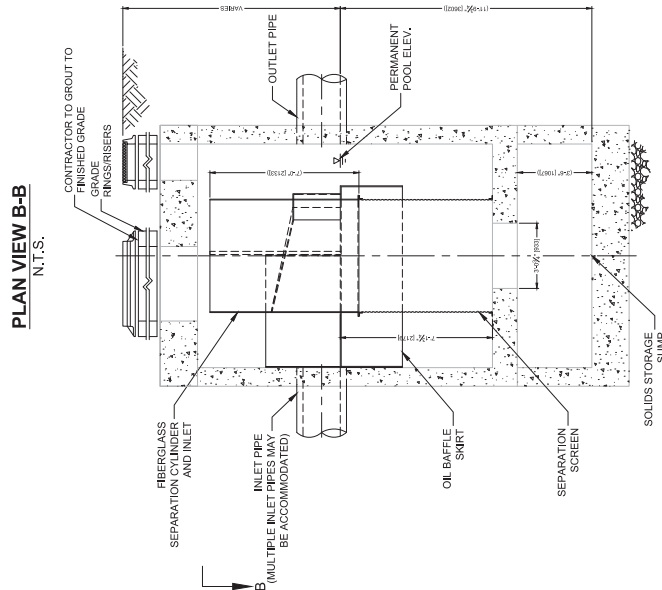
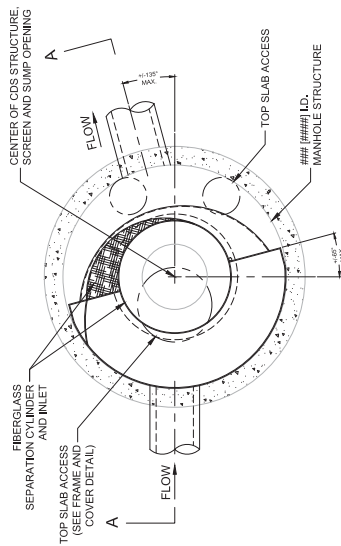


SITE SPECIFIC DATA REQUIREMENTS			
STRUCTURE ID			
WATER QUALITY FLOW RATE (GFS OR U/s)	*		
PEAK FLOW RATE (GFS OR U/s)	*		
RETURN PERIOD OF PEAK FLOW (YRS)	*		
SCREEN APERTURE (2400 OR 4700)	*		
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RM ELEVATION		*	*
ANTI-FLOTATION BALLAST	WIDTH		HEIGHT
		*	*
NOTES/SPECIAL REQUIREMENTS:			
* PER ENGINEER OF RECORD			

1. GENERAL NOTES
- 1.1. CONTRACTOR TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR FABRICATION DRAWINGS WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEER.
4. CSB WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET ASHTO H20 AND CASTINGS SHALL MEET H250 (ASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT OR BELOW THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. THE OUTLET PIPE SHALL BE 18" DIAMETER. THE PLATE IS SHOWN ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE OF CLEANING.

INSTALLATION NOTES

- ANSI, ALL NOTATIONS, BACKFILL, DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE DETERMINED BY THE ENGINEER OF RECORD.
- A. LIFTING CAPACITY SHALL BE SUFFICIENT TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
- B. LIFTING CAPACITY SHALL BE SUFFICIENT TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
- C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
- D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIER. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
- E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW INVERTS ARE GROUTED.

CONTECH
ENGINEERED SOLUTIONS LLC
www.contechcs.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 41099
600.238.4422 613.645.100 613.647.7002 FAX

CDS3035-6-C
ONLINE CDS
STANDARD DETAIL

FOR INFORMATION ONLY
PRELIMINARY 90% SUBMITTAL
NOT FOR CONSTRUCTION

FOR INFORMATION ONLY
PRELIMINARY 90% SUBMITTAL

PRELIMINARY 30% SUBMITTAL
NOT FOR CONSTRUCTION

CDS3025-6-C DESIGN NOTES

CDS3025-6-C RATED TREATMENT CAPACITY IS 2.5 CFS [70.8 L/s], OR PER LOCAL REGULATIONS, MAXIMUM HYDRAULIC INTERNAL BYPASS CAPACITY IS 20.0 CFS [566 L/s]. IF THE SITE CONDITIONS EXCEED 20.0 CFS [566 L/s], AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

THE STANDARD CDS3025-6-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION

GRATED INLET ONLY (NO INLET PIPE)

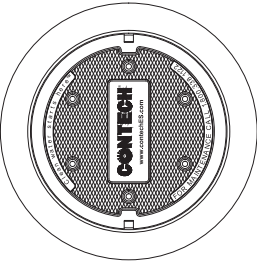
GRATED INLET WITH INLET PIPE OR PIPES

CURB INLET ONLY (NO INLET PIPE)

CURB INLET WITH INLET PIPE OR PIPES

SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)

SEDIMENT WEIR FOR INDEP / NJCAT CONFORMING UNITS

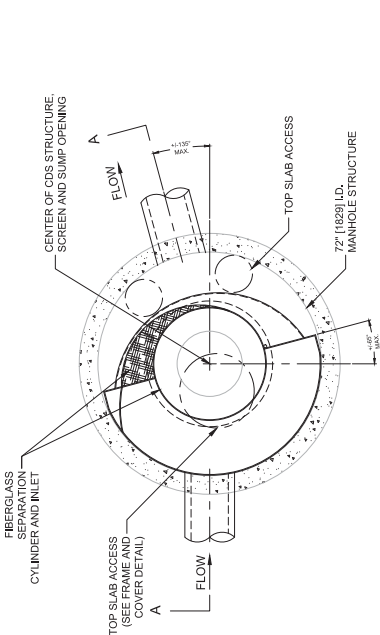


FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

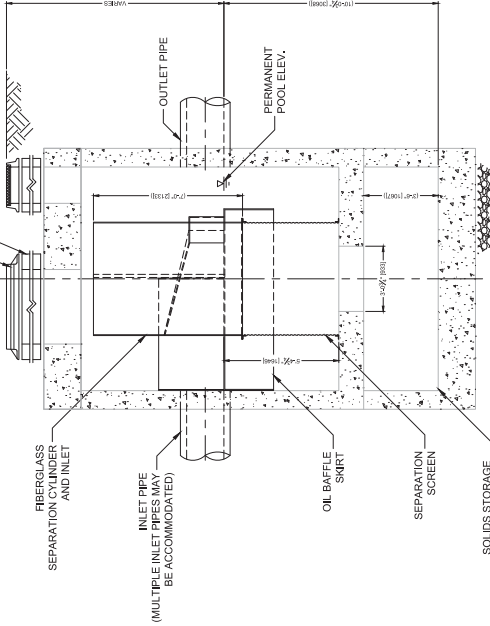
SITE SPECIFIC DATA REQUIREMENTS			
STRUCTURE ID			
* WATER QUALITY FLOW RATE (CFS OR L/s)			
* PEAK FLOW RATE (CFS OR L/s)			
* RETURN PERIOD OF PEAK FLOW (YRS)			
* SCREEN APERTURE (2400 OR 4700)			
PIPE DATA:			
I.E.		MATERIAL	
INLET PIPE 1		*	
INLET PIPE 2		*	
OUTLET PIPE		*	
RIM ELEVATION		*	
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
NOTES/SPECIAL REQUIREMENTS:			
* PER ENGINEER OF RECORD			

- GENERAL NOTES**
- FOR ALL MATERIALS, PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
 - FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEER.
 - SOLUTIONS LLC REPRESENTATIVE, www.conteches.com
 - CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
 - THE OUTLET PIPE INVERT ELEVATION ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
 - IF REQUIRED, PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
 - CDS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

- INSTALLATION NOTES**
- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
 - CONTRACTOR TO PROVIDE LIFTING AND BEACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
 - CONTRACTOR TO INSTALL GROUT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLY STRUCTURE.
 - CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
 - CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT. HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.



PLAN VIEW B-B
N.T.S.



ELEVATION A-A
N.T.S.

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WATER QUALITY SOLUTIONS LLC
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9025 Centre Pointe Dr., Suite 400, West Chester, OH 45389
800-332-1122 913-645-7000 913-645-7803 FAX

CDS3025-6-C
ONLINE CDS
STANDARD DETAIL

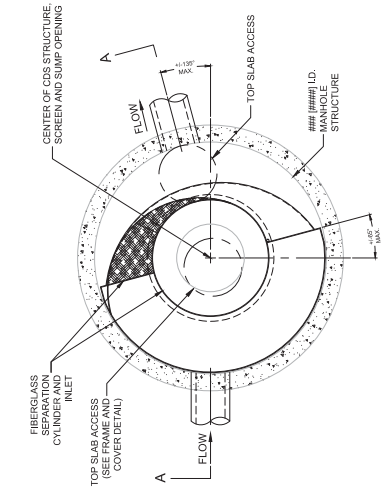
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6583 M11		SH 36 OF 42	
WEST SITCUM STORMWATER TREATMENT		DETAILS - HYDRODYNAMIC SEPARATOR - BASIN B	
APPROVED:		DIRECTOR ENG. DATE	
CHECKED BY DATE		PROJ. ENR DATE	
PRINTED BY: andrew Feb 01, 2018		PORT ADDRESS: ONE SITCUM PLAZA	
TACOMA, WA 98401-1837		DRAWING SCALE: AS NOTED	
PHASE: 90%		TOWNSHIP: 21N	
DATE: 2010.02.01		RANGE: 3E	
CONTRACT: 070664		SECTION: 33 & 34	
MID: 2010.02.01		VERT: MLLW	
PARCEL: SEC 002		DRAWING SCALE: AS NOTED	

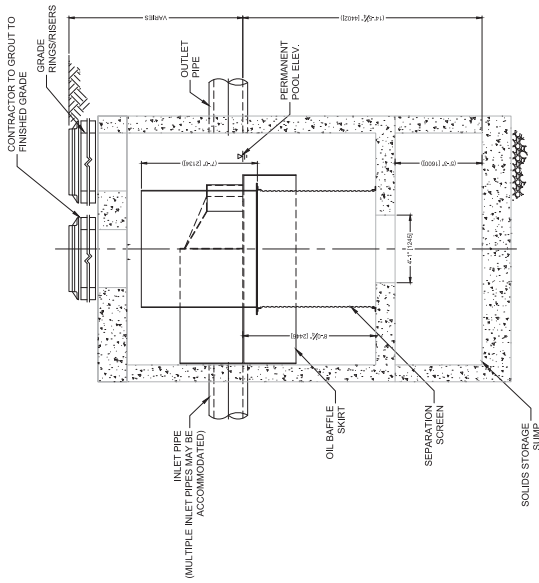
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MARK:	REVISION:	BY:	APPR:	DATE:

Parametrix
ENGINEERING PLANNING ENVIRONMENTAL SCIENCES
Port of Tacoma
1000 WEST TACOMA AVENUE, SUITE 1000, TACOMA, WA 98401-1837



PLAN VIEW B-B
N.T.S.



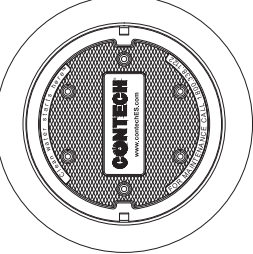
ELEVATION A-A
N.T.S.

CDS4040-8-C DESIGN NOTES

CDS4040-8-C RATED TREATMENT CAPACITY IS 6.0 CFS [166.9 L/s], OR PER LOCAL REGULATIONS, MAXIMUM HYDRAULIC INTERNAL BYPASS CAPACITY IS 30.0 CFS [850 L/s]. IF THE SITE CONDITIONS EXCEED 30.0 CFS [850 L/s], AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.
THE STANDARD CDS4040-8-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION

- GRATED INLET ONLY (NO INLET PIPE)
- GRATED INLET WITH INLET PIPE OR PIPES
- CURB INLET ONLY (NO INLET PIPE)
- CURB INLET WITH INLET PIPE OR PIPES
- SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
- SEDIMENT WEIR FOR INDEP / NJICAT CONFORMING UNITS



SITE SPECIFIC
DATA REQUIREMENTS

STRUCTURE ID	WATER QUALITY FLOW RATE (CFS OR L/s)	PEAK FLOW RATE (CFS OR L/s)	RETURN PERIOD OF PEAK FLOW (YRS)	SCREEN APERTURE (2400 OR 4700)
	*	*	*	*
PIPE DATA:	I.E.	MATERIAL	DIAMETER	
INLET PIPE 1	*	*	*	*
INLET PIPE 2	*	*	*	*
OUTLET PIPE	*	*	*	*
RIM ELEVATION				*
ANTI-FLOTATION BALLAST				*
NOTES/SPECIAL REQUIREMENTS:				*
* PER ENGINEER OF RECORD				

FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

- GENERAL NOTES
- CONTECH SHALL PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
 - DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
 - FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEER.
 - SOLUTIONS LLC REPRESENTATIVE. www.conteches.com
 - CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
 - CONTRACTOR TO PROVIDE SUFFICIENT LIFTING CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
 - AT OR BELOW THE OUTLET PIPE INVERT ELEVATION, ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION, REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
- INSTALLATION NOTES
- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
 - CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
 - CONTRACTOR TO PROVIDE SUFFICIENT LIFTING CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
 - CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES, WATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
 - CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH
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www.conteches.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-332-1122 513-845-7000 513-845-7803 FAX

CDS4040-8-C
ONLINE CDS
STANDARD DETAIL

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6583 M12 SH 37 OF 42	CONT./CONS: 070664	TOWNSHIP: 21N	RANGE: 3E	SECTIONS: 33 & 34	VERT: M.L.W.	PORT ADDRESS: ONE SITUUM PLAZA	PRINTED BY: andrew Feb 01, 2018	DIRECTOR ENG. DATE	CHECKED BY DATE	APPROVED:
	M. ID: 201024.01	DATE-HRZ: WA83-S	VERT: M.L.W.	SECTIONS: 33 & 34	PORT ADDRESS: ONE SITUUM PLAZA	PRINTED BY: andrew Feb 01, 2018	DIRECTOR ENG. DATE	CHECKED BY DATE	APPROVED:	
	PHASE: 90%	DRAWING SCALE: AS NOTED	TACOMA, WA 98401-1837	DATE	DATE	DATE	DATE	DATE	DATE	DATE
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Parametrix
ENGINEERING PLANNING DESIGN ENVIRONMENTAL SCIENCES

Tacoma
PORT OF TACOMA

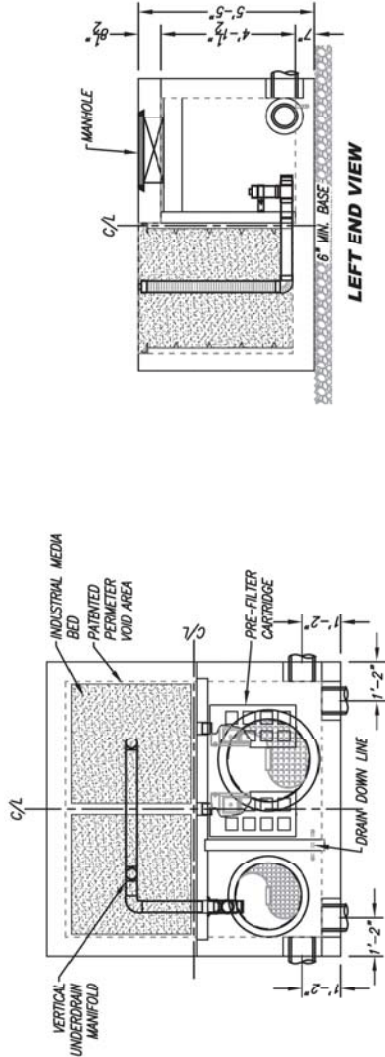
SITE SPECIFIC DATA	
PROJECT NUMBER	6543
PROJECT NAME	MWSA - PORT OF TACOMA - WEST SITTUM
PROJECT LOCATION	TACOMA, WA
STRUCTURE ID	-----
TREATMENT REQUIRED	
VOLUME BASED (CF)	FLOW BASED (GFS)
TREATMENT HIL AVAILABLE (FT)	
PEAK BYPASS REQUIRED (CFS) - IF APPLICABLE	N/A
PIPE DATA	I.E. MATERIAL OFFLINE DIAMETER
INLET PIPE 1	----- PVC 8"
INLET PIPE 2	N/A N/A N/A
OUTLET PIPE	----- PVC 8"
PRETREATMENT	BIOFILTRATION DISCHARGE
RIM ELEVATION	-----
SURFACE LOAD	N/A PEDESTRIAN
FRAME & COVER	#30" N/A #24"
INDUSTRIAL MEDIA VOLUME (CY)	5.63
INDUSTRIAL MEDIA DELIVERY METHOD	PER CONTRACT
ORIFICE SIZE (O/A INCHES)	#2.17"
NOTES: PRELIMINARY, NOT FOR CONSTRUCTION. INDUSTRIAL MEDIA MAX. REQUIRED.	

INSTALLATION NOTES

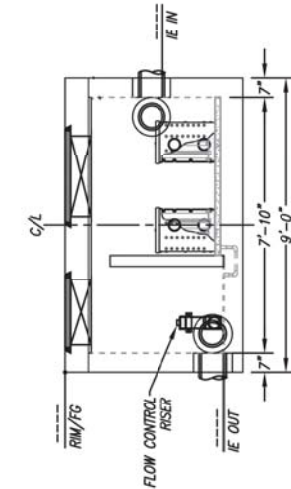
- CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
- UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
- ALL PIPES MUST BE FLOSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLOSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PREP MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
- CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
- CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
- DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.
- CONTRACTOR RESPONSIBLE FOR CONTACTING MODULAR WETLANDS FOR ACTIVATION OF UNIT. MANUFACTURES WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A MODULAR WETLANDS REPRESENTATIVE.

GENERAL NOTES

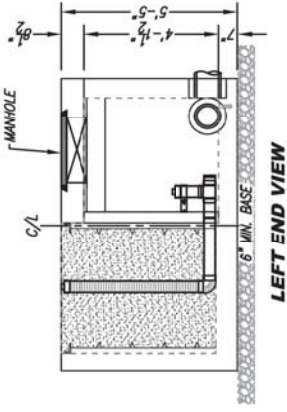
- MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
- ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.



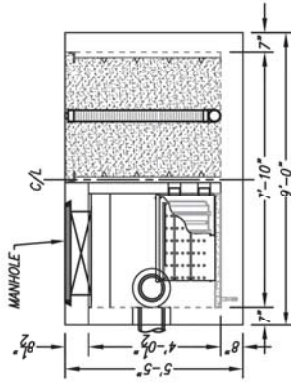
PLAN VIEW



ELEVATION VIEW



LEFT END VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.231
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/ST)	2.0
INDUSTRIAL MEDIA LOADING RATE (GPM/ST)	1.0

MWS-L-8-8-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

PROPRIETARY AND CONFIDENTIAL:
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF MODULAR WETLANDS SYSTEMS. ANY REPRODUCTION IN WHOLE OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF MODULAR WETLANDS SYSTEMS IS FORBIDDEN.

THIS PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS: 7,405,262; 7,410,362; 7,674,179; 8,031,616; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING.

1/1/2017

6543

M13

SH 30 OF 42

CONTS/CONS: 201024.01

DATE: 201024.01

PHASE: 90%

WEST SITTUM

STORMWATER TREATMENT

DETAIL - MWS-L-8-8-V-HC

APPROVED:

CHECKED BY DATE

PROJ. ENGR DATE

PRINTED BY: andrew.fab 01.2018

PORT ADDRESS: ONE SITTUM PLAZA

TACOMA, WA 98401-1837

DRAWING SCALE: AS NOTED

PARCEL: SEE 002

MARK: REVISION:

BY:

APPR: DATE:

Parametrix

PORT OF TACOMA

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1/1/2017

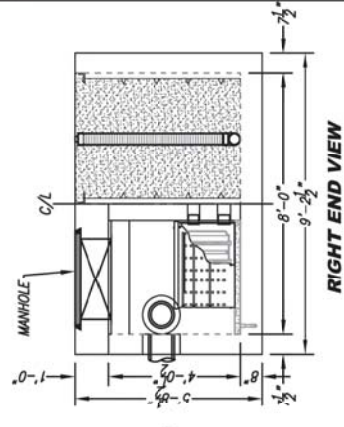
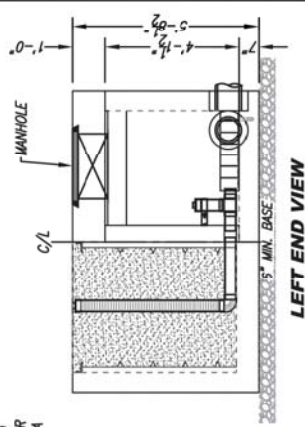
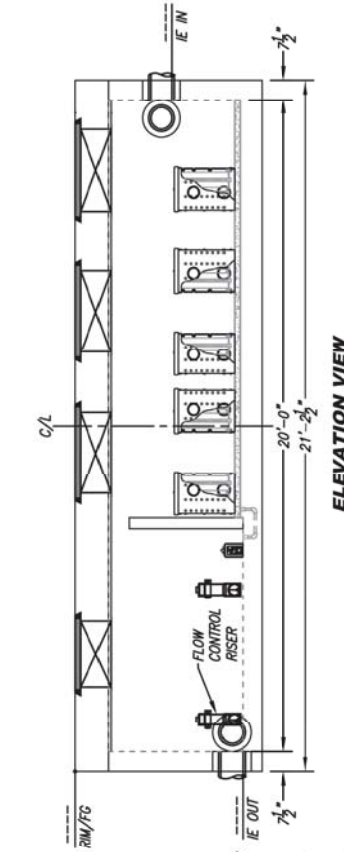
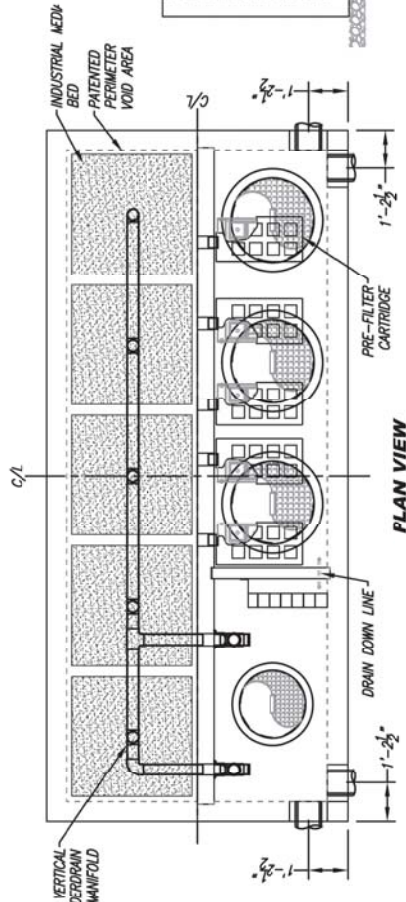
SITE SPECIFIC DATA									
PROJECT NUMBER	6543								
PROJECT NAME	NW5A - PORT OF TACOMA - WEST SITUM								
PROJECT LOCATION	TACOMA, WA								
STRUCTURE ID	-----								
TREATMENT REQUIRED									
VOLUME BASED (CF)		FLOW BASED (GFS)		N/A					
TREATMENT HGL AVAILABLE (FT)									
PEAK BYPASS REQUIRED (GFS) - IF APPLICABLE									
PIPE DATA		I.E.		MATERIAL		DIAMETER			
INLET PIPE 1		-----		PVC		8"			
INLET PIPE 2		N/A		N/A		N/A			
OUTLET PIPE		-----		PVC		8"			
PRETREATMENT		BIOFILTRATION		DISCHARGE					
RIM ELEVATION		-----		-----					
SURFACE LOAD		PEDESTRIAN		N/A					
FRAME & COVER		3 EA #30"		N/A					
INDUSTRIAL MEDIA VOLUME (CY)		14.93						F5R CONTRACT	
INDUSTRIAL MEDIA DELIVERY METHOD		3 EA #2.43"							
ORIFICE SIZE (DIA. INCHES)		INDUSTRIAL MEDIA							
NOTES: PRELIMINARY, NOT FOR CONSTRUCTION. INDUSTRIAL MEDIA MIX REQUIRED.									

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND ACCESSORIES REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GUTTERS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT. PIP MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING MODULAR WETLANDS FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A MODULAR WETLANDS REPRESENTATIVE.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.



TREATMENT FLOW (CFS)	0.577
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
INDUSTRIAL MEDIA LOADING RATE (GPM/SF)	1.0

BioClean
A Forterra Company

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 PROPERTY OF MODULAR METALLOS SYSTEMS. ANY
 REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN
 PERMISSION OF MODULAR METALLOS SYSTEMS IS PROHIBITED.

THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378 & 12,181,616; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.

2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

MWS-L-8-20-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

PRELIMINARY 90% SUBMITTAL
NOT FOR CONSTRUCTION

[illegible]

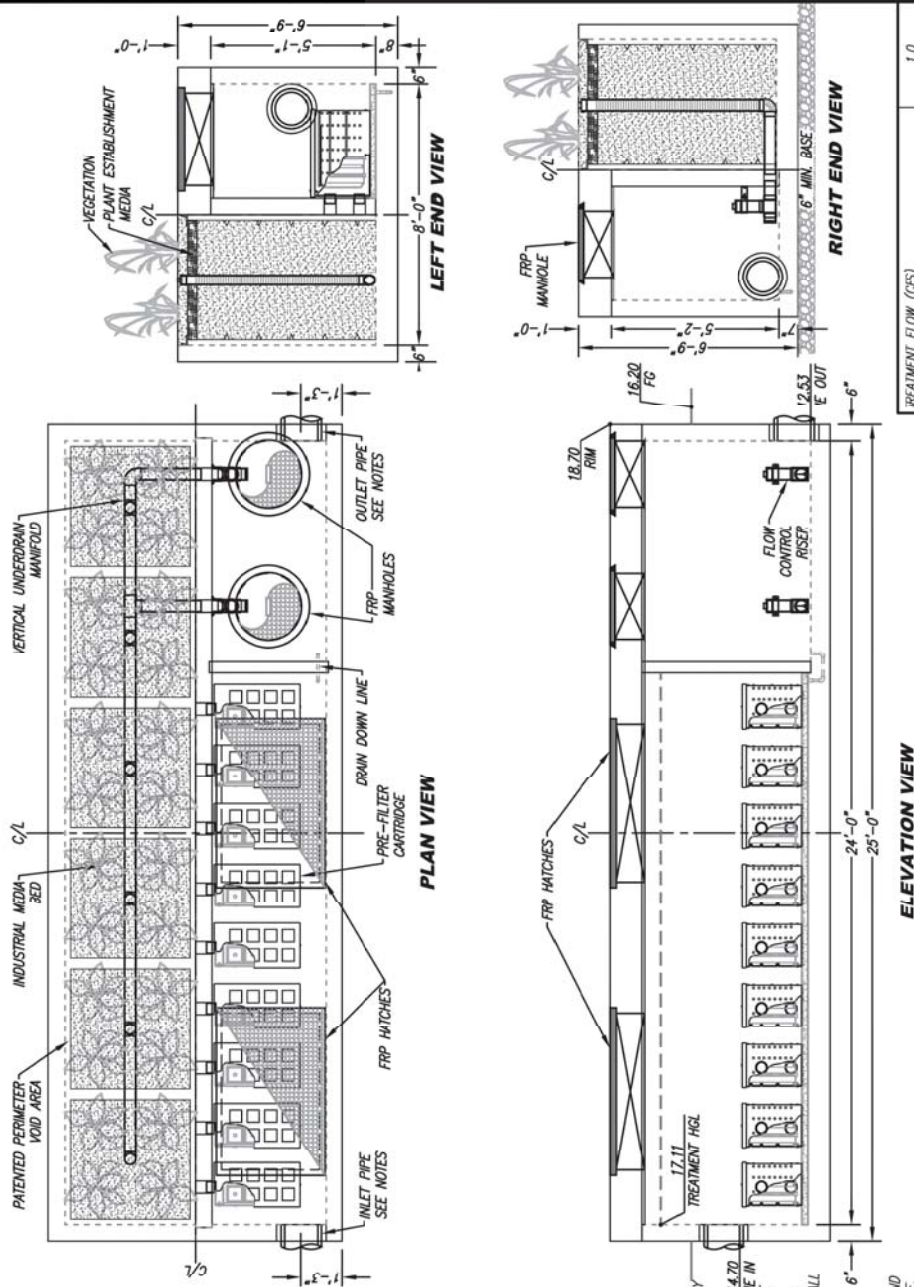
SITE SPECIFIC DATA				
PROJECT NUMBER				
PROJECT NAME				
PROJECT LOCATION				
STRUCTURE ID				
	TREATMENT REQUIRED			
	VOLUME BASED (CF)		FLOW BASED (CFS)	
	TREATMENT HOL AVAILABLE (FT)			N/A
	PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL		DIAMETER
INLET PIPE 1		N/K		N/K
INLET PIPE 2		N/A		N/A
OUTLET PIPE		N/K		N/K
	PRETREATMENT	BIOFILTRATION		DISCHARGE
RIM ELEVATION				
SURFACE LOAD				
FRAME & COVER				
INDUSTRIAL MEDIA VOLUME (CY)				
INDUSTRIAL MEDIA DELIVERY METHOD				FFR CONTRACT
ORifice SIZE (ODA INCHES)				
NOTES: PRELIMINARY, NOT FOR CONSTRUCTION. INDUSTRIAL MEDIA MIX REQUIRED.				

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT. PEP MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION. CONTRACTOR RESPONSIBLE FOR CONTACTING MODULAR WETLANDS FOR PROPER ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A MODULAR WETLANDS REPRESENTATIVE.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.



TREATMENT FLOW (GFS)	1.0
OPERATING HEAD (FT)	4.9
PRETREATMENT LOADING RATE (GPM/SF)	1.9
INDUSTRIAL MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-24-V-HC
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

Bio Clean
A Forterra Company

THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF MODULAR WELDING SYSTEMS. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF MODULAR WELDING SYSTEMS IS PROHIBITED.

PRELIMINARY 90% SUBMITTAL
NOT FOR CONSTRUCTION

ABBREVIATIONS		PLAN SYMBOLS		SINGLE LINE SYMBOLS		LOOP WIRING/ELEMENTARY DIAGRAM SYMBOLS	
GRS GALVANIZED RIGID STEEL	PWR POWER	— P — OVERHEAD POWER LINE (SEE NOTES P2 & P3)	— P — UNDERGROUND POWER (SEE NOTES P2 & P3)	— GROUND CONNECTION	— GROUND CONNECTION	— FUSE, RATING IN AMPERES	— BUS STAB ON MCC, CORD & PLUG CONNECTION FOR MOTORS
HH HAND-OPERATED	RPT RELOCATED	— UNDERGROUND DUCT LINE (CONC. ENCLOSURE)	— UNDERGROUND DUCT LINE (CONC. ENCLOSURE)	— SWITCH, 3 POLE EXCEPT WHERE NOTED. RATING IN AMPERES AS NOTED (NOTE 1)	— SWITCH, 3 POLE EXCEPT WHERE NOTED. RATING IN AMPERES AS NOTED (NOTE 1)	— MOTOR	— THERMAL OVERLOAD
HPS HIGH PRESSURE SODIUM	RT REPEAT CYCLE TIMER	— UNDERGROUND DIRECT	— UNDERGROUND DIRECT	— TEST SWITCH WITH SHORTING BLOCK	— TEST SWITCH WITH SHORTING BLOCK	— ELAPSED TIME METER	— BUZZER
HTR HEAT TAPE, HEAT TRACE	SCCR SHORT CIRCUIT RATING	— UNDERGROUND CONDUIT CONCEALED IN FLOOR, WALL OR CEILING	— UNDERGROUND CONDUIT CONCEALED IN FLOOR, WALL OR CEILING	— AUTOMATIC TRANSFER SWITCH 3 POLE, RATING AS NOTED	— AUTOMATIC TRANSFER SWITCH 3 POLE, RATING AS NOTED	— HORN	— BELL
HV HERTZ (CYCLES PER MIN)	SCR SEMI CONDUCTOR RECTIFIER	— EXPOSED CONDUIT	— EXPOSED CONDUIT	— SHUNT TRIP	— SHUNT TRIP	— CIRCUIT BREAKER	— CIRCUIT BREAKER
IND LT INDICATING LIGHT	SD SIGNAL DETECTOR	— CALLOUT INDICATING CONDUIT SIZE, NUMBER OF CONDUITS, AND SIZE OF CONDUIT	— CALLOUT INDICATING CONDUIT SIZE, NUMBER OF CONDUITS, AND SIZE OF CONDUIT	— FUSE CUTOFF	— FUSE CUTOFF	— SOLENOID VALVE	— SOLENOID VALVE
INSR INTRINSICALLY SAFE	SG SIGNAL	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— SURGE ARRESTER	— SURGE ARRESTER	— PUSH-TO-TEST	— PUSH-TO-TEST
ISB INPUT/OUTPUT SAFETY	SPD SIGNAL PROTECTION	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CURRENT TRANSFORMER	— CURRENT TRANSFORMER	— INDICATING LIGHT	— INDICATING LIGHT
ISG INTRINSICALLY SAFE	SPST SINGLE POLE, SINGLE THROW	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— VOLTAGE TRANSFORMER	— VOLTAGE TRANSFORMER	— LIMIT SWITCHES	— LIMIT SWITCHES
ISR INTRINSICALLY SAFE	SST SIGNAL SWITCH	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— POWER OR DISTRIBUTION TRANSFORMER RATING AS NOTED	— POWER OR DISTRIBUTION TRANSFORMER RATING AS NOTED	— CLOSE ON REACHING LIMIT	— CLOSE ON REACHING LIMIT
JB JUNCTION BOX	SW SWITCH	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— MOTOR, NUMBER INDICATES HORSEPOWER	— MOTOR, NUMBER INDICATES HORSEPOWER	— CLOSE ON LEAVING LIMIT	— CLOSE ON LEAVING LIMIT
KB KILOVOLT	SWB SWITCHBOARD	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— GENERATOR	— GENERATOR	— TIMED CONTACTS	— TIMED CONTACTS
KV KILOVOLTS	SYN SYNCHRONIZING	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— BUS STAB ON MCC OR SWITCHGEAR, CORD & PLUG CONNECTION FOR MOTORS	— BUS STAB ON MCC OR SWITCHGEAR, CORD & PLUG CONNECTION FOR MOTORS	— SYMBOL NORMAL	— SYMBOL NORMAL
KVA KILOVOLT AMPERES	TEL TELEPHONE	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— THERMAL OVERLOAD	— THERMAL OVERLOAD	— OPEN	— OPEN
KVARH KILOVOLT AMPERES REACTIVE HOURS	TER TERMINAL	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— SWITCH, 3-POLE	— SWITCH, 3-POLE	— CLOSED	— CLOSED
KWH KILOWATT HOURS	TR TRANSFORMER	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— AMMETER	— AMMETER	— INSTANTANEOUS	— INSTANTANEOUS
LC LIGHTING	TVSS TRANSIENT VOLTAGE SUPPRESSOR	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— VOLT-METER	— VOLT-METER	— CLOSED	— CLOSED
LP LIGHTING PANEL	UPS UNINTERRUPTIBLE POWER SUPPLY	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— WATT-HOUR METER	— WATT-HOUR METER	— INSTANTANEOUS	— INSTANTANEOUS
LP LIGHTING PANEL	VA VOLT-AMPERES	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— WATT-METER	— WATT-METER	— CLOSED	— CLOSED
LP LIGHTING PANEL	VFD VARIABLE FREQUENCY DRIVE	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— CONDUIT RATING, HATCH MARKS INDICATE NUMBER OF #12 CONDUCTORS, NO HATCH MARKS INDICATE #12 AND (1) #10 GND (2) #12 AND (1) #10 GND	— WATT-METER	— WATT-METER	— CLOSED	— CLOSED



- NOTES:**

PCP-A1 LOAD CALCULATIONS

PCP-B1 LOAD CALCULATIONSPCP-C1 LOAD CALCULATIONS

② ONE-LINE DIAGRAM & LOAD CALCULATIONS

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NOT FOR CONSTRUCTION

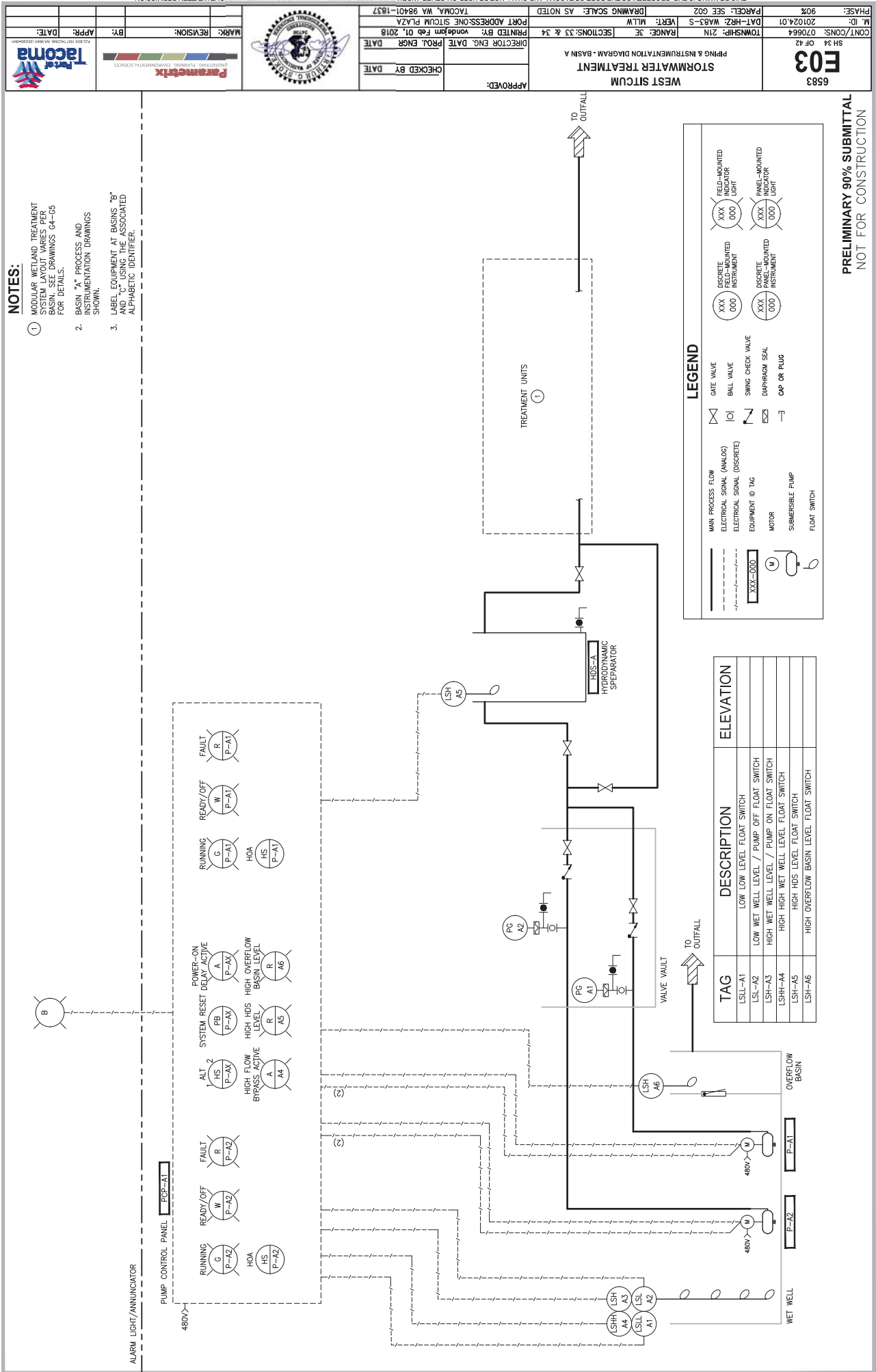


Tacoma
Port



APPROVED:	CHECKED BY _____ DATE _____
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6583
E02
SH 33 OF 42



ALARM LIGHT/ANNUNCIATOR

PUMP CONTROL PANEL: POP-A1

480V

WET WELL

VALVE VAULT

TO OUTFALL

OVERFLOW BASIN

HYDRODYNAMIC SEPARATOR

TREATMENT UNITS

TO OUTFALL

LSL-A1

LSL-A2

LSH-A3

LSH-A4

LSH-A5

LSH-A6

PC-A1

PC-A2

SH-A1

SH-A2

SH-A3

SH-A4

SH-A5

SH-A6

PC-A1

PC-A2

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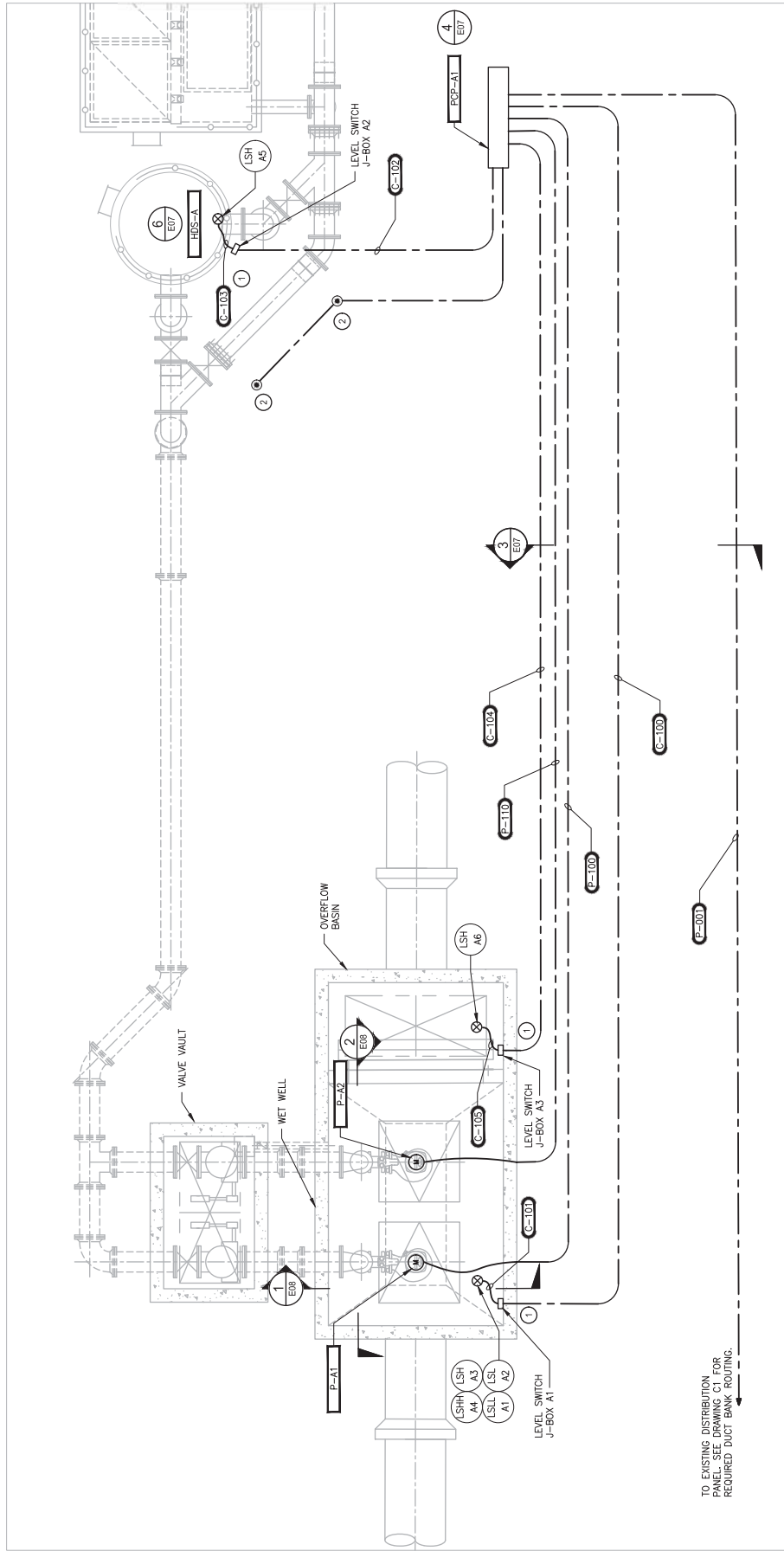
SH-A4

SH-A5

SH-A6

PC-A1

PC-A2



ELECTRICAL SITE PLAN - BASIN A
SCALE: 3/8" = 1'

PRELIMINARY 90% SUBMITTAL
NOT FOR CONSTRUCTION

E04

6583

CONT/CONS: 070664

CONT/CONS: 070664

CONT/CONS: 070664

CONT/CONS: 070664

TO EXISTING DISTRIBUTION
PANEL. SEE DRAWING C1 FOR
REQUIRED DUCT BANK ROUTING.

**WEST SITCUM
STORMWATER TREATMENT
ELECTRICAL SITE PLAN - BASIN A**

APPROVED:

CHECKED BY	DATE
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PRINTED BY: vondejam Feb 01, 2018

PRINTED BY: vondejam Feb 01, 2018

PRINTED BY: vondejam Feb 01, 2018

PRINTED BY: vondejam Feb 01, 2018

PRINTED BY: vondejam Feb 01, 2018

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NOTES:

- ① NATIONAL ELECTRIC CODE CLASS 1, DIVISION 2, GROUP D HAZARDOUS AREA. ALL EQUIPMENT SHALL BE RATED ACCORDINGLY.
- ② PROVIDE #2/0 BARE COPPER GROUNDING CONDUCTOR. ATTACH TO GROUND RODS PER DETAIL ①.

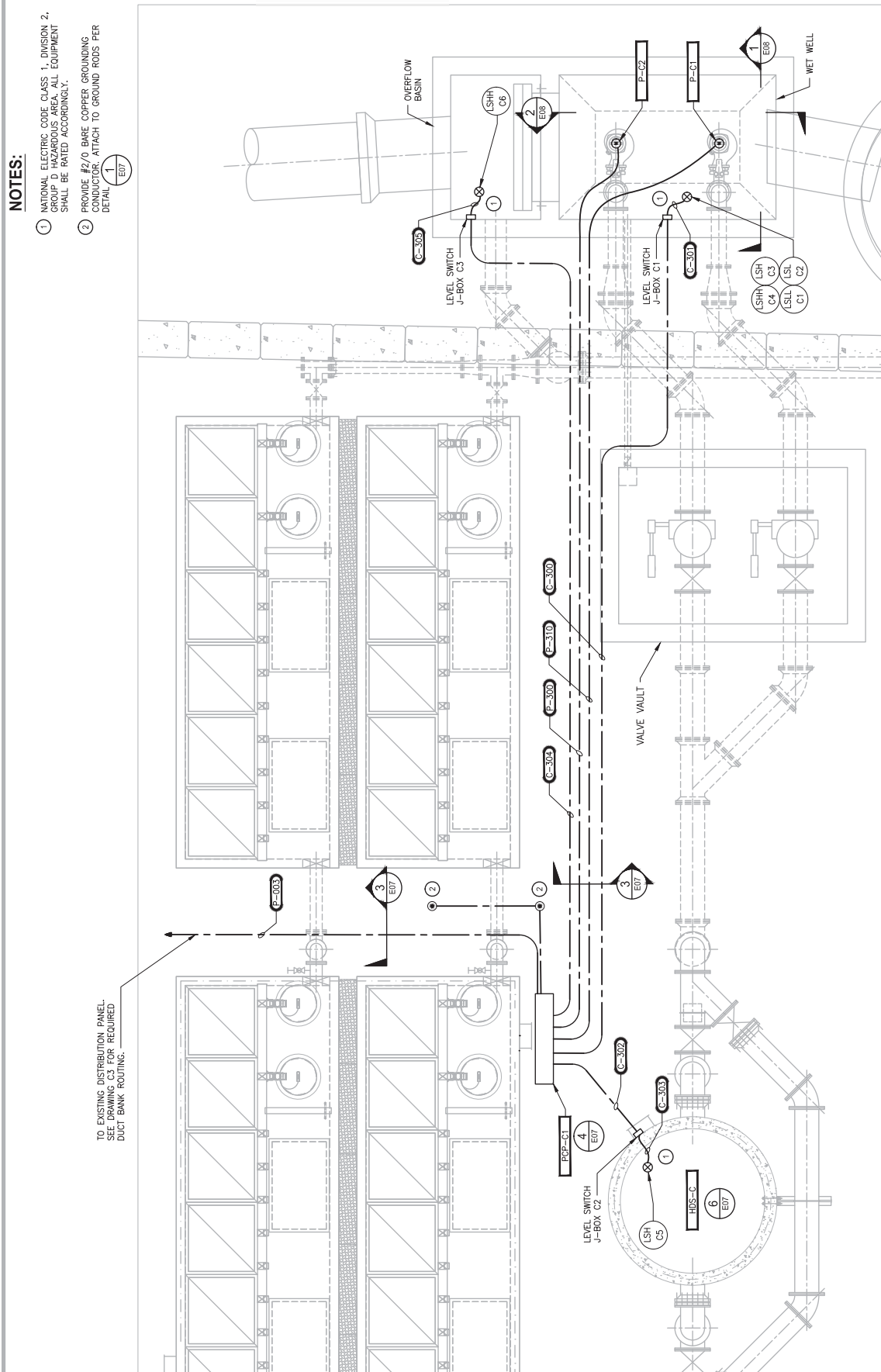


PRELIMINARY 90% SUBMITTAL
NOT FOR CONSTRUCTION

ELECTRICAL SITE PLAN - BASIN B

SCALE: 1" = 3'

6583		E05		CONT/CONS: 0742		PHASE: 90%	
TOWNSHIP: 21N		RANGE: 3E		SECTIONS: 33 & 34		PORT ADDRESS: ONE SITUUM PLAZA	
DATE: 2012.01.01		DAT-HRZ: WAB-5		VERT: MTLW		TACOMA, WA 98401-1837	
PARCEL: SEC 002		DRAWING SCALE: AS NOTED					
APPROVED:		DIRECTOR ENG. DATE		CHECKED BY DATE		PRINTED BY: vondaeng Feb 01, 2018	
WEST SITUUM		PLOL ENGR DATE					
STORMWATER TREATMENT							
ELECTRICAL SITE PLAN - BASIN B							
							
							
PLANNING, ENGINEERING, ENVIRONMENTAL SCIENCES							
APPR: DATE:		BY:		REVISION:		MARK:	



NOTES:

- ① NATIONAL ELECTRIC CODE CLASS 1, DIVISION 2, GROUP D HAZARDOUS AREA. ALL EQUIPMENT SHALL BE RATED ACCORDINGLY.
- ② PROVIDE #2/0 BARE COPPER GROUNDING CONDUCTOR. ATTACH TO GROUND RODS PER SECTION 250.68.

TO EXISTING DISTRIBUTION PANEL.
SEE DRAWING C3 FOR REQUIRED
DUCT BANK ROUTING.

ELECTRICAL SITE PLAN - BASIN C
SCALE: 3/8" = 1'

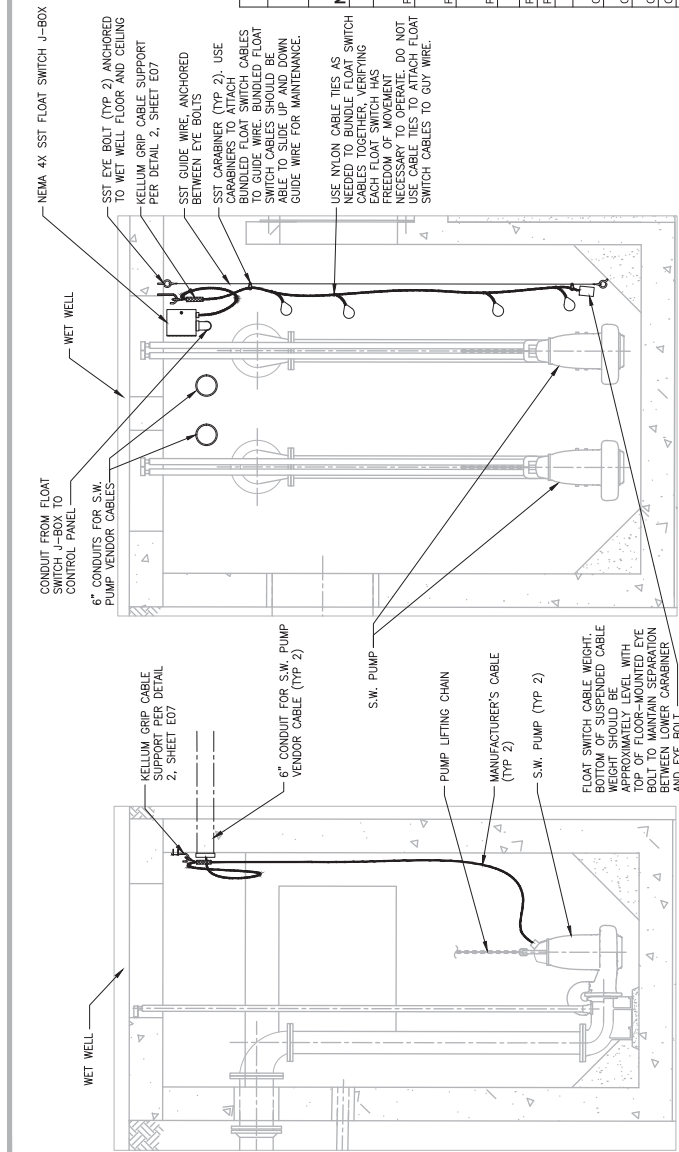
PRELIMINARY 90% SUBMITTAL
NOT FOR CONSTRUCTION

[illegible]



- PRELIMINARY 90% SUBMITTAL**
NOT FOR CONSTRUCTION

6583		WEST SITCUM		APPROVED:		PRINTED BY: wondanah Feb 01, 2018 PORT ADDRESS: ONE SITCUM PLAZA TACOMA, WA 98401-1837				MARK: REVISION: BY:		APPR. DATE:	
6583 SH -- 40' x 42' E07		ELECTRICAL DETAILS - GENERAL STORMWATER TREATMENT		CHECKED BY DATE		PLOT ENGR DATE		CONT/CONS: 070684 PHASE: 201024-01 M-IDE: 90%		6583 SH -- 40' x 42' E07		6583 SH -- 40' x 42' E07	



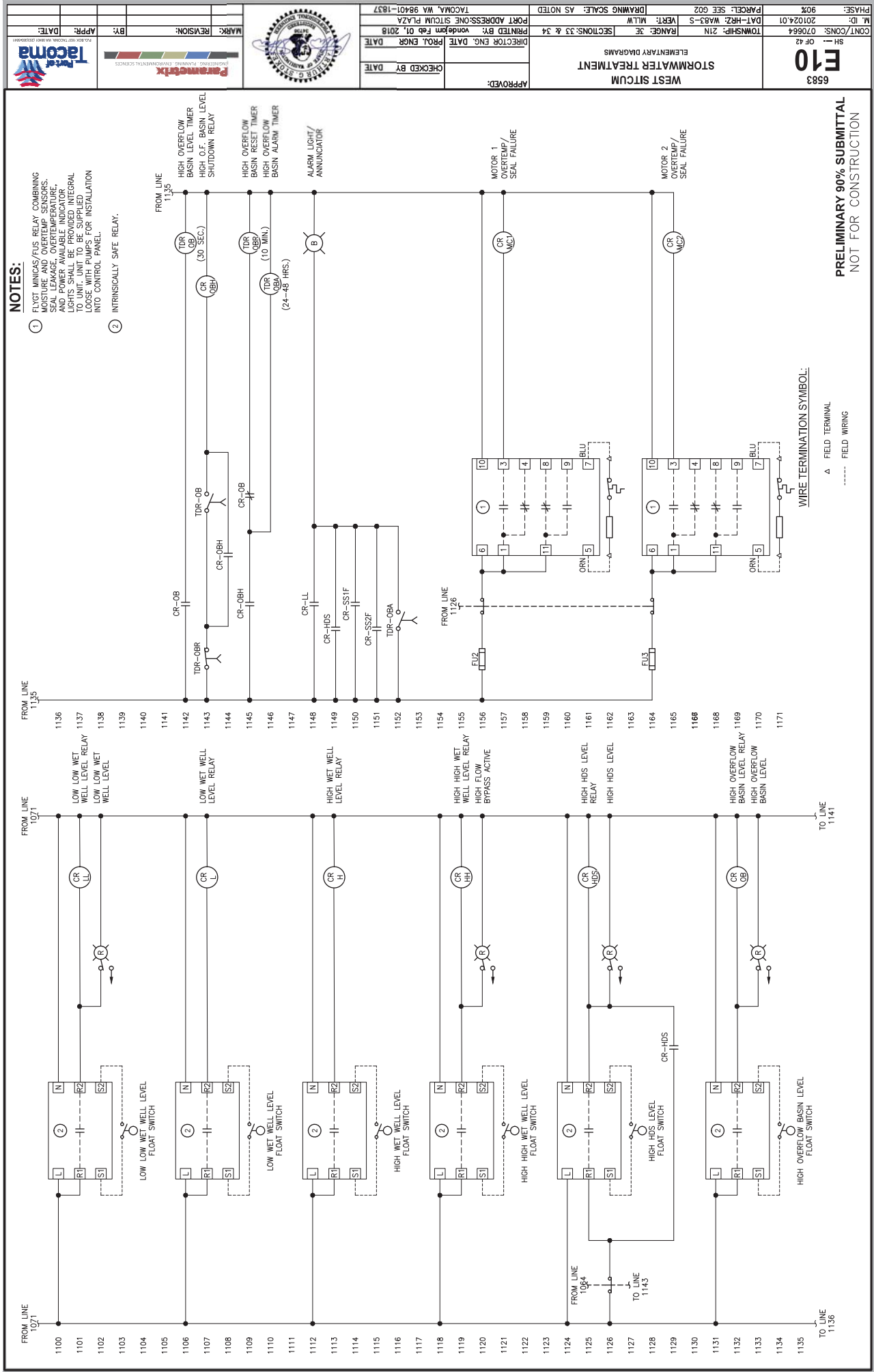
NOTES:

- ① DETAIL IS A TYPICAL ARRANGEMENT. USE THE BASIN ELECTRICAL SITE PLANS TO DETERMINE ACTUAL LOCATIONS OF ELECTRICAL EQUIPMENT.

CONDUIT AND WIRE SCHEDULE

				CONDUIT	CABLE SIZE & QUANTITY			
NUMBER	FROM	TO		SIZE (")	POWER	CONTROL	SIGNAL	COMMENTS
MAIN FEEDS								
P-001	EXISTING DISTRIBUTION PANEL	PCP-A1		1-1/4"	3#3, #6G			
	EXISTING DISTRIBUTION PANEL	PCP-B1		1-1/4"	3#3, #6G			
P-003	EXISTING DISTRIBUTION PANEL	PCP-C1		1-1/4"	3#3, #6G			
BASIN - A								
P-100	PCP-A1	S/W,PUMP 1 (P-A1)		6"	PUMP PLUG			VENDOR CABLE
P-110	PCP-A1	S/W,PUMP 2 (P-A2)		6"	PUMP PLUG			VENDOR CABLE
C-100	PCP-A1	J-B0X-A1 (FOR LEVEL SWITCHES)		3/4"		8#14, #14G		VENDOR CABLE
C-101	J-B0X-A1	LSL-A1, LSL-A2, LSH-A3, LSH-H-4		3/4"		(4) MFR CABLE		VENDOR CABLE
C-102	PCP-A1	J-B0X-A2		3/4"		2#14, #14G		VENDOR CABLE
C-103	J-B0X-A2	LSH-A3		3/4"		(1) MFR CABLE		VENDOR CABLE
C-104	PCP-A1	J-B0X-A3		3/4"		2#14, #14G		VENDOR CABLE
C-105	J-B0X-A3	LSH-A6		3/4"		(1) MFR CABLE		VENDOR CABLE
BASIN - B								
P-200	PCP-B1	S/W,PUMP 1 (P-B1)		6"	PUMP PLUG			VENDOR CABLE
P-210	PCP-B1	S/W,PUMP 2 (P-B2)		6"	PUMP PLUG			VENDOR CABLE
C-200	PCP-B1	J-B0X-B1 (FOR LEVEL SWITCHES)		3/4"		8#14, #14G		VENDOR CABLE
C-201	J-B0X-B1	LSL-B1, LSL-A2, LSH-B3, LSH-H-4		3/4"		(4) MFR CABLE		VENDOR CABLE
C-202	PCP-B1	J-B0X-B2		3/4"		2#14, #14G		VENDOR CABLE
C-203	J-B0X-B2	LSH-B5		3/4"		(1) MFR CABLE		VENDOR CABLE
C-204	PCP-B1	J-B0X-B3		3/4"		2#14, #14G		VENDOR CABLE
C-205	J-B0X-B3	LSH-B6		3/4"		(1) MFR CABLE		VENDOR CABLE
BASIN - C								
P-300	PCP-C1	S/W,PUMP 1 (P-C1)		6"	PUMP PLUG			VENDOR CABLE
P-310	PCP-C1	S/W,PUMP 2 (P-C2)		6"	PUMP PLUG			VENDOR CABLE
C-300	PCP-C1	J-B0X-C1 (FOR LEVEL SWITCHES)		3/4"		8#14, #14G		VENDOR CABLE
C-301	J-B0X-C1	LSL-C1, LSL-C2, LSH-C3, LSH-H-4		3/4"		(4) MFR CABLE		VENDOR CABLE
C-302	PCP-C1	J-B0X-C2		3/4"		2#14, #14G		VENDOR CABLE
C-303	J-B0X-C2	LSH-C5		3/4"		(1) MFR CABLE		VENDOR CABLE
C-304	PCP-C1	J-B0X-C3		3/4"		2#14, #14G		VENDOR CABLE
C-305	J-B0X-C3	LSH-C6		3/4"		(1) MFR CABLE		VENDOR CABLE

PRELIMINARY 90% SUBMITTAL
NOT FOR CONSTRUCTION



PRELIMINARY 90% SUBMITTAL
NOT FOR CONSTRUCTION

Geotechnical Report



HWA GEOSCIENCES INC.

Geotechnical & Pavement Engineering • Hydrogeology • Geoenvironmental • Inspection & Testing

January 24, 2018

HWA Project No. 2017-148-21

Parametrix, Inc.

60 Washington Avenue, Suite 390

Bremerton, Washington 98337

Attention: Ms. Cedar Simmons, P.E.

**SUBJECT: GEOTECHNICAL REPORT
West Sitcum Stormwater Treatment
Port of Tacoma
Tacoma, Washington**

Dear Cedar:

This report presents geotechnical recommendations for three stormwater treatment pump stations in Basins A, B, and C within the West Sitcum terminal of the Port of Tacoma in Tacoma, Washington. The purpose of this work was to evaluate the soil and ground water conditions at each site and provide geotechnical recommendations for design and construction of the proposed facilities.

PROJECT SCOPE AND AUTHORIZATION

Our scope of work was performed in general accordance with our scope email dated December 13, 2017 and per the subconsultant agreement executed December 22, 2017. Our work consisted of advancing three borings to depths of 40 feet, performing engineering analyses for temporary shoring, buoyancy, and seismic liquefaction, and preparation of this report.

PROJECT & SITE DESCRIPTION

The West Sitcum terminal is located in the Port of Tacoma between the Puyallup River and the Sitcum Waterway (see Vicinity Map, Figure 1). The terminal consists of a paved container yard, with cranes along the Sitcum Waterway on the northeastern shore. Stormwater is presently collected from three drainage basins and piped to the Sound. We understand the Northwest Seaport Alliance plans to build a stormwater treatment plant (SWTP) at each of the three locations (Basins A, B, and C) shown on the Site and Exploration Plan, Figure 2. We understand that each SWTP will include a precast concrete wet well (up to 19 feet deep) and a pump station, with adjacent precast concrete boxes for modular wetlands, and connected with mechanical piping.

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The terminal was built upon tide-flats of the Puyallup River delta, which formed where the river empties into Commencement Bay. Prior to its use as a container terminal, the land was used for timber milling and shipping via railroad, and the Milwaukie Waterway extended southeast nearly to 11th Street. Container terminal use began in the 1970s. Much of the Milwaukie Waterway was remediated and filled in the 1990s, with a remaining small area open to the Sound at the northwest end.

FIELD INVESTIGATION

Three boreholes were drilled on January 4, 2018 by Holocene Drilling, Inc. of Puyallup, Washington under subcontract to HWA. The boreholes, designated BH-1 through BH-3, were drilled to depths of 41.5 to 46.5 feet with a Diedrich D-90 truck-mounted drill rig using a hollow-stem auger. Soil samples were collected at 2½- to 5-foot depth intervals per Standard Penetration Test (SPT) sampling methods, which consisted of using a 2-inch outside diameter, split-spoon sampler driven with a 140-pound autohammer. During the test, each sample was obtained by driving the sampler up to 18 inches into the soil with the hammer free-falling 30 inches per stroke. The number of blows required for each 6 inches of penetration was recorded. The standard penetration resistance of the soil was calculated as the number of blows required for the final 12 inches of penetration. If a total of 50 blows was recorded within a single 6-inch interval, the test was terminated, and the blow count was recorded as 50 blows/number of inches of penetration. This resistance provides an indication of the relative density of granular soils and the relative consistency of cohesive soils.

All explorations were advanced under the full-time supervision and observation of an HWA geologist. Soil samples obtained from the explorations were classified in the field and representative portions were placed in plastic bags. Samples were field-screened for potential contaminants using a Photo Ionization (PID) meter. The soil samples were then taken to our Bothell, Washington, laboratory for further examination.

Pertinent information including soil sample depths, stratigraphy, geotechnical engineering characteristics, and ground water occurrence was recorded and used to develop logs of each of the explorations. A legend of the terms and symbols used on the borehole logs is presented on Figure A-1, and the logs are presented on Figures A-2 through A-4.

The stratigraphic contacts shown on the borehole logs represent the approximate boundaries between soil types. Actual transitions may be more gradual. The ground water conditions depicted are only for the specific date and locations reported, and therefore, are not necessarily representative of other locations and times.

GENERAL GEOLOGIC CONDITIONS

The Puget Lowland has repeatedly been occupied by a portion of the continental glaciers that developed during the ice ages of the Quaternary period. During at least four episodes, portions of the ice sheet advanced south from British Columbia into the lowlands of Western Washington. The southern extent of these glacial advances was south of Olympia, Washington. Each major advance included numerous local advances and retreats, and each advance and retreat resulted in its own sequence of deposition and erosion of glacial lacustrine, outwash, till, and drift deposits. Between and following these glacial advances, sediments from the Olympic and Cascade Mountains accumulated in the Puget Lowland in lakes, valleys, and river deltas.

Geologic information for the project area was obtained from the *Geologic Map of Washington - Northwest Quadrant* (Dragovich et al, 2002). According to this map, surface deposits in the vicinity consist of “modified land” (fill) over deltaic soils deposited from the Puyallup River into Commencement Bay. Glacial deposits, and glacially over-consolidated non-glacial deposits, although expected below the deltaic deposits are not typically observed within 100 feet below the ground surface at the Port site.

SUBSURFACE CONDITIONS

Each of the borings encountered approximately 8 inches of asphalt pavement at the surface, over loose fill extending to depths of 12 to 15 feet, above deltaic deposits to the full depths explored. Specific soil units are described in detail below:

- **Fill:** This unit consisted of loose, slightly silty to silty SAND, moist to wet. Traces of gravel, organics, and clumps of silt were observed in some of the samples. This material was evidently placed for construction of the terminal. It is likely that this soil was dredged from the river and/or waterway channels.
- **Marine Delta Sediments:** Native soils consisting of alluvial SILT, PEAT, sandy SILT, and silty SAND was encountered beneath the Fill. The peat was encountered only in borehole BH-2 at Basin B. The deltaic deposits were very soft or loose to a depth of 20 feet, where they became medium dense or stiff to very stiff to the full depths explored for this project. These soils were deposited by the Puyallup River in its estuarine delta in Commencement Bay. Marine shell fragments were encountered in this unit.

Ground water was observed during drilling at depths of approximately 11 to 11.5 feet. Because the drilling was performed using hollow stem drilling techniques, accurate measurement of ground water levels was not possible, however, ground water level is expected to rise above the level witnessed during drilling which is at 11 feet. Due to proximity to tidal water influence, it

will fluctuate with tide level and rainfall. For construction shoring design, the ground water is assumed to be at 8 feet.

CONCLUSIONS & RECOMMENDATIONS

GENERAL

The proposed improvements will consist of underground vaults and piping. These structures can be supported by the existing materials provided the subgrade is undisturbed during excavation. The pump station wet wells will be subject to large buoyancy forces. Extended bases and tremie concrete slabs attached to the precast vaults can provide resistance to these forces.

Excavations for the vault structures will require sheet pile support. Temporary shoring design for the excavation should be the responsibility of the contractor. The design should support the lateral earth pressures of the soils above the base of the excavation. The sheet piles should be extended a sufficient distance below the excavation to prevent heave of the soils at the base of the excavation during placement of the tremie concrete slab.

The following sections provide additional recommendations for design and construction of the proposed stormwater facilities.

BUOYANCY AND UPLIFT

The proposed pump station wet wells and treatment vaults will consist of precast concrete vaults that will be placed within temporary excavations and backfilled up to the existing grade. Because the design ground water level outside many of the proposed structures will be higher than the bottom of the structure, the structures will be subjected to hydrostatic uplift forces. Consequently, structures should be designed to resist such forces. Because the wet well will be installed below ground water, it is necessary to design it to resist buoyancy uplift forces. This can be accomplished using expanded bases, with compacted structural fill placed over the expanded base and adding the weight of tremie concrete slab. The size of the extended bases and the tremie slab weight should be designed assuming empty conditions and with the design ground water at the ground surface. We recommend that the side friction forces within the backfill soils be ignored for buoyancy resistance calculations.

SHALLOW FOUNDATION SUPPORT

The new wet-well underground vaults and modular wetlands will be below the ground surface, which means that the weight of soil to be removed for the underground structures will be greater than the weight of the proposed structures. As a result, the existing soils will be adequate to provide foundation support, provided they are not disturbed during construction. The foundations for these structures should be designed for allowable bearing pressures no greater

than 2,000 pounds per square foot (psf). Their maximum allowable pressure may be increased by 30 percent for seismic loadings.

Footings should have a minimum depth of embedment of 18 inches below the lowest adjacent finished grade. Continuous footings should be at least 24 inches wide and column footings should have a minimum width of 30 inches.

Below are our recommendations for foundation subgrade preparation.

- For constructability of the wet wells, we recommend a 5-foot thick-mud slab be placed by tremie methods at the base of the excavation prior to dewatering for installation of the precast vaults. The vaults can then be placed and structurally tied to the top of the tremie slab.
- For the modular wetland foundation construction, we recommend that a pad comprised of crushed rock be constructed. Prior to placing the crushed rock fill, a geotextile separator fabric be placed over the exposed subgrade and a 2-foot-thick (minimum) pad of Crushed Surfacing Base Course (WSDOT specification 9-03.9(3)), be placed and compacted in lifts over the geotextile.
 - The initial lift of crushed rock should be approximately 12 inches in thickness and tamped in place with a large excavator bucket or large hoe pack in static mode.
 - Following the initial lift, the remainder of the pad should be built up in 8-inch thick lifts compacted to at least 92 percent of the maximum dry density as determined using ASTM D1557 (Modified Proctor).
 - Construction of the pad should be performed after the ground water level is lowered at least by 5 feet below the base of the excavation.
 - The crushed rock pads should extend at least 2 feet outside the perimeters of the footings.

LATERAL EARTH PRESSURES

At-Rest Earth Pressures

Below-grade vault structures, with walls that will be backfilled with compacted structural fill, may be designed for an equivalent at-rest fluid pressure of 60 pounds per cubic foot (pcf) above the water table, and 92 pcf below the water table. Unless perimeter footing drains are installed around structures, we recommend assuming the design ground water level is at the ground

surface. If footing drains are provided, the design ground water level should be taken to be the highest tide that is expected to occur at the site.

Lateral Earth Pressures from Heavy Vehicles

Based on the layout of the SWTP sites, it is likely that the walls of these below-grade structures will be subjected to surcharge loading from vehicles and or equipment such as straddle carriers, cargo stackers, dockyard cranes and trucks. **For the permanent underground vault structures, vehicular traffic surcharge load due to equipment traffic should be added to the design equivalent fluid pressure 92 pcf.**

Seismic Earth Pressures

Because the walls will be designed for at-rest earth pressures with a traffic surcharge, incremental seismic surcharges need not be included.

Passive Pressures

Resistance to lateral forces from wind, seismic loads and deadman anchors will be developed by passive pressures against the buried portion of the structure. The allowable passive earth pressure should be estimated as an equivalent pressure of 150 pcf.

SEISMIC DESIGN CONSIDERATIONS

The Port of Tacoma is within an area of moderate to severe seismic hazard. The site will be subject to large ground motions caused by movement along faults such as the Tacoma Fault and the Cascadia Subduction Zone. These events will impact the pump station wet wells by triggering liquefaction, a phenomenon in which loose to medium dense sands and silts below the water table temporarily lose strength and behave as a liquid in response to moderate to strong earthquake shaking. Our analyses indicate that there is potential for liquefaction in the silty sand layers encountered in all borings.

Soil liquefaction is likely to result in upward vertical displacement of the below grade vaults due to increased buoyancy forces since the buoyant unit weight during liquefaction equals the saturated unit weight of liquefied soils. Lateral displacement of the vaults is also anticipated due to lateral spreading that will occur as the non-liquefied soils above the water table move toward the shore on top of the liquefied soils below.

To reduce the potential for liquefaction, these layers can be densified by rock columns or sand compaction piles. Densification of the soils lowers their susceptibility to liquefy and will significantly reduce lateral or vertical movements of the proposed structures that could occur as a result of liquefaction. If the owner desires to implement soil improvement and densification to

reduce the potential for liquefaction during a seismic event, we will be available to assist in liquefaction mitigation design.

SEISMIC DESIGN CRITERIA

We assume the structures will be designed in accordance with the *2018 International Building Code* (ICC, 2017). For seismic design in accordance with Section 1613 of the IBC, the Seismic Site Class is required. The Seismic Site Class is determined based on the average properties of soils in the upper 100 feet. Based on the presence of soft, compressible soils, the treatment plant qualifies as Site Class E. Accordingly, the design maximum spectral response acceleration at short periods, S_{Ds} , is 0.778 g. The design maximum spectral response acceleration at a period of 1-second, S_{D1} , is 0.806 g. For evaluation of liquefaction and seismic lateral earth pressures, we obtained the design mean peak ground acceleration (PGA_M) associated with an event having a 2 percent probability of being exceeded in a 50-year period (i.e., a 2,475-year event) is 0.45 g.

Note that the site has soils that are susceptible to liquefaction. According to the *IBC*, these soils classify as Site Class F, which would require a site-specific evaluation. The *IBC* provides an exception that site specific analyses are not required if the structural period of the proposed structures is less than 0.5 seconds. As the structures are underground and have total heights of less than 20 feet, we conclude that structural periods are less than 0.5 seconds and site-specific analyses are not required.

TEMPORARY SHORING

Excavation for each of the wet-well vaults can be shored by means of either sheet piles or caissons, but we recommend sheet piles considering that large mechanical inlet and outlet pipe connections will be made to the vaults. The design, installation and maintenance of temporary shoring should be the responsibility of the contractor.

However, we recommend that the minimum sheet pile penetration be 40 feet, for an excavation invert of approximately 20 feet deep plus 5 feet for a concrete tremie slab at the bottom of the excavation.

To avoid the potential for boiling during the excavation, the sheet pile cell should be filled with water until the design excavation level is reached and the tremie concrete pour is completed. The water in the sheet pile cell should be pumped out following curing of the tremie concrete.

Given the soft soils below the site, internal bracing of the sheet piles is likely to be required to provide adequate support for the resulting lateral loads.

If deadman anchors are to be adopted for sheet pile shoring walls in lieu of internal bracing, the allowable passive earth pressure, an equivalent fluid weight of 150 pcf, should be used.

DEWATERING

Ground water levels at the site are likely related to sea level, such that ground water should be anticipated within 8 feet of the ground surface. We recommend a minimum 5-foot thick tremie seal at the base of the excavation prior to pumping out the water within each sheet-piled-cell.

Design and implementation of any dewatering system should be the responsibility of the contractor.

VAULT BACKFILL AND COMPACTION

All backfill around completed structures should be considered structural fill. Backfill around the wet wells and modular wetland vaults should consist of 1¼ inch minus gravel backfill for walls as is specified in Section 9-03.12(2) of WSDOT Standard Specifications.

It should be compacted to a dense and unyielding condition, i.e., 92 percent of laboratory maximum dry density of ASTM D1557 (Modified Proctor). Moderate compaction effort is intentionally specified herein because over compaction may contribute damages to the precast tank walls. A small hand compactor such as a jumping jack should be used near the walls.

However, the upper 2 feet at the ground surface should be compacted to 95 percent of Modified Proctor. Despite the backfill compaction as specified above, 'bird bath' type post construction settlement may appear after few years.

Trench backfill around the mechanical pipes should consist of sand and gravel backfill meeting the requirements for Bank Run Gravel for Trench Backfill, specified in Section 9-03.19 of the *Standard Specifications* (WSDOT, 2018) and should be compacted to 92% of Modified Proctor up to the level 2 feet below the ground surface, and 95 percent of Modified Proctor for the upper 2 feet.

Native materials will not be suitable for trench backfill and should be removed from the site.

PIPE BEDDING & TRENCH BACKFILL RECOMMENDATIONS

General recommendations relative to pipe bedding and utility trench backfill are presented below:

- Pipe bedding material, placement, compaction, and shaping should be in accordance with the project specifications and the pipe manufacturer's recommendations. Pipe bedding should meet the gradation requirements for Gravel Backfill for Pipe Zone Bedding, Section 9-03.12(3) of the *Standard Specifications* (WSDOT, 2018). Native soils will not be suitable for pipe bedding.

- Pipe bedding should provide a firm, uniform cradle for the pipe. We recommend that a minimum 8-inch thickness of bedding material beneath the pipe be provided.
- Pipe bedding material and/or backfill around the pipe should be placed in layers and tamped to obtain complete contact with the pipe.

We recommend that trench backfill meet the specifications for structural fill, as described in this report. During placement of the initial lifts, the trench backfill material should not be bulldozed into the trench or dropped directly on the pipe. Furthermore, heavy equipment should not be permitted to operate directly over the pipe until a minimum of 2 feet of backfill has been placed. Trench backfill should be placed in 8-inch (maximum) lifts and compacted using mechanical equipment to at least 92 percent of Modified Proctor up to 2 feet below the surface and 95 percent of Modified Proctor for the upper 2 foot layer.

CONDITIONS AND LIMITATIONS

We have prepared this report for Parametrix, Inc. and the Northwest Seaport Alliance for use in design and construction of this project. This report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented herein should not be construed as a warranty of the pavement and subsurface conditions. Experience has shown that pavement, soil, and ground water conditions can vary significantly over small distances. Inconsistent conditions can occur between explorations that may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, HWA should be notified for review of the recommendations of this report, and revision of such if necessary. If there is a substantial lapse of time between submission of this report and the start of construction, or if conditions change due to construction operations, it is recommended that this report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

This report is issued with the understanding that it is the responsibility of the owner, or the owners' representative, to ensure that the information and recommendations contained herein are brought to the attention of the appropriate design team personnel and incorporated into the project plans and specifications, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field. HWA is available to monitor construction to evaluate soil and ground water conditions as they are exposed and verify that construction is accomplished in accordance with the specifications.

Within the limitations of scope, schedule and budget, HWA attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology at the time the report was prepared. No warranty, express or implied, is made. The scope of our work did not include environmental

assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water, or ground water at this site.

HWA does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and cannot be responsible for the safety of personnel other than our own on the site. As such, the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considers any of the recommended actions presented herein unsafe.

— ○ • ○ —

DRAFT

January 24, 2018
HWA Project No. 2017-148-21

We appreciate the opportunity to be of service. Should you have any questions regarding this report, or require additional services, please contact us.

Sincerely,

HWA GEOSCIENCES INC.

Sa H. Hong, P.E.
Geotechnical Engineer

Brad W. Thurber, L.G., L.E.G.
Senior Engineering Geologist

Attachments:

Figure 1	Vicinity Map
Figure 2	Site and Exploration Plan
Appendix A	Subsurface Explorations

References:

Dragovich, J.D., Logan, R.L., Schasse, H.W., Walsh, T.J., Lingley, W.S., Jr, Norman, D.K., Gerstel, W.J., Lapen, T.J., Schuster, J.E., and Meyers, K.D., 2002, *Geologic Map of Washington – Northwest Quadrant*: WA Div. of Geology & Earth Resources Map GM-50, scale 1:250,000.

International Code Council, 2018, International Building Code.



WEST SITCUM TERMINAL



MAP NOT TO SCALE

BASE MAP FROM NWSA / MAPBOX OPENSTREETMAP © 2018



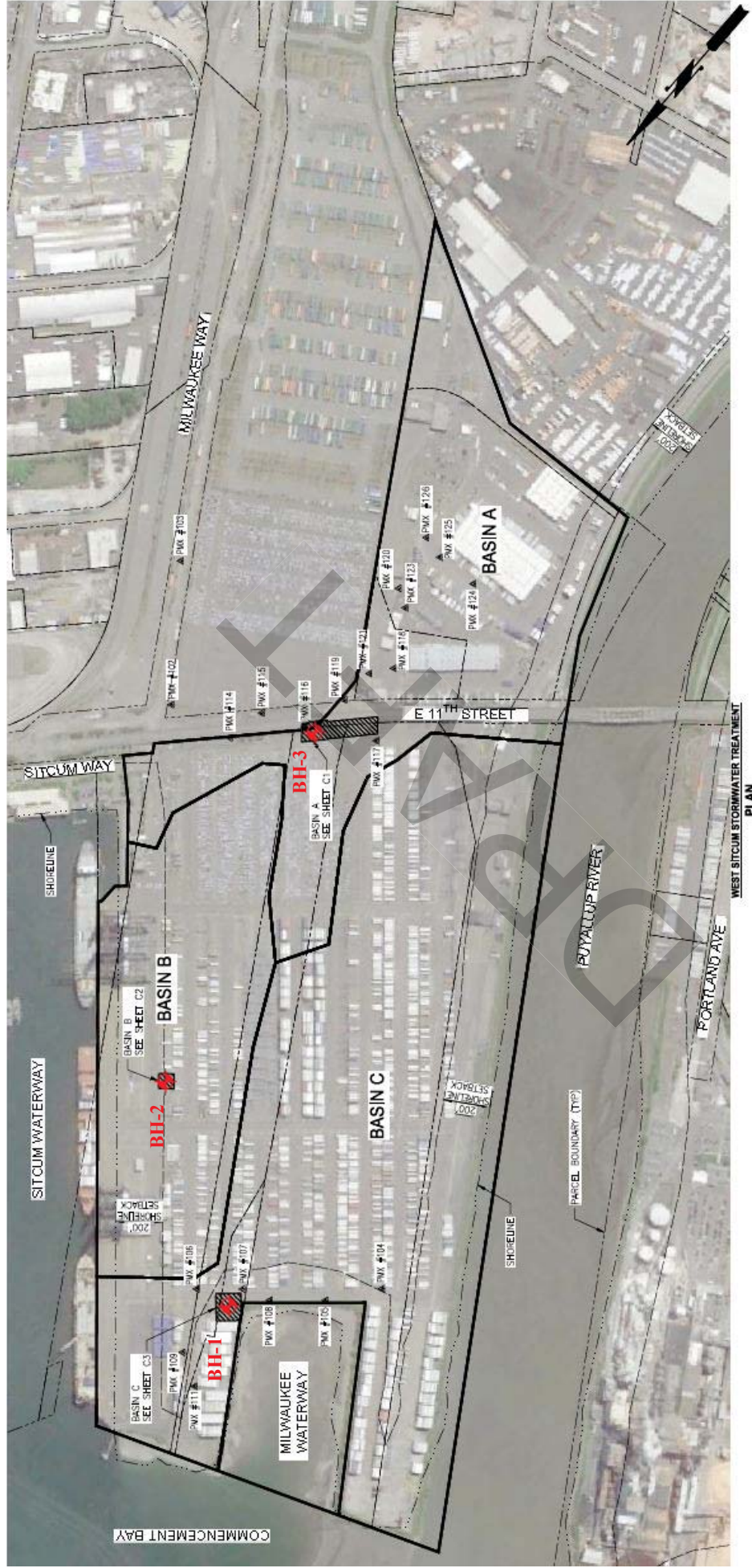
HWA GEOSCIENCES INC.

VICINITY MAP

**WEST SITCUM STORMWATER TREATMENT
TACOMA, WASHINGTON**

FIGURE NO. **1**

PROJECT NO.
2017-148-21



NOT TO SCALE

Legend

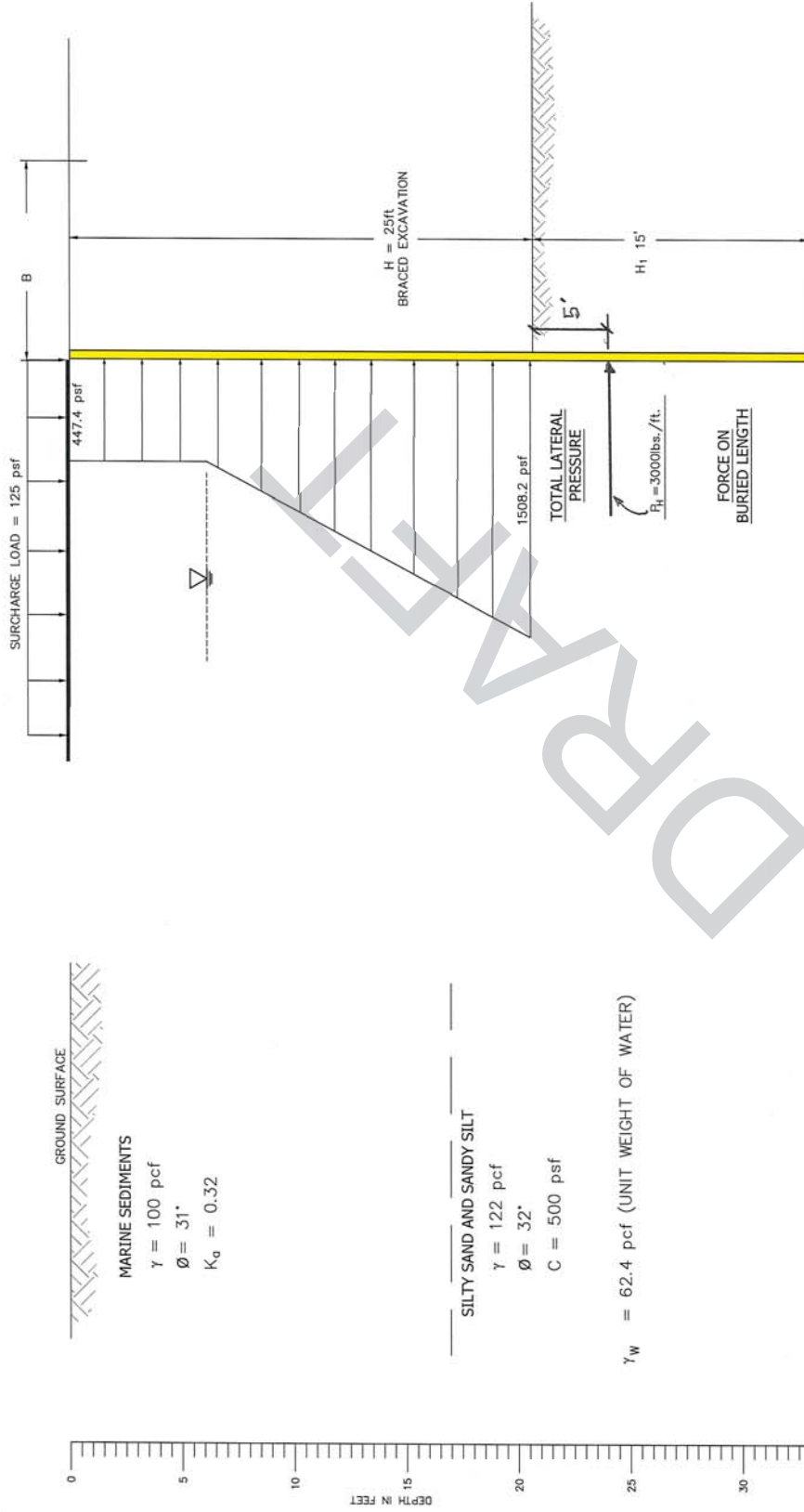


BH-3 Borehole Designation and Approximate Location



SITE AND EXPLORATION PLAN
WEST SITCUM WASTEWATER
TREATMENT
TACOMA, WASHINGTON

FIGURE NO. 2
PROJECT NO. 2017-148-21



 HWA GeoSCIENCES INC.	West Sitcum Stormwater Treatment Port of Tacoma	LATERAL PRESSURE DIAGRAM FOR SHORING	DRAWN BY	BFM	FIGURE #	3	
			CHECK BY	DS			PROJECT #
			DATE:	01.23.2018	2017-148-21		

S:\2017 PROJECTS\2017-148-21 WEST SITCUM STORMWATER TREATMENT PORT OF TACOMA\CA\DWG\2017-148-21 EP DWG -FIG 3- Pressure 1/23/2018 5:43 PM

APPENDIX A

EXPLORATION LOGS

DRAFT

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
Density	N (blows/ft)	Approximate Relative Density(%)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	0 - 15	Very Soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	35 - 65	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	over 30	>4000

USCS SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP DESCRIPTIONS			
Coarse Grained Soils	Gravel and Gravelly Soils	Clean Gravel (little or no fines)		GW	Well-graded GRAVEL	
				GP	Poorly-graded GRAVEL	
		More than 50% of Coarse Fraction Retained on No. 4 Sieve	Gravel with Fines (appreciable amount of fines)		GM	Silty GRAVEL
					GC	Clayey GRAVEL
	Sand and Sandy Soils	Clean Sand (little or no fines)		SW	Well-graded SAND	
				SP	Poorly-graded SAND	
		50% or More of Coarse Fraction Passing No. 4 Sieve	Sand with Fines (appreciable amount of fines)		SM	Silty SAND
					SC	Clayey SAND
Fine Grained Soils	Silt and Clay	Liquid Limit Less than 50%		ML	SILT	
				CL	Lean CLAY	
				OL	Organic SILT/Organic CLAY	
	Silt and Clay	Liquid Limit 50% or More		MH	Elastic SILT	
				CH	Fat CLAY	
				OH	Organic SILT/Organic CLAY	
			Highly Organic Soils			PT

%F	Percent Fines
AL	Atterberg Limits: PL = Plastic Limit LL = Liquid Limit
CBR	California Bearing Ratio
CN	Consolidation
DD	Dry Density (pcf)
DS	Direct Shear
GS	Grain Size Distribution
K	Permeability
MD	Moisture/Density Relationship (Proctor)
MR	Resilient Modulus
PID	Photoionization Device Reading
PP	Pocket Penetrometer Approx. Compressive Strength (tsf)
SG	Specific Gravity
TC	Triaxial Compression
TV	Torvane Approx. Shear Strength (tsf)
UC	Unconfined Compression

SAMPLE TYPE SYMBOLS

	2.0" OD Split Spoon (SPT) (140 lb. hammer with 30 in. drop)
	Shelby Tube
	3-1/4" OD Split Spoon with Brass Rings
	Small Bag Sample
	Large Bag (Bulk) Sample
	Core Run
	Non-standard Penetration Test (3.0" OD split spoon)

GROUNDWATER SYMBOLS

	Groundwater Level (measured at time of drilling)
	Groundwater Level (measured in well or open hole after water level stabilized)

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5 mm) to No. 200 (0.074 mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074mm)

COMPONENT PROPORTIONS

PROPORTION RANGE	DESCRIPTIVE TERMS
< 5%	Clean
5 - 12%	Slightly (Clayey, Silty, Sandy)
12 - 30%	Clayey, Silty, Sandy, Gravelly
30 - 50%	Very (Clayey, Silty, Sandy, Gravelly)
Components are arranged in order of increasing quantities.	

NOTES: Soil classifications presented on exploration logs are based on visual and laboratory observation. Soil descriptions are presented in the following general order:

Density/consistency, color, modifier (if any) GROUP NAME, additions to group name (if any), moisture content. Proportion, gradation, and angularity of constituents, additional comments.
(GEOLOGIC INTERPRETATION)

Please refer to the discussion in the report text as well as the exploration logs for a more complete description of subsurface conditions.

MOISTURE CONTENT

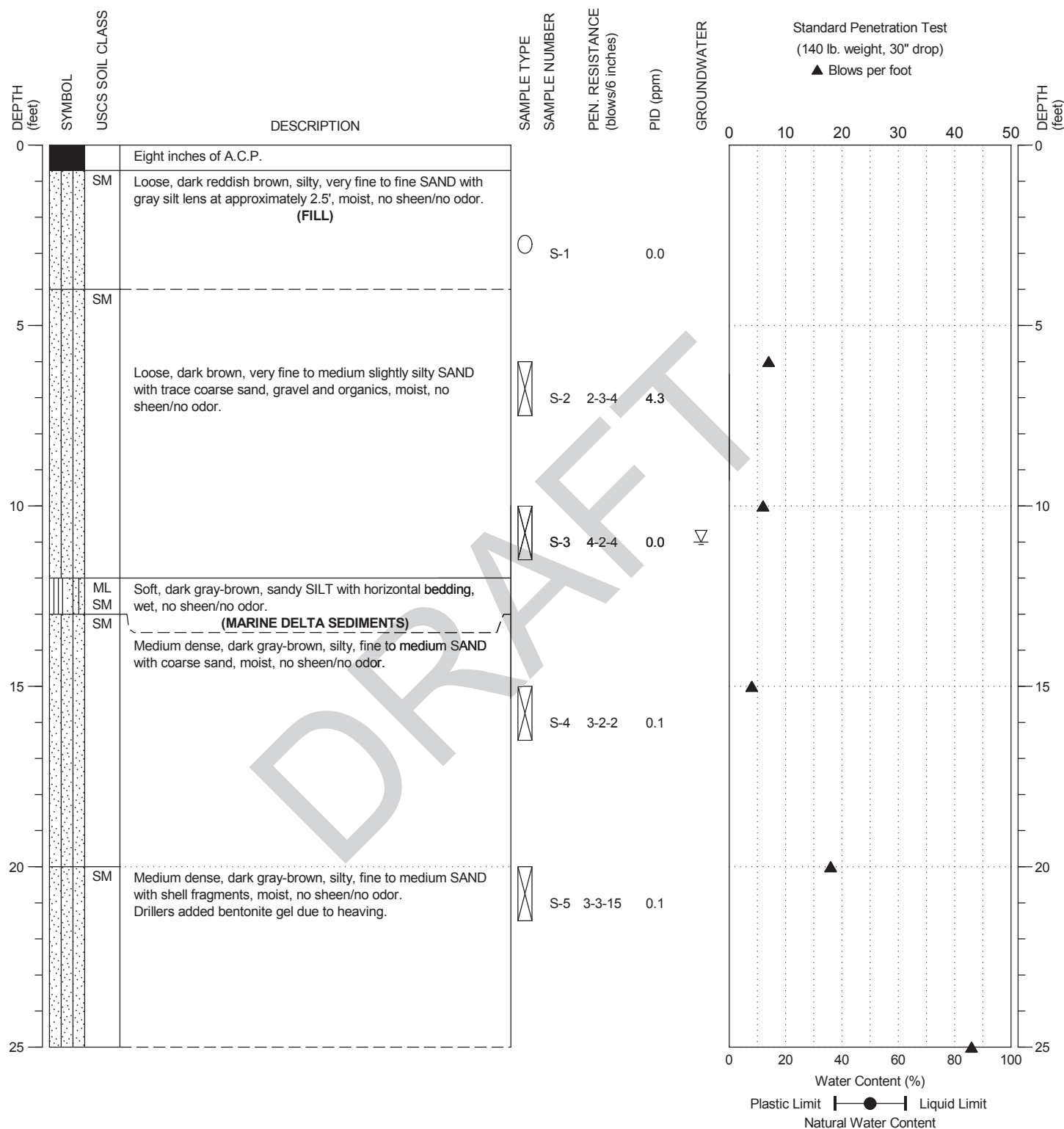
DRY	Absence of moisture, dusty, dry to the touch.
MOIST	Damp but no visible water.
WET	Visible free water, usually soil is below water table.

LEGEND OF TERMS AND SYMBOLS USED ON EXPLORATION LOGS

DRILLING COMPANY: Holocene Drilling
 DRILLING METHOD: HSA, Diedrich D-90 Truck Rig
 SAMPLING METHOD: SPT
 LOCATION: Basin C

SURFACE ELEVATION: 12.00 ± feet
 CASING ELEVATION: ± feet

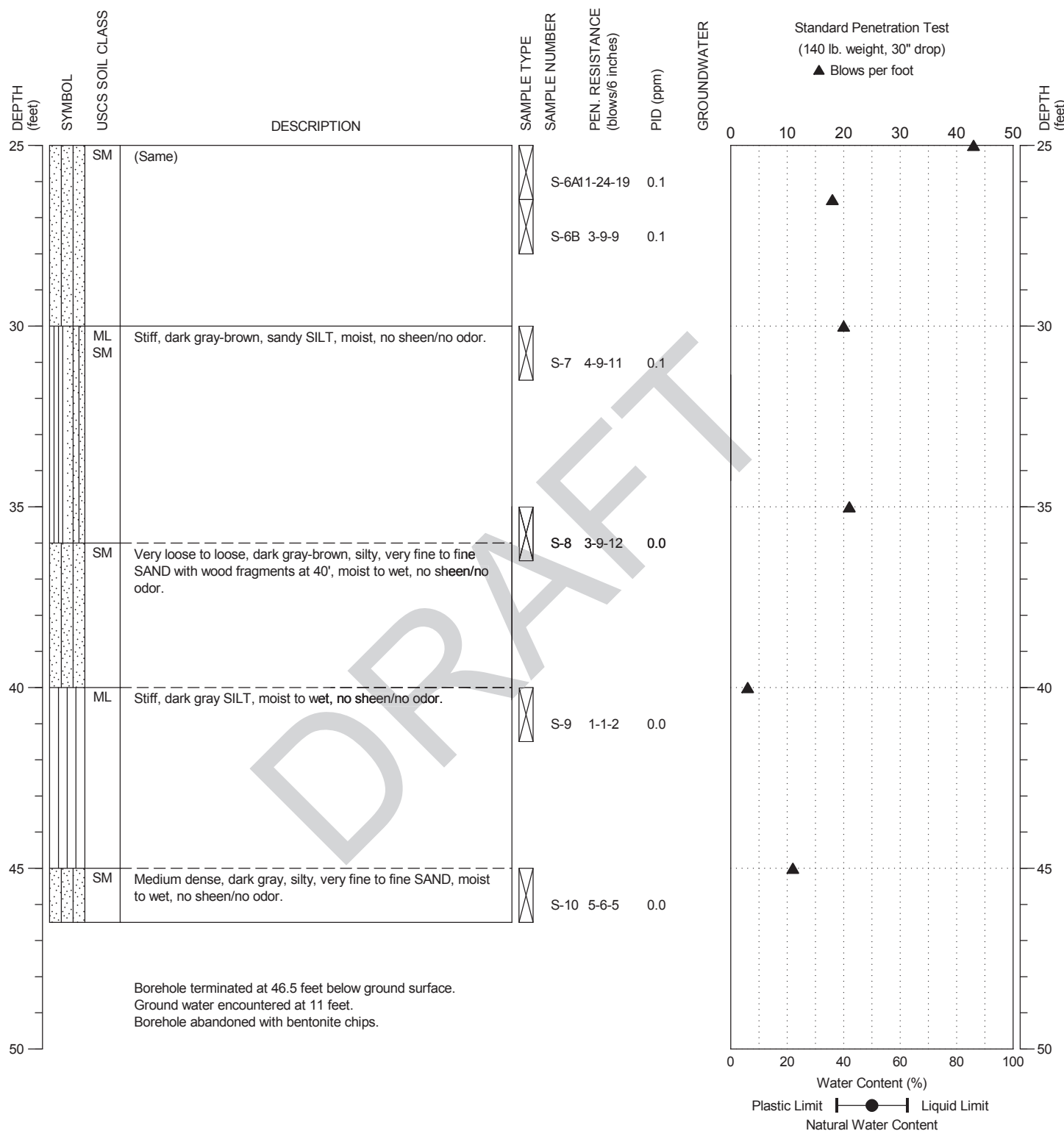
DATE STARTED: 1/4/2018
 DATE COMPLETED: 1/4/2018
 LOGGED BY: NK



DRILLING COMPANY: Holocene Drilling
 DRILLING METHOD: HSA, Diedrich D-90 Truck Rig
 SAMPLING METHOD: SPT
 LOCATION: Basin C

SURFACE ELEVATION: 12.00 ± feet
 CASING ELEVATION ± feet

DATE STARTED: 1/4/2018
 DATE COMPLETED: 1/4/2018
 LOGGED BY: NK

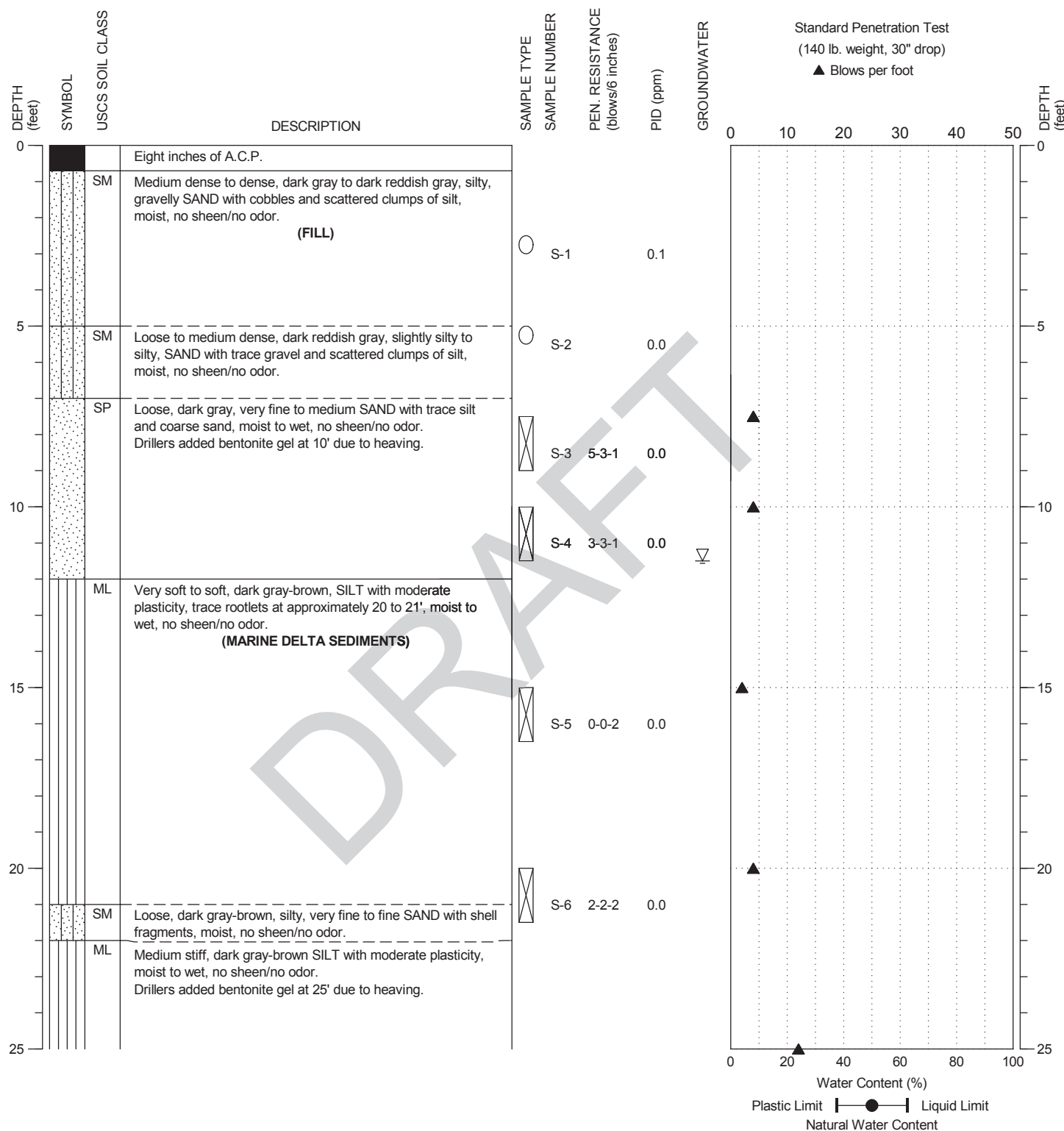


NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

DRILLING COMPANY: Holocene Drilling
 DRILLING METHOD: HSA, Diedrich D-90 Truck Rig
 SAMPLING METHOD: SPT
 LOCATION: Basin B

SURFACE ELEVATION: 14.00 ± feet
 CASING ELEVATION ± feet

DATE STARTED: 1/4/2018
 DATE COMPLETED: 1/4/2018
 LOGGED BY: NK

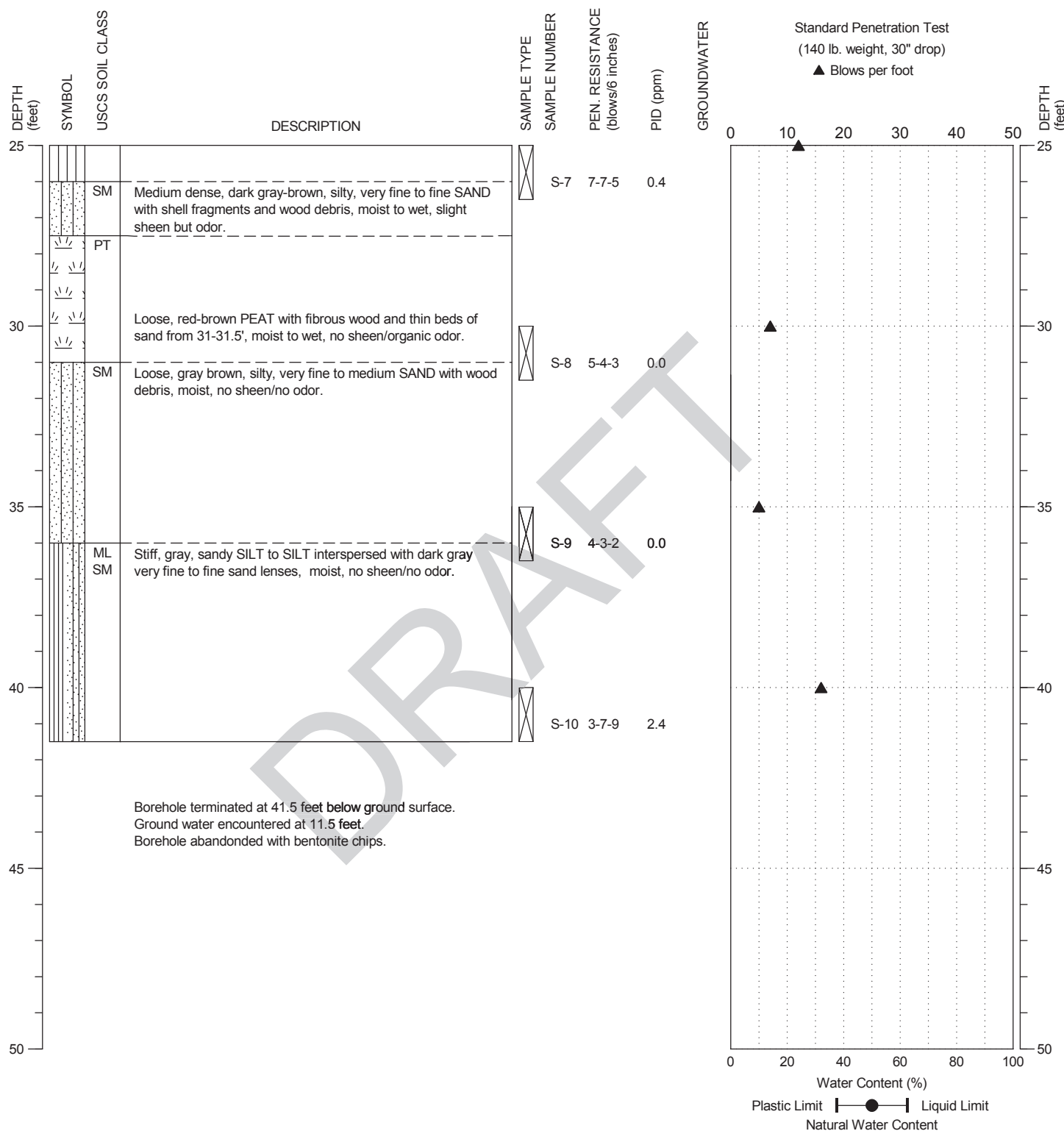


NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

DRILLING COMPANY: Holocene Drilling
 DRILLING METHOD: HSA, Diedrich D-90 Truck Rig
 SAMPLING METHOD: SPT
 LOCATION: Basin B

SURFACE ELEVATION: 14.00 ± feet
 CASING ELEVATION: ± feet

DATE STARTED: 1/4/2018
 DATE COMPLETED: 1/4/2018
 LOGGED BY: NK

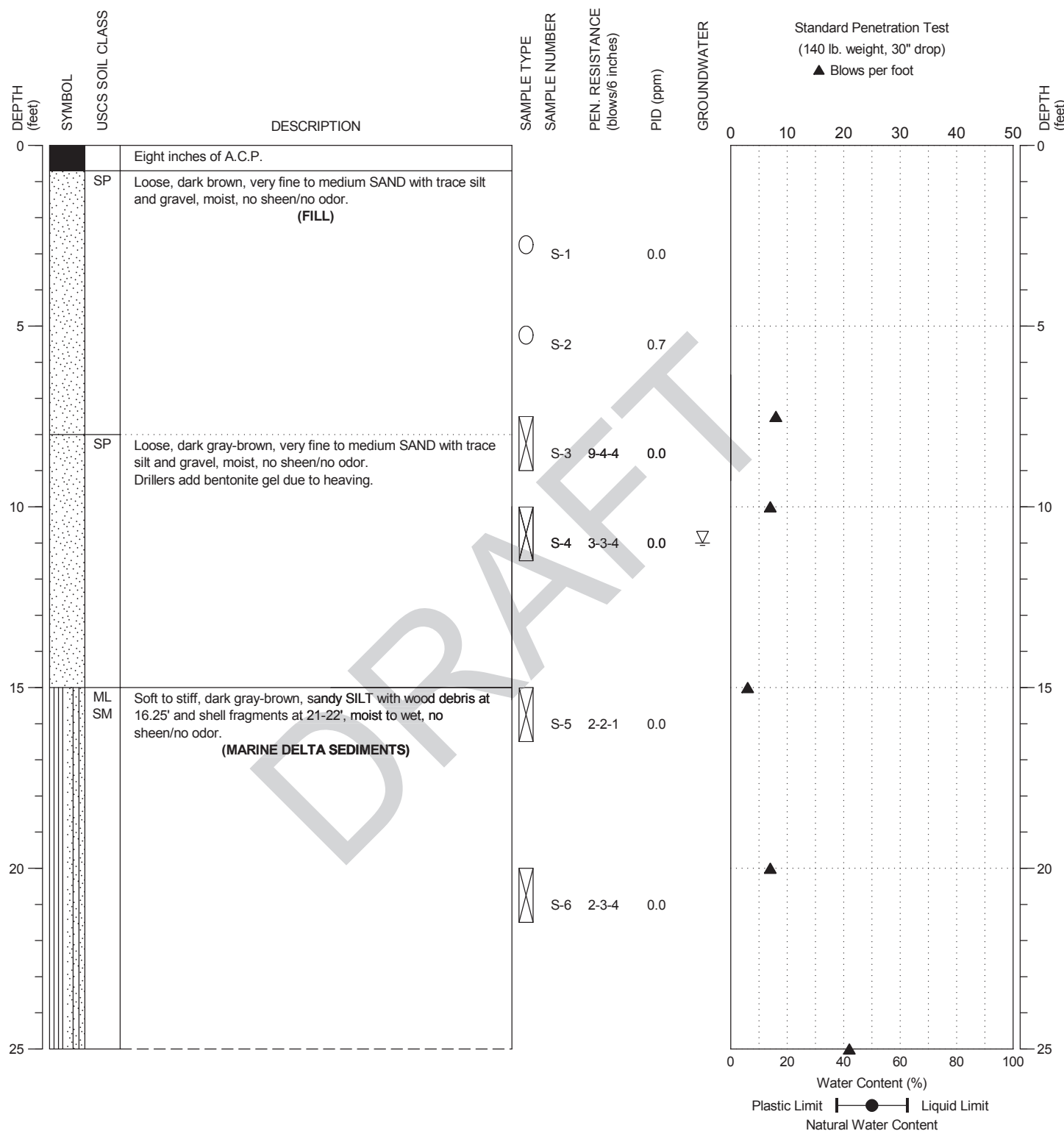


NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

DRILLING COMPANY: Holocene Drilling
 DRILLING METHOD: HSA, Diedrich D-90 Truck Rig
 SAMPLING METHOD: SPT
 LOCATION: Basin A

SURFACE ELEVATION: 14.00 ± feet
 CASING ELEVATION ± feet

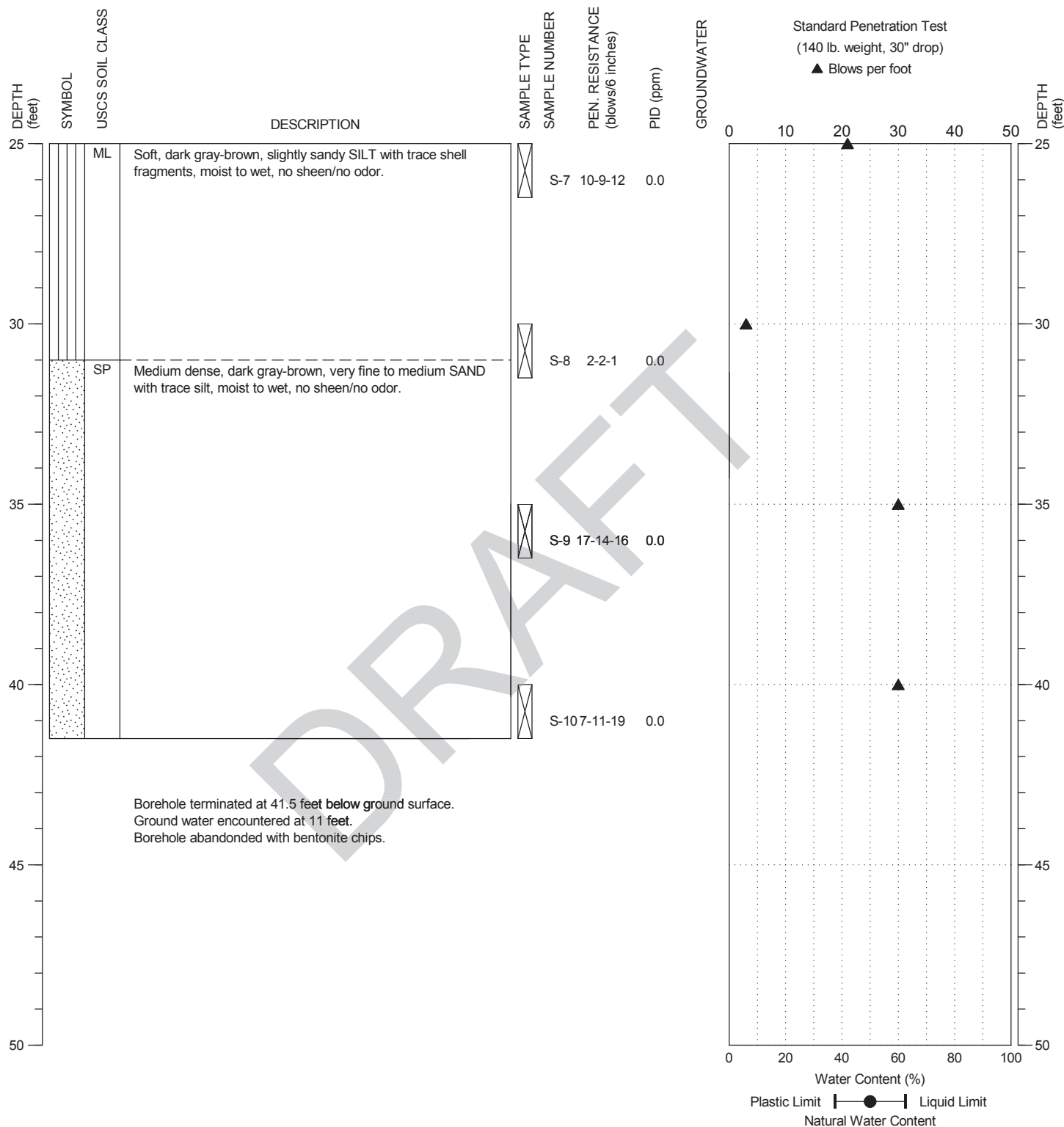
DATE STARTED: 1/4/2018
 DATE COMPLETED: 1/4/2018
 LOGGED BY: NK



DRILLING COMPANY: Holocene Drilling
 DRILLING METHOD: HSA, Diedrich D-90 Truck Rig
 SAMPLING METHOD: SPT
 LOCATION: Basin A

SURFACE ELEVATION: 14.00 ± feet
 CASING ELEVATION ± feet

DATE STARTED: 1/4/2018
 DATE COMPLETED: 1/4/2018
 LOGGED BY: NK



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.