SECTION 4.0
FIGURES

Figure 4-1: Navy Ecological Risk Assessment Tiered Approach

RPM Input and Risk Management Consideration[3]

Step 8: Risk Management

Tier 1. Screening Risk Assessment (SRA): Identify pathways and compare exposure point concentrations to bench marks.

Step 1: Site visit; Pathway Identification/Problem Formulation; Toxicity Evaluation

Step 2: Exposure Estimate; Risk Calculation (SMDP) [1]

Proceed to Exit Criteria for SRA

Exit Criteria for the Screening Risk Assessment: Decision for exiting or continuing the ecological risk assessment.

1) Site passes screening risk assessment: A determination is made that the site poses acceptable risk and shall be closed out for ecological concerns.

2) Site fails screening risk assessment: The site must have both complete pathway and unacceptable risk. As a result the site will either have an interim cleanup or moves to the second tier.

Tier 2. Baseline Ecological Risk Assessment (BERA): Detailed assessment of exposure and hazard to "assessment endpoints" (ecological qualities to be protected). Develop site specific values that are protective of the environment.

Step 3a: Refinement of Conservative Exposure Assumptions[2] (SRA)---- **Proceed to Exit Criteria for Step 3a**

Step 3b: Problem Formulation - Toxicity Evaluation; Assessment Endpoints; Conceptual Model; Risk Hypothesis (SMDP)

Step 4: Study Design/DQO - Lines of Evidence; Measurement Endpoints; Work Plan and Sampling & Analysis Plan (SMDP)

Step 5: Verification of Field Sampling Design (SMDP)

Step 6: Site Investigation and Data Analysis [SMDP]

Step 7: Risk Characterization

Proceed to Exit Criteria for BERA

Exit Criteria Step 3a Refinement

1) If re-evaluation of the conservative exposure assumptions (SRA) support an acceptable risk determination then the site exits the ecological risk assessment process.

2) If re-evaluation of the conservative exposure assumptions (SRA) do not support an acceptable risk determination then the site continues in the Baseline Ecological Risk Assessment process. **Proceed to Step 3b**.

Exit Criteria Baseline Risk Assessment

1) If the site poses acceptable risk then no further evaluation and no remediation from an ecological perspective is warranted.

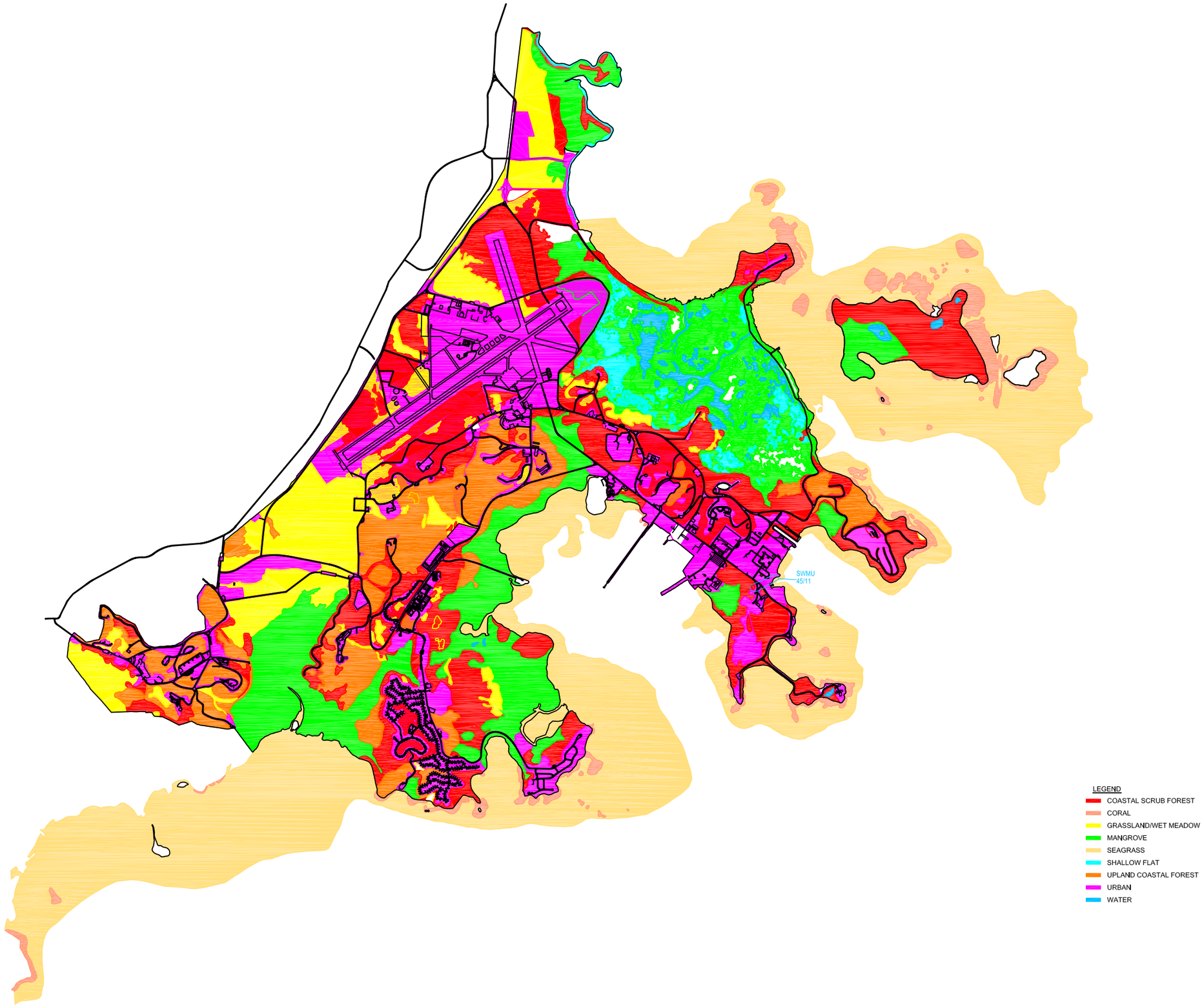
2) If the site poses unacceptable ecological risk and additional evaluation in the form of remedy development and evaluation is appropriate, proceed to third tier.

Tier 3. Evaluation of Remedial Alternative (RAGs C)

a. Develop site specific risk based cleanup values.

b. Qualitatively evaluate risk posed to the environment by implementation of each alternative (short term) impacts and estimate risk reduction provided by each (long-term) impacts; provide quantitative evaluation where appropriate. Weigh alternative using the remaining CERCLA 9 Evaluation Criteria. Plan for monitoring and site closeout.

Notes: 1) See USEPA's 8 Step ERA Process for requirements for each Scientific Management Decision Point (SMDP).
2) Refinement includes but is not limited to background, bioavailability, detection frequency, etc.
3) Risk Management is incorporated throughout the tiered approach.



SOURCE: GEO-MARINE, INC.

REVISIONS			
DRAWN	GLB/RRR	NORTH	
REVIEWED	MEK		
S.O.#	100309		
CADD#	CH2271807		

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

BAKER ENVIRONMENTAL, Inc.
Coraopolis, Pennsylvania

Baker

"TERRESTRIAL AND AQUATIC HABITAT OCCURRING AT NAVAL STATION ROOSEVELT ROADS"

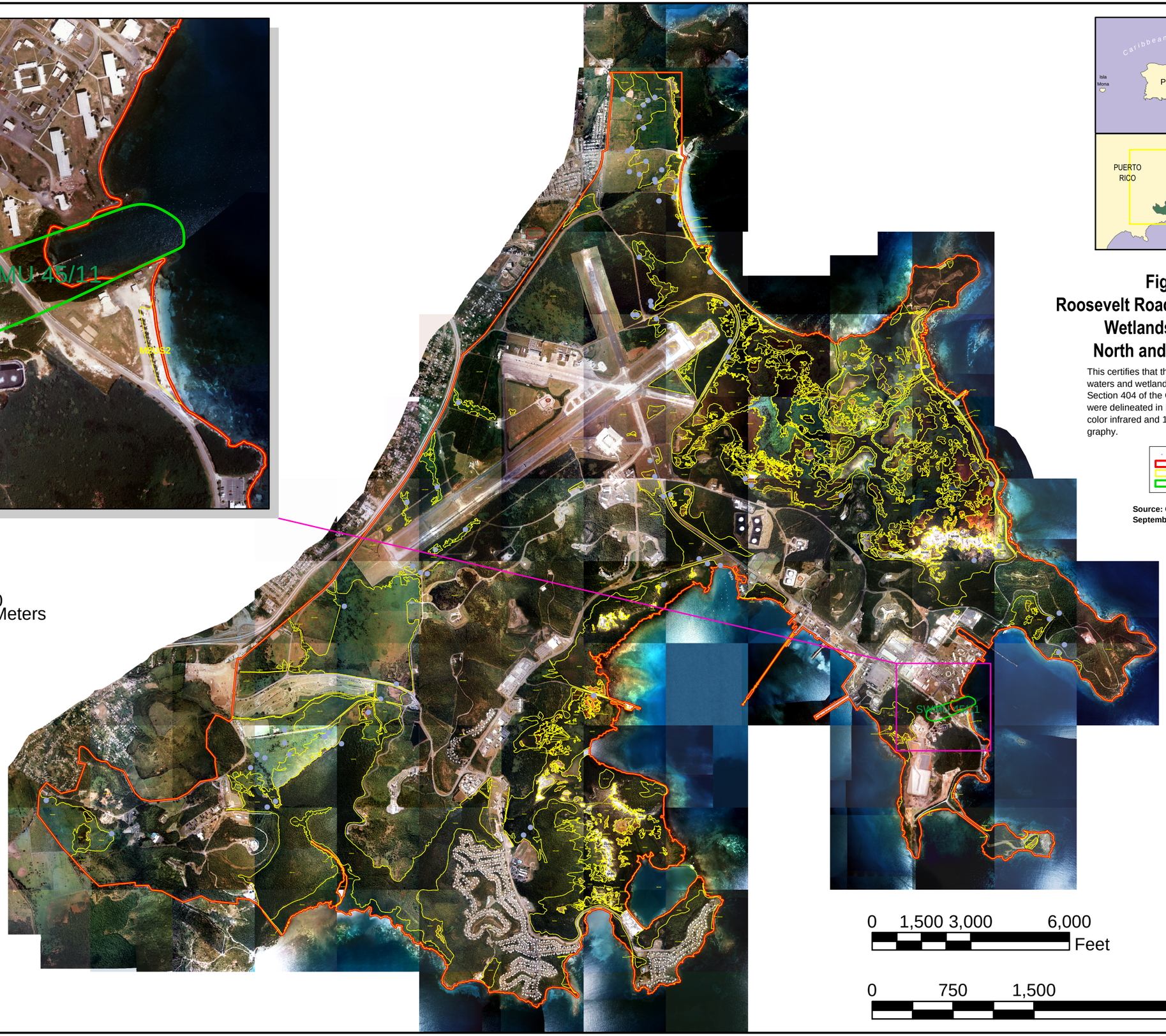
SCALE 1" = 600'

DATE JANUARY 2004

FIGURE
4-2

0 250 500 1,000 Feet

0 100 200 400 Meters



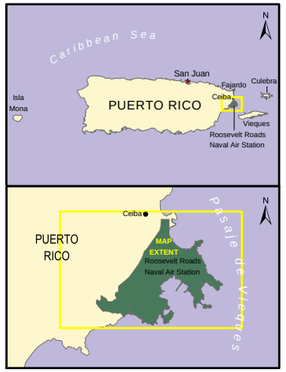


Figure 4-3
Roosevelt Roads Naval Air Station Wetlands Delineation North and East Sections

This certifies that this plat identifies potential waters and wetlands regulated persuant to Section 404 of the Clean Water Act. Wetlands were delineated in December, 1999 from 1993 color infrared and 1998 true color aerial photography.

Data form locations
Roosevelt Roads base boundary
Wetland boundaries
SWMU's

N

Source: Geo-Marine, Inc., September 6, 2000

0 1,500 3,000 6,000 Feet

0 750 1,500 3,000 Meters

FIGURE 4-4
THE COWARDIN WETLAND CLASSIFICATION SYSTEM
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
SWMU 45
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

SYSTEM: M - MARINE

SUBSYSTEM	1 - SUBTIDAL					2 - INTERTIDAL			
CLASS	RB - Rock Bottom	UB - Unconsolidated Bottom	AB - Aquatic Bed	RF - Reef	OW - Open Water (unknown bottom)	AB - Aquatic Bed	RF - Reef	RS - Rocky Shore	US - Unconsolidated Shore
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 3 Rooted Vasc 5 Unknown	1 Coral 3 Worm		1 Algal 3 Rooted Vasc 5 Unknown	1 Coral 3 Worm	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic

SYSTEM: E - ESTUARINE

SUBSYSTEM	1 - SUBTIDAL			2 - INTERTIDAL						
CLASS	RB - Rock Bottom	UB - Unconsolidated Bottom	AB - Aquatic Bed	RF - Reef	OW - Open Water *(unknown bottom)*	AB - Aquatic Bed	RF - Reef	SB - Streambed	RS - Rocky Shore	US - Unconsolidated Shore	EM - Emergent	SS - Scrub-Shrub	FO - Forested
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	2 Mollusk 3 Worm		1 Algal 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	2 Mollusk 3 Worm	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic 5 Dead	1 Persistent 2 Nonpersistent	1 Broad-leaved Decid. 2 Needle-leaved Decid. 3 Broad-leaved Everg. 4 Needle-leaved Everg. 5 Dead 6 *Deciduous* 7 *Evergreen*	1 Broad-leaved Decid. 2 Needle-leaved Decid. 3 Broad-leaved Everg. 4 Needle-leaved Everg. 5 Dead 6 *Deciduous* 7 *Evergreen*

SYSTEM: R - RIVERINE

SUBSYSTEM	1 - TIDAL	2 - LOWER PERENNIAL		3 - UPPER PERENNIAL		4 INTERMITTENT		5 - UNKNOWN PERENNIAL		
CLASS	RB - Rock	UB - Unconsolidated Bottom	SB - Streambed	AB - Aquatic Bed	RS - Rocky Shore	US - Unconsolidated Shore	OW - Open Water *(unknown bottom)*	**EM - Emergent	RB - Rock Bottom	UB - Unconsolidated Bottom
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Bedrock 2 Rubble 3 Cobble - Gravel 4 Sand 5 Mud 6 Organic 7 Vegetated	1 Algal 2 Aquatic Moss 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic		2 Nonpersistent	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic

SYSTEM: L - LACUSTRINE

SUBSYSTEM	1 - LIMNETIC			2 - LITTORAL					
CLASS	AB - Aquatic Bed	OW - Open Water *(unknown bottom)*	RB - Rock Bottom	RS - Rocky Shore	UB - Unconsolidated Bottom	AB - Aquatic Bed	US - Unconsolidated Shore	EM - Emergent	OW - Open Water *(unknown bottom)*
Subclass	1 Algal 2 Aquatic Moss 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*		1 Bedrock 2 Rubble	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	2 Nonpersistent	

SYSTEM: P - PALUSTRINE

CLASS	RB - Rock Bottom	UB - Unconsolidated Bottom	AB - Aquatic Bed	US - Unconsolidated Shore	ML - Moss-Lichen	EM - Emergent	SS - Scrub-Shrub	FO - Forested	OW - Open Water *(unknown bottom)*
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	1 Moss 2 Lichen	1 Persistent 2 Nonpersistent	1 Broad-leaved Decid. 2 Needle-leaved Decid. 3 Broad-leaved Everg. 4 Needle-leaved Everg. 5 Dead 6 *Deciduous* 7 *Evergreen*	1 Broad-leaved Decid. 2 Needle-leaved Decid. 3 Broad-leaved Everg. 4 Needle-leaved Everg. 5 Dead 6 *Deciduous* 7 *Evergreen*	

MODIFIERS

WATER REGIME

Non-Tidal

A Temp. Flooded
B Saturated
C Seasonally Flooded
D Seasonally Flooded/ Well Drained
E Seasonally Flooded/ Saturated
F Semipermanently Flooded
G Intermittently Exposed
H Permanently Flooded
J Intermittently Flooded
K Artificially Flooded
W Intermittently Flooded/ Temporary
Y Saturated/Semipermanent/ Seasonal
Z Intermittently Exposed Permanent
U Unknown

Tidal

K Artificially Flooded
L Subtidal
M Irregularly Flooded
N Regularly Flooded
P Irregularly Flooded
*S Temporary-Tidal
*R Seasonal-Tidal
*T Semipermanent- Tidal
*V Permanent-Tidal
U Unknown

* These water regimes are only used in tidally influenced, freshwater systems.

WATER CHEMISTRY

Coastal Halinity

1 Hyperhaline
2 Euhaline
3 Mixohaline
4 Polyhaline
5 Mesohaline
6 Oligohaline
0 Fresh

Inland Salinity

7 Hypersaline
8 Eusaline
9 Mixosaline
0 Fresh

pH (fresh water)

a Acid
t circumneutral
i Alkaline

SOIL

g Organic
n Mineral

SPECIAL

b Beaver
d partially drained/ditched
f Farmed
h Diked/Impounded
r Artificial Substrate
s Spoil
x Excavated

SOURCE: UNITED STATES, FISH AND WILDLIFE SERVICE. CLASSIFICATION OF WETLANDS AND DEEPWATER HABITATS OF THE UNITED STATES, 1985

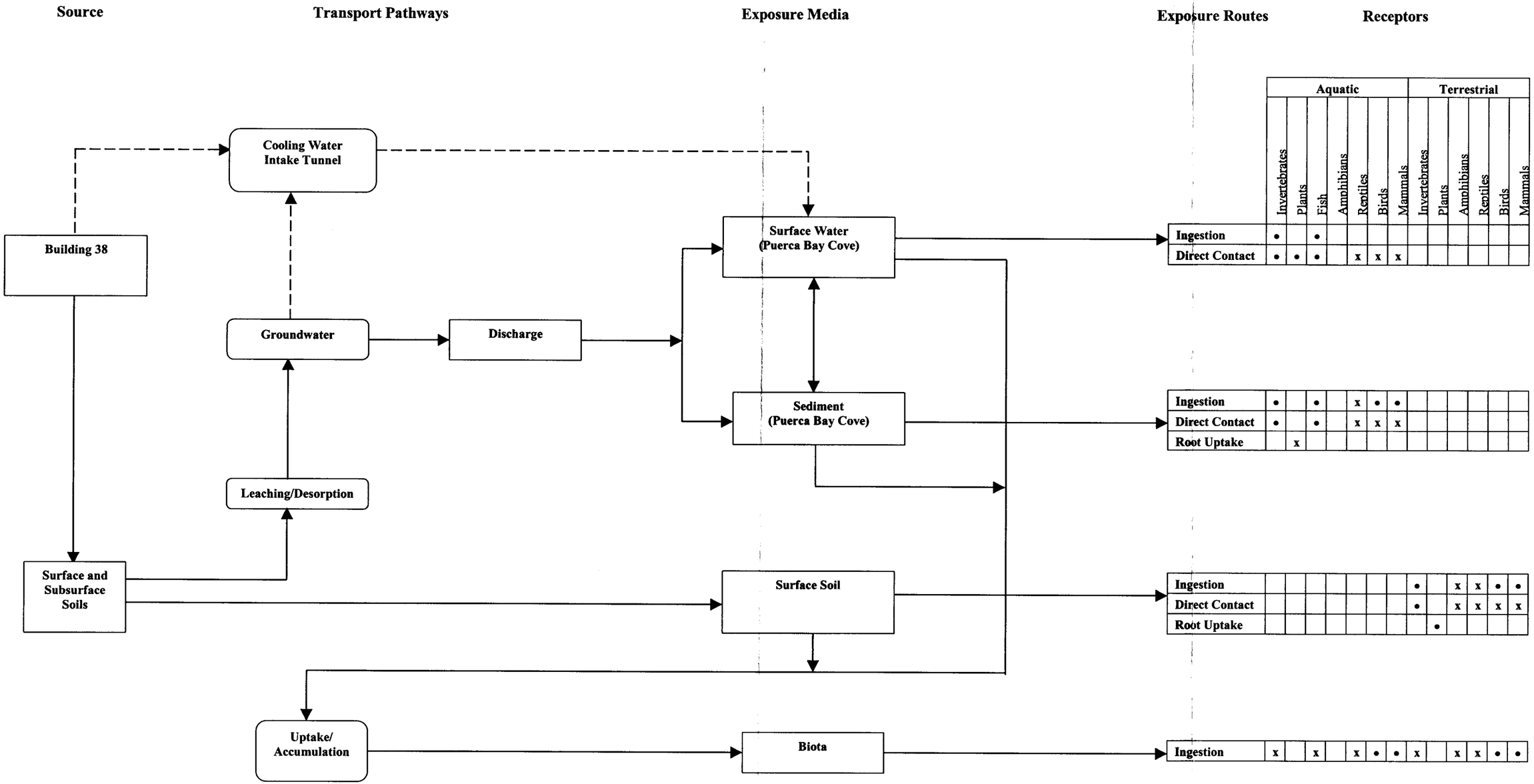
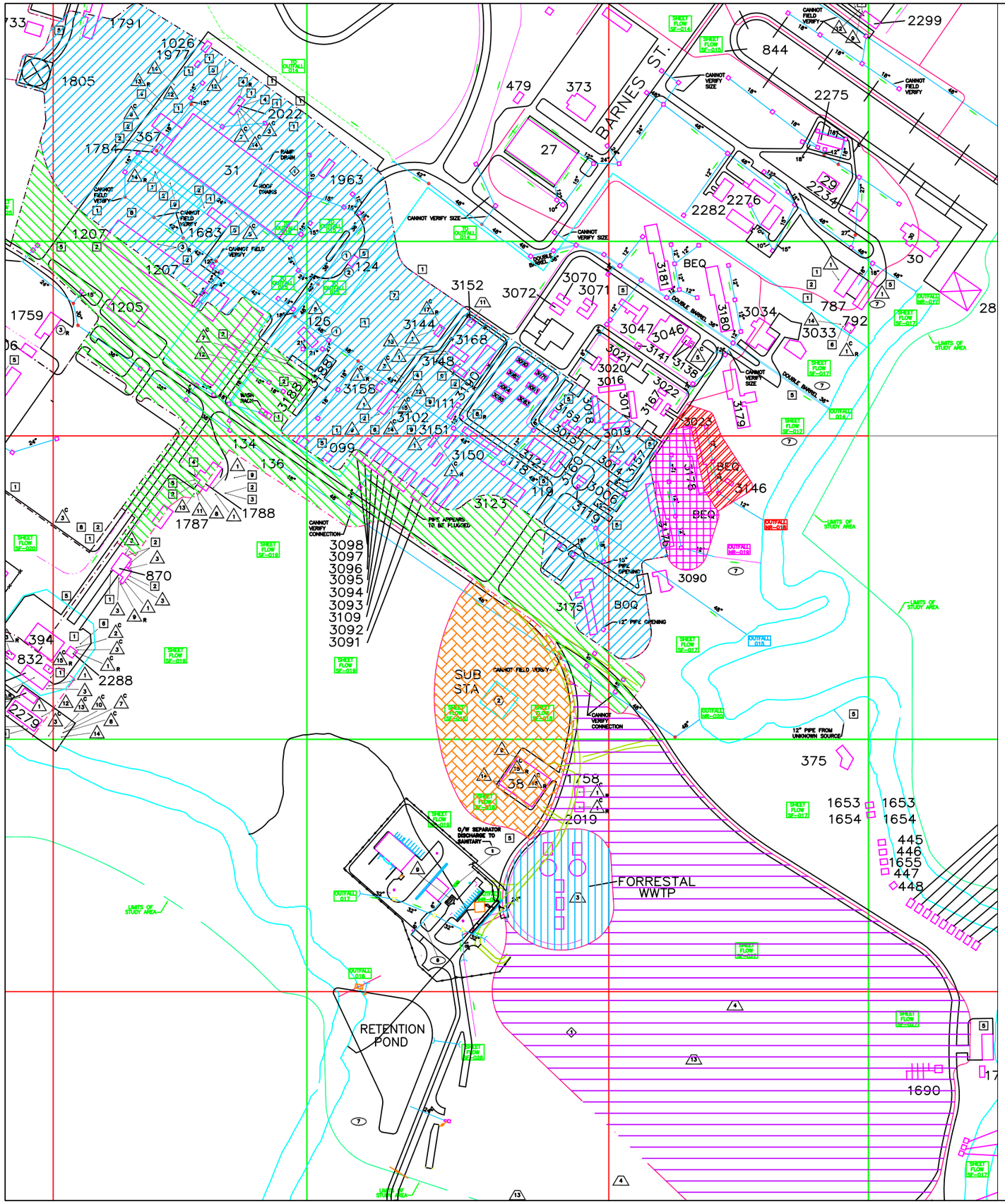


FIGURE 4-5
PRELIMINARY CONCEPTUAL MODEL
SWMU 45 – AREA OUTSIDE BUILDING 38 (FORMER POWER PLANT)
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

K:\CTO271(100309)\SWMU 45 ERA\Figures\Figure 4-5 (SWMU 45 conceptual model)



NOTES:

1. $\triangle^{C}$ THE SUPERSCRIPT "C" ON THE OUTSIDE OF A SYMBOL INDICATES SECONDARY CONTAINMENT.

2. $\triangle_{R}$ THE SUBSCRIPT "R" ON THE OUTSIDE OF A SYMBOL INDICATES THE AREA IS COVERED BY A ROOF.

HM/HW/POL STORAGE

1. FLAMMABLES IN METAL CABINETS/ STORAGE BUILDINGS
2. FLAMMABLES IN DRUMS
3. PETROLEUM OILS AND LUBRICANTS (POL'S) DRUM/TANK STORAGE
4. ABOVEGROUND JP-4, 5 TANKS
5. ABOVEGROUND DIESEL TANKS
6. ABOVEGROUND UNLEADED GAS TANKS
7. ABOVEGROUND WASTE OIL/JP-5 TANKS
8. ETHYLENE GLYCOL
9. COMPRESSED GAS CYLINDERS/TANKS
10. SOLVENTS/CLEANING COMPOUNDS
11. CORROSIVES
12. BATTERIES
13. PAINT AND PAINT RELATED MATERIALS/WASTE
14. WASTE IN DRUMS
15. SATELLITE HAZARDOUS WASTE ACCUMULATION
16. PCB CONTAINMENT/STORAGE
17. RADIOACTIVE MATERIAL
18. CHEMICAL AST

REGULATED INDUSTRIAL CATEGORIES

1. AIRPORTS/FLIGHT LINES
2. MARINE CARGO HANDLING
3. SEWAGE TREATMENT PLANTS>1 MGD
4. ACTIVE LANDFILLS
5. SOLID WASTE TRANSFER
6. HAZARDOUS WASTE STORAGE AREA
7. PETROLEUM BULK STORAGE
8. U.S. POSTAL SERVICE WITH VEHICLE MAINTENANCE FACILITIES
9. MARINA
10. SCRAP AND WASTE MATERIALS
11. PESTICIDE FORMULATION
12. SHIP REPAIR
13. IR PROGRAM SITE
14. VEHICLE WASHDOWN

MATERIAL STORAGE AREAS

1. VEHICLE/EQUIPMENT STORAGE
2. MISCELLANEOUS METALS
3. PLASTIC/RUBBER STORAGE
4. TIRE STORAGE
5. GARBAGE DUMPSTERS
6. EMPTY DRUMS
7. AGGREGATE STORAGE
8. WOOD/LUMBER STORAGE
9. MISCELLANEOUS CONSTRUCTION MATERIAL STORAGE
10. PORTABLE TOILET
11. AFFF

MATERIALS LOADING AND ACCESS AREAS

1. FUELING STATIONS
2. BULK FUEL TRANSFER
3. WAREHOUSE LOADING/ UNLOADING AREAS
4. CHEMICAL TRANSFER

LEAKS AND SPILLS

1. PETROLEUM FUELS
2. WASTE OIL

EXISTING BEST MANAGEMENT PRACTICES (BMP'S)

1. OIL/WATER SEPARATOR
2. OIL SPILL RECOVERY BOAT
3. ABSORBENT MATERIALS
4. BOOMS
5. SKIMMER DAM
6. SPILL CONTROL GATE/VALVE
7. VEGETATIVE FILTERS

CHEMICAL APPLICATION AREAS

1. PESTICIDES
2. HERBICIDES
3. FERTILIZERS

LEGEND

- PIPE
- DRAINAGE BOUNDARY
- STUDY AREA
- DITCH
- UNDER DRAIN
- CONCRETE DITCH
- DROP INLET
- MANHOLE
- OUTFALL XXX — REGULATED OUTFALL
- OUTFALL NR-XXX — NON-REGULATED OUTFALL
- SHEET FLOW SF-XXX — SHEET FLOW DISCHARGE

REVISIONS

DRAWN	/RRR
REVIEWED	MEKJCE
S.O.#	26007-033
CADD#	CH2271815

ATLANTIC DIVISION
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND

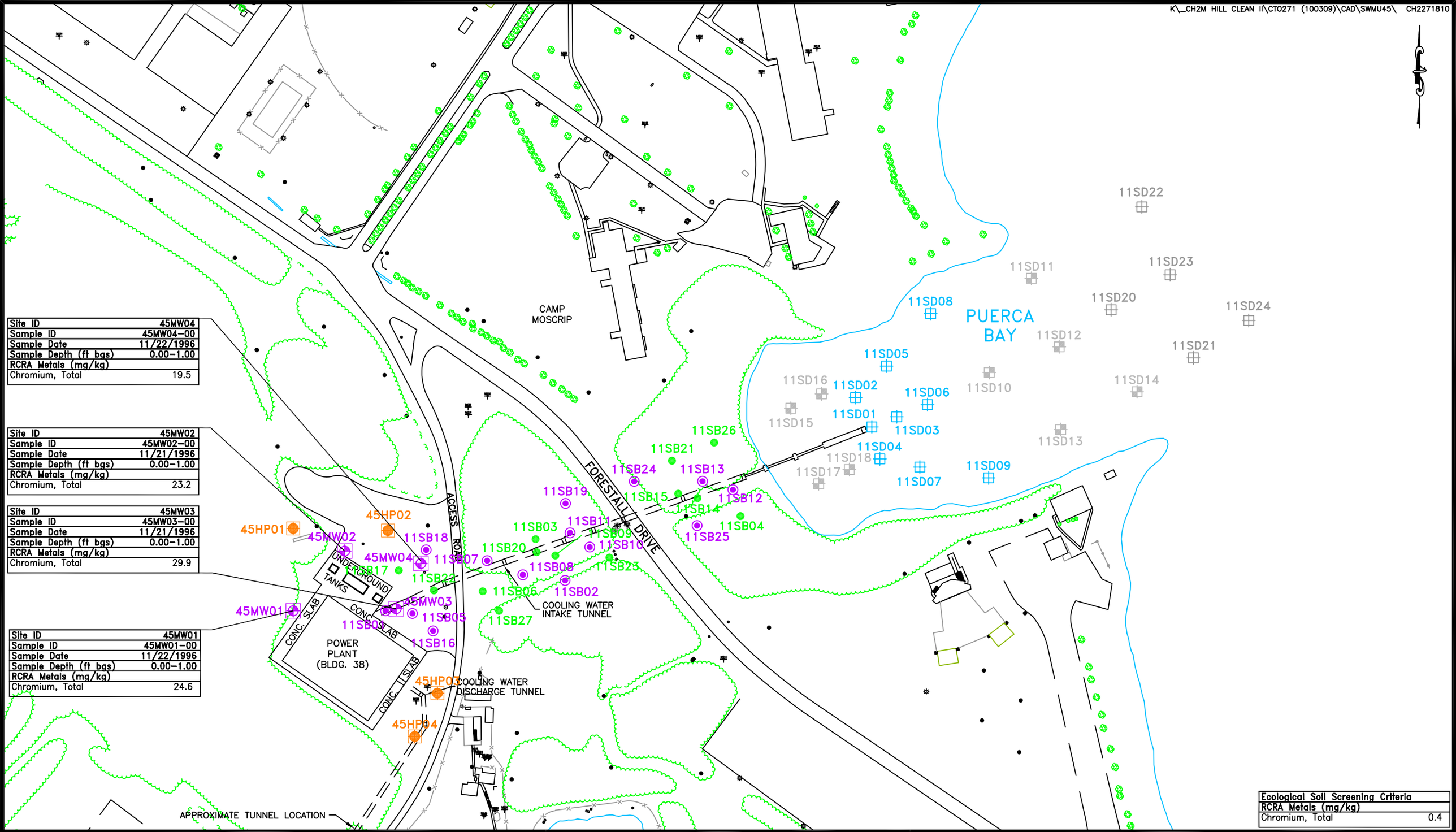
Michael Baker, Inc.
Coraopolis, Pennsylvania

STORMWATER DRAINAGE MAP

DATE 1/12/04

SCALE 1" = 15'

FIGURE 4-6



Site ID	45MW04
Sample ID	45MW04-00
Sample Date	11/22/1996
Sample Depth (ft bgs)	0.00-1.00
RCRA Metals (mg/kg)	
Chromium, Total	19.5

Site ID	45MW02
Sample ID	45MW02-00
Sample Date	11/21/1996
Sample Depth (ft bgs)	0.00-1.00
RCRA Metals (mg/kg)	
Chromium, Total	23.2

Site ID	45MW03
Sample ID	45MW03-00
Sample Date	11/21/1996
Sample Depth (ft bgs)	0.00-1.00
RCRA Metals (mg/kg)	
Chromium, Total	29.9

Site ID	45MW01
Sample ID	45MW01-00
Sample Date	11/22/1996
Sample Depth (ft bgs)	0.00-1.00
RCRA Metals (mg/kg)	
Chromium, Total	24.6

Ecological Soil Screening Criteria	
RCRA Metals (mg/kg)	
Chromium, Total	0.4

LEGEND

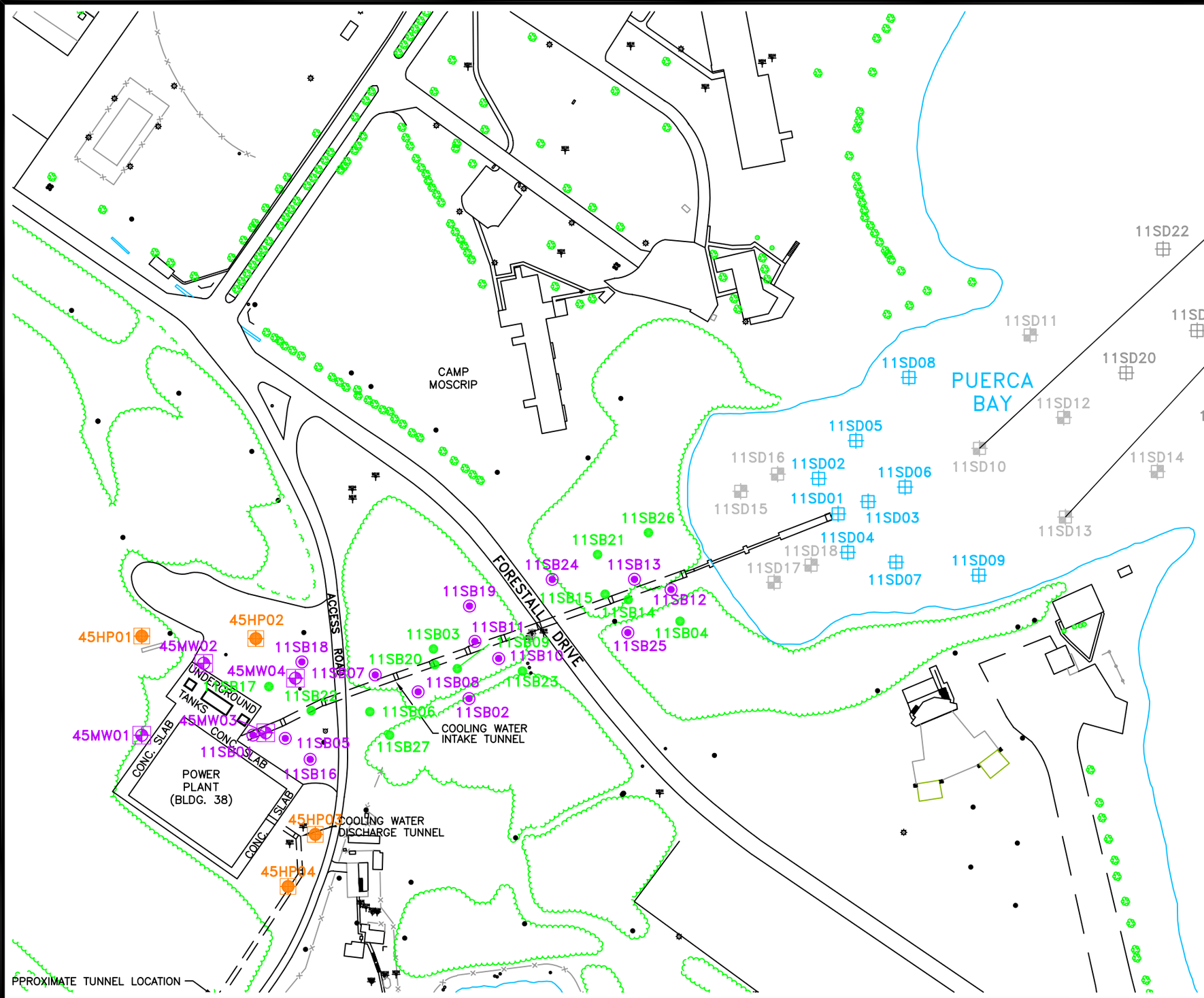
- DIRECT PUSH SOIL SAMPLE LOCATION (1997 RFI)
- SEDIMENT SAMPLE LOCATION (1997 RFI)
- DIRECT PUSH SOIL AND GROUNDWATER SAMPLE LOCATION (1997 RFI)
- HYDROPUNCH LOCATION (1996 RFI)
- MONITOR WELL LOCATION (1996 RFI)
- SEDIMENT SAMPLE LOCATION (2003 ADDITIONAL DATA COLLECTION INVESTIGATION)
- SURFACE WATER\SEDIMENT SAMPLE LOCATION (2003 ADDITIONAL DATA COLLECTION INVESTIGATION)

150 0 75 150
1 inch = 150 ft.

Baker

FIGURE 4-7
SURFACE SOIL DATA EXCEEDING SURFACE SOIL SCREENING VALUES-SWMU 45

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



Site ID	11SD10
Sample ID	110WSW10
Sample Date	8/5/2003
Inorganics, Total (mg/kg)	
Copper	0.0039 J

Site ID	11SD13
Sample ID	110WSW13
Sample Date	8/6/2003
Inorganics, Total (mg/kg)	
Copper	0.005 J

Ecological Surface Water Screening Criteria	
Inorganics (mg/kg)	
Copper	3.7

LEGEND

- DIRECT PUSH SOIL SAMPLE LOCATION (1997 RFI)
- SEDIMENT SAMPLE LOCATION (1997 RFI)
- DIRECT PUSH SOIL AND GROUNDWATER SAMPLE LOCATION (1997 RFI)
- HYDROPUNCH LOCATION (1996 RFI)
- MONITOR WELL LOCATION (1996 RFI)
- SEDIMENT SAMPLE LOCATION (2003 ADDITIONAL DATA COLLECTION INVESTIGATION)
- SURFACE WATER\SEDIMENT SAMPLE LOCATION (2003 ADDITIONAL DATA COLLECTION INVESTIGATION)

150 0 75 150

1 inch = 150 ft.

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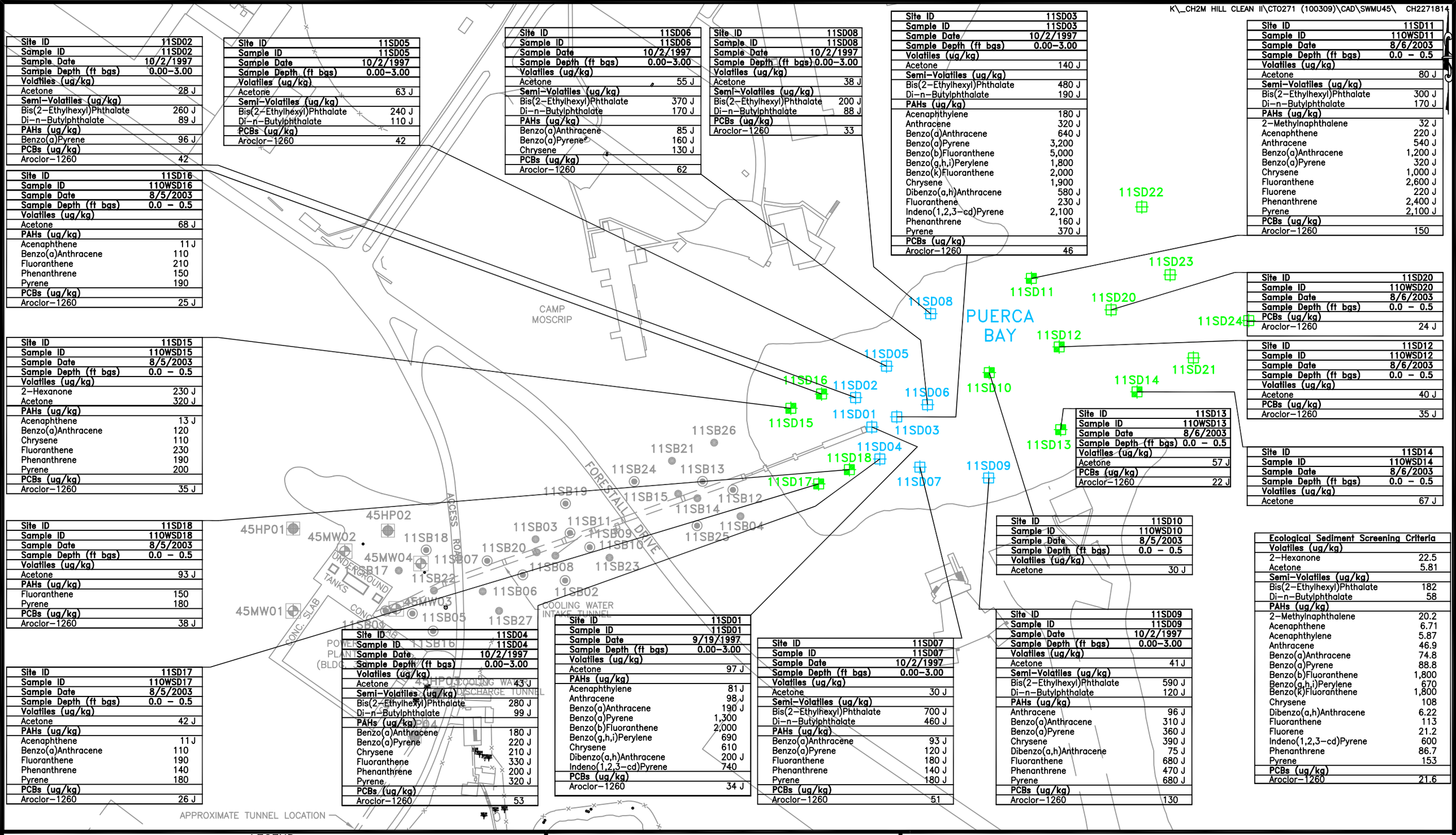
FIGURE 4-8
OPEN WATER MARINE SURFACE WATER DATA EXCEEDING SURFACE WATER SCREENING VALUES-SWMU 45

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



Site ID	11SD02
Sample ID	11SD02
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Volatiles (ug/kg)	
Acetone	28 J
Semi–Volatiles (ug/kg)	
Bis(2–Ethylhexyl)Phthalate	260 J
Di–n–Butylphthalate	89 J
PAHs (ug/kg)	
Benzo(a)Pyrene	96 J
PCBs (ug/kg)	
Aroclor–1260	42

Site ID	11SD05
Sample ID	11SD05
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Volatiles (ug/kg)	
Acetone	63 J
Semi–Volatiles (ug/kg)	
Bis(2–Ethylhexyl)Phthalate	240 J
Di–n–Butylphthalate	110 J
PCBs (ug/kg)	
Aroclor–1260	42

Site ID	11SD06
Sample ID	11SD06
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Volatiles (ug/kg)	
Acetone	55 J
Semi–Volatiles (ug/kg)	
Bis(2–Ethylhexyl)Phthalate	370 J
Di–n–Butylphthalate	170 J
PAHs (ug/kg)	
Benzo(a)Anthracene	85 J
Benzo(a)Pyrene	160 J
Chrysene	130 J
PCBs (ug/kg)	
Aroclor–1260	62

Site ID	11SD08
Sample ID	11SD08
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Volatiles (ug/kg)	
Acetone	38 J
Semi–Volatiles (ug/kg)	
Bis(2–Ethylhexyl)Phthalate	200 J
Di–n–Butylphthalate	88 J
PCBs (ug/kg)	
Aroclor–1260	33

Site ID	11SD03
Sample ID	11SD03
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Volatiles (ug/kg)	
Acetone	140 J
Semi–Volatiles (ug/kg)	
Bis(2–Ethylhexyl)Phthalate	480 J
Di–n–Butylphthalate	190 J
PAHs (ug/kg)	
Acenaphthylene	180 J
Anthracene	320 J
Benzo(a)Anthracene	640 J
Benzo(a)Pyrene	3,200
Benzo(b)Fluoranthene	5,000
Benzo(g,h,i)Perylene	1,800
Benzo(k)Fluoranthene	2,000
Chrysene	1,900
Dibenzo(a,h)Anthracene	580 J
Fluoranthene	230 J
Indeno(1,2,3–cd)Pyrene	2,100
Phenanthrene	160 J
Pyrene	370 J
PCBs (ug/kg)	
Aroclor–1260	46

Site ID	11SD11
Sample ID	11OWSD11
Sample Date	8/6/2003
Sample Depth (ft bgs)	0.0 – 0.5
Volatiles (ug/kg)	
Acetone	80 J
Semi–Volatiles (ug/kg)	
Bis(2–Ethylhexyl)Phthalate	300 J
Di–n–Butylphthalate	170 J
PAHs (ug/kg)	
2–Methylnaphthalene	32 J
Acenaphthene	220 J
Anthracene	540 J
Benzo(a)Anthracene	1,200 J
Benzo(a)Pyrene	320 J
Chrysene	1,000 J
Fluoranthene	2,600 J
Fluorene	220 J
Phenanthrene	2,400 J
Pyrene	2,100 J
PCBs (ug/kg)	
Aroclor–1260	150

Site ID	11SD16
Sample ID	11OWSD16
Sample Date	8/5/2003
Sample Depth (ft bgs)	0.0 – 0.5
Volatiles (ug/kg)	
Acetone	68 J
PAHs (ug/kg)	
Acenaphthene	11 J
Benzo(a)Anthracene	110
Fluoranthene	210
Phenanthrene	150
Pyrene	190
PCBs (ug/kg)	
Aroclor–1260	25 J

Site ID	11SD20
Sample ID	11OWSD20
Sample Date	8/6/2003
Sample Depth (ft bgs)	0.0 – 0.5
PCBs (ug/kg)	
Aroclor–1260	24 J

Site ID	11SD15
Sample ID	11OWSD15
Sample Date	8/5/2003
Sample Depth (ft bgs)	0.0 – 0.5
Volatiles (ug/kg)	
2–Hexanone	230 J
Acetone	320 J
PAHs (ug/kg)	
Acenaphthene	13 J
Benzo(a)Anthracene	120
Chrysene	110
Fluoranthene	230
Phenanthrene	190
Pyrene	200
PCBs (ug/kg)	
Aroclor–1260	35 J

Site ID	11SD12
Sample ID	11OWSD12
Sample Date	8/6/2003
Sample Depth (ft bgs)	0.0 – 0.5
Volatiles (ug/kg)	
Acetone	40 J
PCBs (ug/kg)	
Aroclor–1260	35 J

Site ID	11SD13
Sample ID	11OWSD13
Sample Date	8/6/2003
Sample Depth (ft bgs)	0.0 – 0.5
Volatiles (ug/kg)	
Acetone	57 J
PCBs (ug/kg)	
Aroclor–1260	22 J

Site ID	11SD14
Sample ID	11OWSD14
Sample Date	8/6/2003
Sample Depth (ft bgs)	0.0 – 0.5
Volatiles (ug/kg)	
Acetone	67 J

Site ID	11SD18
Sample ID	11OWSD18
Sample Date	8/5/2003
Sample Depth (ft bgs)	0.0 – 0.5
Volatiles (ug/kg)	
Acetone	93 J
PAHs (ug/kg)	
Fluoranthene	150
Pyrene	180
PCBs (ug/kg)	
Aroclor–1260	38 J

Site ID	11SD10
Sample ID	11OWSD10
Sample Date	8/5/2003
Sample Depth (ft bgs)	0.0 – 0.5
Volatiles (ug/kg)	
Acetone	30 J

Ecological Sediment Screening Criteria	
Volatiles (ug/kg)	
2–Hexanone	22.5
Acetone	5.81
Semi–Volatiles (ug/kg)	
Bis(2–Ethylhexyl)Phthalate	182
Di–n–Butylphthalate	58
PAHs (ug/kg)	
2–Methylnaphthalene	20.2
Acenaphthene	6.71
Acenaphthylene	5.87
Anthracene	46.9
Benzo(a)Anthracene	74.8
Benzo(a)Pyrene	88.8
Benzo(b)Fluoranthene	1,800
Benzo(g,h,i)Perylene	670
Benzo(k)Fluoranthene	1,800
Chrysene	108
Dibenzo(a,h)Anthracene	6.22
Fluoranthene	113
Fluorene	21.2
Indeno(1,2,3–cd)Pyrene	600
Phenanthrene	86.7
Pyrene	153
PCBs (ug/kg)	
Aroclor–1260	21.6

Site ID	11SD17
Sample ID	11OWSD17
Sample Date	8/5/2003
Sample Depth (ft bgs)	0.0 – 0.5
Volatiles (ug/kg)	
Acetone	42 J
PAHs (ug/kg)	
Acenaphthene	11 J
Benzo(a)Anthracene	110
Fluoranthene	190
Phenanthrene	140
Pyrene	180
PCBs (ug/kg)	
Aroclor–1260	26 J

Site ID	11SD04
Sample ID	11SD04
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Volatiles (ug/kg)	
Acetone	43 J
Semi–Volatiles (ug/kg)	
Bis(2–Ethylhexyl)Phthalate	280 J
Di–n–Butylphthalate	99 J
PAHs (ug/kg)	
Benzo(a)Anthracene	180 J
Benzo(a)Pyrene	220 J
Chrysene	210 J
Fluoranthene	330 J
Phenanthrene	200 J
Pyrene	320 J
PCBs (ug/kg)	
Aroclor–1260	53

Site ID	11SD01
Sample ID	11SD01
Sample Date	9/19/1997
Sample Depth (ft bgs)	0.00–3.00
Volatiles (ug/kg)	
Acetone	97 J
PAHs (ug/kg)	
Acenaphthylene	81 J
Anthracene	98 J
Benzo(a)Anthracene	190 J
Benzo(a)Pyrene	1,300
Benzo(b)Fluoranthene	2,000
Benzo(g,h,i)Perylene	690
Chrysene	610
Dibenzo(a,h)Anthracene	200 J
Indeno(1,2,3–cd)Pyrene	740
PCBs (ug/kg)	
Aroclor–1260	34 J

Site ID	11SD07
Sample ID	11SD07
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Volatiles (ug/kg)	
Acetone	30 J
Semi–Volatiles (ug/kg)	
Bis(2–Ethylhexyl)Phthalate	700 J
Di–n–Butylphthalate	460 J
PAHs (ug/kg)	
Benzo(a)Anthracene	93 J
Benzo(a)Pyrene	120 J
Fluoranthene	180 J
Phenanthrene	140 J
Pyrene	180 J
PCBs (ug/kg)	
Aroclor–1260	51

Site ID	11SD09
Sample ID	11SD09
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Volatiles (ug/kg)	
Acetone	41 J
Semi–Volatiles (ug/kg)	
Bis(2–Ethylhexyl)Phthalate	590 J
Di–n–Butylphthalate	120 J
PAHs (ug/kg)	
Anthracene	96 J
Benzo(a)Anthracene	310 J
Benzo(a)Pyrene	360 J
Chrysene	390 J
Dibenzo(a,h)Anthracene	75 J
Fluoranthene	680 J
Phenanthrene	470 J
Pyrene	680 J
PCBs (ug/kg)	
Aroclor–1260	130

LEGEND

- DIRECT PUSH SOIL SAMPLE LOCATION (1997 RFI)
- SEDIMENT SAMPLE LOCATION (1997 RFI)
- DIRECT PUSH SOIL AND GROUNDWATER SAMPLE LOCATION (1997 RFI)
- HYDROPUNCH LOCATION (1996 RFI)
- MONITOR WELL LOCATION (1996 RFI)
- SEDIMENT SAMPLE LOCATION (2003 ADDITIONAL DATA COLLECTION INVESTIGATION)
- SURFACE WATER\SEDIMENT SAMPLE LOCATION (2003 ADDITIONAL DATA COLLECTION INVESTIGATION)

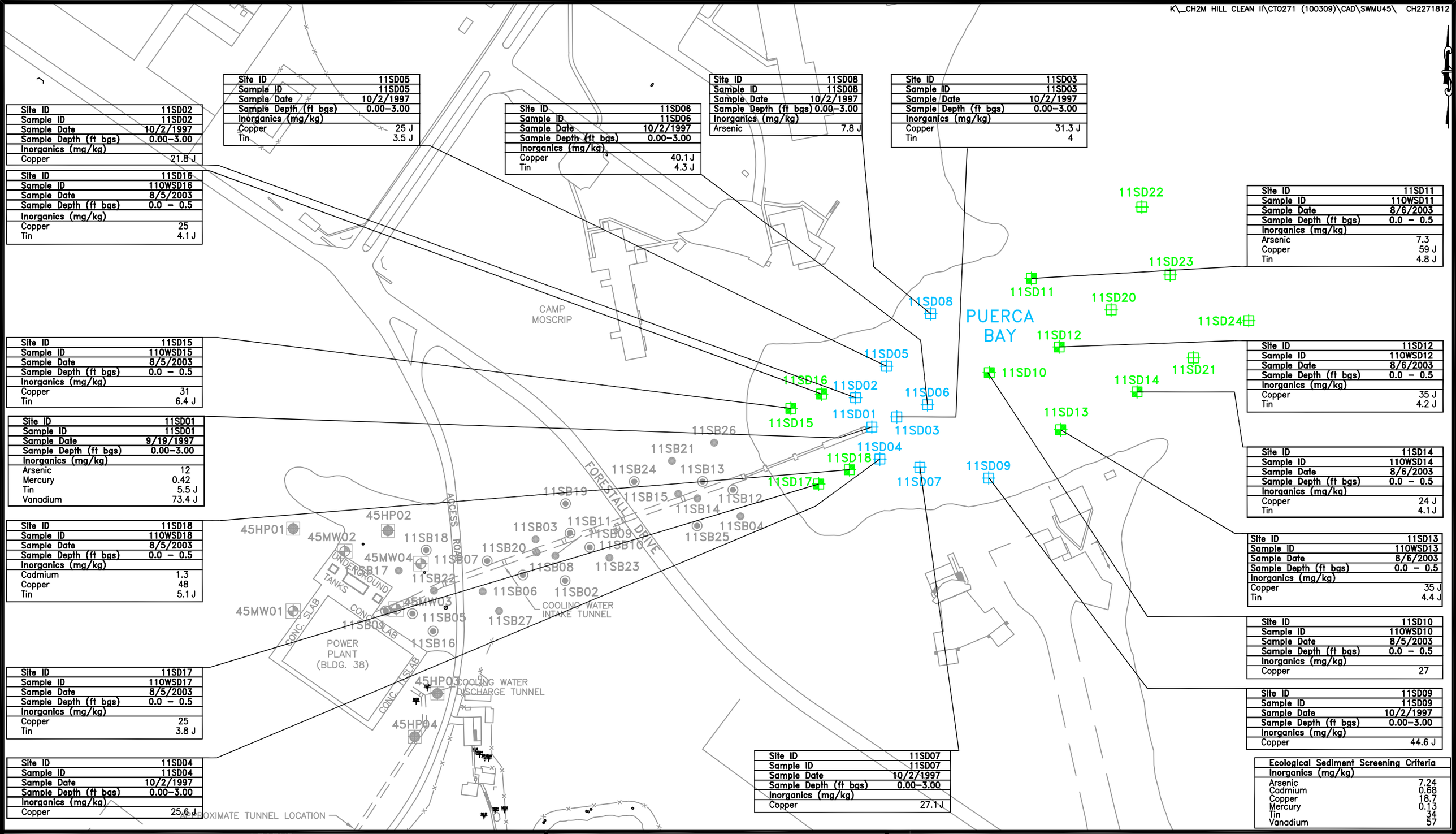
150 0 75 150

1 inch = 150 ft.

Baker

FIGURE 4–9
OPEN WATER MARINE SEDIMENT ORGANIC DATA EXCEEDING SEDIMENT SCREENING VALUES–SWMU 45

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



Site ID	11SD02
Sample ID	11SD02
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Inorganics (mg/kg)	
Copper	21.8 J

Site ID	11SD16
Sample ID	11OWSD16
Sample Date	8/5/2003
Sample Depth (ft bgs)	0.0 – 0.5
Inorganics (mg/kg)	
Copper	25
Tin	4.1 J

Site ID	11SD05
Sample ID	11SD05
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Inorganics (mg/kg)	
Copper	25 J
Tin	3.5 J

Site ID	11SD06
Sample ID	11SD06
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Inorganics (mg/kg)	
Copper	40.1 J
Tin	4.3 J

Site ID	11SD08
Sample ID	11SD08
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Inorganics (mg/kg)	
Arsenic	7.8 J

Site ID	11SD03
Sample ID	11SD03
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Inorganics (mg/kg)	
Copper	31.3 J
Tin	4

Site ID	11SD11
Sample ID	11OWSD11
Sample Date	8/6/2003
Sample Depth (ft bgs)	0.0 – 0.5
Inorganics (mg/kg)	
Arsenic	7.3
Copper	59 J
Tin	4.8 J

Site ID	11SD15
Sample ID	11OWSD15
Sample Date	8/5/2003
Sample Depth (ft bgs)	0.0 – 0.5
Inorganics (mg/kg)	
Copper	31
Tin	6.4 J

Site ID	11SD12
Sample ID	11OWSD12
Sample Date	8/6/2003
Sample Depth (ft bgs)	0.0 – 0.5
Inorganics (mg/kg)	
Copper	35 J
Tin	4.2 J

Site ID	11SD01
Sample ID	11SD01
Sample Date	9/19/1997
Sample Depth (ft bgs)	0.00–3.00
Inorganics (mg/kg)	
Arsenic	12
Mercury	0.42
Tin	5.5 J
Vanadium	73.4 J

Site ID	11SD14
Sample ID	11OWSD14
Sample Date	8/6/2003
Sample Depth (ft bgs)	0.0 – 0.5
Inorganics (mg/kg)	
Copper	24 J
Tin	4.1 J

Site ID	11SD18
Sample ID	11OWSD18
Sample Date	8/5/2003
Sample Depth (ft bgs)	0.0 – 0.5
Inorganics (mg/kg)	
Cadmium	1.3
Copper	48
Tin	5.1 J

Site ID	11SD13
Sample ID	11OWSD13
Sample Date	8/6/2003
Sample Depth (ft bgs)	0.0 – 0.5
Inorganics (mg/kg)	
Copper	35 J
Tin	4.4 J

Site ID	11SD10
Sample ID	11OWSD10
Sample Date	8/5/2003
Sample Depth (ft bgs)	0.0 – 0.5
Inorganics (mg/kg)	
Copper	27

Site ID	11SD17
Sample ID	11OWSD17
Sample Date	8/5/2003
Sample Depth (ft bgs)	0.0 – 0.5
Inorganics (mg/kg)	
Copper	25
Tin	3.8 J

Site ID	11SD09
Sample ID	11SD09
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Inorganics (mg/kg)	
Copper	44.6 J

Site ID	11SD04
Sample ID	11SD04
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Inorganics (mg/kg)	
Copper	25.6 J

Site ID	11SD07
Sample ID	11SD07
Sample Date	10/2/1997
Sample Depth (ft bgs)	0.00–3.00
Inorganics (mg/kg)	
Copper	27.1 J

Ecological Sediment Screening Criteria	
Inorganics (mg/kg)	
Arsenic	7.24
Cadmium	0.68
Copper	18.7
Mercury	0.13
Tin	34
Vanadium	57

LEGEND

- DIRECT PUSH SOIL SAMPLE LOCATION (1997 RFI)
- SEDIMENT SAMPLE LOCATION (1997 RFI)
- DIRECT PUSH SOIL AND GROUNDWATER SAMPLE LOCATION (1997 RFI)
- HYDROPUNCH LOCATION (1996 RFI)
- MONITOR WELL LOCATION (1996 RFI)
- SEDIMENT SAMPLE LOCATION (2003 ADDITIONAL DATA COLLECTION INVESTIGATION)
- SURFACE WATER\SEDIMENT SAMPLE LOCATION (2003 ADDITIONAL DATA COLLECTION INVESTIGATION)

150 0 75 150

1 inch = 150 ft.

Baker

FIGURE 4–10
OPEN WATER MARINE SEDIMENT INORGANICS DATA EXCEEDING SEDIMENT SCREENING VALUES–SWMU 45

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

FIGURE 4-10a

Revised: September 22, 2004

STATISTICAL ANALYSIS PROCESS
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

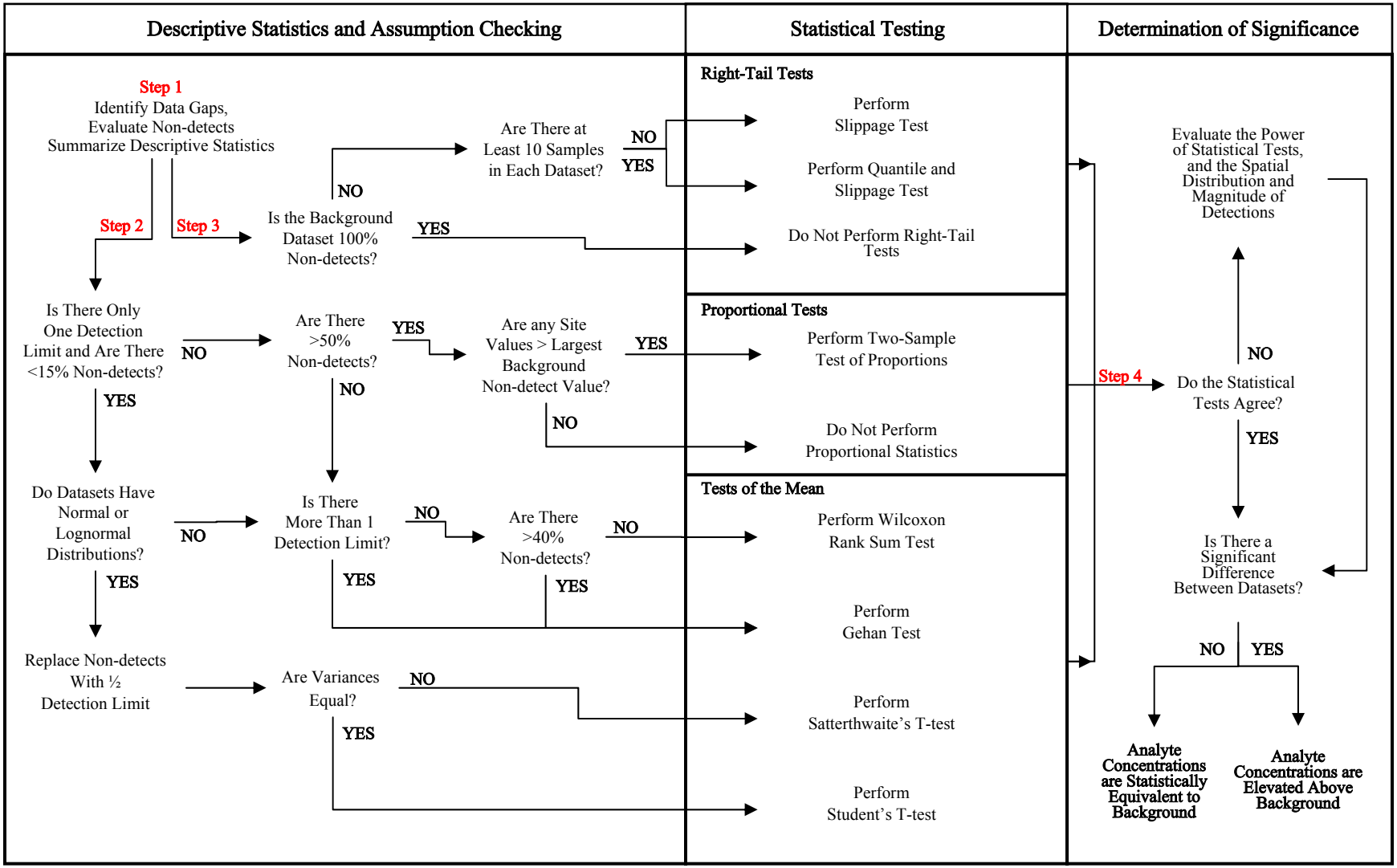
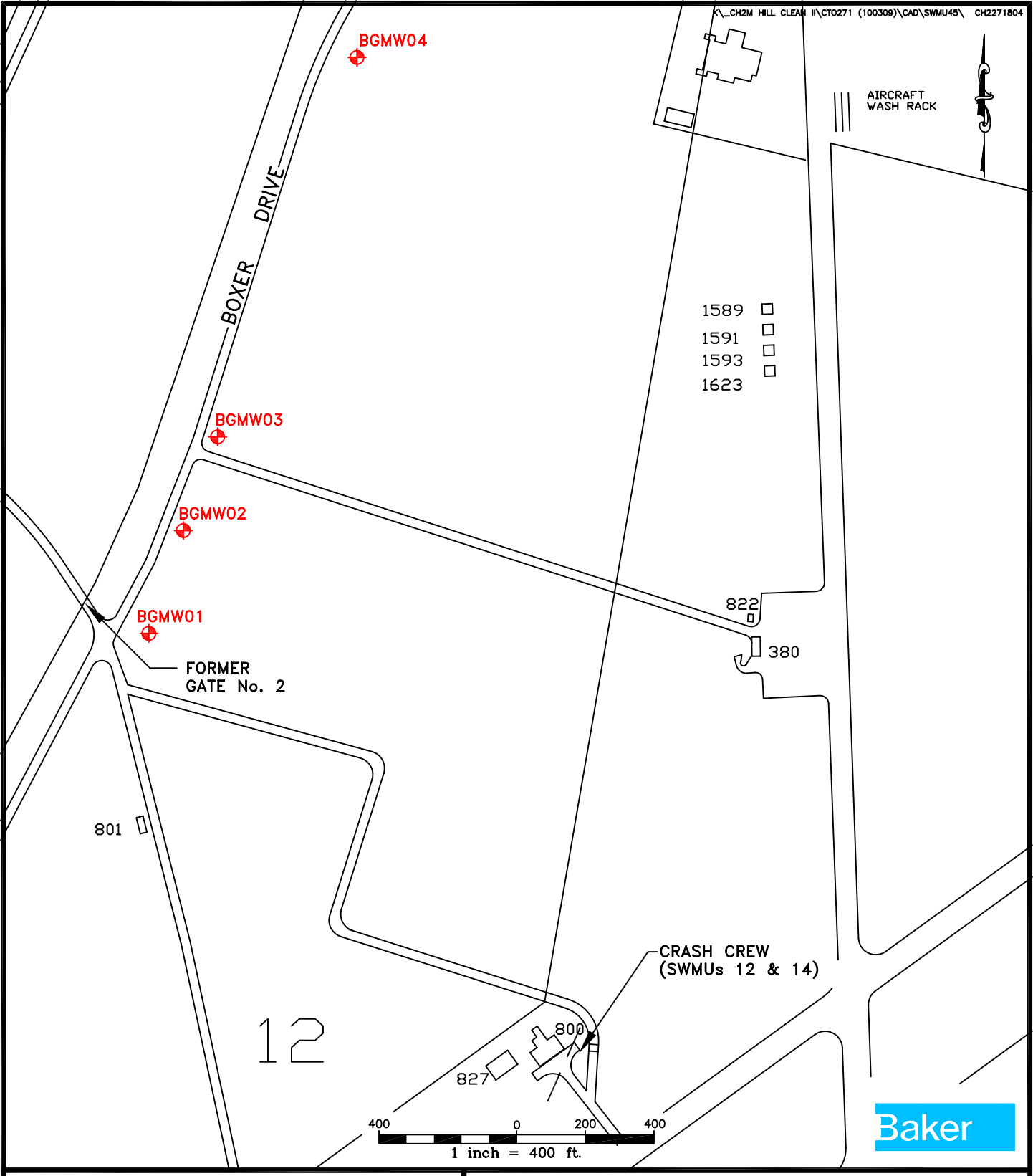


Figure Adapted from NFESC, 1998

T-tests performed on log-transformed data if datasets have lognormal distributions.

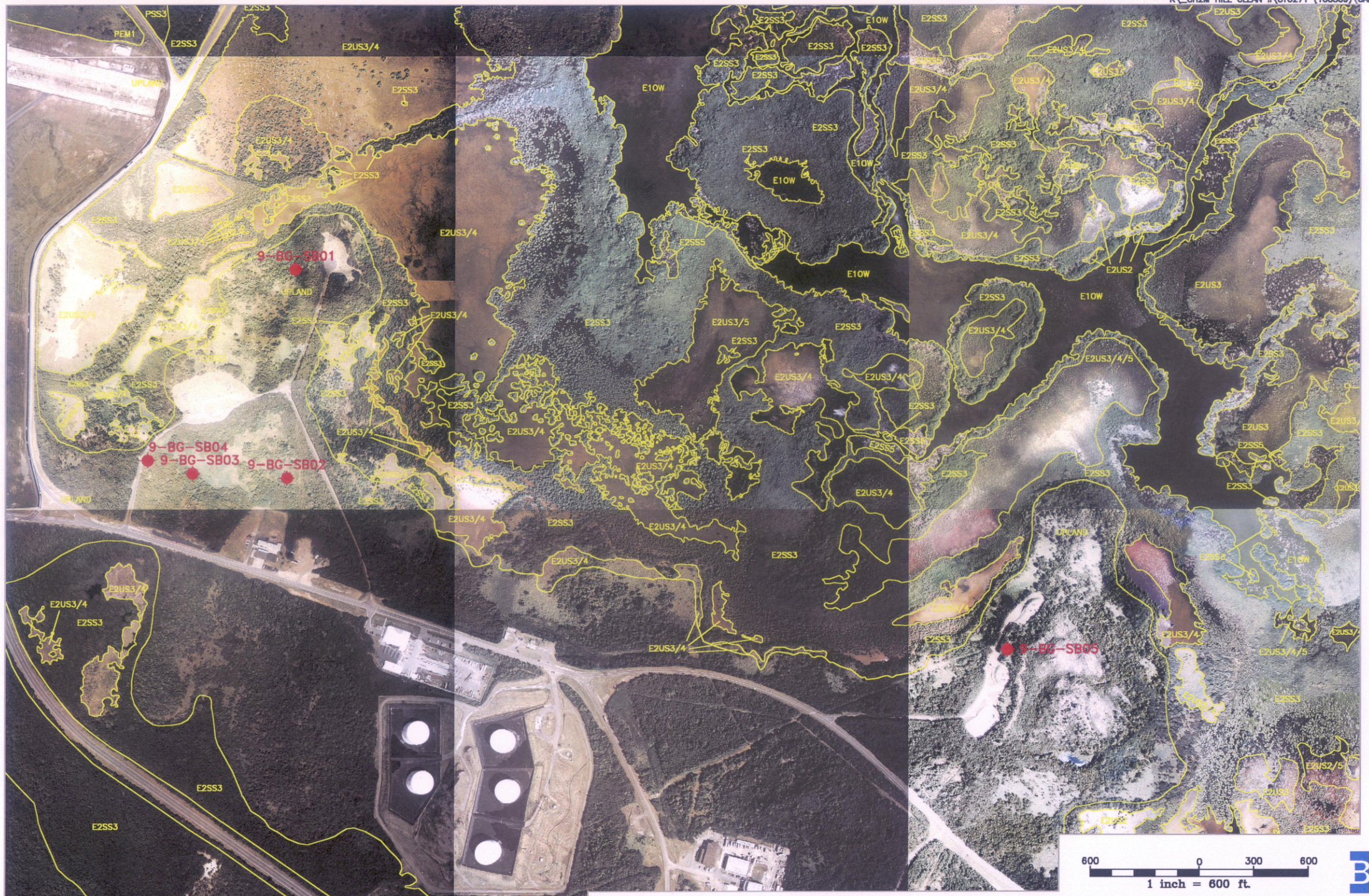


LEGEND

BGMW01 – BACKGROUND MONITOR WELL, BACKGROUND SOIL, AND BACKGROUND GROUNDWATER SAMPLE LOCATIONS

FIGURE 4–11
BASE BACKGROUND SURFACE SOIL SAMPLE LOCATIONS
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



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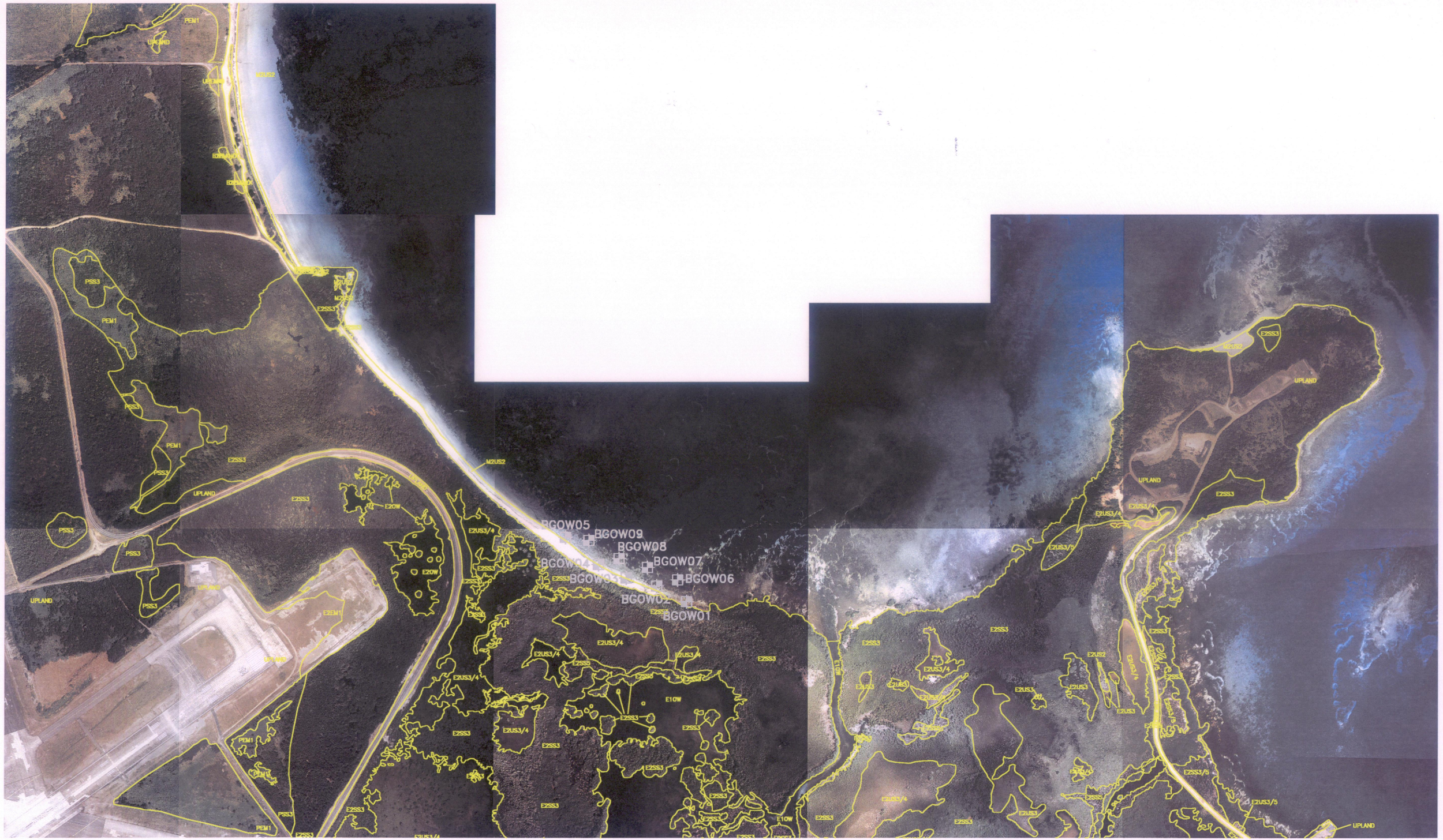
LEGEND

- HYDROPUNCH SOIL AND/OR GROUNDWATER SAMPLE LOCATION
- E2SS3 – E2SS3 WETLANDS BOUNDARIES (SEE FIGURE 4-4 FOR CLASSIFICATIONS)

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

FIGURE 4-12
SWMU 9 BACKGROUND
SURFACE SOIL SAMPLE LOCATIONS
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

OPEN WATER MARINE
- SURFACE WATER/SEDIMENT SAMPLE LOCATION

E2SS3 — E2SS3 WETLANDS BOUNDARIES (SEE FIGURE 2-3 FOR CLASSIFICATIONS)

800 0 400 800
1 inch = 800 ft.

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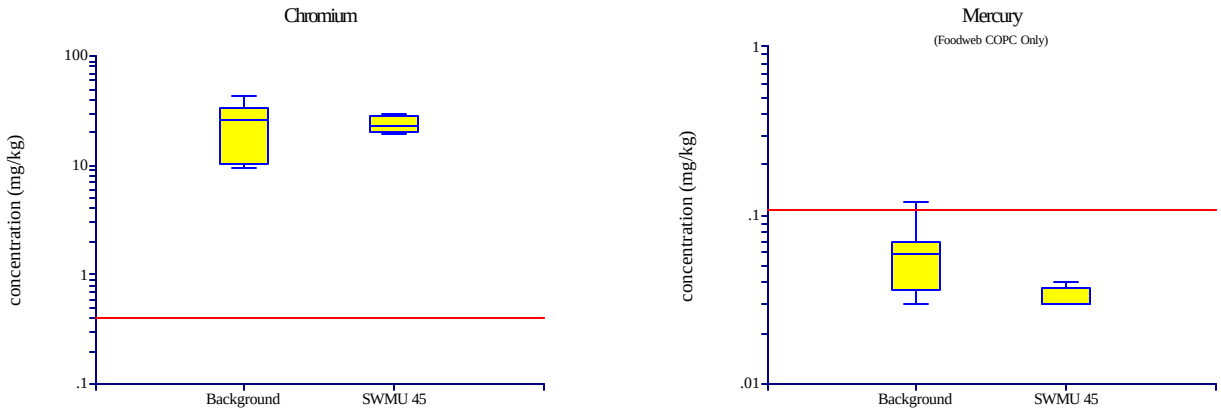
FIGURE 4-13
BASE BACKGROUND SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS-OPEN WATER MARINE
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

SOURCE: GED-MARINE, INC., SEPTEMBER 6, 2000.

FIGURE 4-14

BOXPLOT COMPARISON OF SITE AND BACKGROUND SURFACE SOIL
SWMU 45 – AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A
OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

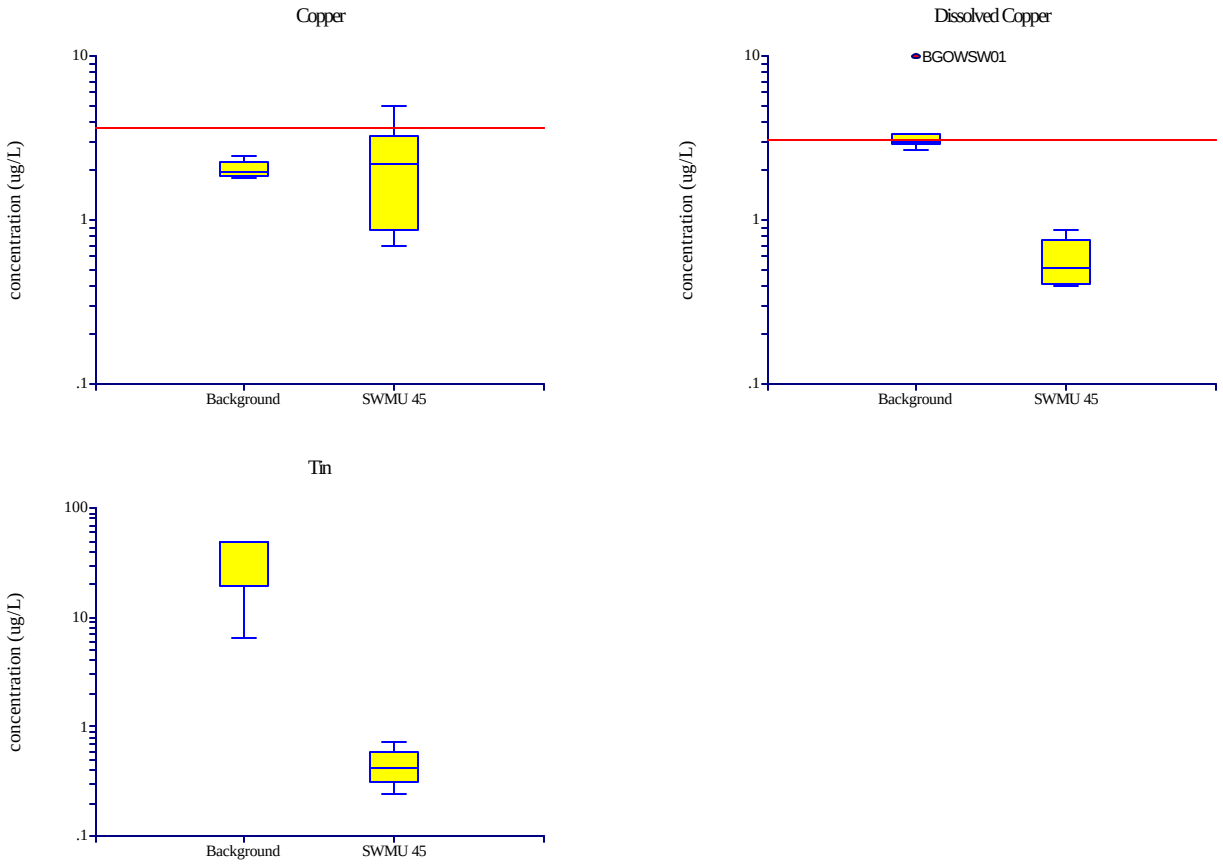


Notes:

Surface Soil Screening Value

FIGURE 4-15

BOXPLOT COMPARISON OF SITE AND BACKGROUND SURFACE WATER
SWMU 45 – AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A
OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO



Notes:

Surface Water Screening Value
No screening value available for tin.

FIGURE 4-16

BOXPLOT COMPARISON OF SITE AND BACKGROUND SEDIMENT
SWMU 45 – AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A
OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

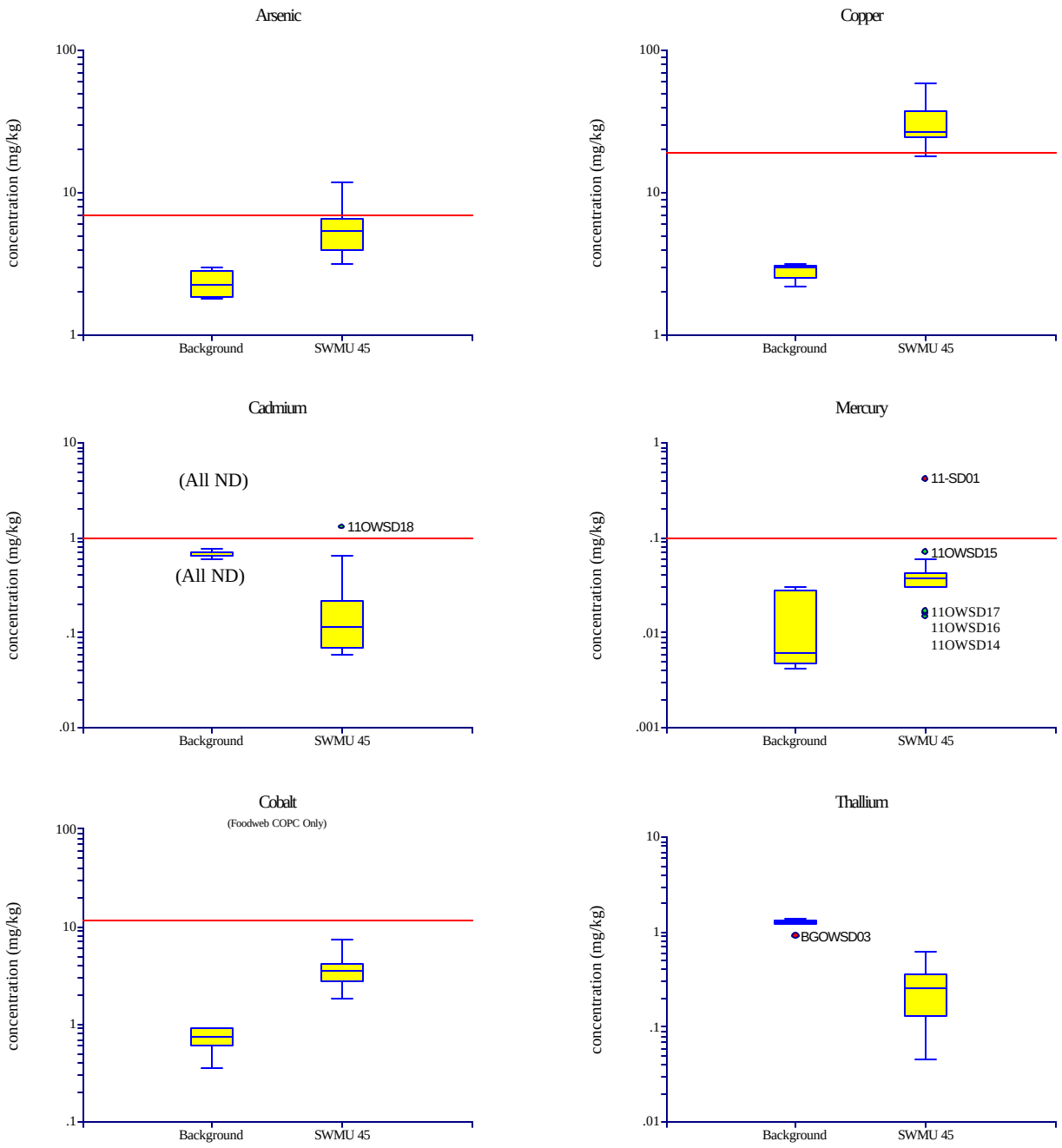
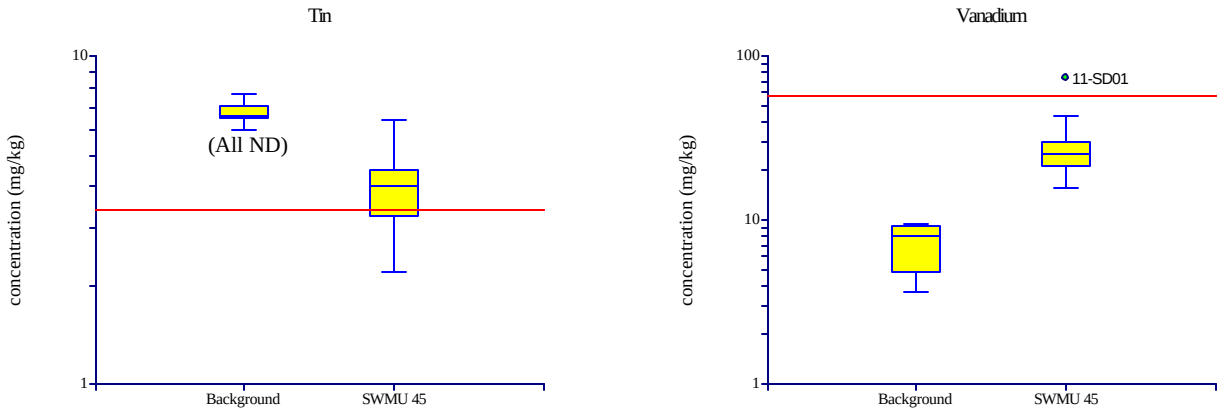


FIGURE 4-16

BOXPLOT COMPARISON OF SITE AND BACKGROUND SEDIMENT
SWMU 45 – AREA OUTSIDE BUILDING 38 (THE FORMER POWER PLANT)
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A
OF THE BASELINE ECOLOGICAL RISK ASSESSMENT
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO



Notes:

Sediment Screening Value
No screening value available for beryllium or thallium.

FIGURE 4-17
Geochemical Evalution of Copper in Embayment and Background Sediment
SWMU 45 - Area Outside Building 38 (The Former Power Plant)
Screening-Level Ecological Risk Assessment and Step 3A of the Baseline Ecological Risk Assessment

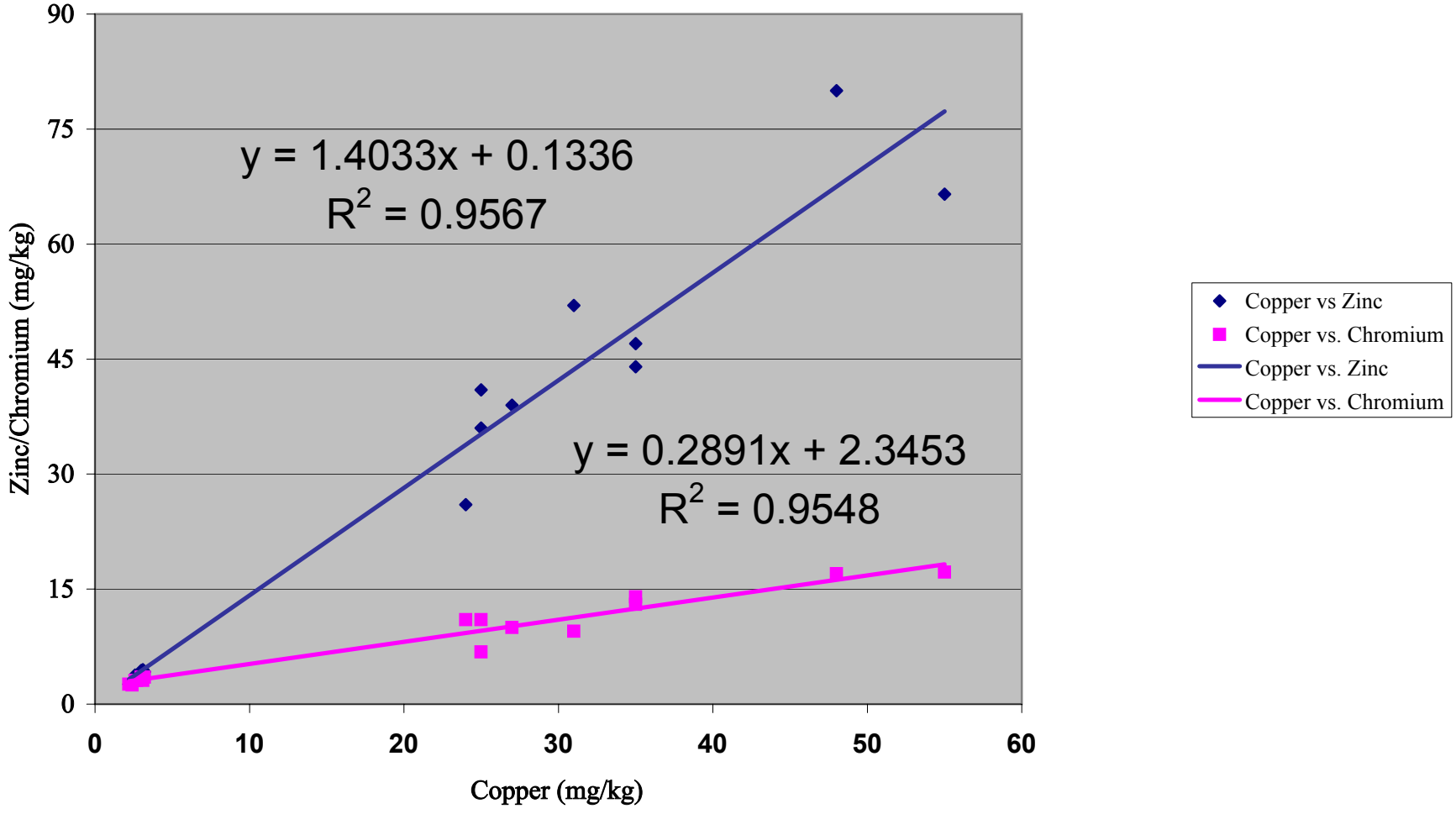
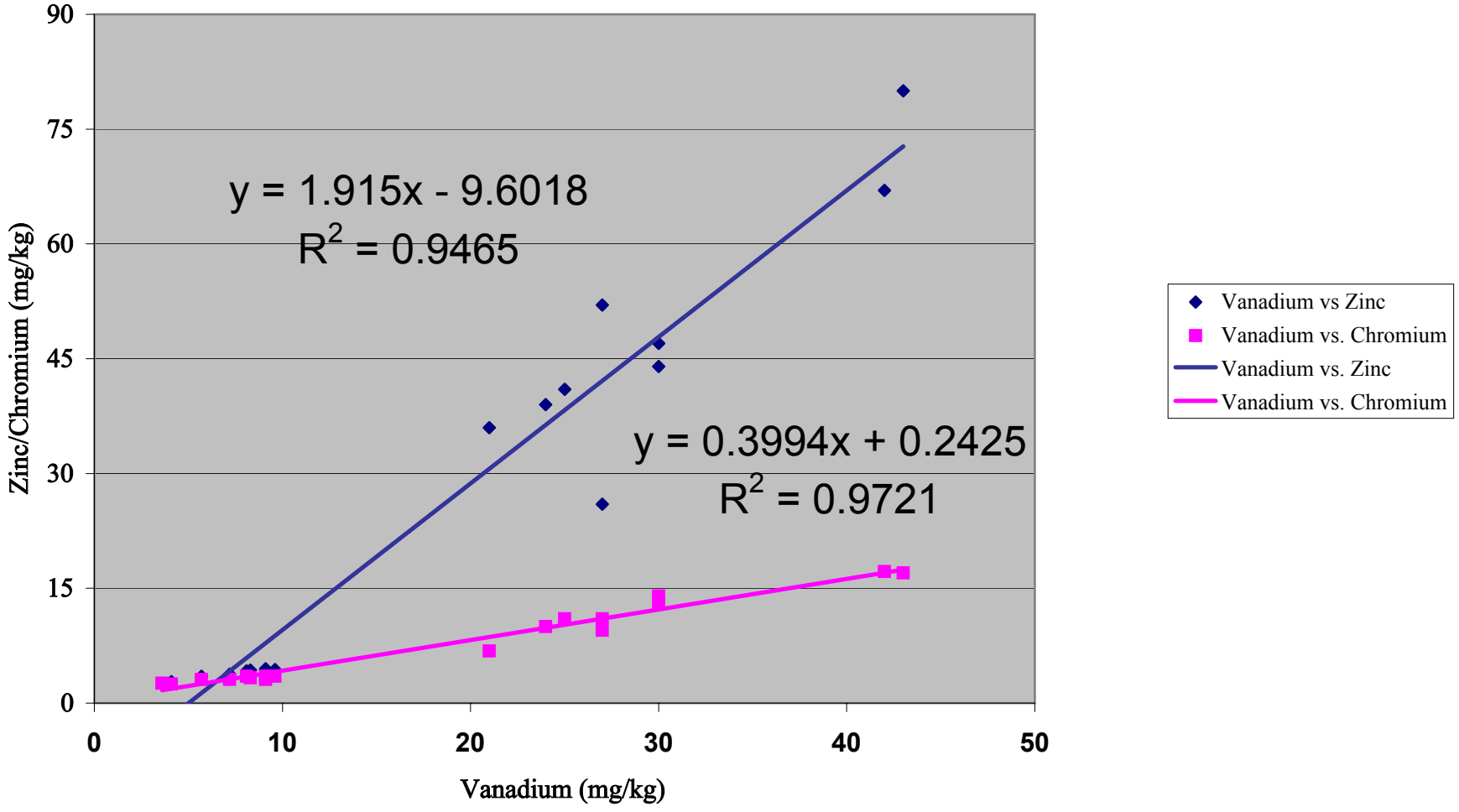



FIGURE 4-18
Geochemical Evalution of Vanadium in Embayment and Background Sediment
SWMU 45 - Area Outside Building 38 (The Former Power Plant)
Screening-Level Ecological Risk Assessment and Step 3A of the Baseline Ecological Risk Assessment