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NWS EARLE
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SOILS AND SEDIMENT EROSION CONTROL PLAN
FOR THE
BILGE WATER PLANT
NAVAL WEAPONS STATION - EARLE
LEONARDO, NEW JERSEY

Issued:
March 1999

Prepared for:
Naval Facilities Engineering Command
10 Industrial Highway
Lester, PA 19113

Prepared by:
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REMEDIAL ACTION CONTRACT N62472-94-D-0398
DELIVERY ORDER NO. 0034

SEDIMENT EROSION CONTROL PLAN
FOR THE
BILGE WATER PLANT
NAVAL WEAPONS STATION - EARLE
LEONARDO, NEW JERSEY

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1.0 SITE DESCRIPTION

Naval Weapons Station Earle (NWS-Earle) is located in Monmouth County in east-central New Jersey as presented on Figure 1 and Figure 2 (see Appendix D), Vicinity Map and Site Location Map. The base consists of a Mainside area and a Water front area occupying a total of approximately 11,134 acres. The Mainside of the base is located approximately 10 miles inland from the Atlantic Ocean. The Mainside and the Waterfront areas of the base are linked by a narrow tract of land that serves as a right-of-way for a government road and railroad line.

NWS Earle is responsible for furnishing ammunition to the naval fleet, and coordinates all port services and logistical support for home-ported and visiting ships. The base also conducts safety inspections, supervises ammunition loading for the United States Coast Guard, and provides marine fire fighting capability and standby tug services.

The Bilge Water Plant (the "Plant") is located at the Waterfront area of the NWS-Earle Base and is the focus of this soil erosion and sediment control plan. The Waterfront consists of an ammunition depot and associated piers for loading and servicing the naval fleet. The Bilge Water Plant is a small treatment operation which processes bilge water from the ships docked at the piers. The bilge water is transported from ships at the pier in railroad cars, and then transferred to the Bilge water Plant for processing.

1.1 Present Activities and Existing Conditions

Bilge water from ships docked at the pier is transported to the treatment facility via rail tank cars. Tank cars being utilized have capacities of 10,000, 12,000 or 14,000 gallons. Primarily 10,000 gallon tank cars are used. Only a few 12,000 and 14,000 gallon tanker cars exist at the facility. The treatment plant is bordered on the west and east by rail lines which are used for unloading of bilge water and loading of treatment by-products respectively (see Appendix D, drawing C-1 "Existing Site Conditions").

Rail cars are brought from the pier to the west side of the treatment building. Along the west side of the treatment building are three connections penetrating the ground surface which feed underground single containment transfer piping to a sump within the treatment building. Rail cars are connected to the transfer piping by flexible hoses. The area where unloading is presently performed is a non-vegetated gravel area. The only spill containment provided is a small curbed pad around each of the piping connections. The existing curbed areas are designed to hold a minor spill for clean-up with an absorbent material or similar method.

The bilge water being treated at the plant is an oily water which is separated through several processes resulting in three separate discharge streams: 1) treated water; 2) oil and sludge; and 3) wash water. The original design of the system provided a connection for

each stream along the east side of the site for transfer to rail cars. Presently only wash water and oil and sludge are loaded to rail cars (oil infrequently). Treated water is discharged directly to the Township of Middletown Sewage authority via an underground force main. In addition, collected oil and sludge is predominately removed from the site using drums instead of by rail car. As with the rail unloading area, the area where rail tank cars are loaded with treatment by-products is predominately a non-vegetated gravel area with only a small containment curb at each connection point.

Currently No. 2 diesel fuel required for boilers located on the pier at Weapons Station Earle are fueled by rail cars moved out onto the pier from the mainland. Due to the limited maneuvering room on the pier, tanker trucks can not easily deliver diesel directly to the boiler plants. As a result, diesel fuel is transferred between tanker trucks and rail cars near the bilge water plant and then the rail cars are moved out onto the pier. Presently no secondary containment is provided for this transfer.

At present a leak or spill from either the loading or unloading areas could result in the contamination of the soil and potential seepage to the groundwater.

1.2 Existing Drainage Conditions

The existing storm water runoff occurs as shallow flow over tightly compacted gravel with no or minimal vegetation present in this area of the site. Presently there are no subsurface storm water conveyances installed in the area. All storm water flows overland as shallow sheet flow from south to north, discharging at the northeast portion of the site. The discharge travels through the railroad ballast, which is predominantly coarse gravel, to the lower gravel area to the northeast. Attached Drawing C-1 presents the current flow patterns for the area of disturbance. Flow then travels as shallow sheet flow to the northeast and ultimately discharges to Sandy Hook Bay. These flow patterns beyond the area of disturbance are presented in Figure 3.

Runoff for the affected area under the existing gravel conditions has been calculated as presented in Appendix B, "Containment and Drainage Calculations." Runoff is calculated for the area of disturbance only, not the entire drainage area, to determine the differential between existing and proposed conditions.

2.0 PROPOSED CONTAINMENT AND FACILITY DRAINAGE

The spill containment measures were determined based on the requirements of N.J.A.C. 7:1E-2.6 "Facility Drainage and Secondary Containment". The regulations require that sufficient containment be provided to contain the volume of the largest tank and six inches of rainwater.

In an effort to meet the requirements of N.J.A.C. 7:1E-2.6, Foster Wheeler is proposing fiberglass spill pans under each rail car in both the loading and unloading areas. These spill pans will discharge to a central sump with an overflow basin to handle catastrophic

spill events. Drains will be installed at each connection point to convey spills to a central sump. All piping utilized for the spill containment system will be double containment HDPE fused piping. In addition, all existing single containment transfer piping (used to transfer liquid between the rail cars and treatment plant) will be replaced with double containment HDPE piping and all new piping.

In addition, the area surrounding the transfer building will be paved with asphalt. As mentioned previously, this area is currently covered with tightly packed gravel with no to minimal vegetation. Storm water runoff will continue to flow in the north easterly direction.

The location and details of spill containment measures are presented on drawings C-2 "Proposed Spill Containment Measures" and Drawing C-3 "Details and Sections" respectively (these can be found in Appendix D).

2.1 Sump and Overflow Basin

All spill control piping from track pans and spill pad basins will discharge to a central concrete sump. If the sump area is filled the water will overflow into the basin. The overflow basin has been sized to allow the spill containment system to hold an aggregate volume of the largest tank and six inches of rainfall. The required volume of containment was determined to be 27,897 gallons as presented in Table 1 below. A total of 28,785 gallons of containment is provided as presented in Table 2 below.

Table 1: Required Spill Containment Volume

Source	**Volume (gal)**
largest rail car	14,000
rainfall (6")	
track pans (1,938 sf)	7,248
spill pads (80 sf)	299
sump (30 sf)	112
basin (1,780 sf)	6,658
transfer pad (508 sf)	1,908
Total	**27,897**

Table 2: Provided Spill Containment Volume

Location	Volume (gal)
overflow basin	24,000
track pans	4,000
sump	785
Total	**28,785**

Water accumulated in the sump will be removed using a submersible pump within the sump. Collected rainwater and spilled oily water will be pumped to the treatment building for processing and disposed in the same manner that bilge water is presently treated.

2.2 Proposed Drainage Conditions

In the proposed condition, storm water runoff from the affected area will be segregated. Storm water runoff from the spill containment measures will be processed through the treatment plant and discharged to the municipal sewer due to the potential for contamination. Therefore, this flow will be removed from the site discharge.

Storm water runoff from the newly paved areas outside the spill containment areas, will be directed to the northeast end of the site, similar to the existing conditions, and result in shallow sheet flow to the lower gravel area to the northeast. Proposed runoff from the paved area will be directed through a 6 inch HDPE pipe that will be installed under the existing rail road tracks on the east side of the transfer building. The pipe discharges to a rip-rap apron prior to discharge to the gravel area to the east, to reestablish shallow flow into the area as in the existing condition. The proposed rip-rap apron has been oversized to 5 feet by 5 feet using 3 inch median diameter rip-rap. Pipe and rip rap apron sizing calculations are presented in Appendix B.

As demonstrated in the calculations presented in Appendix B, peak storm water runoff in the proposed condition will not exceed peak storm water runoff for the existing condition.

2.3 Soil and Erosion Control Measures During Construction

There are three major phase of construction for installation of secondary containment measures: 1) installation of subsurface piping; 2) grading of subgrade; and 3) paving placement.

Prior to the start of any activities, silt fenced will be placed around the perimeter of the site as shown on attached Drawing C-2.

Installation of double containment piping and sump will require excavation between three and five feet in depth. The length of open excavation will be limited to the minimum necessary. Piping will be fused above ground and then lowered into the excavation. The flexible nature of the pipe will allow a continuos piece of pipe to be partially buried and fused together at the surface at the same time. Encountered groundwater will be removed using a vacuum truck due to the potential for hydrocarbons in the surface soil due to previous operations.

After completion of the installation of subsurface piping, grading of the subgrade will performed. Limited grading is required around the building. The majority of the grading will be required for installation of the overflow basin. The majority of the excavation will result in cut of existing grade. All remaining excess after grading will be disposed of off site. Excess material will be stockpiled within the silt fence prior to removal to minimize potential erosion off-site.

Asphalt subbase, base and surface course will then be placed as shown on attached Drawing C-3. At the completion of paving, after sufficient time has been provided for the asphalt to set, silt fence will be removed from the perimeter of the site. Silt fence will be placed around the new rip rap apron prior to being put into service. The silt fence around the rip-rap will not be removed until completion of construction activities.

1.0 SITE DESCRIPTION

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spill events. Drains will be installed at each connection point to convey spills to a central sump. All piping utilized for the spill containment system will be double containment HDPE fused piping. In addition, all existing single containment transfer piping (used to transfer liquid between the rail cars and treatment plant) will be replaced with double containment HDPE piping and all new piping.

As with the connection points for the underground transfer piping, the potential for spills also exists at the tanker truck connection during diesel transfer to rail cars. The parking area for the tanker truck during diesel fuel transfer will be pitched to the south and containment curbs will be provided on the east, west, and south sides. At the southern extent of the loading area, at the low point, there will be an inlet to capture any spillage. As with the bilge water transfer spill pads, the inlet conveys discharge to the central sump.

In addition, the area surrounding the transfer building will be paved with asphalt. As mentioned previously, this area is currently covered with tightly packed gravel with no to minimal vegetation. Storm water runoff will continue to flow in the north easterly direction.

The location and details of spill containment measures are presented on drawings C-2 "Proposed Spill Containment Measures" and Drawing C-3 "Details and Sections" respectively (these can be found in Appendix D).

2.1 Sump and Overflow Basin

All spill control piping from track pans and spill pad basins will discharge to a central concrete sump. If the sump area is filled the water will overflow into the basin. The overflow basin has been sized to allow the spill containment system to hold an aggregate volume of the largest tank and six inches of rainfall. The required volume of containment was determined to be 31,669 gallons as presented in Table 1 below. A total of 33,446 gallons of containment is provided as presented in Table 2 below.

Table 1: Required Spill Containment Volume

Source	Volume (gal)
largest rail car	14,000
rainfall (6")	
track pans (2,316 sf)	8,662
spill pads (90 sf)	337
sump (30 sf)	112
basin (1,780 sf)	6,658
transfer pad (508 sf)	1,908
Total	**31,677**

Table 2: Provided Spill Containment Volume

Location	Volume (gal)
overflow basin	28,330
track pans	4,331
sump	785
Total	**33,466**

Water accumulated in the sump will be removed using a submersible pump within the sump. Collected rainwater and spilled oily water will be pumped to the treatment building for processing and disposed in the same manner that bilge water is presently treated.

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After completion of the installation of subsurface piping, grading of the subgrade will performed. Limited grading is required around the building. The majority of the grading will be required for installation of the overflow basin. The majority of the excavation will result in cut of existing grade. All remaining excess after grading will be disposed of off site. Excess material will be stockpiled within the silt fence prior to removal to minimize potential erosion off-site.

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New Jersey Natural Resources Conservation Program

For District Use Only
Application Number
Disposition

APPLICATION FOR SOIL EROSION AND SEDIMENT CONTROL PLAN CERTIFICATION

The enclosed soil erosion and sediment control plan and supporting information are submitted for certification pursuant to the Soil Erosion and Sediment Control Act, Chapter 251, P.L. 1975 as amended (NJSA 4:24-39 et seq.). An application for certification of a soil erosion and sediment control plan shall include the items listed on the reverse side of this form.

Name of Project: Bilge Water Plant	Project Location: Municipality: Leonardo	
Project Street Address: Naval Weapons Station - Earle	Block: N/A	Lot: N/A
Project Owner(s) Name: U.S. Navy - Contact: Tom Dunn		Phone: (732) 866-2048
Project Owner(s) Address: NWS - Earle, 201 Hwy 34South, Bldg C-23	City: Colts Neck	State: NJ Zip: 07722-5025
Total Area of Project: 0.22 Ac / Total Area of Land to be Disturbed: 0.22 Ac	No. Dwelling or other Units: 1	Fee: $ 330.00
Plans Prepared by*: Foster Wheeler Environmental Corporation		
Address: One Oxford Valley,Suite 200,Langhorne	State: PA Zip: 19047	Phone: (215) 702-4000

*(Engineering related items of the Soil Erosion and Sediment Control Plan **MUST** be prepared by or under the direction of and be sealed by a Professional Engineer or Architect licensed in the State of New Jersey, in accordance with NJAC 13:27-6.1 et. seq.)

Agent Responsible During Construction: NWS - Earle - Tom Dunn	Job Supervisor: Mike Heffron
Address: 201 Hwy 34 South,Bldg C-23, Colts Neck	Address: One Oxford Valley - Suite 200, Langhorne
State: New Jersey Zip: 07722 Phone: (732) 866-2048	State: PA Zip: 19047 Phone: (215) 702-4015

The applicant hereby certifies that all soil erosion and sediment control measures are designed in accordance with current **Standards for Soil Erosion and Sediment Control in New Jersey** and will be installed in accordance with those Standards and the plan as approved by the Soil Conservation District and agrees as follows:

1. To notify the District in writing at least 48 hours in advance of any land disturbance activity. Failure to provide such notification may result in additional inspection fees.
2. To notify the District upon completion of the Project. (Note: No certificate of occupany can be granted until a report of compliance is issued by the District.
3. To maintain a copy of the certified plan on the project site during construction.
4. To allow District agents to go upon project lands for inspection.
5. That any conveyance of this project or portion thereof prior to its completion will transfer full responsibility for compliance with the certified plan to any subsequent owners.
6. To comply with all terms and conditions of this application and certified plan including payment of all fees prescribed by the district fee schedule hereby incorporated by reference.

The applicant hereby acknowledges that structural measures contained in the Soil Erosion and Sediment Control Plan are reviewed for adequacy to reduce offsite soil erosion and sedimentation and not for adequacy of structural design. The applicant shall retain full responsibility for any damages which may result from any construction activity notwithstanding district certification of the subject soil erosion and sediment control plan. It is understood that approval of the plan submitted with this application shall be valid only for the duration of the initial project approval granted by the municipality. All municipal renewals of this project will require resubmission and approval by the district. In no case shall this approval extend beyond three and one half years at which time resubmission and certification by the district will be required.

1. Applicant Certification† Signature _____ Date _____ Applicant Name (Print) _____	3. Plan determined complete: Signature of District Official _____ Date _____
2. Receipt of fee, plan and supporting documents is hereby acknowledged: Signature of District Official _____ Date _____	4. Plan certified, denied or other action as noted above. Special Remarks: Signature of District Official _____ Date _____

† If other than project owner, written authorization of owner must be attached.

SSCC 251 AP9 2/92

Addendum to Application For Soil Erosion and Sediment Control Plan Certification
Naval Weapons Station-Earle, Leonardo, New Jersey
U.S. Navy Contract No. N62472-94-D-0398
Delivery Order No. 0034
Bilge Water Plant Spill Containment Measures

1.a. The proposed drain and culvert are depicted in Drawing C-2 of Appendix D. The drainage calculations are provided in Appendix B.

1.b. The subject site is located within the 100 year flood plain as depicted in Figure 3 of Appendix D.

1.c. The Bilge Water Plant Area of Concern (AOC) is located approximately 400 feet northeast of the Sandy Hook Bay. Drawing 3 in Appendix D depicts the site in relation to the Sandy Hook Bay.

1.d. Location of the site is indicated on the attached soil map in Appendix E. Soils underlying the Bilge Water Plant area are mapped as Udorthents-Urban land complex.

1.e. The Bilge Water Plant is currently used to off-load and treat bilge water transported from the pier. The surrounding land use includes storage yards and a maintenance building.

1.f. The Bilge water Plant area is located on the outcrop of the Red Bank Sand Aquifer. This formation is underlain by the confining beds of the Navesink Formation. The average hydraulic conductivity reported for the Red Bank Sand is 9.74×10^{-4} cm/sec or 2.76 ft/day. Appendix E contains the hydrogeologic information.

2. Four copies of the project drawings are provided.

2.a. The schedule of duration is provided in Appendix C.

2.b. The existing site plan is provided as Drawing C-1 of Appendix D, and Drawing C-3 depicts the final grading plan.

2.c. Contours are shown on the drawings in Appendix D.

2.d. Site surface water run-off features and the proposed drain culvert are provided in Drawing 3 of Appendix D. The details of the drain culvert are provided in Drawing C-2 of Appendix D.

Addendum to Application For Soil Erosion and Sediment Control Plan Certification
Naval Weapons Station-Earle, Leonardo, New Jersey
U.S. Navy Contract No. N62472-94-D-0398
Delivery Order No. 0034
Bilge Water Plant Spill Containment Measures

2.e. Section 2.2 of this Plan and calculations in Appendix B provide the details on the channel stability for the stormwater control.

2.f. The proposed location and the detail of the silt fence installation are located on Drawing C-2 of Appendix D. The standard for the Sediment Barrier can be located in Appendix F.

2.g. The disturbed areas shall be paved, therefore there is no information on nonstructural soil stabilization such as seeding and mulching.

2.h. Silt fence will be left in place until the paving is completed.

2.i. Not applicable. This is a nonresidential application.

2.j. No permanent maintenance is required. The paving shall alleviate any erosional concerns. The storm water discharge basin will be maintained by navy personnel.

3. The appropriate fee of $330.00 is enclosed with this application.

APPENDIX B
Containment and Drainage Calculations

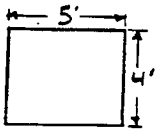
FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY T VERACCO DATE 1/26/99
CHKD. BY MWJ DATE 1/29/99
SHEET 1 OF 5
OFS NO. _____ DEPT. NO. _____
CLIENT DEPARTMENT OF NAVY - NAVAL WEAPONS STATION EARLE
PROJECT RAIL CAR SPILL CONTAINMENT
SUBJECT SOIL EROSION CONTROL PLAN - AREA CALCULATIONS

SCALE OFF DRAWING:

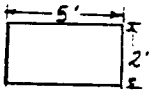
1" = 10'

TRANSFER STATION
SPILL PAD (TYP)



AREA = (4')(5') = 20 FT²
× 4 SPILL PADS THIS SIZE
80 FT²

TRANSFER STATION
SPILL PAD (DIRECTLY EAST OF WATER PLANT BLDG)



AREA = (5')(2') = 10 FT²

SUMP AREA (JUST NORTH OF THE OVERFLOW BASIN)

(6')(5') = 30 FT²

TRACK PANS:

2 END PANS
@ 18'-11" LONG = 227 IN.
10'-0" WIDE = 120 IN

(227 IN)(120 IN) = 27,240 IN² ≡ 189 FT²
× 4
756 FT²

3 CENTER PANS
@ 39'-5" LONG = 473 IN
10'-0" WIDE = 120 IN

(473 IN)(120 IN) = 56,760 IN² = 394 FT²
× 3
1,182 FT²

FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY J VERACCO DATE 1/26/99 SHEET 2 OF 5
CHKD. BY MWJ DATE 1/29/99 OFS NO. _____ DEPT. NO. _____
CLIENT DEPARTMENT OF NAVY - NAVAL WEAPONS STATION EARLE
PROJECT RAIL CAR SPILL CONTAINMENT
SUBJECT SOIL EROSION CONTROL PLAN - AREA CALCULATIONS (CONT'D.)

TRACK PANS (CONT'D.)

~~TANKER TRUCK TRANSFER AREA~~

~~2 PANS~~ REV 1 3/5/99 MWJ

~~EACH: 18'-11" LONG = 227 IN~~
~~10'-0" WIDE = 120 IN~~

~~(227 IN)(120 IN) = 27,240 IN² = 189 FT²~~
~~× 2~~
~~378 FT²~~

~~TANKER TRUCK TRANSFER PAD AREA = 508 FT.²~~
~~(FROM AUTO CAD)~~

OVERFLOW BASIN AREA = ~~1,780~~ 1,668 FT² REV 1 3/5/99 MWJ
(FROM AUTO CAD)

TOTAL AREA NO LONGER LEAVING THE SITE AS RUNOFF:

SPILL PADS	80 FT-
	10
SUMP AREA	3
TRACK PANS	756
	1,182
+	~~378~~ 0
TRANSFER PAD	~~508~~ 0
OVERFLOW BASIN	~~1,780~~ 1,668
	~~4,724~~ FT.²
	3,726

REV 1 3/5/99 MWJ

FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY T. VERACCO DATE 1/26/99 SHEET 3 OF

CHKD. BY MWJ DATE 1/29/99 OFS NO. DEPT. NO.

CLIENT DEPARTMENT OF NAVY - NAVAL WEAPONS STATION EARLE

PROJECT RAIL CAR SPILL CONTAINMENT

SUBJECT SOIL EROSION CONTROL PLAN - AREA CALCULATIONS (CONT'D.)

EXISTING GRAVEL AREA THAT IS PROPOSED TO BE PAVED:

4,669 FT² (FROM AUTOCAD)

RATIONAL EQUATION:

$$Q = CIA$$

Q = peak rate of runoff
I = Intensity of rainfall
A = drainage area
C = friction coefficient

C → asphalt or concrete paving → 0.70-0.95 × 0.9
C → based on field conditions of well compacted gravel, existing C = 0.45
I = 7.8 (from chart)

Asphalt area = ~~4,669~~ 3,933 FT²

Spill Containment area = ~~4,724~~ 3,726 FT²

CONVERSION FACTOR 1 acre = 43,560 ft.²

$$Q_{EXIST} = (0.45)(7.8)\left(\frac{\cancel{4,669}\ 3,933 + \cancel{4,724}\ 3,726}{43,560}\right)$$

$= \cancel{0.76}\ 0.62$ ft³/sec. Existing [illegible]

REV 1
3/5/99
MWJ

$$Q_{PROP} = (0.9)(7.8)\left(\frac{\cancel{4,669}\ 3,933}{43,560}\right)$$

$= \cancel{0.75}\ 0.62$ ft³/sec. ∴ Proposed less than exist

OK

FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY J VERACCO DATE 1/27/99
CHKD. BY MWJ DATE 1/29/99
SHEET 4 OF
OFS NO.
DEPT. NO.
CLIENT DEPARTMENT OF NAVY - NAVAL WEAPONS STATION EARLE
PROJECT RAIL CAR SPILL CONTAINMENT
SUBJECT SOIL EROSION CONTROL PLAN CALCULATIONS (CONT'D.)

VERIFY THAT DRAINAGE PIPE IS SUFFICIENT FOR PEAK FLOW OF ~~0.75~~ 0.62 FT³/SEC :

$Q_{PIPE} = 0.\cancel{75}\ 62\ FT^3/SEC$

6" PIPE

$A = \pi r^2$

$= (\pi)(0.25\ FT)^2$

$A = 0.196\ FT^2$

$S = 1.2\% = 0.012$

$n = 0.01$ (FOR SMOOTH PLASTIC PIPE)

$V = \left(\frac{0.62\ FT^3}{SEC}\right)\left(\frac{1}{0.196\ FT^2}\right) = \cancel{3.03}\ 3.16\ FT/SEC > 2\ FT/$

$R_h = \pi r^2 / 2\pi r$ (FOR PIPE FLOWING FULL)

$= (0.196)/(2 \cdot \pi \cdot 0.25)$

$= 0.125\ FT.$

$Q = \frac{1.49}{n} A R_h^{2/3} S_o^{1/2}$

$= \left(\frac{1.49}{0.01}\right)(0.196)(0.125)^{2/3}(0.012)^{1/2}$

$Q = 0.80\ FT^3/SEC > \cancel{0.75}\ 0.62\ FT^3/SEC$ ∴ OK

REV 1 3/5/99
MWJ

FOSTER WHEELER ENVIRONMENTAL CORPORATION

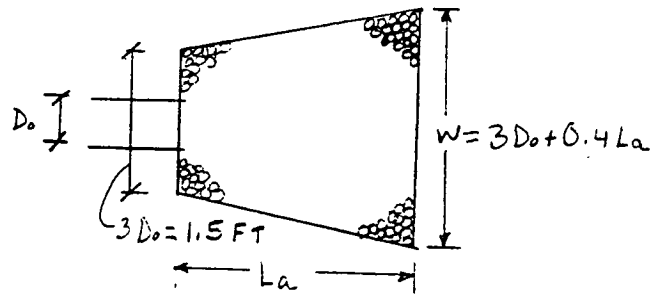
BY TVERACCO DATE 1/27/99
CHKD. BY MWJ DATE 1/29/99
SHEET 5 OF
OFS NO.
DEPT. NO.
CLIENT DEPARTMENT OF NAVY - WEAPONS STATION EARLE
PROJECT RAIL CAR SPILL CONTAINMENT
SUBJECT SOIL EROSION CONTROL PLAN - CALCULATIONS (CONT'D.)

OUTLET PROTECTION

REV 1 3/5/99, MWJ
- New Flow lower, Mat OK

MAT SIZE

FLOW = 0.75 FT³/SEC
6" PIPE



$$L_a = \frac{3Q}{D_o^{3/2}}$$

$$= \frac{(3)(0.75)}{(0.5)(3/2)}$$

$L_a = 3$ FT. (MINIMUM)
↳ USE 5 FT

$W = (3)(0.5) + (0.4)(3)$
$W = 2.7$ FT $\approx$ 3 FT. (MINIMUM)
↳ USE 5 FT.

STONE SIZE

$T_W \geq 1/2\, D_o$

$(1/2)(0.5) = 0.25$ USE $0.3 = T_W$

$$d_{50} = \left(\frac{0.02}{T_W}\right)\left(\frac{Q}{D_o}\right)^{4/3}$$

$$d_{50} = \left(\frac{0.02}{0.3}\right)\left(\frac{0.75}{0.5}\right)^{4/3}$$

$d_{50} = 0.11' = 1.32''$ (MINIMUM)

USE 3" & 6 DEEP MAT

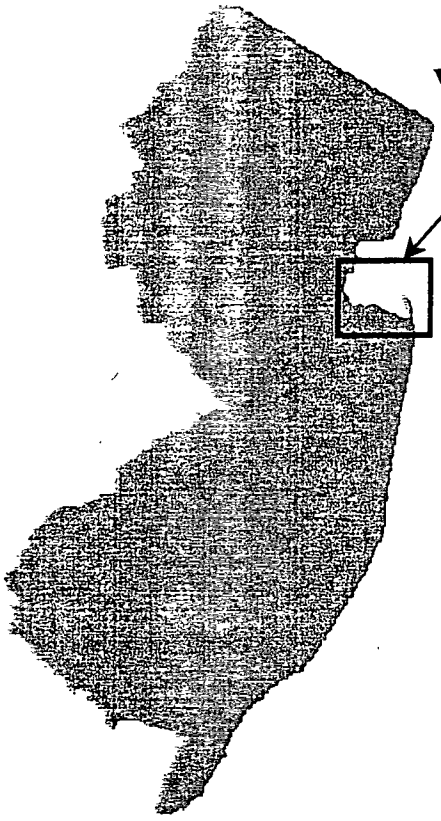
APPENDIX C
Construction Schedule

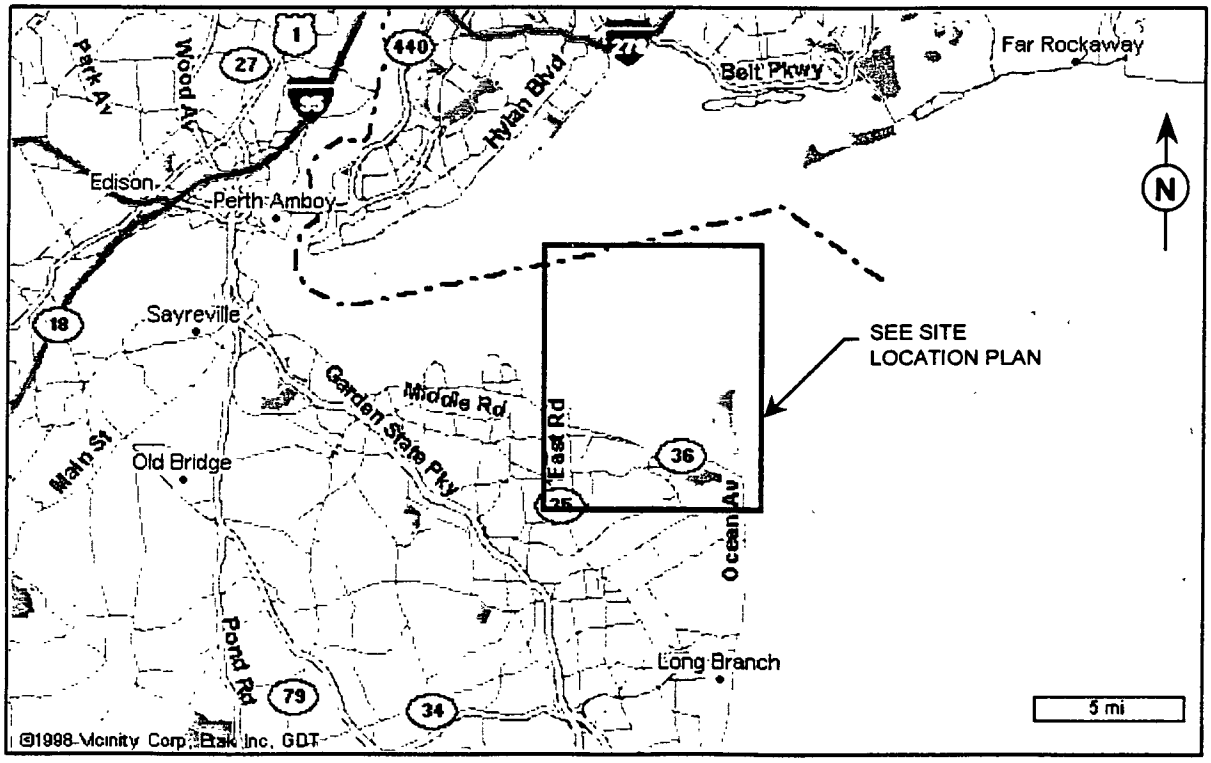
APPROXIMATE CONSTRUCTION SCHEDULE

TASK	TIME TO COMPLETE
1. Installation of soil erosion control measures	2 days
2. Installation of subsurface piping and trenches	4 weeks
3. Installation of track pans	1 week
4. Installation of discharge pipe	1 day
5. Asphalt paving and (including catch pads)	4 days
6. Removal of temporary control measures	1 day

NAVAL WEAPONS STATION EARLE
BILGE WATER TREATMENT PLANT

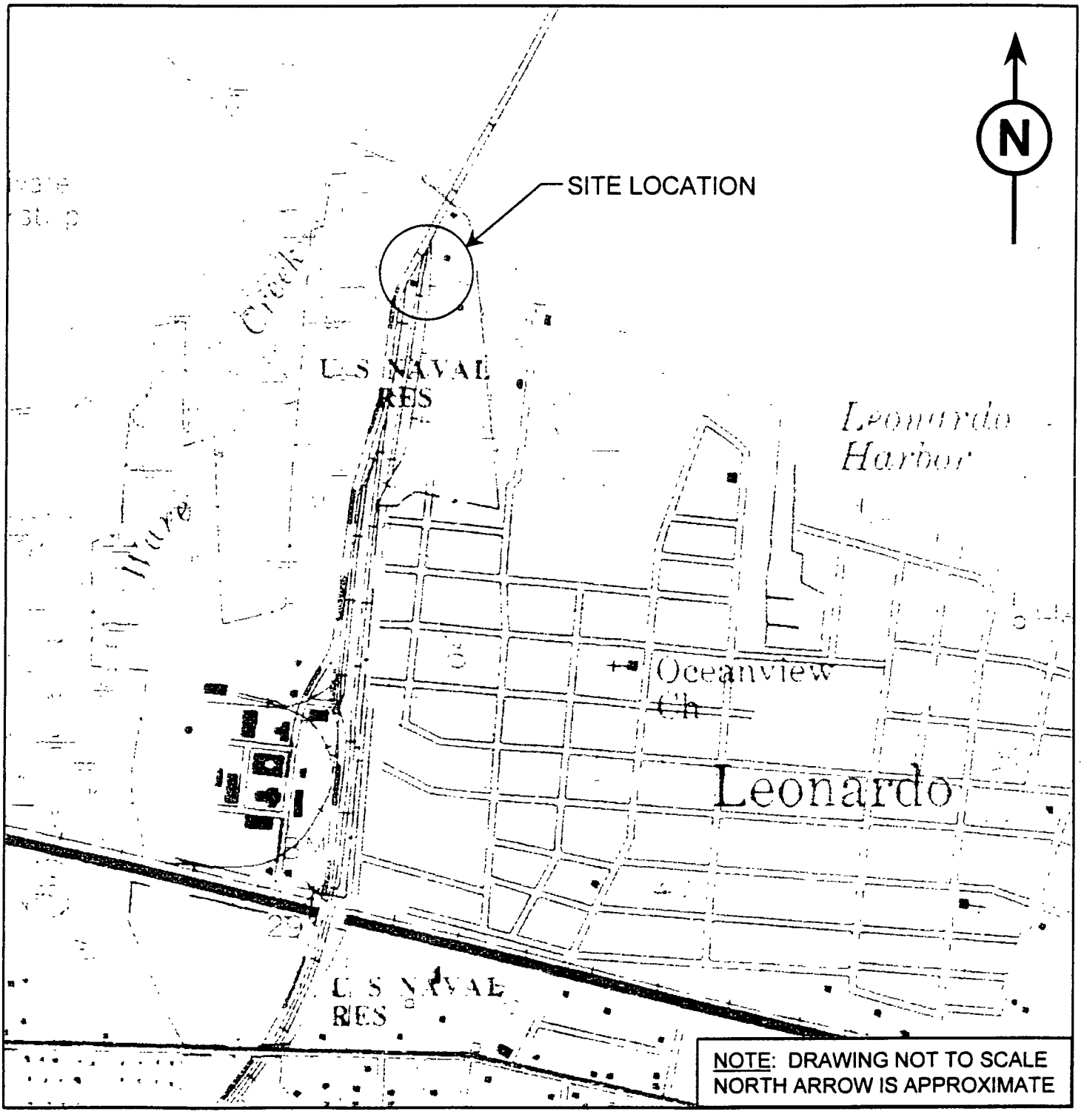
FIGURE 1
VICINITY MAP

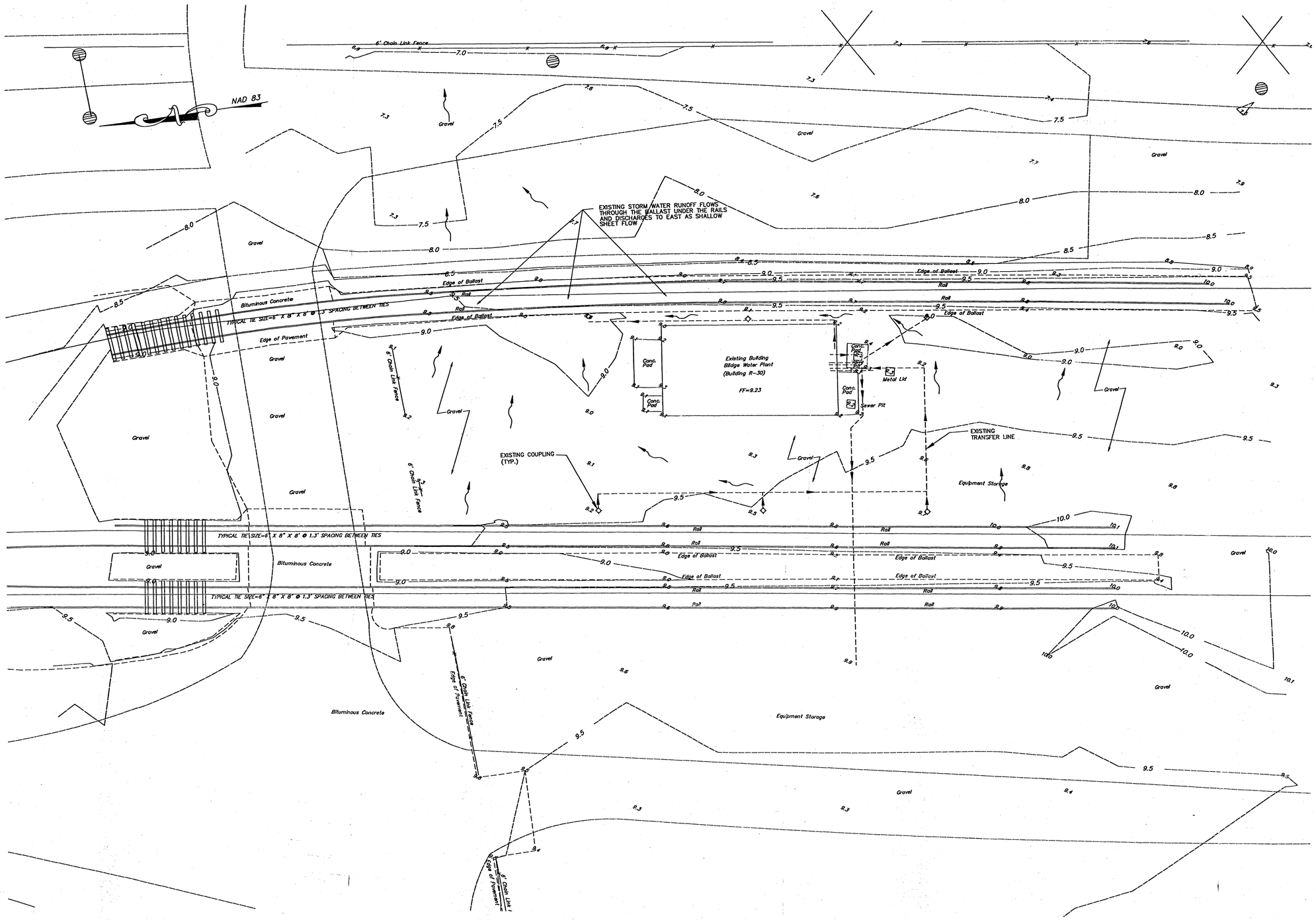




NAVAL WEAPONS STATION EARLE
BILGE WATER TREATMENT PLANT

FIGURE 2
LOCATION PLAN





SURVEY NOTES:

HORIZONTAL DATUM IS BASED UPON NAD 83

VERTICAL DATUM IS BASED UPON NAD 88.
HORIZONTAL AND VERTICAL CONTROL ESTABLISHED USING GLOBAL POSTIONING METHODOLOGY UTILIZING N.J.G.S.MONUMENT THROCKMORTON 3 AS FIXED.

UTILITY LOCATIONS SHOWN HEREON ARE FROM ABOVE GROUND OBSERVATIONS THE TYPE AND LOCATION OF UNDERGROUND AND OTHER UTILITIES IS NOT GUARANTEED TO BE ACCURATE OR ALL-INCLUSIVE. THE USER OF THIS SURVEY IS RESPONSIBLE FOR MAKING HIS OWN DETERMINATIONS AS TO THE TYPE AND LOCATIONS OF UNDERGROUND AND OTHER UTILITIES AS MAY BE NECESSARY.

THE UNDERSIGNED IS NOT QUALIFIED TO MAKE ANY DETERMINATION OF THE EXISTENCE OR NON-EXISTENCE OF WETLANDS AND/OR CONTAMINATION AFFECTING THIS SURVEY. THEREFORE, NO STATEMENT IS BEING MADE OR IMPLIED NOR SHOULD IT BE CONSTRUED THAT ANY STATEMENT IS BEING MADE BY THE FACT THAT NO EVIDENCE OF WETLANDS OR CONTAMINATION IS SHOWN.

IF DIGITAL INFORMATION IS ALSO SUPPLIED, IT IS DONE SO FOR INFORMATIONAL PURPOSES, ONLY. THE ORIGINAL SIGNED AND SEALED DOCUMENT IS THE DOCUMENT OF RECORD.

IF THIS SURVEY DOES NOT CONTAIN THE RAISED SEAL OF THE SURVEYOR, IT IS AN UNAUTHORIZED REPRODUCTION OF THE SURVEY.

LEGEND:

- EXISTING SUBSURFACE TRANSFER LINE
- 90 EXISTING CONTOUR
- 9.2 EXISTING SPOT GRADE
- EXISTING FORCEMAIN TO MIDDLETOWN SEWAGE AUTHORITY
- EXISTING COLLECTION POINT
- EXISTING DRAINAGE SURFACE FLOW

0 10 20 30 40
SCALE IN FEET

FOSTER WHEELER ENVIRONMENTAL

DSGN: M.W.J. DR: J.R. CHK: D.D
SUPV: D.D. CH ENG:
SUBMITTED BY: (FIRM MEMBER) (TITLE) (DATE)
NORTHDIV DM: HD: HD: DR:
FPE:

REV.	DESCRIPTION	PREP BY	DATE	APPRVD
0	ISSUED FOR NAVY REVIEW			

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
LESTER PENNSYLVANIA
NAVAL CONSTRUCTION BATTALION CENTER DAVISVILLE, RHODE ISLAND

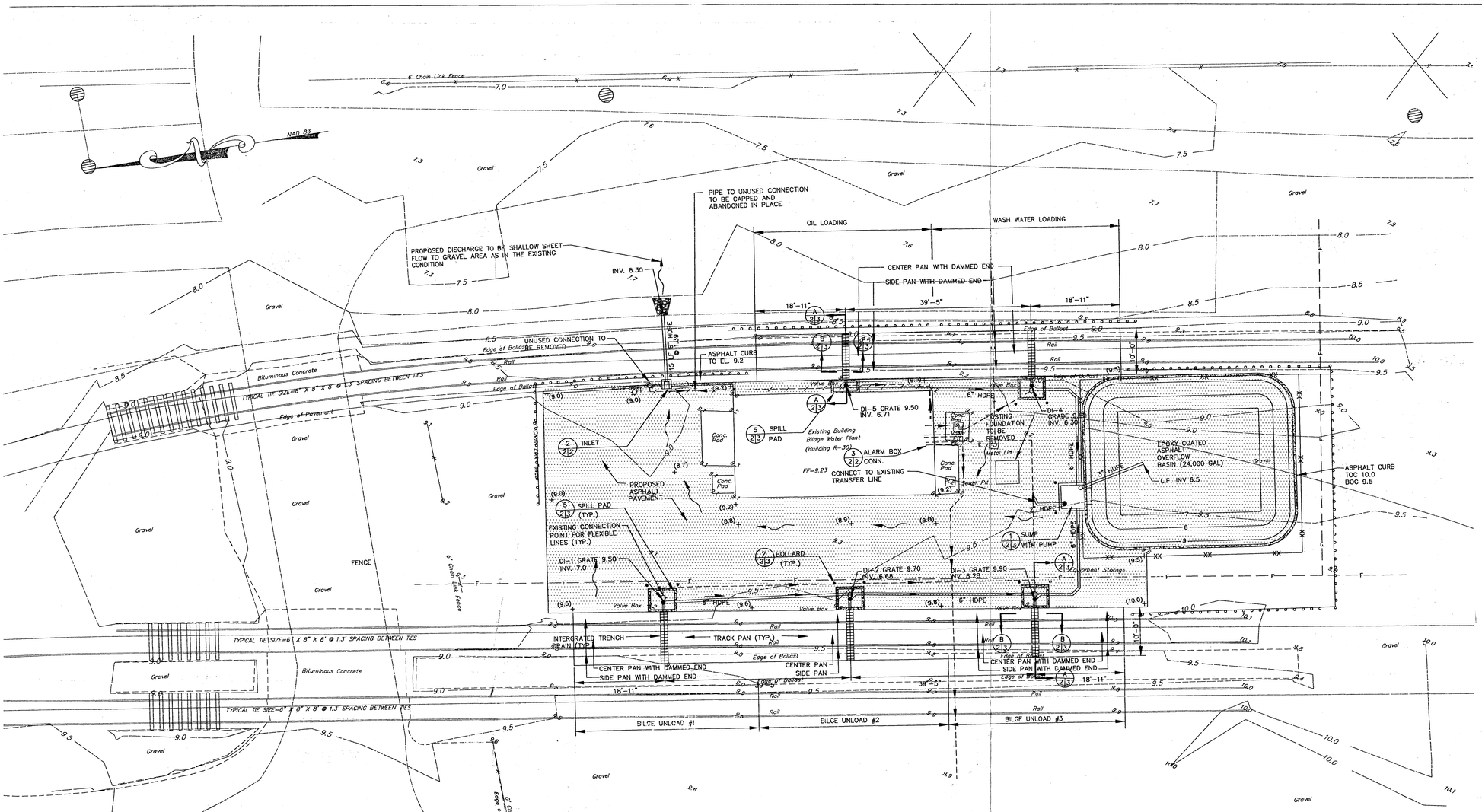
NAVAL WEAPONS STATION EARLE
BILGE WATER PLANT
EXISTING CONDITIONS

SEAL AREA

MICHAEL W. JUNGHANS
N.J.P.E. NO. 39677
CODE I.D. NO.
SCALE : 1"=10'
SPEC. NO. 04-
CONSTRN. CONTR. NO. N62472-
NAVFAC DRAWING NO.
SHEET 1 OF 3
SIZE: G
DIS. SH. NO. C-1

CAD FILE NAME: WF12198.DWG DATE: 2/23/99
PLOT SCALE: 1=1 TIME: 4:00 PM

DATE CREATED
LATEST CHANGE

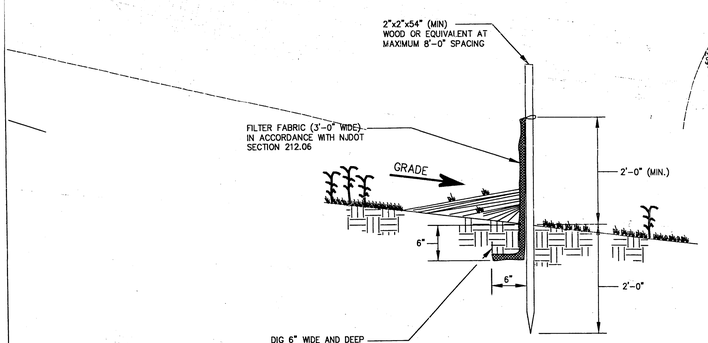


NOTES:

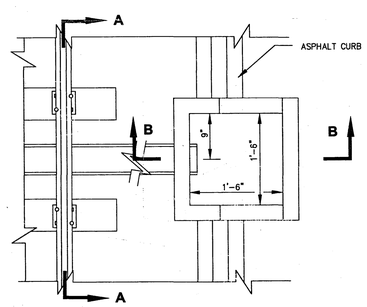
1. HORIZONTAL DATUM IS BASED UPON NAD 83
   VERTICAL DATUM IS BASED UPON NAD 88.
2. HORIZONTAL AND VERTICAL CONTROL ESTABLISHED USING GLOBAL POSITIONING METHODOLOGY UTILIZING N.J.G.S. MONUMENT THROCKMORTON 3 AS FIXED.
3. UTILITY LOCATIONS SHOWN ARE BASED ON ABOVE GROUND OBSERVATIONS THE TYPE AND LOCATION OF UNDERGROUND AND OTHER UTILITIES IS NOT GUARANTEED TO BE ACCURATE OR ALL-INCLUSIVE. THE CONTRACTOR IS RESPONSIBLE FOR MAKING DETERMINATIONS AS TO THE TYPE AND LOCATIONS OF UNDERGROUND AND OTHER UTILITIES AS MAY BE NECESSARY.
4. ALL EXISTING TRANSFER PIPING SHALL BE REPLACED IN THE SAME LOCATION WITH DOUBLE CONTAINMENT HDPE PIPING OF THE SAME INSIDE DIAMETER.
5. ALL ASPHALT CURBS TO BE PAINTED YELLOW.
6. A LEAK DETECTION SENSOR CORD SHALL BE PROVIDED FOR DOUBLE CONTAINMENT TRANSFER PIPING FROM THE RAIL CARS TO THE TREATMENT BUILDING. THREE SENSOR CORDS SHALL BE INSTALLED: 1) TRANSFER MAIN FROM RAIL CAR BILGE UNLOADING AREAS TO BUILDING (ONE CORD IN MAIN MANIFOLD ORIGINATING AT DI-1) ; 2) OIL LOADING AREA TO BUILDING; AND 3) WASH WATER LOADING AREA TO BUILDING. THE LEAK DETECTION CORDS SHALL EXTEND TO THE ALARM BOX ON THE SOUTH WALL OF THE TREATMENT BUILDING ADJACENT TO THE PENETRATION AS SHOWN ON DETAIL 3, THIS SHEET. PROVIDED SENSOR CORD SHALL BE CAPABLE OF MAPPING LINEAR FEET TO DETECTED LEAK.

LEGEND:

- PROPOSED SUBSURFACE SPILL CONTAINMENT LINE
- EXISTING SUBSURFACE TRANSFER LINE
- EXISTING TRANSFER LINE TO BE REMOVED
- 90 EXISTING CONTOUR
- 90 PROPOSED CONTOUR
- 9.2 EXISTING SPOT GRADE
- + (9.0) PROPOSED SPOT GRADE
- 6" ASPHALT CURBING WITH YELLOW PAINTING
- PROPOSED ASPHALT PAVING (DETAIL 6, SHEET 3)
- EXISTING FORCEMAIN TO MIDDLETOWN SEWAGE AUTHORITY
- EXISTING CONNECTION POINT TO TRANSFER LINES
- PROPOSED DRAINAGE SURFACE FLOW
- SILT FENCE (DETAIL 1, SHEET 2)
- DETAIL/SECTION DESIGNATION
- DETAIL/SECTION SHEET LOCATION
- REFERENCE SHEET LOCATION
- —X— EXISTING FENCE
- —XX— PROPOSED 5' CHAIN LINK FENCE
- —E— EXISTING UNDERGROUND ELECTRIC LINE
- —F— ABANDONED FIRE MAIN

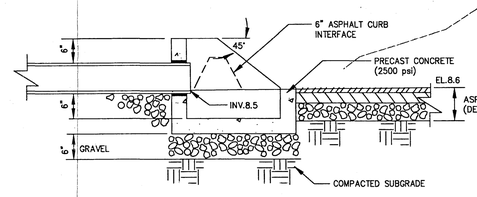


DETAIL 1/22 SILT FENCE
(NOT TO SCALE)

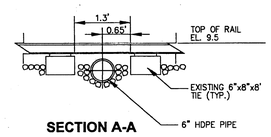


PLAN

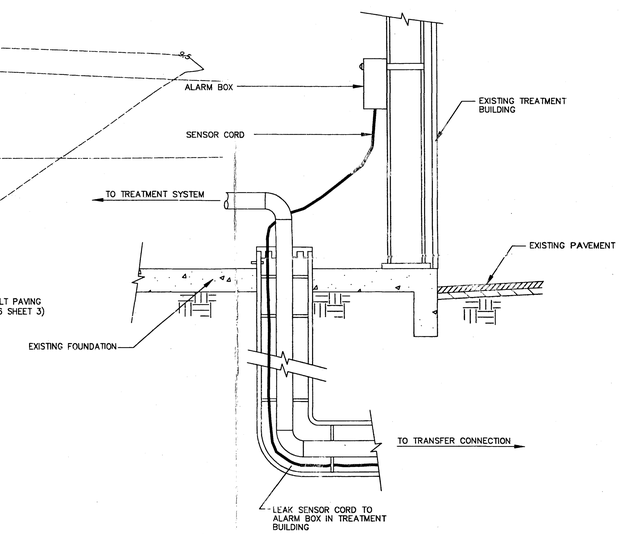
DETAIL 2/22 INLET
(NOT TO SCALE)



SECTION B-B



SECTION A-A



DETAIL 3/22 ALARM BOX CONN.
(NOT TO SCALE)

REV.	DESCRIPTION	PREP BY	DATE	APPRVD
0	ISSUED FOR NAVY REVIEW	M.W.J.	2/23/99	D.D.
1	REMOVED FUEL STATION			

FOSTER WHEELER ENVIRONMENTAL

DSGN: M.W.J. DR: J.R. CH: D.D.
SUPV: D.D. CH ENG.
SUBMITTED BY: (TITLE) (DATE)
(TRIM MEMBER)
NORTHDIV DM: HD: RD: DR: FPE:
OFFICER IN CHARGE
APPROVED DATE

NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
DEPARTMENT OF THE NAVY
LESTER PENNSYLVANIA
NAVAL CONSTRUCTION BATTALION CENTER DAVISVILLE, RHODE ISLAND

NAVAL WEAPONS STATION EARLE
BILGE WATER PLANT
SITE PLAN
RAIL CAR SPILL CONTAINMENT

NORTHDIV FOR COMMANDER, NAVFAC

SEAL AREA

MICHAEL W. JUNGHANS
N.J.P.E. NO. 39077

CODE I.D. NO.	80091
SCALE : AS NOTED	
SPEC. NO. 04--	
CONSTRN. CONTR. NO. N62472--	
HAVFAC DRAWING NO.	
SHEET 2 OF 3	
SIZE: C	DIS. SH. NO. C-2

CAD FILE NAME: WF11398.DWG DATE: 3/5/99
PLOT SCALE: 1=1 TIME: 2:35 PM

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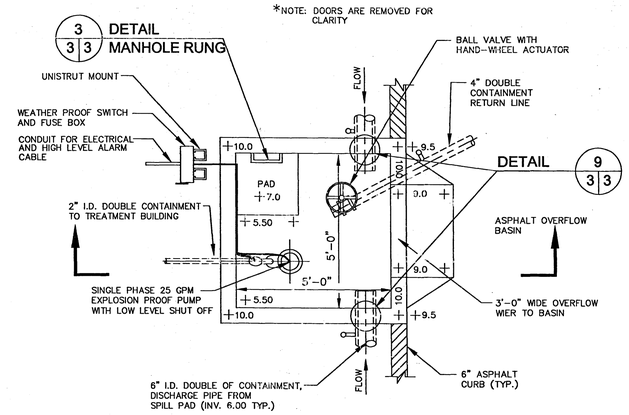
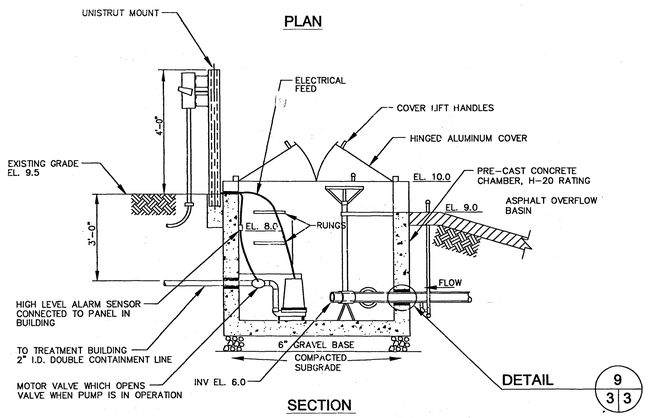
LATEST CHANGE
CHANGED BY:



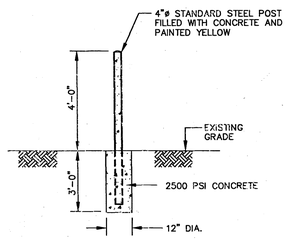
3 | 3 DETAIL MANHOLE RUNG

PLAN

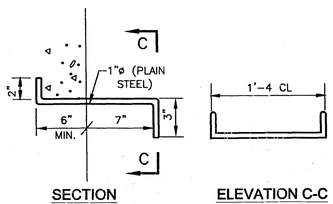


SECTION

DETAIL 1 / SUMP 2|3
NOT TO SCALE

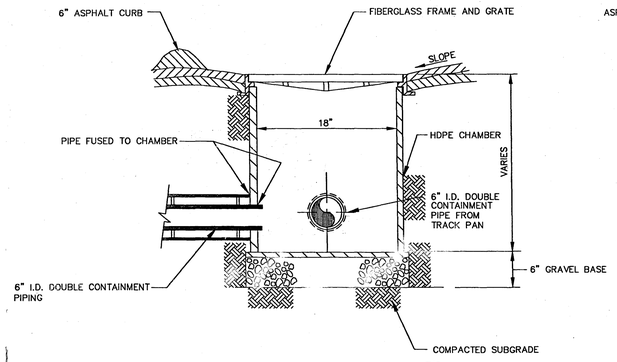


DETAIL 2 / BOLLARD POST 2|3
NOT TO SCALE

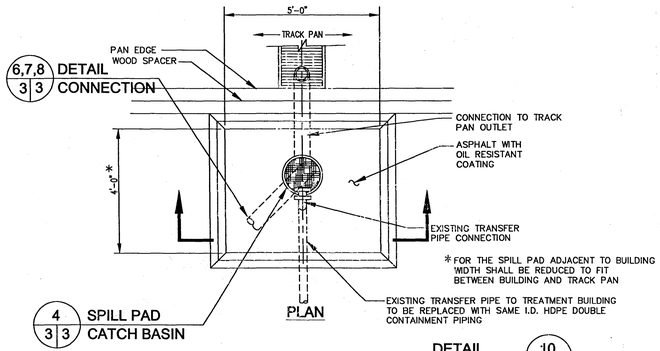


SECTION ELEVATION C-C

DETAIL 3 / MANHOLE RUNG 3|3
NOT TO SCALE



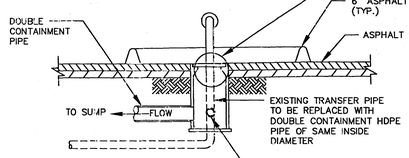
DETAIL 4 / SPILL PAD CATCH BASIN 3|3
NOT TO SCALE



6,7,8 | 3 DETAIL CONNECTION

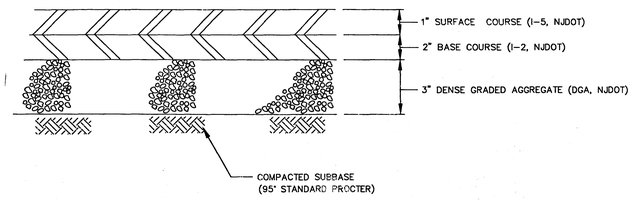
4 | 3 SPILL PAD CATCH BASIN

DETAIL 10 / 3|3



SECTION

DETAIL 5 / SPILL PAD 2|3
NOT TO SCALE



DETAIL 6 / ASPHALT PAVEMENT 2|3
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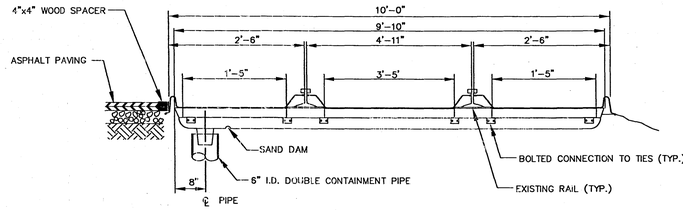
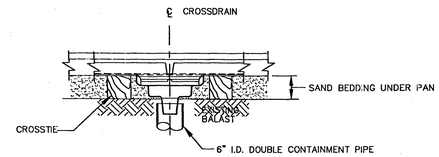


TYPICAL SECTION A / FIBERGLASS TRACK PAN 2|3
NOT TO SCALE



TYPICAL SECTION B / FIBERGLASS TRACK PAN 2|3
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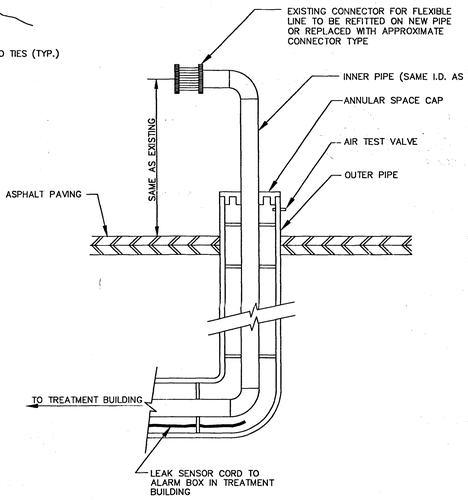

DETAIL 10 / FLEXIBLE LINE CONNECTION 3|3
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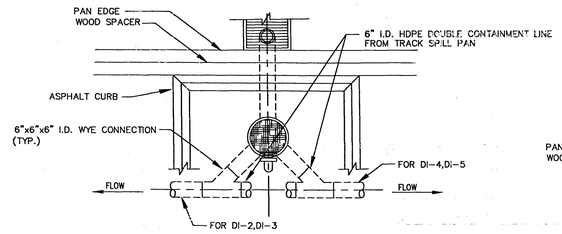
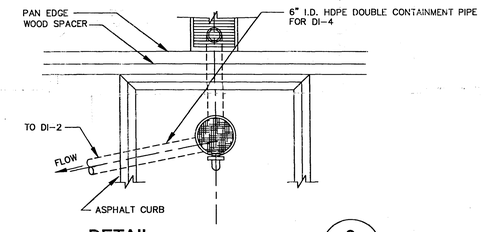
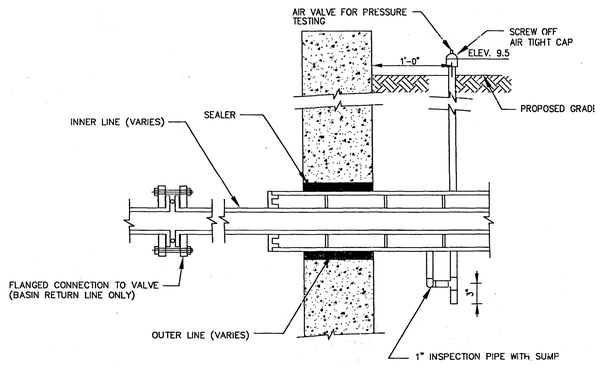


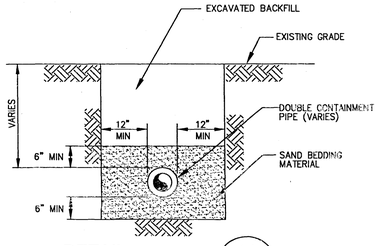
DETAIL 7 / PIPE CONNECTION DI-2,DI-3,DI-4,DI-5 3|3
NOT TO SCALE



DETAIL 8 / PIPE CONNECTION DI-1 3|3
NOT TO SCALE



DETAIL 9 / DOUBLE CONTAINMENT PIPE SUMP WELL PENETRATION 3|3
NOT TO SCALE



DETAIL 11 / PIPE TRENCH 2|3
NOT TO SCALE

REV.	DESCRIPTION	PREP BY	DATE	APPRVD
0	ISSUED FOR NAVY REVIEW	M.W.J.	2/23/99	D.D.
1	REMOVED FUEL STSTAION DETAIL			

FOSTER WHEELER ENVIRONMENTAL

DSGN: M.W.J. DR: J.R. CHK: D.D. SUPV: D.D. SUBMITTED BY: (TITLE) (DATE) (FIRM MEMBER) NORTHDIV DM: PPC: HD: DR: OFFICER IN CHARGE DATE APPROVED

NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
DEPARTMENT OF THE NAVY
LESTER PENNSYLVANIA
NAVAL CONSTRUCTION BATTALION CENTER DAVISVILLE, RHODE ISLAND
NAVAL WEAPONS STATION EARLE
BILGE WATER PLANT
DETAILS AND SECTIONS
RAIL CAR SPILL CONTAINMENT
NORTHDIV FOR COMMANDER, NAVFAC
DATE

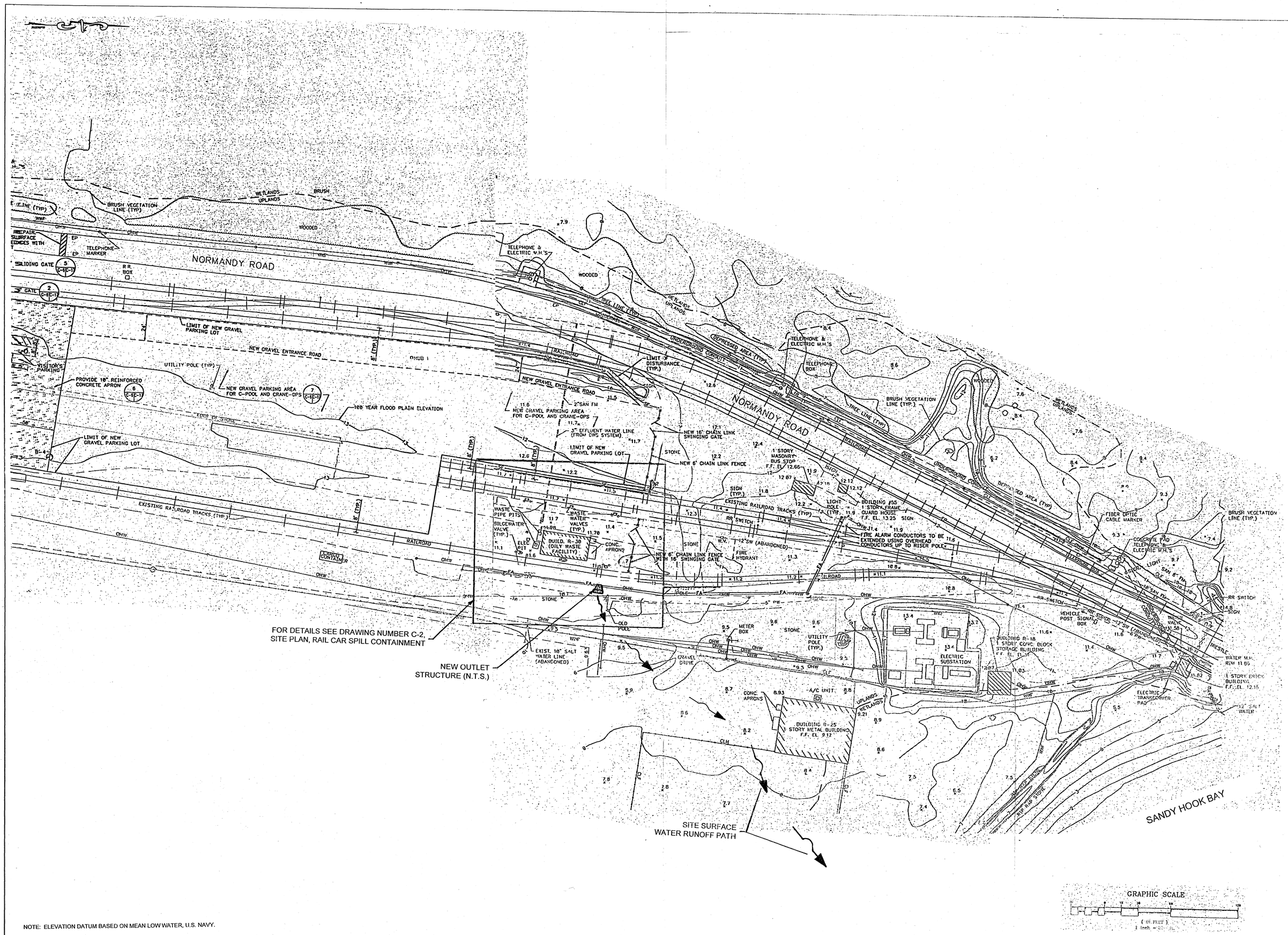
SEAL AREA

MICHAEL W. JUNGHANS
N.J.P.E. NO. 39877

CODE I.D. NO.	80091
SCALE : AS NOTED	
SPEC. NO. 04-	
CONSTRN. CONTR. NO. N62472-	
NAVFAC DRAWING NO.	
SHEET 3 OF 3	
SIZE: G	DIS. SH. NO. C-3

AD FILE NAME: WF111898.DWG DATE: 3/5/99
PLOT SCALE: .5=1' TIME: 2:30 PM

DATE CREATED
LATEST CHANGE



NOTE: ELEVATION DATUM BASED ON MEAN LOW WATER, U.S. NAVY.

FOSTER WHEELER ENVIRONMENTAL

REV.	DESCRIPTION	PREP BY	DATE	APPRVD
0	ISSUED FOR NAVY REVIEW			

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
LESTER PENNSYLVANIA
NAVAL CONSTRUCTION BATTALION CENTER DAVISVILLE, RHODE ISLAND

NAVAL WEAPONS STATION EARLE
BILGE WATER PLANT
DRAINAGE MAP

SEAL AREA

MICHAEL W. JUNGHANS
N.J.P.E. NO. 39877
CODE I.D. NO. 80
SCALE : 1" = 30'
SPEC. NO. 04-
CONSTRN. CONTR. NO. N62472-
NAVFAC DRAWING NO.
SHEET OF
SIZE: G
DIS. SH. NO. FIGURE 3

CONTRACTOR DRAWINGS & INFORMATION SUBMITTAL
NORTHNAVFACENGCOM 4335/3 (Rev. 6/80)

Prepare in quintuplicate (original and 4 copies)
CONTROL NO. 48

CONTRACT NO.	DELIVERY ORDER #	ACTIVITY LOCATION
N62472-94-D-0398	0034	Naval Weapons Station (NWS) @ Earle, Colts Neck, NJ

PROJECT TITLE:
SPCC Actions at Bilge Facility

FROM:
Foster Wheeler Environmental Corp. Program QC Manager: Mark Miller — DATE March 16, 1999

TO:
DESIGN NTR: T BRAMHALL (1 COPY) — DATE March 16, 1999

1. THE CONTRACTOR SUBMITTALS LISTED BELOW ARE FORWARDED FOR YOUR REVIEW AND RECOMMENDATIONS.
   (a) APPLY APPROPRIATE STAMP IMPRINT TO EACH SUBMITTAL AND INDICATE REVIEW COMMENTS, AS REQUIRED.
   (b) RETAIN ONE (1) COPY OF THIS TRANSMITTAL FORM AND RETURN REMAINING COPIES WITH REVIEWED SUBMITTALS TO ROICC.
2. THESE SUBMITTALS SHOULD BE RETURNED TO THIS OFFICE BY _____

COPY TO:

[X] ROICC T. Dunn (1 copy) [X] RPM NTR M Hunt (4 copies) [X] OTHER L Burg (1 copy)

Mark Miller 3-16-99
SIGNATURE AND DATE

TO: _____ DATE _____

TO: _____ DATE _____

1. THE SUBMITTALS LISTED BELOW HAVE BEEN REVIEWED AND ARE RETURNED, WITH ACTION TAKEN AS INDICATED.
2. _____

COPY TO:
[ ] ROICC [ ] DESIGNER

SIGNATURE AND DATE

FROM: ROICC — DATE

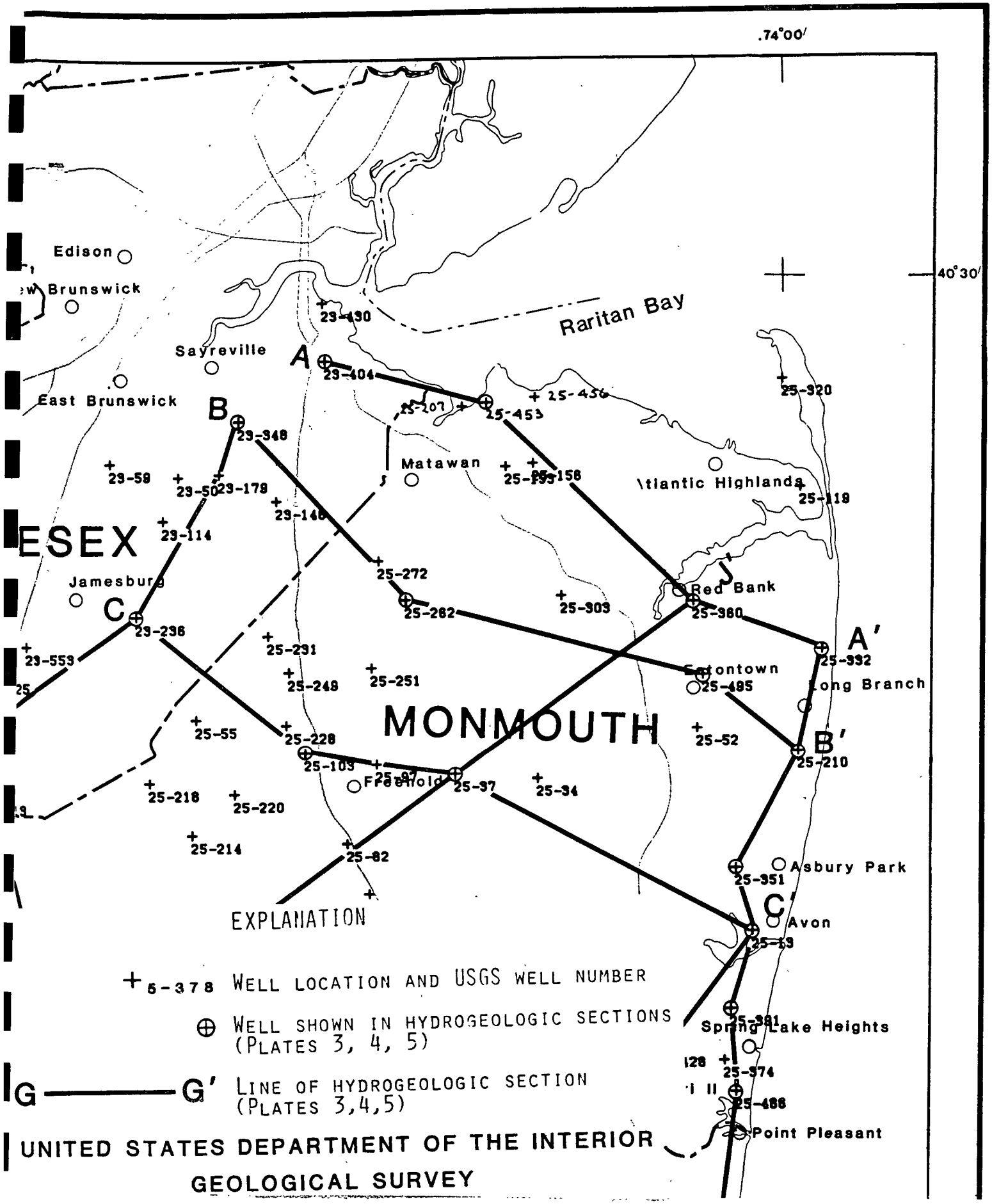
TO: CONTRACTOR — DATE

1. THE SUBMITTALS LISTED BELOW HAVE BEEN REVIEWED AND ARE APPROVED/DISAPPROVED AS SHOWN BELOW AND ON EACH STAMP IMPRINT.

COPY TO:
[ ] ROICC [ ] OTHER

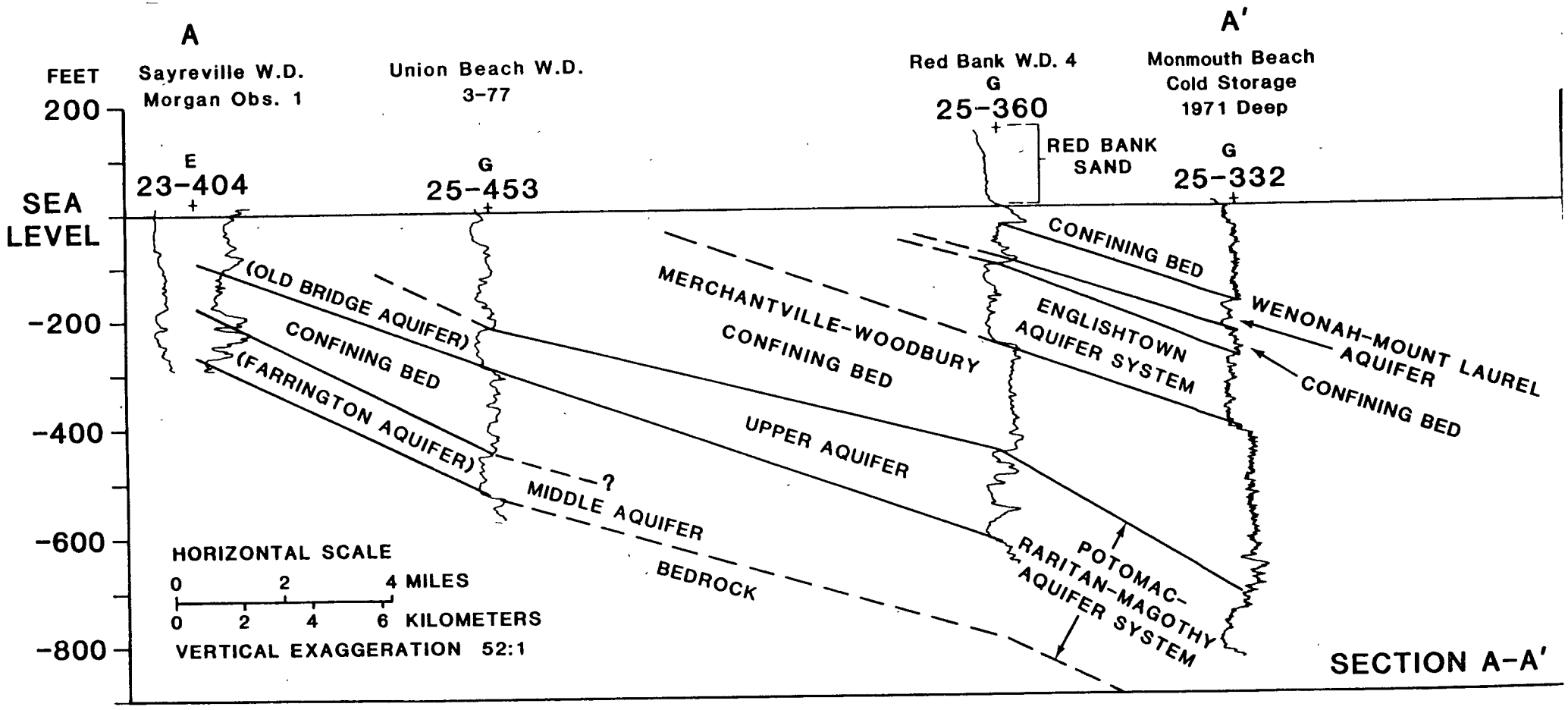
FOR COMMANDING OFFICER, NORTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND — DATE

ITEM NO.	SUBMITTAL DESCRIPTION	PREPARED/ SUBMITTED BY	APPROVED	DISAPPROVED	REMARKS
73	SD-08, Statements; Soil and Sediment Control Plan for Bilge Water Plant (R0)	M. Miller			

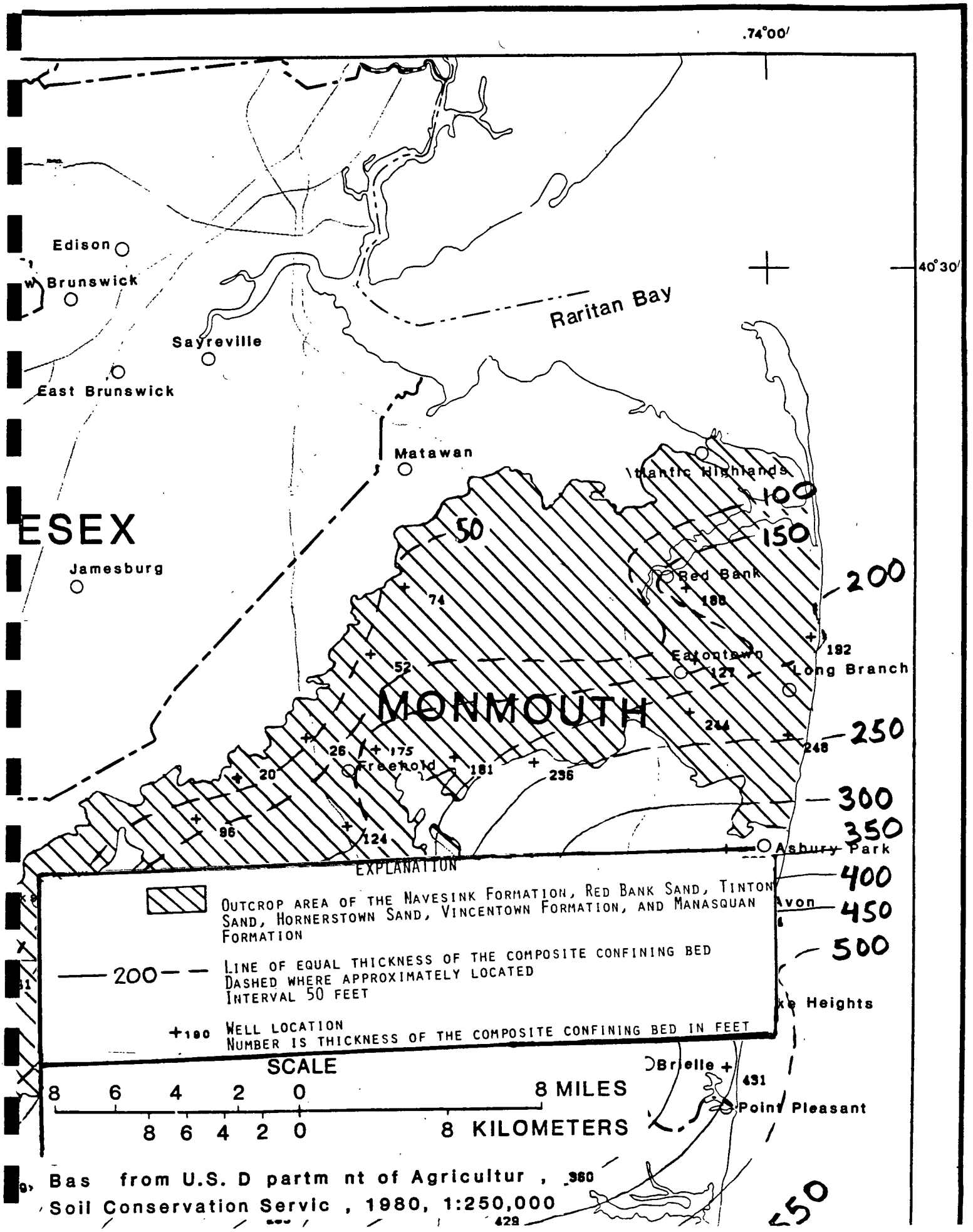


UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

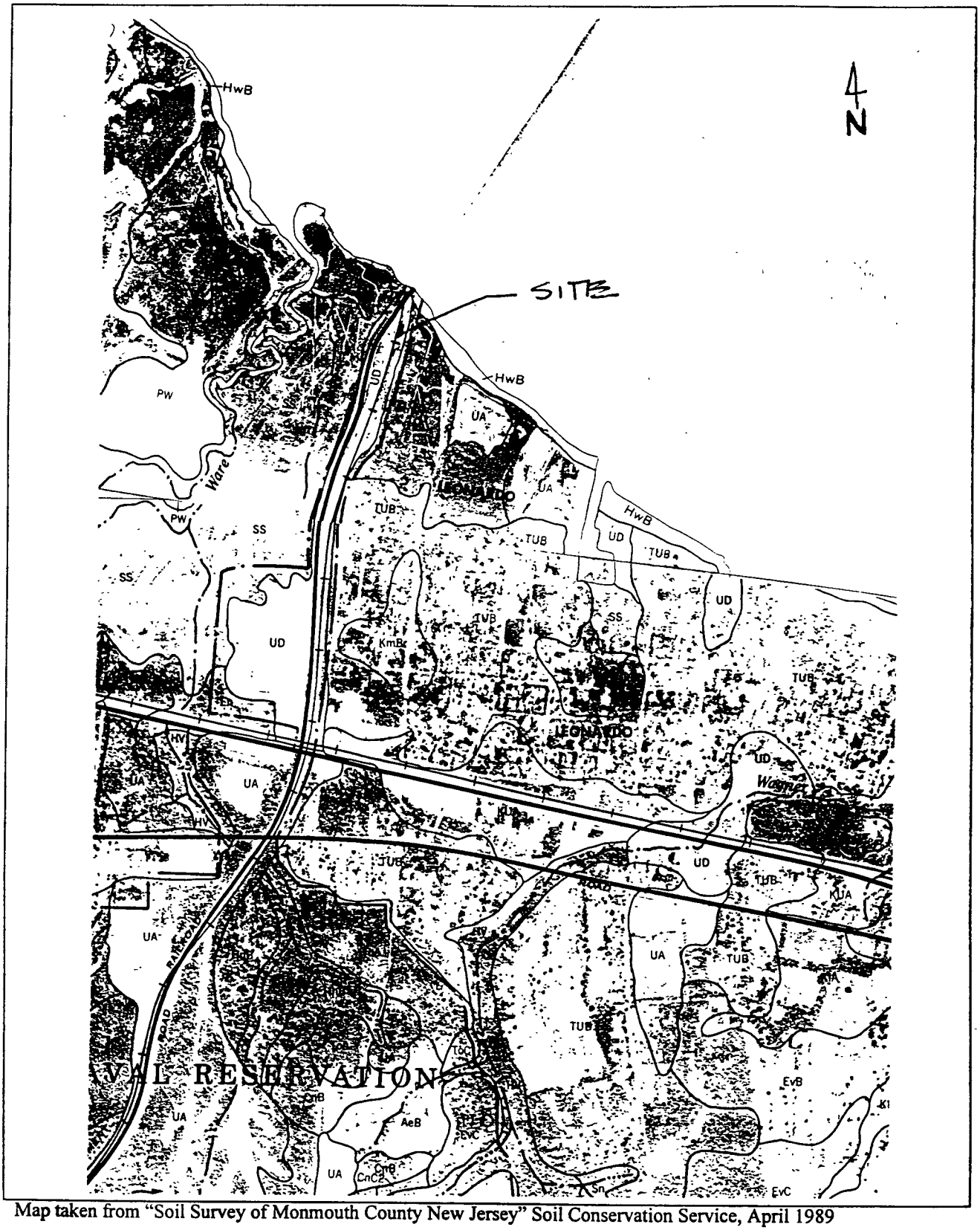
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



HYDROGEOLOGIC SECTIONS, COASTAL PLAIN, NEW JERSEY,
A-A' through E-E'



Bas from U.S. D partm nt of Agricultur , Soil Conservation Servic , 1980, 1:250,000



Map taken from "Soil Survey of Monmouth County New Jersey" Soil Conservation Service, April 1989

SOIL SURVEY MAP

Weapons Station Earle, Bilge Water Treatment Facility

SOIL LEGEND

Publication symbols consist of letters or a combination of letters and numbers. The initial two letters represent the kind of soil. A capital letter of A, B, C, D or E following the first two letters indicates the class of slope. Symbols without a slope letter are for nearly level soils, soils named for higher categories or for miscellaneous areas. A number following the letter represents an eroded phase.

SYMBOL	NAME
AeA	Adelphia loam, 0 to 2 percent slopes
AeB	Adelphia loam, 2 to 5 percent slopes
ALA	Adelphia loam - Urban land complex, 0 to 5 percent slopes
At	Atsion sand
Cm	Colemantown loam
CnB	Collington sandy loam, 2 to 5 percent slopes
CnC2	Collington sandy loam, 5 to 10 percent slopes, eroded
CnD3	Collington sandy loam, 10 to 15 percent slopes, severely eroded
CoA	Collington loam, 0 to 2 percent slopes
CRB	Collington sandy loam - Urban land complex, 0 to 10 percent slopes
CtB	Colts Neck sandy loam, 2 to 5 percent slopes
CtC	Colts Neck sandy loam, 5 to 10 percent slopes
CtC2	Colts Neck sandy loam, 5 to 10 percent slopes, eroded
CtD2	Colts Neck sandy loam, 10 to 15 percent slopes, eroded
CtE2	Colts Neck sandy loam, 15 to 25 percent slopes, eroded
DnA	Downer loamy sand, 0 to 5 percent slopes
DnC	Downer loamy sand, 5 to 10 percent slopes
DoA	Downer sandy loam, 0 to 2 percent slopes
DoB	Downer sandy loam, 2 to 5 percent slopes
DUB	Downer sandy loam - Urban land complex, 0 to 10 percent slopes
En	Elkton loam
EvB	Evesboro sand, 2 to 5 percent slopes
EvC	Evesboro sand, 5 to 10 percent slopes
EvD	Evesboro sand, 10 to 15 percent slopes
EvE	Evesboro sand, 15 to 25 percent slopes
EWB	Evesboro sand - Urban land complex, 0 to 10 percent slopes
Fb	Fallsington loam
FnA	Freehold loamy sand, 0 to 5 percent slopes
FnC	Freehold loamy sand, 5 to 10 percent slopes
FrB	Freehold sandy loam, 2 to 5 percent slopes
FrC	Freehold sandy loam, 5 to 10 percent slopes
FrC2	Freehold sandy loam, 5 to 10 percent slopes, eroded
FrD	Freehold sandy loam, 10 to 15 percent slopes
FrD2	Freehold sandy loam, 10 to 15 percent slopes, eroded
FrE2	Freehold sandy loam, 15 to 25 percent slopes, eroded
FsA	Freehold loam, 0 to 2 percent slopes
FUB	Freehold sandy loam - Urban land complex, 0 to 10 percent slopes
HaB	Hammonton loamy sand, 0 to 3 percent slopes
HbA	Hammonton sandy loam, 0 to 2 percent slopes
HbB	Hammonton sandy loam, 2 to 5 percent slopes
HLA	Hammonton sandy loam - Urban land complex, 0 to 3 percent slopes
HnA	Holmdel sandy loam, 0 to 2 percent slopes
HnB	Holmdel sandy loam, 2 to 5 percent slopes
HUA	Holmdel sandy loam - Urban land complex, 0 to 5 percent slopes
HwB	Hooksan sand, 0 to 5 percent slopes
HxA	Hooksan Variant sand, 0 to 2 percent slopes
HV	Humaquepts, frequently flooded

SYMBOL	NAME
KeA	Keyport sandy loam, 0 to 2 percent slopes
KeB	Keyport sandy loam, 2 to 5 percent slopes
KeC	Keyport sandy loam, 5 to 10 percent slopes
KeD	Keyport sandy loam, 10 to 15 percent slopes
KGB	Keyport sandy loam - Urban land complex, 0 to 10 percent slopes
KIA	Klej loamy sand, 0 to 3 percent slopes
KmB	Klej loamy sand, clayey substratum, 0 to 5 percent slopes
KUA	Klej loamy sand - Urban land complex, 0 to 3 percent slopes
KvA	Kresson loam, 0 to 5 percent slopes
LaA	Lakehurst sand, 0 to 2 percent slopes
LeB	Lakewood sand, 0 to 5 percent slopes
LeC	Lakewood sand, 5 to 10 percent slopes
Ma	Manahawkin muck
MbC	Marlton sandy loam, 5 to 10 percent slopes
MlB	Marlton loam, 2 to 5 percent slopes
PeA	Pemberton loamy sand, 0 to 5 percent slopes
PhB	Phalanx loamy sand, 0 to 10 percent slopes
PhD	Phalanx loamy sand, 10 to 25 percent slopes
PT	Pits, sand and gravel
PW	Psamments, waste substratum
SaB	Sassafras sandy loam, 2 to 5 percent slopes
SaC	Sassafras sandy loam, 5 to 10 percent slopes
SaD	Sassafras sandy loam, 10 to 15 percent slopes
SaE	Sassafras sandy loam, 15 to 25 percent slopes
SgB	Sassafras gravelly sandy loam, 2 to 5 percent slopes
SgC	Sassafras gravelly sandy loam, 5 to 10 percent slopes
SlA	Sassafras loam, 0 to 2 percent slopes
Sn	Shrewsbury sandy loam
SS	Sulfaquents and Sulfihemists, frequently flooded
ToA	Tinton loamy sand, 0 to 5 percent slopes
ToC	Tinton loamy sand, 5 to 10 percent slopes
ToD	Tinton loamy sand, 10 to 25 percent slopes
TUB	Tinton loamy sand - Urban land complex, 0 to 5 percent slopes
UA	Udorthents, smoothed
UD	Udorthents - Urban land complex, 0 to 3 percent slopes
UL	Urban land
WnB	Woodstown sandy loam, 2 to 5 percent slopes
WoA	Woodstown loam, 0 to 2 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label)
- Located object (label)
- Tank (label)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot