13/69; 8/22/69

DEPTH, feet: 0, 10, 20, 30, 40, 50

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) △ Blows per foot (0 – 50 – 100)

50/3"; 50/5"; 50/6"; 50/6"; 50/4"; 50/5"; 50/1"; 50/4"; 50/4"

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered

Atterberg limits:
- Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

○ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-88

JANUARY 15, 1970 W-1509-4

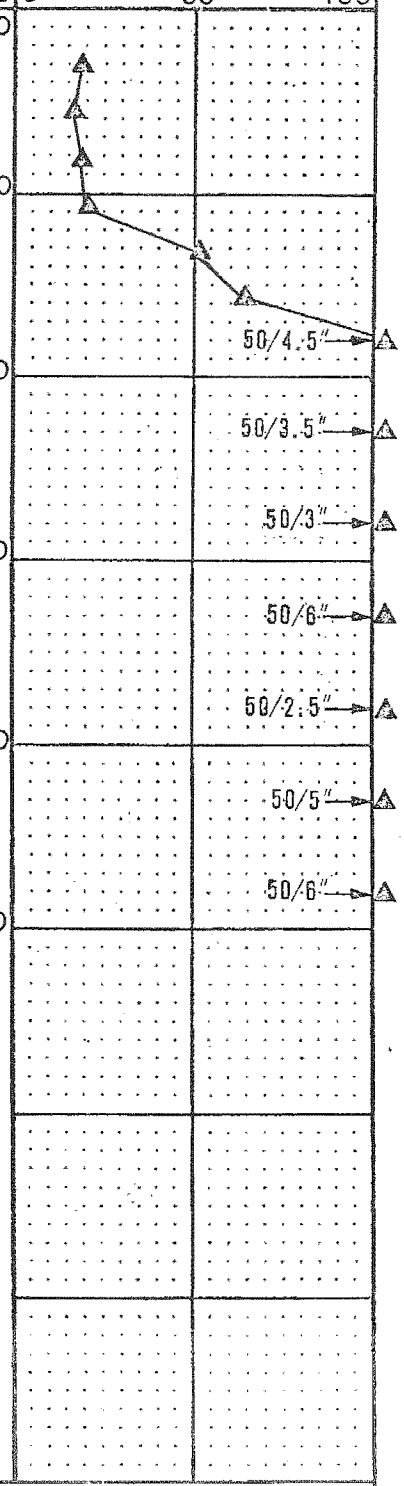
SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG A-73

USC	SOIL DESCRIPTION Surface Elevation: Approx. 166'	DEPTH, feet	SAMPLES
SM	Forest Duff	0.5	
SM ML	Loose, tan, very silty, fine to coarse SAND Medium dense, brown, silty, fine SAND and stiff, tan, slightly clayey fine sandy SILT (layered)	2.5 7.0	1, 2
SM	Medium dense, light brown, silty, fine to medium SAND with scattered coarse sand (Waterbearing)		3, 4
SM	Very dense, brown, silty, fine to coarse SAND with scattered gravel (Waterbearing)	13.2	5, 6, 7
ML	Hard, dark gray, fine sandy, clayey SILT	22.8	8
SM	Very dense, dark gray, very silty, fine to coarse SAND	25.0	9
SW	Very dense, gray, slightly silty, fine to coarse SAND with scattered, fine gravel (Waterbearing below 45.0 ft.)	31.0	10, 11, 12
	Boring Completed 8/14/69	48.5	13

GROUND WATER: 8/14/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) ▲ Blows per foot



LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- Sample not recovered
- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

Atterberg limits: Liquid limit; Natural water content; Plastic limit

● % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-89

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-74

USC	SOIL DESCRIPTION Surface Elevation: Approx. 165'	DEPTH, feet	SAMPLES
SM	Loose, tan to rusty brown, very silty, fine to coarse SAND with roots and organics	0 2.0	1
SM	Dense, tan, very silty, fine to coarse SAND with scattered gravel	4.0	2
SM	Dense to very dense, tan to light brown, slightly silty to silty, fine to medium SAND with scattered coarse sand and fine gravel		3 4 5
SM	Very dense, brown, silty, fine SAND	14.0	6
ML	Hard, dark gray, sandy, clayey SILT with scattered fine gravel	17.0	7
ML CL	Hard, dark gray, clayey SILT to silty CLAY	21.0	8
SM	Very dense, dark gray, silty, fine to medium SAND with scattered coarse sand and fine gravel	28.0	9 10
SW	Very dense, gray, fine to coarse SAND with scattered fine gravel and a trace of silt (Waterbearing)	35.0	11 12 13 14
	Boring Completed 8/14/69	52.8	

GROUND WATER: 8/22/69; 8/14/69

STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) △ Blows per foot

DEPTH, feet: 0, 10, 20, 30, 40, 50, 60

0 50 100

50/4"; 50/4"; 50/3.5"; 50/4"; 50/4"; 50/6"; 50/6"; 50/6"; 50/4"; 50/4"

0

LEGEND

- I 2.0" O.D. split spoon sample
- II 3.0" O.D. thin-wall sample
- * Sample not recovered

Atterberg limits:
- L Liquid limit
- Natural water content
- Plastic limit

- Impervious seal
- Water level
- Piezometer tip
- P Sampler pushed
- USC Unified Soil Classification
- Perched Water Level

○ % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-90

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG A-75

USC	SOIL DESCRIPTION Surface Elevation: Approx. 193'	DEPTH, feet	SAMPLES	GROUND WATER	DEPTH, feet	STANDARD PENETRATION RESISTANCE (140 lb. weight, 30" drop) △ Blows per foot 0 50 100
SM	Dense, light brown, silty, gravelly SAND	0				
SP	Very dense, dark gray, slightly silty, fine gravelly, fine to medium SAND	2.0				
SM	Very dense, light gray to brown, very silty, gravelly, fine to coarse SAND (TILL)	4.0	1 I 2 I 3 I 4 I 5 I 6 I		10	58/6"
SP	Very dense, gray, fine SAND	16.5	7 I			50/4" 50/5"
SP SW	Very dense, light gray to brown, slightly silty, fine to coarse SAND with scattered fine gravel	21.0	8 II 9 I		20	52/6" 50/6"
SP	Very dense, gray to light brown, fine SAND	30.0	10 I		30	50/6"
SP SW	Very dense, light brown, slightly silty, gravelly, fine to coarse SAND	35.0				
	Boring Completed 11/4/69	38.0	11 II		40	54/6"

0

LEGEND

I 2.0" O.D. split spoon sample
II 3.0" O.D. thin-wall sample
* Sample not recovered

Atterberg limits:
Liquid limit
Natural water content
Plastic limit

Impervious seal
Water level
Piezometer tip
P Sampler pushed
USC Unified Soil Classification
Perched Water Level

● % Water content

THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

LOG OF BORING NO. B-91

JANUARY 15, 1970 W-1509-4

SHANNON & WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS

FIG. A-76

SHANNON & WILSON, INC.
SOIL MECHANICS AND FOUNDATION ENGINEERS
SEATTLE • PORTLAND • BURLINGAME • SPOKANE
1105 NORTH 38TH STREET, SEATTLE, WASHINGTON 98103
• (206) ME 2-8020

LETTER OF TRANSMITTAL

DATE: 20 March, 1970
JOB NO.: W-1509-04
ATTENTION: Mr. Norm Johnson
RE: Notes from meeting at Shannon & Wilson

TO THE EVERGREEN STATE COLLEGE
1020 East 5th Avenue
Olympia, Washington

FACILITIES PLANNING	
J. L. Schillinger	
D. S. Parry	
R. A. Strecker	
K. N. Johnson	KNJ
W. A. Phipps	WAP
Don Moser	

Copy
Copy
Copy

RECEIVED
MAR 24 1970
THE EVERGREEN STATE COLLEGE
OFFICE OF FACILITIES PLANNING

GENTLEMEN:

WE ARE SENDING YOU ☒ Attached ☐ ~~Under separate cover via~~ _____ the following items:

☐ Report ☐ Proposal ☐ Drawings ☐ Samples ☐ Specifications File

☒ Copy of Notes from Meeting ☐ Site Improvement Clearing & Grading Bid

COPIES	DATE	NO.	DESCRIPTION
15	4 Feb. 1970		Notes from meeting with interested engineers and architects at Shannon & Wilson to discuss "Comprehensive Foundation Investigation, The Evergreen State College, Olympia, Washington" dated Jan. 15, 1970

THESE ARE TRANSMITTED as checked below

☐ For your retention ☒ For action specified below ☐ _____
☐ For your use ☐ With corrections ☐ _____
☐ As requested ☐ _____
☐ For review and comment ☐ _____
☐ Please return by _____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS We are sending these copies to you ~~we~~ for distribution as we do not have all of the addresses of all of the people who attended the meeting

COPY TO _____

INVOICE FILE ☐ CORRESP. FILE ☒ SIGNED: Robin D. Abbott

IF ENCLOSURES ARE NOT AS NOTED, KINDLY NOTIFY US AT ONCE.

PIONEER G.F.

SHANNON & WILSON, INC.
Soil Mech. & Foundation Engr.
1105 North 38th Street
Seattle, Washington 98103
Phone (206) 632-8020

MEMORANDUM

RECEIVED
MAR 24 1970
THE EVERGREEN STATE COLLEGE
OFFICE OF FACILITIES PLANNING

JOB NO. W-1509-04

DAY Wednesday

DATE Feb. 4, 1970

SUBJECT:

☐ FIELD INSPECTION REPORT SHEET 1 OF 8

☒ Notes from meeting at Shannon & Wilson

PROJECT: The Evergreen State College
Olympia, Washington

TO: The Evergreen State College
1020 East 5th Avenue
Olympia, Washington

ATTN: Mr. J. L. Schillinger

Mr. J. L. Schillinger, Director of Facilities Planning for The Evergreen State College, called a meeting with interested architects and engineers, to review conclusions and discuss questions arising from the preliminary draft of the Shannon & Wilson, Inc. report entitled, "Comprehensive Foundation Investigation, The Evergreen State College, Olympia, Washington," dated January 15, 1970. The meeting was held the morning of Feb. 4, 1970 at the Seattle office of Shannon & Wilson, Inc. A list of those attending the meeting is attached.

The following is a brief summary in outline form of the topics presented and discussed at the meeting.

I. PRESENTATION OF THE TOTAL WORKING AREA AND COMMON PROBLEMS AT THE EVERGREEN STATE COLLEGE by Charles Torkko, Quinton-Budlong, Inc.

FACILITIES PLANNING	
J. L. Schillinger	
D. S. Parry	
R. A. Strecker	
✓ K. N. Johnson	
W. A. Phipps	

A. Description of Working Area
   1. Main Building Area
   2. Roads and Parking and Ancillary Facilities

B. Services Provided by Quinton-Budlong, Inc.
   1. Stockpile of backfill material for backfilling Library and Activities Buildings.
   2. Stockpile of fill for landscaping purposes
   3. Develop disposal sites for strippings.
   4. Provide drainage system with deep pipes which may aid in excavation dewatering.

C. Construction Problems Anticipated at Site
   1. Locally difficult excavations in SILT soils where water level is high.
   2. Construction, particularly earthwork during wet weather

II. PRESENTATION OF SOILS AND FOUNDATION INFORMATION
by Raymond P. Miller, Shannon & Wilson, Inc.

A. Summary of Contents and Organization of Shannon & Wilson Report
   1. Preliminary draft contains soils and foundation information for the main building area in essentially complete form
   2. Final report will also contain section pertaining to Roads, Parking and Ancillary Facilities

B. Philosophy of Grid Borings (VS. building by building investigations)
   1. Provides a composite view of subsurface conditions
   2. Reduced cost
   3. Consistency and applicability to individual buildings
      a) When additional borings are needed
      b) Why follow-up review of plans and specifications pertaining to foundations and earthwork are needed

C. Subsurface Soil Conditions
   1. Topsoil and SILT, surficial organically enriched materials or lake deposits, not foundation soils
   2. Drift, loose to dense, lenticular sands, silts, clays, till and gravel; suitability as foundation soil depends upon relative density
   3. Glaciolacustrine SILT and CLAY STRATA, hard silt and clay, relatively persistant across site except for local erosional features or "windows"
   4. Very dense SAND, slightly silty, deepest strata encountered in borings

D. Groundwater
   1. Perched Water
      a) Found 6 to 36 feet below ground surface
      b) Usually encountered between 8 to 12 feet below ground surface

c) Should not be considered as one "table" but as several perched zones of water, not necessarily hydraulically interconnected

2. Lower Groundwater
   a) Usually encountered between elevation 140 to 130 feet
   b) Soils at this elevation usually the hard CLAY-SILT or very dense sand

E. Foundations
1. Spread Footings should be suitable for all structures
2. Footings on Original Ground
   a) Suitable bearing soils within 10 to 15 feet of present ground surface
   b) Bearing pressures on SAND soils (1.5 to 4 tsf) use SPT results from boring logs and Fig. 11 from report
   c) Bearing pressures on CLAY-SILT soils 4 tsf for square footings, 3.5 tsf for continuous footings
3. Footings on Structural Fill
   a) Bearing pressure limited to 2 tsf
   b) See Fig. 12 for structure founded partially on fill and partially on natural ground
4. Plate Bearing Tests at Library
   a) Confirmed that recommended bearing pressures are well within desired performance requirements
   b) Consistent with other tests on similar materials in Seattle area

F. Drainage Requirements
1. Review of drain well tests at Library
2. Effective use of SAND drains for dewatering Library excavation and less-effective use for Activities Building excavations
3. Deep well pumps may be required in some areas
4. Perimeter and Underfloor Drain Systems required (see attached Figs. for underfloor drainage system)

Feb. 4, 1970

W-1509-04

III. EARTHWORK AT THE EVERGREEN STATE COLLEGE

By Thomas E. Kirkland, Shannon & Wilson, Inc.

A. EXCAVATION PROCEDURES

1. Rip dense soil; blast boulders
2. Dewater perched water zone
   a) Not well points due to erratic soil distribution
   b) Consider vertical gravity sand drains
   c) Supplement as necessary by pumping from vertical sand drains, or wells
   d) Ditching and pumping from low spots may be necessary
   e) If seepage heavy, blanket slope with gravel
3. Excavation slopes
   a) Responsibility of contractor; comply with State Safety Code
   b) No steeper than:
      1) 1.5H:1V in sandy overburden-unbraced
      2) 0.75H:1V in hard CLAY & SILT - unbraced
   c) Provide 5 foot bench and ditch at SAND-CLAY contact
4. Weather Proofing

Provisions in contract to install the following as necessary to prevent softening by water at any time of year, particularly during rainy season (Sept. thru May):

   a) Working surface of lean concrete or asphalt in bottom of excavation, such as asphalt at existing excavation for future Library
   b) Working surface of 2" to 4" of lean concrete immediately upon excavation of footing
   c) Pre-fabricated reinforcing immediately following excavation of footing
5. Consider disposition of excavated soil
   a) Where to stockpile for future backfilling use?
   b) Waste site location and difficulties of disposal during rainy periods
   c) Make contractor responsible for constructing and maintaining haul roads and haul routes within waste areas, importing suitable granular soil as needed
   d) Clay and silt materials difficult to dispose of during wet weather because they became soft when wet and become unstable under construction activity
   e) Sloping, rolling and sealing surface of waste or stockpile sites (or any fill area) increases runoff and minimizes infiltration of rain water into soil; site soils when wet are generally susceptable to disturbance and instability under construction activity. Infiltration of water into near surface soils requires longer period of time for drainage or drying to take place so that a firm, workable surface is possible.
   f) Stockpiles may be covered to prevent water infiltration

B. FILL PROCEDURES

1. Four types of filling:
   a) Landscaping Purposes: Use topsoil, 12-inch loose lifts, 85% of Modified compaction. Existing stockpile (15,000 cu. yd.) contains numerous roots; may need screening or hand picking. In stockpile, some granular soils were placed by mistake.
   b) Structural Fill, minor settlements (roads, parking lots, sidewalks)
      1) See report for lift thickness
      2) 90% Modified Compaction
   c) Structural Fill, settlements minimized (footings, floor support, wall backfill)
      1) See report for lift thickness
      2) 95% Modified Compaction
   d) Gravel backfill for drains (drainage layers)
      1) State specifications for this material
      2) 6" loose lifts
      3) 95% Modified compaction with hand-operated vibrating plate compactor
      4) Import this material
2. Soils for structural filling
   a) Moisture Sensitive Soil (12% to 50% fines)
      1) Silty sands & gravels readily available from site excavations
      2) Possibility of soft, spongy fills in wet weather
      3) Use only in SUMMER (June thru August) during non-rainy periods, as fills or backfills
      4) May be very wet when excavated due to perched water
      5) Dry as required for compaction, by disking or working
      6) When possible, spread wet soil over large areas to be worked and dried
   b) Select On-Site Mat'l (5 to 12% fines)
      1) Available in limited quantities by selective excavation of cleaner sands & gravels
      2) Moderately sensitive to moisture
      3) May also be wet when excavated due to perched water, requiring drying
      4) Suitability for structural fills and backfills marginal during rainy season (Sept. thru May); may only be used under controlled conditions during non-rainy periods
      5) If near optimum moisture when placed, good fill material except during rain
   c) Clean Soil ($<$ 5% fines)
      1) Rather insensitive to moisture
      2) Can generally be used during wet weather
      3) Use such soil to establish a base for fills in wet areas
      4) Not found as yet in large quantities at site; therefore importing necessary

3. Compaction behind walls and above tunnels

To prevent buildup of soil pressures:
a) No heavy equipment near walls or tunnel roof
b) Compaction within 3' of walls to be with vibrating plate compactor
c) Compact soil near tunnel roof with vibratory plate compactor

4. Existing Select Fill Material Stockpile (20,000 cu.yds.)
a) Generally borderline soil between select on-site soil and moisture sensitive soil
b) Some topsoil mixed in by mistake
c) Some silt and clay and wet granular soil at north side of stockpile
d) Use this soil during summer months as fill or backfill, during non-rainy periods
e) During the rainy season, use clean imported soil for fill or backfill

5. All filling and backfilling should be observed and tested by experienced technician or engineer

C. LARGE GROUP INSTRUCTION BUILDING

1. Over-excavation beneath structure made inadvertently
2. Backfilling controlled and tested
3. Location of over-excavation and density test results of backfill compaction shown in available report
4. Consider existence of this backfill relative to foundation and floor support, designing to minimize differential settlements between elements on fill and those supported by original ground
5. Wherever structural fill and original ground supports foundations or floor slabs, possible differential settlements should be studied and minimized. The report presents one method on Fig. 12(D) to minimize differential settlements by over-excavation and backfilling for footing support in original ground.
6. Loaded scrapers did not compact the site soils to values consistently greater than 95% compaction.
7. A vibratory roller did compact the site soils to values consistently greater than 95% compaction.

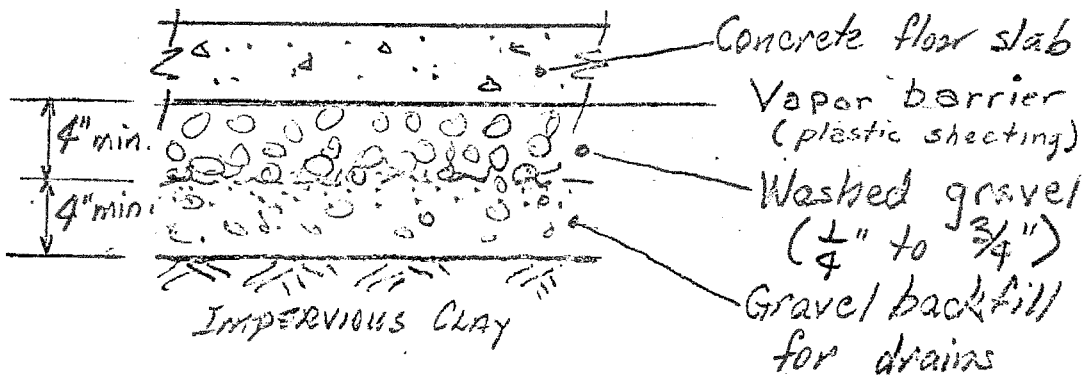
ATTENDANCE LIST

NAME	AFFILIATION
Harold K Loe	Durham Anderson Freed
Edward Larkin	Quinton-Rudolph
Robert B. Pruett	Engineer
Alvin Dreger	Architect
Tom Hickman	Archt - NBBJ
Jack Christensen	S.E - SHCR
H. Helle	" "
K.N. Johnson	T.E.S.C.
J.L. Schillinger	T.E.S.C.
Paul W Henderson	Div. Eng & Arch.
Don Hanson	Hanson & Chelton Inc
Ted Litzenberger	Harris Reed & Litzenberger
M. Sherrod	Kirk - Wallace - McKinley
R.P. Nunez	Shannon & Wilson, Inc.
George Yamane	Shannon & Wilson, Inc
Thomas E. Kirkland	Shannon & Wilson, Inc.
Robert Abbott	" " "
Earl G. Dilling	" " "

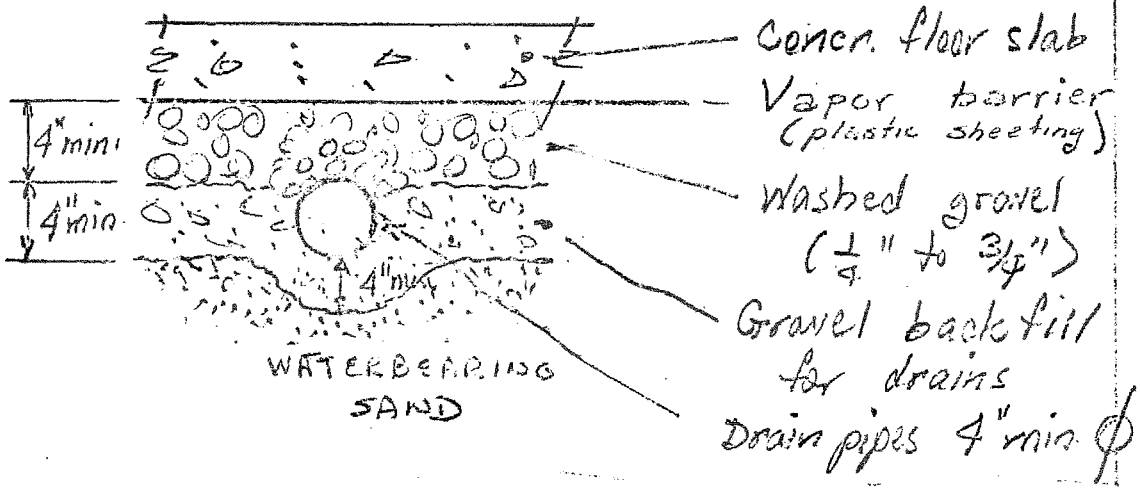
UNDERFLOOR DRAINAGE – T.E.S.C.

Conditions: High water table and effective perimeter drain system.

A. Basement founded in impervious (clay) soils



B. Basement founded in waterbearing sand soils



SHANNON & WILSON, INC.
Soil Mech. & Foundation Engr.
1105 North 38th Street
Seattle, Washington 98103
Phone (206) 632-8020

MEMORANDUM

JOB NO. W-1509-04

DAY Wednesday

DATE Feb. 4, 1970

SHEET 1 OF 8

SUBJECT:

☐ FIELD INSPECTION REPORT

☒ Notes from meeting at Shannon & Wilson

PROJECT: The Evergreen State College
Olympia, Washington

TO: The Evergreen State College
1020 East 5th Avenue
Olympia, Washington

ATTN: Mr. J. L. Schillinger

Mr. J. L. Schillinger, Director of Facilities Planning for The Evergreen State College, called a meeting with interested architects and engineers, to review conclusions and discuss questions arising from the preliminary draft of the Shannon & Wilson, Inc. report entitled, "Comprehensive Foundation Investigation, The Evergreen State College, Olympia, Washington," dated January 15, 1970. The meeting was held the morning of Feb. 4, 1970 at the Seattle office of Shannon & Wilson, Inc. A list of those attending the meeting is attached.

The following is a brief summary in outline form of the topics presented and discussed at the meeting.

I. PRESENTATION OF THE TOTAL WORKING AREA AND COMMON PROBLEMS AT THE EVERGREEN STATE COLLEGE by Charles Torkko, Quinton-Budlong, Inc.

A. Description of Working Area
   1. Main Building Area
   2. Roads and Parking and Ancillary Facilities

B. Services Provided by Quinton-Budlong, Inc.
   1. Stockpile of backfill material for backfilling Library and Activities Buildings.
   2. Stockpile of fill for landscaping purposes
   3. Develop disposal sites for strippings.
   4. Provide drainage system with deep pipes which may aid in excavation dewatering.

C. Construction Problems Anticipated at Site
   1. Locally difficult excavations in SILT soils where water level is high.
   2. Construction, particularly earthwork during wet weather

II. PRESENTATION OF SOILS AND FOUNDATION INFORMATION
by Raymond P. Miller, Shannon & Wilson, Inc.

A. Summary of Contents and Organization of Shannon & Wilson Report
   1. Preliminary draft contains soils and foundation information for the main building area in essentially complete form
   2. Final report will also contain section pertaining to Roads, Parking and Ancillary Facilities

B. Philosophy of Grid Borings (VS. building by building investigations)
   1. Provides a composite view of subsurface conditions
   2. Reduced cost
   3. Consistency and applicability to individual buildings
      a) When additional borings are needed
      b) Why follow-up review of plans and specifications pertaining to foundations and earthwork are needed

C. Subsurface Soil Conditions
   1. Topsoil and SILT, surficial organically enriched materials or lake deposits, not foundation soils
   2. Drift, loose to dense, lenticular sands, silts, clays, till and gravel; suitability as foundation soil depends upon relative density
   3. Glaciolacustrine SILT and CLAY STRATA, hard silt and clay, relatively persistant across site except for local erosional features or "windows"
   4. Very dense SAND, slightly silty, deepest strata encountered in borings

D. Groundwater
   1. Perched Water
      a) Found 6 to 36 feet below ground surface
      b) Usually encountered between 8 to 12 feet below ground surface

c) Should not be considered as one "table" but as several perched zones of water, not necessarily hydraulically interconnected

2. Lower Groundwater
   a) Usually encountered between elevation 140 to 130 feet
   b) Soils at this elevation usually the hard CLAY-SILT or very dense sand

E. Foundations
1. Spread Footings should be suitable for all structures
2. Footings on Original Ground
   a) Suitable bearing soils within 10 to 15 feet of present ground surface
   b) Bearing pressures on SAND soils (1.5 to 4 tsf) use SPT results from boring logs and Fig. 11 from report
   c) Bearing pressures on CLAY-SILT soils 4 tsf for square footings, 3.5 tsf for continuous footings
3. Footings on Structural Fill
   a) Bearing pressure limited to 2 tsf
   b) See Fig. 12 for structure founded partially on fill and partially on natural ground
4. Plate Bearing Tests at Library
   a) Confirmed that recommended bearing pressures are well within desired performance requirements
   b) Consistent with other tests on similar materials in Seattle area

F. Drainage Requirements
1. Review of drain well tests at Library
2. Effective use of SAND drains for dewatering Library excavation and less-effective use for Activities Building excavations
3. Deep well pumps may be required in some areas
4. Perimeter and Underfloor Drain Systems required (see attached Figs. for underfloor drainage system)

Feb. 4, 1970

W-1509-04

III. EARTHWORK AT THE EVERGREEN STATE COLLEGE

By Thomas E. Kirkland, Shannon & Wilson, Inc.

A. EXCAVATION PROCEDURES

1. Rip dense soil; blast boulders
2. Dewater perched water zone
   a) Not well points due to erratic soil distribution
   b) Consider vertical gravity sand drains
   c) Supplement as necessary by pumping from vertical sand drains, or wells
   d) Ditching and pumping from low spots may be necessary
   e) If seepage heavy, blanket slope with gravel
3. Excavation slopes
   a) Responsibility of contractor; comply with State Safety Code
   b) No steeper than:
      1) 1.5H:1V in sandy overburden-unbraced
      2) 0.75H:1V in hard CLAY & SILT - unbraced
   c) Provide 5 foot bench and ditch at SAND-CLAY contact
4. Weather Proofing

Provisions in contract to install the following as necessary to prevent softening by water at any time of year, particularly during rainy season (Sept. thru May):

   a) Working surface of lean concrete or asphalt in bottom of excavation, such as asphalt at existing excavation for future Library
   b) Working surface of 2" to 4" of lean concrete immediately upon excavation of footing
   c) Pre-fabricated reinforcing immediately following excavation of footing
5. Consider disposition of excavated soil
   a) Where to stockpile for future backfilling use?
   b) Waste site location and difficulties of disposal during rainy periods
   c) Make contractor responsible for constructing and maintaining haul roads and haul routes within waste areas, importing suitable granular soil as needed
   d) Clay and silt materials difficult to dispose of during wet weather because they became soft when wet and become unstable under construction activity
   e) Sloping, rolling and sealing surface of waste or stockpile sites (or any fill area) increases runoff and minimizes infiltration of rain water into soil; site soils when wet are generally susceptable to disturbance and instability under construction activity. Infiltration of water into near surface soils requires longer period of time for drainage or drying to take place so that a firm, workable surface is possible.
   f) Stockpiles may be covered to prevent water infiltration

B. FILL PROCEDURES

1. Four types of filling:
   a) Landscaping Purposes: Use topsoil, 12-inch loose lifts, 85% of Modified compaction. Existing stockpile (15,000 cu. yd.) contains numerous roots; may need screening or hand picking. In stockpile, some granular soils were placed by mistake.
   b) Structural Fill, minor settlements (roads, parking lots, sidewalks)
      1) See report for lift thickness
      2) 90% Modified Compaction
   c) Structural Fill, settlements minimized (footings, floor support, wall backfill)
      1) See report for lift thickness
      2) 95% Modified Compaction
   d) Gravel backfill for drains (drainage layers)
      1) State specifications for this material
      2) 6" loose lifts
      3) 95% Modified compaction with hand-operated vibrating plate compactor
      4) Import this material
2. Soils for structural filling
   a) Moisture Sensitive Soil (12% to 50% fines)
      1) Silty sands & gravels readily available from site excavations
      2) Possibility of soft, spongy fills in wet weather
      3) Use only in SUMMER (June thru August) during non-rainy periods, as fills or backfills
      4) May be very wet when excavated due to perched water
      5) Dry as required for compaction, by disking or working
      6) When possible, spread wet soil over large areas to be worked and dried
   b) Select On-Site Mat'l (5 to 12% fines)
      1) Available in limited quantities by selective excavation of cleaner sands & gravels
      2) Moderately sensitive to moisture
      3) May also be wet when excavated due to perched water, requiring drying
      4) Suitability for structural fills and backfills marginal during rainy season (Sept. thru May); may only be used under controlled conditions during non-rainy periods
      5) If near optimum moisture when placed, good fill material except during rain
   c) Clean Soil ($<$ 5% fines)
      1) Rather insensitive to moisture
      2) Can generally be used during wet weather
      3) Use such soil to establish a base for fills in wet areas
      4) Not found as yet in large quantities at site; therefore importing necessary

3. Compaction behind walls and above tunnels

To prevent buildup of soil pressures:
a) No heavy equipment near walls or tunnel roof
b) Compaction within 3' of walls to be with vibrating plate compactor
c) Compact soil near tunnel roof with vibratory plate compactor

4. Existing Select Fill Material Stockpile (20,000 cu.yds.)
a) Generally borderline soil between select on-site soil and moisture sensitive soil
b) Some topsoil mixed in by mistake
c) Some silt and clay and wet granular soil at north side of stockpile
d) Use this soil during summer months as fill or backfill, during non-rainy periods
e) During the rainy season, use clean imported soil for fill or backfill

5. All filling and backfilling should be observed and tested by experienced technician or engineer

C. LARGE GROUP INSTRUCTION BUILDING

1. Over-excavation beneath structure made inadvertently
2. Backfilling controlled and tested
3. Location of over-excavation and density test results of backfill compaction shown in available report
4. Consider existence of this backfill relative to foundation and floor support, designing to minimize differential settlements between elements on fill and those supported by original ground
5. Wherever structural fill and original ground supports foundations or floor slabs, possible differential settlements should be studied and minimized. The report presents one method on Fig. 12(D) to minimize differential settlements by over-excavation and backfilling for footing support in original ground.
6. Loaded scrapers did not compact the site soils to values consistently greater than 95% compaction.
7. A vibratory roller did compact the site soils to values consistently greater than 95% compaction.

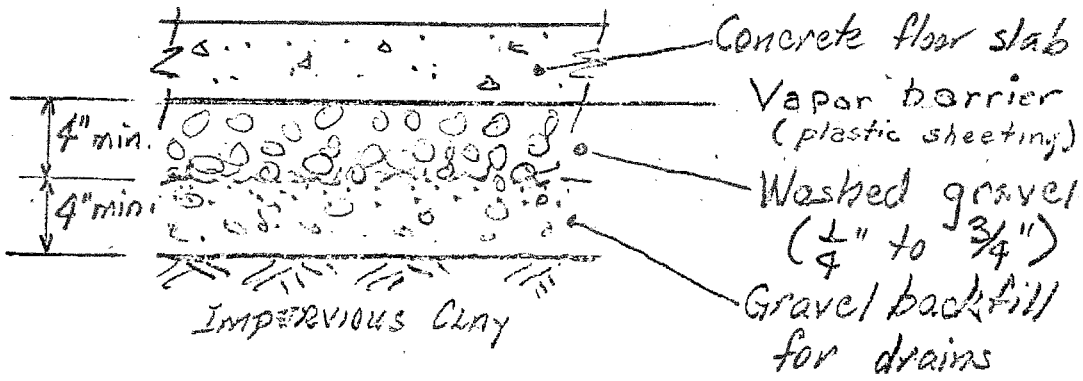
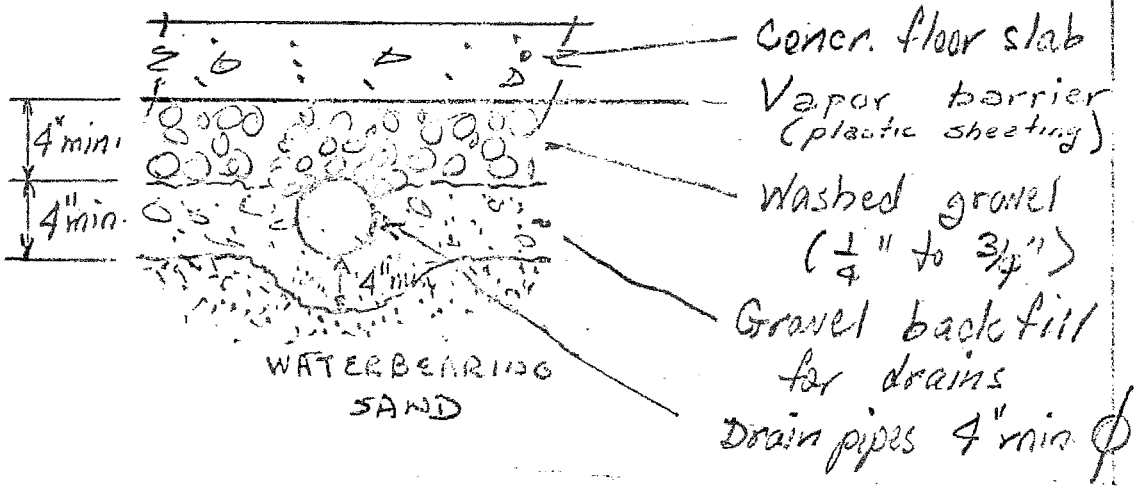
ATTENDANCE LIST

NAME	AFFILIATION
Harold K Loe	Durham Anderson Freed
Erwin Lorkko	Quinton-Burlong
Robert B Priest	Architect
Alvin Dreger	Architect
Tom Hickman	Archt-Nbrt.
Jack Christensen	S.E. - SHCR
H. Helle	" "
K.N. Johnson	T.E.S.C.
J.L. Schillinger	T.E.S.C.
Donald W Henderson	Dir. Eng & Arch.
Don Hanson	Hanson & Chelton Inc
Ted Litzenberger	Harris Reed & Litzenberger
M. Jellison	Kirk-Wallace-McKinley
R.P. Allred	Shannon & Wilson, Inc.
George Yamane	Shannon & Wilson, Inc
Thomas E. Kirkland	Shannon & Wilson, Inc.
Robert Abbott	" " "
Earl G. Sibley	" " "

UNDERFLOOR DRAINAGE – T.E.S.C.

Conditions: High water table and effective perimeter drain system.

A. Basement founded in impervious (clay) soils



B. Basement founded in waterbearing sand soils