N69321_003866
VIEQUES EAST, PR
SSIC 5000-33a

FINAL UNEXPLODED ORDNANCES 2, 7 AND 8 (UXO 2, UXO 7 AND UXO 8) REMEDIAL INVESTIGATION MASTER SAMPLING AND ANALYSIS PLAN ADDENDUM 6 ATLANTIC FLEET WEAPONS TRAINING AREA, FORMER VIEQUES NAVAL TRAINING RANGE VIEQUES PUERTO RICO

04/01/2018

CH2M HILL

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Final

UXOs 2, 7, and 8 Remedial Investigation Master Sampling and Analysis Plan Addendum 6

Atlantic Fleet Weapons Training Area – Vieques Former Vieques Naval Training Range Vieques, Puerto Rico

Contract Task Order 0004

April 2018

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic

Under the

NAVFAC CLEAN 9000 Program
Contract N62470-16-D-9000

Prepared by
CH2M HILL, Inc.
Virginia Beach, Virginia

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Executive Summary

The Master Sampling and Analysis Plan (SAP), East Vieques Terrestrial UXO Sites, Former Vieques Naval Training Range, Vieques, Puerto Rio (CH2M, 2013), hereafter referred to as the Master SAP, was prepared to guide Remedial Investigation (RI) activities at multiple UXO sites within the former Vieques Naval Training Range (VNTR) that will take place over multiple years. Because of the robust and long-term nature of the activities covered by the Master SAP, it intentionally does not identify a specific laboratory but instead includes the protocols any selected laboratory is requested to meet. It is therefore designed to be used in conjunction with site-specific addenda that provide laboratory-specific chemistry-related worksheets and any update to the planned activities based on information gathered since the Master SAP was issued. The Master SAP was reviewed and updated information is provided in this SAP Addendum.

This is Addendum 6 to the Master SAP and it includes the laboratory-specific worksheets for analysis of discrete soil and incremental soil samples to be collected from UXOs 2, 7, and 8. For all other worksheets (i.e., those unchanged or unchanged substantively by selection of the specific laboratories), please refer to the Master SAP (CH2M, 2013); however, Worksheets 10, 11, and 17 (applicable to these sites) are included as **Attachment A** for ease of reference. **Figure ES-1** through **Figure ES-5** show the location of UXOs 2, 7, and 8 and the historical features relevant to the planned investigation, respectively. **Figure ES-6** summarizes the various beach names and numbers associated with all of the beaches within the former VNTR.

The original sampling approach for UXOs 2, 7, and 8 was established in the Master SAP (CH2M, 2013; **Attachment A**), which includes the sample collection techniques, analyses, and locations. The locations were based on the munitions and explosives of concern (MEC) information that had been collected through October 2012. No information has been gathered since the Master RI SAP was issued that would warrant a revision to the sampling protocol in the Master SAP; the only Non-Time-Critical Removal Action (NTCRA) since that date was along several beaches at Punta Carenero within UXO 8, but the findings do not alter the conceptual site model (i.e., only one MEC was identified at Playa Jalova [Beach 17] in the area where a sampling unit is already located). In addition, the discrete deeper surface soil depth interval for the turtle nesting scenario has been revised to 18 to 36 inches below ground surface (bgs) from 18 to 24 inches bgs, in accordance with the revised Vieques Master Protocols (CH2M, 2018). In total, 18 incremental surface soil and 16 discrete deeper surface soil samples will be collected from UXOs 2, 7, and 8. Sample locations are shown in **Figures ES-1** through **ES-5**.

The following laboratories were selected for performing the sample analyses. Laboratory-specific worksheets contained herein demonstrate that the laboratories adhere to the Master SAP protocols or, as applicable, provide justification for deviation.

- APPL, Inc. in Clovis, CA for analysis of explosives, inorganics (metals), pH (potential of hydrogen), and total organic carbons (TOC).
- ALS Environmental in Keslo, WA for the analysis of soil oxidation reduction potential (ORP).

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Resumen Ejecutivo

Se preparó el Plan Maestro Final de Muestreo y Análisis (SAP, por sus siglas en inglés) para los Antiguos Sitios UXO Terrestres del Este de Vieques, Antiguo Campo de Adiestramiento Naval de Vieques, Vieques, Puerto Rico (CH2M, 2013), que de aquí en adelante se referirá como el SAP Maestro, para guiar las actividades de Investigación para la Remediación (RI, por sus siglas en inglés) en múltiples sitios UXO dentro del antiguo Campo de Adiestramiento Naval de Vieques (VNTR, por sus siglas en inglés), que se llevarán a cabo durante varios años. Debido a la naturaleza robusta y el largo plazo de las actividades cubiertas por el SAP Maestro, el mismo intencionalmente no identifica un laboratorio específico, sino que incluye los protocolos que se requiere que cualquier laboratorio seleccionado cumpla. Por lo tanto, el plan está diseñado para ser utilizado en conjunto con anejos específicos para cada sitio, los cuales proveen hojas de trabajo relacionadas a la química específica para el laboratorio, e incluye cualquier actualización a las actividades planificadas en base a información obtenida desde que se emitió el SAP Maestro. Se revisó el SAP Maestro y la información actualizada se provee en este Anejo al SAP.

Este es el Anejo 6 al SAP Maestro e incluye las hojas de laboratorio específicas para el análisis de muestras discretas de suelos y para muestras incrementales de suelo a ser obtenidas en los UXOs 2, 7 y 8. Para todas las demás hojas de trabajo (es decir, las hojas que no han cambiado, o han tenido cambios poco substanciales debido a la selección de laboratorios específicos), favor consultar el SAP Maestro (CH2M, 2013). La **Figura ES-1** hasta la **Figura ES-5** muestra la ubicación de los UXOs 2, 7 y 8 y las características históricas relevantes a la investigación planificada, respectivamente. **Figura ES-6** muestra los nombres y números de las playas dentro del antiguo Campo de Adiestramiento Naval de Vieques (VNTR, por sus siglas en inglés).

El enfoque original de muestreo para los UXOs 2, 7 y 8 se estableció en el SAP Maestro (CH2M, 2013: **Adjunto A**), que incluye las técnicas de obtención, análisis y las localizaciones de las muestras. Las localizaciones se basaron en la información sobre municiones y explosivos de interés (MEC, por sus siglas en inglés) obtenida hasta octubre de 2012. No se ha recolectado ninguna información desde que se emitió el SAP Maestro del RI que justifique una revisión del protocolo de muestreo en el SAP Maestro; la única Acción de Remoción de Tiempo No Crítico (NTCRA por sus siglas en inglés) desde esa fecha ha sido a lo largo de varias playas en Punta Carenero dentro de UXO 8, pero los resultados no alteran el modelo conceptual del sitio (ya que sólo se identificó un MEC en Playa Jalova [Beach 17], en el área donde ya se encuentra una unidad de muestreo). Además, el intervalo de profundidad para suelo superficial para el escenario de anidación de tortugas ha sido revisado de 18 a 24bajo la superficie del terreno (bgs, por sus siglas in inglés) a 18 a 36 pulgadas pulgadas bgs, de acuerdo con los Protocolos Maestros de Vieques revisados (CH2M, 2018). En total, se obtendrán 18 muestras incrementales de suelo superficial, y 16 muestras discretas de suelo superficial más profundo serán obtenidas de los UXOs 2, 7 y 8. Las localizaciones de las muestras se encuentran en **Figura ES-1** hasta **ES-5**.

Se seleccionaron los siguientes laboratorios para realizar los análisis de las muestras. Las hojas de trabajo específicas para los laboratorios contenidas en este documento demuestran que los laboratorios se adhieren a los protocolos del SAP Maestro, o si aplica, proveen una justificación por cualquier desviación.

- APPL, Inc. en Clovis, CA para el análisis de explosivos, inorgánicos (metales), pH (potencial de hidrógeno) y carbones orgánicos totales (TOC, por sus siglas en inglés).
- ALS Environmental en Keslo, WA para el análisis del potencial de reducción de la oxidación del suelo (ORP, por sus siglas en inglés).

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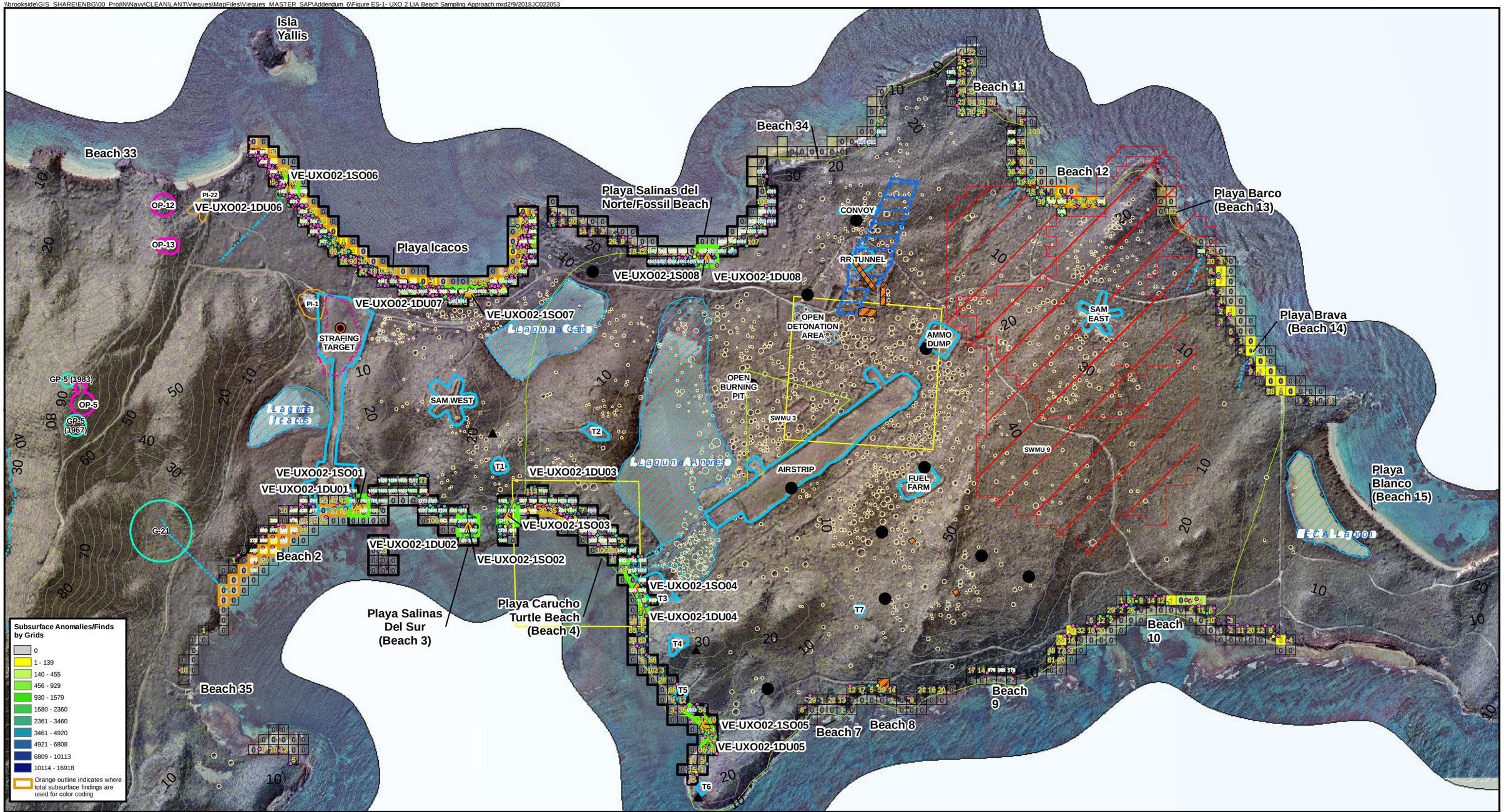
\\brookside\GIS_SHARE\ENBG\00_Proj\N\Navy\CLEAN\LANT\Vieques\MapFiles\Vieques_MASTER_SAP\Addendum_6\Figure ES-1- UXO 2 LIA Beach Sampling Approach.mxd2/9/2018JC022053



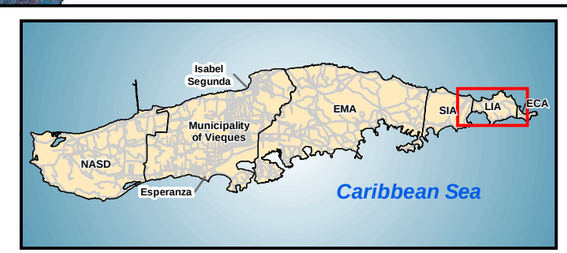
Deep Surface Soil Sample
Sample Unit
Beach Selected for Sampling
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Submunitions

Topographic Contours (10 Meter)
Stream
Crater
Historical Air-To-Ground (ATG) Target
Historical Naval Gunfire Support (NGFS) Target
Bulls Eye Target
LIDAR (Light Detection and Radar) Identified Target Feature
Depleted Uranium Area
Central Processing Center
Gun Positions
2005 Aerial Imagery
2005 Hillshade

Target Area
Observation Point
Open Burn Pit
Open Detonation Area
Naval Gunfire Support (NGFS) Target Area
Dense Submunitions Area
Photo Identified Area
Preliminary Area of Concern
Solid Waste Management Unit
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

Surface Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

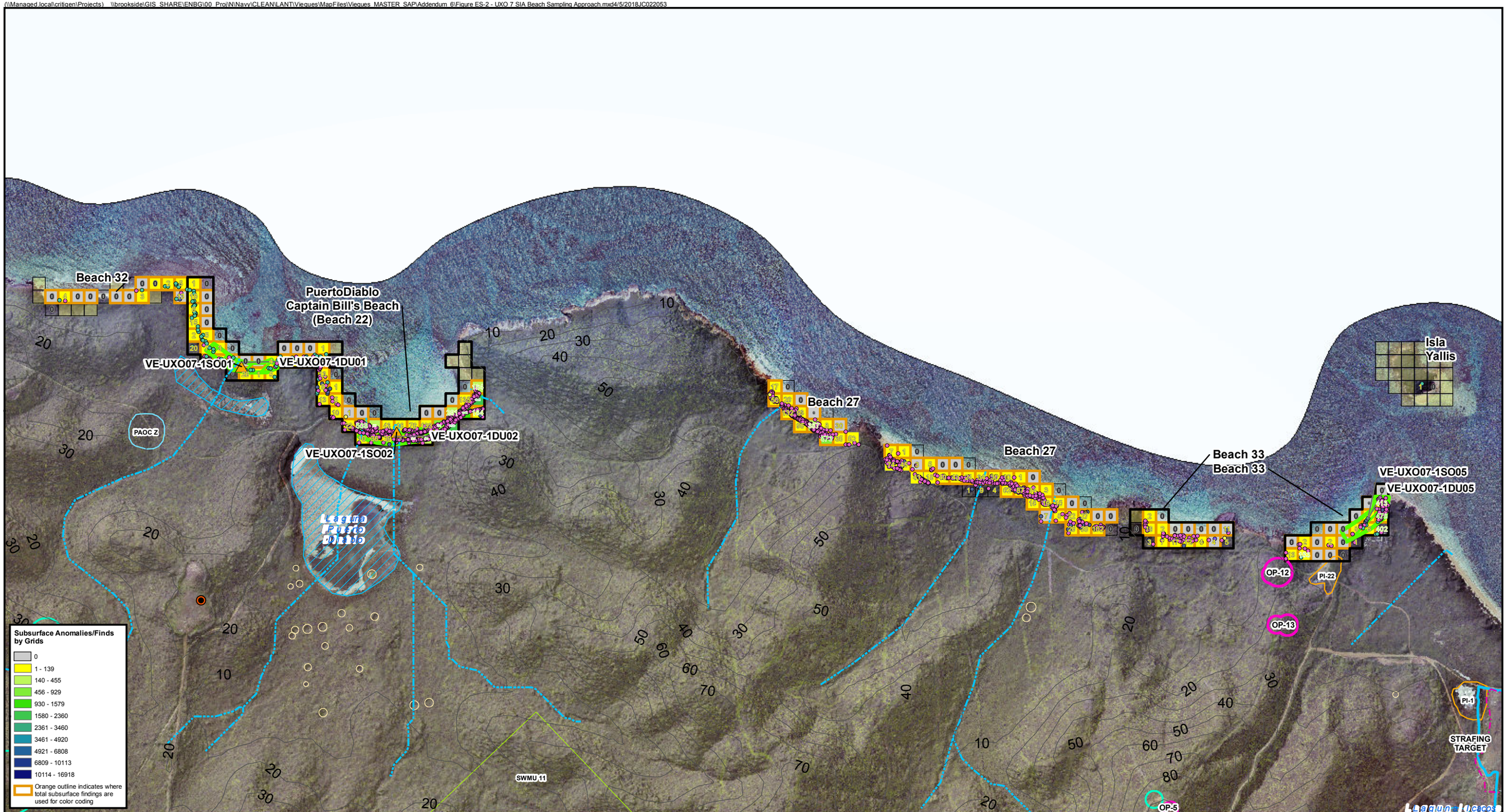


N
W E
S

0 500 1,000
Feet

Figure ES-1
UXO 2 LIA Beach Sampling Approach
Master Sampling and Analysis Plan - Addendum 6
Former VNTR
Vieques, Puerto Rico

(\\Managed.local\critigen\Projects) \\brookside\GIS_SHARE\ENBG\00_Proj\N\Navy\CLEAN\LANT\Vieques\MapFiles\Vieques_MASTER_SAP\Addendum_6\Figure ES-2 - UXO 7 SIA Beach Sampling Approach.mxd4/5/2018JC022053



- Deep Surface Soil Sample
- Sample Unit
- Bombs
- Flares-Pyrotechnics
- Grenades
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Beach Selected for Sampling

2005 Aerial Imagery
2005 Hillshade

- Topographic Contours (10 Meter)
- Stream
- Crater
- Bulls Eye Target
- Central Processing Center
- Gun Positions

- Target Area
- Observation Point
- Photo Identified Area
- Preliminary Area of Concern
- Solid Waste Management Unit
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Lagoon

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

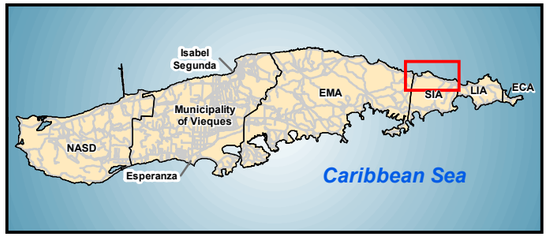


Figure ES-2
UXO 7 SIA Beach Sampling Approach
Master Sampling and Analysis Plan - Addendum 6
Former VNTR
Vieques, Puerto Rico

N W E S

0 350 700 Feet

Deep Surface Soil Sample
Sample Unit
Beach Selected for Sampling
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)

Topographic Contours (10 Meter)
Stream
Gun Positions
Range
Photo Identified Area
Preliminary Area of Concern
Solidl Waste Management Unit
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

2005 Aerial Imagery
2005 Hillshade

Surface Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

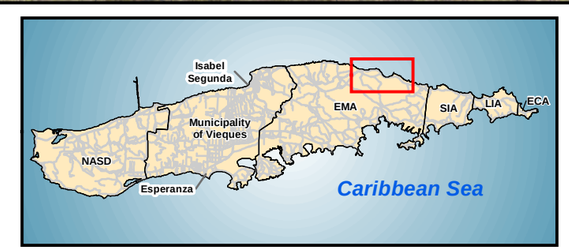
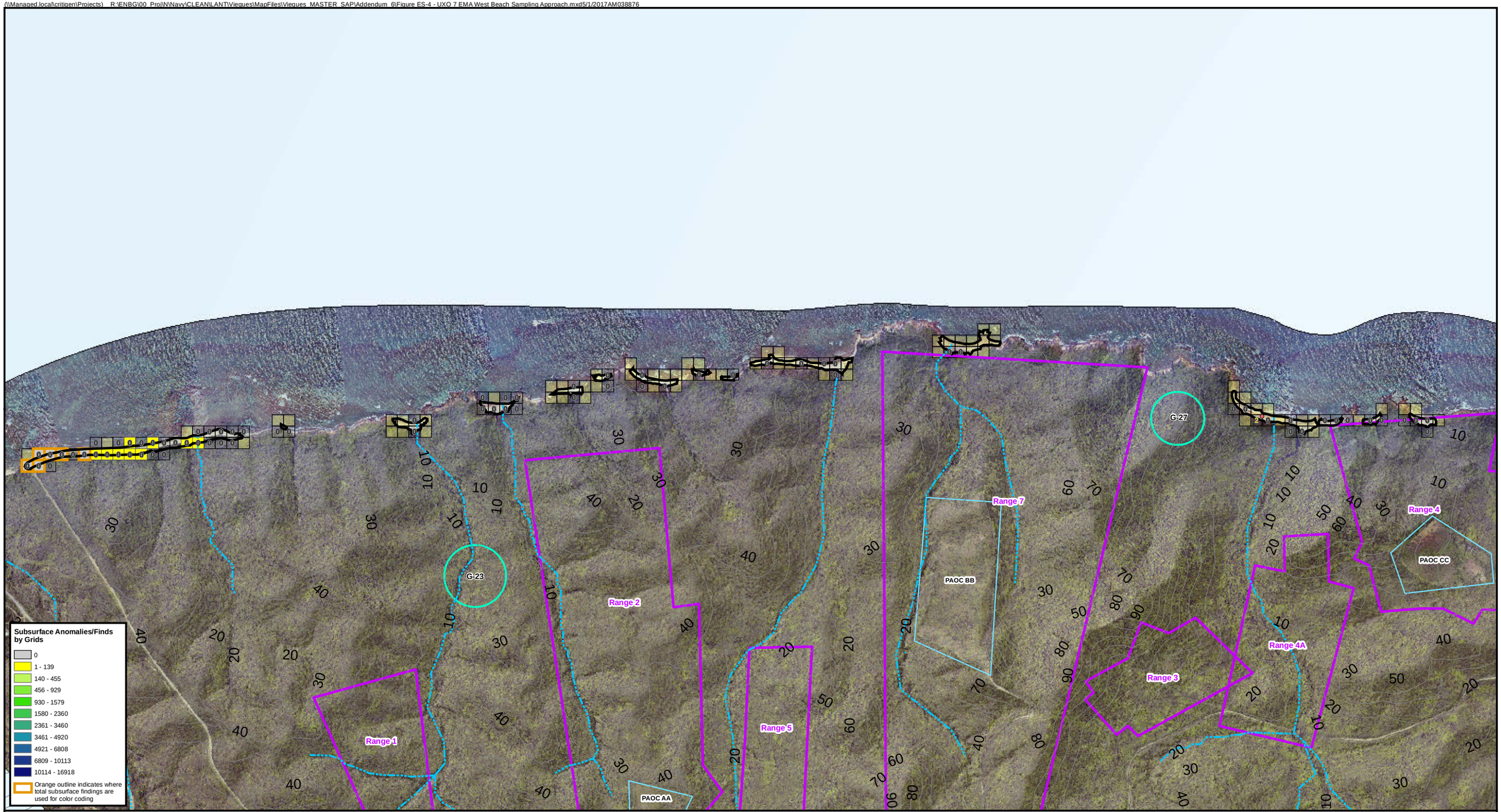


Figure ES-3
UXO 7 EMA East Beach Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

N W E S

0 400 800 Feet

(\\Managed.local\critigen\Projects) R:\ENBG\00_Proj\N\Navy\CLEAN\LANT\Vieques\MapFiles\Vieques_MASTER_SAP\Addendum_6\Figure ES-4 - UXO 7 EMA West Beach Sampling Approach.mxd5/1/2017AM038876



- Bombs
- Flares-Pyrotechnics
- Grenades
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Beach Selected for Sampling

- Topographic Contours (10 Meter)
- Stream
- Gun Positions
- Range
- Preliminary Area of Concern
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918

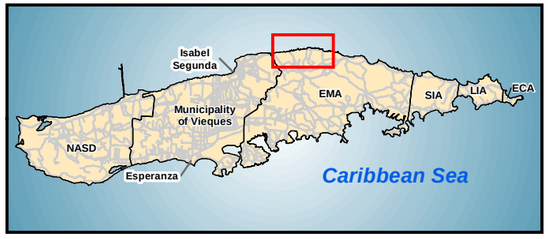


Figure ES-4
UXO 7 EMA West Beach Sampling Approach
Master Sampling and Analysis Plan - Addendum 6
Former VNTR
Vieques, Puerto Rico

N W E S

0 400 800 Feet

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Deep Surface Soil Sample
Brown Pelican Habitat
Sample Unit
Beach Selected for Sampling
Bombs
Flares-Pyrotechnics
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
2005 Aerial Imagery
2005 Hillshade

Topographic Contours (10 Meter)
Stream
Crater
Gun Positions
Observation Point
Photo Identified Area
Solid Waste Management Unit
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

Surface Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

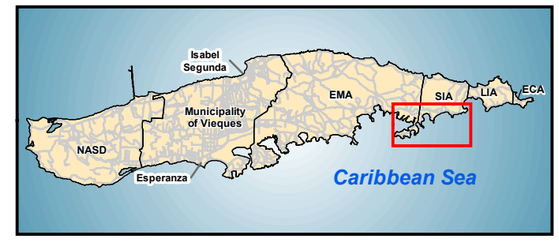


Figure ES-5
UXO 8 SIA South Beaches Sampling Approach
Master Sampling and Analysis Plan - Addendum 6
Former VNTR
Vieques, Puerto Rico

N W E S

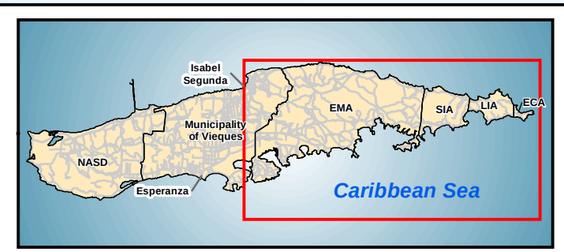
0 500 1,000 Feet

\\brookside\GIS_SHARE\ENBG\00_Proj\N\Navy\CLEAN\LANT\Vieques\MapFiles\Vieques_MASTER_SAP\Addendum_6\Figure ES-6 - Beach Names and Numbers.mxd5/9/2017JC022053

Beach ID	Names	Beach ID	Names	Beach ID	Names
1	Playa Matias/Yellow Beach (Beach 1)	22	Beach 22	34	Beach 34
2	Beach 2	22	Beach 22	35	Beach 35
3	Beach 3	23	Puerto Negro (Beach 23)	36	Beach 36
4	Playa Carucho/Turtle Beach (Beach 4)	24	Playa Campana/Purple Beach (Beach 24)	36	Beach 36
5	Icacos Beach (Beach 5)	25	Beach 25	36	Beach 36
7	Beach 7	26	Beach 26	38	Beach 38
8	Beach 8	27	Beach 27	39	Punta Carenera (Beach 39)
9	Beach 9	27	Beach 27	40	Beach 40
10	Beach 10	28	Beach 28	40	Beach 40
11	Beach 11	28	Beach 28	40	Beach 40
12	Beach 12	29	Beach 29	-	Punta Goleta
13	Playa Barco (Beach 13)	29	Beach 29	-	Isla Yallis
14	Playa Brava (Beach 14)	30	Punta Brigadier (Beach 30)	-	Fossil Beach
15	Playa Blanco (Beach 15)	31	Beach 31	-	Punta Este
16	Beach 16	32	Beach 32	-	Playa La Plata/Orchid Beach/Silver Beach
17	Playa Jalova (Beach 17)	32	Beach 32	-	Playa La Plata/Orchid Beach/Silver Beach
18	Playa Jalovita (Beach 18)	32	Beach 32	-	Punta Conejo
19	Playa Yoye (Beach 19)	32	Beach 32	-	Cayo de Chiva
20	Playa Fanduca (Beach 20)	33	Beach 33	-	Playa de la Chiva/Blue Beach
21	Beach 21	33	Beach 33	-	Pata Prieta
				-	Playa Caracas/Red Beach

Legend

- Beach



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Feet

Figure ES-6
Beach Names and Numbers
Master Sampling and Analysis Plan - Addendum 6
Former VNTR
Vieques, Puerto Rico

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ES-5 UXO 8 SIA South Beaches Sampling Approach
ES-6 Beach Names and Numbers

Acronyms and Abbreviations

µg/kg	microgram per kilogram
µg/L	microgram per liter
µmol/g	micromole per gram
ASTM	American Society for Testing and Materials
AVS/SEM	acid volatile sulfide/simultaneously extracted metals
bgs	below ground surface
CCV	continue calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action—Navy
CSM	Conceptual Site Model
CTO	Contract Task Order
DL	detection limit
DOD	Department of Defense
DQI	data quality indicator
EMA	Eastern Maneuver Area
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
ESV	ecological screening value
FD	field duplicate
FTL	Field Team Leader
g	gram
ICAL	initial calibration
ICB/CCB	initial and continuing calibration blank
ICP	Inductive Coupled Plasma Atomic Emission Spectrometry
ICS	interference check solutions
ICV	initial calibration verification
IS	incremental sampling
IS	internal standards
LCL	lower control limit
LCS	laboratory control sample
LD	laboratory duplicate
LDR	linear dynamic range
LIA	Live Impact Area
LOD	limits of detection
LOQ	limits of quantitation
LRB	laboratory reagent blank
MB	method blank
MCL	maximum contaminant level
MCT	matrix conductivity threshold
MD	matrix duplicate
MEC	munitions and explosives of concern
mg/kg	milligram per kilogram

MS	matrix spike
MSD	matrix spike duplicate
N/A	not applicable
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NOAA	National Oceanic and Atmospheric Administration
NTCRA	Non-Time-Critical Removal Action
ORP	oxidation reduction potential
OU	Operable Unit
PAL	project action limit
pH	potential of hydrogen
PIL	project indicator limit
PM	Project Manager
POC	Point of Contact
PQL	practical quantitation limit
PRDNER	Puerto Rico Department of Natural and Environmental Resources
PREQB	Puerto Rico Environmental Quality Board
QA	quality assurance
QAMS	Quality Assurance Management Section
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
QSM	Quality Systems Manual
RI	Remedial Investigation
RPD	relative percent difference
RRT	relative retention times
RSD	relative standard deviation
RSL	regional screening level
RT	retention time
SAP	Sampling and Analysis Plan
SD	sediment sample
SEM	scanning electron microscope
SMI	multi-incremental sampling
SMP	Site Management Plan
SOP	Standard Operating Procedure
SS	surface soil sample
TBD	to be determined
TOC	total organic carbon
UCL	upper confidence limit
UFP	Uniform Federal Policy
USFWS	United States Fish and Wildlife Service
UXO	unexploded ordnance
VNTR	Vieques Naval Training Range
WCHEM	wet chemistry

SAP Worksheet #1—Title and Approval Page

UXOs 2, 7, and 8 Remedial Investigation
Master Sampling and Analysis Plan
Addendum 6

Atlantic Fleet Weapons Training Area – Vieques
Former Vieques Naval Training Range
Vieques, Puerto Rico

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Department of the Navy
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Prepared by
CH2M HILL, Inc.
Virginia Beach, Virginia

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G. Brett Doerr Digitally signed by G. Brett Doerr
Date: 2018.04.05 13:07:34 -04'00'

Brett Doerr
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EPA Region 2 – Remedial Project Manager

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Susan Silander
USFWS – Remedial Project Manager

SAP Worksheet #1—Title and Approval Page

UXOs 2, 7, and 8 Remedial Investigation
Master Sampling and Analysis Plan
Addendum 6

Atlantic Fleet Weapons Training Area – Vieques
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Virginia Beach, Virginia

QA Review Signature:

Brett Doerr
Vieques Activity Manager

Other Approval Signatures:

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DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=CLOE.KEVIN.R.1229533947
Date: 2018.03.26 09:13:53 -04'00'

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Craig Lilyestrom
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Susan Silander
USFWS – Remedial Project Manager

SAP Worksheet #1—Title and Approval Page

UXOs 2, 7, and 8 Remedial Investigation
Master Sampling and Analysis Plan
Addendum 6

Atlantic Fleet Weapons Training Area – Vieques
Former Vieques Naval Training Range
Vieques, Puerto Rico

Contract Task Order 0004

April 2018

Prepared for
Department of the Navy
Naval Facilities Engineering Command, Atlantic

Under the
NAVFAC CLEAN 9000 Program
Contract N62470-16-D-9000

Prepared by
CH2M HILL, Inc.
Virginia Beach, Virginia

QA Review Signature:

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USFWS – Remedial Project Manager

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SAP Worksheet #2—Sampling and Analysis Plan Identifying Information

Site Name/Number: UXO 2, 7, and 8, Atlantic Fleet Weapons Training Area – Vieques, Former Vieques Naval Training Range, Vieques, Puerto Rico

Operable Unit (OU): Not applicable

Contractor Name: CH2M HILL, Inc.

Contract Number: N62470-16-D-9000

Contract Title: Navy Comprehensive Long-term Environmental Action—Navy (CLEAN) Program9000

Work Assignment Number (optional): Contract Task Order (CTO) 0004

1. This SAP addendum was prepared in general accordance with the requirements of the Uniform Federal Policy-Quality Assurance Project Plans (UFP-QAPP; IDQTF, 2005) and United States Environmental Protection Agency (EPA) Guidance for QAPPs, EPA QA/G-5, Quality Assurance Management Section (QAMS; EPA, 2002).
2. Regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
3. This SAP is prepared as an addendum to the *Master SAP for East Vieques Terrestrial UXO Sites* (denoted as the Master SAP in this SAP Addendum; CH2M, 2013; **Attachment A**) to update the Conceptual Site Model (CSM) for UXOs 2, 7, and 8 based on data collected during the NTCRA for MEC. It is the sixth addendum to the Master SAP. In addition, this SAP Addendum provides the analytical laboratory worksheets specific to the UXO 2, 7, and 8 RI.
4. Dates of scoping sessions:

Scoping Session	Date
Scoping sessions are provided in the Master SAP	

5. Dates and titles of any SAP documents written for previous site work that are relevant to the current investigation:

Title	Date
Master Standard Operating Procedures, Protocols, and Plans, Environmental Restoration Program, Vieques, Puerto Rico (CH2M, 2018)	April 2018
Status Report, Time-Critical Removal Action, Interim Action for the Removal of Surface Munitions and Explosives of Concern at Munitions Response Areas – Live Impact Area and Eastern Conservation Area, Former Vieques Naval Training Range, Vieques, Puerto Rico (CH2M, 2010b)	October 2010
Master Sampling and Analysis Plan for East Vieques Terrestrial UXO Sites, Former Vieques Naval Training Range, Vieques, Puerto Rico (CH2M, 2013)	January 2013
Quality Assurance Project Plan, Beach Dynamic Investigation, Eleven Beaches at the Former Vieques Naval Training Range and the Former Naval Ammunition Support Detachment, Atlantic Fleet Weapons Training Area – Vieques, Vieques, Puerto Rico (CH2M, 2014)	February 2014

SAP Worksheet #2—Sampling and Analysis Plan Identifying Information (continued)

6. Organizational partners (stakeholders) and connection with lead organization:
   - **EPA Region 2** – Federal regulatory stakeholder overseeing CERCLA Vieques Environmental Restoration Program (ERP) implemented by lead organization
   - **Puerto Rico Environmental Quality Board (PREQB)** – Commonwealth regulatory stakeholder overseeing CERCLA Vieques ERP implemented by lead organization
   - **Puerto Rico Department of Natural and Environmental Resources (PRDNER)** – The agency responsible for protecting natural resources, Commonwealth-owned conservation areas, submerged lands, and the coastal zone in the Commonwealth of Puerto Rico
   - **United States Fish and Wildlife Service (USFWS)** – Landowner of land transferred from lead organization and on which UXOs 2, 7, and 8 ERP activities are conducted
   - **National Oceanic and Atmospheric Administration (NOAA)** – Marine habitat stakeholder and technical advisor to EPA
7. Lead organization (see Worksheet #7 from the Master SAP [CH2M, 2013] for a detailed list of data users):
   - Department of Navy (Navy)
8. The omitted SAP elements excluded and provide an explanation for their exclusion below:

   This addendum includes only those worksheets revised as a result of the procurement of an analytical laboratory. Worksheets from the Master SAP that were prepared for this project previously, but not included in this addendum, remain applicable and will be followed during the RI. Those worksheets are Worksheets #3, 4-14, 21, 22, 26, 27, 29, and 31-37. Please consult the Master SAP for the associated information. Worksheets 10, 11, and 17 are included in **Attachment A**.

SAP Worksheet #12—Measurement Performance Criteria Table for Field Quality Control Samples

As requested by EPA Region 2 for another site in Puerto Rico, all field quality control (QC) sample information is provided within Worksheet #28 and Worksheet #12 is not applicable.

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SAP Worksheet #15-1—Reference Limits and Evaluation Table

Matrix: SS and SMI
Analytical Group: EXPLO

Analyte[1]	CAS #	Method	RSLs Residential Soil Adjusted[2] (ug/kg)	RSLs Industrial Soil Adjusted[2] (ug/kg)	Ecological Soil ESVs[3] (ug/kg)	Project QL Goal[4] (ug/kg)	Laboratory Limits[6] (ug/kg)			LCS and MS/MSD Recovery Limits and RPD[5](%)		
							LOQ	LOD	DL	LCL	UCL	RPD
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	8330B	220,000	3,200,000	NC	110,000	500	200	79	80	116	20
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	8330B	630	8,200	NC	315	450	200	63	73	119	
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	8330B	3,600	51,000	10,000	1,800	500	200	83	71	120	
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	8330B	1,700	7,400	11,000	850	500	200	83	75	121	
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	8330B	360	1,500	8,500	180	500	200	83	79	117	
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	8330B	15,000	230,000	80,000	7,500	500	200	75	71	123	
2-Nitrotoluene (2-NT)	88-72-2	8330B	3,200	15,000	NC	1,600	500	200	66	70	124	
3-Nitrotoluene (3-NT)	99-08-1	8330B	630	8,200	NC	315	500	200	71	67	129	
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	19406-51-0	8330B	15,000	230,000	80,000	7,500	500	200	75	64	127	
4-Nitrotoluene (4-NT)	99-99-0	8330B	25,000	140,000	NC	12,500	500	200	80	71	124	
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	8330B	6,100	28,000	10,000	3,050	500	200	80	67	129	
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	8330B	16,000	230,000	10,000	5,000	500	200	91	68	135	
Nitrobenzene (NB)	98-95-3	8330B	5,100	22,000	2,260	1,130	500	200	75	67	129	
Nitroglycerin (NG)	55-63-0	8330B	630	8,200	NC	315	500	200	85	73	124	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	8330B	390,000	5,700,000	10,000	5,000	500	200	80	74	124	
Pentaerythritol tetranitrate (PETN)	78-11-5	8330B	13,000	160,000	NC	6,500	2500	1000	579	72	128	
Perchlorate	14797-73-0	6850	5,500	82,000	1,000	500	6	4	2	84	121	15
Picric Acid	88-89-1	8321A	5,700	74,000	NC	2,850	200	120	60	**30**	**130**	**20**

Notes:
Shading represents instances where the project action limit (PAL) is less than the laboratory limit of detection (LOD). Non-detects will not be treated as exceedances and the resulting uncertainty will be discussed in the data quality evaluation.
[1] Full 8330B-list (excluding 3,5-dinitroaniline [3,5-DNA] due to a lack of toxicity data) plus Picric Acid via method 8321A and Perchlorate via method 6850.
[2] Refer to Worksheet #11 from the Master SAP (**Attachment A**) for specific identification of PALs by matrix. PALs in this context refer to the sets of screening levels shown on this table. Regional screening level (RSL) values are current as of November 2017 and are reflective of an HQ = 0.1.
[3] The Vieques Environmental Restoration Program Ecological Soil ecological screening values (ESVs) are listed.
[4] The practical quantitation limit (PQL) Goal is 1/2 the lesser of the applicable screening levels.
[5] Department of Defense (DOD) Quality Systems Manual (QSM) v5.1 is the basis for laboratory control sample (LCS) and matrix spike (MS)/matrix spike duplicate (MSD) limits. Bolded values indicate analytes for which DOD QSM v5.1 does not provide limits and laboratory in-house limits are used.
[6] Results for non-aqueous samples are reported on a dry-weight basis. For fractions which have been dried prior to analysis, results are reported on an as-received basis (for the dried fraction).
NC indicates that there is no criterion for an analyte.
The ammonium picrate concentration will be calculated by taking the reported picric acid result and converting it to ammonium picrate using the following equation: (ammonium picrate [ug/kg]) = (picric acid [ug/kg]) * (246.13/229.10).

Worksheet #15-2—Reference Limits and Evaluation Table

Matrix: SS and SMI
Analytical Group: METAL

Analyte	CAS #	Method	RSLs Residential Soil Adjusted[1] (mg/kg)	RSLs Industrial Soil Adjusted[1] (mg/kg)	Ecological Soil ESVs[2] (mg/kg)	Project QL Goal[3] (mg/kg)	Laboratory Limits[4] (mg/Kg)			LCS and MS/MSD Recovery Limits and RPD[5](%)		
							LOQ	LOD	DL	LCL	UCL	RPD
Aluminum	7429-90-5	6010C	7,700	100,000	NC[2]	3,850	50	4	1.98	74	119	20
Antimony	7440-36-0	6020A	3.1	47	78	1.55	0.2	0.2	0.1	72	124	
Arsenic	7440-38-2	6020A	0.68	3	18	0.34	0.5	0.3	0.08	82	118	
Barium	7440-39-3	6010C	1,500	22,000	330	165	2	0.4	0.07	83	113	
Beryllium	7440-41-7	6010C	16	230	40	8	0.5	0.2	0.04	83	113	
Cadmium	7440-43-9	6020A	7.1	98	32	3.55	0.1	0.08	0.03	84	116	
Calcium	7440-70-2	6010C	NC	NC	NC	20	100	20	12	81	116	
Chromium	7440-47-3	6020A	NC	NC	64	32	0.5	0.2	0.07	83	119	
Chromium III and compounds [calculated]	16065-83-1	--	12000	100000	NC	--	--	--	--	**--**	**--**	
Chromium (hexavalent)	18540-29-9	7199	0.3	6.3	0.4	0.15	0.6	0.4	0.3	**80**	**120**	
Cobalt	7440-48-4	6020A	2.3	35	13	1.15	0.1	0.08	0.02	84	115	
Copper	7440-50-8	6010C	310	4,700	70	35	5	0.4	0.21	81	117	
Iron	7439-89-6	6010C	5,500	82,000	NC[2]	2,750	80	4	3.5	81	118	
Lead	7439-92-1	6010C	400	800	120	60	0.9	0.8	0.25	81	112	
Magnesium	7439-95-4	6010C	NC	NC	NC	4	30	4	3.5	78	115	
Manganese	7439-96-5	6010C	180	2,600	220	90	4.5	0.4	0.13	84	114	
Nickel	7440-02-0	6010C	150	2,200	38	19	4	0.4	0.11	83	113	
Potassium	7440-09-7	6010C	NC	NC	NC	50	300	50	40	81	116	
Selenium	7782-49-2	6020A	39	580	0.52	0.26	0.5	0.1	0.1	80	119	
Silver	7440-22-4	6020A	39	580	560	19.5	0.1	0.05	0.02	83	118	
Sodium	7440-23-5	6010C	NC	NC	NC	50	500	50	45	83	118	
Thallium	7440-28-0	6020A	0.078	1.2	1	0.039	0.1	0.05	0.02	83	118	
Vanadium	7440-62-2	6010C	39	580	130	19.5	2	0.4	0.1	82	114	
Zinc	7440-66-6	6010C	2,300	35,000	120	60	8	4	1.15	82	113	

Notes:
Shading represents instances where the PAL is less than the laboratory LOD. Non-detects will not be treated as exceedances and the resulting uncertainty will be discussed in the data quality evaluation. Note that Hexavalent chromium data are used in conjunction with total chromium data to determine the type of chromium present at the site.

[1] Refer to Worksheet #11 from the Master SAP (**Attachment A**) for specific identification of PALs by matrix. PALs in this context refer to the sets of screening levels shown on this table. RSLs values are current as of November 2017 and are reflective of an HQ = 0.1 for non-carcinogens.

[2] The Vieques Environmental Restoration Program Ecological Soil ESVs are listed. ESVs for aluminum and iron are pH-based.

[3] The PQL Goal is 1/2 the lesser of the applicable screening levels.

[4] Results for non-aqueous samples are reported on a dry-weight basis. For fractions which have been dried prior to analysis, results are reported on an as-received basis (for the dried fraction).

[5] DOD QSM v5.1 is the basis for LCS and MS/MSD limits. Bolded values indicate analytes for which DOD QSM v5.1 does not provide limits and laboratory in-house limits are used (i.e. Hexavalent chromium).
NC indicates that there is no criterion for an analyte.

Worksheet #15-3—Reference Limits and Evaluation Table

Matrix: SS and SMI
Analytical Group: WCHEM

Analyte	CAS #[1]	Units	Project Indicator Limit (PIL)[2]	Project QL Goal[2]	Laboratory Limits		
					LOQ	LOD	DL
pH	PH	pH units	NA	NA	NA	NA	NA
Redox (MV) (ORP)	REDOX	MV	NA	NA	NA	NA	NA
Total Organic Carbon (TOC)	TOC	MG/KG	NA	NA	200	150	100

Notes:

[1] Some CAS numbers are contractor-specific.

[2] There are not project indicator limits for these WCHEM data. pH data are used to help interpret metals data for ecological receptors. TOC data may be used to create site-specific leaching factors. ORP and pH data are used to help interpret hexavalent chromium results.

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SAP Worksheet #16—Project Schedule / Timeline

The official schedule for this investigation is included in the Site Management Plan (SMP) schedule that is updated on a periodic basis.

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SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table

Station ID / Sample ID[1]	Matrix	Depth	Analytical Group[2]	Number of Samples	Sampling Standard Operating Procedure (SOP) Reference
UXO 2 - Decision Unit 1 -Beaches					
Playa Salinas del Sur					
SMI Samples					
VE-UXO02-1DU01 / VE-UXO02-1SMI01-MMYY VE-UXO02-1DU01 / VE-UXO02-1SMI01T-MMYY VE-UXO02-1DU01 / VE-UXO02-1SMI01TT-MMYY	SMI	0 - 2.5 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	3 (Triplicate)	See Worksheet #21
VE-UXO02-1DU02 / VE-UXO02-1SMI02-MMYY				1	
Surface Soil Samples					
VE-UXO02-1SO01 / VE-UXO02-1SS01-1H03 VE-UXO02-1SO01 / VE-UXO02-1SS01P-1H03	SS	18-36 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	2 (FD)	See Worksheet #21
VE-UXO02-1SO02 / VE-UXO02-1SS02-1H03				1	
Turtle Beach					
SMI Samples					
VE-UXO02-1DU03 / VE-UXO02-1SMI03-MMYY VE-UXO02-1DU03 / VE-UXO02-1SMI03-MMYY-MS VE-UXO02-1DU03 / VE-UXO02-1SMI03-MMYY-MSD	SMI	0 - 2.5 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	3 (MS/MSD)	See Worksheet #21
VE-UXO02-1DU04 / VE-UXO02-1SMI04-MMYY				1	
VE-UXO02-1DU05 / VE-UXO02-1SMI05-MMYY				1	
Surface Soil Samples					
VE-UXO02-1SO03/ VE-UXO02-1SS03-1H03 VE-UXO02-1SO03/ VE-UXO02-1SS03-1H03-MS VE-UXO02-1SO03/ VE-UXO02-1SS03-1H03-MSD	SS	18-36 inches	EXPLO, METAL, WCHEM (pH, TOC and ORP)	3 (MS/MSD)	See Worksheet #21
VE-UXO02-1SO04 / VE-UXO02-1SS04-1H03				1	
VE-UXO02-1SO05 / VE-UXO02-1SS05-1H03				1	
Icacos/Playa Yallis					
SMI Samples					
VE-UXO02-1DU06/ VE-UXO02-1SMI06-MMYY	SMI	0 - 2.5 inches	EXPLO, METAL, WCHEM (pH, TOC and ORP)	1	See Worksheet #21
VE-UXO02-1DU07 / VE-UXO02-1SMI07-MMYY				1	
Surface Soil Samples					
VE-UXO02-1SO06 / VE-UXO02-1SS06-1H03	SS	18-36 inches	EXPLO, METAL, WCHEM (pH, TOC and ORP)	1	See Worksheet #21
VE-UXO02-1SO07 / VE-UXO02-1SS07-1H03				1	
Playa Salinas Del Norte/Fossil Beach					
SMI Samples					
VE-UXO02-1DU08 / VE-UXO02-1SMI08-MMYY	SMI	0 -2.5 inches	EXPLO, METAL, WCHEM (pH, TOC and ORP)	1	See Worksheet #21
Surface Soil Samples					
VE-UXO02-1SO08 / VE-UXO02-1SS08-1H03	SS	18-36 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	1	See Worksheet #21
UXO 7 - Decision Unit 1 -Beaches					
Diablo Beach					
SMI Samples					
VE-UXO07-1DU01 / VE-UXO07-1SMI01-MMYY VE-UXO07-1DU01 / VE-UXO07-1SMI01T-MMYY VE-UXO07-1DU01 / VE-UXO07-1SMI01TT-MMYY	SMI	0 - 2.5 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	3 (Triplicate)	See Worksheet #21
VE-UXO07-1DU02 / VE-UXO07-1SMI02-MMYY				1	
Surface Soil Samples					
VE-UXO07-1SO01 / VE-UXO07-1SS01-1H03 VE-UXO07-1SO01 / VE-UXO07-1SS01P-1H03	SS	18-36 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	2 (FD)	See Worksheet #21
VE-UXO07-1SO02 / VE-UXO07-1SS02-1H03				1	

SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Station ID / Sample ID[1]	Matrix	Depth	Analytical Group[2]	Number of Samples	Sampling SOP Reference
Purple Beach					
SMI Samples					
VE-UXO07-1DU03 / VE-UXO07-1SMI03-MMYY VE-UXO07-1DU03 / VE-UXO07-1SMI03-MMYY-MS VE-UXO07-1DU03 / VE-UXO07-1SMI03-MMYY-SD	SMI	0 - 2.5 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	3 (MS/MSD)	See Worksheet #21
VE-UXO07-1DU04/ VE-UXO07-1SMI04-MMYY				1	
Surface Soil Samples					
VE-UXO07-1SO03 / VE-UXO07-1SS03-1H03 VE-UXO07-1SO03 / VE-UXO07-1SS03-1H03-MS VE-UXO07-1SO03 / VE-UXO07-1SS03-1H03-SD	SS	18-36 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	3 (MS/MSD)	See Worksheet #21
VE-UXO07-1SO04 / VE-UXO07-1SS04-1H03				1	
Beach 33					
SMI Samples					
VE-UXO07-1DU05 / VE-UXO07-1SMI05-MMYY	SMI	0 - 2.5 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	1	See Worksheet #21
Surface Soil Samples					
VE-UXO07-1SO05 / VE-UXO07-1SS05-1H03	SS	18-36 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	1	See Worksheet #21
UXO 8 - Decision Unit 1 -Beaches					
Playa Jalova					
SMI Samples					
VE-UXO08-1DU01 / VE-UXO08-1SMI01-MMYY VE-UXO08-1DU01 / VE-UXO08-1SMI01T-MMYY VE-UXO08-1DU01 / VE-UXO08-1SMI01TT-MMYY	SMI	0 - 2.5 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	3 (Triplicate)	See Worksheet #21
Surface Soil Samples					
VE-UXO08-1SO01 / VE-UXO08-1SS01-1H03 VE-UXO08-1SO01 / VE-UXO08-1SS01P-1H03	SS	18-36 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	2 (FD)	See Worksheet #21
Playa Jalovita					
SMI Samples					
VE-UXO08-1DU02 / VE-UXO08-1SMI02-MMYY VE-UXO08-1DU02 / VE-UXO08-1SMI02-MMYY-MS VE-UXO08-1DU02 / VE-UXO08-1SMI02-MMYY-MSD	SMI	0 - 2.5 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	3 (MS/MSD)	See Worksheet #21
Surface Soil Samples					
VE-UXO08-1SO02 / VE-UXO08-1SS02-1H03 VE-UXO08-1SO02 / VE-UXO08-1SS02-1H03-MS VE-UXO08-1SO02 / VE-UXO08-1SS02-1H03-MSD	SS	18-36 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	3 (MS/MSD)	See Worksheet #21
Playa Matias/Yellow Beach					
SMI Samples					
VE-UXO08-1DU03 / VE-UXO08-1SMI03-MMYY	SMI	0 - 2.5 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	1	See Worksheet #21
VE-UXO08-1DU04 / VE-UXO08-1SMI04-MMYY				1	
Surface Soil Samples					
VE-UXO08-1SO03 / VE-UXO08-1SS03-1H03	SS	18-36 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	1	See Worksheet #21
VE-UXO08-1SO04 / VE-UXO08-1SS04-1H03				1	
Cayo Conejo					
SMI Samples					
VE-UXO08-1DU05 / VE-UXO08-1SMI05-MMYY	SMI	0 -2.5 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	1	See Worksheet #21
Surface Soil Samples					
VE-UXO08-1SO05 / VE-UXO08-1SS05-1H03	SS	18-36 inches	EXPLO, METAL, WCHEM (pH, TOC, and ORP)	1	See Worksheet #21

Notes
[1] MMYY = Two digit month and year of sampling date.
[2] Field QC samples will not be analyzed for WCHEM.

SAP Worksheet #19—Field Sampling Requirements Table

Matrix	Analytical Group[1,2]	Analytical and Preparation Method / SOP Reference	Containers[2]	Sample Volume[3]	Preservation Requirements	Maximum Holding Time
SMI	EXPLO	SW-846 8330B / HPL8330, MSE018MIS	1 Gallon bag(s)	10 g	≤ 6°C but not frozen	14 days / 40 days
		SW8330B, SW-846 8321A / MSE018, HPL8321		10 g		
		SW-846 6850 / HPL6850		10 g[5]		28 days
	METAL	SW-846 3050B[6], 6010C, 6020A / PREMETALSIS, PRE3050B, ANA6010, ANA6020		10 g		180 days
		SW-846 3060A, SW-846 7199/ PREMETALSIS, ANA3060A, ANA218.6-7199		2.5 g		30 days / 7 days
	WCHEM (pH)	SW-846 9045D / ANA9045		50 g		ASAP
	WCHEM (TOC)	Walkley Black / ANAWALKLEY		5 g		28 days
	WCHEM (ORP)	ASTM D1498 / GEN-CR6		10 g		30 days
SS	EXPLO	SW-846 8330B / HPL8330, MSE018	1 x 8 oz amber glass wide-mouth jar with Teflon lined screw cap	20 g[4]	≤ 6°C but not frozen	14 days / 40 days
		SW8330B, SW-846 8321A/MSE018, HPL8321				
		SW-846 6850 / HPL6850		10 g[5]		28 days
	METAL	SW-846 3050B[6], 6010C, 6020A / PRE3050B, ANA6010, ANA6020	1 x 8 oz amber glass wide-mouth jar with Teflon lined screw cap	1 g		180 days
		SW-846 3060A, SW-846 7199/ ANA3060A, ANA218.6-7199		2.5 g		30 days / 7 days
	WCHEM (pH)	SW-846 9045D / ANA9045		20 g		ASAP
	WCHEM (TOC)	Walkley Black / ANAWALKLEY		0.5 g		28 days
	WCHEM (ORP)	ASTM D1498 / GEN-CR6	1 x 4 oz glass jar	10 g		30 days

Notes:

[1] Refer to Worksheet #18 for details regarding analytical groups to be tested for each media.

[2] All fractions are shipped to APPL.

[3] Fill to capacity. These are minimum required for preparation and/or analysis.

[4] 8330B Explosives and Picric Acid are analyzed from the same extract.

[5] APPL will extract 10g of soil for perchlorate rather than the typical 1g. This is intended to provide a more-representative extraction.

[6] The laboratory may digest samples using SW-846 3015A / PRE3015A instead of SW-846 3050B / PRE3050B.

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SAP Worksheet #20—Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Triplicates	No. of Field Duplicates	No. of MS/ MSD Pairs	No. of Trip Blanks[1]	No. of Equipment Blanks[1]	Total No. of Samples to Lab
SMI	EXPLO	18	3	--	3	--	3	33
	METAL	18	3	--	3	--	3	33
	WCHEM (pH)	18	--	--	--	--	--	18
	WCHEM (TOC)	18	--	--	--	--	--	18
	WCHEM (ORP)	18	--	--	--	--	--	18
SS	EXPLO	16	--	3	3	--	3	28
	METAL	16	--	3	3	--	3	28
	WCHEM (pH)	16	--	--	--	--	--	16
	WCHEM (TOC)	16	--	--	--	--	--	16
	WCHEM (ORP)	16	--	--	--	--	--	16

Notes:

[1] The number of equipment blanks is based on a fundamental assumptions. For surface soil (SS) samples, it was assumed that 10 samples can be collected per day.

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SAP Worksheet #23—Analytical SOP References Table

Lab SOP Number	Title, Revision Date[1], and/or Number	Date Last Revisited if not Revised[1]	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis[1,2]	Variance to QSM	Modified for Project Work? (Y/N)
MSE018IS	Mechanical Shaker Extraction for Solid Explosive Samples using Incremental sampling (IS) techniques EPA METHOD 8330B; 08/2016; Rev. 6	1/17/2017	Definitive	SMI / EXPLO	N/A (extraction)	APPL	None	N
MWE3535	Solid phase extraction for aqueous explosive samples EPA method 3535A, Rev. 3, 06/2016		Definitive	SW / EXPLO	N/A (extraction)	APPL	None	N
PRE3015A	Microwave Assisted Acid Digestion of Soil Samples and Extracts by EPA Method 3015A; 09/2016; Rev. 4		Definitive	SS/SMI / METAL	N/A (digestion)	APPL	None	N
PREMETALSIS	Incremental Sampling (IS) techniques for Digestion of Soil Samples; 06/2014; Rev. 2	6/1/2016	Definitive	SMI / METAL	N/A (digestion)	APPL	None	N
ANAISM02.2	Percent Solids and Percent Moisture Analysis of Solids; 05/01/17; Rev. 2		Screening	SS/SMI / EXPLO, METAL, WCHEM	N/A	APPL	None	N
ANA6010	Inductively Coupled Plasma Atomic Emission Spectroscopy by EPA Method 6010; 12/2016; Rev. 10		Definitive	SS/SMI / METAL	ICP-AES	APPL	None	N
ANA6020	Inductively Coupled Plasma-Mass Spectrometry by EPA Method 6020; 12/2016; Rev. 10		Definitive	SS/SMI / METAL	ICP-MS	APPL	None	N
ANA218.6-7199	Hexavalent Chromium Analysis EPA Method 7199/218.6; 12/2016; Rev. 7		Definitive	SS/SMI / METAL	IC	APPL	None	N
ANAWALKLEY	Total Organic Carbon (TOC) in Soil (Walkley-Black, Modified); 01/2016; Rev. 2		Screening	SS/SMI / WCHEM	N/A (titration)	APPL	None	N
HPL6850	Analysis of Perchlorate in Environmental Samples by EPA 6850; 06/2016; Rev. 5	7/22/2016	Definitive	SS/SMI / EXPLO	HPLC	APPL	None	Y[3]
HPL8321	Method 8321 LC-Mass Spectrometer Analysis of Carbamate / Urea and Nitroaromatic / Nitrosamine Compounds; 01/2016; Rev. 5		Definitive	SS/SMI / EXPLO (Picric Acid only)	HPLC	APPL	None	N
HPL8330	Explosive Compounds: Diode Array Detector by High Pressure Liquid Chromatography; 12/2016; Rev. 10		Definitive	SS/SMI / EXPLO	HPLC	APPL	None	N
PRE3050B	Acid Digestion of Sediments, Sludges, and Soils by EPA Method 3050B; 09/2016; Rev. 5		Definitive	SS/SMI / METAL	N/A (digestion)	APPL	None	Y[4]
ANA3060A	Alkaline Digestion for Hexavalent Chromium (Method 3060A); 06/2014; Rev. 1	1/10/2017	Definitive	SS/SMI / METAL (Hexavalent Chromium only)	N/A (digestion)	APPL	None	N
ANA9045D	pH in Soil and Waste (EPA SW846 Method 9045C&D); 06/2016; Rev. 3		Screening	SS/SMI / WCHEM	pH Probe	APPL	None	N
SHR001	Receiving Samples; 08/04/2016; Rev. 6		N/A (Receiving)	SS/SMI / EXPLO, METAL, WCHEM AVS/SEM	N/A (Receiving)	APPL	None	N
SHR003	Subcontracting Samples to Other Laboratories; 10/01/2015; Rev. 17	1/20/2017	N/A (Receiving)	SS/SMI / EXPLO, METAL, WCHEM AVS/SEM	N/A (Receiving)	APPL	None	N
SHR012	Sample Disposal and Waste Collection, Storage and Disposal; 11/07/2016; Rev. 17		N/A (Disposal)	SS/SMI / EXPLO, METAL, WCHEM AVS/SEM	N/A (Disposal)	APPL	None	N
MSE018	EPA Method 8330 Mechanical Orbital Shaker Extraction for Solid Explosive Samples; 08/2016; Rev. 1		Definitive	SS / EXPLO	N/A (extraction)	APPL	None	N

SAP Worksheet #23—Analytical SOP References Table (continued)

Lab SOP Number	Title, Revision Date[1], and/or Number	Date Last Revisited if not Revised[1]	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis[1,2]	Variance to QSM	Modified for Project Work? (Y/N)
ASTM D1498	ALS-Kelso employs ASTM D1498 for analysis of ORP in soil. Due to copyright restrictions, this method is not available for distribution.		Screening	SS/SMI / WCHEM	ORP Probe	ALS - Kelso	None	N
SMO-SCOC	Sample Tracking and Internal Chain-of-Custody; 12/01/12; Rev. 13		N/A (Receiving)	SS/SMI / WCHEM	N/A (Receiving)	ALS - Kelso	None	N
SMO-DISP	Sample Disposal; 11/23/2016; Rev. 13		N/A (Disposal)	SS/SMI / WCHEM	N/A (Disposal)	ALS - Kelso	None	N
SMO-GEN	Sample Receiving; 12/21/2015; Rev. 33.1		N/A (Receiving)	SS/SMI / WCHEM	N/A (Receiving)	ALS - Kelso	None	N

Notes:

1. This worksheet was prepared in January 2017. It is intended to be a snapshot as it pertains to dates for SOP revision/re-visitation and DOD ELAP accreditation.
2. The laboratories are DOD ELAP accredited for analysis methods they are to perform which will generate definitive data. Refer to **Attachment B**.
   APPL's DOD ELAP accreditation through A2LA is granted through June 30, 2019. ALS-Kelso's DOD ELAP accreditation through PJLA is granted through April 28, 2018.
3. Due to regulator request, APPL will extract 10 gm of soil for perchlorate rather than the typical 1 gm. This is intended to provide a more-representative extraction.
4. In accordance with EPA's request, APPL will digest 10 gm of incremental soil for 6010/6020 rather than the typical 1 gm. This is intended to provide a more-representative preparation.

SAP Worksheet #24—Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
HPLC (for 8330B EXPLO)	Initial Calibration (ICAL) for all analytes (including surrogates)	At instrument setup and after ICV or CCV failure, prior to sample analysis.	ICAL must meet one of the three options below: Option 1: Relative standard deviation (RSD) for each analyte ≤ 15%; Option 2: linear least squares regression for each analyte: $r^2 \geq 0.99$; Option 3: non-linear least squares regression (quadratic) for each analyte: $r^2 \geq 0.99$.	Correct problem then repeat ICAL. Flagging is not appropriate. No samples shall be analyzed until ICAL has passed.	Analyst	HPL8330
	Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard prior to sample analysis.	All reported analyte(s) and surrogates within ± 20% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL. Flagging is not appropriate. No samples shall be analyzed until calibration has been verified with a second source.		
	Continuing Calibration Verification (CCV)	Before sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All reported analytes and surrogates within ± 20% of the true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternatively, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification. Results may not be reported without valid CCVs. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		
HPLC-MS (for Picric Acid)	ICAL	At instrument set-up and after ICV or CCV failure, prior to sample analysis.	Minimum 5 levels for linear and 6 levels for quadratic. ICAL must meet one of the three options below: Option 1: RSD for each analyte ≤ 20%; Option 2: linear least squares regression for each analyte: $r^2 \geq 0.99$; Option 3: non-linear least squares regression (quadratic) for each analyte: $r^2 \geq 0.99$.	Correct problem then repeat ICAL.	Analyst	HPL8321
	Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	N/A		
	Retention Time (RT) window width	At method set-up and after major maintenance (e.g., column change).	RT width is ± 3 times standard deviation for each analyte RT from the 72-hour study.	N/A		
	ICV	Once after each ICAL, analysis of a second source standard prior to sample analysis.	All reported analytes within established RT windows. All reported analytes within ± 15% of true value.	Correct problem, rerun ICV. If that fails, repeat ICAL.		

SAP Worksheet #24—Analytical Instrument Calibration Table (continued)

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
HPLC-MS (for Picric Acid)	CCV	Before sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All reported analytes and surrogates within established RT windows. All reported analytes and surrogates within ± 15% of true value.	Recalibrate, and reanalyze all affected samples since the last acceptable CCV; or immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective action(s) and recalibrate; then reanalyze all affected samples since the last acceptable CCV.	Analyst	HPL8321
HPLC-MS (for Perchlorate)	Interference Threshold Study	At initial setup and when major changes occur in the method's operating procedures (e.g., addition of cleanup procedures, column changes, mobile phase changes).	Measure the threshold of common suppressors (chloride, sulfate, carbonate, bicarbonate) that can be present in the system without affecting the quantitation of perchlorate. The threshold is the concentration of the common suppressors where perchlorate recovery falls outside an 80-120% window.	Flagging criteria are not appropriate.	Analyst	HPL6850
	Mass Calibration	Instrument must have a valid mass calibration prior to any sample analysis. The mass calibration is updated on an as- needed basis (e.g., QC failures, ion masses show large deviations from known masses, major instrument maintenance is performed, or the instrument is moved)	Mass calibration range must bracket the ion masses of interest. The most recent mass calibration must be used for an analytical run, and the same mass calibration must be used for all data files in an analytical run. Mass calibration must be verified by acquiring a full scan continuum mass spectrum of a perchlorate stock standard.	If the mass calibration fails, recalibrate. If it still fails, consult manufacturer instructions on corrective maintenance. Flagging criteria are not appropriate. Problem must be corrected. No samples may be analyzed under a failing mass calibration. Perchlorate ions should be within ±0.3 m/z of mass 99, 101, and 107 or their respective daughter ion masses (83, 85, and 89), depending on which ions are quantitated.		
	Tune Check	Prior to ICAL and after any mass calibration or maintenance is performed.	Tuning standards must span the mass range of the analytes of interest and meet acceptance criteria outlined in the laboratory SOP.	Retune instrument and verify. If the tune check will not meet acceptance criteria, an instrument mass calibration must be performed and the tuning redone. Flagging is not appropriate. No samples shall be analyzed without an acceptable tune check.		
	ICAL	At instrument setup or after ICV or CCV failure, prior to sample analysis.	Minimum of 6 calibration levels must be used. ICAL must meet one of the two options below: Option 1: RSD for each analyte ≤ 15%; Option 2: linear least squares regression for each analyte: $r^2 \geq 0.995$.	Correct problem, then repeat ICAL. Flagging criteria are not appropriate. No samples shall be analyzed until ICAL has passed.		
	ICV	Once after each ICAL. ICV shall be a second source standard with its concentration at the midpoint of the calibration.	Perchlorate concentration must be within ± 15% of its true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL. Flagging is not appropriate. No samples shall be analyzed until calibration has been verified with a second source.		
	CCV	On days an ICAL is performed, after every 10 field samples and at the end of the analytical sequence. On days an ICAL is not performed, at the beginning of the sequence, after every 10 field samples and at the end of the analytical sequence.	Perchlorate concentration must be within ± 15% of its true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternatively, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification. Results may not be reported without valid CCVs. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		

SAP Worksheet #24—Analytical Instrument Calibration Table (continued)

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
HPLC-MS (for Perchlorate)	Laboratory Reagent Blank (LRB)	Prior to calibration and at the end of the analytical sequence.	No perchlorate detected > ½ limit of quantitation (LOQ).	Reanalyze reagent blank (until no carryover is observed) and all samples processed since the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated batch. Problem must be corrected. Results may not be reported without valid reagent blanks. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Additional LRBs may be needed to ensure that there was no carryover from over range samples.	Analyst	HPL6850
ICP-AES (for METAL)	Linear Dynamic Range (LDR) or high-level check standard	At initial set up and checked every 6 months with a high standard at the upper limit of the range.	Within ± 10% of true value.	Dilute samples within the calibration range, or re-establish/ verify the LDR. Flagging is not appropriate. Data cannot be reported above the high calibration range without an established/passing high-level check standard.	Analyst	ANA6010
	ICAL	Daily ICAL prior to sample analysis.	Minimum one high standard and a calibration blank. If more than one calibration standard is used, $r^2 \geq 0.99$.	Correct problem, then repeat ICAL. Flagging is not appropriate. No samples shall be analyzed until ICAL has passed.		
	ICV	Once after each ICAL, analysis of a second source standard prior to sample analysis.	All reported analytes within ± 10% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL. Flagging is not appropriate. No samples shall be analyzed until calibration has been verified with a second source.		
	CCV	After every 10 field samples, and at the end of the analysis sequence.	All reported analytes within ± 10% of the true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternatively, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification. Results may not be reported without valid CCVs. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		
	Low-level Calibration Check Standard (LLCCV)	Daily.	All reported analytes within ± 20% of true value.	Correct problem and repeat ICAL. Flagging is not appropriate. No samples shall be analyzed without a valid low-level check standard (LLCCV). Low-level calibration check standard should be less than or equal to the LOQ. If the concentration of the lowest calibration standard is less than or equal to the LOQ, the lowest standard may be re-quantified against the calibration curve as a LLCCV. Otherwise, a separate standard must be analyzed as LLCCV prior to the analysis of any sample.		

SAP Worksheet #24—Analytical Instrument Calibration Table (continued)

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
	Initial and Continuing Calibration Blank (ICB/CCB)	Immediately after the ICV and immediately after every CCV.	The absolute values of all analytes must be <½ LOQ or <1/10th the amount measured in any sample.	ICB: Correct problem and repeat ICV/ICB analysis. If that fails, rerun ICAL. All samples following the last acceptable Calibration Blank must be reanalyzed. CCBs may not be reanalyzed without reanalysis of the associated samples and CCV(s). Flagging is not appropriate. Results may not be reported without valid Calibration Blanks. Non-detects associated with positive blank infractions may be reported. Sample results >10X the LOQ associated with negative blanks may be reported. For CCB, failures due to carryover may not require an ICAL.		
ICP-AES (for METAL)	ICS (also called Spectral Interference Checks)	After ICAL and prior to sample analysis.	ICS-A: Absolute value of concentration for all non-spiked project analytes <1/2 LOD (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value. All analytes must be within the LDR. ICS-AB is not needed if instrument can read negative responses.	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples. If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the failed ICS.	Analyst	ANA6010
ICP-MS (for METAL)	Linear Dynamic Range (LDR) or High-level Check Standard	At initial set-up and checked every 6 months with a high standard at the upper limit of the range.	Within ±10% of true value.	Dilute samples within the calibration range, or re-establish/verify the LDR. Flagging is not appropriate. Data cannot be reported above the calibration range without an established/passing high-level check standard.	Analyst	ANA6020
	Tuning	Prior to ICAL.	Mass calibration ≤ 0.1 amu from the true value; Resolution <0.9 amu full width at 10% peak height.	Retune instrument and verify. Flagging is not appropriate. No samples shall be analyzed without a valid tune.		
ICP-MS (for METAL)	ICAL	Daily ICAL prior to sample analysis.	Minimum one high standard and a calibration blank. If more than one calibration standard is used, $r^2 \geq 0.99$.	Correct problem, then repeat ICAL. Flagging is not appropriate. No samples shall be analyzed until ICAL has passed.	Analyst	ANA6020
	ICV	Once after each ICAL, analysis of a second source standard prior to sample analysis.	All reported analytes, within ± 10% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL. Flagging is not appropriate. No samples shall be analyzed until calibration has been verified with a second source.		
	CCV	After every 10 field samples and at the end of the analysis sequence.	All reported analytes within ± 10% of the true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, preform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternatively, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable CCV. Results may not be reported without valid CCVs. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		

SAP Worksheet #24—Analytical Instrument Calibration Table (continued)

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
	Low-Level Calibration Check Standard (LLCCV)	Daily. Low-level calibration check standard shall be less than or equal to the LOQ.	All reported analytes within ± 20% of the true value.	Correct problem and repeat ICAL. Flagging is not appropriate. No samples shall be reanalyzed without a valid low-level calibration check standard. If the concentration of the lowest calibration standard is less than or equal to the LOQ, the lowest standard may be re-quantified against the calibration curve as LLCCV. Otherwise, a separate standard must be analyzed as the LLCCV prior to the analysis of any samples.		
	ICB/CCB	Immediately after the ICV and immediately after every CCV.	The absolute values of all analytes must be <½ LOQ or <1/10th the amount measured in any sample.	ICB: Correct problem and repeat ICV/ICB analysis. If that fails, rerun ICAL. All samples following the last acceptable Calibration Blank must be reanalyzed. CCBs may not be reanalyzed without reanalysis of the associated samples and CCV(s). Flagging is not appropriate. Results may not be reported without valid Calibration Blanks. Non-detects associated with positive blank infractions may be reported. Sample results > 10X the LOQ associated with negative blanks may be reported. For CCB, failures due to carryover may not require an ICAL.		
ICP-MS (for METAL)	ICS (also called Spectral Interference Checks)	After ICAL and prior to sample analysis.	ICS-A: Absolute value of concentration for all non-spiked project analytes < ½ LOQ (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value. ICS-AB is not needed if instrument can read negative responses.	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples. If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the failed ICS. All analytes must be within the LDR.	Analyst	ANA6020
IC (for Hexavalent Chromium)	ICAL (minimum three standards and a calibration blank)	Daily ICAL prior to sample analysis.	$r^2 \geq 0.99$	Correct problem, then repeat ICAL.	Analyst	ANA218.6-7199
	ICV	Immediately following ICAL.	Value of second source within ± 10% of true value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat calibration.		
	CCV	Before and after every 10 field samples and at the end of the run.	Value of CCV within ± 10% of true value.	Recalibrate, and reanalyze all affected samples since the last acceptable CCV; or immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective action(s) and recalibrate; then reanalyze all affected samples since the last acceptable CCV		
IC (for Hexavalent Chromium)	CCB	Before and after every 10 field samples and at the end of the run.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed.	Analyst	ANA218.6-7199
pH meter	Minimum 3-point calibration	Daily or prior to analyzing samples.	±0.05 unit	Terminate analysis, recalibrate, and verify before sample analysis.	Analyst	ANA9045
	CCV	One CCV every 10 samples.	±0.05 unit	Terminate analysis, recalibrate, and verify before sample analysis.		
ORP Probe	Electrode zero	Daily.	±0.5mV	Correct the problem and repeat the electrode zero.	Analyst	ASTM D1498
	Check to Standard Redox Solution	Daily.	Within ±30mV of expected value. A second reading (from fresh solution) within ±10mv of first reading.	Correct the problem and repeat the check.		

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SAP Worksheet #25—Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
HPLC	Change guard cartridge, inlet filter and PTFE frit.	EXPLO	Review pressure profile.	As needed, based on pressure profile.	Part was replaced.	Replace them and check often.	Analyst / Supervisor	HPL8330
	Change analytical column.		Check peak tailing, decreased sensitivity, retention time changes, etc.	When chromatography indicates.	Analyte separation and calibration curve meets 20% RSD.	Replace column, if needed.		
	Replace mobile phase daily.		Visually inspect for sufficient level of solvent.	Daily.	Solvent was replaced.	Prepare fresh mobile phase solution.		
HPLC-MS	Change guard cartridge, inlet filter and PTFE frit.	Picric Acid	Review pressure profile.	As needed, based on pressure profile.	Passing ICAL and CCV.	Replace them and check often.	Analyst / Supervisor	HPL8321
	Change analytical column.		Check peak tailing, decreased sensitivity, retention time changes, etc.	When chromatography indicates.	Passing ICAL and CCV.	Replace with another analytical column.		
	Replace mobile phase daily.		Check the stability of the base line.	Daily.	minimum noise in the base line.	Prepare fresh mobile phase solution.		
	Monitor for subtle changes in chromatography and detector quality.		Warning flags indicating a decrease in data quality include: a decreased detector response, elevated baseline or calibration inconsistencies .	Daily.	N/A	Tune MS.		
	Tune MS.		Manufacturer comes on-site to re-tune annually.	Annual.	Calibrations meet method acceptance criteria.	A service call should be placed with the manufacturer.		
HPLC	Change guard cartridge, inlet filter, and Ftpp frit.	Perchlorate	Review pressure profile.	As needed based on pressure profile.	Part was replaced.	Replace them and check often.	Analyst / Supervisor	HPL6850
	Chang analytical column.		Check peak tailing, decreased sensitivity, retention time changes, etc.	When chromatography indicates.	Analyte separation and calibration curve meets 20% RSD.	Replace column, if needed.		
	Replace mobile phase daily.		N/A	Daily.	minimum noise in the base line.	Prepare fresh mobile phase solution.		
ICP-AES	Check instrument connections, gas flow, pressure.	Conduct leak test.	Visually inspect for wear or damage and indicator from computer controls.	Daily and annual maintenance from manufacturer.	Intensity of spectrum is within manufacture's recommendation.	Call for maintenance service.	Analyst / Supervisor	ANA6010
	Clean the torch in Aqua Regia solution and align the torch.	Conduct leak test and adjust alignment.	Inspect for leaks and align the torch and ensure that it is in the center.	Each week (minimum every 2 weeks).	Torch is centered and no leaks.	Replace or call for maintenance service.		

SAP Worksheet #25—Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (continued)

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
ICP-AES	Clean the chamber and nebulizer.	METAL	Visually inspect for foreign objects.	Each week.	Make sure chamber and nebulizer are clean.	Replace or call for maintenance service.	Analyst / Supervisor	ANA6010
	Clean the lens and optimize the detector sensitivity.		Clean up the dust from the lens.	Every 6 months.	In accordance with manufacturer's recommendation or lab SOP.	Install new lens.		
ICP-MS	Check windings.	METAL	Visually inspect for wear or damage.	8 hrs of operation.	Part was replaced.	Replace windings.	Analyst / Supervisor	ANA6020
	Clean nebulizer.		Visually inspect for wear or damage.	Daily prior to operation.	Part was replaced.	Flush with DI water.		
	Clean spray chamber.		Visually inspect for dirt or deterioration.	As necessary.	Part was replaced.	Rinse with DI water.		
	Clean torch.		Visually inspect for dirt or deterioration.	Monthly.	Part was replaced.	Clean with a 10% HNO3 solution and soak any parts with buildup overnight in a 5% HNO3 solution. Rinse with DI water and air dry.		
Dionex IC	Inject DI rinse at the end of every run; rinse the piston seals.	Hexavalent Chromium, Anions	Check for and isolate leaks.	Daily.	None.	Clean up and repair any leaks.	Analyst / Supervisor	ANA218.6-7199
	Locate and replace any pinched or damaged airlines.		When chromatography indicates a flow problem.	As necessary.	None.	Repair any airlines.		
	Replace primary and rinse seals in pump heads.		When chromatography indicates a flow problem.	As necessary.	None.	Repair any seals or rinse pump heads.		
pH meter	Check LCD display and pH probe.	3 point calibration using known standards.	Visually inspect for wear or damage and indicator from computer controls.	Daily and annual maintenance from manufacturer.	± 0.05 units	Return to manufacturer for recalibration or call for maintenance service.	Analyst / Supervisor	ANA9045

SAP Worksheet #28-0—Laboratory QC Samples Table

Matrix: SMI

Analytical Group: EXPLO, METAL, WCHEM

Analytical Method/SOP Reference: SW-846 8330B (preparation) / MSE018IS, PREMETALSIS

Deviations from Master SAP

1. Ground laboratory control sample (LCS) (or CRM) frequency will be 'one per site' rather than 'one per preparatory batch.' Because the standard material is unreasonably expensive, many projects waive the requirement for this QC sample. However, this project will simply use a reduced frequency in order to avoid being excessive.
2. A gloved hand is not used to break up pieces of soil during the soil sieving procedure. Instead, a mortar and pestle is used (if necessary) prior to the #10 sieve.
3. WCHEM (pH and TOC) do not require grinding. However, they will be hand-ground along with the Picric Acid and METAL fraction.

Clarifications to Master SAP

1. Picric Acid is hand-ground due to the heat generated during the grinding process. This is done simultaneously with the METALs (and WCHEM) fraction.

Laboratory Preparation of a Multi-incremental Sample

1. The sample material is dried.
2. The sample material is #10 sieved. If necessary, a mortar and pestle is used to break up soil clumps.
3. Calculate how much soil does not require mechanical grinding (depending on the requested analyses other than 8330B EXPLO and Perchlorate):
    a. 10g for 6010/6020 metals
    b. 2.5g for HexCr
    c. 5g for TOC
    d. 50g for pH
    e. 10g for Picric Acid
    f. Multiply by 2 (remove twice that needed for analytical preparation) for potential re-extraction/reanalysis
4. Subsample (30 or more increments) the soil, per #3 above, which does not require mechanical grinding.
5. The remainder of the soil is mechanically ground with the puck mill grinder.
    a. Selected option: one 90s cycle (per MSE018IS)
    b. Not selected: Five 60s cycles separated by two minute cool-down periods (because samples are not expected to contain NC-based residues)

SAP Worksheet #28-0—Laboratory QC Samples Table (continued)

6. Subsample (30 or more increments) the soil which has been mechanically-ground via puck mill as described in 8330B.
    a. 10g for Explosives
    b. 10g for Perchlorate
7. Hand-grind (using equipment suitable for metals) the soil from #4.
8. Subsample (30 or more increments) from the soil which has been hand-ground.

SAP Worksheet #28-1—Laboratory QC Samples Table

Matrix: SS and SMI
Analytical Group: EXPLO
Analytical Method / SOP Reference: SW-846 8330B / HPL8330

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory QA/QC Samples						
Soil Drying Procedure	Each Sample, LCS, and Method Blank.	Laboratory must have a procedure to determine when the sample is dry to constant mass. Record date, time, and ambient temperature on a daily basis while drying samples. Entire sample must be air dried at room temperature. Drying should be performed in the laboratory, not the field.	NA. Flagging is not appropriate. Commercial PT samples must reflect the grinding, extraction, and analysis steps as a minimum. If a laboratory utilizes a self-spiked LCS, the fortification must be performed prior to any preparation steps performed (dry, grinding, etc.). Drying may introduce a bias and is not recommended for certain compounds. LCS reference material is not required if the vendor specifies that drying is not required. LCS and Blank matrix can be Ottawa sand, clean soil, or other vendor provided clean matrix.	Analyst/Supervisor	N/A	Same as Method/SOP QC Acceptance Limits
Soil Sieving Procedure	Each Sample, LCS, and Method Blank.	Weigh entire sample. Sieve entire sample with a 10 mesh sieve. Breakup pieces of soil (especially clay) with gloved hands. Do not include vegetation or debris in the portion of the sample that passes through the sieve unless that is a project specific requirement. Collect and weigh any portion unable to pass through the sieve. Projects may require an alternate sieve size.	NA. Flagging is not appropriate.		N/A	
Soil Grinding Procedure	Initial demonstration at start up and any time major equipment is changed or when a reduction in the number or time of grinding cycles occur. Each required sample, LCS, Blank, and Matrix Spike sample.	Initial demonstration of grinding equipment: The laboratory must initially demonstrate that the grinding procedure is capable of reducing the particle size to < 75 µm by passing representative portions of ground sample through a 200 mesh sieve (ASTM E11). Grinding and sieving is an iterative process, so cycles and duration can be varied to reduce heat if all samples are treated the same.	NA. Flagging is not appropriate. Grinding may introduce a bias and is not recommended for certain compounds. Each sample, LCS, and Method Blank must use the same grinding process (i.e., same time intervals and number of grinding cycles).		N/A	
Grinding Blanks	One per batch of samples. The Grinding Blank must be processed: after the LCS (if ground), or after a client identified sample with known contamination, or at the end of the batch. At least one Grinding Blank per batch must be analyzed. For batch preparation, the Grinding Blank and the Method Blank can be on in the same.	No reported analytes must be detected > 1/2 LOQ. A Grinding Blank using clean solid matrix (such as Ottawa sand) must be prepared (e.g., ground and subsampled) and analyzed in the same manner as the sample. If cross-contamination is a concern, then more than one Grinding Blank per batch may be necessary.	Blank results must be reported and the affected samples must be flagged accordingly if blank criteria are not met. If required, re-prep and reanalyze Method Blank and all QC samples and field samples processed with the contaminated blank. If any individual Grinding blank is found to exceed the acceptance criteria, apply B-flag to the samples following that blank.		Contamination	

SAP Worksheet #28-1—Laboratory QC Samples Table (continued)

Matrix: SS and SMI
Analytical Group: EXPLO
Analytical Method / SOP Reference: SW-846 8330B / HPL8330

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Soil Subsampling Process	Each sample, LCS, blank, and Matrix Spike sample. All samples types must be subsampled, including those that were not initially dried, ground, or sieved.	Entire sample is mixed and spread out evenly on a large flat surface (e.g., baking tray), and 30 or more randomly located increments are removed from the entire depth and breadth to obtain the appropriate subsample size. The total subsample weight collected can vary based on the requirements of the extraction process.	NA. Flagging is not appropriate.	Analyst/Supervisor	N/A	Same as Method/SOP QC Acceptance Limits
Soil Sample Triplicate	At the subsampling step, performed on one sample per batch. Cannot be performed on any sample identified as a blank (e.g., Field Blank, Method Blank, Grinding Blank). Sample triplicates are randomly selected unless the project specifies the sample to be used.	The RSD for results above the LOQ must not exceed 20%.	Examine the project-specific requirements. Contact the client as to additional measures to be taken. If reported per the client, apply J-flag to all samples within that batch if acceptance criteria are not met and explain in the Case Narrative.		Accuracy	
Ion Transitions (Parent -> Product)	Prior to method implementation.	The chemical derivation of the ion transitions must be documented.	NA. Flagging is not appropriate.		N/A	
Method Blank (MB)	One per preparatory batch.	No analytes detected > 1/2 LOQ or >1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater. For batch preparation, the Grinding Blank and the Method Blank can be one in the same.	Correct problem. If required, re-prep and reanalyze Method Blank and all QC samples and field samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Results may not be reported without a valid Method Blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		Contamination	
Laboratory Control Sample (LCS)	One per preparatory batch.	See Worksheet #15.	Correct problem. If required, re-prep and reanalyze the LCS and all samples in the associated preparatory batch for the failed analytes, from the sub-sampling step on, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch. A solid reference material containing all reported analytes must be prepared (e.g., ground and subsampled) and analyzed in exactly the same manner as a field sample. A Standard Reference Material (SRM) that is used for a LCS can be ground as a single batch and subsampled repeatedly as long as the SRM is within expiration date. If a laboratory utilizes a self-spiked LCS, the fortification must be performed prior to any preparation steps performed, such as drying, grinding, and sieving. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		Accuracy	

SAP Worksheet #28-1—Laboratory QC Samples Table (continued)

Matrix: SS and SMI
Analytical Group: EXPLO
Analytical Method / SOP Reference: SW-846 8330B / HPL8330

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike (MS) / Matrix Spike Duplicate (MSD)	One per preparatory batch.	See Worksheet #15.	Examine the project-specific requirements. Contact the client as to additional measures to be taken. For specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the Case Narrative. Analytes and surrogates are spiked into the MS and MSD after subsampling. For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference (i.e., matrix effect or analytical error).	Analyst/Supervisor	Accuracy, Precision	Same as Method/SOP QC Acceptance Limits
Surrogate Spike	All field and QC samples.	1,2-Dinitrobenzene: 78-119%	Correct problem, then re-prep and reanalyze all failed samples for all surrogates in the associated preparatory batch if sufficient sample material is available. If obvious chromatographic interference is present, reanalysis may not be necessary, but the client must be notified prior to reporting data and the failures must be discussed in the Case Narrative. Apply Q-flag to all associated analytes if acceptance criteria are not met and explain in the Case Narrative. Alternative surrogates are recommended when there is obvious chromatographic interference.		Accuracy	
Confirmation of positive results (second column)	All results > the DL must be confirmed.	Calibration and QC criteria are the same for the confirmation analysis as for initial and primary column analysis. Results between primary and second column RPD ≤ 40%.	Correct problem, then re-prep and reanalyze all failed samples for all surrogates in the associated preparatory batch if sufficient sample material is available. If obvious chromatographic interference is present, reanalysis may not be necessary, but the client must be notified prior to reporting data and the failures must be discussed in the Case Narrative. Apply Q-flag to all associated analytes if acceptance criteria are not met and explain in the Case Narrative. Alternative surrogates are recommended when there is obvious chromatographic interference.		Accuracy	
Field QA/QC Samples						
Field Duplicate (for SS)	One per 10 normal field samples per matrix.	% Relative Percent Difference (RPD) < 30%.	Assess laboratory homogenization procedures and precision. Examine laboratory replicate. Assess field homogenization procedures. Qualify as per Worksheet #36.	Project Manager (PM)/Field Team Leader (FTL), Data Validator	Precision	Same as Method/SOP QC Acceptance Limits
Field Triplicate (for SMI only)	One per 10 normal field samples per matrix.	% Relative Standard Deviation (RSD) < 30% (advisory only).	None.	NA	Precision	
Equipment Blank	One per day per equipment type (when decontaminated). One per event per equipment type (when disposable).	Same as method blank (see above).	Assess decontamination procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Contamination	
Matrix Spike/Matrix Spike Duplicate	One per 20 normal field samples per matrix.	See above.				

SAP Worksheet #28-1—Laboratory QC Samples Table (continued)

Matrix: SS and SMI
Analytical Group: EXPLO
Analytical Method / SOP Reference: SW-846 8330B / HPL8330

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Temperature Blank	One per cooler.	≤ 6°C but not frozen.	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Representativeness	Same as Method/SOP QC Acceptance Limits

Notes:
The specifications in this table meet the requirements of DOD QSM v5.1 .

SAP Worksheet #28-2—Laboratory QC Samples Table

Matrix: SS and SMI
Analytical Group: EXPLO
Analytical Method/SOP Reference: SW-846 8321A / HPL8321

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory QA/QC Samples						
Method Blank (MB)	One per preparatory batch.	No analytes detected > 1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, re-prep and reanalyze MB and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst / Supervisor	Contamination	Same as Method/SOP QC Acceptance Limits
Laboratory Control Sample (LCS)	One per preparatory batch.	See Worksheet #15.	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		Accuracy	
Matrix Spike (MS)	One per preparatory batch.	See Worksheet #15.	Examine the project- specific requirements. Contact the client as to additional measures to be taken.		Accuracy	
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	See Worksheet #15.	Examine the project- specific requirements. Contact the client as to additional measures to be taken.		Accuracy, Precision	
Surrogate Spike	All field and QC samples.	1,2-Dinitrobenzene: 50-150%	Correct problem, then re-prep and reanalyze all failed samples for all surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary, but the client must be notified prior to reporting data and the failures must be discussed in the Case Narrative.		Accuracy	
Confirmation of positive results (second column)	All results > the DL must be confirmed.	Calibration and QC criteria for second column are the same as for initial or primary column analysis. Results between primary and secondary column RPD ≤ 40%.	Apply J-flag if RPD > 40%. Discuss in the case narrative.		Accuracy, Precision	
Field QA/QC Samples						
Field Duplicate (for SS)	One per 10 normal field samples per matrix.	% Relative Percent Difference (RPD) < 30%.	Assess laboratory homogenization procedures and precision. Examine laboratory replicate. Assess field homogenization procedures. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Precision	

SAP Worksheet #28-2—Laboratory QC Samples Table (continued)

Matrix: SS and SMI
Analytical Group: EXPLO
Analytical Method/SOP Reference: SW-846 8321A / HPL8321

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Triplicate (for SMI only)	One per 10 normal field samples per matrix.	% Relative Standard Deviation (RSD) < 30% (advisory only).	None.	N/A	Precision	
Equipment Blank	One per day per equipment type (when decontaminated). One per event per equipment type (when disposable).	Same as method blank (see above).	Assess decontamination procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Contamination	
Matrix Spike/Matrix Spike Duplicate	One per 20 normal field samples per matrix.	See above.				
Temperature Blank	One per cooler.	≤ 6°C but not frozen.	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Representativeness	Same as Method/SOP QC Acceptance Limits

Notes:
The specifications in this table meet the requirements DoD QSM version 5.1.

SAP Worksheet #28-3—Laboratory QC Samples Table

Matrix: SS and SMI
Analytical Group: EXPLO
Analytical Method/SOP Reference: SW-846 6850 / HPL6850

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory QA/QC Samples						
Laboratory Reagent Blank (LRB)	Prior to calibration and at the end of the analytical sequence.	No perchlorate detected > ½ LOQ.	Reanalyze reagent blank (until no carryover is observed) and all samples processed since the contaminated blank. Problem must be corrected. Results may not be reported without a valid reagent blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst / Supervisor	Contamination	Same as Method/SOP QC Acceptance Limits
Method Blank (MB)	One per preparatory batch.	No analytes detected >1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		Contamination	
Laboratory Control Sample (LCS)	One per preparatory batch.	See Worksheet #15.	Correct problem. Re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Problems must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		Accuracy	
Matrix Spike (MS)	One per preparatory batch per matrix.	See Worksheet #15.	Examine the project specific requirements. Contact the client as to additional measures to be taken.		Accuracy	
Matrix Spike Duplicate (MSD) or Laboratory Duplicate (LD)	One per preparatory batch per matrix.	See Worksheet #15.	Examine the project specific requirements. Contact the client as to additional measures to be taken.		Accuracy, Precision	
Internal Standard (IS)	Addition of ^{18}O-labeled perchlorate to every sample, batch QC sample, standard, instrument blank, and method blank.	Measured ^{18}O IS area within ± 50% of the value from the average of the IS area counts of the ICAL. RRT of the perchlorate ion must be 1.0 ± 2% (0.98 - 1.02).	Rerun the sample at increasing dilutions until the ± 50% acceptance criteria are met. If criteria cannot be met with dilution, the interference is suspected and the sample must be re-prepped using additional pretreatment steps.		Accuracy	

SAP Worksheet #28-3—Laboratory QC Samples Table (continued)

Matrix: SS and SMI
Analytical Group: EXPLO
Analytical Method/SOP Reference: SW-846 6850 / HPL6850

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Interference Check Sample (ICS)	One ICS is prepared with every batch of 20 samples and must undergo the same preparation and pretreatment steps as the samples in the batch. It verifies the method performance at the matrix conductivity threshold (MCT). At least one ICS must be analyzed daily. The ICS shall be prepared at the LOQ.	Perchlorate concentration must be within ± 20% of its true value.	Correct problem. Reanalyze all samples and QC samples in the batch. If poor recovery from the cleanup filters is suspected, a different lot of filters must be used to re-extract all samples in the batch. If column degradation is suspected, a new column must be calibrated before the samples can be reanalyzed.	Analyst / Supervisor	Accuracy, Bias	Same as Method/SOP QC Acceptance Limits
Isotope Ratio $^{35}Cl/^{37}Cl$	Every sample, batch QC sample, and standard.	Monitor for either the parent ion at masses 99/101 or the daughter ion at masses 83/85 depending on which ions are quantitated. Must fall within 2.3 to 3.8.	If criteria are not met, the sample must be rerun. If the sample was not pretreated, the sample must be re- extracted using cleanup procedures. If, after cleanup, the ratio still fails, use alternative techniques to confirm presence of perchlorate, e.g., a post spike sample or dilution to reduce any interference.		Accuracy	
Field QA/QC Samples						
Field Duplicate (for SS)	One per 10 normal field samples per matrix.	% Relative Percent Difference (RPD) < 30%.	Assess laboratory homogenization procedures and precision. Examine laboratory replicate. Assess field homogenization procedures. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Precision	
Field Triplicate (for SMI only)	One per 10 normal field samples per matrix.	% Relative Standard Deviation (RSD) < 30% (advisory only).	None.	N/A	Precision	
Equipment Blank	One per day per equipment type (when decontaminated). One per event per equipment type (when disposable).	Same as method blank (see above).	Assess decontamination procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Contamination	
Matrix Spike/Matrix Spike Duplicate	One per 20 normal field samples per matrix.	See above.				
Temperature Blank	One per cooler.	≤ 6°C but not frozen.	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Representativeness	Same as Method/SOP QC Acceptance Limits

Notes:
The specifications in this table meet the requirements of DOD QSM v5.1, the laboratory's SOP, and the analytical method.

SAP Worksheet #28-4—Laboratory QC Samples Table

Matrix: SS and SMI
Analytical Group: METAL
Analytical Method/SOP Reference: SW-846 6010C / ANA6010

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory QA/QC Samples						
Method Blank	One per preparatory batch.	The absolute values of all analytes must be < ½ LOQ or <1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater.	Correct problem. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst / Supervisor	Contamination	Same as Method/SOP QC Acceptance Limits
Laboratory Control Sample (LCS)	One per preparatory batch.	See Worksheet #15.	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Must contain all reported analytes. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		Accuracy	
Matrix spike (MS) / Matrix Spike Duplicate (MSD)	One per preparatory batch.	See Worksheet #15.	Examine the project- specific requirements. Contact the client as to additional measures to be taken.		Accuracy, Precision	
Dilution test	One per preparatory batch if MS or MSD fails. Only applicable for samples with concentrations > 50 x LOQ (prior to dilution).	Five-fold dilution must agree within ± 10% of the original measurement.	No specific CA, unless required by the project.		Accuracy, Precision	
Post-digestion spike (PDS) addition	Perform if MS/MSD fails. One per preparatory batch (using the same sample as used for the MS/MSD if possible). Criteria applies for samples with concentrations <50 X LOQ prior to dilution.	Recovery within 80-120%.	No specific CA, unless required by the project.		Accuracy, Precision	
Method of Standard Additions (MSA)	When dilution test or post-digestion spike fails and if required by the project.	N/A	Document use of MSA in the case narrative.		Accuracy	
Field QA/QC Samples						
Field Duplicate (for SS)	One per 10 normal field samples per matrix.	% Relative Percent Difference (RPD) < 30%.	Assess laboratory homogenization procedures and precision. Examine laboratory replicate. Assess field homogenization procedures. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Precision	
Field Triplicate (for SMI only)	One per 10 normal field samples per matrix.	% Relative Standard Deviation (RSD) < 30% (advisory only).	None.	N/A	Precision	

SAP Worksheet #28-4—Laboratory QC Samples Table (continued)

Matrix: SS and SMI
Analytical Group: METAL
Analytical Method/SOP Reference: SW-846 6010C / ANA6010

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	One per day per equipment type (when decontaminated). One per event per equipment type (when disposable).	Same as method blank (see above).	Assess decontamination procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Contamination	
Matrix Spike/Matrix Spike Duplicate	One per 20 normal field samples per matrix.	See above.				
Temperature Blank	One per cooler.	≤ 6°C but not frozen.	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Representativeness	Same as Method/SOP QC Acceptance Limits

Notes:
The specifications in this table meet the requirements of DOD QSM v5.1.

SAP Worksheet #28-5—Laboratory QC Samples Table

Analytical Group: METAL
Analytical Method/SOP Reference: SW-846 6020A / ANA6020

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory QA/QC Samples						
Internal Standards (IS)	Every field sample, standard, and QC sample.	IS intensity in the samples within 30-120% of intensity of the IS in the ICAL blank.	If recoveries are acceptable for QC samples, but not field samples, the field samples may be considered to suffer from a matrix effect. Reanalyze sample at 5- fold dilutions until criteria is met. For failed QC samples, correct problem, and rerun all associated failed field samples.	Analyst / Supervisor	Accuracy	Same as Method/SOP QC Acceptance Limits
Method Blank (MB)	One per preparatory batch.	The absolute values of all analytes must be < ½ LOQ or <1/10th the amount measured in any sample.	Correct problem. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		Contamination	
Laboratory Control Sample (LCS)	One per preparatory batch.	See Worksheet #15.	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Must contain all reported analytes. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		Accuracy	
Matrix Spike (MS)	One per preparatory batch.	See Worksheet #15.	Examine the project- specific requirements. Contact the client as to additional measures to be taken.		Accuracy	
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	See Worksheet #15.	Examine the project- specific requirements. Contact the client as to additional measures to be taken.		Accuracy, Precision	
Dilution Test	One per preparatory batch if MS or MSD fails.	Five-fold dilution must agree within ± 10% of the original measurement.	No specific CA, unless required by the project.		Accuracy, Precision	
Post Digestion Spike (PDS) Addition	One per preparatory batch if MS or MSD fails (using the same sample as used for the MS/MSD if possible).	Recovery within 80-120%.	No specific CA, unless required by the project.		Accuracy, Precision	
Method of Standard Additions (MSA)	When dilution or post-digestion spike fails, and if required by the project.	N/A	Document use of MSA in the case narrative.		Accuracy	
Field QA/QC Samples						
Field Duplicate (for SS)	One per 10 normal field samples per matrix.	% Relative Percent Difference (RPD) < 30%.	Assess laboratory homogenization procedures and precision. Examine laboratory replicate. Assess field homogenization procedures. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Precision	

SAP Worksheet #28-5—Laboratory QC Samples Table (continued)

Matrix: SS and SMI
Analytical Group: METAL
Analytical Method/SOP Reference: SW-846 6020A / ANA6020

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Triplicate (for SMI only)	One per 10 normal field samples per matrix.	% Relative Standard Deviation (RSD) < 30% (advisory only).	None.	N/A	Precision	
Equipment Blank	One per day per equipment type (when decontaminated). One per event per equipment type (when disposable).	Same as method blank (see above).	Assess decontamination procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Contamination	
Matrix Spike/Matrix Spike Duplicate	One per 20 normal field samples per matrix.	See above.				
Temperature Blank	One per cooler.	≤ 6°C but not frozen.	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Representativeness	Same as Method/SOP QC Acceptance Limits

Notes:
The specifications in this table meet the requirements of DOD QSM v5.1.

SAP Worksheet #28-6—Laboratory QC Samples Table

Matrix: SS and SMI
Analytical Group: METAL
Analytical Method/SOP Reference: SW-846 7199 / ANA218.6-7199

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory QA/QC Samples						
Method blank	One per preparatory batch of up to 20 samples.	No analytes detected >1/2 LOQ and >1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise effect sample results for common laboratory contaminants no analytes >LOQ.	Correct problem, then re-prep and reanalyze the MB and all samples in the associated batch for failed analytes, except when sample results are below the LOD if sufficient material is available.	Analyst / Supervisor	Contamination	Same as Method/SOP QC Acceptance Limits
Laboratory Control Sample (LCS)	One per preparatory batch of up to 20 samples.	See Worksheet #15.	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated batch for failed analytes, if sufficient material is available. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.		Accuracy	
Matrix Spike (MS)	One per preparatory batch of up to 20 samples.	See Worksheet #15.	Dilute and reanalyze sample; persistent interference indicates the need to use the method of standard addition, alternative analytical conditions, or an alternative method.		Accuracy	
Matrix Spike Duplicate (MSD) or Matrix Duplicate	One per preparatory batch.	See Worksheet #15.			Accuracy, Precision	
Pre-digestion matrix spikes (solid matrix samples only, Method 3060)	One soluble and insoluble pre-digestion MS analyzed per preparatory batch prior to analysis.	Spike recovery within 75–125%.	Correct problem and re-homogenize, re-digest, and reanalyze samples. If that fails, evaluate against LCS results.		Accuracy, Precision	
Post-digestion matrix spike (solid matrix samples only)	One per preparatory batch.	Spike recovery between 85–115%.	Examine project-specific DQOs. Contact the client as to additional measures to be taken. If requested, correct problem and re-homogenize, re-digest, and reanalyze samples.		Accuracy, Precision	
Field QA/QC Samples						
Field Duplicate (for SS)	One per 10 normal field samples per matrix.	% Relative Percent Difference (RPD) < 30%.	Assess laboratory homogenization procedures and precision. Examine laboratory replicate. Assess field homogenization procedures. Qualify as per Worksheet #36.	PM/FTL, Data Validator	Precision	
Field Triplicate (for SMI only)	One per 10 normal field samples per matrix.	% Relative Standard Deviation (RSD) < 30% (advisory only).	None.	N/A	Precision	

SAP Worksheet #28-6—Laboratory QC Samples Table (continued)

Matrix: SS and SMI
Analytical Group: METAL
Analytical Method/SOP Reference: SW-846 7199 / ANA218.6-7199

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	One per day per equipment type (when decontaminated). One per event per equipment type (when disposable).	Same as method blank (see above).	Assess decontamination procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Contamination	
Matrix Spike/Matrix Spike Duplicate	One per 20 normal field samples per matrix.	See above.				
Temperature Blank	One per cooler.	≤ 6°C but not frozen.	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Representativeness	Same as Method/SOP QC Acceptance Limits

Notes:
The specifications in this table meet the requirements of the laboratory's SOP and analytical method.

SAP Worksheet #28-7—Laboratory QC Samples Table

Matrix: SS and SMI
Analytical Group: WCHEM (pH)
Analytical Method/SOP Reference: SW-846 9045D / ANA9045

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory QA/QC Samples						
Laboratory Replicate	One per every 10 samples.	%RPD ≤ 3% (between sample and laboratory replicate).	Correct problem and reanalyze sample and duplicate.	Analyst / Supervisor	Precision	Same as Method/SOP QC Acceptance Limits
Field QA/QC Samples						
Temperature Blank	One per cooler.	≤ 6°C but not frozen.	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Representativeness	Same as Method/SOP QC Acceptance Limits

Notes:
The specifications in this table meet the requirements of the laboratory's SOP and analytical method.

SAP Worksheet #28-8—Laboratory QC Samples Table

Matrix: SS and SMI
Analytical Group: WCHEM (ORP)
Analytical Method/SOP Reference: ASTM D1498

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory QA/QC Samples						
Laboratory Replicate	One per batch of 20 or fewer samples.	≤ 30% RPD.	Repeat until QC acceptance limits are met. Narrate as "difficult sample matrix" if the system is slow to stabilize and thus will not yield a meaningful result.	Analyst / Supervisor	Precision	Same as Method/SOP QC Acceptance Limits
Field QA/QC Samples						
Temperature Blank	One per cooler.	≤ 6°C but not frozen.	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Representativeness	Same as Method/SOP QC Acceptance Limits

Notes:
The specifications in this table meet the requirements of the laboratory's SOP and analytical method.

SAP Worksheet #28-9—Laboratory QC Samples Table

Matrix: SS and SMI
Analytical Group: WCHEM (TOC)
Analytical Method/SOP Reference: Walkley Black / ANAWALKLEY

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory QA/QC Samples						
Method Blank	One per preparation batch.	No target analytes ≥ ½ LOQ in accordance with DOD QSM requirements.	Correct problem, then re-extract and reanalyze method blank and all samples processed with the contaminated blank in accordance with DOD QSM requirements.	Analyst / Supervisor	Contamination	Same as Method/SOP QC Acceptance Limits
LCS	One LCS per analytical/preparation batch.	See Worksheet #15.	Correct problem, re-analyze or re-extract the LCS and all associated batch samples in accordance with DOD QSM requirements.		Accuracy	
MS/MSD	One MS/MSD pair per analytical/preparation batch of 20 samples or less.	See Worksheet #15.	Examine the project- specific requirements. Contact the client as to additional measures to be taken.		Accuracy, Precision	
Field QA/QC Samples						
Temperature Blank	One per cooler.	≤ 6°C but not frozen.	Notify project chemist. Assess sample packaging and shipment procedures. Consider recollection if the exceedance may cause data rejection. Qualify as per Worksheet #36.	Laboratory PM, PM/FTL, Data Validator	Representativeness	Same as Method/SOP QC Acceptance Limits

Notes:
The specifications in this table meet the requirements of the laboratory's SOP and analytical method.

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SAP Worksheet #30—Analytical Services Table

Matrix	Analytical Group	Sample Locations/ID Number	Analytical SOP	Data Package Turnaround Time	Laboratory / Organization[1]	Backup Laboratory / Organization
SS and SMI	EXPLO	See Worksheet #18	SW-846 8330B / MSE018, HPL8330	Standard 28 Calendar-day TAT	APPL, Inc. 908 North Temperance Avenue Clovis, CA 559 275-2175 Point of Contact (POC): Libby Cheeseborough	TBD
	EXPLO (Picric Acid)		SW-846 8321A / MSE018, HPL8321			
	EXPLO (Perchlorate)		SW-846 6850 / HPL6850			
	METAL		SW-846 6010C, 6020A / PRE3050B, ANA6010, ANA6020			
	METAL (Hexavalent Chromium)		SW-846 7199 / NA3060A, ANA218.6-7199			
	WCHEM (pH)		SW-846 9045D / ANA9045D			
	WCHEM (TOC)		Walkley Black / ANAWALKLEY			
	WCHEM (ORP)		ASTM D1498		ALS – Kelso 1317 South 13th Avenue Kelso, WA 98626 360-577-7222 POC: Howard Holmes	

Notes:
[1] All samples will be shipped from the field to APPL. APPL will ship ORP fractions to ALS – Kelso.

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CH2M. 2013. *Master Sampling and Analysis Plan, East Vieques Terrestrial UXO Sites, Former Vieques Naval Training Range, Vieques, Puerto Rico*. January.

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Attachment A
Master SAP Worksheets 10, 11, and 17

SAP Worksheet #10 — Problem Definition

This worksheet provides a summary of the background information and key elements of the conceptual site model (CSM) in common to all sites, followed by a narrative description of the general objectives and environmental questions to be answered during the field activities. Following this, individual sub-worksheets (Worksheets #10a through 10o) provide site-specific descriptions pertinent to developing site-specific characterization approaches. In addition, these sub-worksheets provide the status of the munitions investigations/interim actions at each site. For sites where munitions investigations have not been completed and additional data are needed to facilitate the environmental investigations, the planned munitions activities are provided in Worksheet #17, along with the environmental investigation sampling design.

The Master SAP provides for environmental characterization of the various terrestrial sites based on existing information and historical activities, upon which the CSMs are developed. In most cases, that information is sufficient to detail the characterization activities in the Master SAP. However, in some cases, as noted above, supplemental information may be gathered before the characterization activities are conducted (e.g., from ongoing munitions response activities) that may warrant a modification to the planned characterization activities. In other cases, insufficient information about a site currently exists to provide the details of the characterization approach; the planned characterization activities for these sites are more conceptual in the Master SAP. For sites where either of the two situations above apply, site-specific addenda will be prepared that update the CSM (as applicable) and provide the modifications/details of the characterization approach.

Background

Figure 1 illustrates the location of Vieques, Puerto Rico, in the Caribbean Sea, approximately 7 miles southeast across Vieques Passage from the eastern tip of the main island of Puerto Rico. The former VNTR consists of approximately 14,600 acres and is divided into four separate operational areas that from west to east comprise: the 11,000-acre EMA; the 2,500-acre SIA; the 900-acre Live Impact Area (LIA); and the 200-acre Eastern Conservation Area (**Figure 2**). The former VNTR is bound by the Caribbean Sea to the north, east, and south, and the Municipality of Vieques (MOV) to the west.

Former military operations at the former VNTR included ground warfare and amphibious training for Marines, naval gunfire support training, and air to ground training. The former military operations including the ranges, targets, and gun positions at each operational area are shown in **Figure 3**. Following cessation of military operations on the former VNTR, the Navy subdivided the former operational areas into smaller parcels based on considerations such as historic use, geographic features, and land use. The parcels, referred to as UXO sites, were delineated in such a way to make them more manageable for the purposes of prioritization, munitions removal, site characterization, and decision making. It should be noted that “UXO” in the site names is simply convenient nomenclature; it does not indicate the presence or potential presence of UXO. Background information for each of the terrestrial UXO sites is discussed below by former operational area.

Eastern Maneuver Area

The EMA was first established in 1947 and provided military maneuvering areas and ranges for the training in amphibious landings, small arms fire, artillery and tank fire, shore fire control, and combat engineering tasks (CH2M HILL, 2010e). The EMA contains all or part of nine UXO sites (**Figure 3**); two of the sites extend into the adjacent SIA:

- UXO 6 (EMA/SIA Public Roads) – roadway anticipated for public use along the southern portion of the EMA, currently used by personnel for range access (also extends into the SIA)
- UXO 7 (EMA/SIA North Beaches) – sandy beaches and potential turtle nesting areas located along the northern shore (also extends into the SIA)
- UXO 11 (EMA Public Roads) – roadways anticipated for public use along the northern and interior portion of the EMA, currently used by personnel for range access

SAP Worksheet #10 — Problem Definition (continued)

- UXO 12 (EMA Interior) – area where multiple large-scale artillery gun positions fired toward targets located within the SIA and LIA
- UXO 13 (EMA West) - multiple training ranges used for small arms, rifles, submachine guns, rifle and hand grenades, rocket launchers, and shape charges
- UXO 14 (EMA South) - two artillery gun positions and a range that was used for frontal assaults using pistols, rifles, machine guns, and demolition charges
- UXO 15 (Puerto Ferro) – offloading for munitions; the site is being investigated separately and not included in this SAP
- UXO 17 (Other Sites) – includes four Site Screening Areas (SSAs); a former munitions storage area at Potential Area of Concern (PAOC) EE; a former gun position at Photo-Identified (PI) 21 that is being investigated separately and not included in this SAP; a former munitions storage area at PI-14 that is no further action; and a former gun position at PAOC FF that is no further action
- UXO 18 (Cayo la Chiva) – small island where five munitions rocket items were identified

Surface Impact Area

The SIA was established in the 1950s when several Marine artillery targets were constructed. In 1969, two bulls-eye targets were constructed and used for inert bombing; one of which is located within the SIA (CH2M HILL, 2010e). The SIA consists of four UXO sites, plus portions of the two UXO sites previously described (UXO 6, UXO 7) that extends into the SIA (**Figure 3**):

- UXO 5 (SIA Restricted Roads) – roadway anticipated for public use located along the northern and eastern portion of the site, currently used by personnel for range access
- UXO 8 (SIA South Beaches) – sandy beaches located along the southern shore
- UXO 9 (SIA Exterior) – target areas for marine artillery and air-to-ground bombing of practice munitions
- UXO 10 (SIA Interior) – target areas for marine artillery and air-to-ground bombing of practice munitions

Live Impact Area

The LIA was established in 1965 where several targets were maintained for aerial bombing including old tanks and vehicles, a simulated railroad tunnel, simulated ammunition dump, simulated fuel farm, and simulated airstrip, two simulated surface-to-air missile (SAM) sites, and a strafing target (CH2M HILL, 2010e). In addition, several point and area targets were used for ships to practice naval gunfire support. One bulls-eye target was used for inert bombing. The LIA consists of three UXO sites (**Figure 3**):

- UXO 2 (LIA Beaches) – sandy beaches and potential turtle nesting areas located along the northern and southern shores
- UXO 3 (LIA Roads) – roadways within the LIA, restricted to personnel for range access
- UXO 4 (LIA Interior) – formerly contained numerous targets for aerial bombing and naval gunfire, open burn/open detonation (OB/OD) for treatment of retrograde ordnance and open burning of propellants and pyrotechnics. The targets were removed as a part of the TCRA.

The former Central Processing Center (CPC) was established in 2007 for staging and processing of inert metallic items collected during the munitions response activities at the former VNTR (Figure 3). Equipment in the CPC was used to demilitarize inert items and to thermally treat all munitions debris for off-island recycling. The CPC was taken out of full-time service in 2011 because the amount of metal/debris being recovered during ongoing investigations and munitions response activities is significantly less than that recovered during past TCRA and NTCRA activities. However, once the volume of material reaches the point that makes processing viable, processing equipment will be mobilized to the CPC to process and ship the explosive-free metals.

SAP Worksheet #10 — Problem Definition (continued)

Eastern Conservation Area

The ECA, which was wholly designated UXO 1, was established as a conservation area and not used as an operational area for munitions; however, the site is located adjacent to the LIA, where MEC and other munitions-related material identified in the ECA were most likely from munitions directed toward the LIA that missed their intended target.

VNTR Investigation and Interim Action History

On April 30, 2003, the former VNTR was transferred to the Department of Interior (DOI) to be operated and managed by the USFWS as a National Wildlife Refuge and, in some places, a Wilderness Area. Although the DOI is directed to protect and conserve the transferred land as a wildlife refuge, the Navy retains the responsibility for conducting the environmental investigations and clean-up of the property, as warranted.

In 2005, the former VNTR was placed on the National Priorities List (NPL). The NPL required all subsequent environmental restoration activities for Navy Installation Restoration (IR) sites on Vieques to be conducted under CERCLA unless and until removed from CERCLA authority.

The Navy, EPA, PREQB, and the DOI entered into a Federal Facility Agreement (FFA) for the former VNTR in 2007, as a result of the NPL listing and pursuant to CERCLA. The FFA establishes the procedural framework and schedule for implementing the CERCLA response actions for Vieques environmental and munitions sites. SSAs, including PI, PAOC, and Solid Waste Management Units (SWMUs) were also identified as requiring further investigation as part of the FFA. SSAs located within UXO sites and associated with past munitions activities are shown in **Figure 4**.

Below is a list of previous munitions investigations/interim actions (i.e., those focused solely or primarily on the physical presence of munitions) and environmental investigations (i.e., those focused solely or primarily on chemical constituents or hydrogeologic information pertinent to past munitions-related activities) have been conducted at the former VNTR:

- Hydrogeologic Investigation (1999) - groundwater sampling and surface soil sampling conducted along the western boundary of the EMA to determine if explosive constituents were migrating offsite (Baker, 1999) (**Figure 5**).
- Live Impact Area Soil Sampling and Analysis (2000) - 37 surface soil samples analyzed for explosives and inorganic constituents within the LIA (CH2M HILL, 2000) (**Figure 5**).
- Environmental Baseline Survey (2003) (NAVFAC, 2003) –4 soil samples collected from beneath drums and low-lying areas at PI-22 (located within UXO 9); analyzed for Appendix IX Resource Conservation and Recovery Act (RCRA) constituents and total petroleum hydrocarbon (**Figure 5**).
- Preliminary Range Assessment (PRA) (2003) – interviews, records searches, and field inspection of sites using a hand held magnetometer (CH2M HILL, 2003).
- Expanded Range Assessment/ Site Inspection (ERA/SI) (2005-2010) (CH2M HILL, 2007a and 2010e)
  - Initial site investigations – select areas within the former VNTR were inspected to locate, catalog, and remove munitions items at the surface and to locate and qualitatively catalog subsurface metallic anomalies detected using a handheld magnetometer. Information from this investigation is provided in **Attachment A**.
  - Transect inspections and magnetometer survey (mag and flag) – ground-based detector aided visual inspections of munitions items and determination of relative densities of subsurface metallic anomalies along transects within the inland UXO sites (UXOs 4, 9, 10, 12, and 13). Transect inspection paths are shown on **Figure 6**.
  - Light detection and radar (LiDAR) and high resolution orthophotography – aerial survey and photography of the former VNTR to identify ordnance-related ground features such as bomb craters and target areas, as shown in **Figure 3**.

SAP Worksheet #10 — Problem Definition (continued)

  - Aerial magnetometer survey (AMS) – helicopter equipped with an array of magnetometers identified elevated anomaly density areas (EADAs) based on high densities of ferrous metallic objects (or ferrous iron, such as in iron-bearing rock) on the surface and/or subsurface (**Figure 7**).

- TCRA (2005 to present) – interim removal action for munitions located on the surface at the LIA and ECA (**Figure 6)**.
- Non-time critical removal action (NTRCA) (2008 to present) – interim removal action for munitions located in the subsurface of the roads and beaches at the ECA, LIA, and EMA. Digital geophysical mapping (DGM) was conducted along the roads and beaches, as shown in **Figure 6**.
- Preliminary Assessment/Site Inspection (2008) – five surface soil samples were collected from environmental site SWMU 12 located immediately north of OP-1.
- Non-Time-Critical Removal Action (NTCRA) (2009 to present) – interim removal action for munitions located on the surface at UXOs 9 and 10 (SIA) (**Figure 6)**.
- Preliminary Site Inspections of Cayo la Chiva (UXO 18) (2011) and PAOC EE (UXO 17) (2011) - ground-based detector aided visual inspections of UXOs 17 and 18.
- Preliminary Assessment/Site Inspection at Playa La Plata and Secret Beaches (2011) – conducted DGM and anomaly investigation/removal of beach areas that are currently open to the public at UXO 17 (PAOC EE) (**Figure 6**).

As part of the ERA/SI activities, the past use of biological, chemical, and radiological weapons on Vieques was summarized. In May 1969, a test was conducted for four days on non-identified beaches of the former VNTR to determine the operational effects of a persistent, toxic, chemical agent spray attack on US amphibious forces and to evaluate performance of protective clothing worn by troops in the exercise. An aircraft equipped with spray tanks was utilized for the dispersal of tris(2-ethylhexyl)phosphate (U.S. Department of Defense (DoD), 2002). Since the activities were conducted almost 40 years ago and for only a few days on the beaches, which are a dynamic environment, and based on what is known about the persistence of this chemical in the environment, tris(2-ethylhexyl)phosphate is not expected to be present.

In February 1999, a one-time accidental use of armor piercing incendiary depleted uranium (DU) ammunition occurred within the LIA (CH2M HILL, 2010e). Records indicate that ground teams surveyed parts of the LIA in the vicinity of the convoy target area and recovered 116 of the 263 projectiles. Additional details related to the findings of this study are included in Worksheet #10c (UXO 4).

Release History

The primary release mechanisms associated with the former VNTR are particulate deposition as a result of detonations at impact areas and controlled detonations, and from corrosion of the munitions-related items. A less significant release mechanism is propellant detonation from the firing at gun positions. Other potential release mechanisms are site-specific and are therefore discussed in more detail in Worksheets #10a through #10o.

Munitions-related items identified within the former VNTR are generally classified as MEC, Material Potentially Presenting an Explosive Hazard (MPPEH), Munitions Debris (MD) or Range-Related Debris (RRD). MEC is further subcategorized into UXO, Discarded Military Munitions (DMM), and Munitions Constituents (MC). A brief definition of each is summarized below:

- MEC – distinguishes specific categories of military munitions that may pose unique explosive safety risks
- UXO - munitions that have been primed, fused, and armed, or otherwise prepared for action; have been placed in such a manner as to constitute a safety hazard; and remain unexploded
- DMM – munitions that have been abandoned or removed from storage without proper disposal

SAP Worksheet #10 — Problem Definition (continued)

- MC – any materials originating from UXO, discarded military munitions, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such munitions
- MPPEH – material that, prior to determination of its explosives safety status, potentially contains explosives or munitions, or potentially contains a high enough concentration of explosives that the material presents an explosive hazard
- MD – Remnants of munitions remaining after munitions use, demilitarization, or disposal
- RRD – Debris, other than munitions debris, collected from ranges (such as targets and fragments of metal).

MEC found at each site and the potential chemical constituents associated with these items are summarized **Table 19**.

Physical Characteristics

The former VNTR is characterized by gentle to steep rolling hills and valleys with dense vegetation, with the eastern side exhibiting a more rugged terrain. The topography ranges from an elevation of approximately 420 feet (ft) above mean sea level (msl) within the SIA to 0 ft above msl at the beaches. In some areas, large cliff faces separate the ocean from the land. There are two major watersheds within the former VNTR; one to the north and one to the south that are generally divided along the east-west center of the island (**Figure 8**). Surface runoff in the northern watershed generally runs to the north and surface runoff in the southern watershed generally runs to the south.

Surface water on the former VNTR occurs primarily in coastal lagoons and ephemeral streams (**Figure 8)**. Thirty lagoons occur within the former VNTR and are generally not tidally influenced. The ephemeral streams generally only contain water during major precipitation events.

Soil overburden is generally thin and ranges from well-drained soils within the alluvial deposits to fine-grained with a high clay content from the weathering of the bedrock. Bedrock is characterized by volcanic rocks (primarily granodiorite and diorite) generally overlain by alluvial deposits, with limestone and dolomite exposed on the eastern end (**Figure 9**). The alluvial deposits (sand, silt, and clay) are found in valleys and coastal areas and have been found to range up to 50 feet thick (Baker, 1999).

Groundwater is derived from percolating rainwater that infiltrates downward into the alluvial deposits and fractures of the bedrock. The Esperanza aquifer occurs within the alluvial deposits generally within the southwestern portion of the former VNTR (**Figure 10**). Groundwater within the remainder of the former VNTR likely occurs within the bedrock. In areas near the coast, groundwater is tidally influenced and likely brackish to saline. Groundwater discharge is primarily to the ocean, with some minor discharge to the lagoons that are not periodically dry.

The vast majority of east Vieques is undeveloped and supports a variety of habitat types (**Figure 11**). These include bare ground, beach, salt/sand flat, lagoon, mangrove, evergreen scrub, forest scrub, forested, sparse thorn scrub, thick thorn scrub, and grassland. Typical plant species in bare ground areas consist of scattered milkweeds (*Calotropis procera*), low scattered mesquite (*Prosopis juliflora*), and low herbaceous vervain (*Stachytarpheta jamaicensis*). Open sandy beach and beach scrub communities typically include the beach creeper (*Ipomoea pes-caprae*), sand spur (*Cenchrus* spp.), and seagrapes (*Coccoloba uvifera*). Mangrove communities are typically associated with open-water lagoons and shallow salt/sand flats or tidal mudflats, and include red mangrove (*Rhizophora mangle*), white mangrove (*Laguncularia racemosa*), black mangrove (*Avicennia germinans*), and button mangrove (*Conocarpus erectus*) (Geo-Marine, 2003).

Thorn scrub is the predominant habitat type, occurring over approximately 80 percent of the area. Common species include Acacia spp., mesquite, *Leucaena glauca*, box-briar (*Randia aculeata*), goatbush (*Pithecellobium unguis-cati*), sage (*Lantana involucrate*), and Croton spp. The forest scrub and forested communities are limited within the area,

SAP Worksheet #10 — Problem Definition (continued)

typically occurring along quebradas and low areas near the coastline where the water table is high or periodically high, such as along the inland borders of mangrove forests. Common species include oxhorn bucida (*Bucida buceras*), box-briar, tachuelo (*Pictetia aculeate*), goatbush, and Jamaican caper (*Capparis cynophallophora*). Evergreen scrub consists mainly of drought-resistant shrubs with leathery leaves and occurs on rocky coasts and limestone formations that are exposed to sea breezes. Dominant species in this community include spoon tree (*Cassine xylocarpa*), uverillo (*Coccoloba microstachya*), Alelí (*Plumeria alba*), palmetto (*Thrinax morrissi*), crabwood (*Coccoloba krugii*), and black torch (*Erithalis fruticosa*). The grassland plant community is dominated by short bunch grasses and sod grasses, including pitted bluestem (*Bothriochloa pertusa*), southern crabgrass (*Digitaria ciliaris*), bermuda grass (*Cynodon dactylon*), Dutch grass (*Eleusine indica*), smutgrass (*Sporobulus indicus*), and sandbur (*Cenchrus brownii*) (Geo-Marine, 2003).

Land Use

The former VNTR was transferred to the DOI in 2003 to be managed by USFWS as a National Wildlife Refuge and, in some places, a Wilderness Area, pursuant to Section 1049 of the National Defense Authorization Act for Fiscal Year 2002 (Public Law 107-107). A provision of this law states that the LIA must be managed as a wilderness area and public access is to be prohibited (Public Laws 106-398 and 107-107). Therefore, no lawful public access is allowed on the LIA and groundwater is not intended for use at this time. The existing legal land use controls accompanying the Congressional transfer of the LIA to the USFWS as a wilderness area render future residential land use unrealistic without a subsequent Congressional act.

Based on the available plans from the USFWS (landowner), no building construction is anticipated at any of the subject sites, with the exception of the observation tower at UXO 6, and there are no existing buildings. It should be noted that, for the sites addressed in this SAP, an SVOC is potentially present at only one site (i.e., hexachloroethane at Cayo La Chiva – UXO 18). Therefore, vapor intrusion is not an issue.

A Comprehensive Conservation Plan (CCP) for the Vieques National Wildlife Refuge was completed by USFWS that outlines the land use plan for managing the former VNTR as a wildlife refuge (DOI, 2007). The land use plan includes areas desired for public use (i.e., picnic areas, beaches, road access, etc.) within the SIA and EMA (**Figure 12**). The exact location of the proposed future recreational areas, such as hiking trails and scenic areas, are not known at this time, USFWS does not have plans to develop additional recreational areas and trails than what is shown in the CCP. The existing legal land use controls accompanying the Congressional transfer of the SIA and EMA to the USFWS as a wildlife refuge render future residential land use unrealistic without a subsequent Congressional act. An exception is a small parcel of land located within the northwest portion of UXO 13 (denoted as Parcel C), which is being considered for transfer by DOI to the Puerto Rico Conservation Trust (PRCT) or Municipality of Vieques (MOV) for unrestricted public use.

In addition, the eastern end of Vieques houses a variety of natural resources in the form of wide-ranging plant and wildlife species. A number of conservation zones have been established in the former VNTR to help protect these resources (Geo-Marine, 2003) (**Figure 12**). The Conservation Zones include:

- The Punta Este Conservation Zone located on the southeastern end of the LIA, consisting primarily of drought-resistant scrub that no longer can be found elsewhere in Puerto Rico.
- The Cayo Conejo Conservation Zone is a small island located southwest of the LIA in Bahia Salina del Sur area. This area is an important nesting habitat for the endangered brown pelican and one of the last nesting areas for this species in Puerto Rico.
- The Ensenada Honda Conservation Zone lies between Blue and Yellow Beaches on the southern coast of Vieques. This area has the best example of lowland forest growth on Vieques and is also home to a variety of extensive mangrove populations that appear to be healthy and expanding.
- The South Coast Bays Conservation zone is located on the southern coastline of Vieques directly south of the Camp Garcia area and western portions of the EMA. Two bays at this location, Bahia Tapon and Puerto Mosquito, have bioluminescent properties and are a valuable tourism resource for the island.

SAP Worksheet #10 — Problem Definition (continued)

Sea turtle nesting occurs primarily from February through August. The sea turtles that have been observed on Vieques are the green, leatherback, and hawksbill sea turtles (Geo-Marine, 2003). The locations of sea turtle nesting are shown on **Figure 12.**

Potential Receptors

Potential receptors at the former VNTR include both human and ecological. While receptor types are broadly similar across the former VNTR, receptor types are discussed on a site-specific basis because they are influenced by habitat and proposed actual/future land use. The site-specific receptor details are provided in Worksheets #10a through 10o. Subsurface soil receptors may be present at a few sites (e.g., reforestation areas, Parcel C, and UXO 9), and will be identified in consultation with USFWS. At sites where subsurface soil activities are reasonably foreseeable, subsurface exposures will be evaluated for site-specific subsurface receptors (e.g., USFWS workers and/or construction workers). Residential receptors will not be evaluated in the HHRAs, with the exception of Parcel C; residential exposures will be evaluated using two separate EPCs (i.e., surface soil and total soil). Subsurface soil exposures will also be evaluated for construction workers and industrial workers at Parcel C.

It is important to note that if, prior to or during the human health and ecological risk assessments, data gaps are identified that warrant additional sampling, additional sampling will be proposed/conducted prior to completing the risk assessments and RI Reports. The additional sampling will be conducted in accordance with this SAP, an addendum to this SAP, or other mechanism that demonstrates formal concurrence by the Navy and regulatory agencies.

Objectives and General Characterization Approach

The ERP/MRP Technical Subcommittee met in May, August, and October 2011 and March, August, and October 2012 to jointly scope the rationale, sampling approach, and analysis for the investigation of the east Vieques UXO sites. The investigation objectives are to:

- sufficiently characterize the nature and extent of MEC at each UXO site such that:
  - final remedy determinations can be made regarding MEC
  - environmental media can be appropriately characterized
- determine if there has been a release of chemical constituents related to the former munitions-related activities at each UXO site, and, if so:
  - whether the data sufficiently represent the nature and extent of contamination
  - whether site-related contamination, if present, poses unacceptable human health and or ecological risks
  - determine whether site-related contamination, if present, warrants action to achieve the proposed land use goals

Characterizing potential contamination within soil at sites on the former VNTR is challenging due to the large size of the sites (14,600 acres) and the widespread distribution of MEC and related scrap. Various studies have shown that concentrations of energetic residues at military ranges measured using an incremental sampling approach were statistically more representative than those from traditional sampling protocols (USACE, 2009). Desirable levels of statistical confidence and decision uncertainty can be obtained using fewer incremental samples than multiple discrete analyses. Incremental sampling reduces the impacts of soil heterogeneity on laboratory analytical results by providing an average concentration over an exposure area rather than at a discrete point (i.e., reduces field sampling and laboratory processing errors), has a higher likelihood of detecting contamination than discrete sampling if the location of contamination is unknown, and includes particle reduction by grinding or milling and mixing. Quality Assurance/Quality Control (QA/QC) field triplicate samples will also be performed to confirm the

SAP Worksheet #10 — Problem Definition (continued)

representativeness of the analytical results. The highest concentrations among the field triplicate samples will be used to represent the particular sampling unit. On site-specific and objective-specific cases, discrete samples are warranted and will be collected. This is further discussed in Worksheet #17.

Incremental sampling provides a single result (per chemical) for a decision unit or from one or more sampling units within that decision unit. A decision unit and associated sampling units are generally selected based on the exposure domain for human or ecological exposure, by an area influenced by a specific activity, and/or by an area influenced by a single event. Decision unit and sampling unit size and shape are controlled by the environmental concerns posed by the contaminants present and the intended use of the site.

To distinguish inorganic constituent concentrations attributable to site-related releases from those attributable to other sources, soil data collected will be compared to the background data set for soil on Eastern Vieques, documented in the report entitled East Vieques Background Soil Inorganics Investigation Report (CH2M HILL, 2007b). Background incremental soil samples collected as part of the ECA RI were determined to be statistically comparable to the background discrete soil samples collected as part of the background study (**Attachment B**). Since soil background data are not available for the beaches, a multiple lines of evidence approach will be used, such as comparing to the adjacent terrestrial lithologic unit background data. If necessary, background data would be collected from a representative background beach(es), if identified. If a representative background beach(es) is identified, it will be included in an addendum to the Master SAP for regulatory review.

Surface water and sediment samples collected from lagoons will be compared to background data collected from a similar lagoon or in the absence of a representative background dataset, a weight of evidence evaluation will be used, as was done for the ECA lagoon (CH2M HILL, 2011a).

MEC and Environmental Questions to be Answered for Each UXO Site

1. <u>What is nature and extent of MEC?</u>

This question will be answered by having conducted or conducting sufficient MEC investigations/interim actions at the UXO sites, as applicable, for facilitating environmental characterization and for making MEC remedy evaluations and determinations consistent with historical munitions activities and future land use.

2. <u>What is the explosive safety hazard associated with the munitions?</u>

A MEC explosive risk evaluation will be conducted for each site using the MEC Hazard Assessment (MEC HA).

3. <u>Has there been a release of chemical constituents to environmental media related to former site activities and, if so, do the data sufficiently represent the nature and extent of contamination?</u>

Details of the sampling design and rationale for each UXO site are presented in Worksheet #17. Sample data will be evaluated using the 6-Step Decision Process depicted in the decision analysis tree (**Figure 13**).

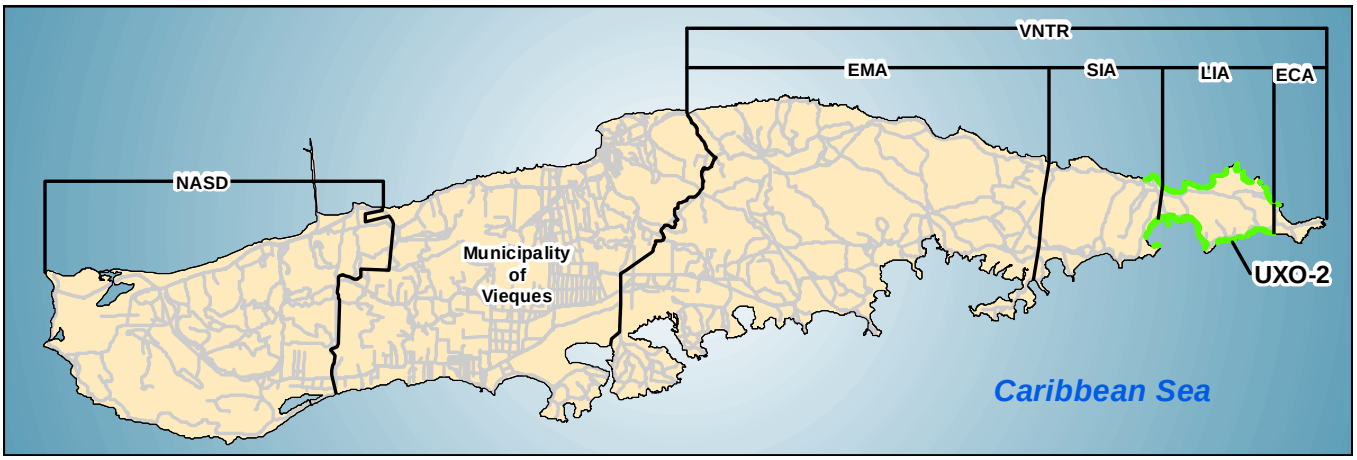
4. <u>What are the potential human health and ecological risks posed by contamination attributable to former site activities?</u>

Results from the environmental media characterization will be evaluated in site-specific HHRAs and ecological risk assessments (ERAs).

5. <u>Based on the data collected during the remedial investigation (including supplemental sampling if additional data needs are identified), what is the appropriate path forward for the site?</u>

The results of the HHRA and ERA will be used, in conjunction with risk management considerations (e.g., land uses, control mechanisms, remedy feasibility), to determine: (1) if additional data are warranted to make site-specific determinations, or (2) if remedy/removal actions are warranted, or (3) if no further action other than land use controls is warranted.

SAP Worksheet #10a — UXO 2 (LIA Beaches)



Site Background

UXO 2 (LIA Beaches) consists of 15 sandy beaches and totals approximately 71 acres in size, located along the perimeter of the LIA (**Figure 14**). Each beach is bounded by the Caribbean Sea and UXO 4 (LIA Interior). Named beaches include Playa Salinas Del Sur (Beach 3), Playa Carucho/Turtle Beach, Icacos/Playa Yallis, Playa Salinas del Norte/Fossil Beach, Playa Brava (Beach 14), and Playa Barco (Beach 13). The designated area of each beach includes not only the proper sandy, unvegetated area, but also potential turtle nesting areas from the beach vegetation line to 60 feet inland. Details of the former operations at the LIA are provided in Worksheet #10c (UXO 4).

Investigation and Release History

- ERA/SI (2005), TCRA – surface removal of MEC (2005 through present), and NTCRA – subsurface removal of MEC (2009 through present)
- No environmental investigations have been conducted at UXO 2

The LIA beaches were surface cleared of munitions located on or protruding from the ground surface as part of the ERA/SI and TCRA. Through October 2012, DGM has been conducted at approximately 13 of the 71 acres, as part of the NTCRA (**Figure 6**). The DGM anomalies were investigated to a maximum depth of 4 ft bgs; the investigation of the anomalies was abandoned if the water table or refusal was encountered prior to reaching 4 ft bgs.

Approximately 8,275 subsurface metallic anomalies have been identified, and removed; however, the NTCRA is currently ongoing. Munitions-related items found at the site in the surface and subsurface (recovered through October 2012) include:

Number of items recovered	UXO	MPPEH	DMM	MD	RRD
Surface	106	553	0	108,401	22,585
Subsurface	256	424	0	24,110	43,654

Through the end of October 2012, the highest densities of munitions items found at beaches within the former VNTR were identified at UXO 2; the density of munitions items recovered was greatest at Playa Carucho/Turtle Beach and Playa Salinas del Norte/Fossil Beach. Munitions items are primarily from naval gunfire and aerial bombing at targets within the LIA Interior. There are no ranges, gun positions, or SSAs located on the LIA beaches (**Figure 14**). Intact and detonated MEC items and munitions debris and the historical detonations had the potential to release chemical contaminants to the environmental media at the beaches. The distribution of MEC and other munitions-related items is discussed in more detail in Worksheet #17a.

SAP Worksheet #10a — UXO 2 (LIA Beaches) (continued)

Conceptual Site Model

Figure 15 presents the generalized conceptual site model of UXO 2.

Physical Characteristics and Transport Pathways

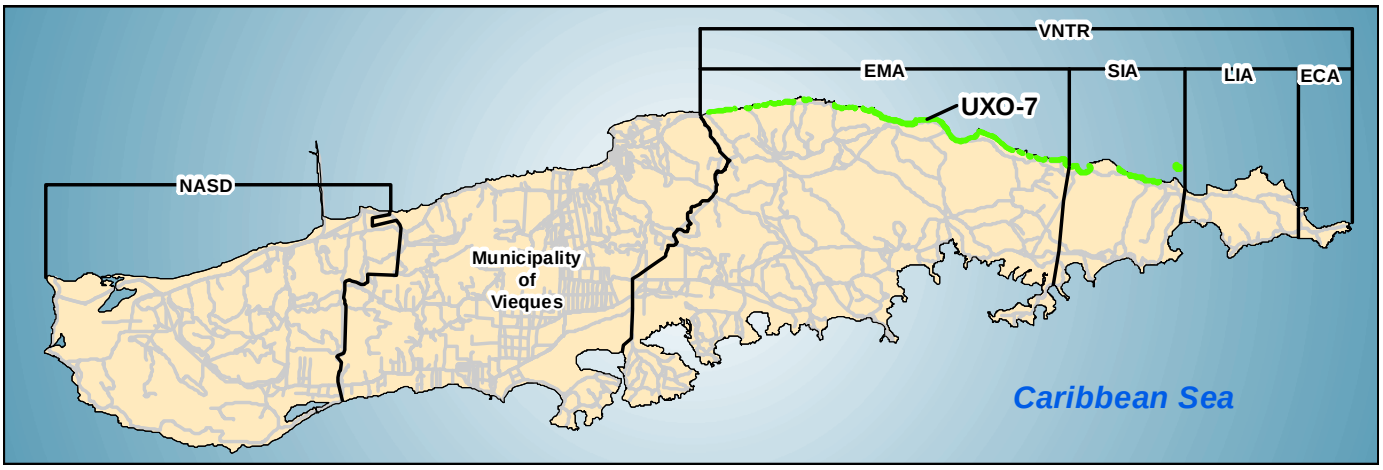
UXO 2 is predominantly sand beaches and dunes that extend from the waterline (low tide waterline during munitions characterization) to the vegetation extent. It also includes vegetated areas that extend approximately 60 feet inland to account for potential turtle nesting areas. The topography slopes toward the ocean and potentially receives runoff from the LIA interior. The beaches are a dynamic environment in that they are prone to tidal, wave, and storm action. Groundwater is shallow and saline due to seawater intrusion. The primary potential migration pathways at UXO 2 are associated with reworking of the beach sands by storm surges, tides, and waves. Constituents could also migrate via leaching to groundwater and wind dispersion.

Future Land Use and Potential Receptors

The LIA is managed as a Wilderness Area and future land use at the LIA beaches is prohibited to the public and is to continue as a wilderness area (Public Laws 106-398 and 107-107). The majority of the beaches are classified as turtle nesting grounds (**Figure 14**), with 14 beaches identified as restricted turtle nesting areas (Geo-Marine, 2003). Eight beaches are identified as major restrictions (where four or more historical sea turtle nesting events have occurred) and six beaches as minor restrictions (one to three historical sea turtle nesting events).

USFWS workers (for turtle monitoring) and trespassers (adults, adolescents, and children) may be exposed to soil and potentially exposed to the explosive hazard associated with MEC. Historical trespassing activities have been observed at Icacos/Playa Yallis Beach. The primary potential ecological receptors are the eggs of hawksbill, green, and leatherback sea turtles exposed to deeper surface soil (18 to 36 inches). Other potential terrestrial receptors for surface soil (upper 2 inches) are terrestrial plants, terrestrial invertebrates, reptiles, Norway rat, Indian mongoose, common ground dove, and pearly-eyed thrasher.

SAP Worksheet #10f — UXO 7 (EMA/SIA North Beaches)



Site Background

UXO 7 (EMA/SIA North Beaches) consists of 14 sandy beaches, including a small island offshore (Isla Yallis). UXO 7 is approximately 54 acres in size, located along the northern perimeter of the EMA and SIA (**Figures 17 and 19**). Named beaches include Puerto Diablo Beach (Beach 22), Puerto Negro (Beach 23), Puerto Brigadier (Beach 30), Playa Campana/Purple Beach (Beach 24), and Isla Yallis. The beaches are bound by the Caribbean Sea and UXOs 10, 12, and 13 (EMA and SIA). The designated area of each beach includes not only the proper sandy, unvegetated area, but also potential turtle nesting areas from the beach vegetation line up to 60 feet inland. Details of the former operations at the EMA and SIA are provided in Worksheet #10i, #10j, #10k, and #10l.

Investigation and Release History

- ERA/SI (2005 through 2010) and NTCRA – surface and subsurface removal of MEC (2009 through present)
- No environmental investigations have been conducted at UXO 7

Transect inspections and a qualitative handheld magnetometer survey was first conducted at UXO 7. Through October 2012, DGM has been conducted at approximately 40 of the 54 acres, as part of the NTCRA (**Figure 6**); however, all of the sandy beaches have been mapped and intrusively investigated. A total of 4,025 subsurface metallic anomalies have been identified and removed from these beaches. The DGM anomalies were investigated to a maximum depth of 4 ft bgs; the investigation of the anomalies was abandoned if the water table or refusal was encountered prior to reaching 4 ft bgs.

MEC items identified within UXO 7 are primarily a result of artillery fire and air to ground bombing at the SIA, potential misfires at the LIA, and from range activities at UXO 13. Munitions-related items found at the site (recovered through October 2012) include:

Number of items recovered	UXO	MPPEH	DMM	MD	RRD
Surface	4	96	0	688	718
Subsurface	30	255	375	13,418	15,806

Through the end of October 2012, the density of munitions items recovered was greatest at unnamed Beach 33 (within the SIA) and Playa Compania/Purple Beach (within a portion of a UXO 13 range). Four ranges associated with UXO 13 overlap into UXO 7 (**Figure 19).** There are no gun positions or SSAs within UXO 7. Intact and detonated MEC items and munitions debris and the historical detonations had the potential to release chemical contaminants to the environmental media. The distribution of MEC and other munitions-related items is discussed in more detail in Worksheet #17f.

SAP Worksheet #10f — UXO 7 (EMA/SIA North Beaches) (continued)

Conceptual Site Model

Figures 18 and 20 present the generalized conceptual site model of UXO 7.

Physical Characteristics and Transport Pathways

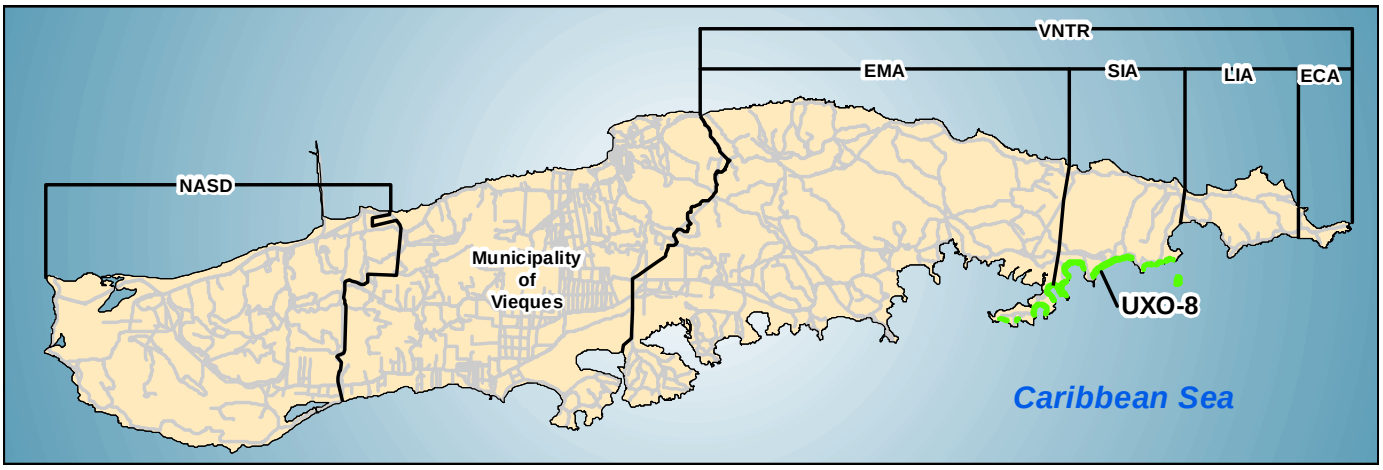
UXO 7 is predominantly sand beaches and dunes that extend from the waterline (low tide waterline during munitions characterization) to the vegetation extent. It also includes vegetated areas that extend approximately 60 feet inland to account for potential turtle nesting areas. The topography slopes toward the ocean and receives runoff from both the EMA and SIA, although most runoff from the EMA and SIA interior is directed into drainage features such as ephemeral streams. The beaches are a dynamic environment in that they are prone to tidal, wave, and storm action. Groundwater is shallow and saline due to seawater intrusion. The primary potential migration pathways at UXO 7 are associated with reworking of beach sands by storm surges, tides, and waves. Constituents could also migrate via leaching to groundwater and wind dispersion.

Future Land Use and Potential Receptors

UXO 7 will continue to be managed as a wildlife refuge. In the CCP, four beaches within UXO 7 are shown as desirable for public access, comprising Beach 33, Puerto Diablo Beach, Puerto Negro, and Playa Compania/Purple Beach. The majority of the beaches in UXO 7 are classified as turtle nesting grounds, with eight beaches identified as restricted turtle nesting areas. Three beaches are identified as major restrictions (four or more historical sea turtle nesting events have occurred) and five beaches as minor restrictions (one to three historical sea turtle nesting events).

Potential human receptors comprise USFWS workers (turtle monitoring), trespassers (adolescent and adult), and public recreators (adolescent and adult and at only four beaches) exposed to soil and potentially exposed to the explosive hazard associated with MEC. The primary potential ecological receptors are the eggs of hawksbill, green, and leatherback sea turtles exposed to deeper surface soil (18 to 36 inches). Other potential terrestrial receptors for surface soil (upper 2 inches) are terrestrial plants, terrestrial invertebrates, reptiles, Norway rat, Indian mongoose, common ground dove, and pearly-eyed thrasher.

SAP Worksheet #10g — UXO 8 (SIA South Beaches)



Site Background

UXO 8 (SIA South Beaches) consists of nine sandy beaches and a small island to the southeast (Cayo Canejo) (**Figure 17**). UXO 8 is approximately 45 acres in size, located along the southern perimeter of the SIA. Named beaches include Playa Matias/Yellow Beach, Playa Jalova, Playa Jalovita, Playa Yoye, Playa Fanduca, Punta Caranera, and Cayo Conejo (a small island to the southeast). The beaches are bound by the Caribbean Sea and UXO 10 (SIA). The designated area of each beach includes not only the proper sandy, unvegetated area, but also potential turtle nesting areas from the beach vegetation line to 60 feet inland. Details of the former operations at the SIA are provided in Worksheets #10h and #10i.

Investigation and Release History

- ERA/SI (2008), NTCRA – surface and subsurface removal of MEC (2009 through present)
- No environmental investigations have been conducted at UXO 8

The beaches were surface cleared of munitions as part of the NTCRA. Through June 2012, DGM has been conducted at approximately 31 of the 45 acres, as part of the NTCRA (**Figure 6**); however, all of the sandy beaches have been mapped and intrusively investigated. A total of 6,128 subsurface metallic anomalies were identified and removed; however, the NTCRA is currently ongoing. The DGM anomalies were investigated to a maximum depth of 4 ft bgs; the investigation of the anomalies was abandoned if the water table or refusal was encountered prior to reaching 4 ft bgs.

MEC items identified within UXO 8 are primarily a result of artillery fire and air to ground bombing at the SIA and from marine amphibious training. Munitions-related items found at the site (recovered through October 2012) include:

Number of items recovered	UXO	MPPEH	DMM	MD	RRD
Surface	7	4	0	222	741
Subsurface	479	168	0	17,419	14,823

Through the end of October 2012, the density of munitions items recovered was greatest at Playa Jalova, Playa Jalovita, and Beach 36. There are no gun positions or SSAs at UXO8. Intact and detonated MEC items and munitions debris and the historical detonations had the potential to release chemical contaminants to the environmental media. The distribution of MEC and other munitions-related items is discussed in more detail in Worksheet #17g.

SAP Worksheet #10g — UXO 8 (SIA South Beaches) (continued)

Conceptual Site Model

Figure 18 presents the generalized conceptual site model of UXO 8.

Physical Characteristics and Transport Pathways

UXO 8 is predominantly sand beaches and dunes that extend from the waterline (low tide waterline during munitions characterization) to the vegetation extent. It also includes vegetated areas that extend approximately 60 feet inland to account for potential turtle nesting areas. The topography slopes toward the ocean and receives runoff from the SIA interior, although most runoff from the EMA and SIA interior is directed into drainage features such as ephemeral streams. The beaches are a dynamic environment in that they are prone to tidal, wave, and storm action. Groundwater is shallow and saline due to seawater intrusion. The primary potential migration pathways at UXO 8 are associated with reworking of beach sands by storm surges, tides, and waves. Constituents could also migrate via leaching to groundwater and wind dispersion.

Future Land Use and Potential Receptors

UXO 8 will continue to be managed as a wildlife refuge. In the CCP, one beach (Playa Matias/Yellow Beach) is shown as desirable for seasonal public use (to minimize wildlife impacts). Five beaches in UXO 8 are classified as turtle nesting grounds. Three beaches are identified as major restrictions (four or more historical sea turtle nesting events have occurred) and two beaches as minor restrictions (one to three historical sea turtle nesting events. Cayo Conejo is a small island associated with UXO 8 that is a conservation zone and is a habitat for the endangered Brown Pelican (**Figure 12**).

Potential human receptors comprise USFWS workers (turtle monitoring), trespassers (adolescent and adult), and public recreators (adolescent and adult and at only one beach) exposed to soil and potentially exposed to the explosive hazard associated with MEC. The primary potential ecological receptors are the eggs of hawksbill, green, and leatherback sea turtles exposed to deeper surface soil (18 to 36 inches), as well as terrestrial ecological receptors (plants, soil invertebrates, birds [including Common Ground Dove and Pearly-eyed Thrasher], mammals [including the Norway Rat and Indian Mongoose], and reptiles) exposed to surface soil at Cayo Conejo.

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements

1. Who will use the data and what will the data be used for?

The Navy, USEPA, EQB, and USFWS will use the data collected during RIs to assess the nature and extent of MEC and whether releases to the environment have occurred as result of munitions-related activities conducted within the former VNTR, and evaluate if there are potentially unacceptable risks to human health and the environment in order to determine what further action is warranted for each site.

2. What are the Project Action Limits (PALs)?

The PALs are defined in the Master Standard Operating Procedures, Protocols, and Plans (CH2M HILL, 2010b) and are listed, by constituent group and medium, in Worksheet #15. In general, the PALs are:

- Vieques human health screening values for soil, sediment, and surface water are the current (as of the time the HHRA is being conducted) Regional Screening Levels (RSLs) (adjusted for a hazard quotient [HQ] of 0.1 for non-carcinogens) provided by USEPA. Adjusted residential RSLs are used for areas where unrestricted use is a potential (i.e., Parcel C of UXO 13), which are the only areas where the residential scenario will be considered, and for areas where recreational use by a child receptor is a potential. In addition, surface water screening values include the Puerto Rico Water Quality Standards (PRWQS) Regulation, Class SB (March 2010). The selected PAL is the lowest of applicable screening levels.
- Vieques human health screening values for groundwater are the current (as of the time the HHRA is being conducted) Tap-Water RSLs (adjusted for an HQ of 0.1 for non-carcinogens) provided by USEPA, the federal drinking water maximum contaminant levels (MCLs), and the PRWQS Regulation, Class SG standards (March 2010). The selected PAL is the lowest of applicable screening levels.
- Vieques ecological screening values for soil, sediment, and surface water are derived from multiple sources, which are listed in the Vieques Master Ecological Risk Assessment Protocol (CH2M HILL, 2010c).
- Vieques soil-to-groundwater leaching screening values provided by USEPA.
- Incremental background sampling was completed as part of the ECA RI. No statistically significant difference in results from the ECA incremental samples and discrete background samples collected as part of the East Vieques background soil study (CH2M HILL, 2007b) was determined. The results of this assessment are provided in **Attachment B** of this SAP. Therefore, the East Vieques background soil inorganics upper tolerance limits (UTLs) (CH2M HILL, 2007b) will be used to compare to incremental and discrete soil samples collected under the Master SAP. Since soil background data are not available for the beaches, soil from the beaches will be evaluated using a multiple lines of evidence approach, such as comparing to the adjacent terrestrial lithologic unit background surface and subsurface soil data. If necessary, background data could be collected from a representative background beach(es), if identified. If a representative background beach(es) is identified, it will be included in an addendum to the Master SAP for regulatory review..
- Screening levels for protection of human health and ecological receptors from radionuclides (i.e., U-234, U-235, and U-238) are discussed in **Attachment C**.
- Results for screening data (i.e., general chemistry parameters such as total organic carbon [TOC], potential of hydrogen (pH), etc.) collected to support the interpretation of potential contaminant data and human and/or ecological risk results will not be compared to strictly-defined PALs, but will be evaluated qualitatively. These parameters are identified in Worksheet #15.
- Each incremental sampling unit sample and discrete sample will be compared to the applicable PALs.

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements (continued)

The laboratory-specific LOQ should be less than the PQL Goal. If that is not possible, the laboratory-specific LOD should be less than the screening level (exceedances of LOD v. screening level shall be highlighted). If that is not possible, then the DL should be less than the screening level. Once the laboratory is identified, an update to WS#15 containing laboratory specific reporting limits, as well as any impact on the resulting data and why alternative analytical methods are not used, will be provided in a site-specific SAP addendum. If there are instances where the laboratory-specific DL is greater than the screening level, then the resulting uncertainty will be discussed in the data quality evaluation.

3. What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?

- Soil, sediment, surface water, and groundwater samples, as applicable to each UXO site, will be submitted to an offsite laboratory for analysis (each laboratory will be selected prior to mobilization)
- Chemicals of interest consist, as applicable to each UXO site, of explosives constituents (USEPA Method 8330B list and perchlorate), elemental and radiological uranium, PAHs, and inorganic constituents, as shown in Worksheets #15 and #18.
- Worksheets #10, #15, and #18 define the matrices, analytical groups, and, where applicable, specific target analytes for East Vieques UXO Sites.
- The classification, quantity, and distribution of MEC, MPPEH, MD, RRD, and cultural debris observed during removal actions and or transect inspections, as applicable to each UXO site and recorded by UXO qualified personnel.

4. How "good" do the data need to be in order to support the environmental decision?

- The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of potential releases and associated human and ecological risks at each UXO site within the former VNTR. Laboratory methods will meet CERCLA, USEPA Region 2, and Navy guidance and the data will be validated per Region 2 guidelines, methodology, and laboratory SOPs as described in Worksheet #36
- The laboratory will follow the Measurement Performance Criteria (MPC) in Worksheet #12 for field QC samples and Worksheet #28 for laboratory QC samples. These MPC are consistent with the DoD Quality Systems Manual (QSM) as applicable and laboratory in-house limits where the QSM does not apply.
- The MEC, MPPEH, MD, RD, and cultural debri data will be identified by qualified UXO Technicians to provide technically sound and defensible assessments regarding the nature and distribution of MEC across each UXO site within the former VNTR.

5. How much data should be collected (number of samples for each analytical group, matrix, and concentration)?

- Worksheet #18 contains the number of samples per matrix per analytical group per UXO site. Worksheets #15 contain the particular analytes and PALs. Worksheet #17 provides the rationale for the particular sampling at each UXO site.
- The basis and rationale for determining the number of groundwater, surface water, sediment, incremental soil, and discrete soil samples is provided on WS# 10 and #17.
- Field measurements of the groundwater and surface water salinity, conductivity, dissolved oxygen (DO), pH, oxidation-reduction potential (ORP), temperature, and turbidity will be made.
- During removal actions and investigations;, the MEC classification, type, quantity, and grid location for the MEC, MPPEH, MD, RRD, or cultural debris found should be documented.

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements (continued)

- Transect inspections fairly uniformly spaced over each UXO site to identify classification and quantity of MEC, MPPEH, MD, RRD, and cultural debris present. The spacing of transects will depend on the nature and size of each UXO site.

- Where, when, and how should the data be collected/generated?
  - Samples will be collected during multiple field mobilizations based on the progress of MEC investigation activities and resource allocation.
  - Data will be collected and generated in accordance with the procedures outlined in the UFP-SAP. Specifically, see the SOPs in Attachment A for more details.
  - MEC, MPPEH, MD, RRD, and cultural debris classifications, quantities, and locations will be recorded during removal actions and or transect inspections. The data collection methods are described in SOP MR-3.
- Who will collect and generate the data? How will the data be reported?
  - CH2M HILL field staff will collect the samples.
  - Laboratory analysis will be performed by a laboratory that meets Navy, USEPA and Puerto Rico laboratory specific requirements. The laboratory will be selected and approved by the Navy. USEPA and PREQB will have an opportunity to review laboratory-specific information in site-specific SAP addenda prior to conducting the sampling.
  - The Navy's munitions response contractors will collect MEC data related to the munitions response activities. The data recorded through each activity will be reported in the munitions response data management system and will be incorporated into the RI report for each UXO site.
- How will the data be archived?
  - The data will be archived in accordance to procedures dictated in the Navy CLEAN program/contract. At the end of the project, archived data will be returned to the Navy. It is anticipated that the Navy will not dispose of project documents.
- List the PQOs in the form of if/then qualitative and quantitative statements
  - The general objectives of the decision analysis process are:
    - To sufficiently characterize the nature and extent of MEC at each UXO site such that: (1) the final remedy determinations can be made regarding MEC based on the explosive safety risk for the intended land use, and (2) environmental media can be appropriately characterized
    - To determine if there has been a release of chemical constituents related to the former munitions-related activities at each UXO site and, if so: (1) whether the data sufficiently represent the nature and extent of contamination, (2) whether site-related contamination, if present, poses unacceptable human health and/or ecological risks, and (3) determine whether site-related contamination, if present, warrants action to achieve the proposed land use goals

The decision analysis process shown in **Figure 13** represents the general PQOs for all sites included in this Master SAP. The 6-step decision analysis and associated PQOs are described below.

Step 1(MC and MEC) —MEC Nature and Extent Determination to Facilitate MC Nature and Extent Determination

As noted above, determination of the nature and extent of MEC has two purposes. The first is to make explosive safety risk and associated remedy determinations for MEC itself. The second is to provide sufficient information on the distribution of MEC such that MC characterization can be performed in areas that can conservatively represent the site as a whole.

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements (continued)

Based on these objectives, the following are the PQOs for this step:

- If the MEC nature and extent have been sufficiently delineated to adequately assess the associated explosive safety risk consistent with the planned land use, make final MEC remedy determinations for the site (via the feasibility study, proposed plan, record of decision process); otherwise, conduct additional MEC delineation activities until sufficiently delineated.
- If the MEC nature and extent have been sufficiently delineated to assess the nature and extent of MC, perform the MC RI; otherwise, conduct additional MEC delineation until sufficiently delineated to perform the MC RI.

It is important to note that it is not necessary to delineate the nature and extent of MEC throughout 100 percent of each site. It is necessary only to delineate the nature and extent of MEC until MEC remedy decisions for the site and conservative MC characterization determinations can be made with confidence. In other words, MEC will have been sufficiently delineated once the remedial actions necessary to protect human health from potential explosive safety risk posed by MEC for the intended land use can be appropriately evaluated and selected. Similarly, with respect to MC characterization, MEC will have been sufficiently delineated once MC sampling locations in areas deemed conservatively representative of the site as a whole can be appropriately selected.

As discussed and shown in each of the site-specific worksheets, the site-specific sampling proposed in the SAP is based on the cumulative information available for the site, including the current understanding of the nature and extent of MEC (the potential contaminant source), which includes not only actual identification of MEC, but also other elements of the CSM, such as historical site use, release mechanisms, fate and transport, and potential exposure pathways. This cumulative information has been deemed sufficient for each site contained in this SAP to identify conservative sampling locations. However, the SAP provides for continual scrutiny of this conclusion in that as additional MEC data are gathered at any particular site (e.g., via NTCRAs) following issuance of this SAP, the data are evaluated to determine if they suggest the understanding of the nature and extent of MEC has been altered such that the MC characterization and/or MEC remedial determinations could be affected. If the former occurs, modifications to the sampling approach at the affected site will be proposed in a site-specific addendum. Ultimately, the conclusions drawn that the nature and extent of MC and MEC have been sufficiently delineated will be subject to review by the regulatory agencies in the corresponding report.

Step 2 (MEC)—Determination of Additional MC Data Needs based on Additional MEC Delineation

The purpose of this step is to determine if any additional MEC delineation data collected after planning or initiation of the MC characterization changes the CSM such that additional environmental media samples should be collected. Since the objective of MC characterization, at least initially, is to collect samples in areas that can conservatively represent the site as a whole, if additional MEC delineation data are gathered that suggest the areas where MC data were (or are planned to be) collected no longer conservatively represent the site as a whole, for example, due to information that would suggest other areas potentially represent higher levels of site-related contamination or the potential release from MEC, additional environmental media samples will be collected in accordance with a Master SAP Addendum (provided for review and approval by the regulatory agencies) in order to achieve the MC characterization objective.

The associated PQO statement for this step is:

- If additional MEC delineation indicates the planned or executed MC RI did not conservatively represent the site as a whole, collect additional environmental media samples to achieve this objective.

Step 2 (MC)—Data Quality Evaluation

The purpose of this step is to determine if the data quality evaluation indicates the dataset as a whole is available and useful for its intended purpose. The data quality evaluation (DQE) assesses the effect of the overall analytical process on the “availability” of the analytical data. “Availability” in this context refers to whether results can be used by the project team based on their analytical soundness. If a result is analytically sound, it is available for use for evaluating potential releases and whether further investigation or action is warranted. However, a particular result or group of results may not be “usable” for these purposes if other conditions apply.

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements (continued)

The three major categories of data availability evaluation are laboratory performance, field collection performance (i.e. blank contamination), and matrix interferences. The data evaluation and validation is a multi-tiered approach. The process begins with an internal laboratory review, continues with an independent review by a third-party validator, and ends with an overall review by the CH2M HILL project chemistry team. While only the data validator is allowed to apply qualifiers to the data, the process provides a medium for essential communication between the laboratory, validator, and project team, and allows for data quality to be thoroughly evaluated.

The data usability evaluation comprises critical assessment of the data with respect to the project objective. Given that the primary objective of the MC RI is to determine the nature and extent of contamination and associated risks, the comprehensive dataset will be reviewed to determine if it is adequate for making the project-specific

determinations. Another aspect of the data usability evaluation is whether PALs were met for non-detect results and, if not, what the effects are on the project-specific determinations. Not achieving PALs does not necessarily mean project-specific determinations cannot be made; it may lend some uncertainty to those decisions and may mean additional lines of evidence are necessary to make the decisions conclusively, which will be discussed in the data usability evaluation.
The associated PQO statement for this step is:

- If the DQE indicates the data are available and useful for the intended purpose, evaluate the nature and extent of contamination and assess potential risks; otherwise, collect sufficient additional samples to achieve an available and useful data set.

Step 3 (MC)—Release, Nature and Extent, and Risk Assessments

The purpose of this step is to determine if there has been a potential CERCLA-related release at a particular site and, if so, a conservative representation of the nature and extent of contamination. A “CERCLA-related release” is a release of hazardous substances, pollutants, and contaminants eligible for CERCLA response as defined in CERCLA Sections 101(14) and 101(33).

A potential release is suspected if any inorganic constituents inconsistent with background (including use of background UTLs, where present, and multiple lines of evidence, such as potential presence based on historic use and/or components of contaminant sources) are detected or if any non-inorganic constituents (e.g., explosives) are detected.

It is important here to emphasize the distinction between the use of background in a “release assessment” versus a “risk assessment.” In determining whether there has been a CERCLA-related release, it is critical that background be considered upon initial evaluation of site-specific data. In other words, whether a potential release occurred can be determined only if site-specific data are evaluated relative to background (and potentially other lines of evidence as indicated above). On the other hand, when a risk assessment is performed, a release has already been determined to have occurred and the risk assessment is performed to evaluate the potential risks based on the nature and extent of the contaminant release. In that circumstance, background is considered only after the potential risks posed by all constituents of potential concern (COPCs) are evaluated, in accordance with EPA policy.

The associated PQO statement for this step is:

If any inorganics not attributable to background or non-inorganics (e.g., explosives) are detected, use the data to conservatively evaluate the nature and extent of contamination and assess potential human health and ecological risks; otherwise, make a final evaluation of the adequacy of the data set (see Step 5) prior to preparation of the RI Report. Inorganics detected within background will be addressed in the human health risk assessment; however, if the only chemicals exceeding RSLs are inorganic constituents within background levels, a human health risk assessment will not be prepared.

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements (continued)

Step 4 (MC)—Whole-Site Applicability Determination

Once the initial data set has been used to conservatively assess the nature and extent of contamination and associated risks, an assessment will be made as to whether those findings are appropriate to apply to the site as a whole. This step is performed to ensure scaling up the conservative results does not potentially result in unintentional or unnecessary remedial action for areas of the site where it may not be warranted. In this case, additional sampling may be performed to refine the understanding of the nature and extent of contamination and associated risks in order to better evaluate and ultimately select any necessary remedial action.

The associated PQO statement for this step is:

- If the results of the conservative nature and extent of contamination determination and associated risk assessments suggest they are not appropriate to apply to the site as a whole because, for example, they do not reflect actual site conditions, are determined to be too conservative, or may result in unintentional or unnecessary remedial actions at the site, collect additional samples in accordance with a Master SAP Addendum (provided for review and approval by the regulatory agencies) to refine the findings; otherwise, make a final evaluation of the adequacy of the data set (see Step 5) prior to preparation of the RI Report.

Step 5 (MC)—Evaluation of Historical Site Information and Spatial Distribution

As a final check before preparing the RI Report, the historical site information, spatial distribution of constituents and constituent concentrations, and risk assessments are collectively evaluated to ensure the site has been sufficiently characterized to make remedy determinations for MC.

The associated PQO statement for this step is:

- If the historical information, nature and extent of contamination determination, and associated risk assessments suggest the site has been sufficiently characterized to make remedy determinations, prepare the RI Report; otherwise, collect additional samples and return to Step 2 (MC).

Step 6 (MC and MEC)—RI Report and FS Report Preparation

Once it has been determined that the nature and extent of MEC and MC have been sufficiently characterized and the associated risks assessed appropriately for the intended land use, the RI and Feasibility Study (FS). Reports will be prepared.

The associated PQO statement for this step is:

- If the RI Report concludes: (1) there is an explosive safety risk associated with the intended land use, or (2) a CERCLA-related release occurred that poses an unacceptable human health and/or ecological risk, prepare an FS Report that evaluates remedial alternatives to address the explosive safety and/or MC exposure risks, as applicable. The explosive safety risk will be calculated using the MEC HA.

As shown above, the 6-step decision process is potentially iterative, whereby the findings based on a particular data set may result in collection of additional data. For efficiency, it is anticipated that concurrence will be reached by the Navy, USEPA, PREQB, and USFWS at critical steps in the decision process (i.e., data grouping, determining if a data set is adequate for its intended purpose, determining the scale-up applicability) and at iterative junctures (i.e., selection of additional data collection media and locations). Concurrence will be accomplished via conference calls, Technical Subcommittee meetings, and SAP addenda, as warranted.

SAP Worksheet #17 — Sampling Design and Rationale

Sampling activities will focus on areas with the highest potential for contamination to provide the most conservative evaluation of releases and nature and extent of contamination. Field activities at each UXO site will comprise environmental characterization of soil (surface and subsurface), sediment, and surface water, as applicable, and regional characterization of groundwater. In addition, the planned future munitions activities at each UXO site are also provided in this worksheet.

Due to the size of the UXO sites, a ranking-based decision approach (in conjunction with a CSM for each site) is used. The approach assesses both common elements and distinguishing features of each site, to focus sampling in areas that best represent potential releases, potential contaminant types, highest contaminant concentrations, key transport pathways, and key exposure areas for potential receptors. The decision analysis to determine the proposed sample areas is provided in **Tables 1 and 2**. Note that an explanation table of each of the category descriptions used in **Tables 1 and 2** is provided in **Table 1**, due to the complexity of the CSM for each site and number of categories used to evaluate where to focus sampling. In general, the tables provide a mechanism to evaluate:

- Potential release and transport areas by using the UXO and Decision Unit categories
- Potential contaminant types and potential areas with the highest contaminant concentrations by using the Site Screening Areas, Range/Target Areas/Gun Positions, Former Activity Features, MEC Type, MEC Scoring, and MEC investigation status categories (based on the CSM summarized in Worksheet #10)
- Potential receptor exposure by using the Biological Assessment and Receptor Exposure Summary (based on the CSM summarized in Worksheet #10)

The decision analysis is described in detail for each specific site summarized in the sampling approach in Worksheets #17a through #17o. The foundation for the overall sampling method and approach is described below.

Figures 29 through 46 provide the munitions characterization data as of the end of June 2012. Each quadrant provides the number of MEC and munitions debris identified during surface clearance activities. In addition, each quadrant has a color code that represents the number of DGM anomalies identified in the subsurface (where investigated); the orange outline represents areas where the anomalies have been investigated and provide the general quantity of MEC and munitions debris identified in the subsurface. The circles within the quadrants indicate the type of MEC and munitions debris identified in both the surface and/or subsurface and the location of the consolidation point within the quadrant.

Sampling Method and Approach

Surface soil sampling will be conducted using the incremental sampling strategy and approach, in general accordance with guidance document prepared by the US Army Corps of Engineers (USACE) titled Interim Guidance 09-02, Implementation of Incremental Sampling (IS) of Soil for the Military Munitions Response Program (USACE, 2009) and the approach used for UXO 1 (ECA) (CH2M HILL, 2011a). Discrete deeper surface soil and subsurface soil, sediment, surface water, and groundwater will be collected in accordance with the applicable Vieques SOPs (CH2M HILL, 2010b).

Incremental sampling is planned for all of the UXO sites, except for UXO-17 (PAOC EE). A discrete soil sampling approach will be used at UXO 17 since the presence of munitions is related to isolated munitions storage and/or discarding and not from range impact or firing activities. This is further discussed in Worksheet #17n.

Incremental Soil Sampling Design

The majority of sampling will be performed using the incremental sampling approach. Incremental sampling is designed to control data variability due to the heterogeneity in contaminant distribution commonly associated with munitions ranges, and has a higher likelihood of detecting contaminants than discrete sampling if the location of contamination is unknown. It allows for sampling large geographic areas with higher sampling density and improves the reliability of sampling data. It also simulates more realistic receptors exposures to potential contaminants at the

SAP Worksheet #17 — Sampling Design and Rationale (continued)

ground surface than discrete samples. For incremental sampling, a single sample is obtained that has an analyte concentration representative of the area in which to base a decision or conclusion (i.e., a decision unit). The decision unit is site-specific and selected to represent a likely contaminant release area or a receptor exposure area. The decision unit may be composed of a single or multiple sampling units. A systematic-random sampling approach is conducted within each sampling unit.

Energetic and inorganic chemicals associated with munitions releases on ranges primarily occur as particulates deposited heterogeneously on the soil surface, primarily from propellant residues at firing points, explosive residues near detonations in impact areas, and from controlled detonations. The highest concentrations are present near the ground surface with the vast majority in the top inch or two. Therefore, incremental sampling at ranges focuses on the top 2.5 inches of soil and represents the most conservative exposure depth interval for human health and terrestrial ecological receptors. However, if the soil or contaminant distribution has been significantly reworked since the former range activities, contamination could be encountered within potential migration pathways from erosion. As a result, sampling will also be conducted in potential transport pathways (such as ephemeral streams), within depositional environments (such as lagoons), and discrete subsurface soil samples will be collected from depths in accordance with the modified Master Protocols to evaluate the vertical extent of contamination, as discussed further below.

Decision Units

Decision units within each UXO site were identified in accordance with the USACE guidance (USACE, 2009). The initial consideration for defining decision units for the UXO sites (specifically the Inland UXO sites) was to design them around watershed areas (**Figure 8**), which capture not only release areas, but the associated transport areas as well. The three major watersheds within eastern Vieques were further refined to smaller watersheds based on the topography and localized drainage. Since the Beach and Road UXO sites generally act as drainage areas, each Beach and Road UXO site is its own decision unit.

Decision units were further refined to represent potential receptor exposure pathways that are unique from other areas (e.g., lagoon fringe areas, potential unrestricted land use, etc.). Potential ecological receptors (based on habitat [**Figure 11**]) and human health receptors (based on proposed land use [**Figure 12**]) were also considered in defining decision units. The term decision unit is synonymous with exposure unit.

In total, 52 decision units (including lagoons and lagoon fringes) were selected for the Inland UXO sites (UXOs 4, 9, 10, 12, 13, 14, and 18) (**Figure 27**). Three decision units were selected for the Beach UXO sites (UXOs 2, 7, and 8) and four decision units were selected for the Roads UXO sites (UXOs 3, 5, 6, and 11).

Sampling Units

Within each decision unit, sampling units were focused in areas with the highest potential for contamination by evaluating the following: site features including former targets, ranges, and gun positions (**Figure 3**); SSAs identified for further investigation (i.e., PAOCs, PIs, AOCs, and SWMUs) (**Figure 4**); quantity, frequency, and type of MEC and munitions scrap items (see site-specific Worksheets below), and subsurface DGM anomaly data (**Figure 28**). In addition, sampling units were also located in potential transport pathways, such as ephemeral streams. Note that ephemeral streams will be sampled during dry conditions. In total, 202 sampling units are planned across the Former VNTR (excluding QA/QC samples) (**Figure 27**).

Sampling units were selected to be representative of the concentrations within a particular exposure area. The proposed sampling units are generally approximately 1 acre in size to account for ecological receptors with smaller exposure areas; since larger exposure areas are typically applicable for human receptors, data from multiple sampling units will be grouped as appropriate for use in the HHRAs. Within each sampling unit, approximately 100 subsamples (increments) will be collected using a 0.5-inch diameter coring device (to a depth of approximately 2.5-inches) to achieve an adequate total sample mass of at least 1,000 grams (in accordance with the approach in the USACE guidance and SOPs in **Attachment D**). Each subsample will include approximately 11 grams of soil (see coring specifications for the incremental sampling tool in **Attachment D**). Subsamples will be collected in a systematic

SAP Worksheet #17 — Sampling Design and Rationale (continued)

random sampling approach, where the subsamples are collected in a general uniform grid across the sampling unit.

It is noted that MEC characterization/removal activities are still being conducted on some UXO sites, so the site-specific evaluation approach conducted under this SAP will be updated, if the newly-acquired information from the ongoing MEC characterization/removal activities necessitates a revision to the sampling approach. In these cases, Master SAP addenda will be submitted to convey the new information and the associated modifications to the characterization approach.

Discrete Soil Sampling Design and Regional Groundwater Characterization

In some cases (e.g., in areas of land crab habitat), discrete surface soil samples are warranted. Discrete surface soil samples will be collected in accordance with the applicable Vieques Master Plans and Protocols (CH2M HILL, 2010b). Depth intervals are site-specific and based on receptor exposure scenarios, as detailed in the site-specific Worksheets #17a through #17o. In addition, subsurface soil samples will be collected from depth intervals in accordance with the modified Master Protocols from each incremental sampling unit (except at the lagoon fringe and beach) and at each of the monitoring well locations, to evaluate the vertical extent of contamination and will not be used in the risk assessment evaluation. Each subsurface soil sample from each incremental sampling unit will be collected in areas with the highest potential for a subsurface release using a geophysical instrument-aided technique if deemed safe. One subsurface soil sample will still be collected if a subsurface munitions item is not identified. Two subsurface soil samples are initially proposed within each sampling unit, and as the data collected from the sites are evaluated on a continuing basis, the number of subsurface soil samples within each sampling unit will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee. Discrete sediment samples and co-located surface water samples will be collected in depositional areas of lagoons, provided munitions safety concerns can be mitigated and allow sample collection. In addition, discrete surface water samples will be collected from sampling unit locations within ephemeral streams, if surface water is present during the time of sampling.

In addition to discrete surface soil, surface water, and sediment sampling, groundwater will be evaluated on a regional scale. A total of 23 regional monitoring wells will be installed to determine if a release to groundwater has occurred (**Figure 26**). Each monitoring well will be screened at the first encountered groundwater using a screen length appropriate for providing sufficient water to facilitate sampling. This will be a judgment call made in the field based on water production observed during drilling and may include screen lengths up to 15 feet. Monitoring wells are conservatively focused in areas with the highest potential for contamination and downgradient of potential release areas (to evaluate migration). The majority of the monitoring wells are located within the LIA, since this area likely has the highest potential for a release to groundwater. The rationale for each monitoring well is summarized in **Table 3**. Monitoring well locations may be adjusted in the field based on site conditions and munitions safety at the time of mobilization. Regional groundwater characterization will follow the 6-step decision analysis and the need for additional future groundwater assessment will be determined by the results of the monitoring well sampling and reviewing soil data to determine the potential for contaminants to leach to groundwater (i.e., fate and transport mechanisms).

Implementing subsurface incremental soil sampling is not technically and economically practical due to subsurface munitions safety concerns. For every incremental subsample, the boreholes would have to be checked and cleared (deemed absent) of magnetic anomalies to the depth of the borehole. Since each incremental sample is composed of approximately 100 subsamples and subsurface metallic anomalies are known to be present, it would not be practical to perform subsurface incremental sampling. In addition, as discussed above, incremental sampling focuses on the area with the highest potential for contamination near the ground surface.

Background Dataset

Soil background data collected during the East Vieques Background Study (CH2M HILL 2007b) will be used for comparison with incremental and discrete soil samples. Background values measured during the UXO 1 RI incremental sampling show that they are comparable with the discrete sampling conducted during the East Vieques

SAP Worksheet #17 — Sampling Design and Rationale (continued)

Background study (**Attachment B**). Since background data are not available for the beaches, a multiple lines of evidence approach will be used to evaluate potential inorganic releases at the beaches, such as using the adjacent terrestrial lithologic unit surface and subsurface soil from the background study. If necessary, background data could be collected from a representative background beach(es), if identified. If a representative background beach(es) is identified, it will be included in an addendum to the Master SAP for regulatory review. Surface water and sediment samples will be compared to background data collected from a similar lagoon (if one is identified) or, in the absence of a representative background dataset, a weight-of-evidence evaluation will be used, as was done for the UXO 1 RI. If appropriate background lagoons are identified, they will be proposed to the regulatory agencies in a SAP addendum prior to sampling activities.

Inorganics data for regional groundwater samples will be compared to existing data from background monitoring wells (such as MW-13 at SWMU 1, MW-02 at SWMU 10, and other non-impacted monitoring wells) identified during historical investigations such as the SI/ESI (CH2M HILL, 2010d) (**Figure 26**). Because the data from these background wells will not be contemporaneous with the regional groundwater data nor necessarily from the same lithologic units, the background data will be used in conjunction with a weight-of-evidence approach for interpreting the regional groundwater data.

Risk Evaluation

Each decision unit is evaluated separately from one another and is not combined. For areas with a low potential for munitions constituents but were selected as a sampling unit because of the presence of a unique human health exposure area, will generally be evaluated as separate exposure areas. However, in some cases, the proposed sampling unit data are appropriate for use in characterizing these unique exposure areas and the details are provided in the site-specific discussions in Worksheet #17. The data groupings will be determined after the site-specific data are available and reviewed. As indicated in the HHRA Protocol, data must be evaluated spatially prior to determination of data groupings for the HHRA. This step will be performed and documented in the HHRA Pre-Interim Deliverable and discussed with the agencies prior to preparation of the HHRA Interim Deliverable, consistent with the HHRA Protocol.

The approach, methods, and assumption used for the ERA will be based upon the final ERA protocol presented in the *Master Standard Operating Procedures, Protocols, and Plans* (CH2M HILL, 2010) and the *Master Ecological Risk Assessment Protocol for Vieques Environmental Restoration Program – Update 1 (Addendum)* (CH2M HILL, 2010).

For the ERA, the data groupings will also be determined after the site-specific data are available and will consider factors such as habitat type. The data groupings will be documented as part of the ERA Interim Deliverable and may differ from the groupings used in the HHRA.

In accordance with the ERA protocol, the exposure point concentration (EPC) at the screening level (SERA; Step 2) will be the maximum detected concentration, while at the baseline level (BERA; Step 3) the EPC will be a central tendency estimate (arithmetic mean and the 95 percent upper confidence limit [UCL] of the arithmetic mean). Therefore, the ERA will be conducted per the protocol, which includes evaluations of both maximum and mean exposure concentrations, and uncertainties related to the sizes of decision units versus the number of sampling units will be addressed in the risk characterization. Also, please note that the placement of sampling units is biased toward worst-case exposures so that central tendency estimates for particular receptor populations will still include a substantial level of conservatism. Where an individual sampling unit associated with a specific human receptor is biased towards low contaminant concentrations, the sampling unit will not be included in the central tendency estimate for other receptors in the larger decision unit.

In Step 3 of the BERA, the area represented by each sampling unit relative to the area of the associated decision unit will be considered with respect to the home range size of each target wildlife receptor. For receptors with small home ranges such that their entire range is less than that of a sampling unit, maximum detected sampling unit concentrations would be considered representative of decision unit exposure. For wider ranging receptors

SAP Worksheet #17 — Sampling Design and Rationale (continued)

with home ranges greater than the area of a sampling unit, central tendency estimates (arithmetic mean and the 95 percent UCL) would be considered representative of decision unit exposure. For each decision unit a description of the decisions made for identifying Step 3 wildlife exposure concentrations will be included in the BERA, along with any potential deviations required based on site specific conditions.

Risk assessment elements presented in the HHRA and ERA pre-interim and/or interim deliverables, such as grouping of decision unit data, will be subject to additional regulatory review and comment, as will any site-specific modifications to the procedures and methods outlined in the final HHRA and ERA protocols that may be included in the HHRA and ERA pre-interim and/or interim deliverables. Decision unit central tendency estimates will be the same for the HHRA and ERA.

Laboratory Analysis

Details regarding laboratory analyses for each site are discussed in Worksheets #17a through #17o and in Worksheet #28.

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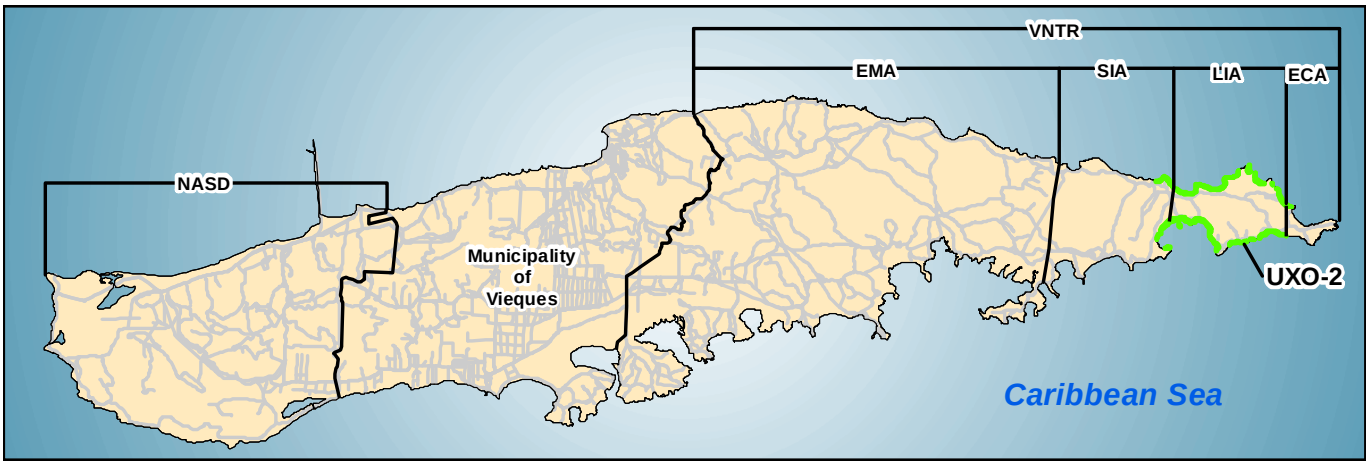
SAP Worksheet #17a — UXO 2 (LIA Beaches)



Future Munitions Activities

To meet the general MEC PQOs identified in Worksheet #11, the following site-specific PQOs and approach for the MEC investigations were developed for UXO 2:

1. Conduct a characterization of MEC identified within each of the sandy beaches and vegetation buffer areas to sufficiently delineate the location, type, and spatial extent of munitions-related items along the surface, and to evaluate the explosive safety hazard at the site.
2. Conduct DGM and subsequent intrusive investigation of anomalies to a depth of 4 ft bgs within each of the sandy beaches and vegetation buffer areas to sufficiently delineate the location, type, and vertical extent of munitions-related items within the subsurface.
3. Characterize the munitions-related information collected as part of these activities to sufficiently evaluate if there are complete exposure pathways based on the intended future land use and the explosive safety hazard at the site; the general information on the data needs are provided in Worksheet #11.

To address site-specific PQO #1, the TCRA for surface removal of MEC (CH2M HILL, 2010f) has been completed for the entire site. The surface clearance cleared nearly 100 percent of UXO 2 and nearly 100 percent of the data is adequate to determine the lateral extent of MEC. As a result, the evaluation of the data from the surface clearance will meet this PQO.

To address site-specific PQO # 2, the NTCRA for the subsurface removal of MEC at UXO 2 has been ongoing. Through October 2012, over 60,000 munitions related items (RRD, MD, UXO, MEC, MPPEH) have been recovered from the subsurface at UXO 2. It is estimated that at least 57 acres of DGM remains to be completed. Therefore, the data from the NTCRA, and the remaining DGM data should provide sufficient information to characterize the vertical nature and extent of MEC at UXO 2.

To address PQO #3, the NTCRA depth of investigation (4 ft bgs) was a depth that was determined to be protective of human health and the environment during the development of the NTCRA. The NTCRA removal depth was selected based on the known USFWS turtle monitoring activities at the sandy beaches, where personnel could be exposed to MEC up to a depth of 3 ft bgs. The beaches are part of the LIA which is designated as a wilderness area and the anticipated future land use scenarios and MEC exposure routes will remain consistent with the current uses/exposure routes. Therefore, the MEC removal depth applied during the NTCRA is conservatively protective of future receptors at the site. The available data and remaining DGM date should provide sufficient information to meet PQO #3.

Based on this information, there are no additional MEC removal actions anticipated at UXO 2 prior to making final remedy determinations for the site. However, if information gathered during the TCRA and NTCRA or other site-related investigations or a step-down plan detailing USFWS's intended use of the area indicate additional MEC investigation is warranted prior to making final remedy determinations for the site, appropriate inter-agency discussions and preparation of pertinent documentation will be conducted.

SAP Worksheet #17a — UXO 2 (LIA Beaches) (continued)

An investigation to study the dynamics at several beaches within UXOs 2, 7, and 8 is being conducted in support of the RI investigations. The intent of the beach dynamics investigation is to augment the current understanding of the dynamic nature of the beach environment at the former VNTR and its impact on the potential distribution and removal /deposition of MEC. As part of the beach dynamics investigation, the selected beaches will be surveyed using DGM several times throughout a 1-year period and the resulting anomalies with a reading above 2.5 mV will be intrusively investigated following each DGM survey. Data from the investigation will be included in the RI, as appropriate, to help assess the nature, extent, and mobility of MEC contamination at the beaches.

Sampling Approach

It is important to note that, as shown in **Figure 6**, munitions removal activities are still ongoing at some of the UXO 2 beaches. However, the soil characterization approach developed in this SAP is based on existing munitions information. As discussed previously, if information gathered during future munitions-related activities necessitates a modification to the UXO 2 soil characterization approach contained herein, the modification will be presented in an addendum to this SAP provided for regulatory review prior to collecting the samples. However, if the additional information suggests the beach(e)s selected for sampling herein are still the most conservatively representative of all UXO 2 beaches, characterization will proceed as described in this SAP.

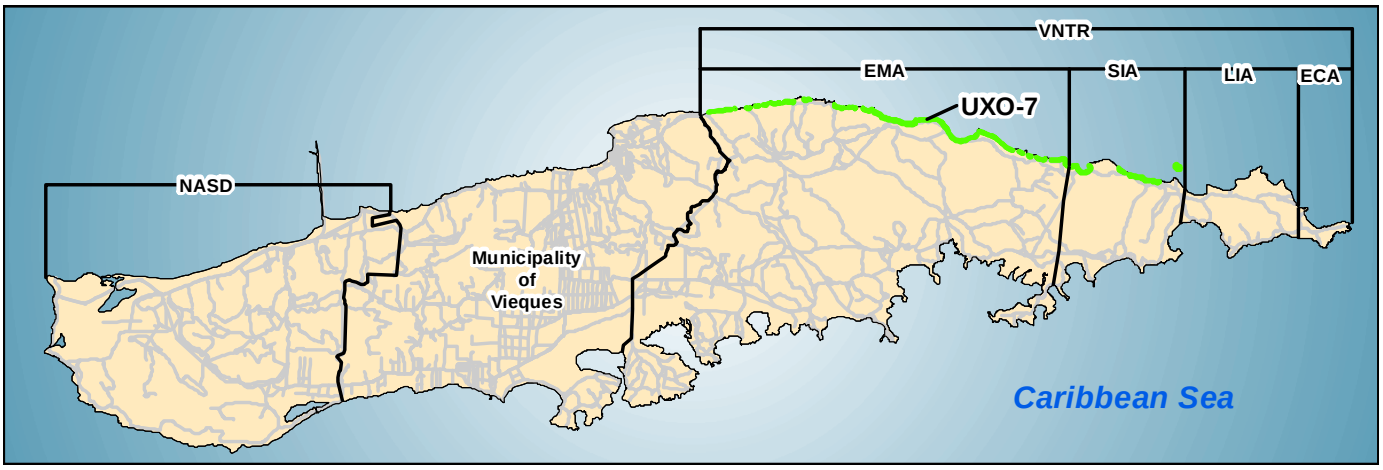
UXO 2 is considered its own decision unit since the beach generally acts as a drainage area; therefore, UXO 2 consists of one decision unit. Each of the 15 beaches within UXO 2 was evaluated as a potential beach to be sampled using the ranking-based decision approach (**Table 2**). Four beaches (Playa Salinas del Sur [Beach 3], Turtle Beach, Icacos/Playa Yallis, and Playa Salinas del Norte/Fossil Beach) were selected for sampling as they have the most conservative contaminant release potential and receptor exposure scenarios of all the UXO 2 beaches (**Figure 29**). Each of these beaches has the highest quantity and diversity of MEC and munitions scrap, and three of the beaches are designated as a major turtle nesting habitat. Although Icacos/Playa Yallis is not a major turtle nesting beach, trespassing activities have historically been observed at this beach. In addition, each beach selected for sampling potentially receives surface runoff from the areas with the highest potential for contamination within UXO 4 (see Worksheet 17c). Additional rationale as to why these beaches are conservatively representative of the other beaches is summarized in **Table 2**.

Each sampling unit is approximately 1 acre in size. Since each beach is different in size, the number of sampling units was biased toward diversity and quantity of MEC and munitions scrap on the surface and within the subsurface, DGM density, and potential depositional area for surrounding drainage on each beach (**Figure 29**). In total, eight incremental surface soil samples (0 to approximately 2.5 inches) and eight discrete deeper surface soil samples (18 to 36 inches) will be collected at the four beaches; two of each at Playa Salinas del Sur; three of each at Turtle Beach; two of each at

Icacos/Playa Yallis; and one of each at Playa Salinas del Norte/Fossil Beach. **Table 4** summarizes the MEC and munitions scrap items historically found and removed within each UXO 2 sampling unit and the rationale for why each sampling unit was selected. The discrete deeper surface soil samples will be collected to best represent the depth of turtle egg nests. The discrete sample locations will be located where historical turtle nests have occurred, and as close as possible to where relatively higher frequencies of MEC have been identified.

Each soil sample will be analyzed for explosives, inorganic constituents, pH, and TOC. Explosives and inorganics are the potential contaminants released at this site from past munitions-related activities. Explosive D (picric acid) will also be analyzed since the types of armaments likely used on Vieques contained this constituent. Although there are no widely accepted human health or ecological screening levels for this analyte, the laboratory will report the results at its reporting limit. pH and TOC data help interpret the potential contaminant data. With respect to nature and extent evaluation, the surface soil data will be compared to the adjusted RSLs, ecological screening value, and background data. Potential risks to human health at the beach will be evaluated using both the surface and deeper surface soil samples. The incremental and discrete soil samples will be evaluated as separate exposure media in the ecological risk assessment: surface soil to terrestrial receptors, and deeper surface soil to turtle eggs only.

SAP Worksheet #17f – UXO 7 (EMA/SIA North Beaches)



Future Munitions Activities

To meet the general MEC PQOs identified in Worksheet #11, the following site-specific PQOs and approach for the MEC investigations were developed for UXO 7:

1. Characterize the MEC identified within each of the sandy beaches and associated buffer areas to sufficiently delineate the location, type, and spatial extent of munitions-related items along the surface, and to evaluate the explosive safety hazard at the site.
2. Conduct DGM and subsequent intrusive investigation of anomalies to a depth of 4 ft bgs within each of the sandy beaches and associated buffer areas to sufficiently delineate the location, type, and vertical extent of munitions-related items within the subsurface.
3. Assess the munitions-related information as part of these activities that will be sufficient to evaluate if there are complete exposure pathways based on the intended future land use and the explosive safety hazard at the site; the general information on the data needs are provided in Worksheet #11 .

To address site-specific PQO # 1, the surface removal of MEC has been completed for the sandy beaches at UXO 7, providing data on over 1,500 munitions related items. Therefore, the available data is sufficient to meet PQO # 1.

To address site-specific PQO #2, the subsurface MEC removal has been completed at UXO 7, providing data on over 29,000 munitions items from all of the sandy beaches.

To address PQO #3, the NTCRA depth of investigation (4 ft bgs) was a depth that was determined to be protective the known USFWS turtle monitoring activities at the sandy beaches, where personnel could be exposed to MEC up to a depth of 3 ft bgs. The future use of the UXO 7 sandy beaches will be by USFWS personnel conducting refuge management and turtle monitoring activities, authorized recreations users at select beaches, and trespassers. It is anticipated that the continued turtle monitoring activities will result in the maximum potential MEC exposure depth (3 ft bgs), with a majority of authorized recreational users only being exposed to items on the ground surface and a relative few conducting shallow intrusive activities to a depth of less than 3 ft bgs.

Based on this information, there are no additional MEC investigations or removal actions anticipated at UXO 7 prior to making final remedy determinations for the site. However, a step-down plan detailing USFWS's intended use of the area indicates additional MEC investigation is warranted prior to making final remedy determinations for the site, appropriate inter-agency discussions and preparation of pertinent documentation will be conducted.

The DGM and MEC data currently available will provide sufficient data to select sample locations. Based on historical information and data available through October 2012, the sampling approach has been preliminarily defined.

SAP Worksheet #17f – UXO 7 (EMA/SIA North Beaches) (continued)

An investigation to study the dynamics at several beaches within UXOs 2, 7, and 8 is being conducted in support of the RI investigations. The intent of the beach dynamics investigation is to augment the current understanding of the dynamic nature of the beach environment at the former VNTR and its impact on the potential distribution and removal /deposition of MEC. As part of the beach dynamics investigation, the selected beaches will be surveyed using DGM several times throughout a 1-year period and the resulting anomalies with a reading above 2.5 mV will be intrusively investigated following each DGM survey. Data from the investigation will be included in the RI, as appropriate, to help assess the nature, extent, and mobility of MEC contamination at the beaches.

Sampling Approach

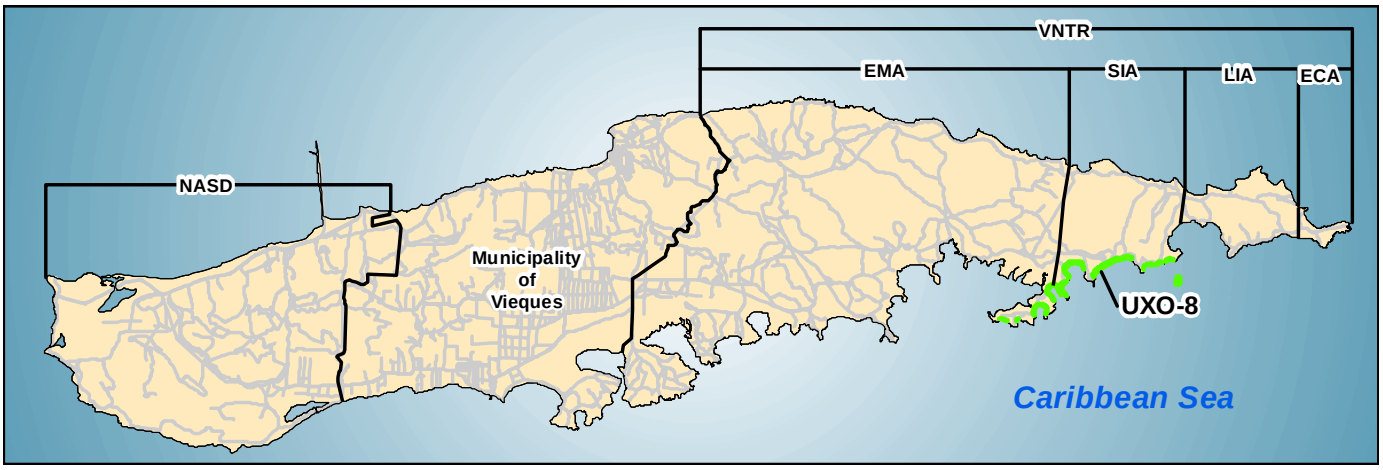
It is important to note that, as shown in **Figure 6**, munitions removal activities are still ongoing at some of the UXO 7 beaches. However, the soil characterization approach developed in this SAP is based on existing munitions information. As discussed previously, if information gathered during future munitions-related activities necessitates a modification to the UXO 7 soil characterization approach contained herein, the modification will be presented in an addendum to this SAP provided for regulatory review prior to collecting the samples. However, if the additional information suggests the beach(e)s selected for sampling herein are still the most conservatively representative of all UXO 7 beaches, characterization will proceed as described in this SAP.

UXO 7 is considered its own decision unit since the beach generally acts as a drainage area. Each of the 14 beaches within UXO 7 was evaluated as a potential sampling unit using the ranking-based decision approach (**Table 2**). Three beaches (Diablo, Purple Beach, and Beach 33 [unnamed]) were selected for sampling as they have the most conservatively representative contaminant release potential and receptor exposure scenarios of all the UXO 7 beaches (**Figures 35a through 35c**). Each of these beaches has the highest quantity and diversity of MEC and munitions scrap and are the only UXO 7 beaches being considered as recreational beaches for the public. In addition, the beaches likely receive surface runoff from UXOs 9 and 13. Additional rationale as to why these beaches are representative of the other UXO 7 beaches is summarized in **Table 2**.

Each sampling unit is approximately 1 acre in size. Since each beach is different in size, the number of sampling units was biased toward diversity and quantity of MEC and munitions scrap, DGM anomalies, and potential depositional area for surrounding drainage on each beach (**Figures 35a through 35c**). In total, five incremental surface soil samples (0 to approximately 2.5 inches) and four discrete deeper surface soil samples (18 to 36 inches) will be collected at the three beaches; two of each at Diablo; two of each at Purple Beach; and one incremental surface soil sample at Beach 33 (a discrete deeper surface soil sample will not be collected since the beach is not a major turtle nesting habitat). **Table 9** summarizes the MEC and munitions scrap items historically found and removed within each UXO 7 sampling unit and the rationale for why each sampling unit was selected. The discrete deeper surface soil samples will be collected to best represent the depth of turtle egg nests. The discrete sample locations will be located where historical turtle nests have occurred, and as close to possible where higher frequencies of MEC have been identified.

Each soil sample will be analyzed for explosives, inorganic constituents, pH, and TOC. Explosives and inorganics are the potential contaminants released at this site from past munitions-related activities. pH and TOC data help interpret the potential contaminant data. With respect to nature and extent evaluation, the soil data will be compared to the adjusted RSLs, ecological screening value, and background data. Potential risks to human health at the beach will be evaluated using both the surface and deeper surface soil samples. The incremental and discrete soil samples will be evaluated as separate exposure media in the ecological risk assessment; surface soil to terrestrial receptors, and deeper surface soil to turtle eggs only.

SAP Worksheet #17g – UXO 8 (EMA/SIA South Beaches)



Future Munitions Activities

To meet the general MEC PQOs identified in Worksheet #11, the following site-specific PQOs and approach for the MEC investigations were developed for UXO 8:

1. Characterize MEC identified within each of the sandy beaches and associated buffer areas to sufficiently delineate the location, type, and spatial extent of munitions-related items along the surface.
2. Conduct DGM and subsequent intrusive investigation of anomalies to a depth of 4 ft bgs within each of the sandy beaches and associated buffer areas to sufficiently delineate the location, type, and vertical extent of munitions-related items within the subsurface.
3. Assess munitions-related information collected as part of these activities to sufficiently evaluate if there are complete exposure pathways based on the intended future land use and the explosive safety hazard at the site; the general information on the data needs are provided in Worksheet #11 .

To address site-specific PQO #1 the surface clearance of UXO 8 was completed as part of the ERA/SI and NTCRA, providing data on over 970 munitions related items. Therefore, the available data is sufficient to meet PQO #1.

The subsurface clearance of MEC at UXO 8 has also been completed as part of the NTCRA, providing data on over 32,800 munitions related items from the sandy beaches. Therefore, information has been collected to sufficiently characterize the nature and vertical extent of MEC to meet specific PQO # 2.

To address PQO #3, the NTCRA depth of investigation (4 ft bgs) was a depth that was determined to be protective the known USFWS turtle monitoring activities at the sandy beaches, where personnel could be exposed to MEC up to a depth of 3 ft bgs. The future use of the UXO 8 sandy beaches will be by USFWS personnel conducting refuge management and turtle monitoring activities, authorized recreations users at select beaches, and trespassers. It is anticipated that the continued turtle monitoring activities will result in the maximum potential MEC exposure depth (3 ft bgs), with a majority of authorized recreational users only being exposed to items on the ground surface and a relative few conducting shallow intrusive activities to a depth of less than 3 ft bgs.

Based on this information, there are no additional MEC investigations or removal actions anticipated at UXO 8 prior to making final remedy determinations for the site. However, if a step-down plan detailing USFWS's intended use of the area indicates additional MEC investigation is warranted prior to making final remedy determinations for the site, appropriate inter-agency discussions and preparation of pertinent documentation will be conducted.

The sampling at UXO 8 is currently planned to occur following completion of the DGM and intrusive investigation of the anomalies. The DGM and MEC data available at that time will provide sufficient data to select sample locations. Based on historical information and data available through October 2012, the sampling approach has been preliminarily defined.

SAP Worksheet #17g – UXO 8 (EMA/SIA South Beaches) (continued)

An investigation to study the dynamics at several beaches within UXOs 2, 7, and 8 is being conducted in support of the RI investigations. The intent of the beach dynamics investigation is to augment the current understanding of the dynamic nature of the beach environment at the former VNTR and its impact on the potential distribution and removal /deposition of MEC. As part of the beach dynamics investigation, the selected beaches will be surveyed using DGM several times throughout a 1-year period and the resulting anomalies with a reading above 2.5 mV will be intrusively investigated following each DGM survey. Data from the investigation will be included in the RI, as appropriate, to help assess the nature, extent, and mobility of MEC contamination at the beaches.

Sampling Approach

It is important to note that, as shown in **Figure 6**, munitions removal activities are still ongoing at some of the UXO 8 beaches. However, the soil characterization approach developed in this SAP is based on existing munitions information. As discussed previously, if information gathered during future munitions-related activities necessitates a modification to the UXO 8 soil characterization approach contained herein, the modification will be presented in an addendum to this SAP provided for regulatory review prior to collecting the samples. However, if the additional information suggests the beach(e)s selected for sampling herein are still the most conservatively representative of all UXO 8 beaches, characterization will proceed as described in this SAP.

UXO 8 is considered its own decision unit since the beach generally acts as a drainage area; therefore, UXO 8 consists of one decision unit. Each of the nine beaches within UXO 8 was evaluated as a potential sampling unit using the ranking-based decision approach (**Table 2**). Five beaches (Playa Jolova, Playa Jolovita, Playa Matias/Yellow Beach, and Cayo Conejo) were selected for sampling as they have the most conservatively representative contaminant release potential and receptor exposure scenarios of all the UXO 8 beaches **(Figure 36**). Playa Jolova and Playa Jolovita have the highest quantity and diversity of MEC and are major turtle nesting beaches. Although a low quantity of munitions was identified at Playa Matias/Yellow Beach, it is selected for sampling since it is being considered as a recreational beach for the public and is a major turtle nesting beach. Although Cayo Conejo is not a sandy beach or turtle nesting area and also had a low quantity of munitions items identified, it was selected for surface soil sampling to evaluate potential exposure to terrestrial plants and animals. Additional rationale as to why these beaches are representative of the other UXO 8 beaches is summarized in **Table 2**.

Each sampling unit is approximately 1 acre in size. Since each beach is different in size, the number of sampling units was biased toward diversity and quantity of MEC and munitions scrap on the surface and within the subsurface, DGM anomalies, and potential depositional area for surrounding drainage on each beach (**Figure 36**). In total, five incremental surface soil samples (0 to approximately 2.5 inches) and four discrete deeper surface soil samples (18 to 36 inches) will be collected at the four beaches; two of each at Playa Matias/Yellow Beach; one of each at Playa Jolova; one of each at Playa Jolovita; and one incremental surface soil sample at Cayo Conejo (a discrete deeper surface soil sample will not be collected since the beach is not a major turtle nesting habitat). **Table 10** summarizes the MEC and munitions scrap items historically found and removed within each UXO 8 sampling unit and the rationale for why each sampling unit was selected. The discrete deeper surface soil samples will be collected from 18 to 36 inches to best represent the depth of turtle egg nests. The discrete sample locations will be located where historical turtle nests have occurred, and as close to possible where higher frequencies of MEC have been identified.

Each soil sample will be analyzed for explosives, inorganic constituents, pH, and TOC. Explosives and inorganics are the potential contaminants released at this site from past munitions-related activities. pH and TOC data help interpret the potential contaminant data. With respect to nature and extent evaluation, the surface soil data will be compared to the adjusted RSLs, ecological screening value, and background data. Potential risks to human health at the beach will be evaluated using both the surface and deeper surface soil samples. The incremental and discrete soil samples will be evaluated as separate exposure media in the ecological risk assessment; surface soil to terrestrial receptors, and deeper surface soil to turtle eggs only.

Tables

Table 1
Category Descriptions
Inland Terrestrial UXO Sites Evaluation and Rationale for Sampling Approach
Master Sampling and Analysis Plan - East Vieques Terrestrial UXO Sites
Vieques, Puerto Rico

Category	Description/Explanation
UXO	• Column 1 describes which UXO site the particular area is located in.
Decision Units	• Column 2 describes the decision units within each UXO site. • Decision units divide are based on hydrologic drainage areas. • The decision units are named based on their location within the UXO site.
Site Screening Areas (i.e., PI/SWMUs, etc.)	• Column 3 indicates whether any decision units have previously identified site screening areas, such as a PI, PAOC, AOC, or SWMU that need to be considered for sampling purposes.
Range/Target Areas/Gun Positions	• Column 4 indicates whether any military training features such as ranges, target areas, or gun positions are present within the decision unit. • An 'X' located in the column, represents that a previously used military feature was identified within the given decision unit area. • This data was determined based on the information provided during the ERA/SI.
Former Activity Features	• Column 5 identifies how many former activity features are present in each decision unit. • The former activity features potentially located within each decision unit are as follows: ranges, naval gunfire support target areas, targets, gun positions, consolidation points, controlled detonation locations, EADAs, LIDAR indicated areas, bulls-eyes, open burn areas, open detonation areas, and sub-munitions areas. • The number located in each column quantitatively identifies how many of each type of feature is located within that decision unit. • This data was determined based on the information provided during the ERA/SI.
Munitions Type	• Munitions type features are discussed in column 6. • Each column represents one of the 7 categories of munitions type as follows: flares-pyrotechnics, bombs, grenades, projectiles/mortars, rockets/guided missiles, sub-munitions, or MEC components. • An 'X' located in one of the columns, represents that a particular munitions type was identified within the given decision unit area. • In order to conserve space the types of munitions items were abbreviated in the excel file as follows: Flares-Pyrotechnics = FP Bombs = B Grenades = G Projectiles/Mortars = P/M Rockets/Guided Missiles = R/G Sub-munitions = S MEC component = MC
Munitions Item Scoring	• Column 7 quantitatively evaluates the number of munitions items identified per 30 ft x 30 ft grid within each decision unit. • In order to evaluate the density of munitions items in each decision area, values were assigned to quantitatively rank each area in comparison to one another. • The combined scores for both the quantity and frequency of munitions items equals the total munitions score, which provides a comparison for approximately how many munitions items were identified and how often they were identified.
Quantity	• Ranks the quantity of munitions items identified per grid area. • The value given is based on the maximum number of munitions items identified within an individual grid, in each decision unit. • The values assigned to each decision unit were determined based on the following, where the left side represents the maximum number of munitions items identified within a single grid, and the left side is the score assigned to that range: 0 munitions items → Score = 0 1 to 5 munitions items → Score = 1 6 to 100 munitions items → Score = 2 101 to 500 munitions items → Score = 3 501 to 1000 munitions items → Score = 4 1001 to 5000 munitions items → Score = 5 5000+ munitions items → Score = 6

Table 1
Category Descriptions
Inland Terrestrial UXO Sites Evaluation and Rationale for Sampling Approach
Master Sampling and Analysis Plan - East Vieques Terrestrial UXO Sites
Vieques, Puerto Rico

Category		Description/Explanation
	Frequency	• The Frequency column quantitatively evaluates each decision unit based on the frequency or reoccurrence that munitions items were identified in grids within each decision area. • The frequency is defined as how often munitions items were identified in a decision unit, based on how many grids within the decision unit had values greater than or equal to 1. • The frequency was determined based on the total percentage of grids that had munitions items identified, over the total number of grids within the decision unit. • The values assigned to each decision unit were determined based on the following, where the left side represents frequency that munitions items were identified in a decision unit, and the left side is the score assigned to that range: 0 to 20% → Score = 1 20 to 40% → Score = 2 40 to 60% → Score = 3 60 to 80% → Score = 4 80 to 100% → Score = 5 • For example: if there were 20 grids within one decision unit, and 5 of the grids had munitions items identified within them, than 5 out of 20 grids or 25% of the grids had MEC items identified. This correlates to a frequency of approximately 25%, and a score of 2.
	Total Munitions Score	• The total munitions score is the quantitative value given to each decision unit, combining the scores for both the quantity and frequency. • The decision units that had both a large quantity of munitions items identified as well as a high frequency had the highest score, while decision units that had a small quantity of MEC items identified and a low frequency had the lowest score.
MEC Investigation Status		• The status of munitions clearance activities is provided in Column 8. The sample units and locations at locations where munitions clearance activities are ongoing will be re-evaluated prior to field mobilization.
Biological Assessment (Inland Terrestrial Sites Only)		• Biological features are discussed in column 9 on Table 1 and evaluates the decision units based on the type of habitat. • Each column represents one of the 9 categories of ecosystems found in East Vieques as follows: evergreen scrub, forest, forest scrub, grass, mangrove, mixed woodlands, sparse thorn scrub, thick thorn scrub, lagoon. • An 'X' located in one of the columns represents that a particular ecosystem was identified within the given decision unit. • This data was determined based on the information provided during the Biological Assessment of East Vieques. • In order to conserve space the ecosystem types were abbreviated in the excel file as follows: Evergreen Scrub = ES Forests = F Forest Scrub = FS Grass = G Mangroves = M Mixed Woodlands = MW Sparse Thorn Scrub = STS Thick Thorn Scrub = TTS Lagoon = L
Receptor Exposure Summary		• Column 10 (Table 1) and Column 9 (Table 2) evaluates the decision unit based on the potential for human exposure and ecological sensitivity. • In order to evaluate the potential receptor exposures for human health and ecological scenarios, values were assigned to quantitatively rank each area in comparison to one another. • The combined scores for both human health and ecological sensitivity provide a scale to evaluate the potential receptor exposure.
	Human Health	• Assigns a value for each decision unit, based on the potential for humans to be exposed to site conditions. • The potential receptor exposures for human health are based on the three categories of future land use as follows: unrestricted use, public or recreational area, or wildlife refuge or restricted area. • Areas planned for unrestricted land use have the highest human health exposure factor and were assigned a value of 3; areas planned to be open to the public as recreational with restrictions were given a score of 2; areas that are restricted to USFWS and had the lowest human health factor and were given a score of 1 because they have the minimum potential for exposure to humans.
	Ecological	• Assigns a value for each decision unit, based on the ecological sensitivity of the area. • Along the beaches, areas that were listed as major turtle nesting areas or have endangered species habitat had the highest value and the highest corresponding concern for potential exposure to a species of noted importance and therefore received a score of 3, versus areas identified as minor turtle nesting areas (score of 2), or very limited/potential turtle nesting areas (score of 1).
		• In the interior, areas that have endangered species habitat had the highest value and the highest corresponding concern for potential exposure to a species of noted importance and therefore received a score of 3. Lagoons and lagoon fringes were identified as potential sensitive habitats due to aquatic organisms and land crab areas and received a score of 2. Upland terrestrial habitats without a noted presence of endangered species received a score of 1.
	Total Receptor Score	• Represents the total combined scores from both a human health and ecological perspective. • The total Receptor Score is a value given to each decision unit based on the potential receptor exposure. • The decision units with the highest value in this category have the highest potential for receptor exposure; where as the areas with the lowest score have the lowest potential for receptor exposure.
Sample Unit Approach and Rationale		• Column 11 (Table 1) and Column 10 (Table 2) describes the reasoning behind determining whether an area will be sampled based on the decision units characteristics evaluated throughout the spreadsheet.

Table 2a
UXO 2
East Vieques Beaches Evaluation and Rationale for Sampling Approach
Master Sampling and Analysis Plan - East Vieques Terrestrial UXO Sites
Vieques, Puerto Rico

1	2	3	4	5									6							7			8			9					10
				Former Activity Features (quantity)									Munitions Type (x=occurs within beach)							Munitions Items Scoring			MEC Investigation Status			Receptor Exposure Scoring					Rationale
UXO	Beach	Site Screening Areas (i.e., PI/SWMUs, etc.) (Y=Yes, N=No)	Range/ Target Areas/ Gun Positions (Y=Yes, N=No)	Range	Naval Gunfire Support Target Area	Target	Gun Position	LIDAR	Bulls-eye	Open Burn	Open Detonation	Sub-munitions Area	FP	B	G	P/M	R/G	S	MC	Quantity	Frequency	Total Munitions Score	Complete (Yes/No)	Is the Potential for Sampling Considered Based on Site Releases? (Yes/No)	Rationale	Human Health	Ecological	Total Receptor Score	Is the Potential for Sampling Considered Based on Receptor Exposure? (Yes/No)	Rationale	Is Sampling Proposed (Yes/No) If Yes, recommend samples	
UXO 2	2 - Unnamed	N	N										X	X	X	X				5	4	9	No	No	Munitions score lower than other beaches	1	3	4	Yes	Highest total receptor score	No	Receptor score addressed at other beaches
UXO 2	3 - Playa Salinas Del Sur	N	Y			1							X	X	X	X			X	5	4	9	No	Yes	Target Area within beach area	1	3	4	Yes	Highest total receptor score	Yes SMI - 2 Discrete Soil - 2	Both potential site releases and receptor are most conservative. See additional explanation on WS#17 for sampling approach and rationale.
UXO 2	4 – Playa Carucho/Turtle Beach	N	Y		1								X	X	X	X	X	X	X	6	4	10	No	Yes	Target Area within beach area; highest munitions score and most diversity of munitions	1	3	4	Yes	Highest total receptor score	Yes SMI - 3 Discrete Soil - 3	Both potential site releases and receptor are most conservative. See additional explanation on WS#17 for sampling approach and rationale.
UXO 2	5 – Icacos/Playa Yallis	N	N										X	X	X	X	X		X	5	4	9	No	No	Munitions score lower than other beaches	1	2	3	Yes	Lower ecological receptor score attributing to lower overall receptor score. However, historical trespassing has been observed at this beach.	Yes SMI - 2 Discrete Soil - 2	Although MEC score and receptor exposure are less than other potential sampling units, sampling is recommended based on historical accounts of trespassing activity. See additional explanation on WS#17 for sampling approach and rationale.
UXO 2	6 – Playa Salinas del Norte/Fossil Beach	N	N										X	X	X	X	X	X	X	6	4	10	No	Yes	Highest munitions score and most diversity of Types of MEC items	1	2	3	No	Lower ecological receptor score attributing to lower overall receptor score.	Yes SMI - 1 Discrete Soil - 1	Potential site releases and receptor addressed with other beaches. See additional explanation on WS#17 for sampling approach and rationale.
UXO 2	7 – Unnamed	N	N										X	X		X				2	3	5	No	No	Munitions score lower than other beaches	1	2	3	No	Lower ecological receptor score attributing to lower overall receptor score.	No	Potential site releases and receptor addressed with other beaches
UXO 2	8 – Unnamed	N	N										X	X		X		X	X	2	3	5	No	No	Munitions score lower than other beaches	1	2	3	No	Lower ecological receptor score attributing to lower overall receptor score.	No	Potential site releases and receptor addressed with other beaches
UXO 2	9 - Unnamed	N	N													X	X			3	4	7	No	No	Munitions score lower than other beaches	1	2	3	No	Lower ecological receptor score attributing to lower overall receptor score.	No	Potential site releases and receptor addressed with other beaches
UXO 2	10 - Unnamed	N	N										X	X		X	X		X	2	3	5	No	No	Munitions score lower than other beaches	1	3	4	Yes	Highest total receptor score	No	Receptor score addressed at other beaches
UXO 2	11 – Unnamed	N	N										X	X		X	X	X	X	5	4	9	No	No	Munitions score lower than other beaches	1	3	4	Yes	Highest total receptor score	No	Receptor score addressed at other beaches
UXO 2	12 – Unnamed	N	N										X	X		X		X	X	3	4	7	No	No	Munitions score lower than other beaches	1	3	4	Yes	Highest total receptor score	No	Receptor score addressed at other beaches
UXO 2	13 – Playa Barco	N	N													X		X		3	1	4	No	No	Munitions score lower than other beaches	1	3	4	Yes	Highest total receptor score	No	Receptor score addressed at other beaches
UXO 2	14 – Playa Brava	N	N										X	X		X	X	X	X	4	2	6	No	No	Munitions score lower than other beaches	1	3	4	Yes	Highest total receptor score	No	Receptor score addressed at other beaches
UXO 2	34 – Unnamed	N	N											X		X	X			6	2	8	No	No	Highest munitions score; but diversity of munitions addressed in other beaches	1	2	3	No	Lower ecological receptor score attributing to lower overall receptor score.	No	Potential site releases and receptor addressed with other beaches
UXO 2	35 - Unnamed	N	N													X				2	2	4	No	No	Munitions score lower than other beaches	1	1	2	No	Lower ecological receptor score attributing to lower overall receptor score.	No	Potential site releases and receptor addressed with other beaches

Table 2b
UXO 7
East Vieques Beaches Evaluation and Rationale for Sampling Approach
Master Sampling and Analysis Plan - East Vieques Terrestrial UXO Sites
Vieques, Puerto Rico

1	2	3	4	5									6							7			8			9					10
UXO	Beach	Site Screening Areas (i.e., PI/SWMUs, etc.) (Y=Yes, N=No)	Range/ Target Areas/ Gun Positions (Y=Yes, N=No)	Former Activity Features (quantity)									Munitions Type (x=occurs within beach)							Munitions Items Scoring			MEC Investigation Status	Is the Potential for Sampling Considered Based on Site Releases? (Yes/No)	Rationale	Receptor Exposure Scoring			Is the Potential for Sampling Considered Based on Receptor Exposure? (Yes/No)	Rationale	Is Sampling Proposed (Yes/No) If Yes, recommend samples	Rationale
				Range	Naval Gunfire Support Target Area	Target	Gun Position	LIDAR	Bulls-eye	Open Burn	Open Detonation	Sub-munitions Area	FP	B	G	P/M	R/G	S	MC	Quantity	Frequency	Total Munitions Score	Complete (Yes/No)			Human Health	Ecological	Total Receptor Score				
UXO 7	33 - Unnamed	N	N										X	X		X			X	2	1	3	Yes	No	Munitions score lower than other beaches	2	2	4	Yes	High human health	Yes SMI - 1 Discrete Soil - 1	Beach is selected based on high receptor score and intended future use. See additional explanation on WS#17 for sampling approach and rationale.
UXO 7	Isla Yallis	N	N											X						1	1	2	No	No	Munitions score lower than other beaches	1	1	2	No	Lower receptor score	No	No for both potential site releases and receptor
UXO 7	27 - Unnamed	N	N													X	X		X	2	2	4	Yes	No	Munitions score lower than other beaches; subsurface DGM anomalies have been investigated and has less than or equivalent to the number of munitions identified than other beaches	1	2	3	No	Lower receptor score	No	No for both potential site releases and receptor
UXO 7	21 - Unnamed	N	N																	0	n/a		No	No	Beach Clearance not complete; if MEC clearance indicates high munitions score, proposal not to sample will be revisited.	1	1	2	No	Lower receptor score	No	No for both potential site releases and receptor
UXO 7	22 - Puerto Diablo	N	N											X		X			X	2	3	5	Yes	Yes	Munitions score lower than other beaches; but munitions type not addressed	2	3	5	Yes	High human health and ecological sensitivitiy	Yes SMI - 2 Discrete Soil - 2	Munitions type and high receptor score. See additional explanation on WS#17 for sampling approach and rationale.
UXO 7	32 - Unnamed	N	N													X				0	0	0	Yes	No	Munitions score lower than other beaches	1	1	2	No	Lower receptor score	No	No for both potential site releases and receptor
UXO 7	31- Unnamed	N	N																	0	0	0	No	No	Munitions score lower than other beaches	1	1	2	No	Lower receptor score	No	No for both potential site releases and receptor
UXO 7	23 - Puerto Negro	N	N																	0	0	0	Yes	No	Munitions score lower than other beaches	2	2	4	No	Lower receptor score	No	No for both potential site releases and receptor
UXO 7	30 - Punta Brigadere	N	Y	1																0	0	0	Yes	No	Clearance has not been conducted at this Site. If munitions type or munitions score are different than other ranges at UXO 8 then this will be considered.	1	2	3	No	Lower receptor score	No	No for both potential site releases and receptor
UXO 7	24 - Playa Compania/Purple Beach	Y	Y	1													X			3	1	4	Yes	Yes	PAOC Site and range features with high munitions score within the UXO site.	2	3	5	Yes	High human health and ecological sensitivitiy	Yes SMI - 2 Discrete Soil - 2	PAOC, major turtle nesting area, recreational; high MEC quantities. See additional explanation on WS#17 for sampling approach and rationale.
UXO 7	25 - Unnamed	Y	Y	1																0	0	0	No	No	Munitions score lower than other beaches; PAOC also on Purple Beach	1	1	2	No	Lower receptor score	No	No for both potential site releases and receptor
UXO 7	29 - Unnamed	N	Y	1											X					1	1	2	No	No	Low munitions and no site release areas	1	1	2	No	Lower receptor score	No	No for both potential site releases and receptor
UXO 7	28 - Unnamed	N	N																	0	0	0	No	No	Low munitions and no site release areas	1	1	2	No	Lower receptor score	No	No for both potential site releases and receptor
UXO 7	26 - Unnamed	N	N																	0	0	0	No	No	Low munitions and no site release areas	1	2	3	No	Lower receptor score	No	No for both potential site releases and receptor

Table 2c
UXO 8
East Vieques Beaches Evaluation and Rationale for Sampling Approach
Master Sampling and Analysis Plan - East Vieques Terrestrial UXO Sites
Vieques, Puerto Rico

1	2	3	4	5									6							7			8			9					10
UXO	Beach	Site Screening Areas (i.e., PI/SWMUs, etc.) (Y=Yes, N=No)	Range/ Target Areas/ Gun Positions (Y=Yes, N=No)	Former Activity Features (quantity)									Munitions Type (x=occurs within beach)							Munitions Items Scoring			MEC Investigation Status	Is the Potential for Sampling Considered Based on Site Releases? (Yes/No)	Rationale	Receptor Exposure Scoring			Is the Potential for Sampling Considered Based on Receptor Exposure? (Yes/No)	Rationale	Is Sampling Proposed (Yes/No) If Yes, recommend samples	Rationale
				Range	Naval Gunfire Support Target Area	Target	Gun Position	LIDAR	Bulls-eye	Open Burn	Open Detonation	Sub-munitions Area	FP	B	G	P/M	R/G	S	MC	Quantity	Frequency	Total Munitions Score	Complete (Yes/No)			Human Health	Ecological	Total Receptor Score				
UXO 8	36 - Unnamed	N	N													X				2	1	3	No	No	Although higher quantity; munitions type is addressed with other sample units.	1	1	2	No	lower receptor score	No	No for both potential site releases and receptor
UXO 8	1 - Playa Matias/Yellow Beach	N	N										X			X	X		X	1	1	2	Yes	No	Lower munitions quantity, highest diversity of munitions	2	3	5	Yes	Highest receptor score for both human health and ecological sensitivity.	Yes SMI - 2 Discrete Soil - 2	Highest receptor score. See additional explanation on WS#17 for sampling approach and rationale.
UXO 8	17 - Playa Jalova	N	N													X	X		X	2	2	4	Yes	Yes	Higher munitions quantity and diversity of munitions	1	3	4	No	Lower receptor score	Yes SMI - 1 Discrete Soil - 1	Based on site releases. See additional explanation on WS#17 for sampling approach and rationale.
UXO 8	18 - Playa Jalovita	N	N										X							2	2	4	Yes	Yes	Diversity of munitions not addressed with other potential sampling units.	1	3	4	No	Lower receptor score	Yes SMI - 1 Discrete Soil - 1	Based on potential site releases. See additional explanation on WS#17 for sampling approach and rationale.
UXO 8	19 - Playa Yoye	N	N													X			X	1	1	2	Yes	No	Lower munitions quantity although clearance activities may not be complete; prior to investigation of beaches a re-evaluation of munitions quantities may be necessary to incorporate into the decision analysis.	1	2	3	No	Lower receptor score	No	No based on potential site releases and receptor evaluation.
UXO 8	20 - Playa Fanduca	N	N										X							1	1	2	Yes	No	Lower munitions quantity although clearance activities may not be complete; prior to investigation of beaches a re-evaluation of munitions quantities may be necessary to incorporate into the decision analysis.	1	2	3	No	Lower receptor score	No	No based on potential site releases and receptor evaluation
UXO 8	38 - Unnamed	N	N																	0	0	0	No	No	Lower munitions quantity although clearance activities may not be complete; prior to investigation of beaches a re-evaluation of munitions quantities may be necessary to incorporate into the decision analysis.	1	1	2	No	Lower receptor score	No	No based on potential site releases and receptor evaluation
UXO 8	39 - Punta Carenera	N	N																	0	0	0	No	No	Lower munitions quantity although clearance activities may not be complete; prior to investigation of beaches a re-evaluation of munitions quantities may be necessary to incorporate into the decision analysis.	1	1	2	No	Lower receptor score	No	No based on potential site releases and receptor evaluation
UXO 8	Cayo Conejo	N	N											X		X			X	1	1	2	No	No	Low munitions quantity	1	3	4	Yes	Ecological receptor score	Yes SMI - 1	Habitat for the endangered brown pelican. See additional explanation on WS#17 for sampling approach and rationale.

Table 3
Monitoring Well Nomenclature and Rationale
Master Sampling and Analysis Plan - East Vieques Terrestrial UXO Sites
Vieques, Puerto Rico

Database ID	Well ID	Decision Unit	Rationale
VE-EAST-MW01	MW-01	North UXO 4	Former mock target area (railroad tunnel), high density of munitions, potential depleted uranium area, northern portion of LIA
VE-EAST-MW02	MW-02	Central UXO 4	Vicinity of OB and OD areas, high density of munitions, central portion of LIA
VE-EAST-MW03	MW-03	Central UXO 4	Former targets (air strip), numerous craters, high density of munitions, central portion of LIA
VE-EAST-MW04	MW-04	Central UXO 4	Former targets (air strip), high density of munitions, central portion of LIA
VE-EAST-MW05	MW-05	East UXO 4	Former targets, numerous craters, high density of munitions, southern portion of LIA
VE-EAST-MW06	MW-06	East UXO 4	Potential migration pathway in south-eastern portion of LIA adjacent to the ECA
VE-EAST-MW07	MW-07	UXO 3 (LIA Roads)/Northwest UXO 4	Bulls Eye Target #1, CPC, high density of munitions, northwestern portion of LIA
VE-EAST-MW08	MW-08	Southwest UXO 4	Former target (strafing target), southwestern portion of LIA
VE-EAST-MW09	MW-09	UXO 5 (SIA Restricted Roads)/Northeast UXO 9	Located downgradient of former targets within SIA, adjacent to ephemeral streams to assess potential migration, northern portion of SIA
VE-EAST-MW10	MW-10	Northeast UXO 9	Located downgradient of former targets within SIA to assess potential migration, northeastern portion of SIA
VE-EAST-MW11	MW-11	UXO 5 (SIA Restricted Roads)/Southeast UXO 9	Located downgradient of former targets within SIA to assess potential migration, southeastern portion of SIA
VE-EAST-MW12	MW-12	UXO 5 (SIA Restricted Roads)/Northwest UXO 9	High density of munitionswithin SIA, located adjacent to Bulls Eye Target #2, northwestern portion of SIA
VE-EAST-MW13	MW-13	UXO 6 (EMA/SIA Public Roads)/South UXO 9	Located downgradient of former targets within SIA adjacent to ephemeral streams to assess potential migration, southern portion of SIA
VE-EAST-MW14	MW-14	South UXO 9	Located downgradient of former targets within SIA adjacent to ephemeral streams to assess potential migration, southeastern portion of SIA
VE-EAST-MW15	MW-15	UXO 11 (EMA Public Roads)/North UXO 12	Vicinity of a gun position, assess potential migration within EMA, northern portion of EMA
VE-EAST-MW16	MW-16	UXO 11 (EMA Public Roads)/North UXO 12	Vicinity of a gun position, assess potential migration within EMA, northern portion of EMA
VE-EAST-MW17	MW-17	UXO 11 (EMA Public Roads)/Northeast UXO 12	East-Central portion of EMA to assess potential migration
VE-EAST-MW18	MW-18	UXO 6 (EMA/SIA Public Roads)/Southeast UXO 12	Located downgradient of gun positions within southeastern portion of EMA to assess potential migration
VE-EAST-MW19	MW-19	UXO 6 (EMA/SIA Public Roads)/West Central UXO 12	Located downgradient of gun positions within southern portion of EMA to assess potential migration
VE-EAST-MW20	MW-20	UXO 6 (EMA/SIA Public Roads)/South Central UXO 12	Southwestern portion of EMA to assess potential migration
VE-EAST-MW21	MW-21	Northeast UXO 13	Located within range, northern portion of EMA
VE-EAST-MW22	MW-22	Central UXO 13	Assess potential migration within northern portion of EMA
VE-EAST-MW23	MW-23	UXO 11 (EMA Public Roads)/North Central UXO 13	Located within range, western portion of EMA to assess potential migration

Table 4
UXO 2 - Munitions Items Removed within Sampling Unit and Sampling Rationale
Master Sampling and Analysis Plan - East Vieques Terrestrial UXO Sites
Vieques, Puerto Rico

Sample ID	Sampling Unit	Quantity of MEC/MD Removed from Surface								DGM Data Available	Site Screening Areas (i.e., PI/SWMUs, etc.)	Former Activity Feature (i.e. ranges, gun positions, target areas)	Preferential Transport Pathway	Sample Rationale (in order of importance)
		Bombs	Flares/ Pyrotechnics	Grenades	MEC Components	Projectiles /Mortars	Rockets/ Guided Missiles	Submunitions	Scrap					
Decision Unit 1, LIA Beaches UXO 2														
VE-UXO2-1DU01	Playa Salinas Del Sur 1	0	0	0	0	1	0	0	3,568	X		X		High site release and receptor scores (Table 2a); where strafing target overlaps beach, high density of munitions, other LIA targets in vicinity
VE-UXO2-1DU02	Playa Salinas Del Sur 2	21	0	2	1	33	0	0	5,248	X		X		High site release and receptor scores (Table 2a); located adjacent to air-to-ground target and other LIA targets, highest density of munitions on beach
VE-UXO2-1DU03	Playa Carucho/Turtle Beach 1	9	0	21	0	64	0	7	6,042			X		High site release and receptor scores (Table 2a); located within Naval Gunfire Support Target Area and adjacent to air-to-ground target, other LIA targets in vicinity, highest density of munitions on beach
VE-UXO2-1DU04	Playa Carucho/Turtle Beach 2	7	1	0	0	5	0	0	1,047			X		High site release and receptor scores (Table 2a); located within Naval Gunfire Support Target Area and Target T3, other LIA targets in vicinity, high density of munitions on beach, drainage area from Laguna Anones
VE-UXO2-1DU05	Playa Carucho/Turtle Beach 3	0	0	0	0	1	0	0	130			X		High site release and receptor scores (Table 2a); high density of munitions on beach, located between Target T5 and Target T6
VE-UXO2-1DU06	Icacos/Playa Yallis 1	6	0	0	0	3	0	0	2,300					Trespassing activities (Table 2a); high density of munitions on beach, vicinity of strafing, bulls-eye, and LIA targets
VE-UXO2-1DU07	Icacos/Playa Yallis 2	9	0	0	0	0	0	0	2,799					Trespassing activities (Table 2a); high density of munitions on beach, adjacent to strafing, bulls-eye target, and other LIA targets
VE-UXO2-1DU08	Playa Salinas Norte/Fossil 1	7	1	0	0	0	0	0	40					High site release score (Table 2a); high density of munitions on beach, adjacent to LIA targets

Table 9
UXO 7 - Munitions Items Removed within Sampling Unit and Sample Rationale
Master Sampling and Analysis Plan - East Vieques Terrestrial UXO Sites
Vieques, Puerto Rico

Sample ID	Sampling Unit	Quantity of MEC/MD Removed from Surface								DGM Data Available	Site Screening Areas (i.e., PI/SWMUs, etc.)	Former Activity Feature (i.e. ranges, gun positions, target areas)	Preferential Transport Pathway	Sample Rationale (in order of importance)
		Bombs	Flares/ Pyrotechnics	Grenades	MEC Components	Projectiles /Mortars	Rockets/ Guided Missiles	Submunitions	Scrap					
UXO 7														
Decision Unit 1 - UXO 7 EMA/SIA North Beaches														
VE-UXO7-1DU01	22 -Diablo 1	48	0	0	0	0	0	0	40	X			X	High site release and receptor scores (Table 2b); Bulls-eye target #2 in vicinity, high density of MEC, downgradient of ephemeral stream
VE-UXO7-1DU02	22 -Diablo 2	0	0	0	0	1	0	0	9	X			X	High site release and receptor scores (Table 2b); downgradient of two ephemeral streams, higher density of subsurface munitions, Bulls-eye target #2 in vicinity
VE-UXO7-1DU03	24 - Playa Compania/Purple Beach 1	0	0	0	0	0	0	0	57	X	X	X		High site release and receptor scores (Table 2b); PAOC Site and occurs within range boundary
VE-UXO7-1DU04	24 - Playa Compania/Purple Beach 2	0	0	0	0	0	0	0	5	X			X	High site release and receptor scores (Table 2b); high diversity of subsurface munitions; ephemeral stream
VE-UXO7-1DU05	Beach 33	0	0	0	0	0	0	0	795	X				High receptor scores (Table 2b); much higher number of munitions debris relative to number of MEC

Table 10
UXO 8 - Munitions Items Removed within Sampling Unit and Sample Rationale
Master Sampling and Analysis Plan - East Vieques Terrestrial UXO Sites
Vieques, Puerto Rico

Sample ID	Sampling Unit	Quantity of MEC/MD Removed from Surface								DGM Data Available	Site Screening Areas (i.e., PI/SWMUs, etc.)	Former Activity Feature (i.e. ranges, gun positions, target areas)	Preferential Transport Pathway	Sample Rationale (in order of importance)
		Bombs	Flares/ Pyrotechnics	Grenades	MEC Components	Projectiles /Mortars	Rockets/ Guided Missiles	Submunitions	Scrap					
UXO 8														
Decision Unit 1 - UXO 8 SIA South Beaches														
VE-UXO8-1DU01	17 - Playa Jalova	0	0	0	1	2	0	0	34	X			X	High site release score (Table 2c); higher density of subsurface munitions, ephemeral stream
VE-UXO8-1DU02	18 - Playa Jalovita	0	0	0	0	0	0	0	45	X			X	High site release score (Table 2c); located at both higher density of surface and subsurface munitions
VE-UXO8-1DU03	1 - Playa Matias/Yellow Beach	0	0	0	1	0	0	0	4	X			X	High receptor score (Table 2c); high density of subsurface munitions, ephemeral stream
VE-UXO8-1DU04	1 - Playa Matias/Yellow Beach	0	0	0	0	0	0	0	0	X			X	High receptor score (Table 2c); high density of subsurface munitions
VE-UXO8-1DU05	Cayo Conejo	3	0	0	0	1	0	0	1					Habitat for the endangered brown pelican

Table 19
MEC/MD Items Encountered at Each UXO Site and Their Constituents
Master Sampling and Analysis Plan - East Vieques Terrestrial UXO Sites
Vieques, Puerto Rico

Item Classification	UXO 2	UXO 3	UXO 4	UXO 5	UXO 6	UXO 7	UXO 8	UXO 9	UXO 10	UXO 11	UXO 12	UXO 13	UXO 14	UXO 15	UXO 17	UXO 18	Possible Munitions Constituents			
																	Primary Metal	Secondary Metal	Possible Additional Metal Constituents	Likely Explosive Filler
Bombs																				
AN-M30 (100lb)			X					X									Steel			Composition B or Tritonal
AN-M64 (500lb)			X	X				X									Steel			TNT or Composition B
AN-M65 (1000lb)			X														Steel			TNT or Composition B
BDU-33	X							X	X								Cast iron	Steel		Depends on signal
BDU-45	X	X	X					X									Steel	Aluminum		Concrete
BDU-48			X														Steel			Depends on signal
BDU-50		X	X								X						Steel			Concrete
M117 (750lb)			X														Steel			Tritonal, H6, or minol
MB2 (Old-style)			X														Unable to find information on this item			
MK-106 (5lb)/BDU-48 (10lb)	X	X	X					X	X	X	X						Steel, maybe tin			Depends on signal
MK-23 (Old-style)	X	X	X														Cast iron			
MK-76/BDU 33 (25lb)	X	X	X	X	X	X	X	X	X	X	X						Cast iron	Steel		
MK-77 (Firebomb)		X		X				X	X								Aluminum			Napalm
MK-78 (Firebomb)							X	X	X								Sheet steel			Napalm
MK-81 (250lb)	X		X					X	X								Steel	Aluminum		Composition H6 or Tritonal
MK-82 (500lb)	X	X	X	X	X	X		X	X		X						Steel	Aluminum		Composition H6 or Tritonal
MK-82 (500lb) and BDU-45	X	X	X														Steel	Aluminum		Concrete
MK-83 (1000lb)	X	X	X	X				X									Steel	Aluminum		Composition H6 or Tritonal
MK-84 (2000lb)	X	X	X					X									Steel	Aluminum		Composition H6 or Tritonal
Flares/Pyrotechnics																				
MK-24 Flare (Parachute)	X		X				X	X	X		X	X	X				Aluminum			Illuminating Mixture
MK-25 Flare (Marine Marker)	X		X			X		X									Aluminum			Pyrotechnic Mixture
MK-45 Flare (Aircraft)	X	X	X					X	X		X						Aluminum			Illuminating Mixture
Grenades																				
40mm Projected Grenade	X	X	X	X				X		X	X	X	X				Aluminum	Steel	Gilding metal	Octol or Composition B
Hand Grenade	X							X	X	X	X	X	X	X			Steel (likely)			Composition B (likely)
Projectiles/Mortars																				
105mm Projectile	X	X	X	X		X	X	X	X	X	X	X	X	X			Steel		Gilding metal	TNT or Composition B
106mm Projectile	X		X	X	X	X	X	X	X		X	X	X	X			Steel	Copper	Aluminum	Composition B
107mm Mortar									X								Steel			TNT
155mm Projectile	X	X	X	X		X	X	X	X	X	X		X				Steel		Gilding metal	TNT or Composition B
16" / 50		X	X														Steel		Gilding metal	Explosive D
175mm Projectile			X						X								Steel		Gilding metal	Composition B
20mm Projectile	X	X	X	X	X	X	X	X	X	X	X		X				Steel		Gilding metal	Tetryl
25mm Projectile	X	X	X					X	X		X						Steel		Gilding metal	RDX
27mm Projectile			X														Unable to find information on this item			
3" Projectile				X				X	X								Steel		Gilding metal	Explosive D
3"/50 (MK-27, MK-29, MK-33)	X	X	X	X	X	X	X	X	X		X	X	X				Steel		Gilding metal	Explosive D
30mm Projectile	X	X	X	X		X	X	X					X				Steel		Gilding metal	RDX
37mm Projectile		X	X					X	X		X						Steel		Gilding metal	TNT
4.2" Mortar			X	X		X		X	X		X						Steel			TNT
4.5" / 38(UK)	X	X	X				X	X	X								Steel		Gilding metal	Composition B
40mm Projectile	X	X	X	X		X		X	X		X	X	X		X		Steel		Gilding metal	Octol
5" / 54			X														Steel		Gilding metal	Explosive D or Composition A3
5" Projectile	X	X	X	X	X	X	X	X	X	X	X	X	X				Steel		Gilding metal	Explosive D or Composition A3

X Item identified at the site

Table 19
MEC/MD Items Encountered at Each UXO Site and Their Constituents
Master Sampling and Analysis Plan - East Vieques Terrestrial UXO Sites
Vieques, Puerto Rico

																	Possible Munitions Constituents			
Item Classification	**UXO 2**	**UXO 3**	**UXO 4**	**UXO 5**	**UXO 6**	**UXO 7**	**UXO 8**	**UXO 9**	**UXO 10**	**UXO 11**	**UXO 12**	**UXO 13**	**UXO 14**	**UXO 15**	**UXO 17**	**UXO 18**	**Primary Metal**	**Secondary Metal**	**Possible Additional Metal Constituents**	**Likely Explosive Filler**
6" Projectile								X									Steel		Gilding metal	Explosive D
60mm Mortar	X	X	X	X	X	X		X	X	X	X	X					Pearlitic malleable iron	Aluminum		Composition B
75mm Projectile	X	X	X	X	X	X	X	X	X	X	X						Steel		Gilding metal	TNT or Composition B
76mm Projectile			X	X				X	X	X							Steel		Gilding metal	Composition B
8" Projectile	X		X			X		X	X		X						Steel		Gilding metal	TNT or Composition B
81mm Mortar	X	X	X	X	X	X	X	X	X	X	X	X	X				Steel		Aluminum	Composition B
90mm Projectile	X	X	X	X	X	X	X	X	X	X	X						Steel		Gilding metal	Composition B
Rockets/Guided Missiles																				
2.75" Rocket	X	X	X	X	X	X	X	X	X	X	X	X					Steel	Aluminum		Composition B
3.5" Rocket			X		X	X		X	X	X	X	X		X			Steel	Aluminum	Copper	Composition B
5" Rocket	X	X	X	X	X		X	X	X	X	X		X			X	Steel	Aluminum		Explosive D or Composition B
AT4 Rocket (84mm)		X	X														Steel	Aluminum		Octol
BGM-71 (TOW)			X					X									Steel (likely)	Aluminum		Octol
LAW (M72 66mm)					X			X				X					Steel	Aluminum		Octol
M47 Dragon Missile								X									Steel	Aluminum		Octol
Submunitions																				
BL-755 (UK No.1 MK1)		X	X														British submunition; do not have information on this item			
BLU-61			X														Steel			Octol
BLU-63	X	X	X														Steel			Cyclotol
BLU-77	X	X	X														Steel (likely)	Aluminum		Octol
BLU-97	X	X	X														Steel	Aluminum	Zirconium	Cyclotol
M39			X														Steel	Aluminum		Composition A5
MK-118	X	X	X	X													Steel	Aluminum	Copper	Composition B
MK-20 Submunition Dispenser			X														Aluminum	Steel		Submuntions
SUU-30 Submunition Dispenser			X														Steel	Aluminum		Submunitions
SUU-40 Submunition Dispenser								X									Steel	Aluminum		Submunitions
Other																				
Flare									X								Unknown; not enough information available about			Pyrotechnic mixture (likely)
Fuze w/Booster									X								Unknown; not enough information available about			Tetryl (likely)

X Item identified at the site

Figures

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 1 - Regional Location Map.mxd11/6/2012fcain

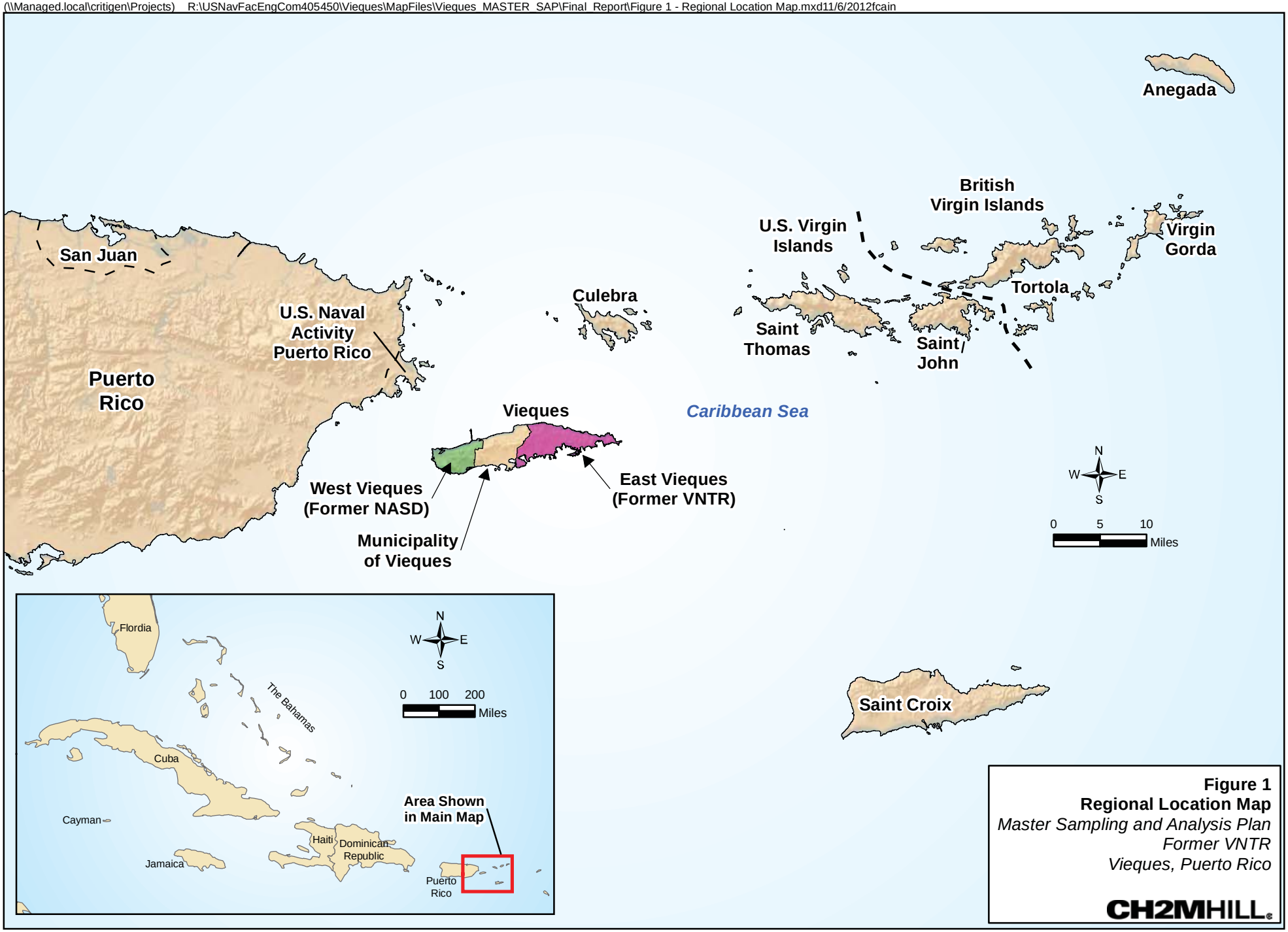


Figure 1
Regional Location Map
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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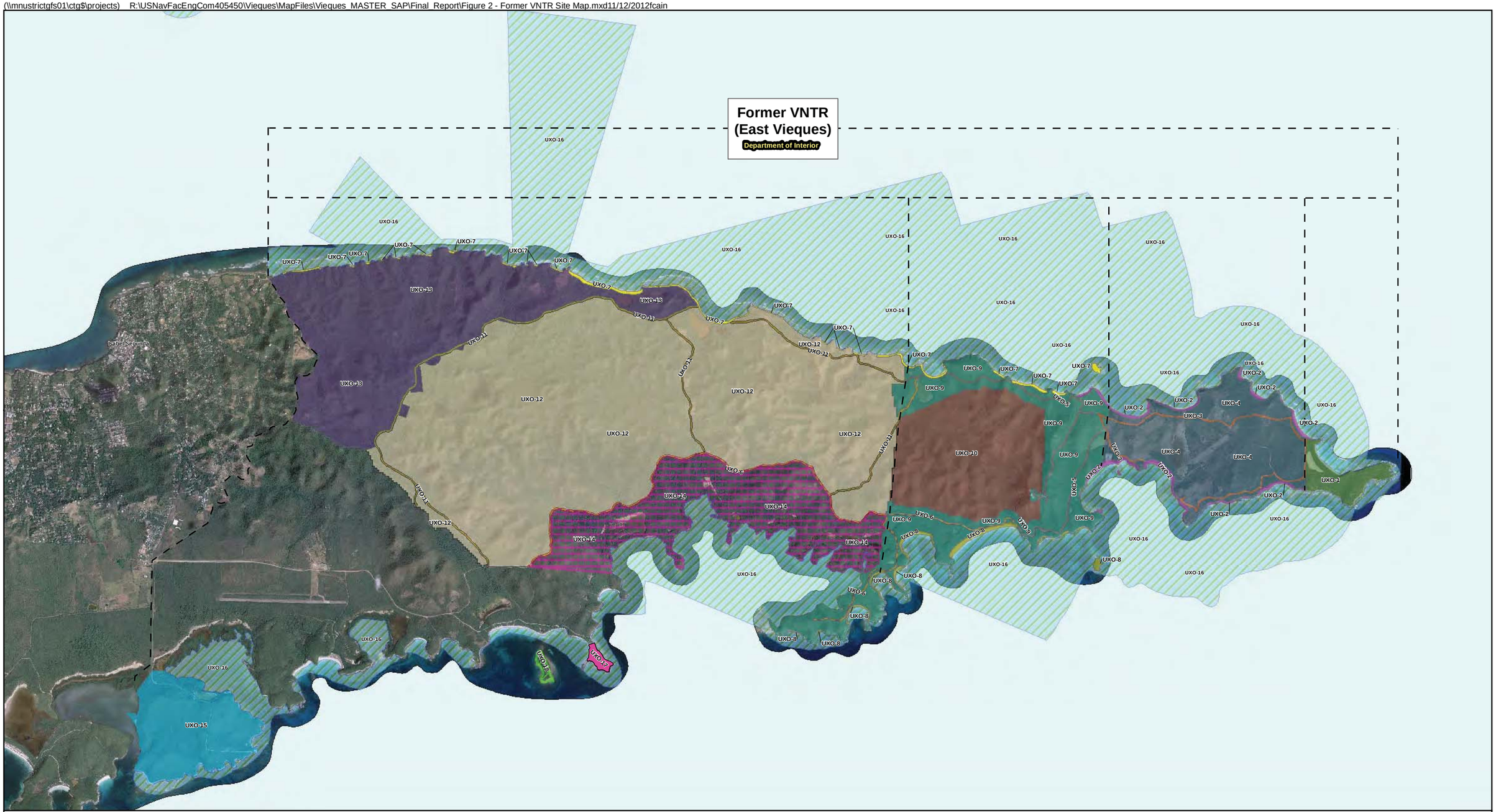
(\\mnustrictgfs01\ctg$\projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 2 - Former VNTR Site Map.mxd11/12/2012fcain



Legend

- UXO 1 - ECA
- UXO 2 - LIA Beaches
- UXO 3 - LIA Roads
- UXO 4 - LIA Interior
- UXO 5 - SIA Restricted Roads
- UXO 6 - EMA/SIA Public Roads
- UXO 7 - EMA/SIA North Beaches
- UXO 8 - SIA South Beaches
- UXO 9 - SIA Exterior
- UXO 10 - SIA Interior
- UXO 11 - EMA Public Roads
- UXO 12 - EMA Interior
- UXO 13 - EMA West
- UXO 14 - EMA South
- UXO 15 - Puerto Ferro (Expanded Site Inspection)
- UXO 16 - Underwater Areas
- UXO-17 - PAOC EE
- UXO 18 - Cayo de la Chiva

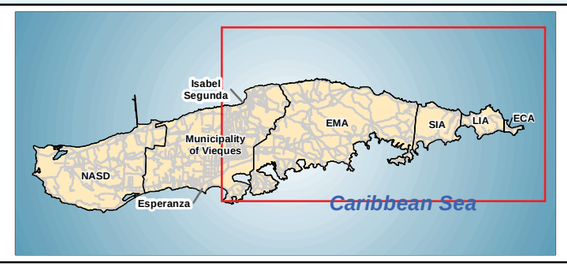


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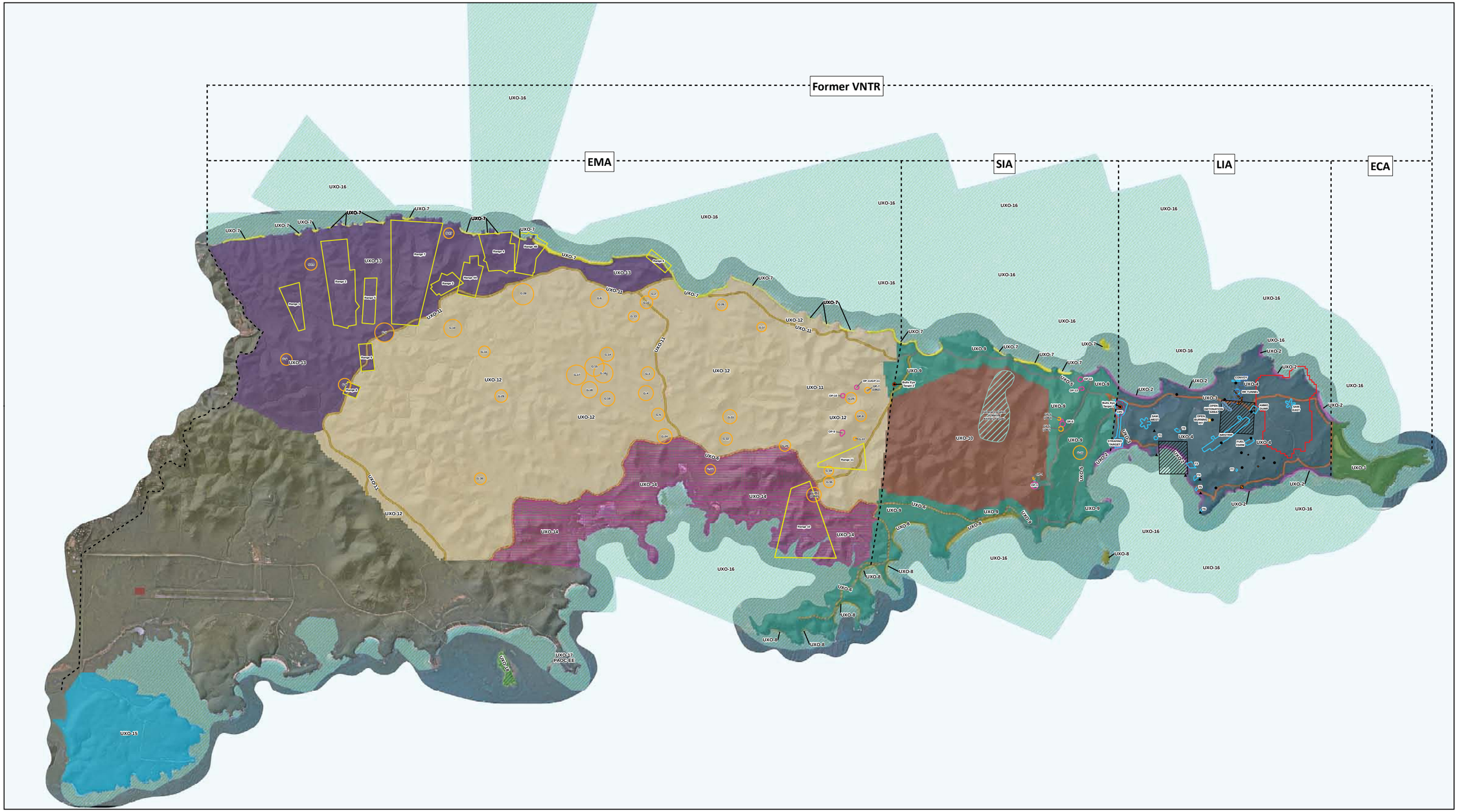
Figure 2
Former VNTR Site Map
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL


Former VNTR
EMA
SIA
LIA
ECA
UXO-1
UXO-2
UXO-3
UXO-4
UXO-5
UXO-6
UXO-7
UXO-8
UXO-9
UXO-10
UXO-11
UXO-12
UXO-13
UXO-14
UXO-15
UXO-16
UXO-17
PAOC-EE
Range 1
Range 2
Range 3
Range 4
Range 4A
Range 4B
Range 5
Range 6
Range 7
Range 8
Range 9
Range 11
Range 18
Bulls Eye Target 1
Bulls Eye Target 2
STRATEGIC TARGET
CONVOY
MR TUNNEL
OPEN DETONATION AREA
OPEN BURNING PIT
AMMO DUMP
SAFE EAST
SAFE WEST
AMTRAC
FIRE PROT
PUBLIC ROAD
Depleted Uranium Area
Munitions Response Area
Munitions Response Area - Underwater Areas
Munitions Response Area - Cayo de la Chiva
OP-1
OP-2
OP-3
OP-4
OP-5
OP-6
OP-7
OP-8
OP-9
OP-10
OP-11
OP-12
OP-13
OP-14
OP-15
OP-16
OP-17
OP-18
OP-19
OP-20
OP-21
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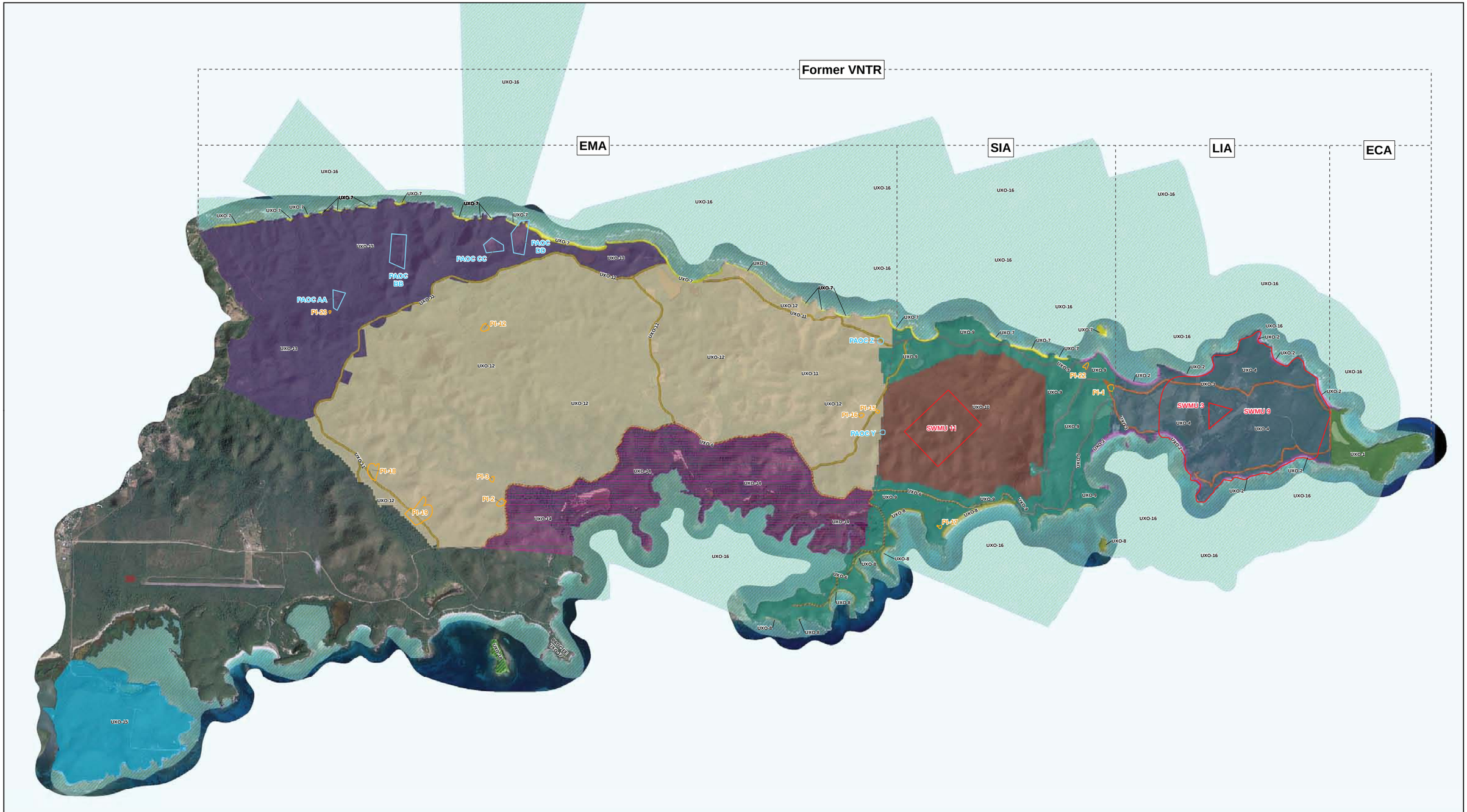
OP-37
OP-38
OP-39
OP-40

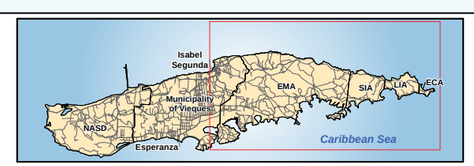


Legend

- Photo Identified Area
- Preliminary Area of Concern
- Solid Waste Management Unit

Munitions Response Sites

- UXO 1 - ECA
- UXO 2 - LIA Beaches
- UXO 3 - LIA Roads
- UXO 4 - LIA Interior
- UXO 5 - SIA Restricted Roads
- UXO 6 - EMA/SIA Public Roads
- UXO 7 - EMA/SIA North Beaches
- UXO 8 - SIA South Beaches
- UXO 9 - SIA Exterior
- UXO 10 - SIA Interior
- UXO 11 - EMA Public Roads
- UXO 12 - EMA Interior
- UXO 13 - EMA West
- UXO 14 - EMA South
- UXO 15 - Puerto Ferro
- UXO 16 -Underwater Areas
- UXO 17 - FAOC-EE/PI-21
- UXO 18 - Cayo de la Chiva



N
W E
S

0 1,500 3,000
Feet

Figure 4
Site Screening Areas - Munitions Response Sites
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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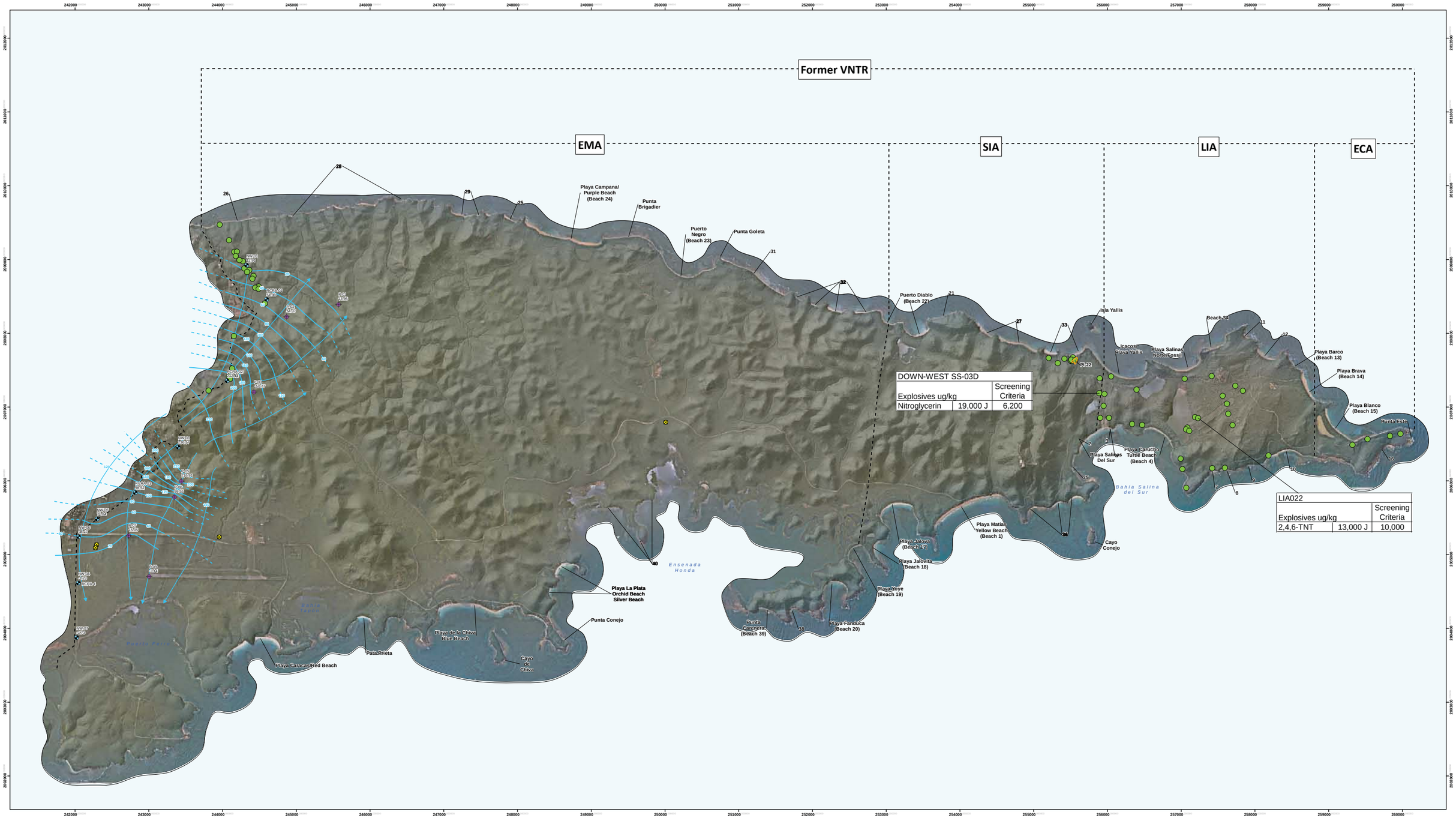
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 4 - Site Screening Areas.mxd11/6/2012fcain
ES011413081845TPA Figure 4 - Site Screening Areas.ai



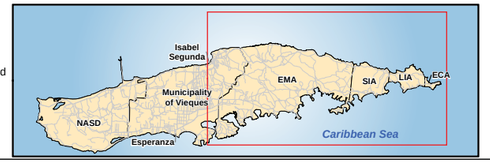
- Peizometer with posted Groundwater Elevation (MSL)(Baker, 1999)
  Note P-03 could not be relocated and is believed to be destroyed.
- Monitoring Well with posted Groundwater Elevation (MSL) (Baker, 1999)
  Note RCRA-04, NW-04, and RCRA-02 could not be relocated and are believed to be destroyed.
- Previous Surface Soil Sample
- Water Supply Well Abandoned or Not Found

2005 Aerial Imagery
2005 Hillshade

- Inferred Groundwater Elevation Contour (Baker, 1999)
- Interpreted Groundwater Elevation Contour (Baker, 1999)
- Interpreted Groundwater Flow Direction (Baker, 1999)
- Photo Identified Site

Note:
(MSL) - Mean Sea Level

The screening criteria are the most conservative screening levels identified in WS 15.



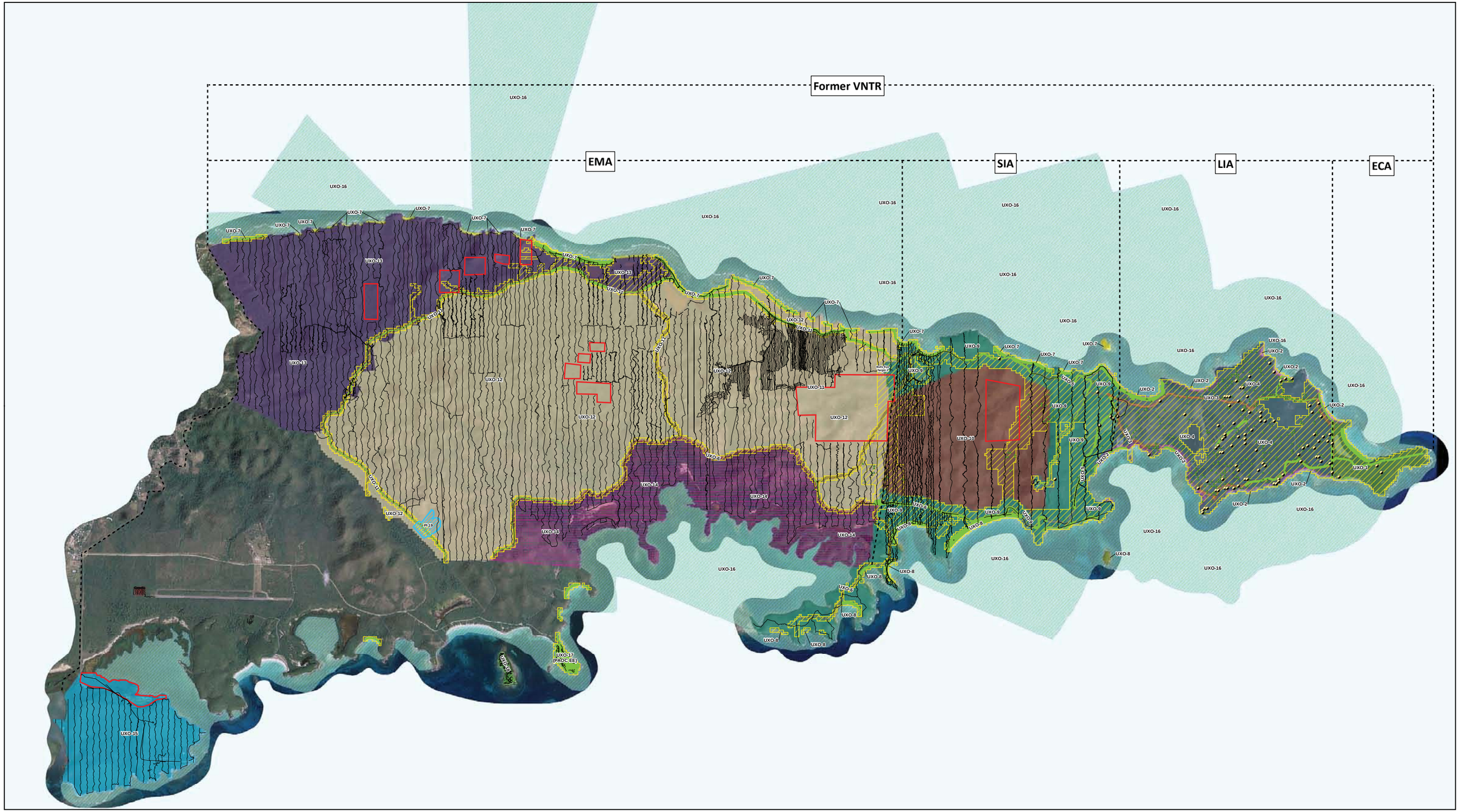
N W E S

0 1,500 3,000 4,500 6,000 Feet

Figure 5
Previous Environmental Investigation Information
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

ES011413081845TPA Figure 5 - Previous Environmental Investigation Information.ai



Legend

- MEC Investigation Transects
- Phase 1 MEC Investigation Area (Refer to Appendix A)
- Site screening area (PI 19)
- Consolidation Point
- Detonation Area
- DGM Coverage
- TCRA and NTCRA Activities

Munitions Response Sites

- UXO 1 - ECA
- UXO 2 - LIA Beaches
- UXO 3 - LIA Roads
- UXO 4 - LIA Interior
- UXO 5 - SIA Restricted Roads
- UXO 6 - EMA/SIA Public Roads
- UXO 7 - EMA/SIA North Beaches
- UXO 8 - SIA South Beaches
- UXO 9 - SIA Exterior
- UXO 10 - SIA Interior
- UXO 11 - EMA Public Roads
- UXO 12 - EMA Interior
- UXO 13 - EMA West
- UXO 14 - EMA South
- UXO 15 - Puerto Ferro
- UXO 16 -Underwater Areas
- UXO 17 - PAOC-EE
- UXO 18 - Cayo de la Chiva

2007 Aerial Imagery

N
W E
S

0 1,500 3,000 4,500 6,000 Feet

Figure 6
MEC Investigation Transects, Controlled Detonation Areas, and Digital Geophysical Mapping Coverage
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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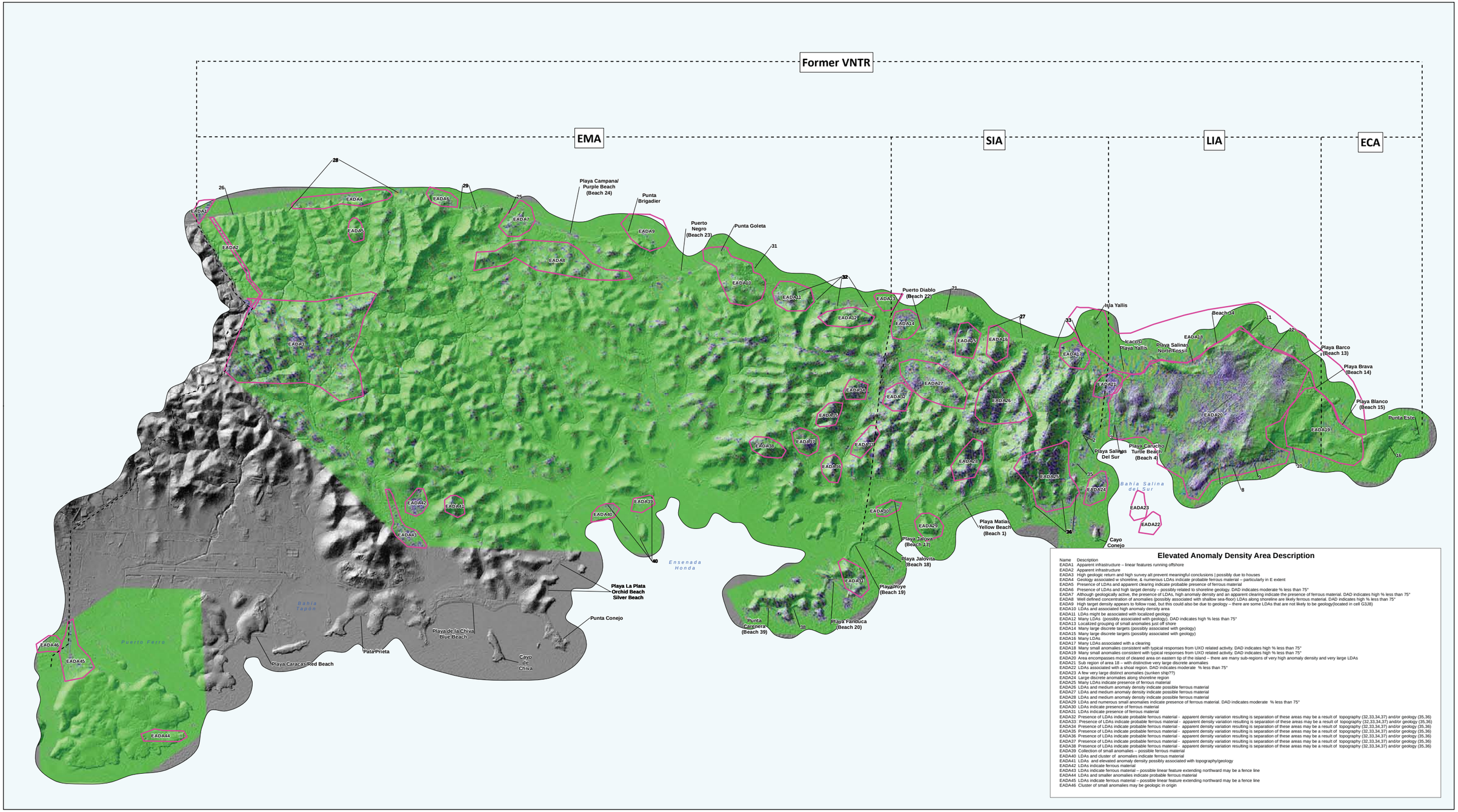
ES011413081845TPA Figure 6 - MEC_Investigation_Transects_and_DGM_Coverage.ai



Elevated Anomaly Density Area Description

Name	Description
EADA1	Apparent infrastructure – linear features running offshore
EADA2	Apparent infrastructure
EADA3	High geologic return and high survey alt prevent meaningful conclusions | possibly due to houses
EADA4	Geology associated w shoreline, & numerous LDAs indicate probable ferrous material – particularly in E extent
EADA5	Presence of LDAs and apparent clearing indicate probable presence of ferrous material
EADA6	Presence of LDAs and high target density – possibly related to shoreline geology. DAD indicates moderate % less than 75°
EADA7	Although geologically active, the presence of LDAs, high anomaly density and an apparent clearing indicate the presence of ferrous material. DAD indicates high % less than 75°
EADA8	Well defined concentration of anomalies (possibly associated with shallow sea-floor) LDAs along shoreline are likely ferrous material. DAD indicates high % less than 75°
EADA9	High target density appears to follow road, but this could also be due to geology – there are some LDAs that are not likely to be geology(located in cell G3J8)
EADA10	LDAs and associated high anomaly density area
EADA11	LDAs might be associated with localized geology
EADA12	Many LDAs (possibly associated with geology). DAD indicates high % less than 75°
EADA13	Localized grouping of small anomalies just off shore
EADA14	Many large discrete targets (possibly associated with geology)
EADA15	Many large discrete targets (possibly associated with geology)
EADA16	Many LDAs
EADA17	Many LDAs associated with a clearing
EADA18	Many small anomalies consistent with typical responses from UXO related activity. DAD indicates high % less than 75°
EADA19	Many small anomalies consistent with typical responses from UXO related activity. DAD indicates high % less than 75°
EADA20	Area encompasses most of cleared area on eastern tip of the island – there are many sub-regions of very high anomaly density and very large LDAs
EADA21	Sub region of area 18 – with distinctive very large discrete anomalies
EADA22	LDAs associated with a shoal region. DAD indicates moderate % less than 75°
EADA23	A few very large distinct anomalies (sunken ship??)
EADA24	Large discrete anomalies along shoreline region
EADA25	Many LDAs indicate presence of ferrous material
EADA26	LDAs and medium anomaly density indicate possible ferrous material
EADA27	LDAs and medium anomaly density indicate possible ferrous material
EADA28	LDAs and medium anomaly density indicate possible ferrous material
EADA29	LDAs and numerous small anomalies indicate presence of ferrous material. DAD indicates moderate % less than 75°
EADA30	LDAs indicate presence of ferrous material
EADA31	LDAs indicate presence of ferrous material
EADA32	Presence of LDAs indicate probable ferrous material - apparent density variation resulting is separation of these areas may be a result of topography (32,33,34,37) and/or geology (35,36)
EADA33	Presence of LDAs indicate probable ferrous material - apparent density variation resulting is separation of these areas may be a result of topography (32,33,34,37) and/or geology (35,36)
EADA34	Presence of LDAs indicate probable ferrous material - apparent density variation resulting is separation of these areas may be a result of topography (32,33,34,37) and/or geology (35,36)
EADA35	Presence of LDAs indicate probable ferrous material - apparent density variation resulting is separation of these areas may be a result of topography (32,33,34,37) and/or geology (35,36)
EADA36	Presence of LDAs indicate probable ferrous material - apparent density variation resulting is separation of these areas may be a result of topography (32,33,34,37) and/or geology (35,36)
EADA37	Presence of LDAs indicate probable ferrous material - apparent density variation resulting is separation of these areas may be a result of topography (32,33,34,37) and/or geology (35,36)
EADA38	Presence of LDAs indicate probable ferrous material - apparent density variation resulting is separation of these areas may be a result of topography (32,33,34,37) and/or geology (35,36)
EADA39	Collection of small anomalies – possible ferrous material
EADA40	LDAs and cluster of anomalies indicate ferrous material
EADA41	LDAs and elevated anomaly density possibly associated with topography/geology
EADA42	LDAs indicate ferrous material
EADA43	LDAs indicate ferrous material – possible linear feature extending northward may be a fence line
EADA44	LDAs and smaller anomalies indicate probable ferrous material
EADA45	LDAs indicate ferrous material – possible linear feature extending northward may be a fence line
EADA46	Cluster of small anomalies may be geologic in origin

Legend

Elevated Anomaly Density Area

Total Magnetic Field - Demedian Filtered (nT)

-4.6 -2.3 0.0 1.9 3.8 5.8 7.7 9.6

2005 Aerial Imagery
2005 Hillshade

Notes:
Coordinate System - NAD 1983 UTM Zone 20 (Meters)

Aerial Magnetometer data providedby Sky Research.

N W E S

0 1,500 3,000 4,500 6,000 Feet

Figure 7
East Vieques Aerial Magnetometer Survey (AMS)
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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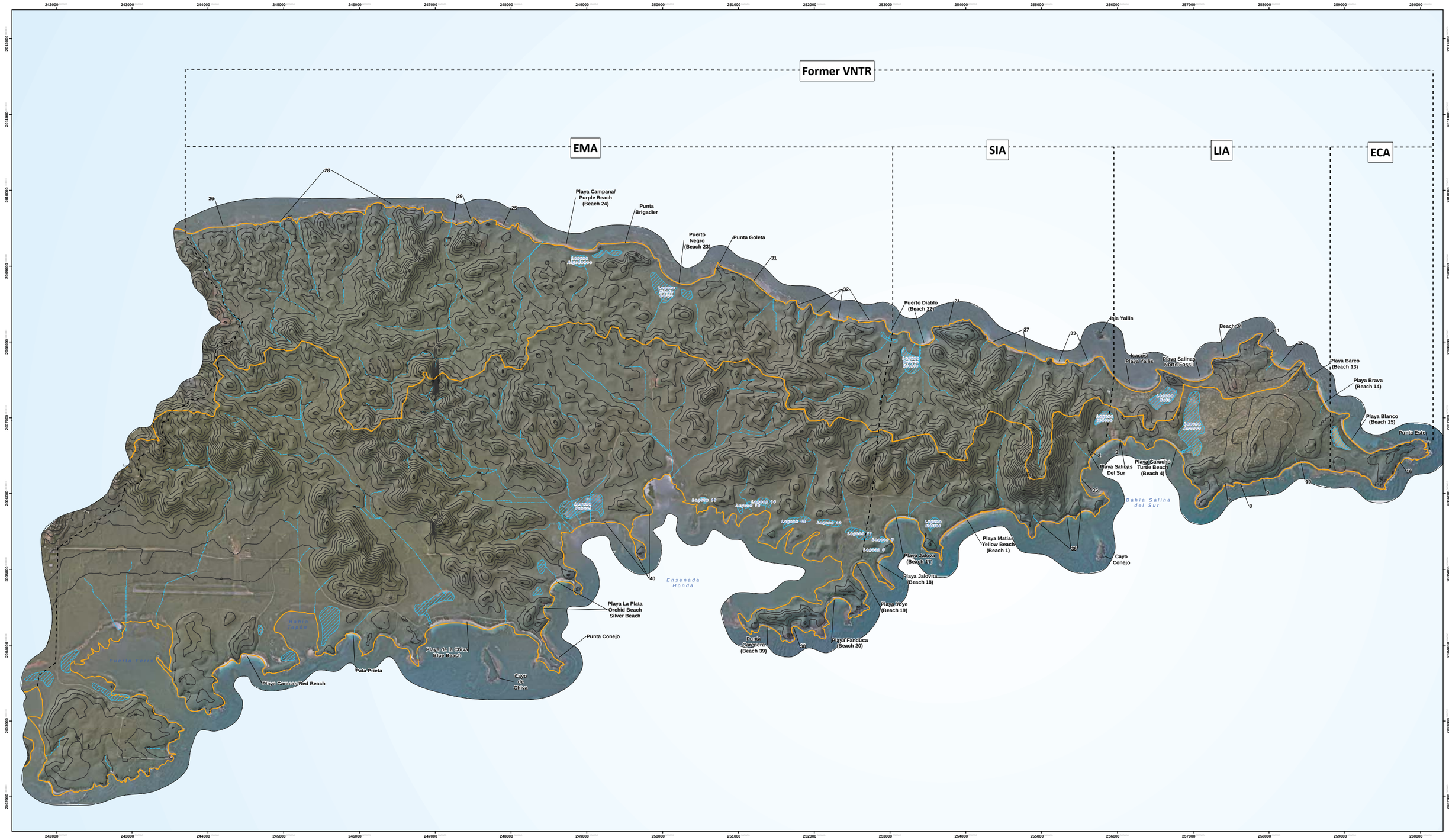
(Managed location\Digital\Projects) R:\S\ShawFedEngCom65x50\Vieques\Map\Files\Vieques_MASTER_SAP\Final_Report\Figure 7 - Aerial magnetometer survey (AMS).mxd11/6/2012\cain

ES011413081845TPA Figure 7 - Aerial magnetometer survey (AMS).ai



Legend

- Topographic Contours (10 Meter)
- Ephemeral Stream
- Lagoon
- North/South Drainage Divide
- Crater

2005 Aerial Imagery
2005 Hillshade

Notes:
Drainage Devide Source: Natural Resources Conservation Service.

Topographic Contours derived from United States Geological Survey 30 Meter Digital Elevation Model.

Stormwater Flow and Ephemeral Streams were derived from LiDAR topographic data using ESRI's Spatial Analyst Hydrology Tools.

Coordinate System - NAD 1983 UTM Zone 20 (Meters)

N
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0 1,500 3,000 4,500 6,000 Feet

Figure 8
East Vieques Topographic/Hydrologic Map
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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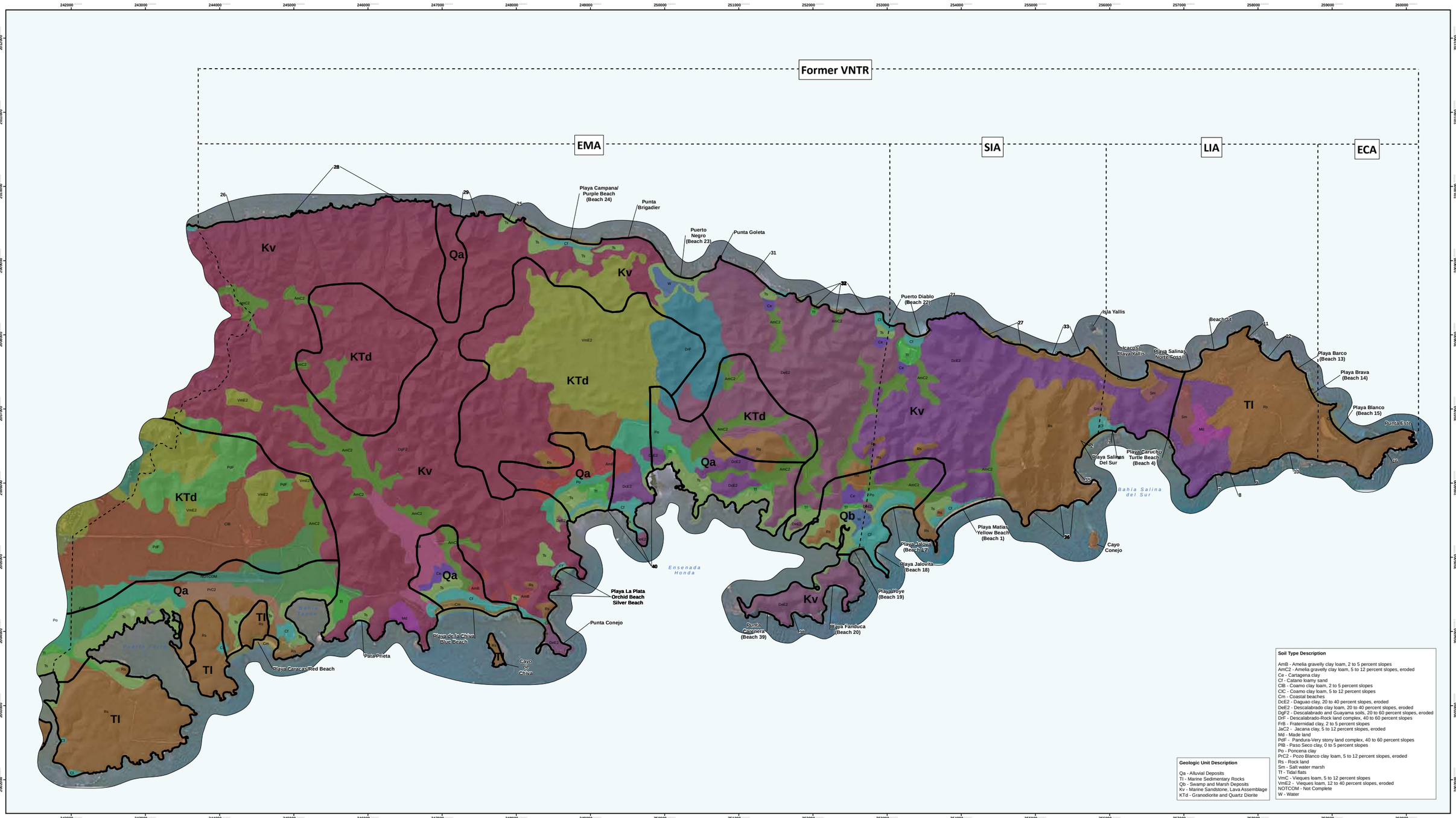


Legend

Geologic Unit

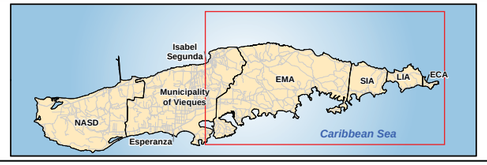
Soil Type

AmB, AmC2, Ce, Cf, CIB, CIC, Cm, DcE2, DeE2, DgF2, DrF, FrB, JaC2, Md, NOTCOM, PdF, PIB, Po, PrC2, Rs, Sm, Tl, Ts, VmC, VmE2, W

2005 Aerial Imagery
2005 Hillshade

Notes:
Soil Data Source - U.S. Department of Agriculture and Natural Resources Conservation Service

Coordinate System - NAD 1983 UTM Zone 20 (Meters)



N W E S

0 1,500 3,000 4,500 6,00 Feet

Figure 9
East Vieques Soil Type and Geologic Unit Map

Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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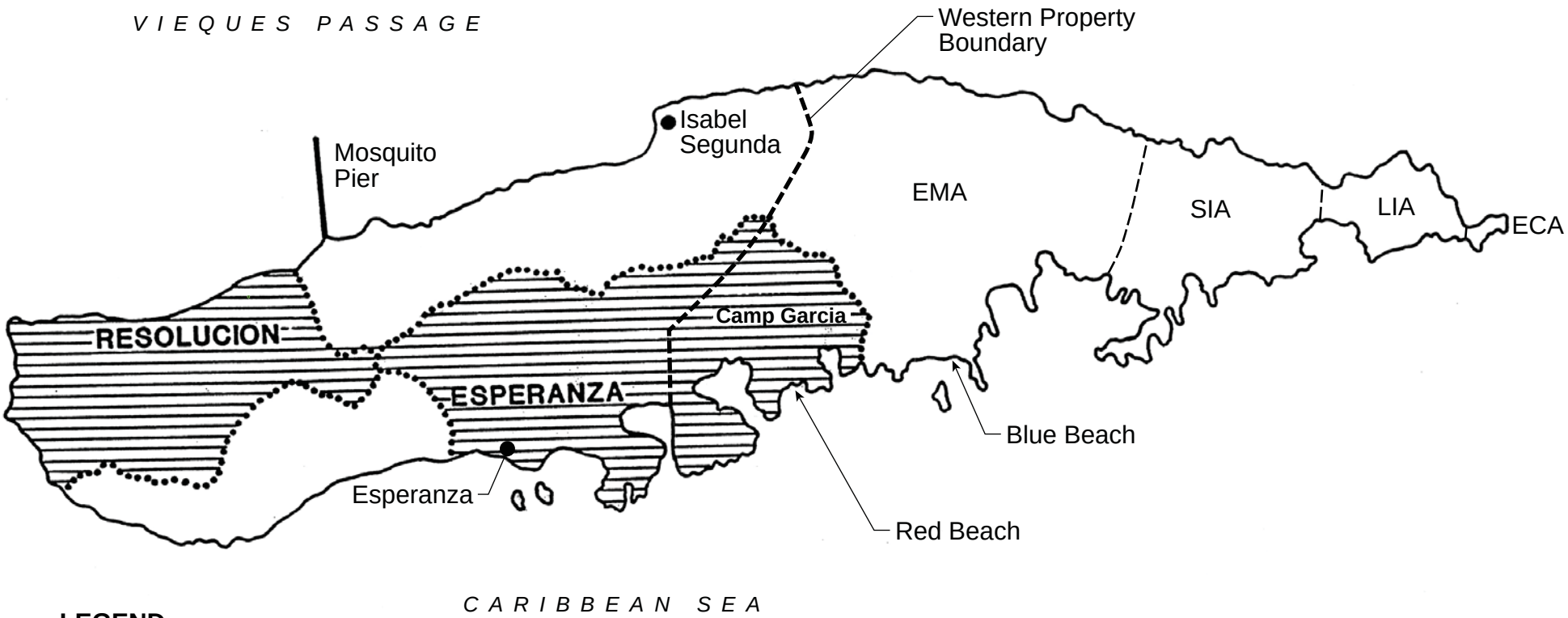
(\\Managed-local\cchillgen\Projects) R:\c25\aufEngCom\45450\ViequesMapFiles\Vieques_MASTER_SAP\Final_Report\Figure 9 - Eastern_Vieques_Soil-Geology_Map.mxd11/5/2012\main

ES011413081845TPA Figure 9 - Eastern_Vieques_Soil-Geology_Map.ai



LEGEND

Aquifer

EMA Eastern Maneuver Area
SIA Surface Impact Area
LIA Live Impact Area
ECA Eastern Conservation Area

0 1 2 3 4 KILOMETERS
0 1 2 3 4 MILES

(Reference: USGS, 1989)

FIGURE 10
Resolución and Esperanza Aquifers
Former VNTR
Vieques, Puerto Rico

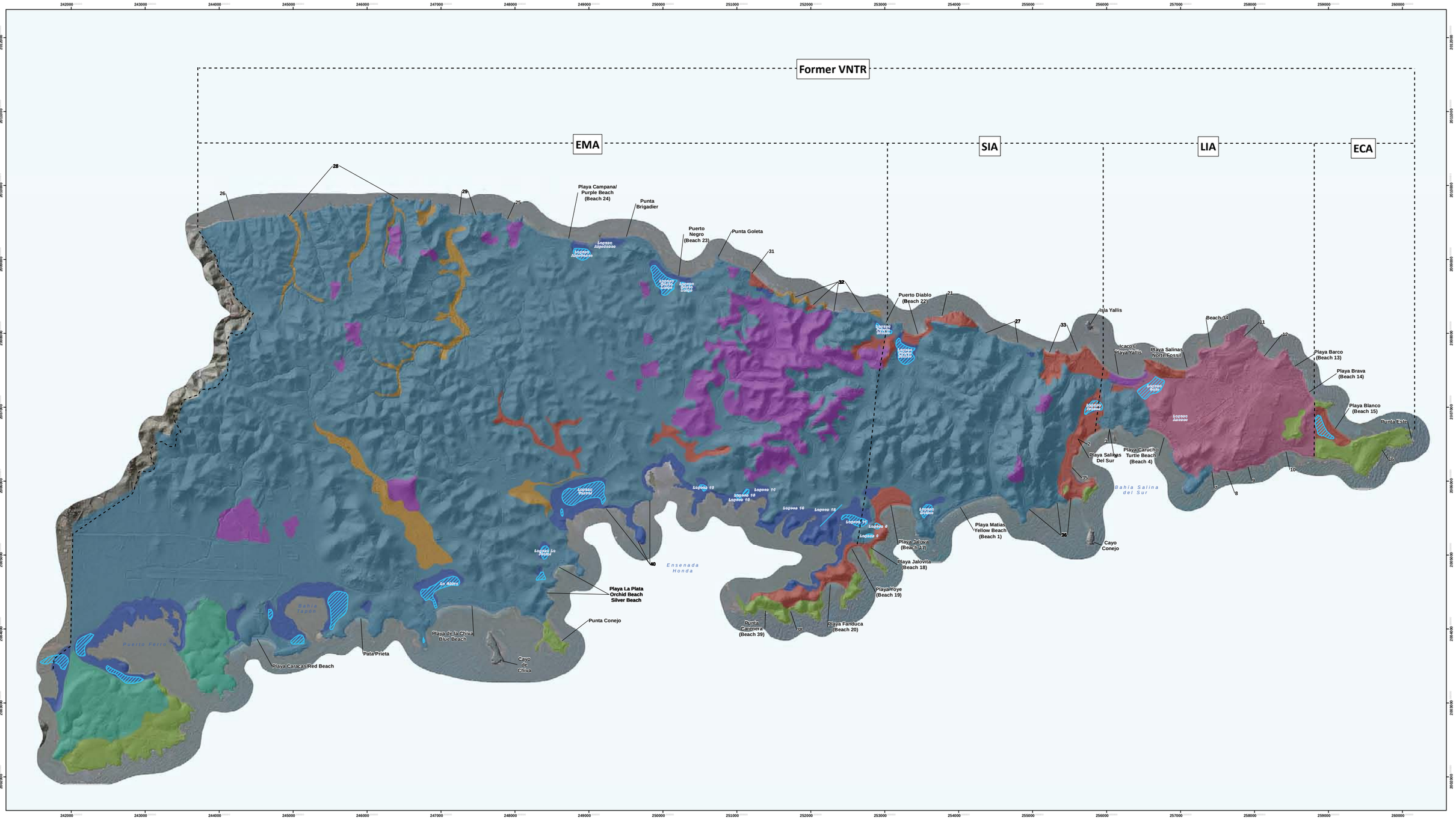


Figure 11
East Vieques General Habitat Map
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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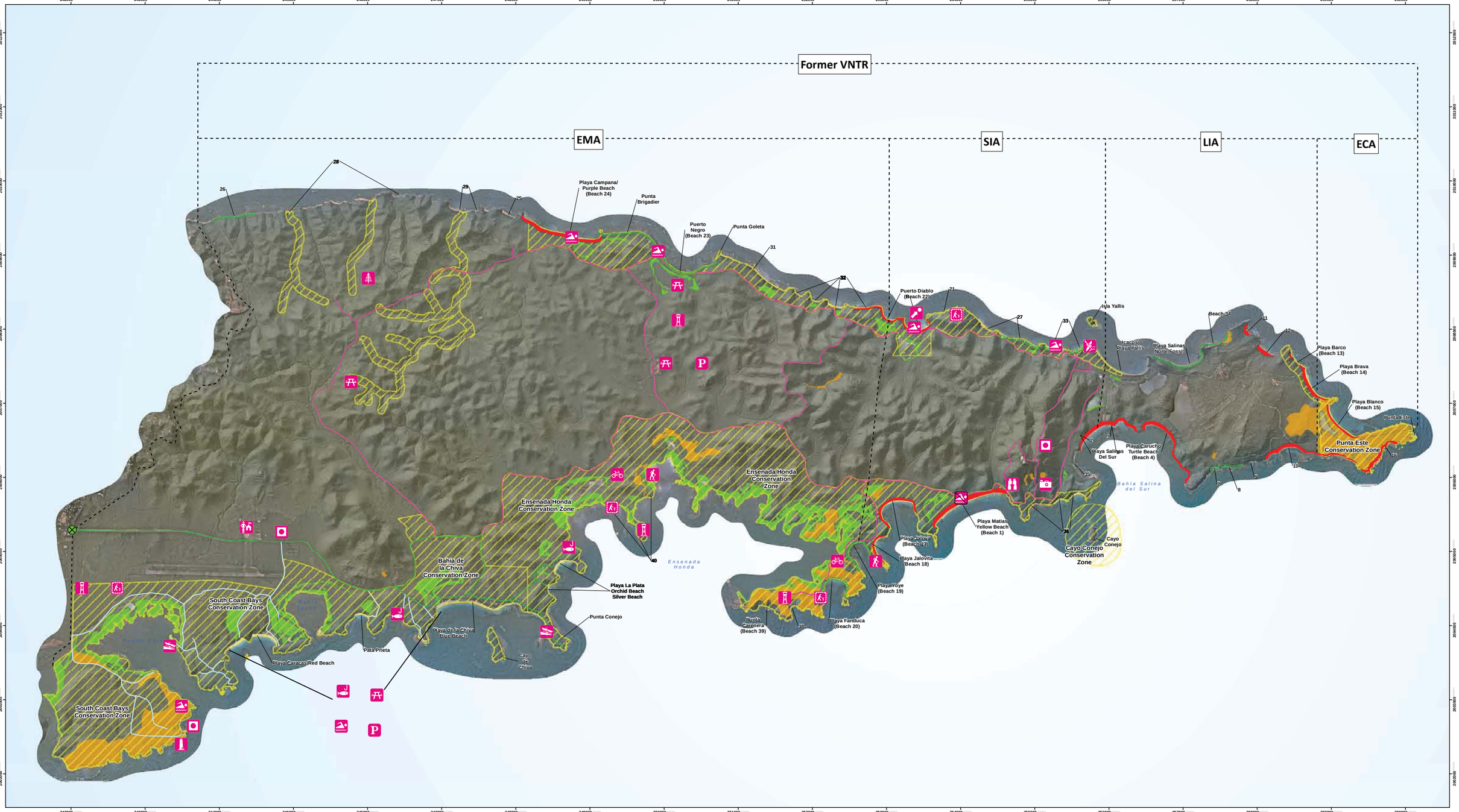
ES011413081845TPA Figure 11 - East_Vieques_Habitat_Map.ai



Legend

- Vehicle Public Use Road Open
- Proposed Hiking/Biking Interpretive Trail
- Vehicle Public Use Road Proposed
- Conservation Zone (Vieques INRMP 2003)
- Mangrove Habitat (Red, White, Black, Button)
- Undelineated Critical Habitat

Turtle Beach Setbacks
- Zone 2 - Minor Restrictions
- Zone 3 - Major Restrictions

Refuge Entrance, Beach Use, Bermuda Triangle Interpretive Site, Biking Trail, Fishermen's Launch Facilities, Fishing Access, Hiking Trail, Historic Site, Interpretive Trail, Kayaking, Faro Berdiales Lighthouse, Lookout Area, Binoculars, Observation Tower, Parking Area, Reforestation Area, Rest Area, Scenic View, Seasonal Beach Use, Beach Use, Visitor Contact Center

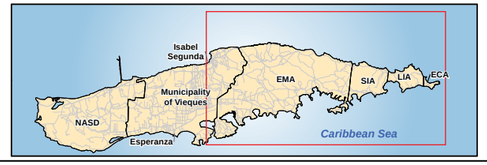
2005 Aerial Imagery
2005 Hillshade

Notes:
Land Use Source: United States Fish & Wildlife Service (USFWS). Draft Comprehensive Conservation Plan/Envrionmental Impact Statement for Vieques National Wildlife Refuge, Vieques, Puerto Rico. October 2006.

Note that the icon placement is not necessarily representative of the actual locations where the proposed recreational uses may occur.

Conservations Zones and Habitat data provided by Geo-marine.

Coordinate System - NAD 1983 UTM Zone 20 (Meters)



N W E S

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Figure 12
USFWS Land Use Plan
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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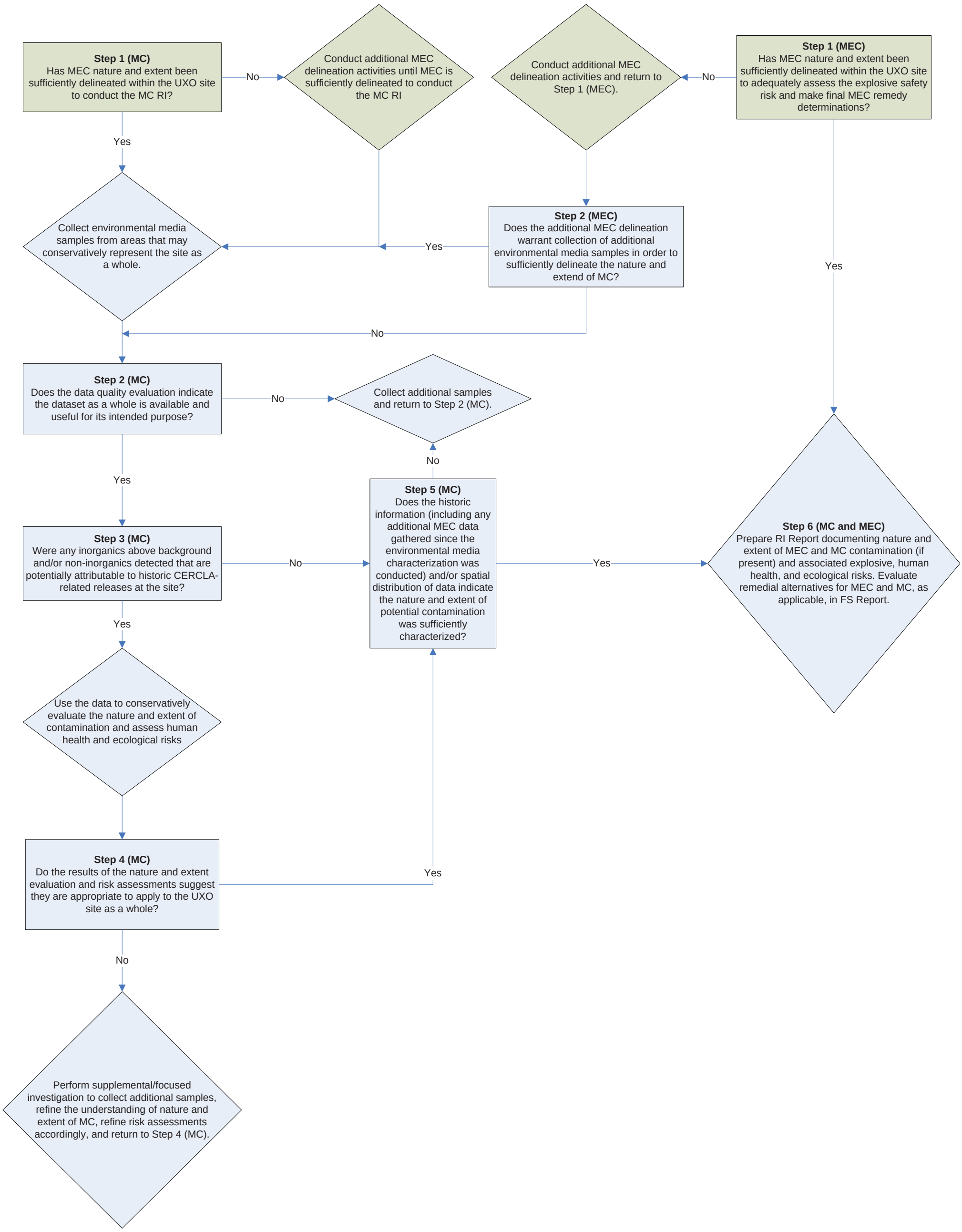
(\\Managed.local\critical\Projects) R:\US\NavFac\Eng\Cont\05-\60\Vieques\Map\Files\Vieques_MASTER_SAP\Final_Report\Figure 12 - Land Use Plan.mxd\11/6/2012\cam

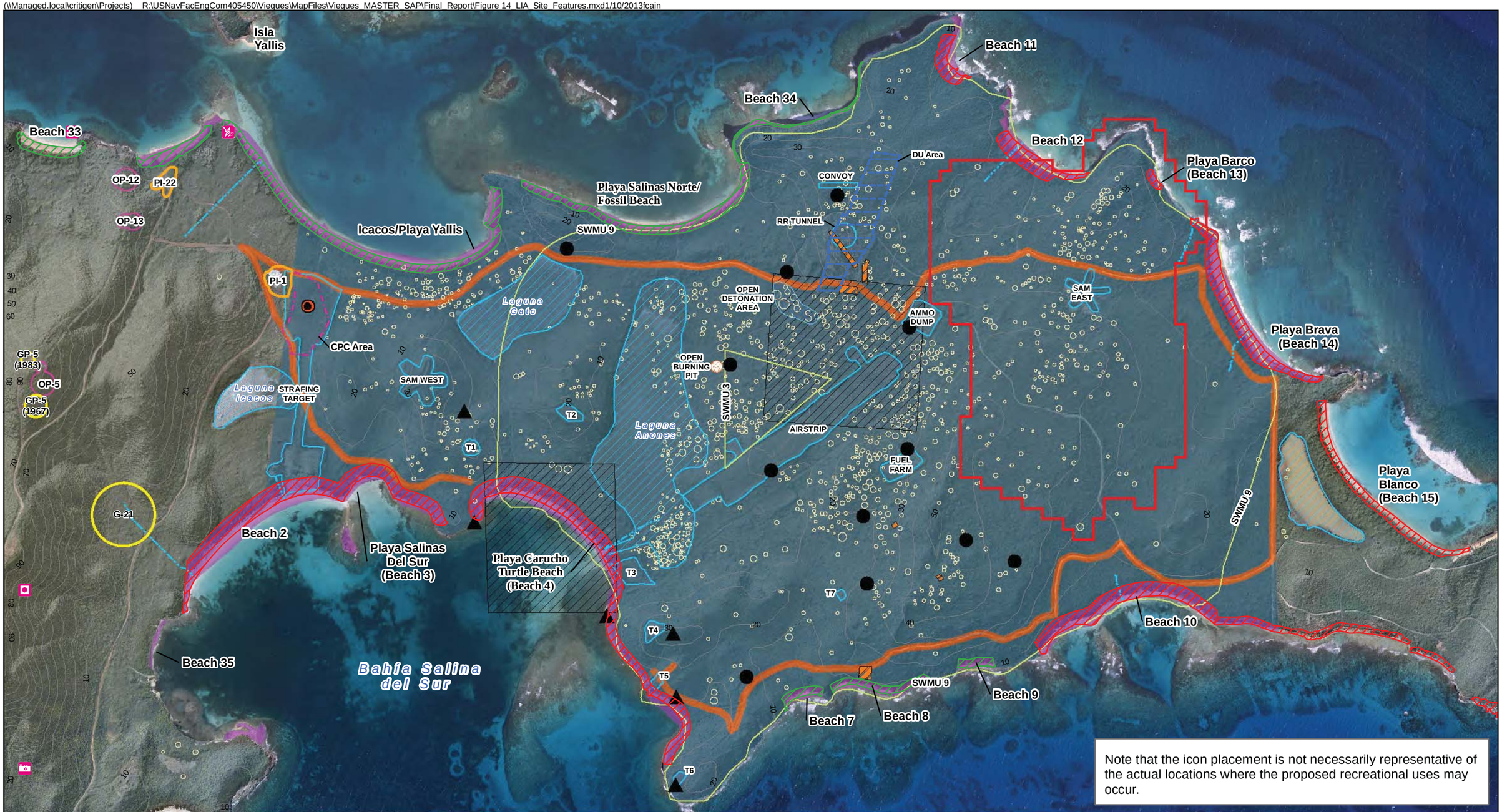
ES011413081845TPA Figure 12 - Land Use Plan.ai



Notes:
The decision makers associated with this decision tree are the Navy, USEPA, PREQB, and USFWS.

FIGURE 13
MEC and MC Remedial Investigation Decision Process
East Vieques Master Sampling Plan
Former Vieques Naval Training Range

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 14_LIA_Site_Features.mxd1/10/2013fcain

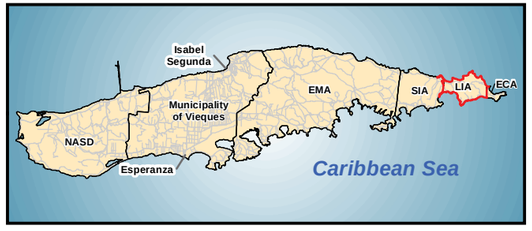


Note that the icon placement is not necessarily representative of the actual locations where the proposed recreational uses may occur.

LIA Munitions Response Sites
- UXO 2 - LIA Beaches
- UXO 3 - LIA Roads
- UXO 4 - LIA Interior

Turtle Beach Setbacks
- Zone 2 - Minor Restrictions
- Zone 3 - Major Restrictions

- Historical Air-To-Ground (ATG) Target
- Historical Naval Gunfire Support (NGFS) Target
- Bulls Eye Target
- Depleted Uranium Area
- Photo Identified Area
- Solid Waste Management Unit
- LIDAR (Light Detection and Radar) Identified Target Feature
- Central Processing Center
- Gun Positions
- Target Area
- Observation Point
- Open Burn Pit
- Open Detonation Area
- Naval Gunfire Support (NGFS) Target Area
- Dense Submunitions Area
- Lagoon
- Crater
- Ephemeral Stream
- Topographic Contours (10 Meter)
- Beach Use
- Historic Site
- Kayaking
- Scenic View



N W E S

0 450 900 Feet

Figure 14
LIA Site Features
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

Note: Geology for the region is interpreted from USGS rock and soil maps.

Land Crabs Exposure
Exposure to deep surface soil (0-2 feet) in appropriate habitat

Upland Areas
Terrestrial Plants and Soil Invertebrates
Exposure to surface soil across the site

Terrestrial Wildlife
Birds, mammals, and reptiles consuming invertebrates, plants, and/or small mammals

- Fruit Bat
- Velvet Free-Tailed Bat
- Norway Rat
- Indian Mongoose
- Common Ground Dove
- Pearl-Eyed Thrasher
- Cave Swallow
- Red-Tailed Hawk
- Lizards

Prevailing Wind Direction

Wind dispersion is a possible potential contaminant migration pathway

Mammalian Omnivore (Indian Mongoose): Ingestion of terrestrial invertebrates, plants, small mammals, and incidental surface soil in upland areas
* Evaluated as invertivore in SLERA

Aquatic Organisms
Fish and invertebrates exposed to surface water and sediment

- Fishing Bat
- Velvet Free-Tailed Bat
- Cave Swallow
- Green Heron
- Spotted Sandpiper
- White-Cheeked Pintail

Aquatic Wildlife
Birds and mammals consuming fish, invertebrates, or plants

Avian Insectivore (Cave Swallow): Ingestion of terrestrial and aquatic insects in all terrestrial and aquatic habitats

Potential Trespasser (adolescent and adult)
Ingestion/dermal/inhalation exposure to surface soil and ingestion of land crab

Mammalian Insectivore (Velvet Free-tailed Bat): Ingestion of terrestrial and aquatic insects in all terrestrial and aquatic habitats

Turtle Nesting Area

Precipitation Infiltration

Soil Invertebrates (earthworms, insects): Dermal exposure and ingestion of surface soil in all upland areas

Terrestrial Reptile (Crested Anole): ingestion of terrestrial insects in all terrestrial environments

Terrestrial Plants and Soil Invertebrates
Exposure to surface soil

Avian Omnivore (Pearly-eyed Thrasher): Ingestion of terrestrial invertebrates, plants, and incidental surface soil in all upland areas
* Evaluated as invertivore in SLERA

Terrestrial Plants: Direct exposure to surface soil in all upland areas

FWS Workers
Ingestion/dermal/inhalation exposures to surface soil and deep surface soil (where planting and turtle nesting area); exposures to sediment (ingestion/dermal) and surface water (dermal) in the lagoon

Avian Carnivore (Red-tailed Hawk): Ingestion of small mammals in all upland areas

Turtle Nesting Beaches
Exposure of buried eggs to deep surface soil (18-24 feet)

Avian Invertivore (Spotted Sandpiper): Ingestion of aquatic invertebrates and incidental sediment

Mammalian Piscivore (Fishing Bat): Ingestion of fish

Fish (snapper, mullet): Direct exposure to surface water and sediment

Avian Piscivore (Green Heron): Ingestion of aquatic fish and invertebrates

Aquatic Invertebrates (crabs, snails): Direct exposure to surface sediment

Mammalian Omnivore (Norway Rat): Ingestion of terrestrial invertebrates, plants, and incidental surface soil in all upland areas.
* Evaluated as herbivore in SLERA

Beach 11
Beach 12
Playa Barco
Playa Brava
Beach 10
Fossil Beach
Icacos Beach
Turtle Beach
Beach 3
Convoy
RR Tunnel
Surface Runoff
Ammo Dump
Historical Detonation and Burning Release
Open Detonation Area
Fuel Farm
Bomb Crater Historical Detonation Release
Open Burning Pit
Air Strip
Laguna Gato
Laguna Anones
Sam West
Bulls Eye Target
CPC Area
Strafing Target
Storm Surge
Controlled detonation release; MEC, scrap metal, and deterioration release
Water Table Seawater Intrusion
T1
T2
T3
T4
T5
T6
T7
Tl
Kv
Qb

LEGEND

- UXO 2 Boundary
- UXO 3 Boundary
- UXO 4 Boundary
- Submunitions Area
- Naval Gunfire Support (NGFS) Target Area
- Target Area
- Turtle Nesting Area
- Historic Naval Gunfire Support (NGFS) Target
- Historic Bulls Eye Target
- Historic Targets
- Ocean
- Qb (Quaternary beach sand)
- Tl (Tertiary Limestone and Dolomite)
- Kv (Cretaceous Andesite, Tuff, and Breccia, and Minor Limestone)

FIGURE 15
LIA Conceptual Site Model (UXO's 2, 3, and 4)
Master Sampling Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 17_SIA_Site_Features_V1.mxd1/10/2013fcain

Note that the icon placement is not necessarily representative of the actual locations where the proposed recreational uses may occur.

SIA Munitions Response Sites
- UXO 5 - SIA Restricted Roads
- UXO 6 - EMA/SIA Public Roads
- UXO 7 - EMA/SIA North Beaches
- UXO 8 - SIA South Beaches
- UXO 9 - SIA Exterior
- UXO 10 - SIA Interior

Turtle Beach Setbacks
- Zone 2 - Minor Restrictions
- Zone 3 - Major Restrictions

- Historical Air-To-Ground (ATG) Target
- Historical Naval Gunfire Support (NGFS) Target
- Bulls Eye Target
- Photo Identified Area
- Preliminary Area of Concern
- General Location of Marine Artillery Targets
- Solid Waste Management Unit
- LIDAR (Light Detection and Radar) Identified Target Feature
- Central Processing Center
- Gun Positions
- Target Area
- Observation Point
- Range
- Crater
- Lagoon
- Topographic Contours (10 Meter)
- Ephemeral Stream
- Beach Use
- Bermuda Triangle Interpretive Site
- Biking Trail
- Hiking Trail
- Historic Site
- Interpretive Trail
- Kayaking
- Lookout Area, Binoculars
- Observation Tower
- Parking Area
- Rest Area
- Scenic View
- Seasonal Beach Use

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Figure 17
SIA Site Features
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

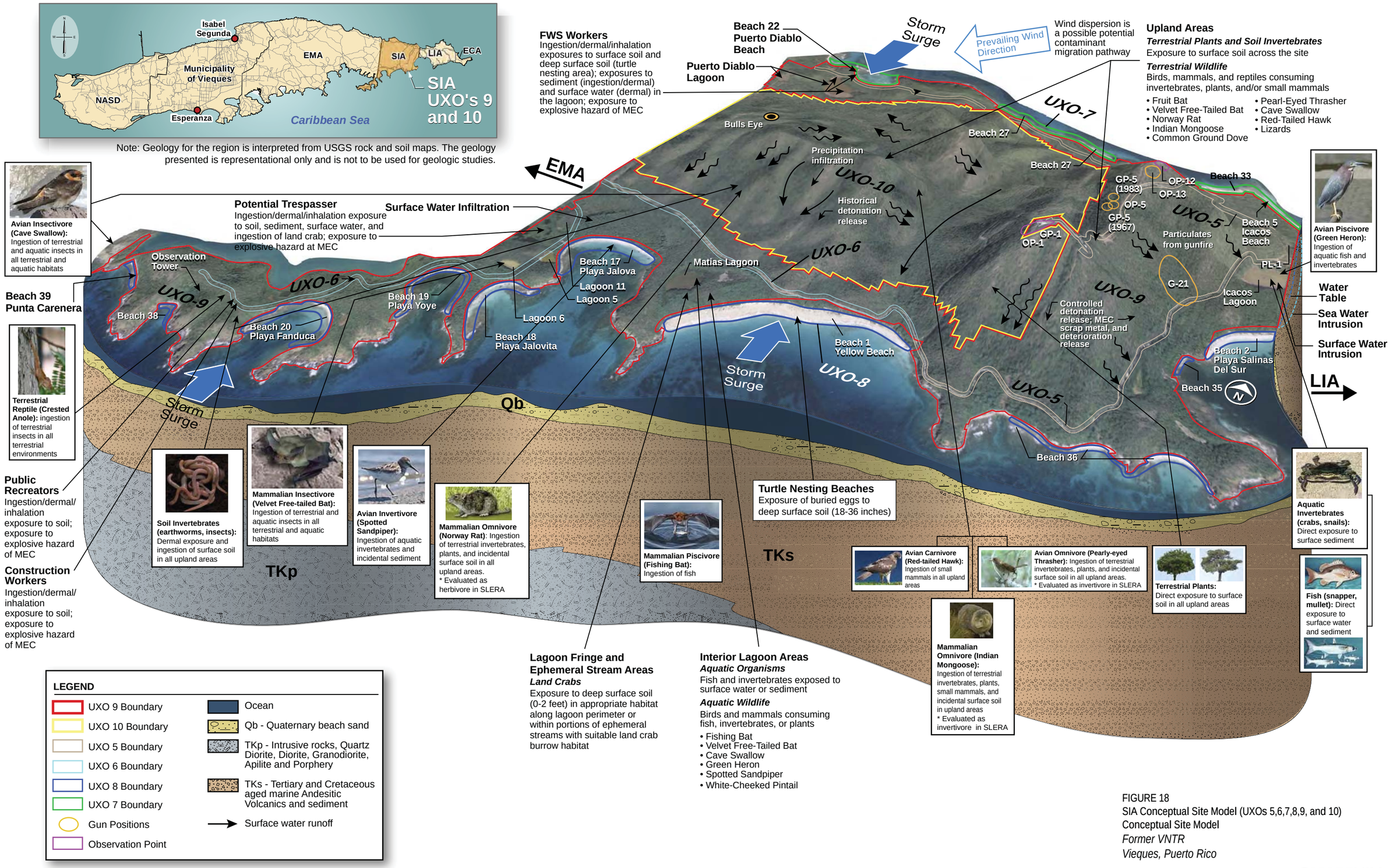
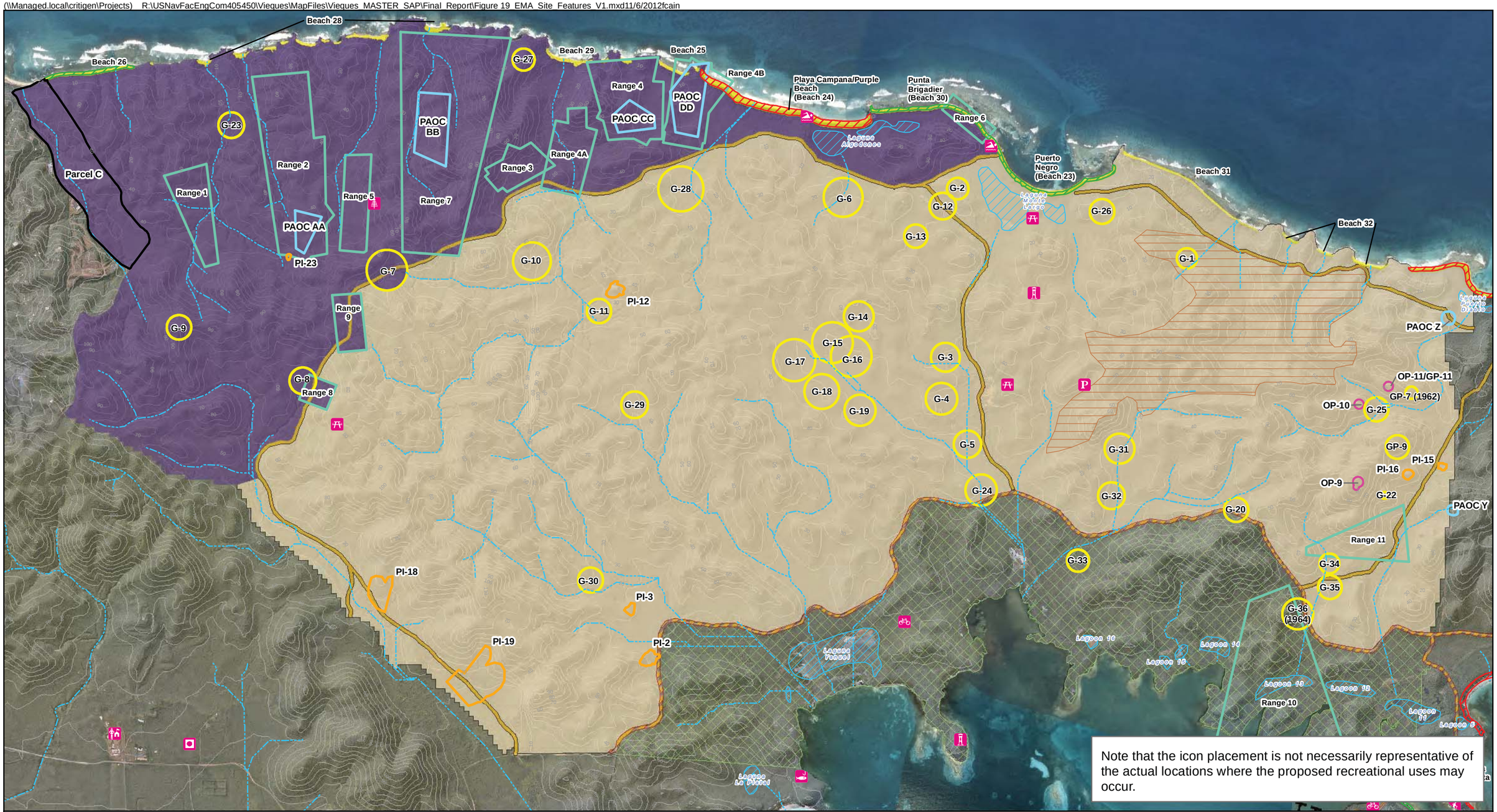


FIGURE 18
SIA Conceptual Site Model (UXOs 5,6,7,8,9, and 10)
Conceptual Site Model
Former VNTR
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 19_EMA_Site_Features_V1.mxd11/6/2012fcain



Note that the icon placement is not necessarily representative of the actual locations where the proposed recreational uses may occur.

EMA Munitions Response Sites
- UXO 6 - EMA/SIA Public Roads
- UXO 7 - EMA/SIA North Beaches
- UXO 11 - EMA Public Roads
- UXO 12 - EMA Interior
- UXO 13 - EMA West
- UXO 14 - EMA South

Turtle Beach Setbacks
- Zone 2 - Minor Restrictions
- Zone 3 - Major Restrictions

- EMA Fire Area
- Parcel C
- Photo Identified Area
- Preliminary Area of Concern
- Gun Positions
- Observation Point
- Range
- Lagoon
- Ephemeral Stream
- Topographic Contours (10 Meter)

- Beach Use
- Biking Trail
- Fishing Access
- Hiking Trail
- Historic Site
- Interpretive Trail
- Observation Tower
- Parking Area
- Reforestation Area
- Rest Area
- Visitor Contact Center

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0 1,000 2,000
Feet

Figure 19
EMA Site Features
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

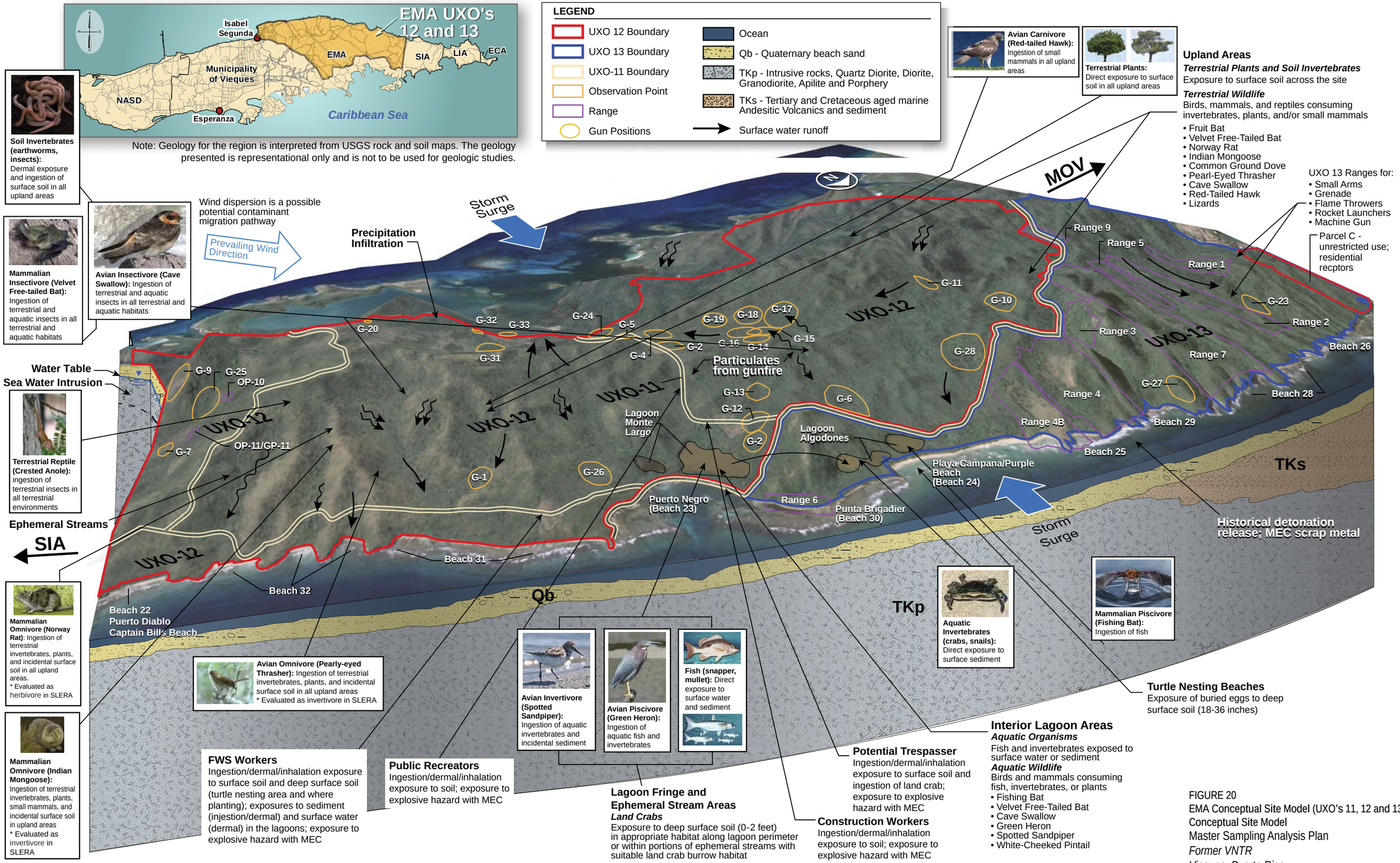
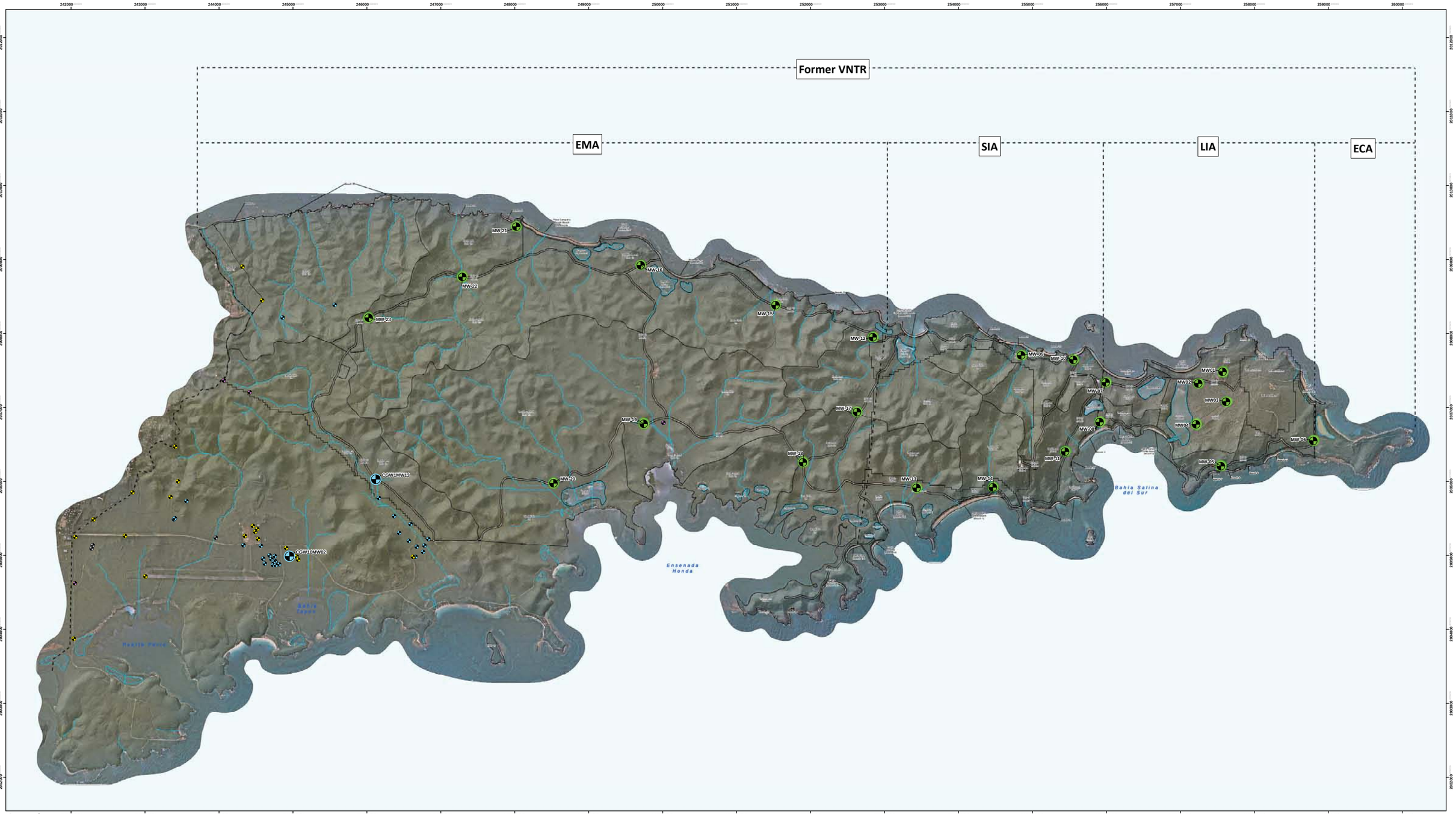


FIGURE 20
EMA Conceptual Site Model (UXO's 11, 12 and 13)
Conceptual Site Model
Master Sampling Analysis Plan
Former VNTR
Vieques, Puerto Rico

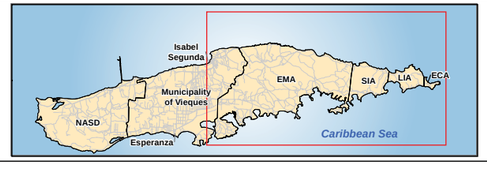
CH2MHILL



Legend

- Well Not Found
- Proposed Monitoring Well
- Existing Monitoring Well
- Abandoned Monitoring Well
- Abandoned Water Supply Well
- Well Not Found
- Ephemeral Stream
- Lagoon
- Decision Units

2005 Aerial Imagery
2005 Hillshade



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Feet

Figure 26
Location of Proposed Regional Monitoring Wells
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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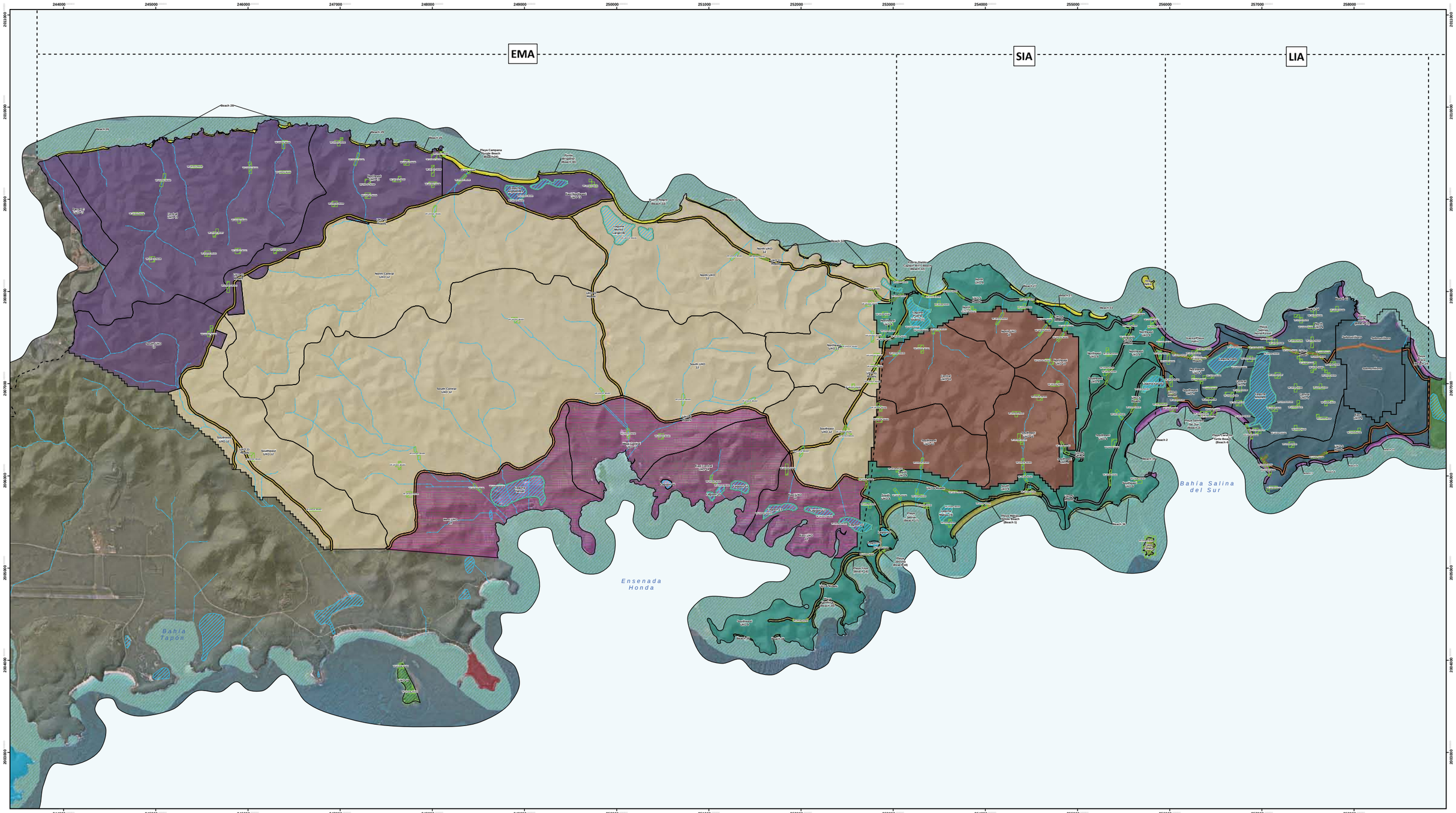
{Managed:local/cltiger/Projects} R:\US\Naval\Eng\Con\405450\Vieques\Map\files\Vieques_MASTER_SAP\Final_Report\Figure 26 - Location of Proposed Regional Monitoring Wells.mxd1/18/2013kain

ES011413081845TPA Figure 26 - Location of Proposed Regional Monitoring Wells.ai



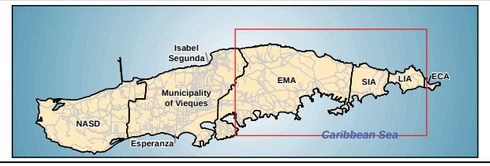
Legend

- Sampling Unit
- Sample Unit (Lagoon Fringe)
- Decision Units
- Ephemeral Stream
- Lagoon

Munitions Response Sites

- UXO 1 - ECA
- UXO 2 - LIA Beaches
- UXO 3 - LIA Roads
- UXO 4 - LIA Interior
- UXO 5 - SIA Restricted Roads
- UXO 6 - EMA/SIA Public Roads
- UXO 7 - EMA/SIA North Beaches
- UXO 8 - SIA South Beaches
- UXO 9 - SIA Exterior
- UXO 10 - SIA Interior
- UXO 11 - EMA Public Roads
- UXO 12 - EMA Interior
- UXO 13 - EMA West
- UXO 14 - EMA South
- UXO 15 - Puerto Ferro
- UXO 16 -Underwater Areas
- UXO-17 - PAOC EE
- UXO 18 - Cayo de la Chiva

2005 Aerial Imagery
2005 Hillshade



N
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0 1,400 2,800 4,200 5,600 Feet

Figure 27
Location of Decision Units and Sampling Units
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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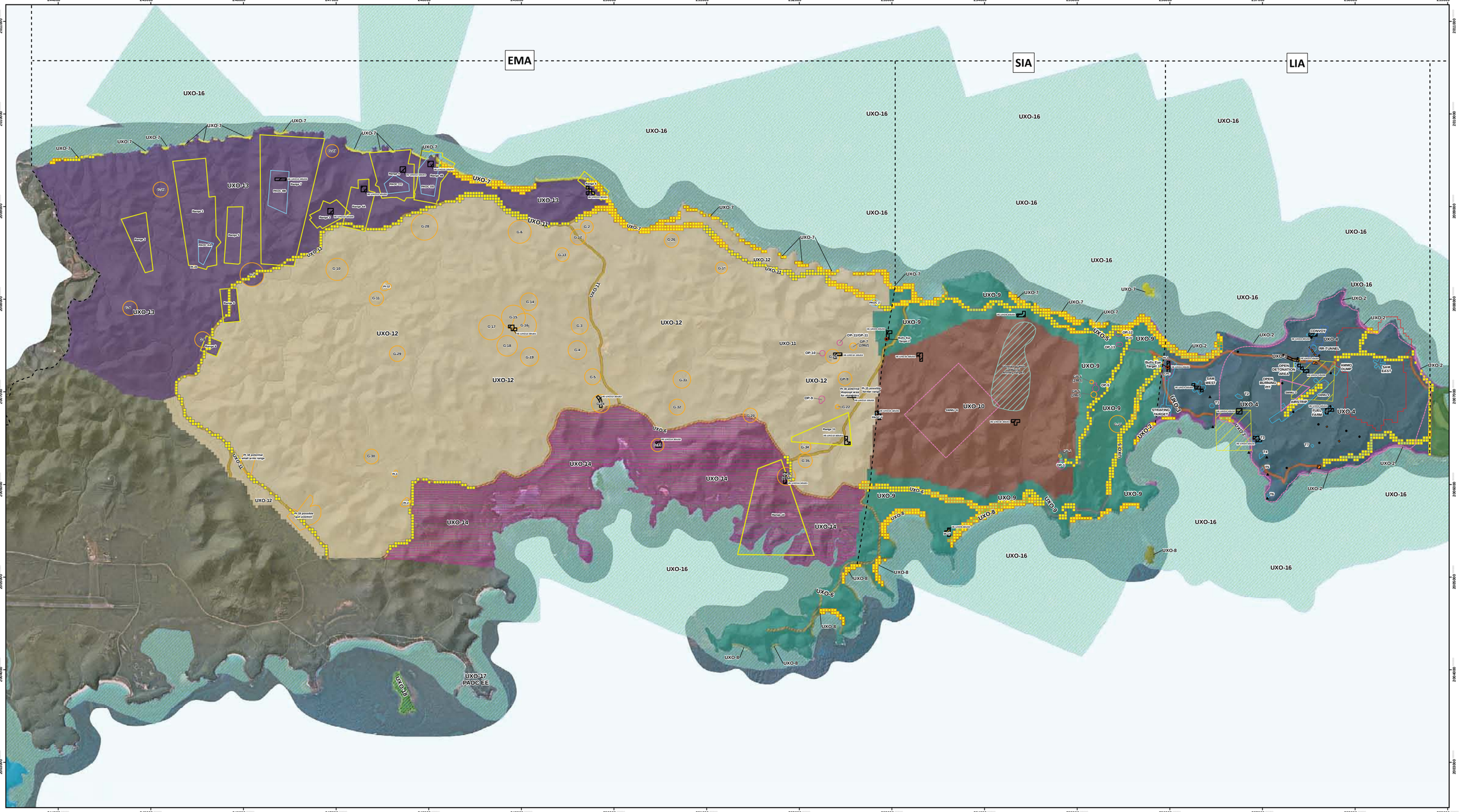
(\\Managed.local\cltgarr\Projects) R:\US\Navf ad\ngCom405-60\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 27 - Location of Decision Units and Sampling Units.mxd11/12/2012\cain

ES011413081845TPA Figure 27 - Location of Decision Units and Sampling Units.ai


EMA
SIA
LIA
UXO-16
UXO-7
UXO-13
UXO-11
UXO-12
UXO-14
UXO-6
UXO-9
UXO-10
UXO-5
UXO-2
UXO-4
UXO-8
UXO-17
PAOC EE
UXO-18
Range 1
Range 2
Range 3
Range 4
Range 5
Range 6
Range 7
Range 8
Range 9
Range 10
Range 11
PAOC 1
PAOC 2
PAOC 3
PAOC 4
PAOC 5
PAOC 6
PAOC 7
PAOC 8
PAOC 9
PAOC 10
Bulls Eye Target 1
Bulls Eye Target 2
SAM WEST
SAM EAST
STRAFING TARGET
CONVOY
IR FLARES
OPEN DETONATION AREA
OPEN BURNING PIT
AMMO DUMP
AIRSTRIP
FUEL FARM
Ph 18 potential small arms range
Ph 18 possible gun position
Ph 18 potential dispersal area for munitions
Ph 25 possible former range
Ph 2
Ph 3
Ph 5
Ph 7
Ph 8
Ph 9
Ph 12
Ph 13
Ph 14
Ph 15
Ph 16
Ph 17
Ph 19
Ph 20
Ph 21
Ph 22
Ph 23
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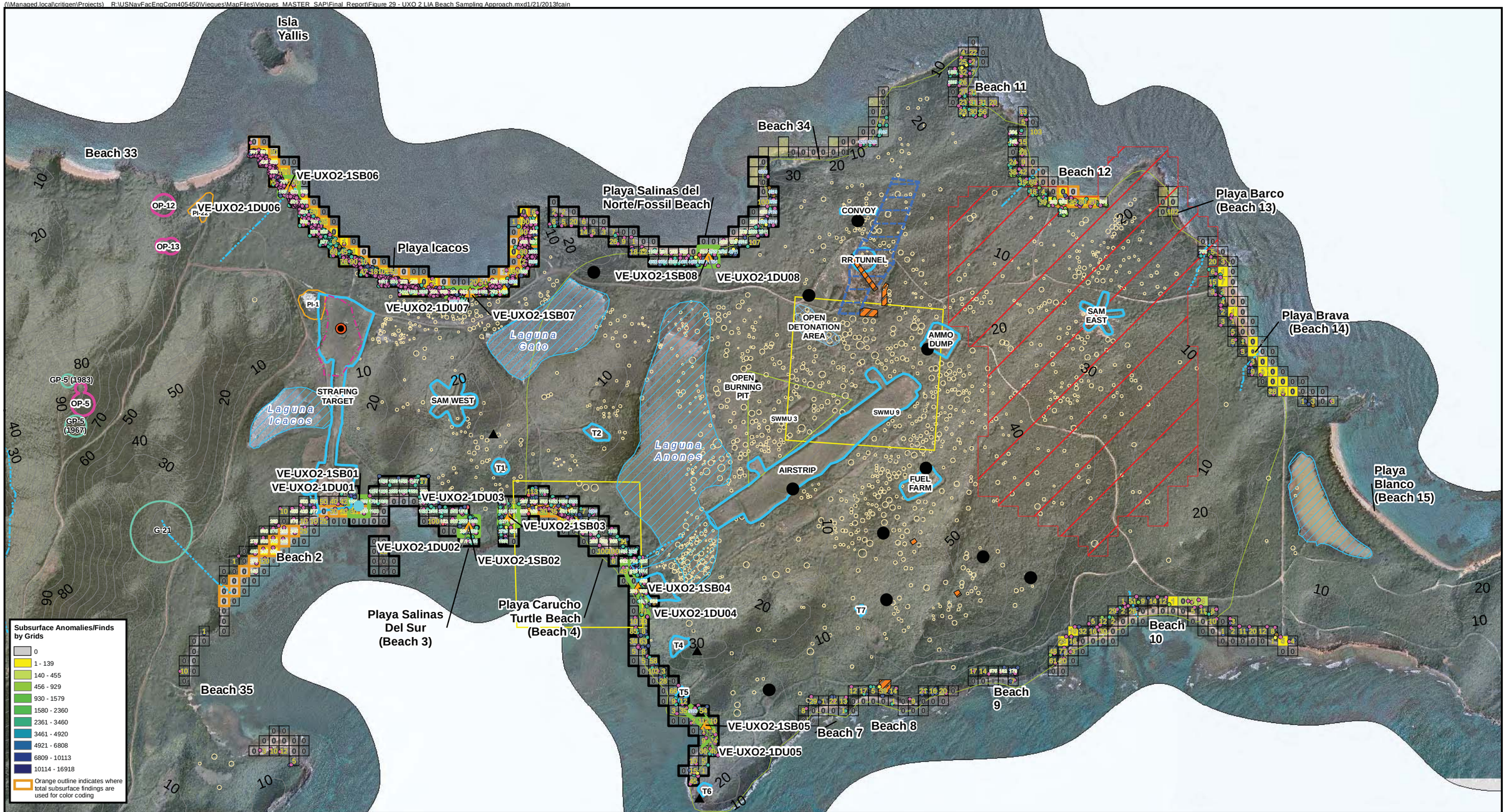


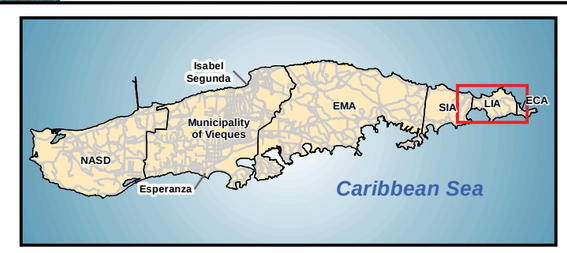
Deep Surface Soil Sample
Sample Unit
Beach Selected for Sampling
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Submunitions

Topographic Contours (10 Meter)
Stream
Crater
Historical Air-To-Ground (ATG) Target
Historical Naval Gunfire Support (NGFS) Target
Bulls Eye Target
LIDAR (Light Detection and Radar) Identified Target Feature
Depleted Uranium Area
Central Processing Center
Gun Positions
2005 Aerial Imagery
2005 Hillshade

Target Area
Observation Point
Open Burn Pit
Open Detonation Area
Naval Gunfire Support (NGFS) Target Area
Dense Submunitions Area
Photo Identified Area
Preliminary Area of Concern
Solid Waste Management Unit
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

Surface Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
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0 500 1,000
Feet

Figure 29
UXO 2 LIA Beach Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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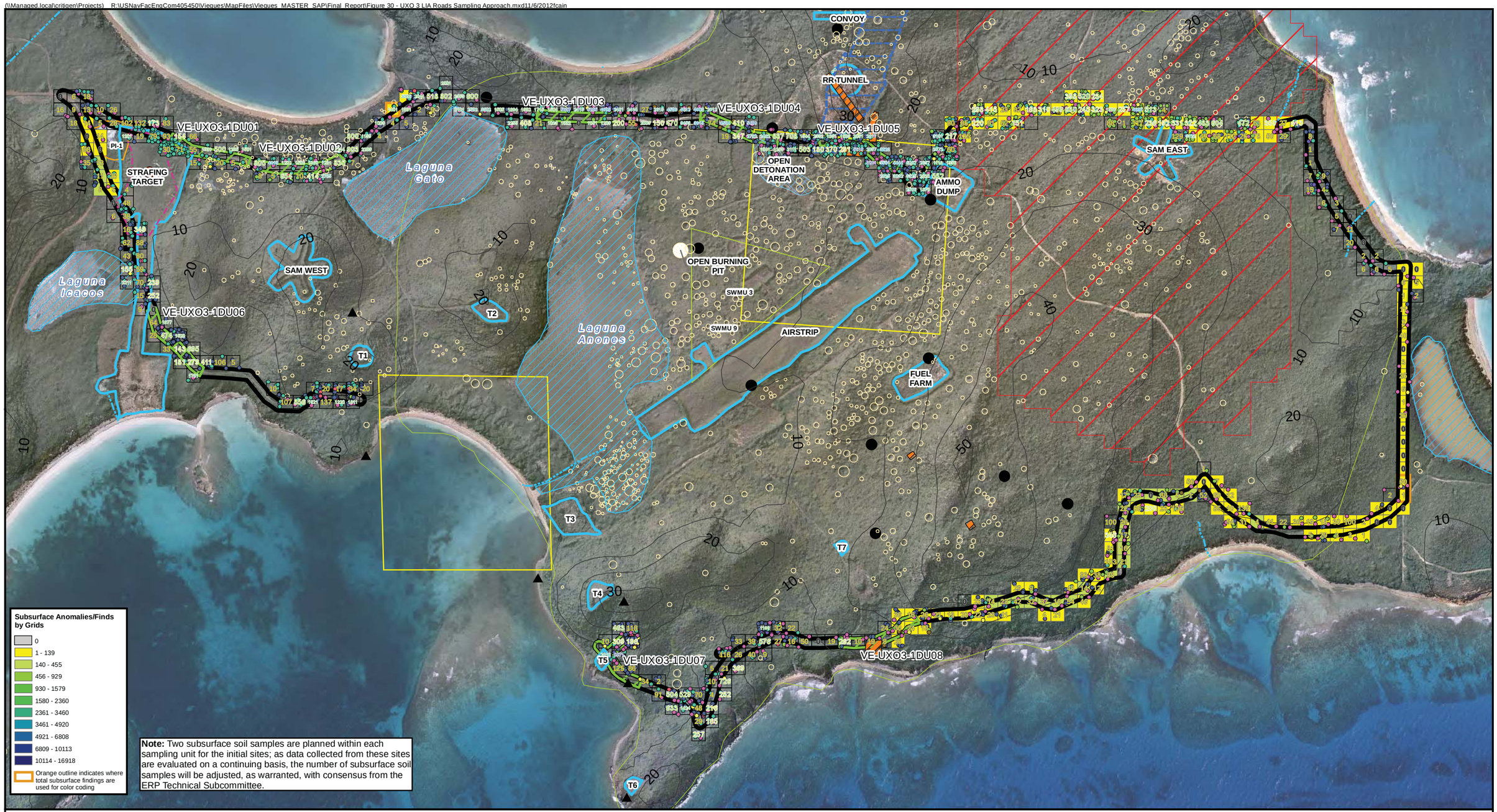
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 30 - UXO 3 LIA Roads Sampling Approach.mxd11/6/2012fcain

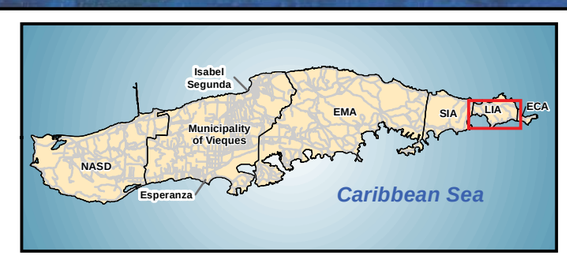


Sampling Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Submunitions
Decision Unit

Topographic Contours (10 Meter)
Stream
Crater
Historical Air-To-Ground (ATG) Target
Historical Naval Gunfire Support (NGFS) Target
Bulls Eye Target
LIDAR (Light Detection and Radar) Identified Target Feature
Depleted Uranium Area
Central Processing Center

Target Area
Open Burn Pit
Open Detonation Area
Naval Gunfire Support (NGFS) Target Area
Photo Identified Area
Preliminary Area of Concern
Solid Waste Management Unit
Grid (30 Meter)
Lagoon
2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)
1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
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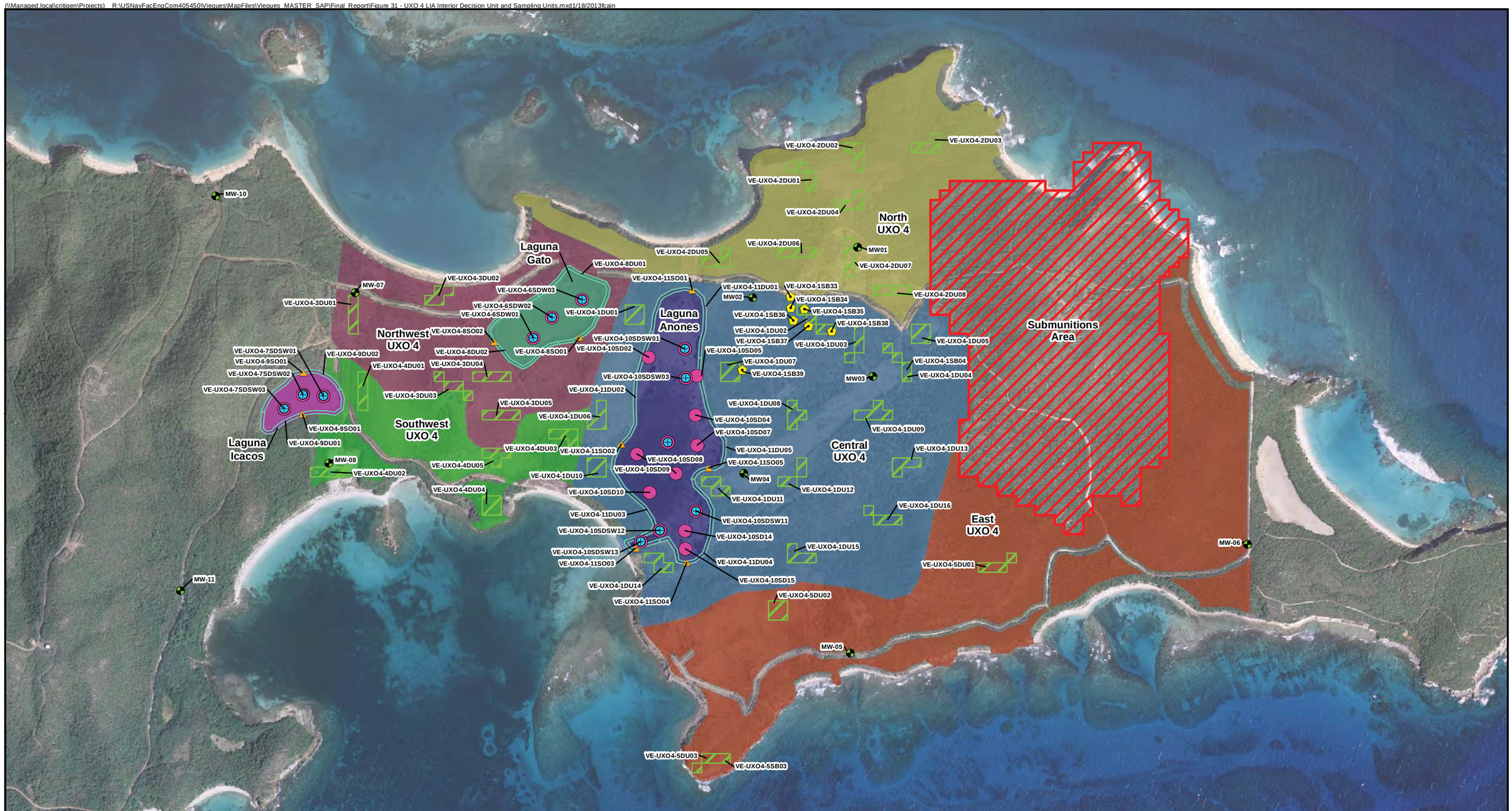
S
0 250 500
Feet

Figure 30
UXO 3 LIA Road Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

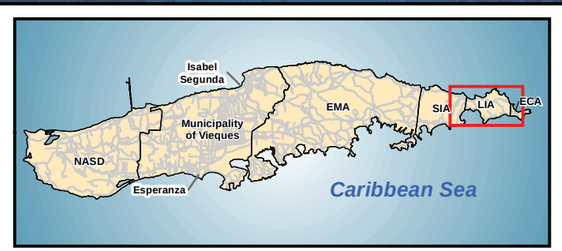
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 31 - UXO 4 LIA Interior Decision Unit and Sampling Units.mxd1/18/2013fcain



Deep Surface Soil Sample
Subsurface Soil Sample
Proposed Monitoring Well
Proposed Surface Water Samples
Proposed Sediment Samples
Sample Unit (Lagoon Fringe)
Sample Unit (Interior)

Decision Unit
- Central UXO 4
- North UXO 4
- Northwest UXO 4
- Southwest UXO 4
- East UXO 4
- Laguna Anones
- Laguna Gato
- Laguna Icacos

Submunitions Area



N
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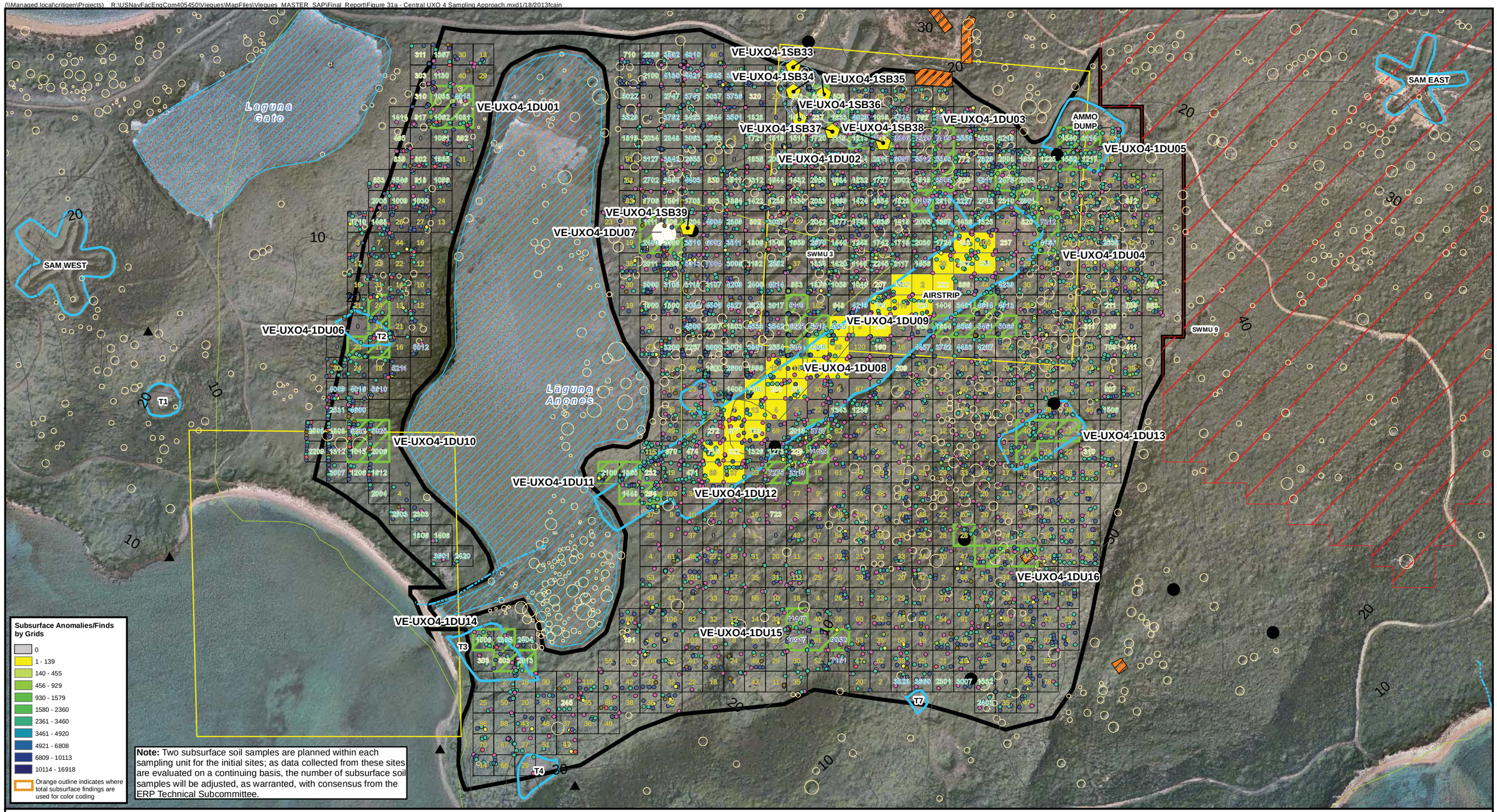
0 500 1,000
Feet

2007 Aerial Imagery

Figure 31
UXO 4 LIA Interior Decision Unit and Sampling Units
Master Sampling Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL



Subsurface Soil Sample
Sample Unit
Decision Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Submunitions

Topographic Contours (10 Meter)
Stream
Crater
Historical Air-To-Ground (ATG) Target
Historical Naval Gunfire Support (NGFS) Target
LIDAR (Light Detection and Radar) Identified Target Feature

Target Area
Open Burn Pit
Open Detonation Area
Naval Gunfire Support (NGFS) Target Area
Dense Submunitions Area
Soild Waste Management Unit
Grid (30 Meter)
Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

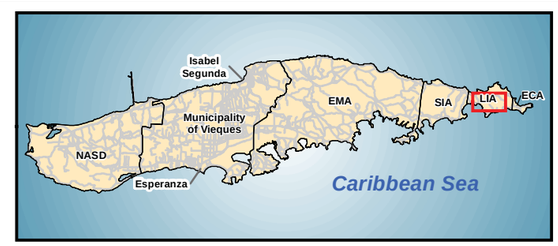


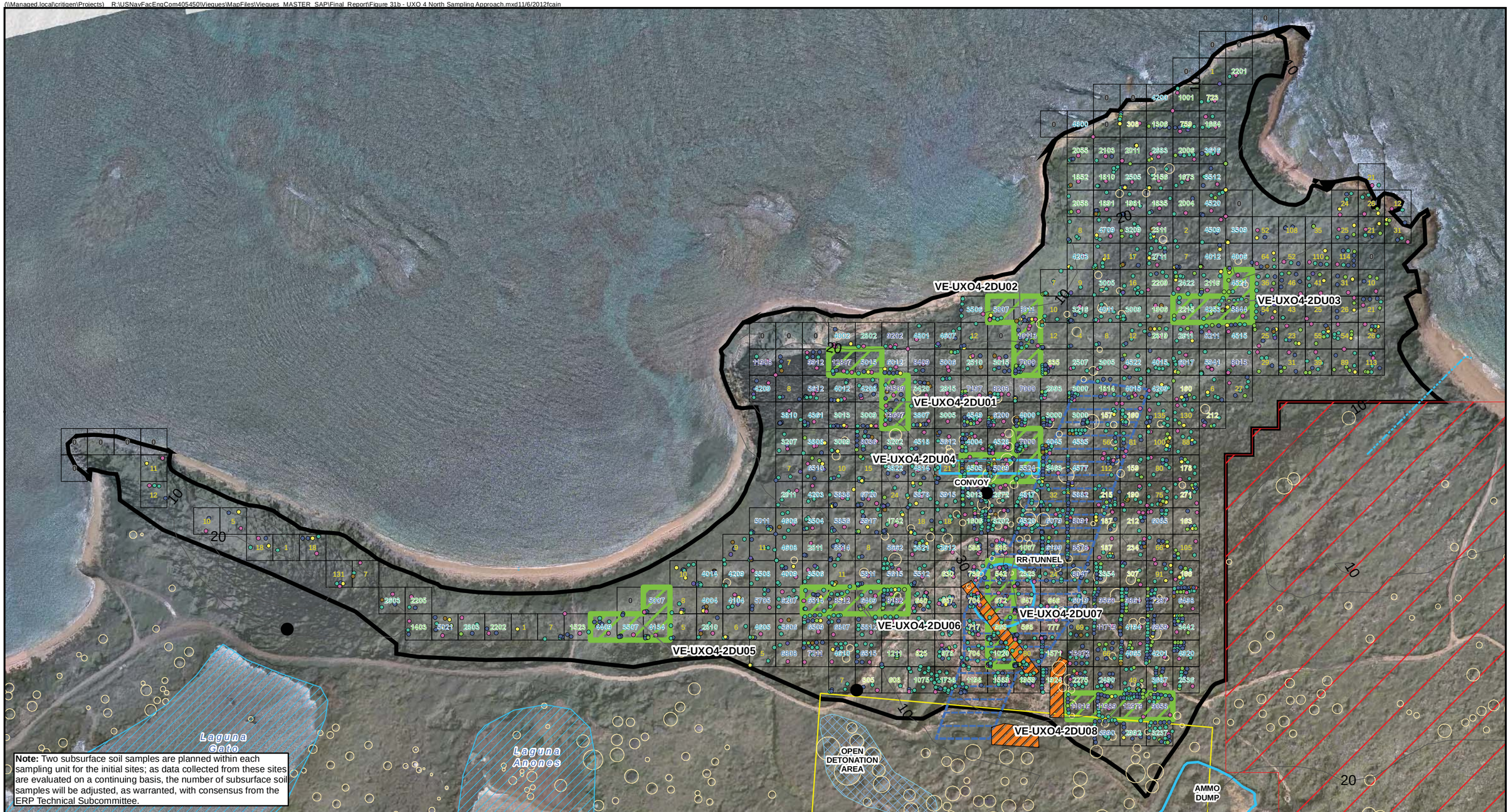
Figure 31a
Central UXO 4 Sampling Approach
Master Sampling Analysis Plan
Former VNTR
Vieques, Puerto Rico

N W E S

0 250 500 Feet

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 31b - UXO 4 North Sampling Approach.mxd11/6/2012fcain



Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Sample Unit
- Decision Unit
- Bombs
- Flares-Pyrotechnics
- Grenades
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Submunitions

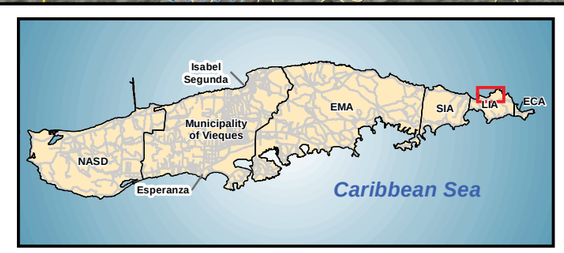
- Topographic Contours (10 Meter)
- Stream
- Crater
- LIDAR (Light Detection and Radar) Identified Target Feature
- Depleted Uranium Area

- Target Area
- Open Burn Pit
- Open Detonation Area
- Naval Gunfire Support (NGFS) Target Area
- Dense Submunitions Area
- Grid (30 Meter)
- Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918



N
W E
S

0 250 500 Feet

Figure 31b
UXO 4 North Sampling Approach
Master Sampling Analysis Plan
Former VNTR
Vieques, Puerto Rico

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(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 31c - UXO 4 Northwest Sampling Approach.mxd11/6/2012fcain

Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

Sample Unit
Decision Unit

Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Submunitions

Topographic Contours (10 Meter)
Stream
Crater
Historical Air-To-Ground (ATG) Target
Bulls Eye Target
Historical Naval Gunfire Support (NGFS) Target
Target Area
Naval Gunfire Support (NGFS) Target Area

Photo Identified Area
Solid Waste Management Unit
Lagoon
Central Processing Center

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

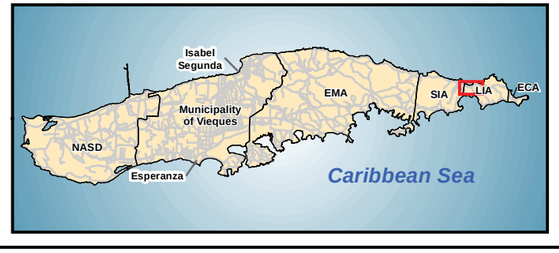

Figure 31c
UXO 4 Northwest Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

N W E S

0 150 300 Feet

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(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 31d - UXO 4 Southwest Sampling Approach.mxd11/6/2012fcain

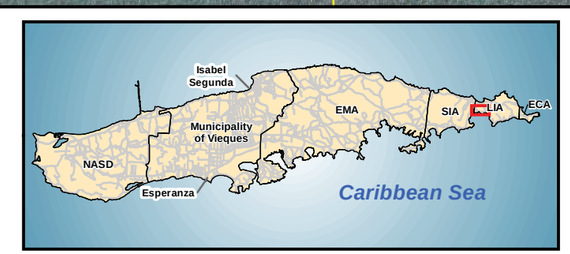
Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

Sample Unit
Decision Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Submunitions
Topographic Contours (10 Meter)
Lagoon
Crater
Stream
Historical Naval Gunfire Support (NGFS) Target
Central Processing Center
Gun Positions
Target Area
Naval Gunfire Support (NGFS) Target Area
Photo Identified Area
Solid Waste Management Unit
Grid (30 Meter)

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 125 250
Feet

Figure 31d
UXO 4 Southwest Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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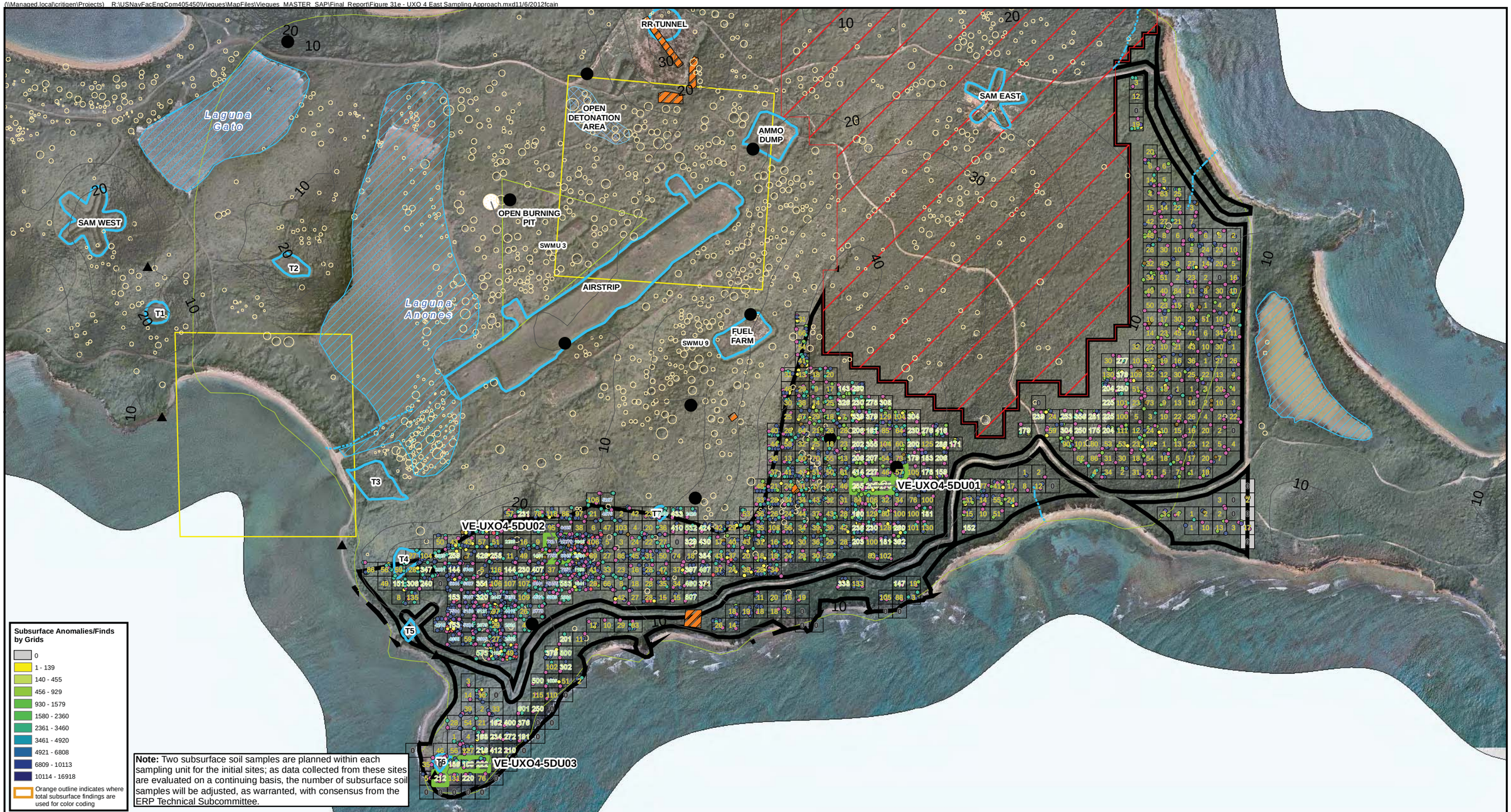
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 31e - UXO 4 East Sampling Approach.mxd11/6/2012fcain



Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

Sample Unit
Decision Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Submunitions

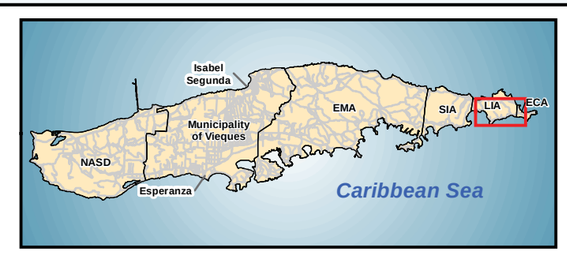
Topographic Contours (10 Meter)
Stream
Crater
Historical Air-To-Ground (ATG) Target
Historical Naval Gunfire Support (NGFS) Target
LIDAR (Light Detection and Radar) Identified Target Feature

Target Area
Open Burn Pit
Open Detonation Area
Naval Gunfire Support (NGFS) Target Area
Dense Submunitions Area
Soil Waste Management Unit
Grid (30 Meter)
Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 500 1,000
Feet

Figure 31e
UXO 4 East Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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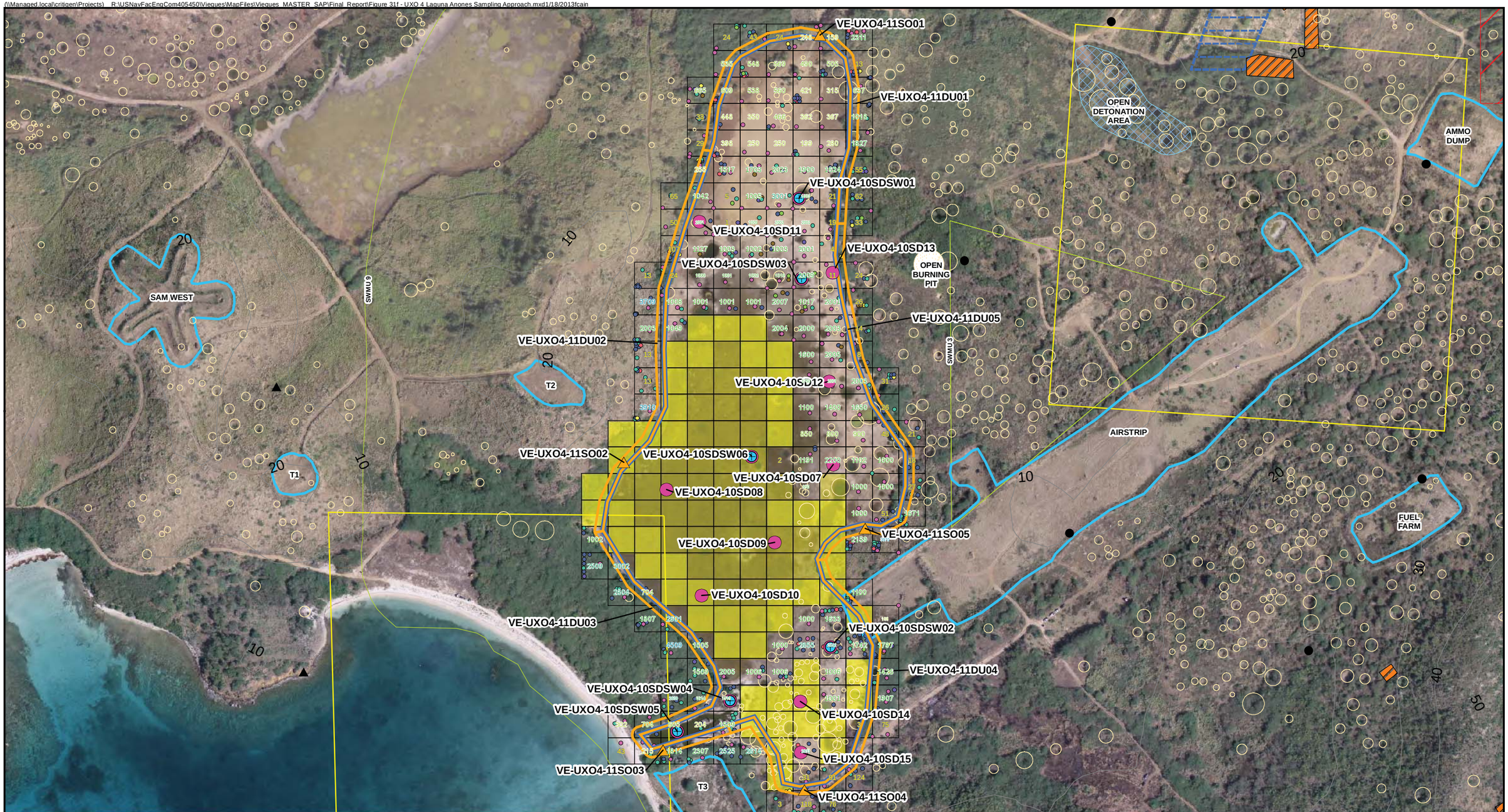
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 31f - UXO 4 Laguna Anones Sampling Approach.mxd1/18/2013fcain



Proposed Surface Water Samples
Proposed Sediment Samples
Deep Surface Soil Sample
Lagoon Fringe
Lagoon

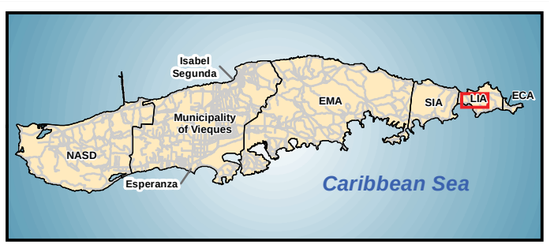
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Submunitions

Topographic Contours (10 Meter)
Crater
Historical Air-To-Ground (ATG) Target
Historical Naval Gunfire Support (NGFS) Target
Depleted Uranium Area
Target Area
LIDAR (Light Detection and Radar) Identified Target Feature
Open Burn Pit
Open Detonation Area
Naval Gunfire Support (NGFS) Target Area
Dense Submunitions Area
Yellow Shading Indicates No MEC Investigation

Soil Waste Management Unit
Grid (30 Meter)

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 250 500
Feet

2007 Aerial Imagery

Figure 31f
UXO 4 Laguna Anones Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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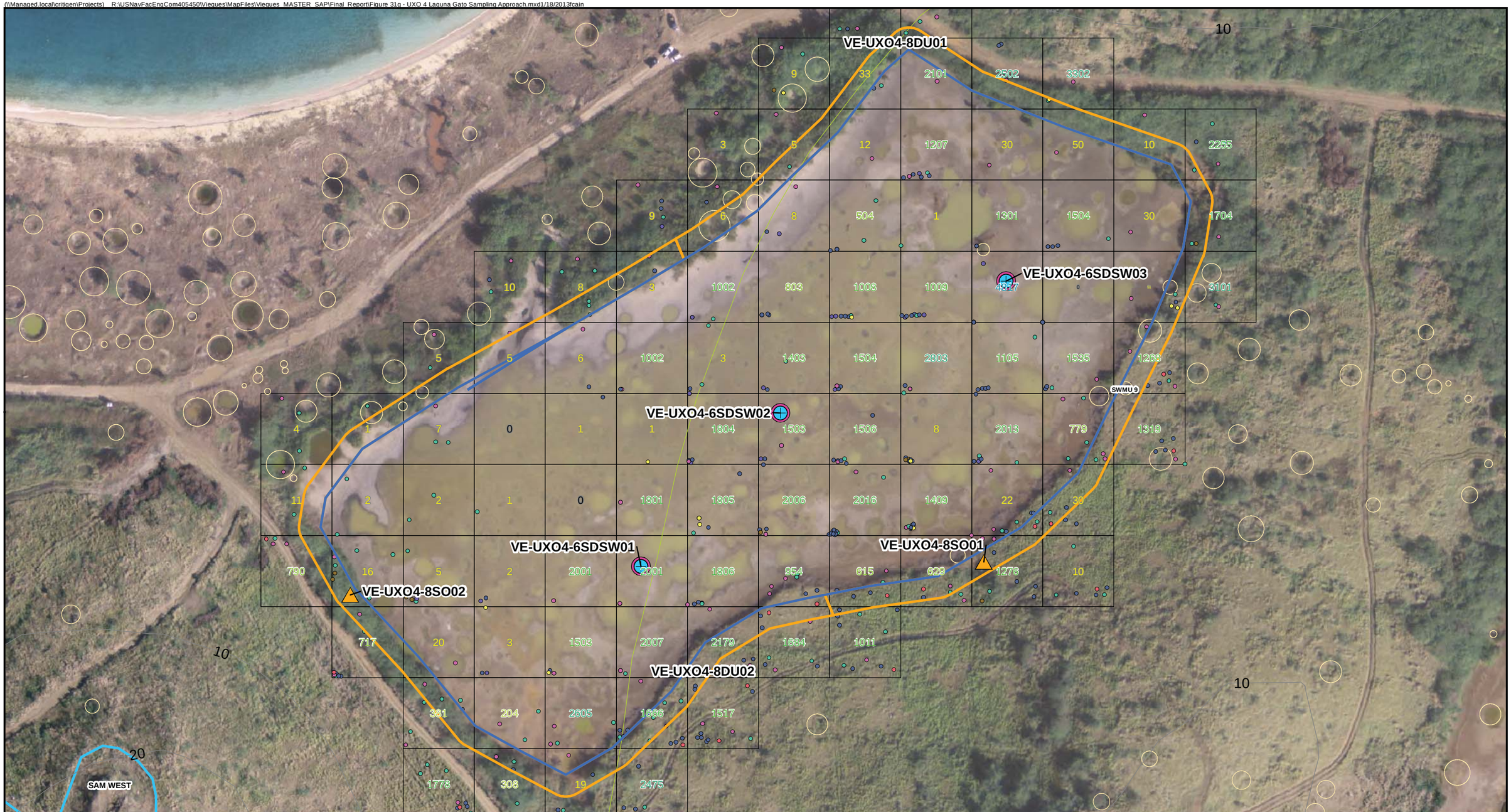
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 31g - UXO 4 Laguna Gato Sampling Approach.mxd1/18/2013fcain



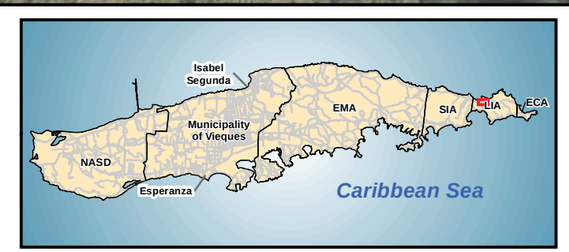
Proposed Surface Water Samples
Proposed Sediment Samples
Deep Surface Soil Sample
Lagoon
Lagoon Fringe

Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)

Topographic Contours (10 Meter)
Crater
Target Area
Solid Waste Management Unit
Grid (30 Meter)

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 75 150
Feet

2007 Aerial Imagery

Figure 31g
UXO 4 Laguna Gato Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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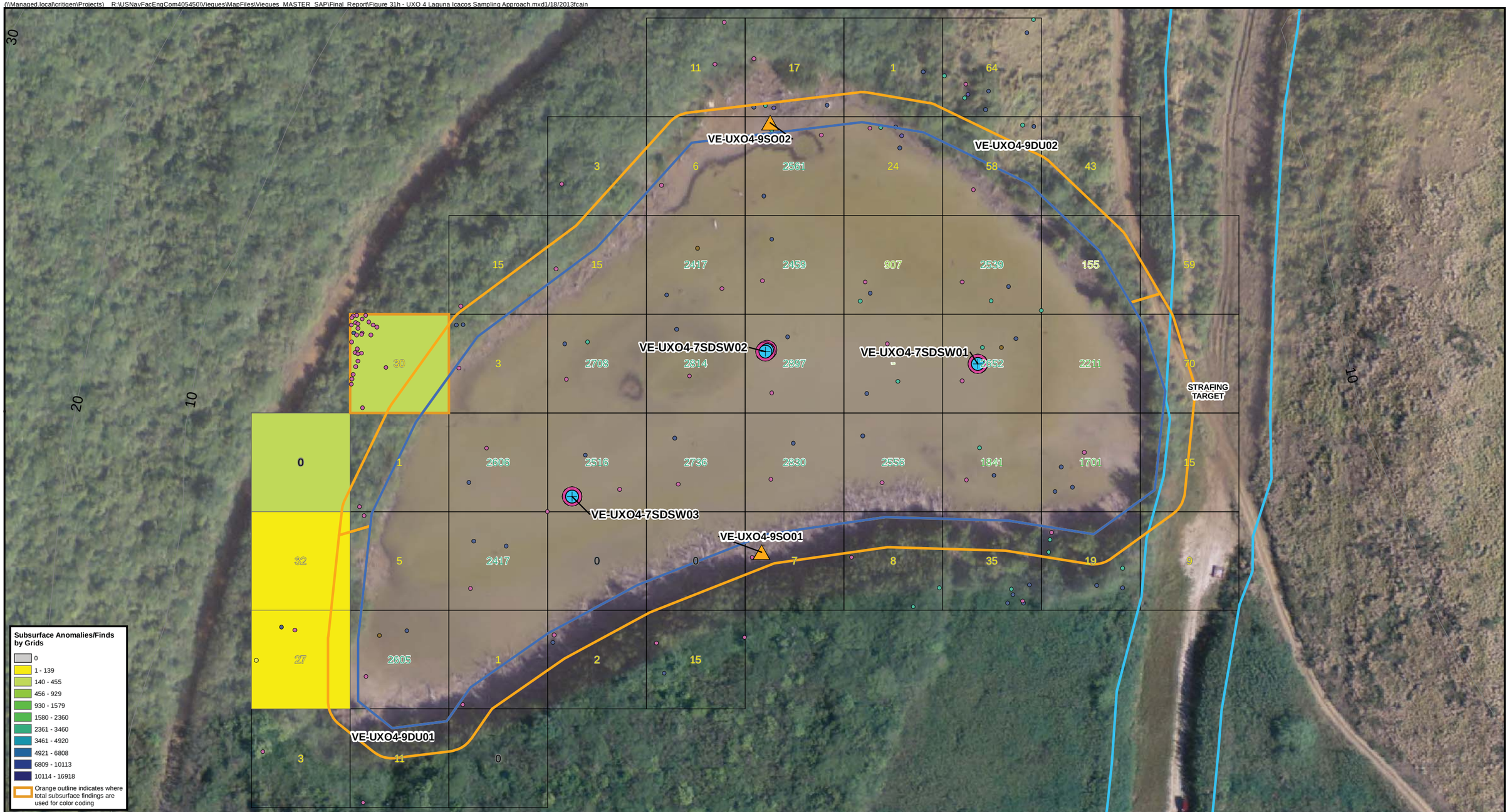
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 31h - UXO 4 Laguna Icacos Sampling Approach.mxd1/18/2013fcain



Deep Surface Soil Sample
Proposed Surface Water Samples
Proposed Sediment Samples
Lagoon
Lagoon Fringe

Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Submunitions

Topographic Contours (10 Meter)
Target Area
Grid (30 Meter)

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

N
W E
S

0 50 100
Feet

2007 Aerial Imagery

Figure 31h
UXO 4 Laguna Icacos Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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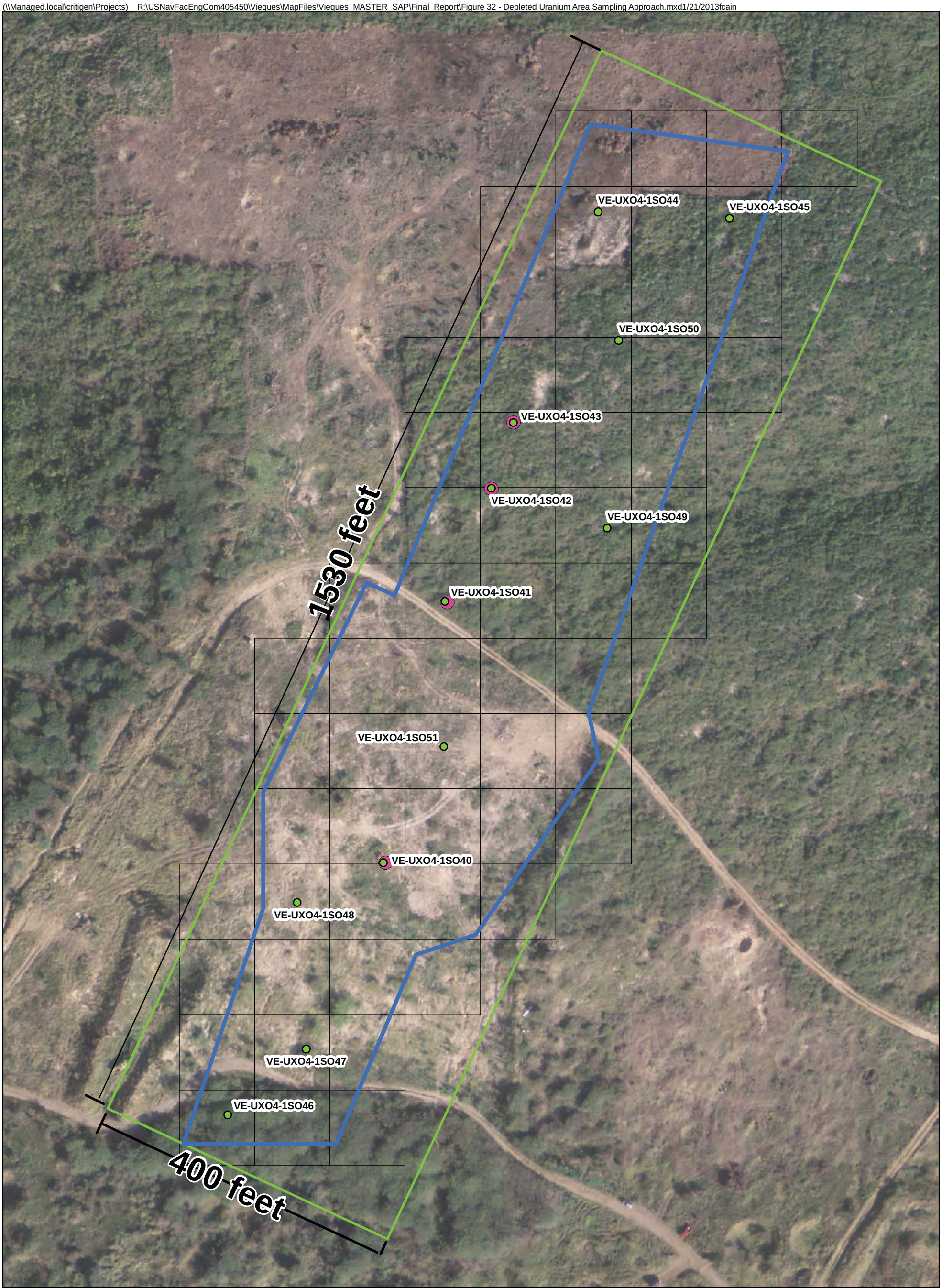
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 32 - Depleted Uranium Area Sampling Approach.mxd1/21/2013fcain



Surface and Subsurface Soil Sample

DU Penetrator Location

Depleted Uranium Area

Rectangular Extent

Grid (30 Meter)

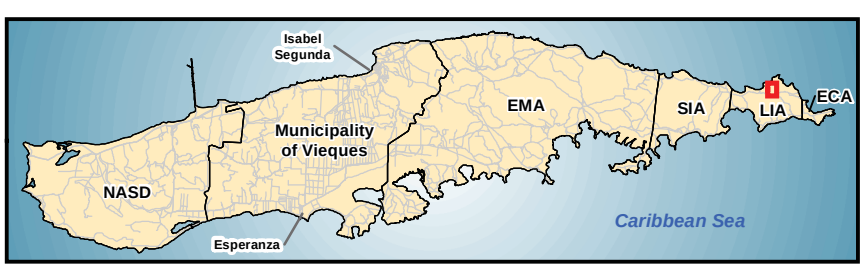


Figure 32
Depleted Uranium Area Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

N W E S

0 50 100 Feet

2007 Aerial Imagery

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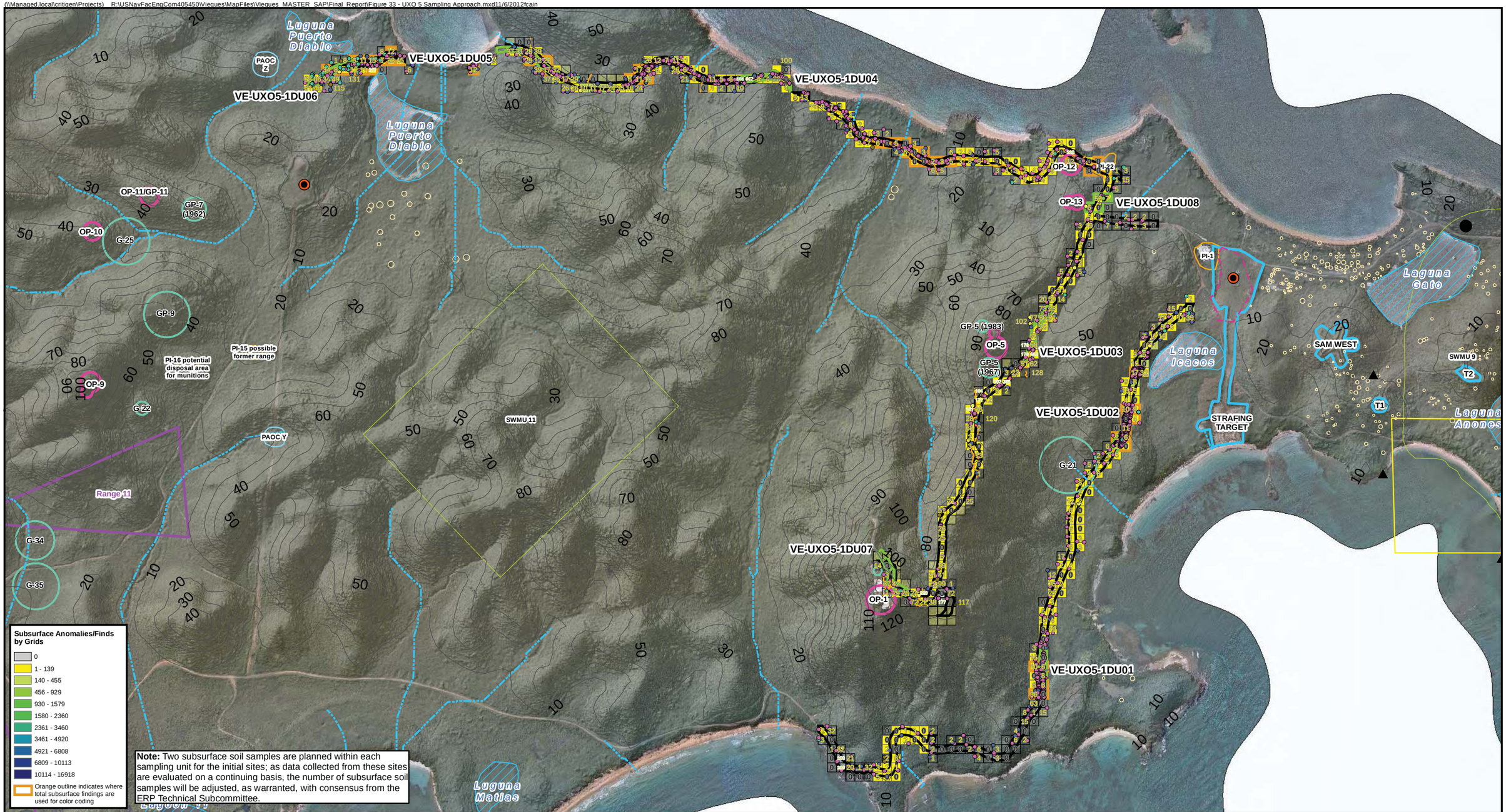
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 33 - UXO 5 Sampling Approach.mxd11/6/2012fcain



Road Sample Units
Decision Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Submunitions
Transect -3 Foot Width was Investigated
Topographic Contours (10 Meter)
Stream

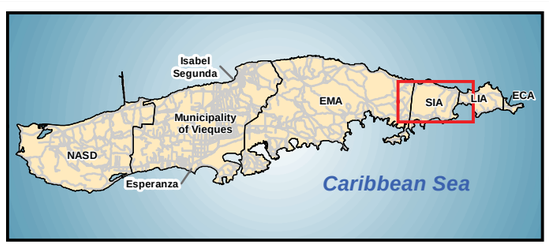
Crater
Historical Air-To-Ground (ATG) Target
Historical Naval Gunfire Support (NGFS) Target
Bulls Eye Target
Central Processing Center
Gun Positions

Target Area
Observation Point
Range
Naval Gunfire Support (NGFS) Target Area
Photo Identified Area
Preliminary Area of Concern
Solid Waste Management Unit
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 500 1,000
Feet

Figure 33
UXO 5 Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 34a - UXO 6 (East Portion) Sampling Approach.mxd11/6/2012fcain

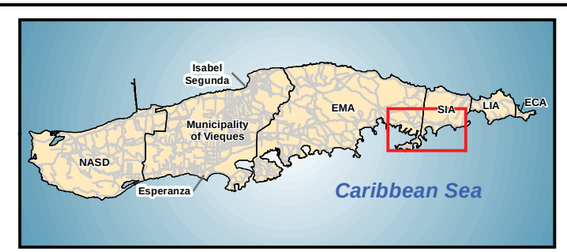
Sampling Unit
Decision Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Transect -3 Foot Width was Investigated

Topographic Contours (10 Meter)
Stream
Gun Positions
Target Area
Observation Point
Range
Photo Identified Area
Preliminary Area of Concern
Solid Waste Management Unit
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 500 1,000
Feet

Figure 34a
UXO 6 (East Portion) Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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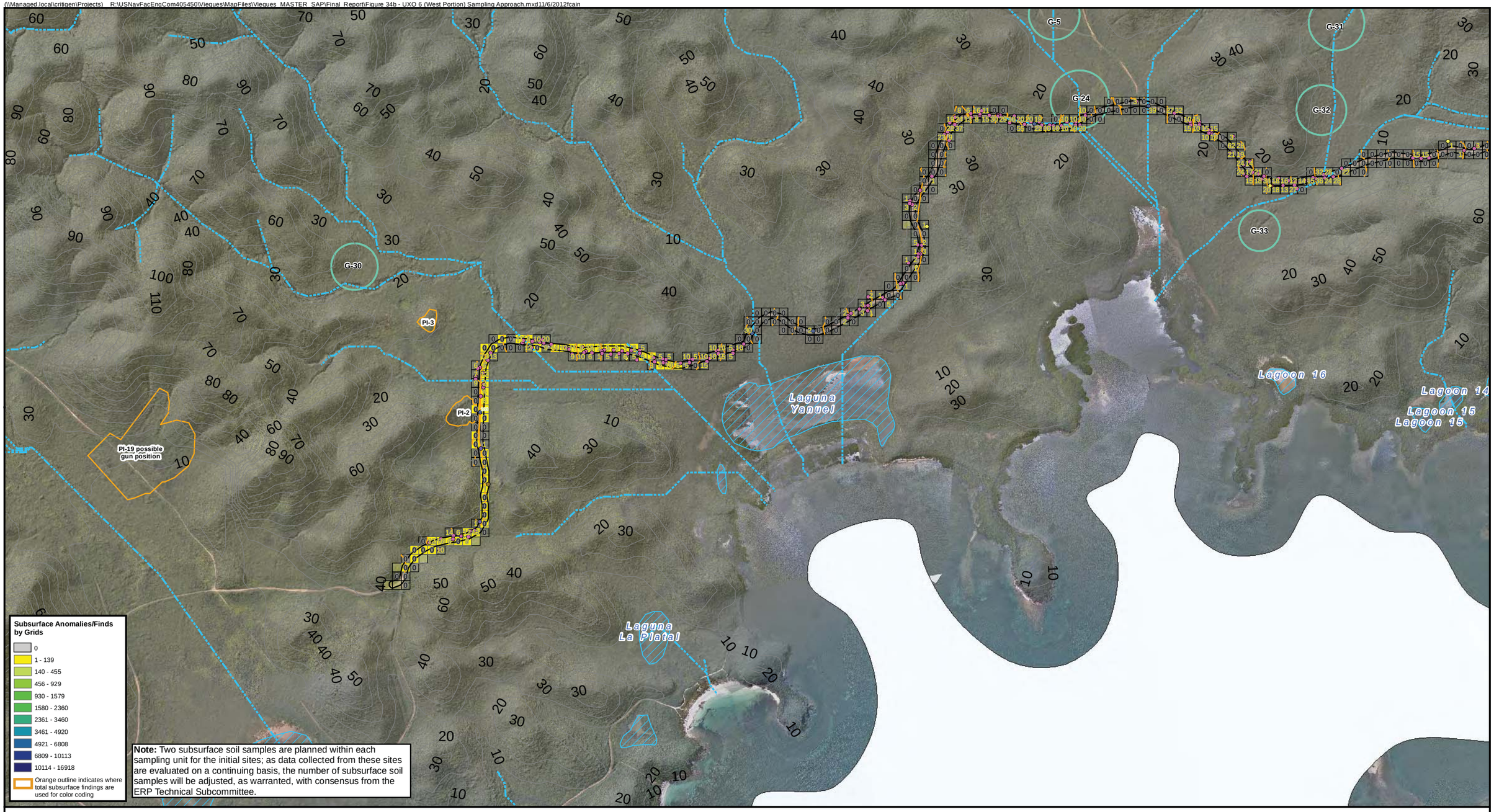
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 34b - UXO 6 (West Portion) Sampling Approach.mxd11/6/2012fcain



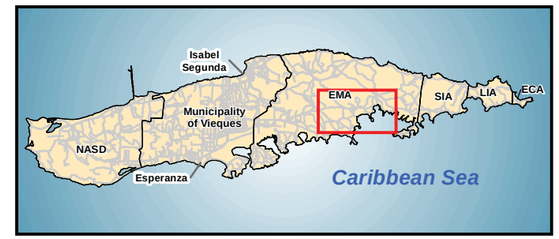
Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Decision Unit
- Bombs
- Flares-Pyrotechnics
- Grenades
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Transect -3 Foot Width was Investigated
- Topographic Contours (10 Meter)
- Stream
- Gun Positions
- Photo Identified Area
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918



N
W E
S

0 500 1,000
Feet

Figure 34b
UXO 6 (West Portion) Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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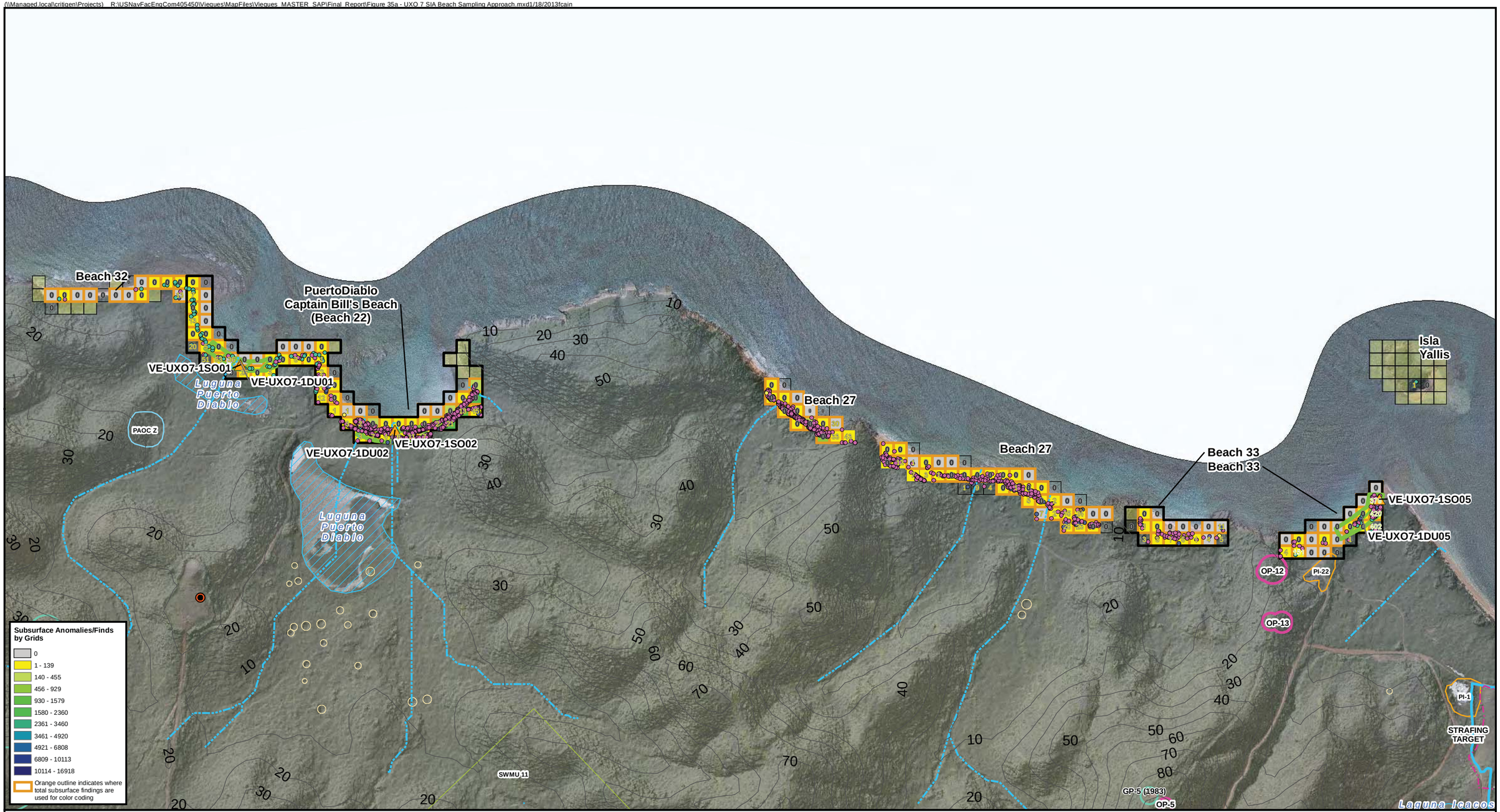


Deep Surface Soil Sample
Sample Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Beach Selected for Sampling

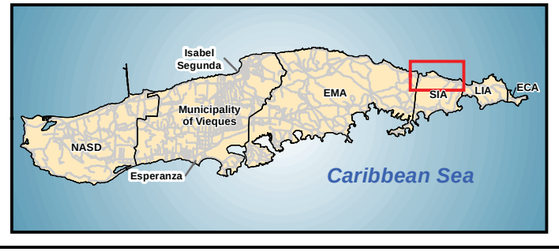
2005 Aerial Imagery
2005 Hillshade

Topographic Contours (10 Meter)
Stream
Crater
Bulls Eye Target
Central Processing Center
Gun Positions

Target Area
Observation Point
Photo Identified Area
Preliminary Area of Concern
Solid Waste Management Unit
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 350 700
Feet

Figure 35a
UXO 7 SIA Beach Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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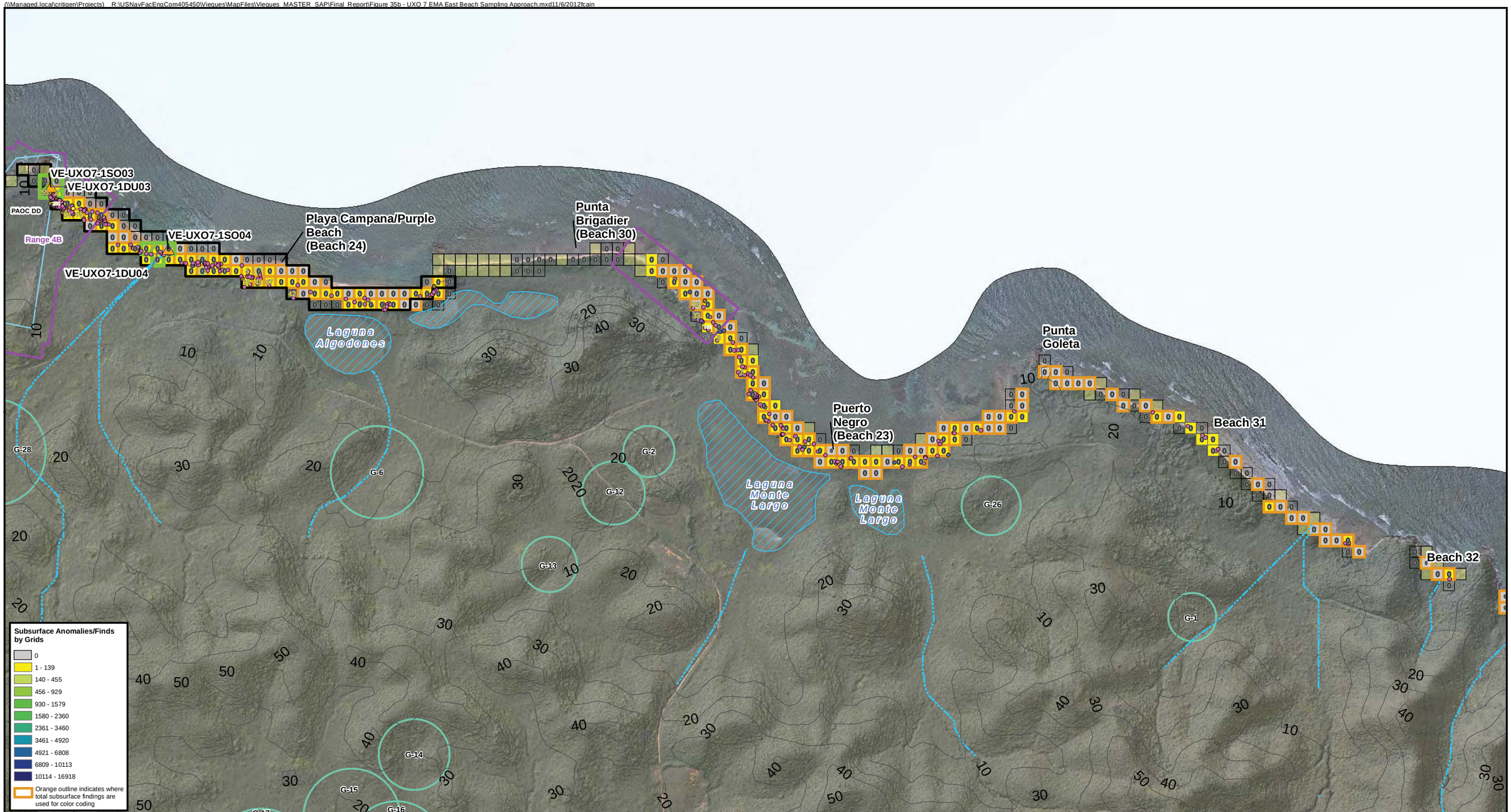
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 35b - UXO 7 EMA East Beach Sampling Approach.mxd11/6/2012fcain



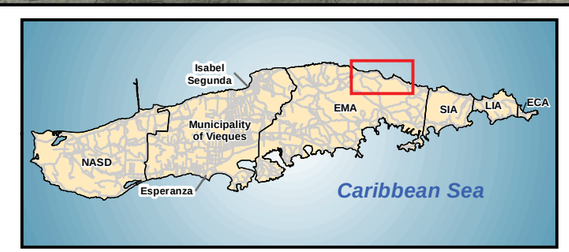
Deep Surface Soil Sample
Sample Unit
Beach Selected for Sampling
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)

Topographic Contours (10 Meter)
Stream
Gun Positions
Range
Photo Identified Area
Preliminary Area of Concern
Solidl Waste Management Unit
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

2005 Aerial Imagery
2005 Hillshade

Surface Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 400 800
Feet

Figure 35b
UXO 7 EMA East Beach Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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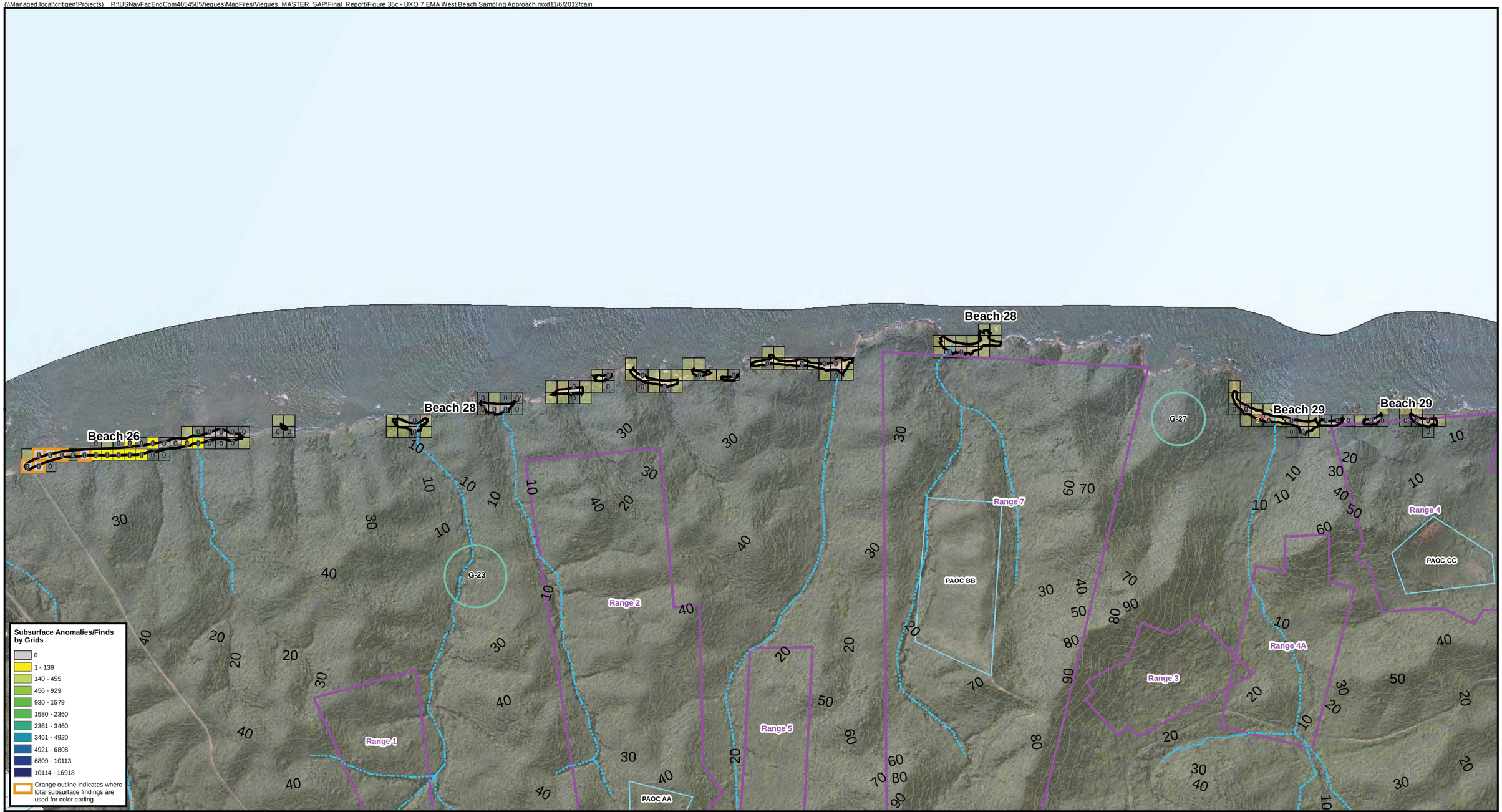
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 35c - UXO 7 EMA West Beach Sampling Approach.mxd11/6/2012fcain



- Bombs
- Flares-Pyrotechnics
- Grenades
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Beach Selected for Sampling

- Topographic Contours (10 Meter)
- Stream
- Gun Positions
- Range
- Preliminary Area of Concern
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918

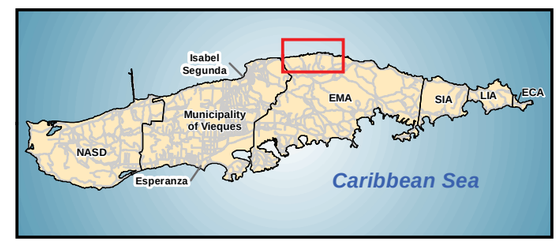


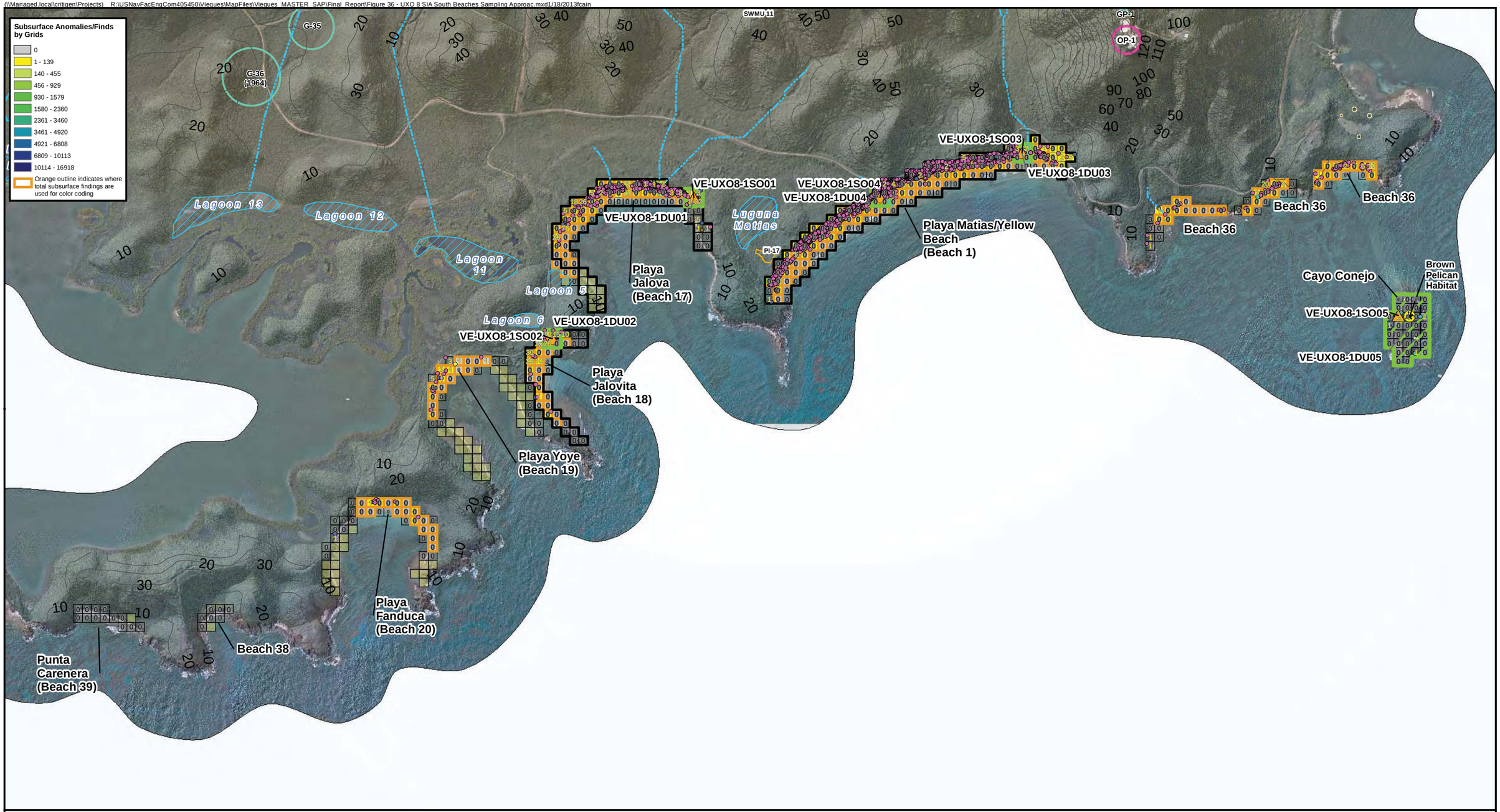
Figure 35c
UXO 7 EMA West Beach Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

N W E S

0 400 800 Feet

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 36 - UXO 8 SIA South Beaches Sampling Approac.mxd1/18/2013fcain

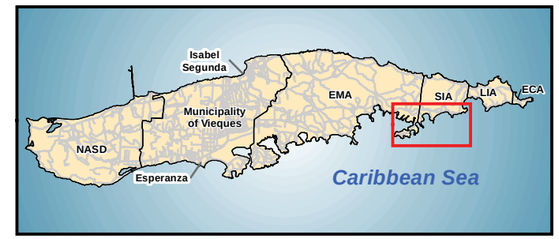


Deep Surface Soil Sample
Brown Pelican Habitat
Sample Unit
Beach Selected for Sampling
Bombs
Flares-Pyrotechnics
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
2005 Aerial Imagery
2005 Hillshade

Topographic Contours (10 Meter)
Stream
Crater
Gun Positions
Observation Point
Photo Identified Area
Solid Waste Management Unit
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

Surface Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 500 1,000
Feet

Figure 36
UXO 8 SIA South Beaches Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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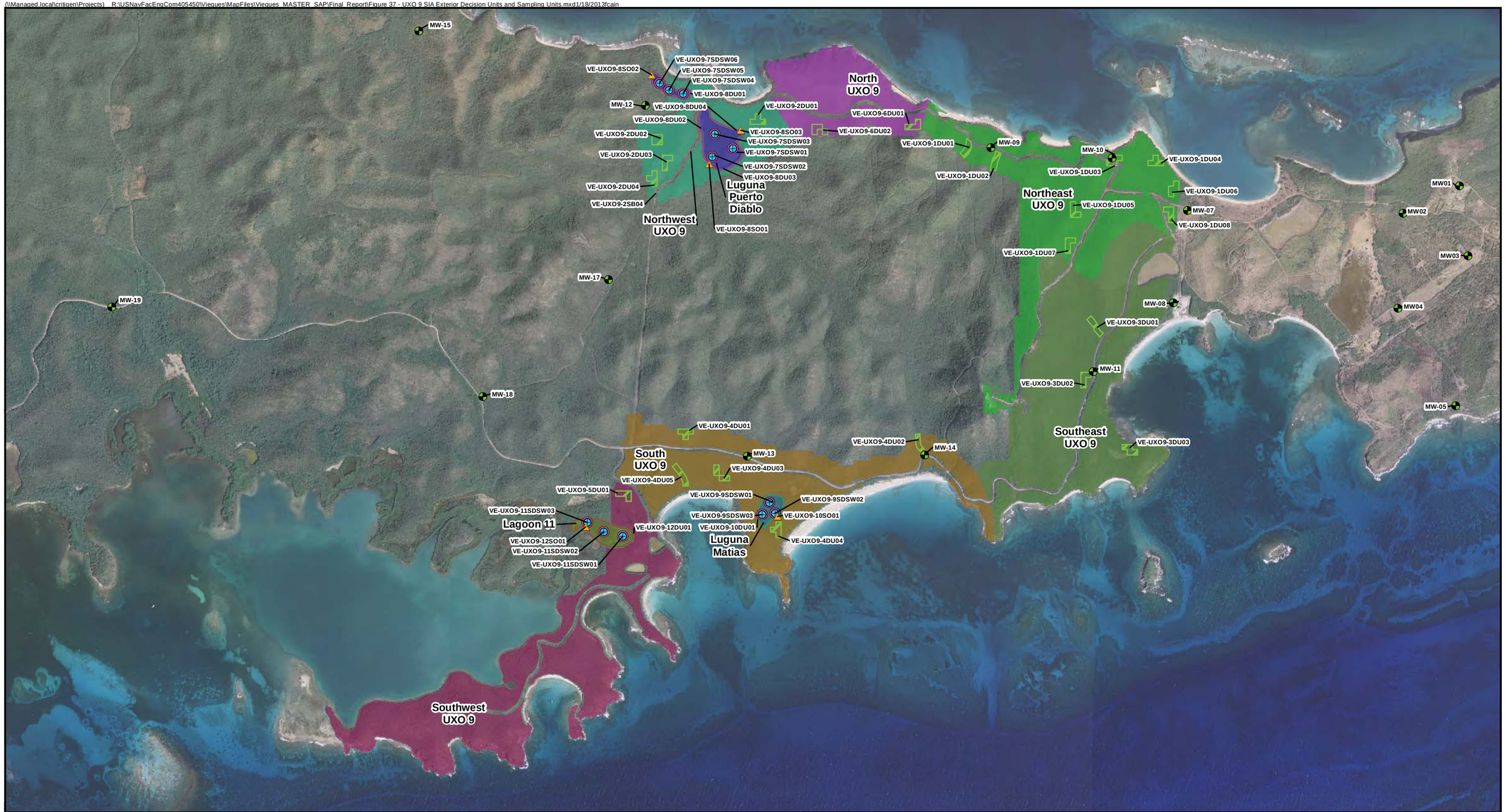
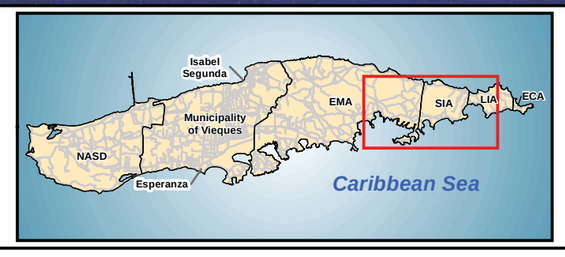
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 37 - UXO 9 SIA Exterior Decision Units and Sampling Units.mxd1/18/2013fcain



Proposed Surface Water Samples
Proposed Sediment Samples
Proposed Monitoring Well
Deep Surface Soil Sample
Sample Unit (Interior)

Decision Unit
- North UXO 9
- Northeast UXO 9
- Northwest UXO 9
- South UXO 9
- Southeast UXO 9
- Southwest UXO 9
- Northwest UXO 9 Lagoons (Laguna Puerto Diablo)
- Luguna Matias
- Southwest UXO 9 Lagoons (Lagoon 11)
- Northwest UXO 9 Lagoon Fringe (Laguna Puerto Diablo)
- Laguna Matias Fringe
- Southwest UXO 9 Lagoon Fringes (Lagoon 11)



N
W E
S

0 900 1,800
Feet

Figure 37
UXO 9 SIA Exterior Decision Units and Sampling Units
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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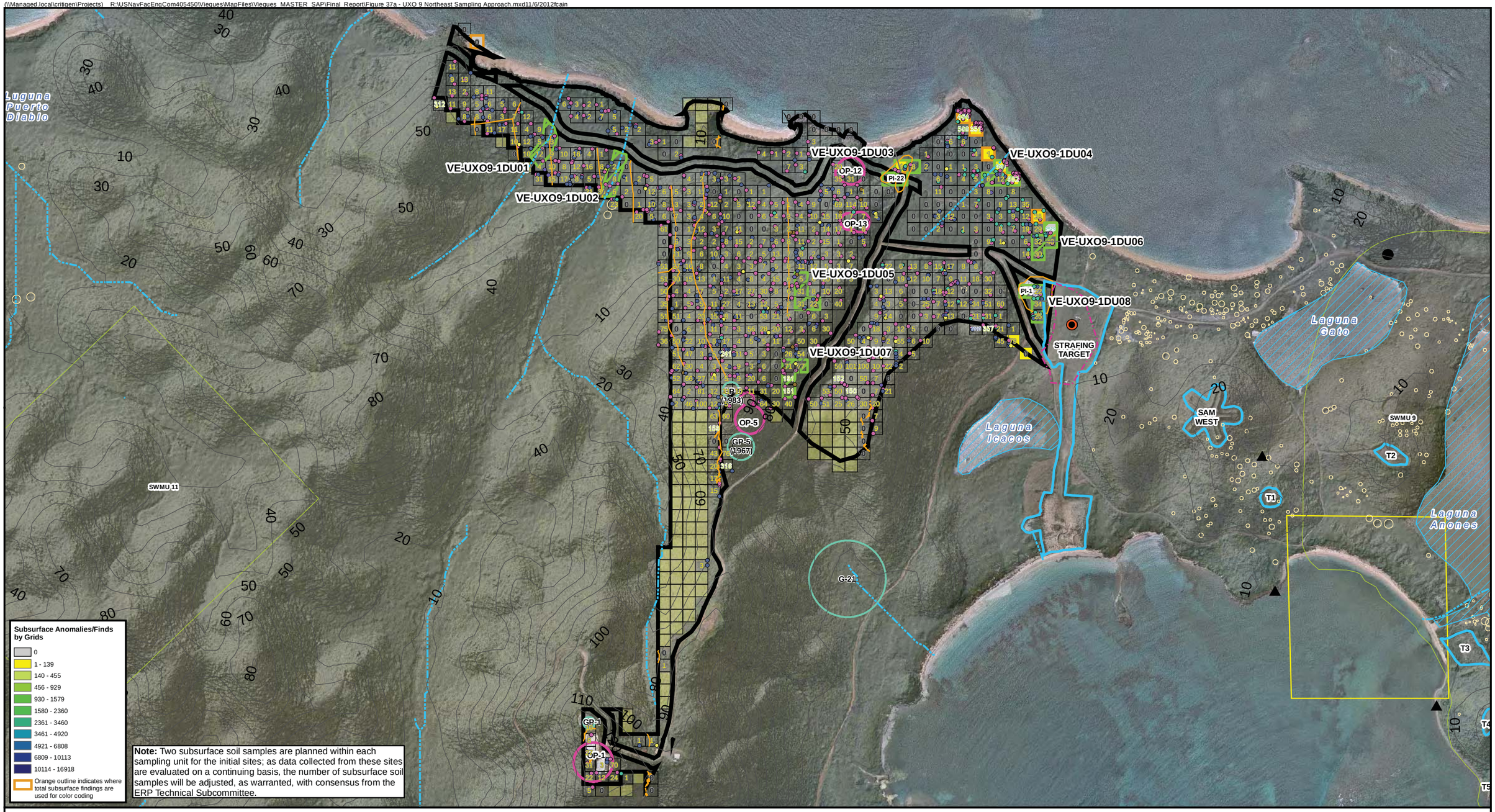
2007 Aerial Imagery

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 37a - UXO 9 Northeast Sampling Approach.mxd11/6/2012fcain

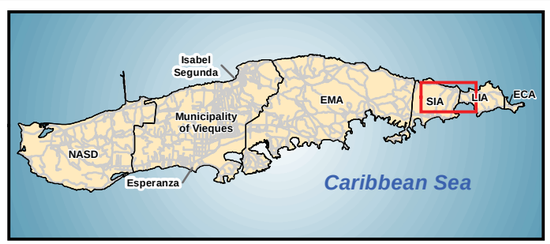


Sample Unit
Decision Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)

Transect -3 Foot Width was Investigated
Topographic Contours (10 Meter)
Stream
Crater
Historical Air-To-Ground (ATG) Target
Historical Naval Gunfire Support (NGFS) Target
Bulls Eye Target
Central Processing Center
Gun Positions
2005 Aerial Imagery
2005 Hillshade

Observation Point
Target Area
Naval Gunfire Support (NGFS) Target Area
Photo Identified Area
Solid Waste Management Unit
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)
1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

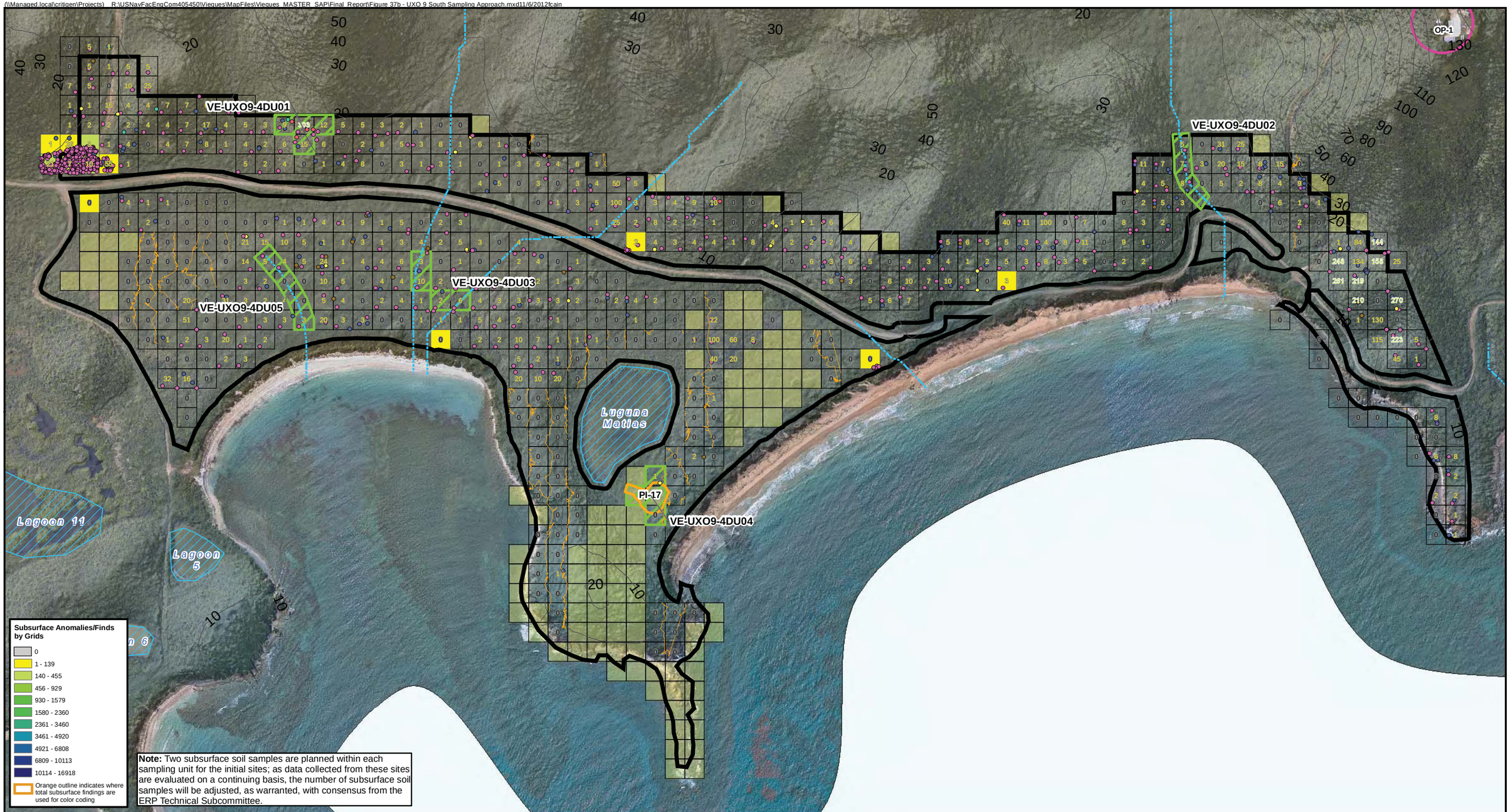


N
W E
S

0 500 1,000
Feet

Figure 37a
UXO 9 Northeast Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL



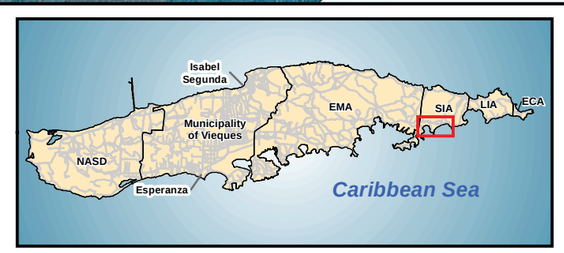
Sample Unit
Decision Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)

Transect -3 Foot Width was Investigated
Topographic Contours (10 Meter)
Stream
Observation Point
Photo Identified Area
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 250 500
Feet

Figure 37b
UXO 9 South Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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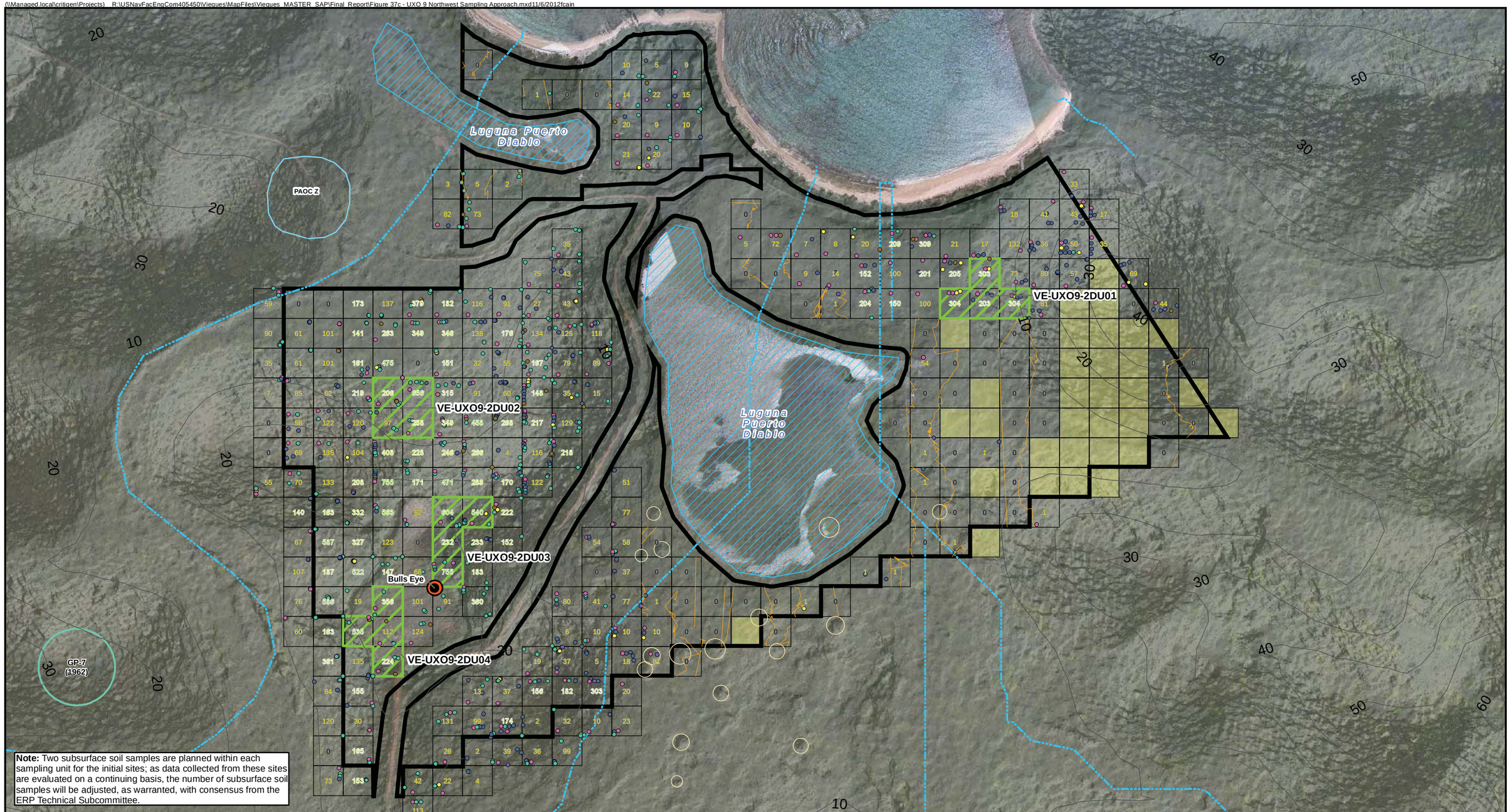
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 37c - UXO 9 Northwest Sampling Approach.mxd11/6/2012fcain



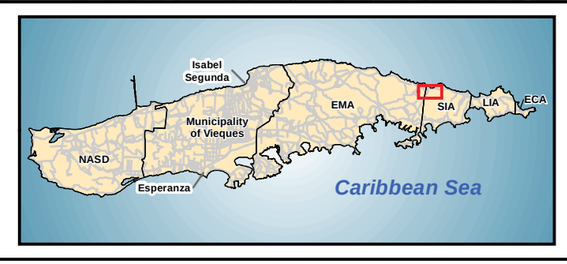
Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Sample Unit
- Decision Unit
- Bombs
- Flares-Pyrotechnics
- Grenades
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Lagoon
- Transect -3 Foot Width was Investigated
- Topographic Contours (10 Meter)
- Stream
- Crater
- Bulls Eye Target
- Gun Positions
- Preliminary Area of Concern
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918



N W E S

0 150 300 Feet

Figure 37c
UXO 9 Northwest Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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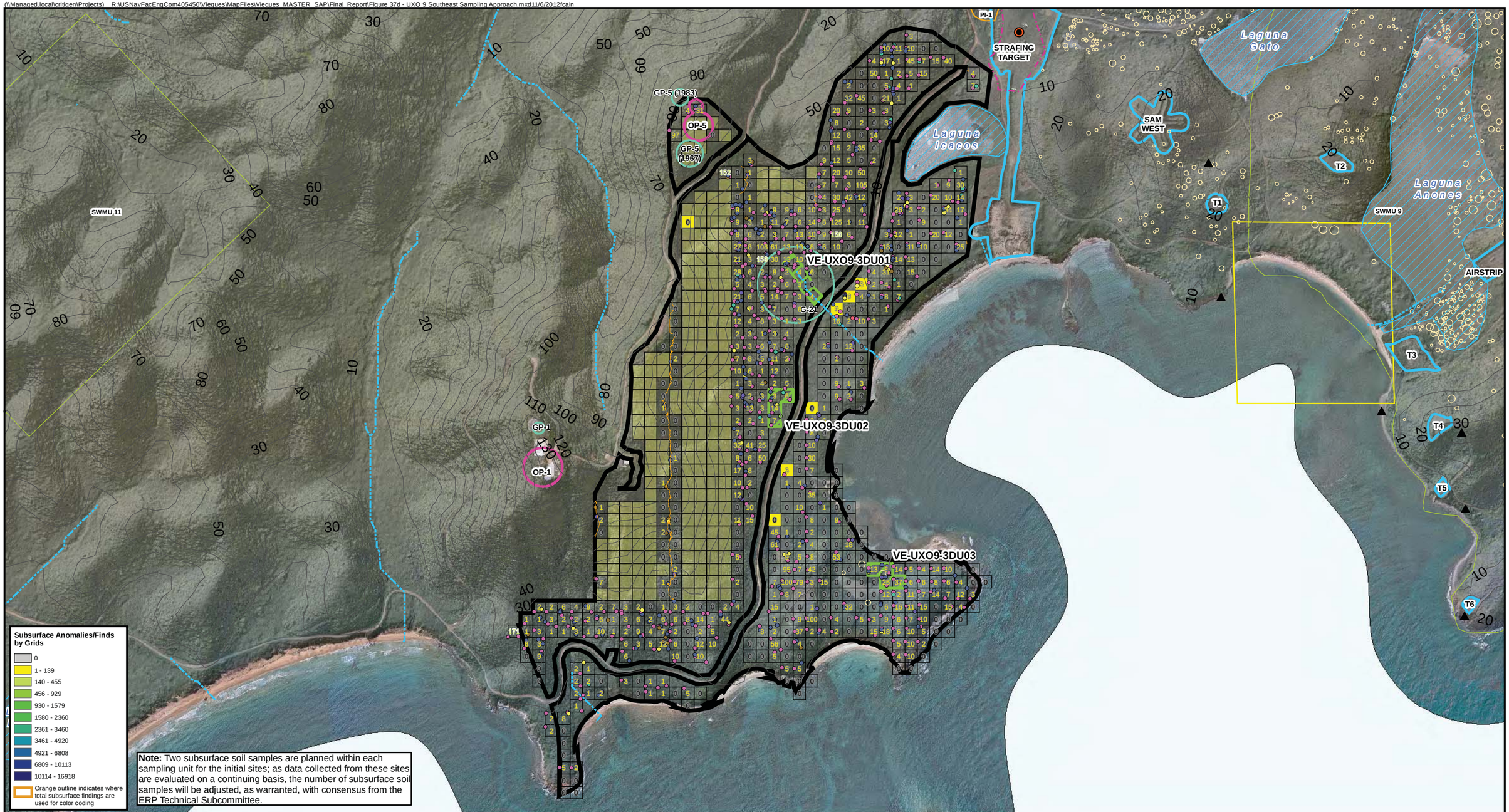
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 37d - UXO 9 Southeast Sampling Approach.mxd11/6/2012fcain



Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Sample Unit
- Decision Unit
- Bombs
- Flares-Pyrotechnics
- Grenades
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Submunitions

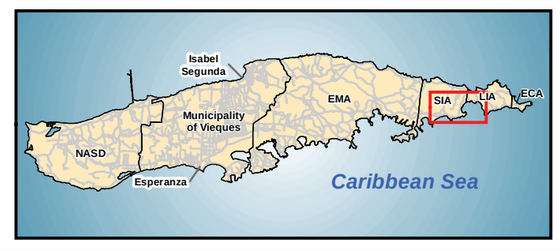
- Transect - 3 Foot Width was Investigated
- Topographic Contours (10 Meter)
- Stream
- Crater
- Historical Naval Gunfire Support (NGFS) Target
- Bulls Eye Target
- Central Processing Center
- Gun Positions

- Target Area
- Observation Point
- Naval Gunfire Support (NGFS) Target Area
- Photo Identified Area
- Solid Waste Management Unit
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918

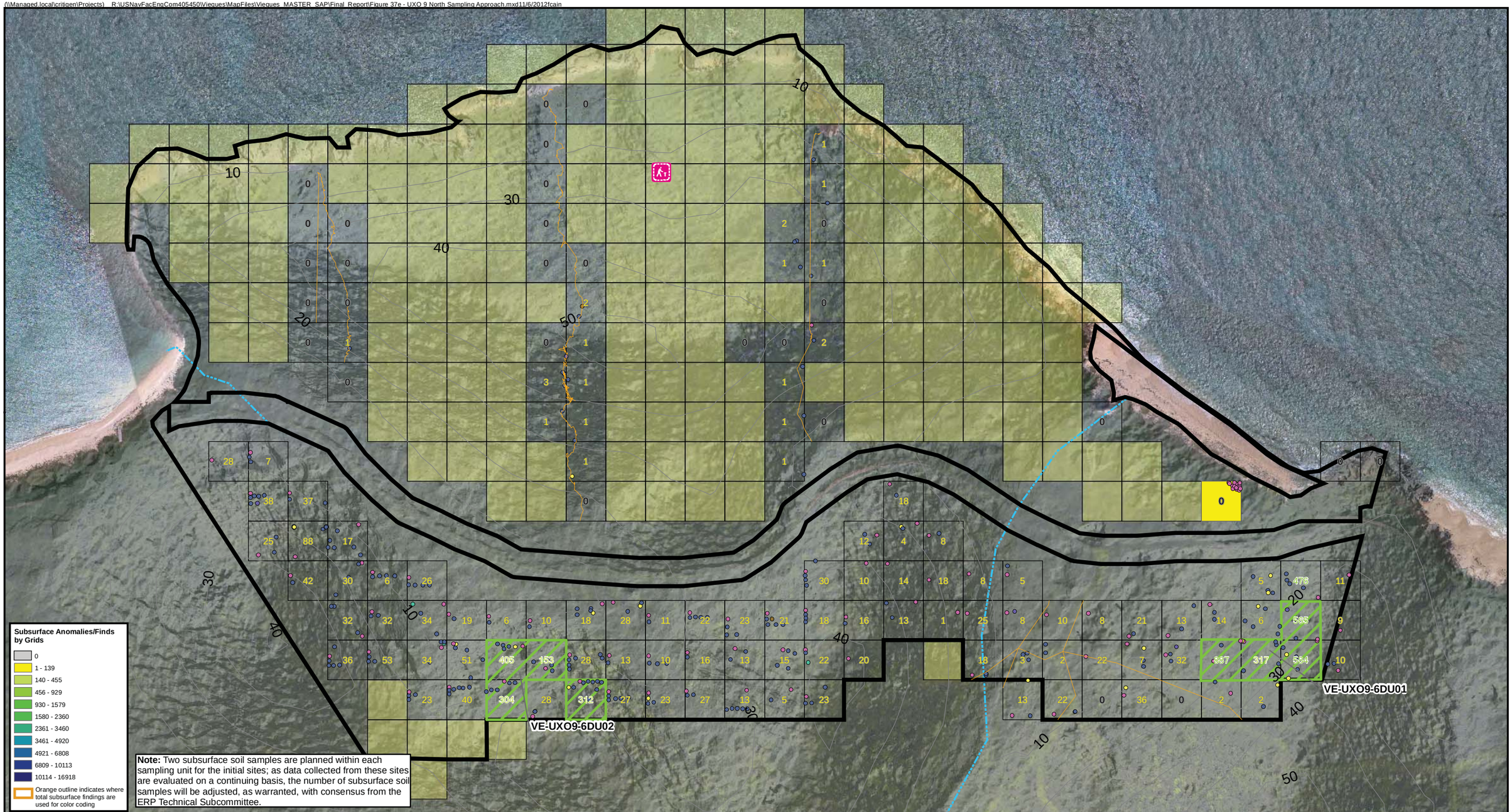


N
W E
S

0 500 1,000
Feet

Figure 37d
UXO 9 Southeast Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL



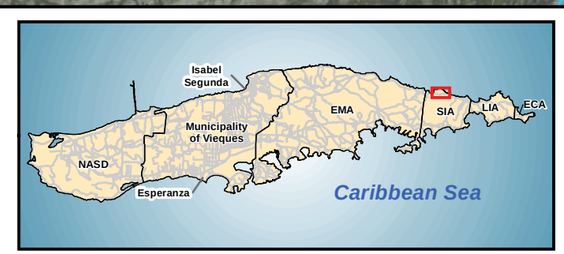
Sample Unit
Decision Unit
Bombs
Flares-Pyrotechnics
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)

Transect - 3 Foot Width was Investigated
Topographic Contours (10 Meter)
Stream
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Interpretive Trail

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 250 500
Feet

Figure 37e
UXO 9 North Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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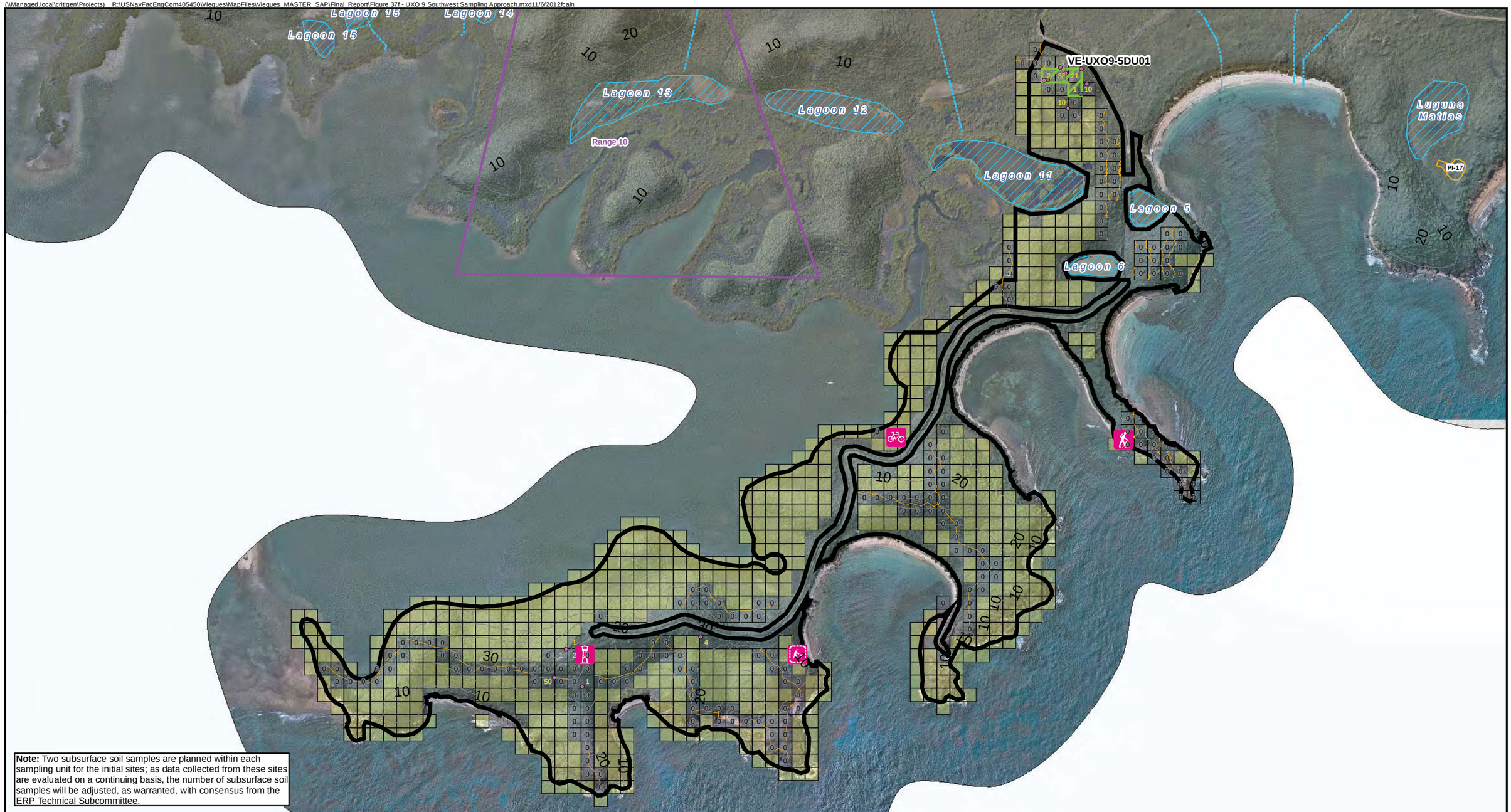
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 37f - UXO 9 Southwest Sampling Approach.mxd11/6/2012fcain



Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Sample Unit
- Decision Unit
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Transect - 3 Foot Width was Investigated
- Topographic Contours (10 Meter)
- Stream
- Lagoon

2005 Aerial Imagery
2005 Hillshade

- Range
- Photo Identified Area
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Biking Trail
- Hiking Trail
- Interpretive Trail
- Observation Tower

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918

N
W E
S

0 500 1,000
Feet

Figure 37f
UXO 9 Southwest Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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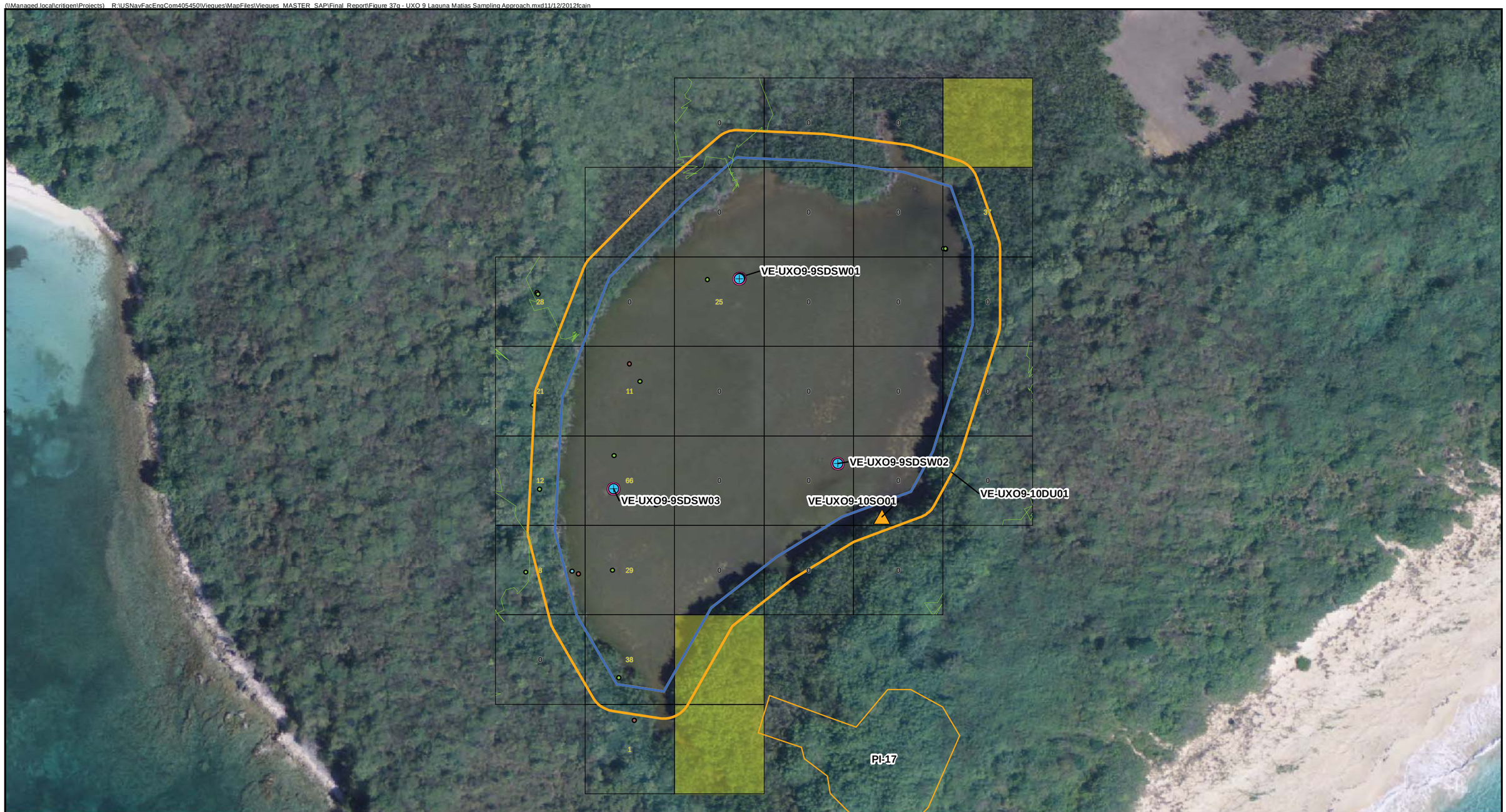
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 37g - UXO 9 Laguna Matias Sampling Approach.mxd11/12/2012fcain



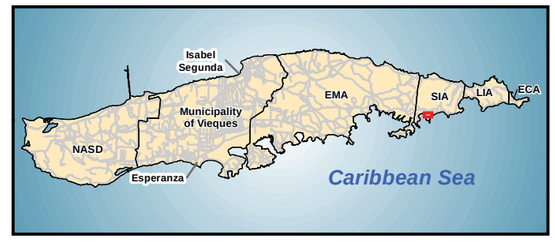
Deep Surface Soil Sample
Proposed Surface Water Samples
Proposed Sediment Samples
Transect - 3 Foot Width was Investigated
Lagoon
Lagoon Fringe
Photo Identified Area
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation

2007 Aerial Imagery

Bombs
Projectiles / Mortars
Rockets / Guided Missiles
Scrap

Denisity of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 75 150
Feet

Figure 37g
UXO 9 Laguna Matias Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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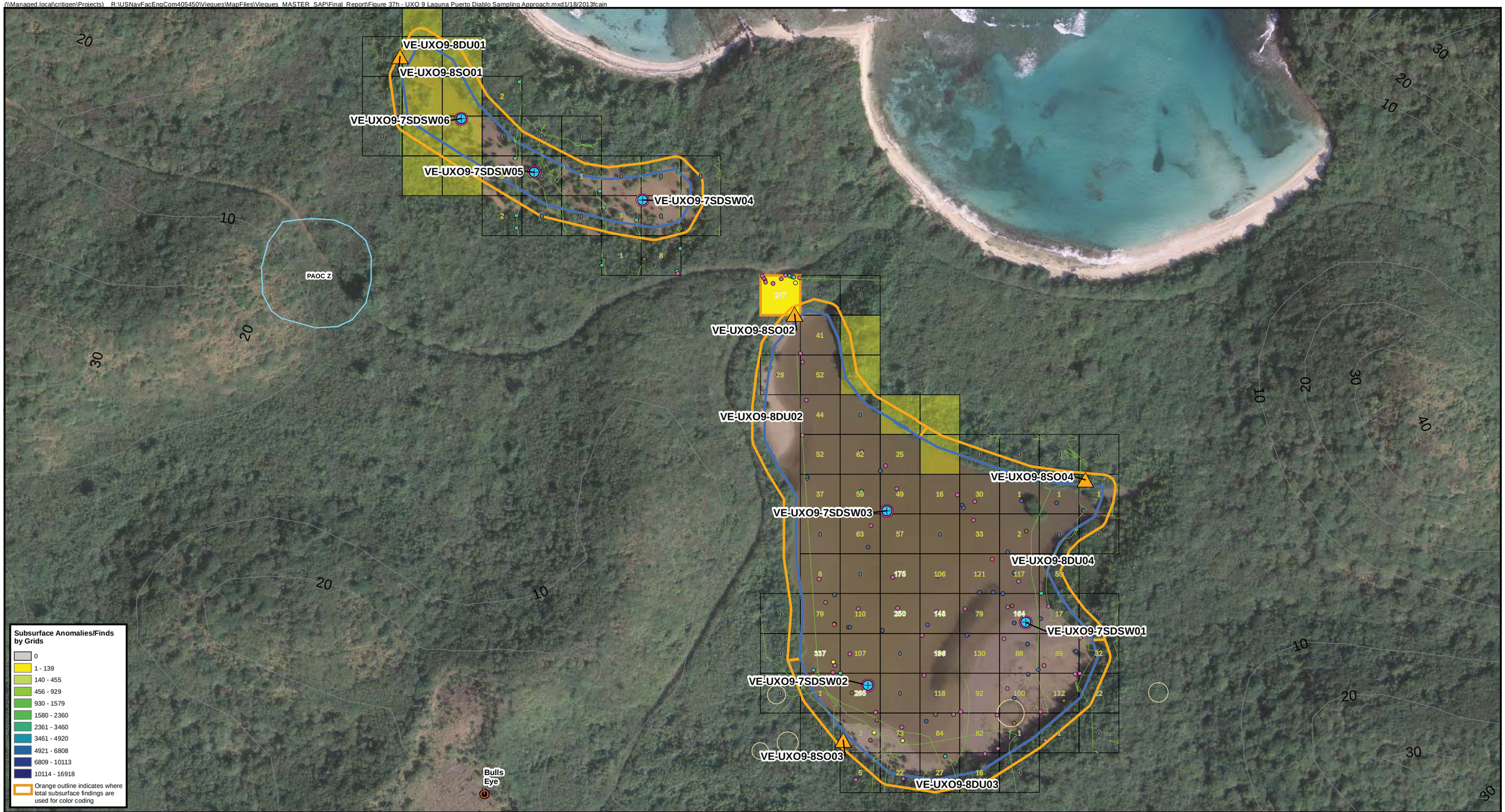
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 37h - UXO 9 Laguna Puerto Diablo Sampling Approach.mxd1/18/2013fcain



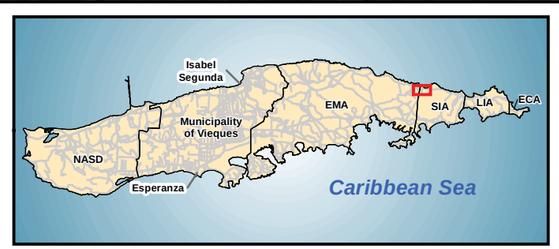
Proposed Surface Water Samples
Proposed Sediment Samples
Deep Surface Soil Sample
Lagoon
Lagoon Fringe
Yellow Shading Indicates No MEC Investigation

Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Bulls Eye Target

Crater
Preliminary Area of Concern
Grid (30 Meter)
Transect - 3 Foot Width was Investigated
Topographic Contours (10 Meter)

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 125 250
Feet

Figure 37h
UXO 9 Laguna Puerto Diablo Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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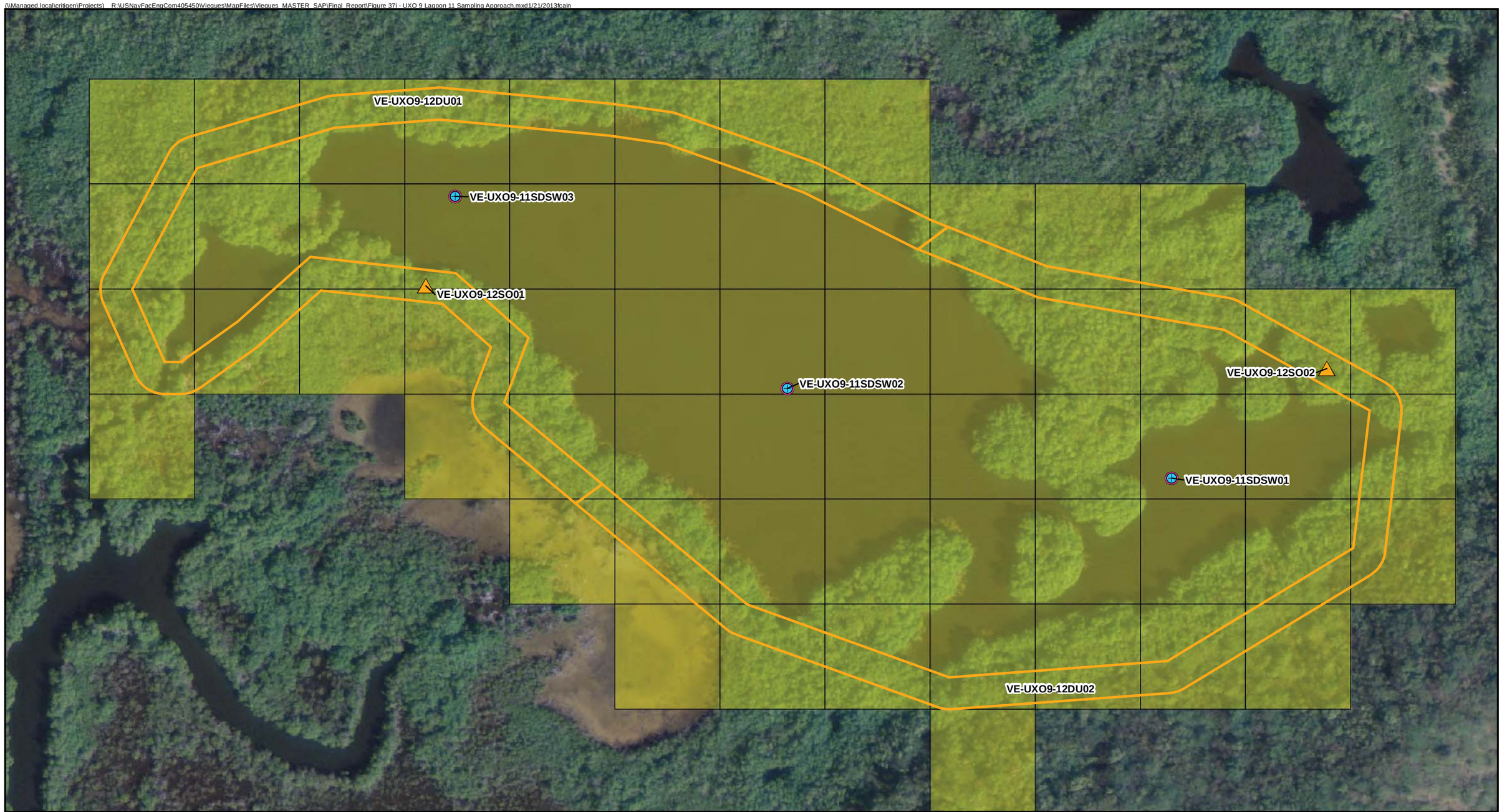
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 37i - UXO 9 Lagoon 11 Sampling Approach.mxd1/21/2013fcain



Proposed Surface Water Samples
Proposed Sediment Samples
Deep Surface Soil Sample
Lagoon Fringe
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation

Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Submunitions

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

N
W E
S

0 45 90
Feet

2007 Aerial Imagery

Figure 37i
UXO 9 Lagoon 11 Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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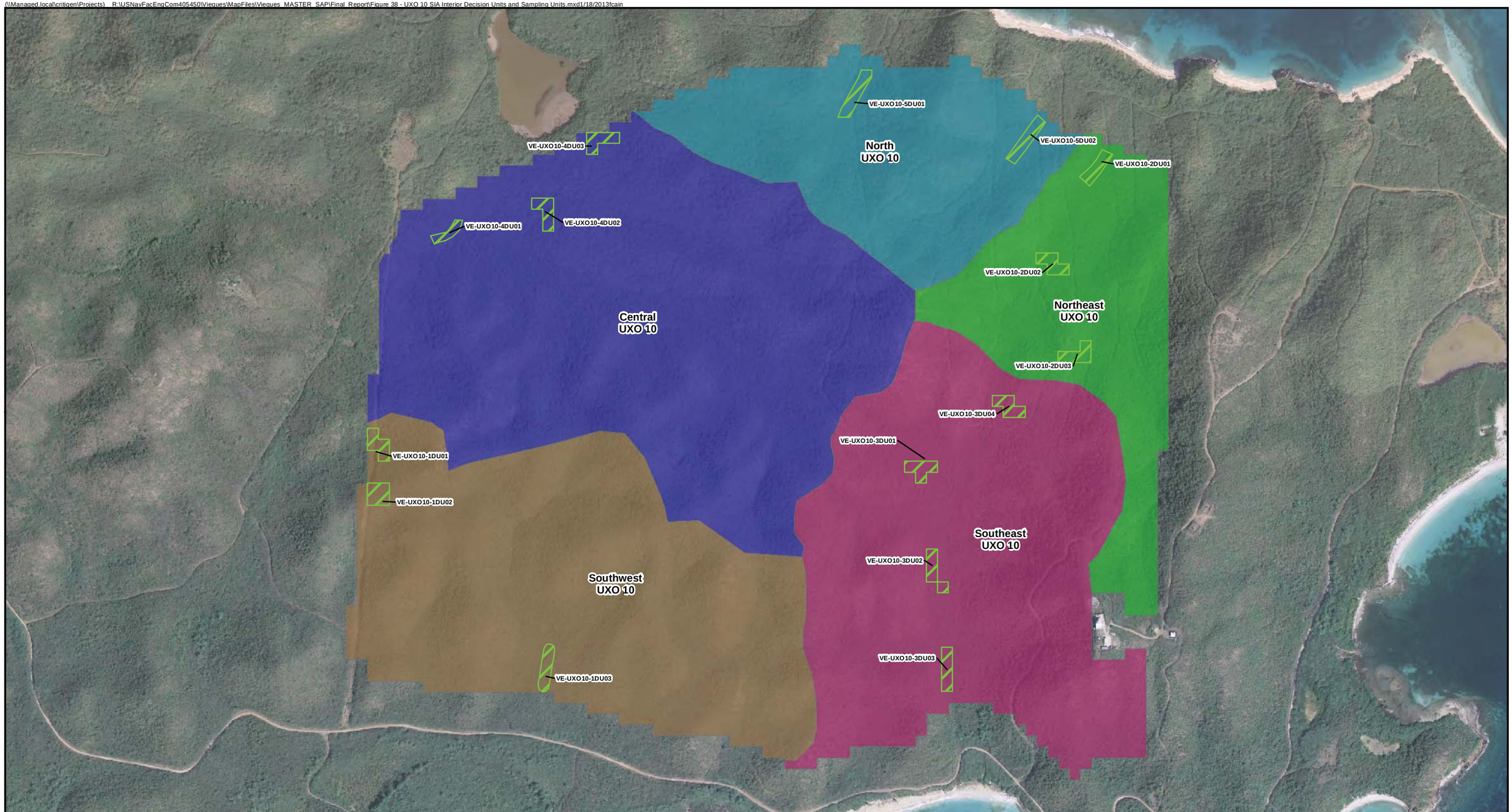
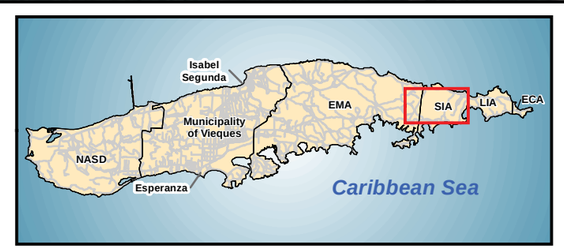
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 38 - UXO 10 SIA Interior Decision Units and Sampling Units.mxd1/18/2013fcain



Sample Unit

Decision Unit

- Central UXO 10
- North UXO 10
- Northeast UXO 10
- Southeast UXO 10
- Southwest UXO 10



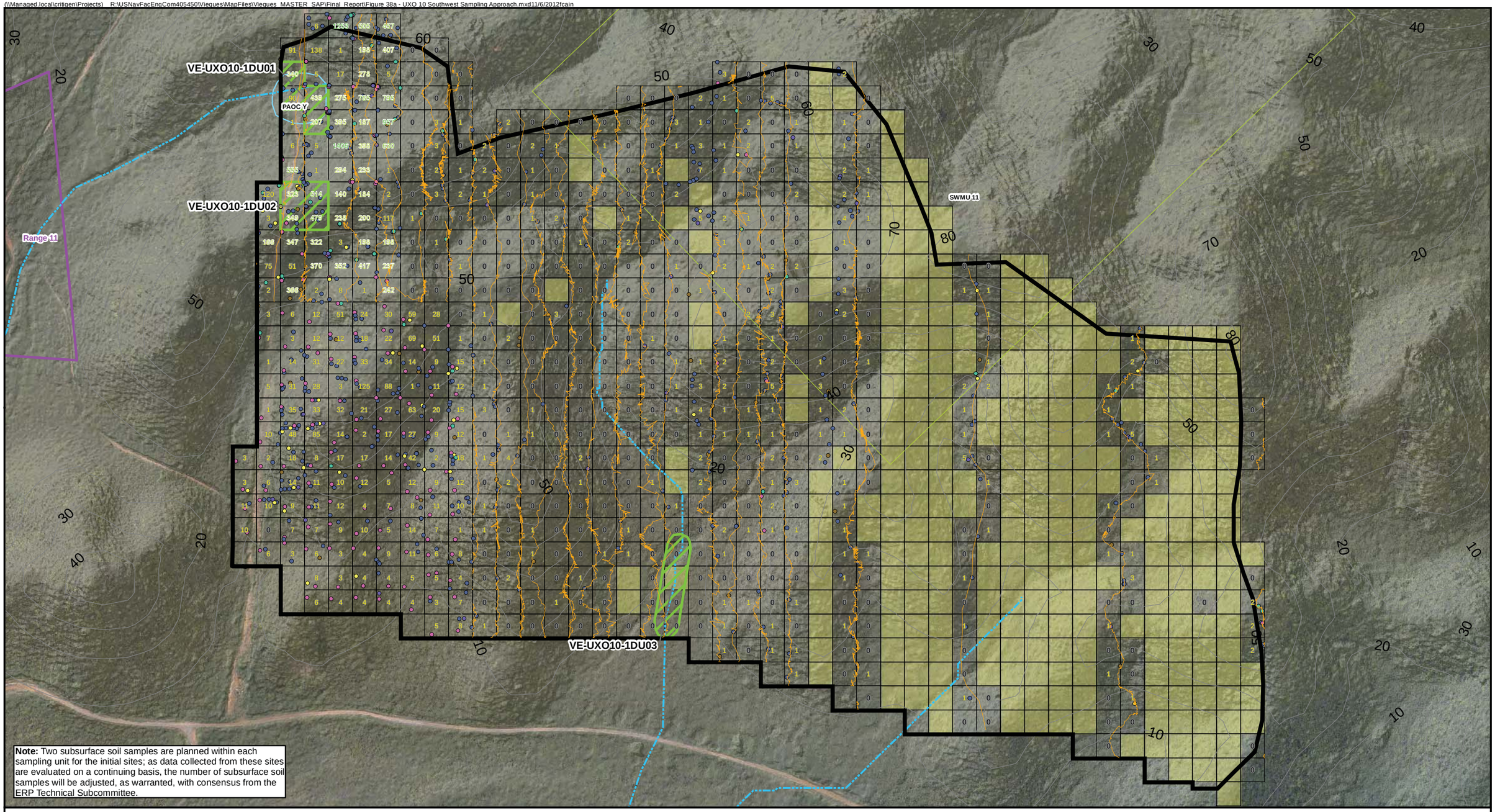
N
W E
S

0 425 850
Feet

Figure 38
UXO 10 SIA Interior Decision Units and Sampling Units
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

2007 Aerial Imagery

CH2MHILL



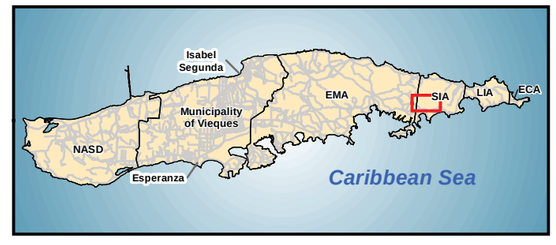
Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Transect - 3 Foot Width was Investigated
- Decision Unit
- Bombs
- Flares-Pyrotechnics
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Sample Unit
- Topographic Contours (10 Meter)
- Stream
- Range
- Preliminary Area of Concern
- Solid Waste Management Unit
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



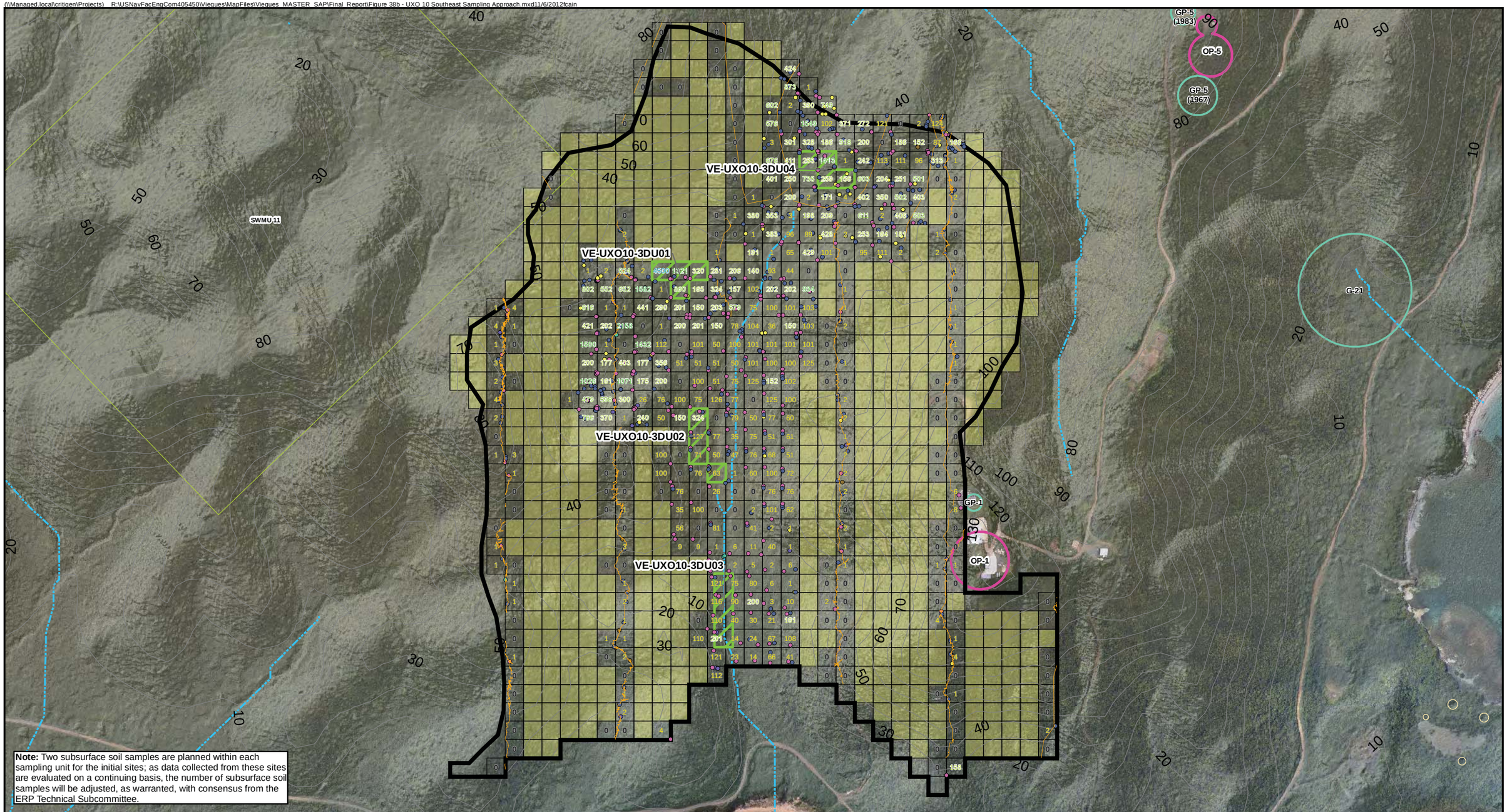
N
W E
S

0 200 400
Feet

Figure 38a
UXO 10 Southwest Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 38b - UXO 10 Southeast Sampling Approach.mxd11/6/2012fcain



Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

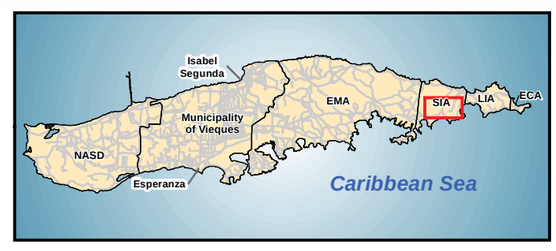
- Sample Unit
- Decision Unit
- Bombs
- Flares-Pyrotechnics
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)

- Transect - 3 Foot Width was Investigated
- Topographic Contours (10 Meter)
- Stream
- Crater
- Gun Positions
- Target Area
- Observation Point
- Solid Waste Management Unit
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918



N W E S

0 250 500 Feet

Figure 38b
UXO 10 Southeast Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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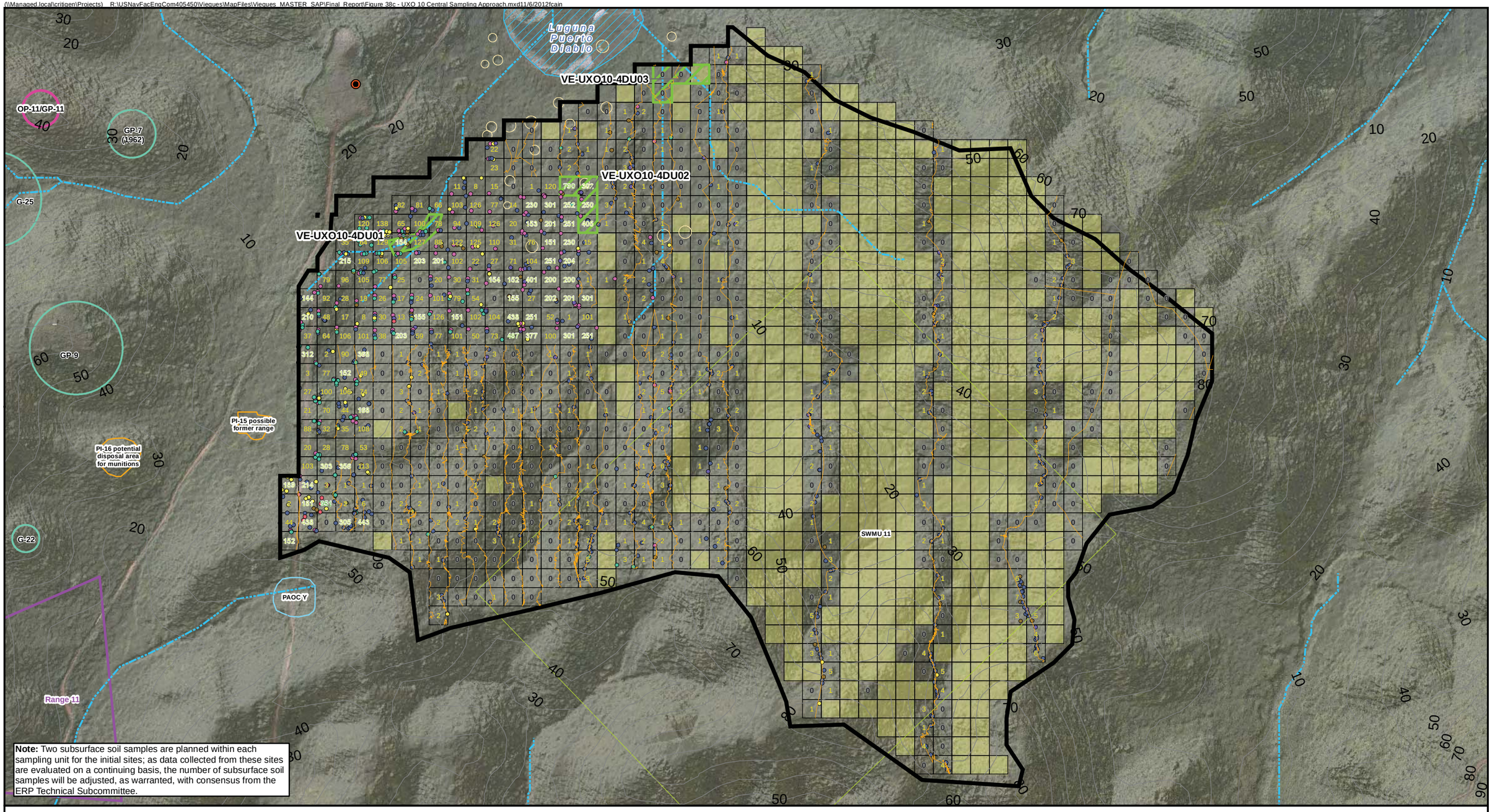
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 38c - UXO 10 Central Sampling Approach.mxd11/6/2012fcain



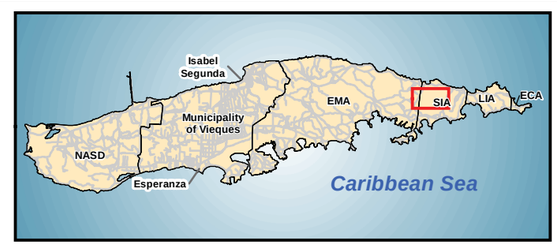
Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Sample Unit
- Decision Unit
- Bombs
- Flares-Pyrotechnics
- Grenades
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Transect - 3 Foot Width was Investigated
- Topographic Contours (10 Meter)
- Stream
- Crater
- Bulls Eye Target
- Gun Positions
- Observation Point
- Range
- Photo Identified Area
- Preliminary Area of Concern
- Solid Waste Management Unit
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918



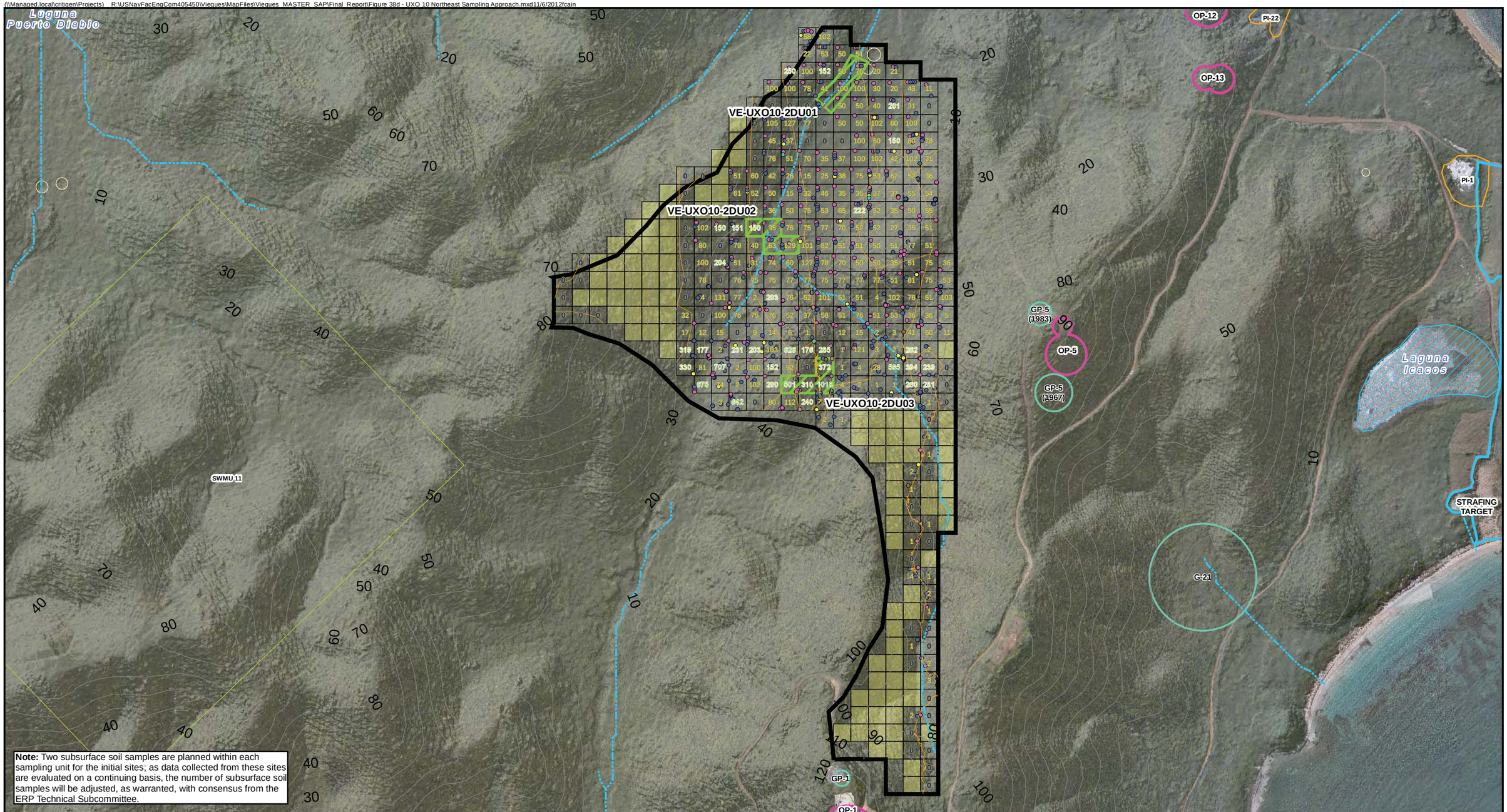
N W E S

0 250 500 Feet

Figure 38c
UXO 10 Central Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 38d - UXO 10 Northeast Sampling Approach.mxd11/6/2012fcain



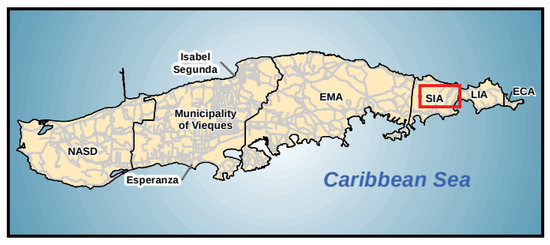
Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Sample Unit
- Decision Unit
- Bombs
- Flares-Pyrotechnics
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Transect - 3 Foot Width was Investigated
- Topographic Contours (10 Meter)
- Stream
- Crater
- Gun Positions
- Target Area
- Observation Point
- Photo Identified Area
- Solid Waste Management Unit
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918



N W E S

0 500 1,000 Feet

Figure 38d
UXO 10 Northeast Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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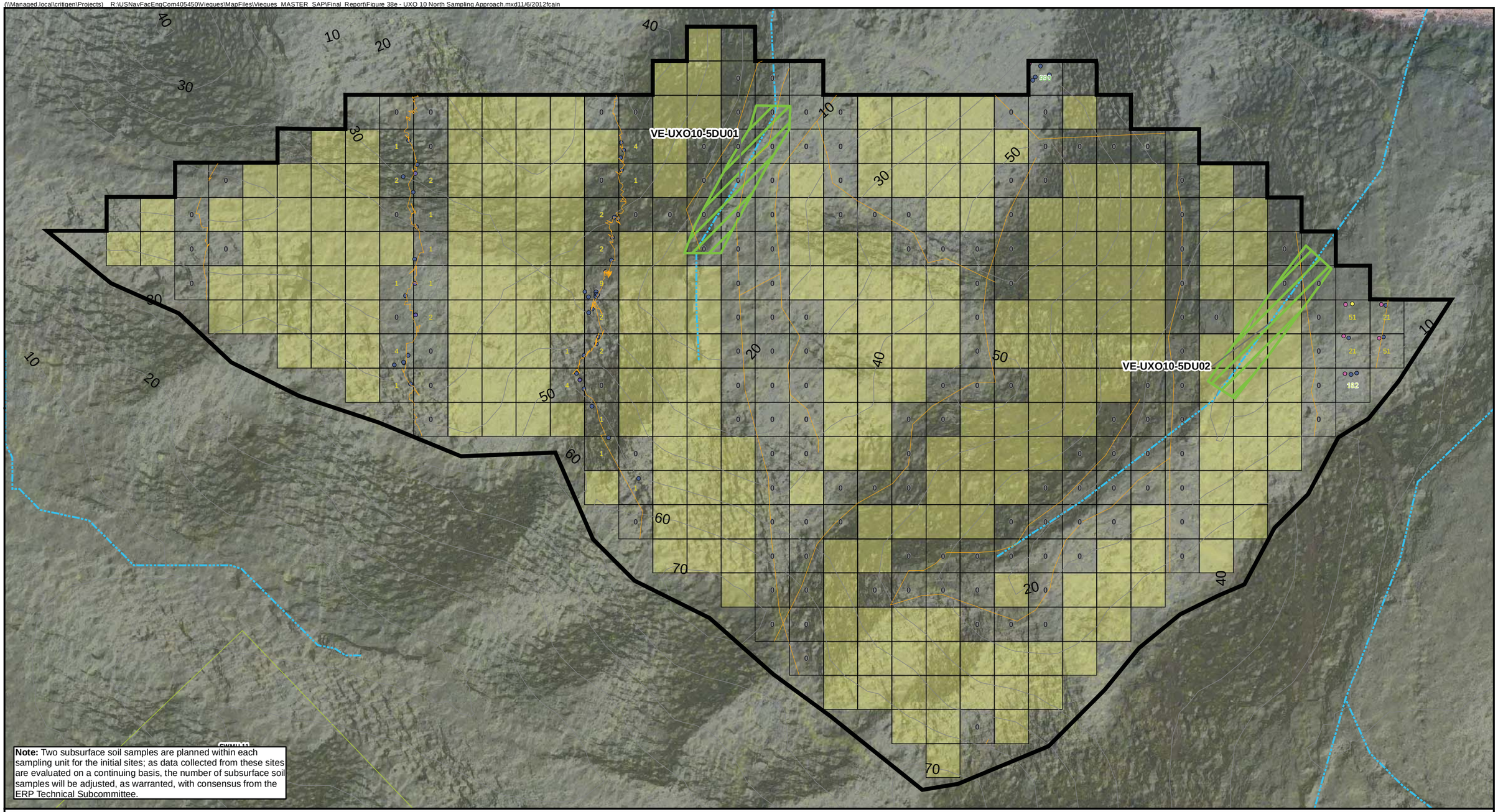
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 38e - UXO 10 North Sampling Approach.mxd11/6/2012fcain



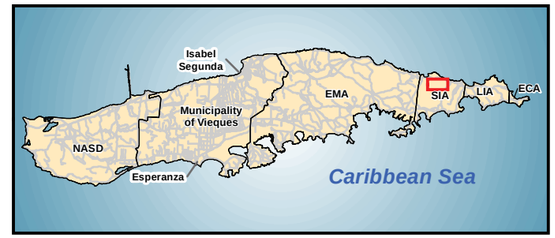
Sample Unit
Decision Unit
Transect - 3 Foot Width was Investigated
Bombs
Flares-Pyrotechnics
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)

Topographic Contours (10 Meter)
Stream
Solid Waste Management Unit
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



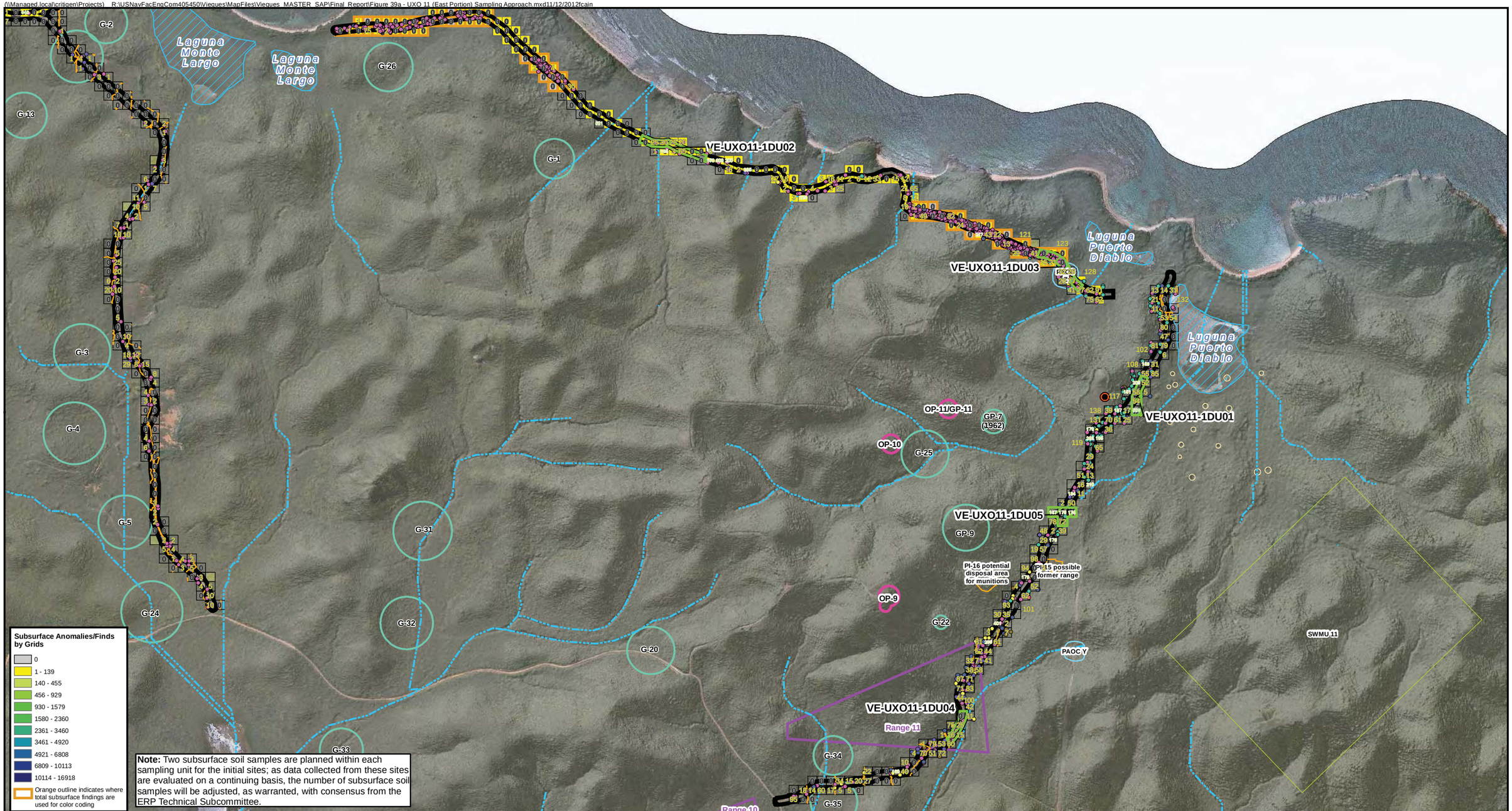
N
W E
S

0 150 300
Feet

Figure 38e
UXO 10 North Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 39a - UXO 11 (East Portion) Sampling Approach.mxd11/12/2012fcain



Subsurface Anomalies/Finds by Grids

- 0
- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3460
- 3461 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918
- Orange outline indicates where total subsurface findings are used for color coding

Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Sample Unit
- Decision Unit
- Bombs
- Flares-Pyrotechnics
- Grenades
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)

- Transect -3 Foot Width was Investigated
- Stream
- Crater
- Bulls Eye Target
- Gun Positions
- Observation Point
- Range
- Photo Identified Area
- Preliminary Area of Concern
- Solidl Waste Management Unit

- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918

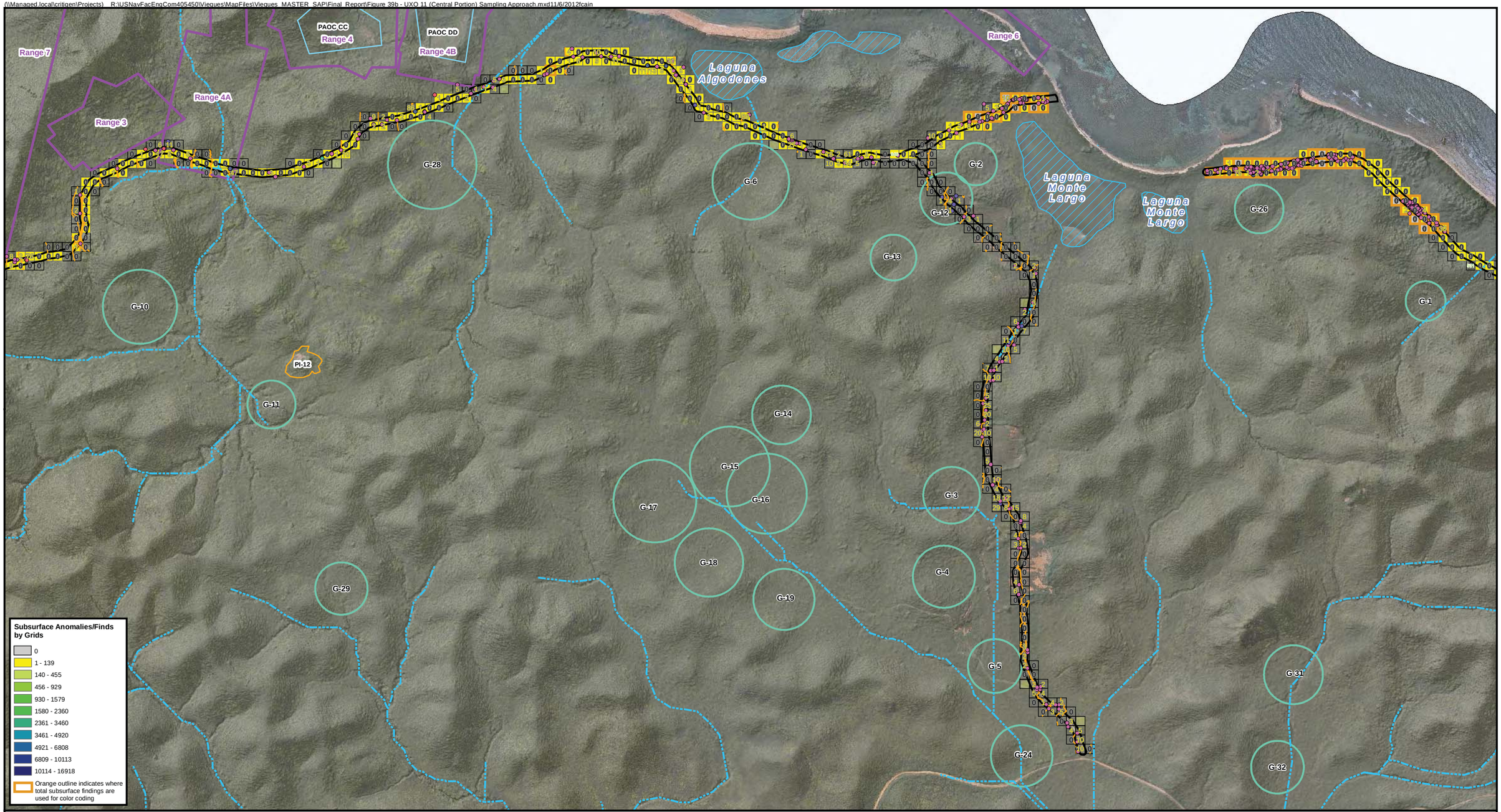
N
W E
S

0 500 1,000
Feet

Figure 39a
UXO 11 (East Portion) Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 39b - UXO 11 (Central Portion) Sampling Approach.mxd11/6/2012fcain



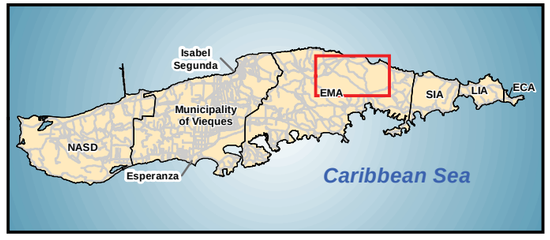
Decision Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Transect -3 Foot Width was Investigated
Stream

2005 Aerial Imagery
2005 Hillshade

Gun Positions
Range
Photo Identified Area
Preliminary Area of Concern
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 500 1,000
Feet

Figure 39b
UXO 11 (Central Portion) Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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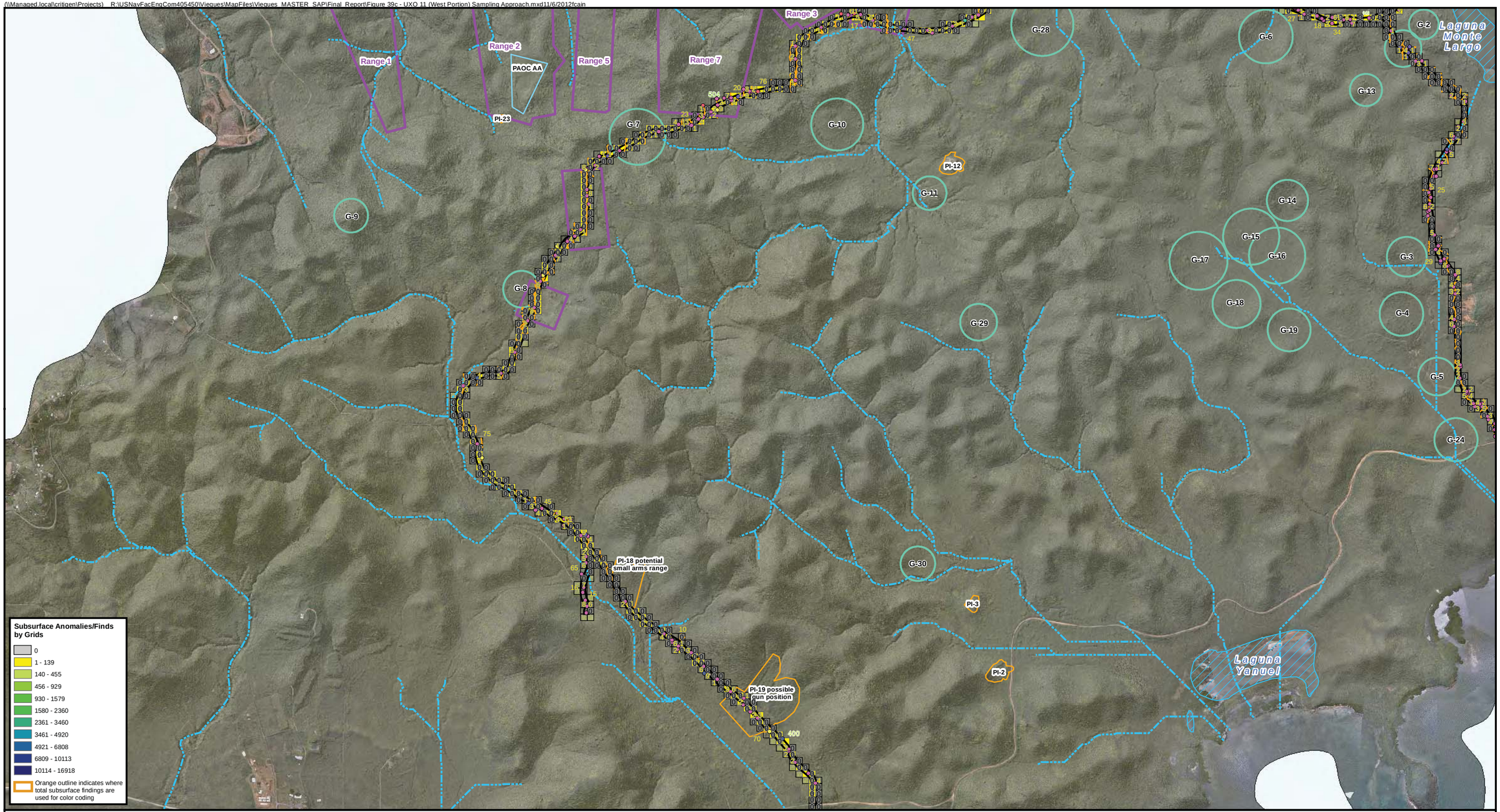
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 39c - UXO 11 (West Portion) Sampling Approach.mxd11/6/2012fcain



- Bombs
- Flares-Pyrotechnics
- Grenades
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Transect -3 Foot Width was Investigated
- Stream

- Decision Unit
- Gun Positions
- Range
- Photo Identified Area
- Preliminary Area of Concern
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

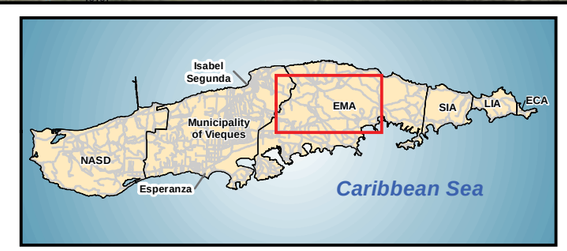


Figure 39c
UXO 11 (West Portion) Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

N W E S

0 700 1,400 Feet

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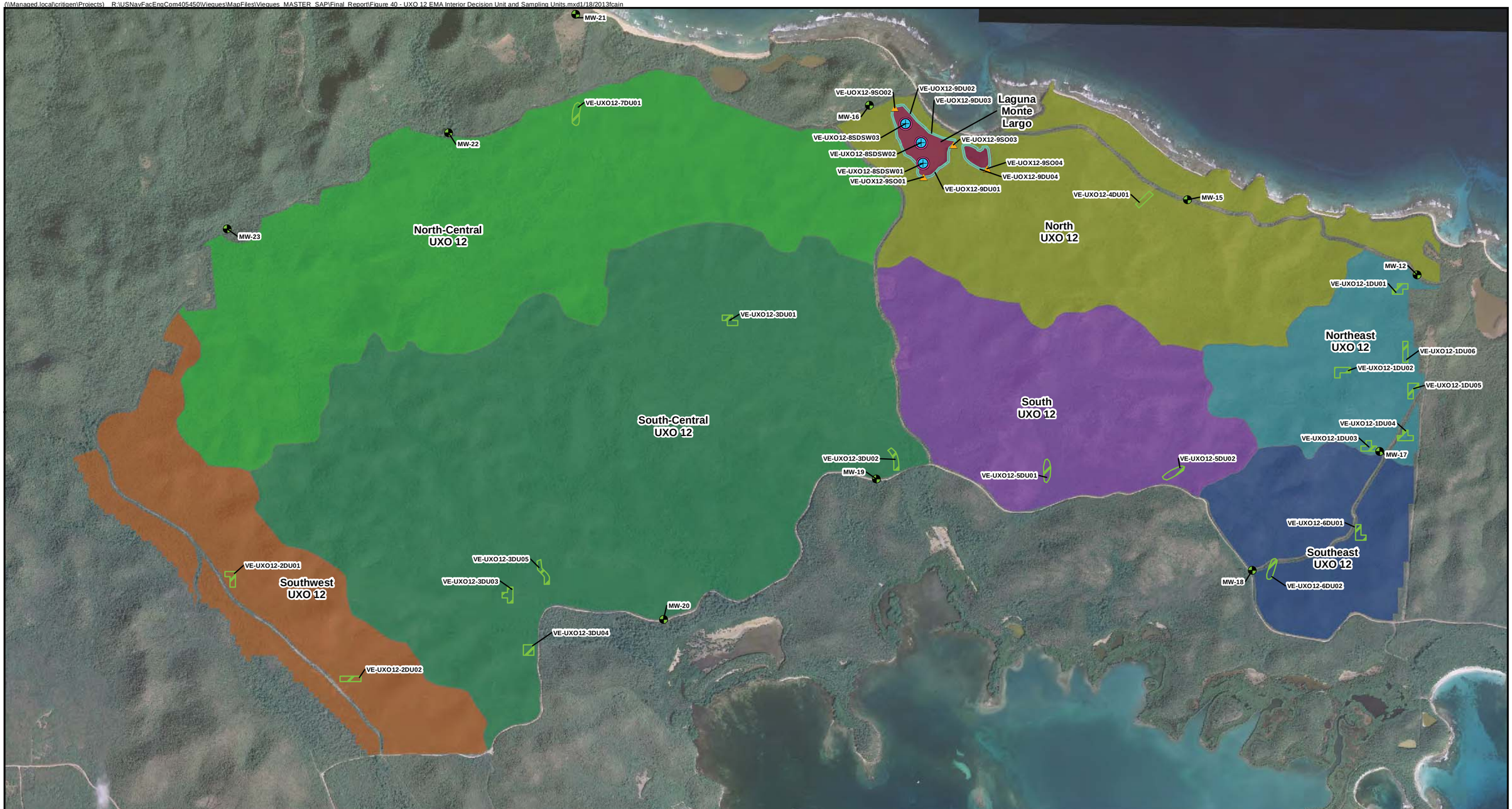
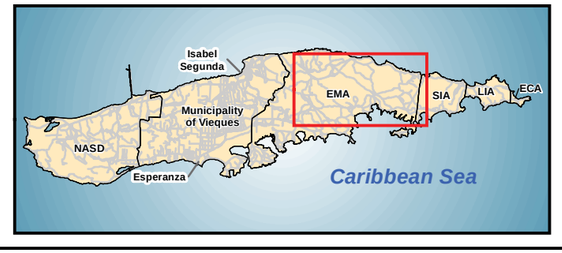
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 40 - UXO 12 EMA Interior Decision Unit and Sampling Units.mxd1/18/2013fcain



- Deep Surface Soil Sample
- Proposed Surface Water Samples
- Proposed Sediment Samples
- Proposed Monitoring Well
- Sample Unit (Lagoon Fringe)
- Sample Unit (Interior)

Decision Unit

- North UXO 12
- North-Central UXO 12
- Northeast UXO 12
- South UXO 12
- South-Central UXO 12
- Southeast UXO 12
- Southwest UXO 12
- Laguna Monte Largo



N
W E
S

0 900 1,800
Feet

Figure 40
UXO 12 EMA Interior Decision Unit and Sampling Units
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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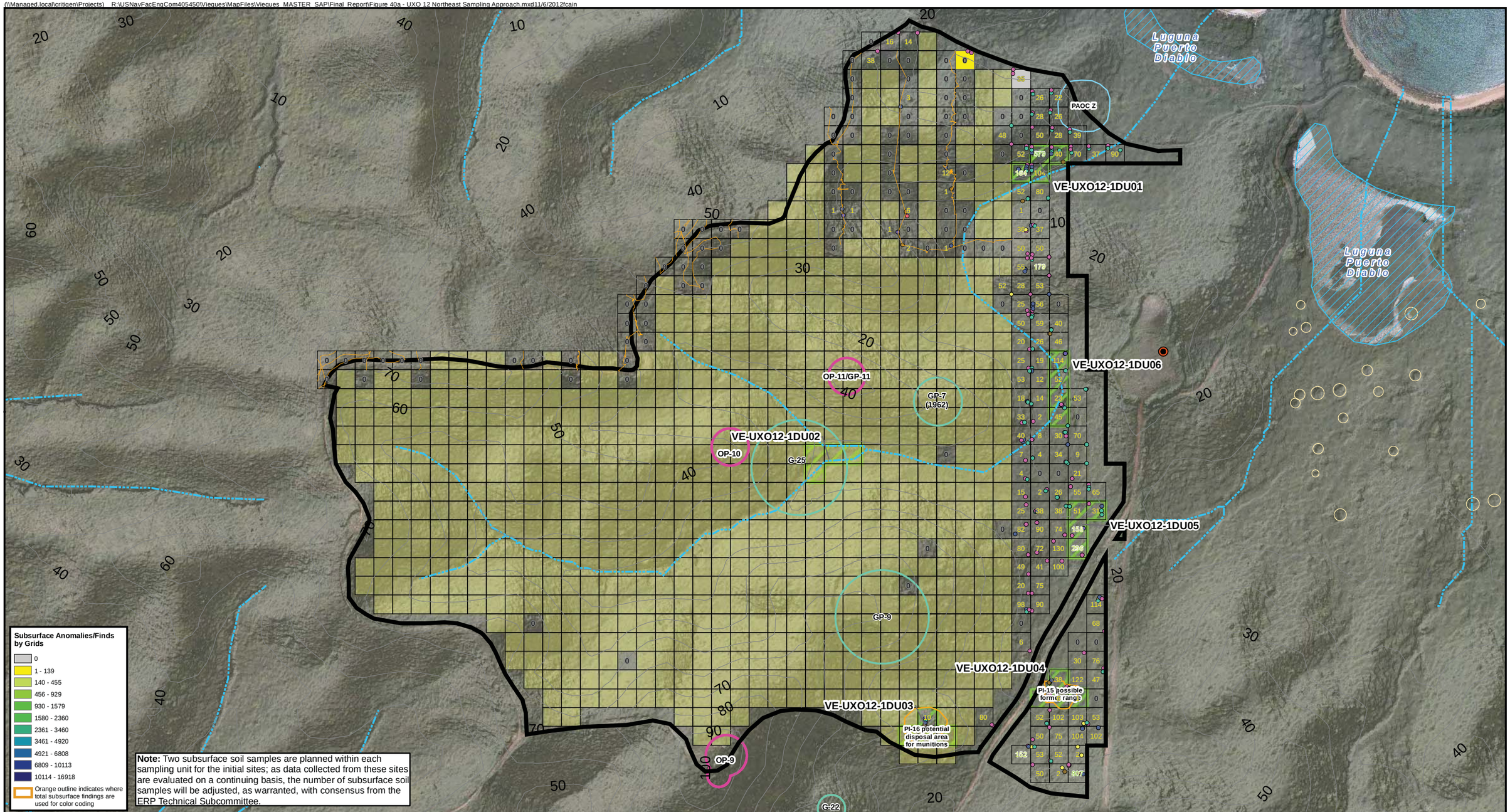
2007 Aerial Imagery

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 40a - UXO 12 Northeast Sampling Approach.mxd11/6/2012fcain



Sample Unit
Decision Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)

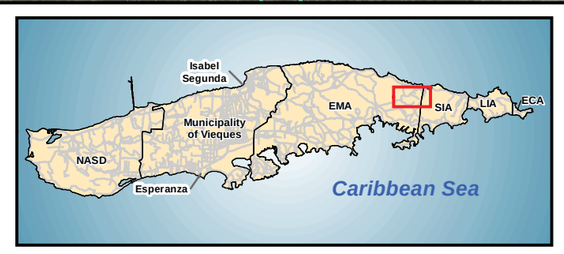
2005 Aerial Imagery
2005 Hillshade

Transect - 3 Foot Width was Investigated
Topographic Contours (10 Meter)
Stream
Crater
Bulls Eye Target
Gun Positions
Observation Point
Photo Identified Area
Preliminary Area of Concern
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation

Lagoon

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 250 500
Feet

Figure 40a
UXO 12 Northeast Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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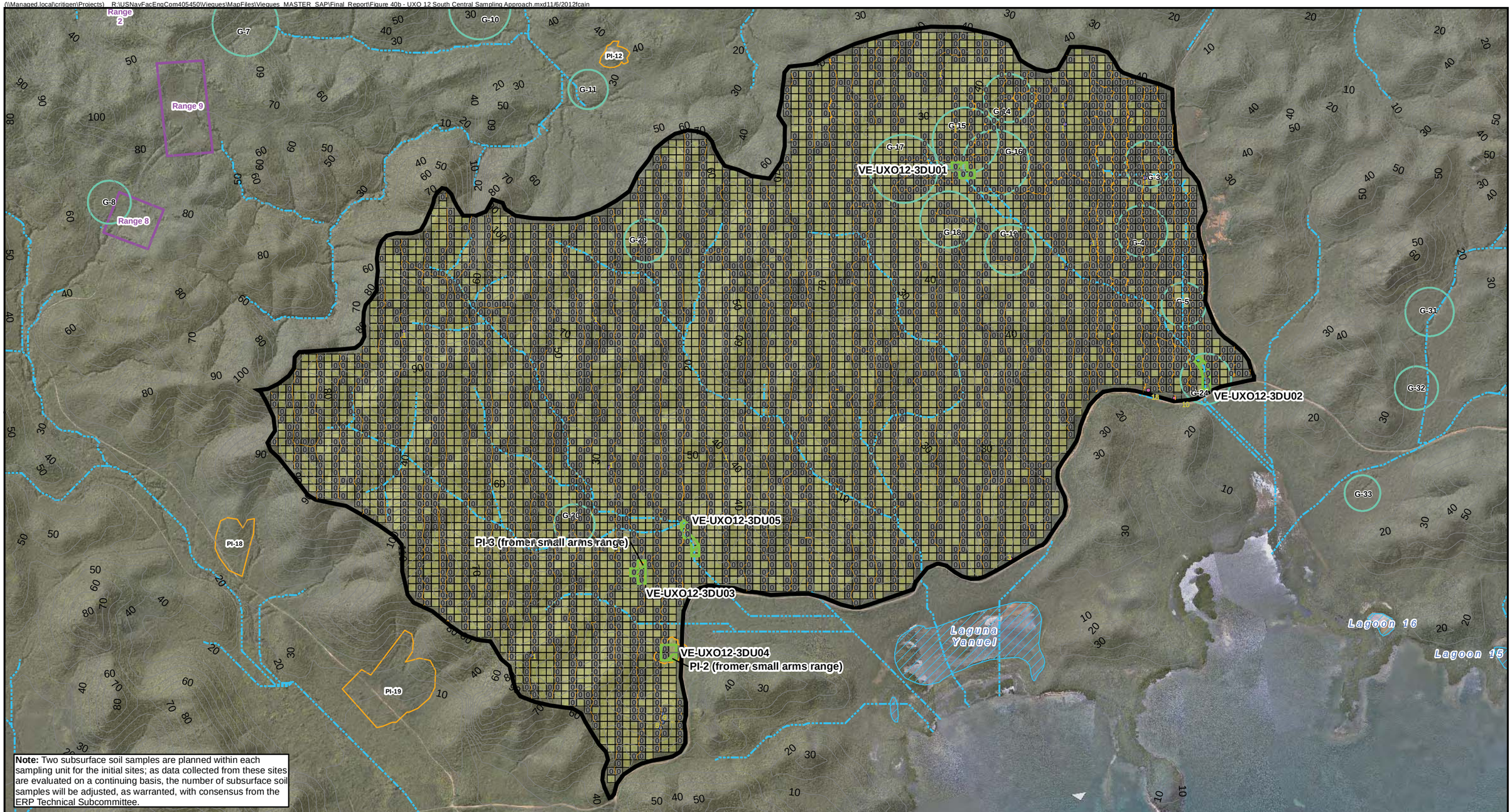
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 40b - UXO 12 South Central Sampling Approach.mxd11/6/2012fcain



Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

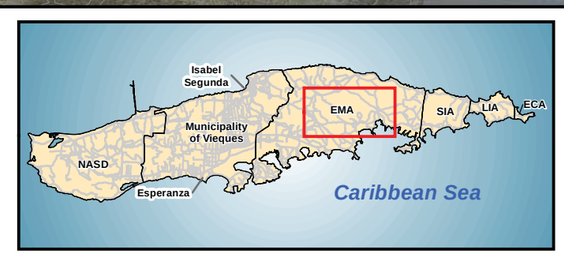
Sample Unit
Transect - 3 Foot Width was Investigated
Decision Unit
Flares-Pyrotechnics
Projectiles / Mortars
Scrap (Munitions Debris)
Topographic Contours (10 Meter)
Stream

Gun Positions
Range
Photo Identified Area
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 600 1,200
Feet

Figure 40b
UXO 12 South Central Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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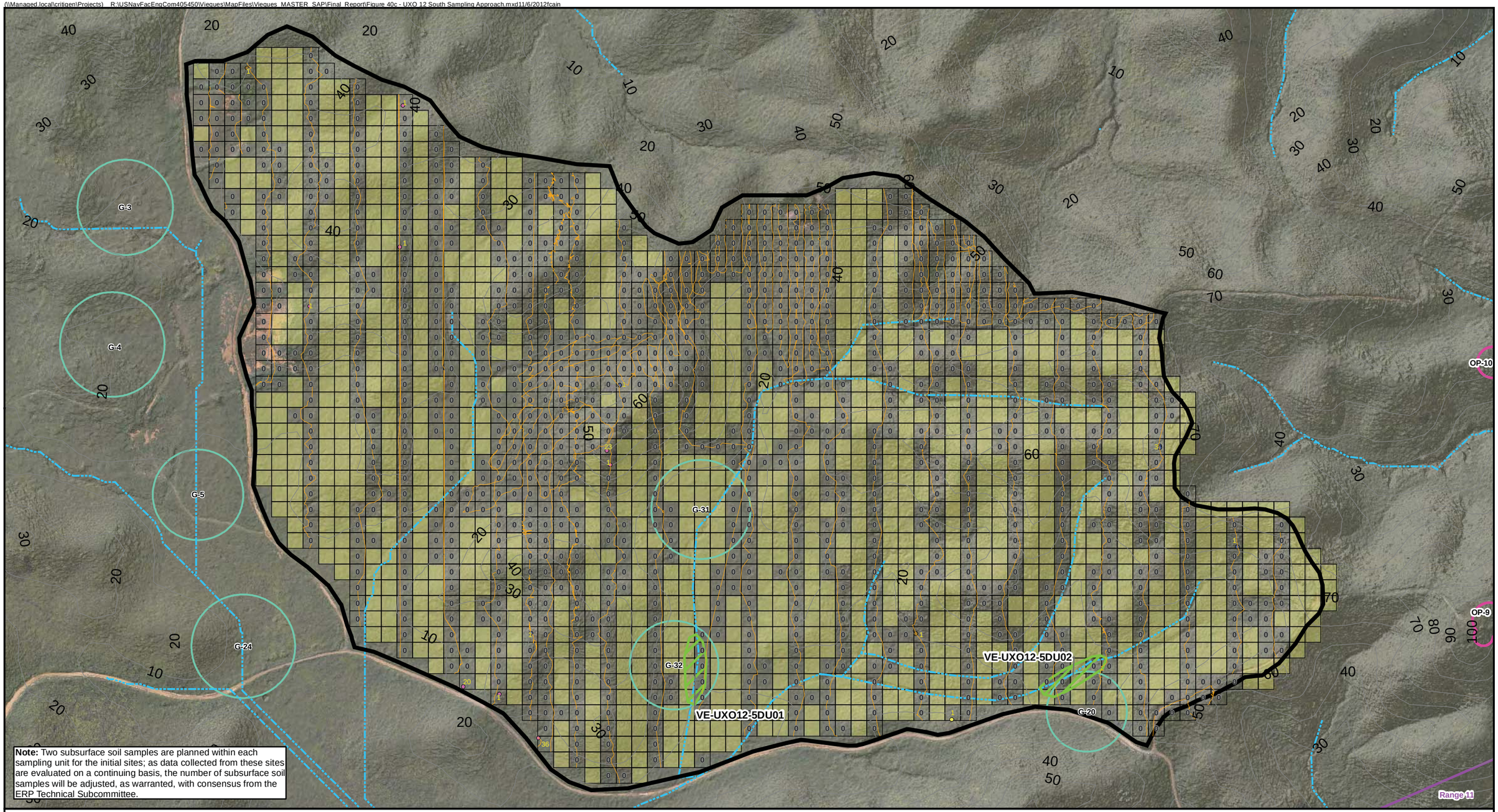
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 40c - UXO 12 South Sampling Approach.mxd11/6/2012fcain



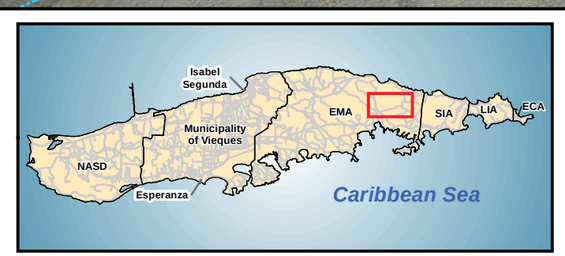
Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Transect - 3 Foot Width was Investigated
- Decision Unit
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Sample Unit
- Topographic Contours (10 Meter)
- Stream
- Gun Positions
- Observation Point
- Range
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918



N W E S

0 500 1,000 Feet

Figure 40c
UXO 12 South Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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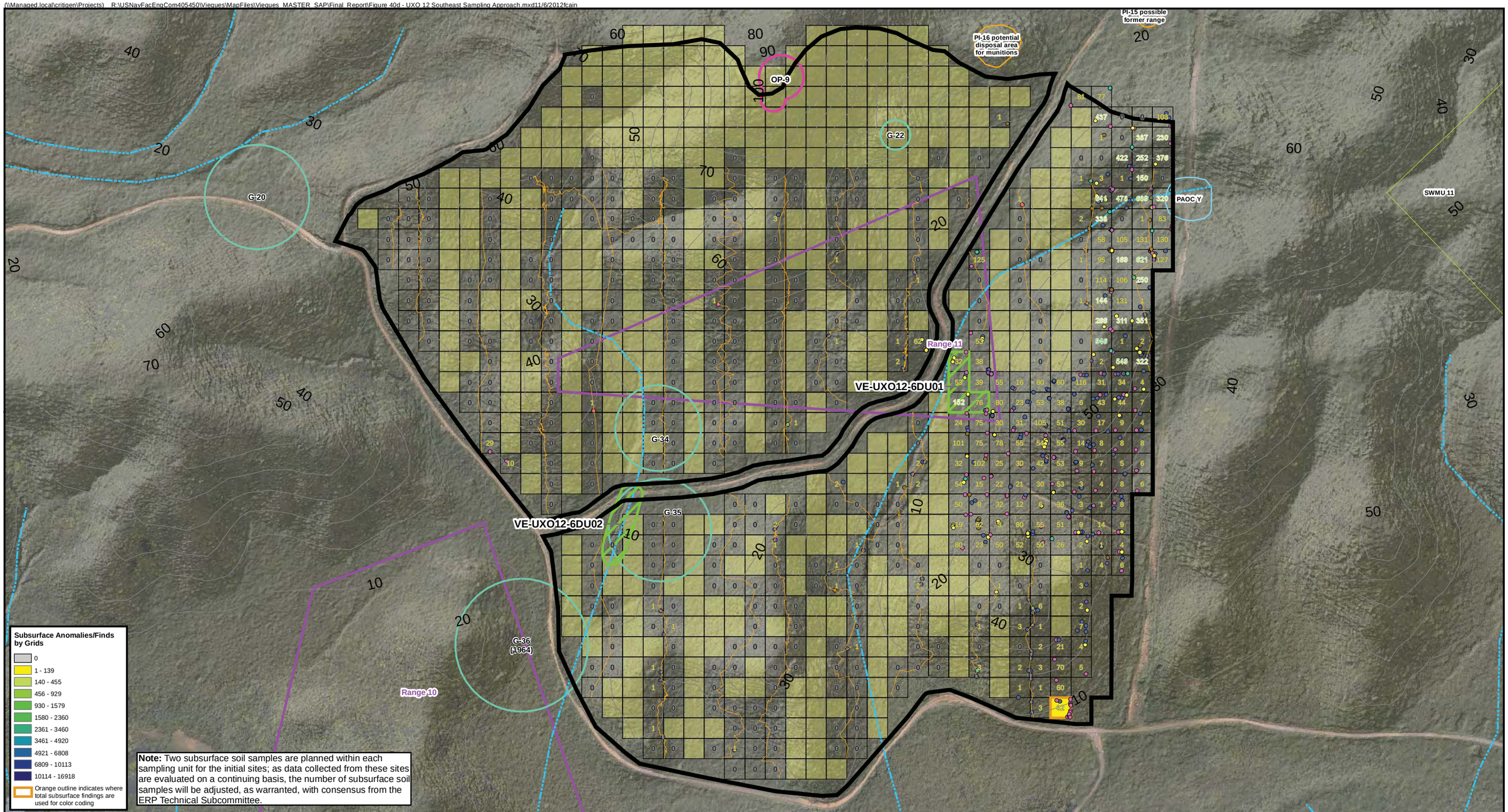
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 40d - UXO 12 Southeast Sampling Approach.mxd11/6/2012fcain



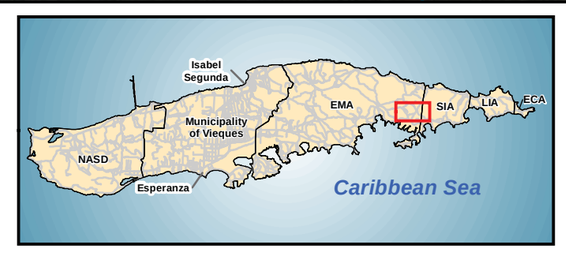
Sample Unit
Decision Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)

Transect - 3 Foot Width was Investigated
Topographic Contours (10 Meter)
Stream
Gun Positions
Observation Point
Range
Photo Identified Area
Preliminary Area of Concern
Solid Waste Management Unit
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



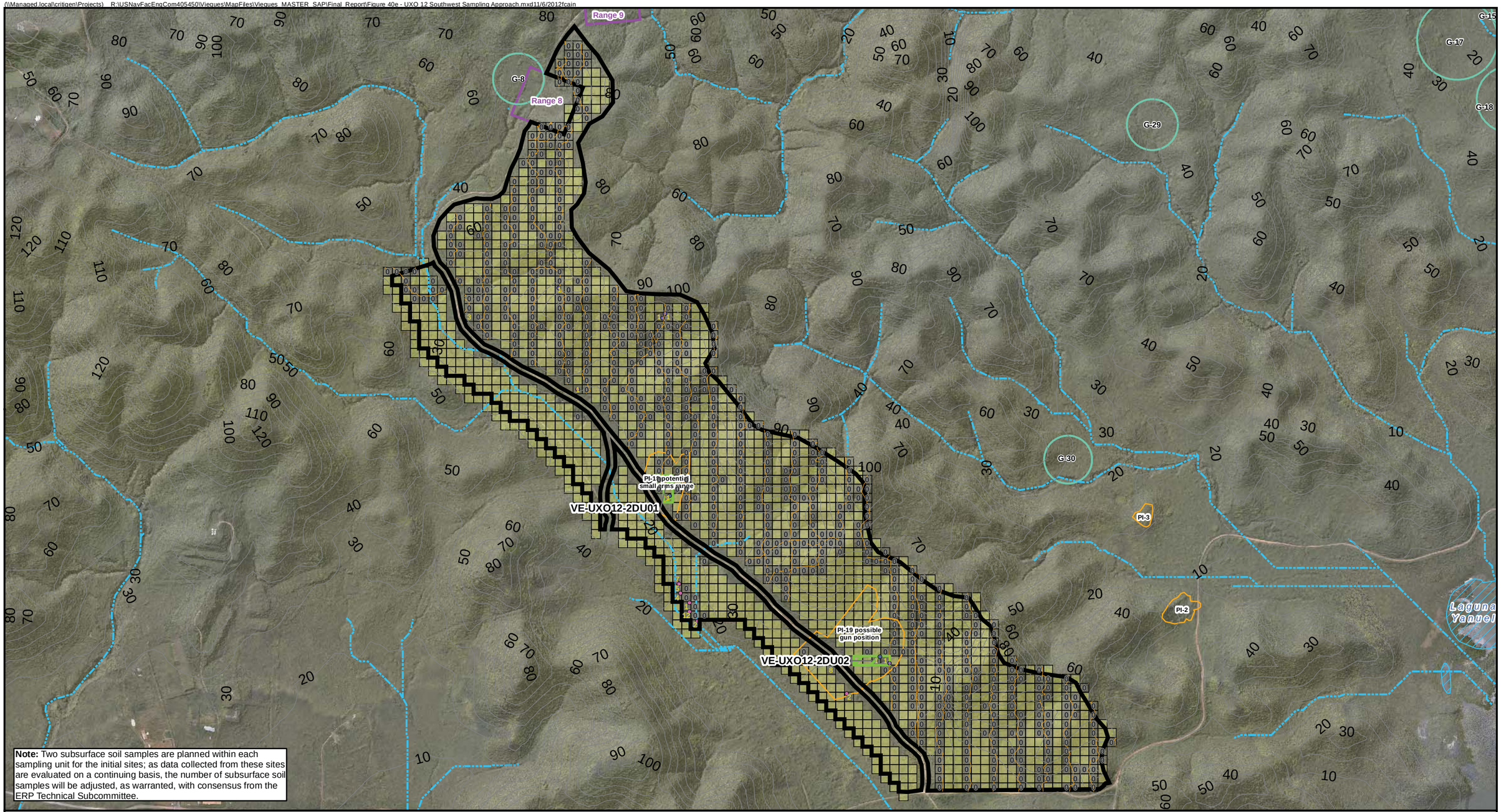
N
W E
S

0 250 500
Feet

Figure 40d
UXO 12 Southeast Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 40e - UXO 12 Southwest Sampling Approach.mxd11/6/2012fcain



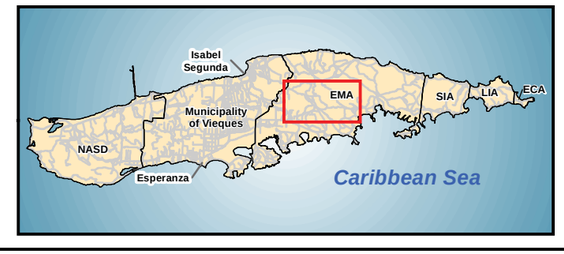
Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Sample Unit
- Decision Unit
- Flares-Pyrotechnics
- Grenades
- Projectiles / Mortars
- Scrap (Munitions Debris)
- Transect - 3 Foot Width was Investigated
- Topographic Contours (10 Meter)
- Stream
- Gun Positions
- Range
- Photo Identified Area
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918



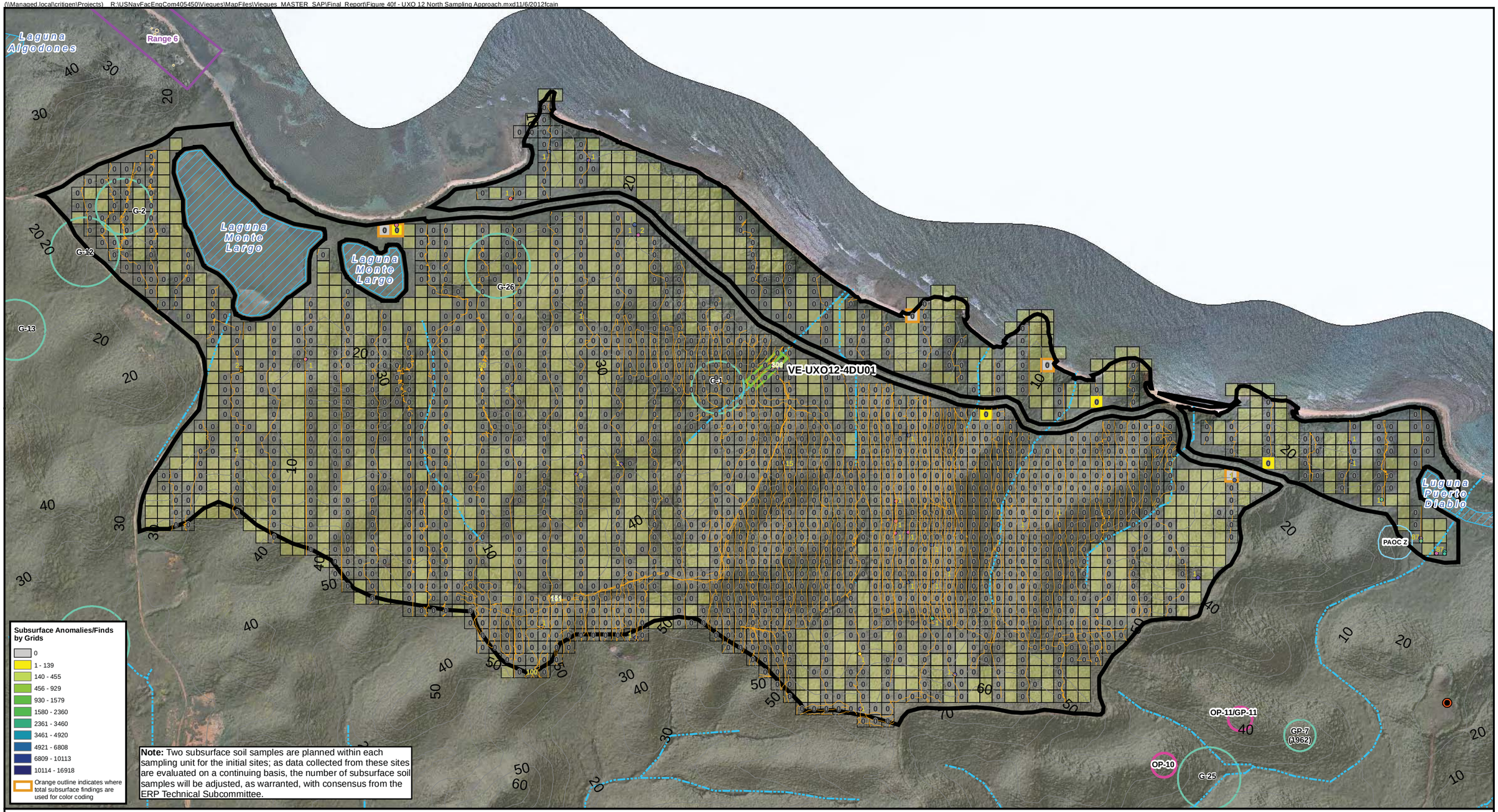
N
W E
S

0 500 1,000
Feet

Figure 40e
UXO 12 Southwest Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 40f - UXO 12 North Sampling Approach.mxd11/6/2012fcain



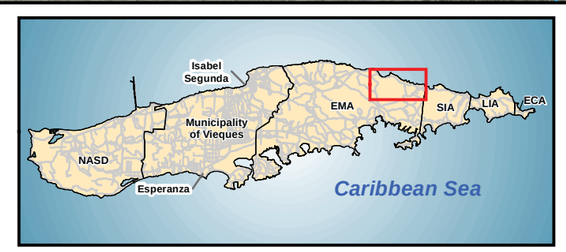
Sample Unit
Decision Unit
Bombs
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)
Lagoon

2005 Aerial Imagery
2005 Hillshade

Transect - 3 Foot Width was Investigated
Topographic Contours (10 Meter)
Stream
Crater
Bulls Eye Target
Gun Positions
Observation Point
Range
Preliminary Area of Concern
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 500 1,000
Feet

Figure 40f
UXO 12 North Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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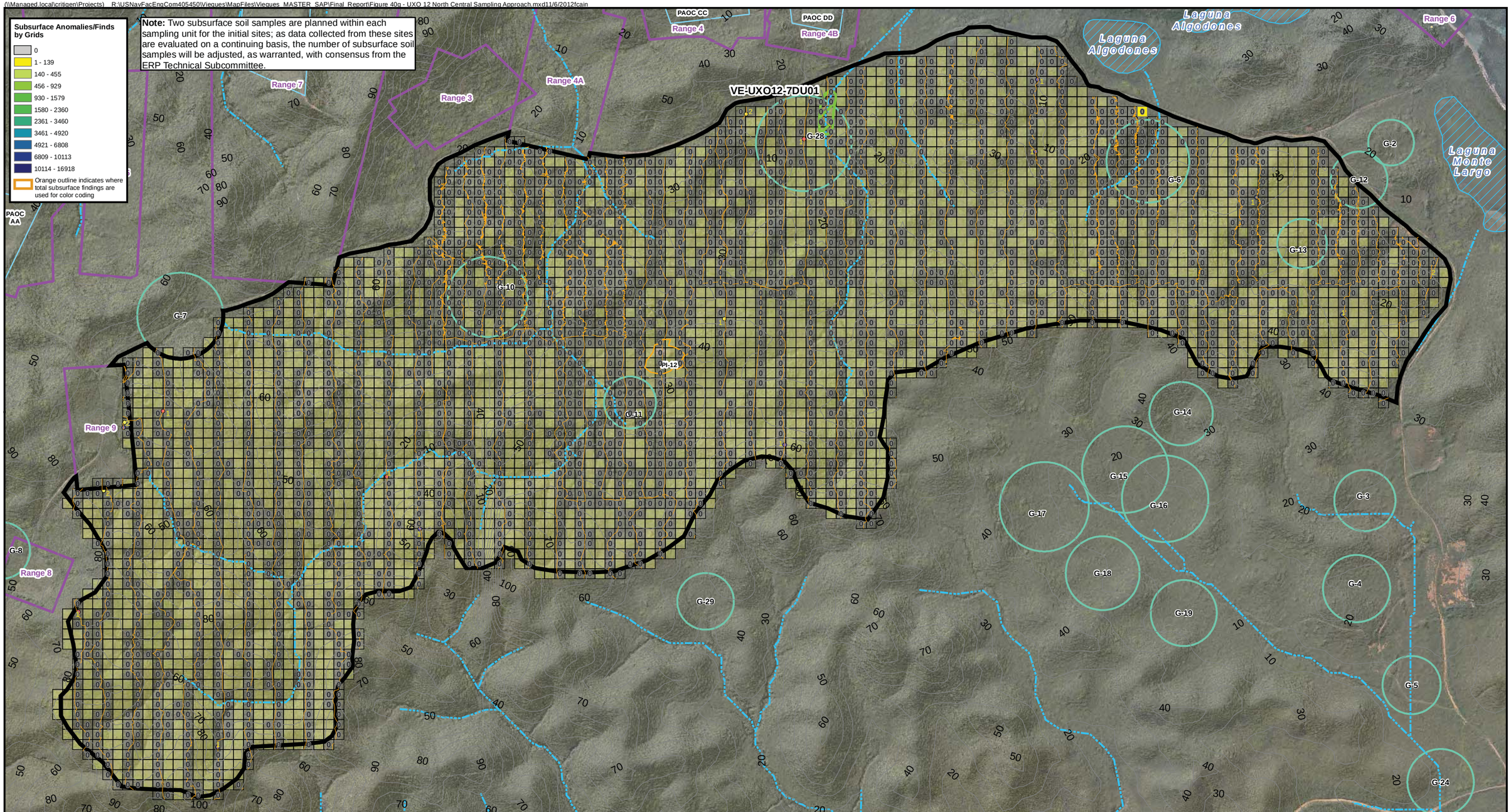
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 40g - UXO 12 North Central Sampling Approach.mxd11/6/2012fcain



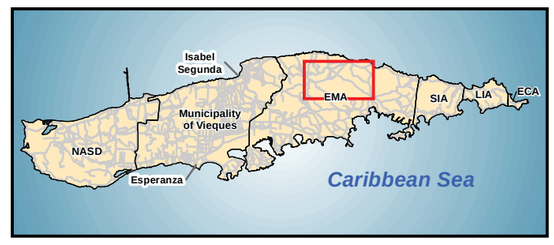
Sample Unit
Transect - 3 Foot Width was Investigated
Decision Unit
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Topographic Contours (10 Meter)
Stream

Crater
Gun Positions
Range
Photo Identified Area
Preliminary Area of Concern
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 500 1,000
Feet

Figure 40g
UXO 12 North Central Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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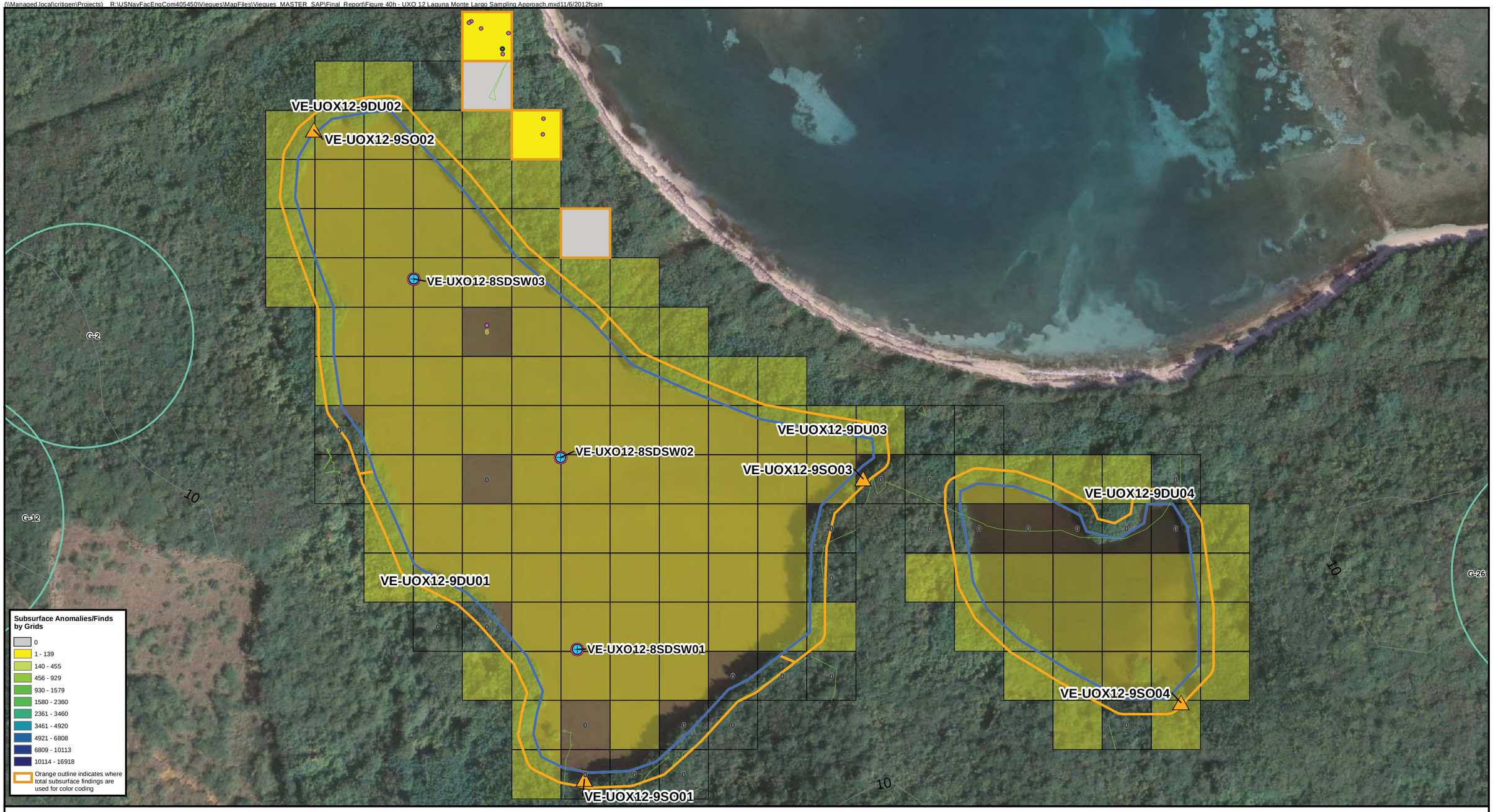
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 40h - UXO 12 Laguna Monte Largo Sampling Approach.mxd11/6/2012fcain



Proposed Surface Water Samples
Proposed Sediment Samples
Deep Surface Soil Sample
Lagoon
Lagoon Fringe
Transect - 3 Foot Width was Investigated
Topographic Contours (10 Meter)
Gun Positions
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
2007 Aerial Imagery

Scrap (Munitions Debris)
Projectiles / Mortars

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)
1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

N
W E
S

0 100 200
Feet

Figure 40h
UXO 12 Laguna Monte Largo Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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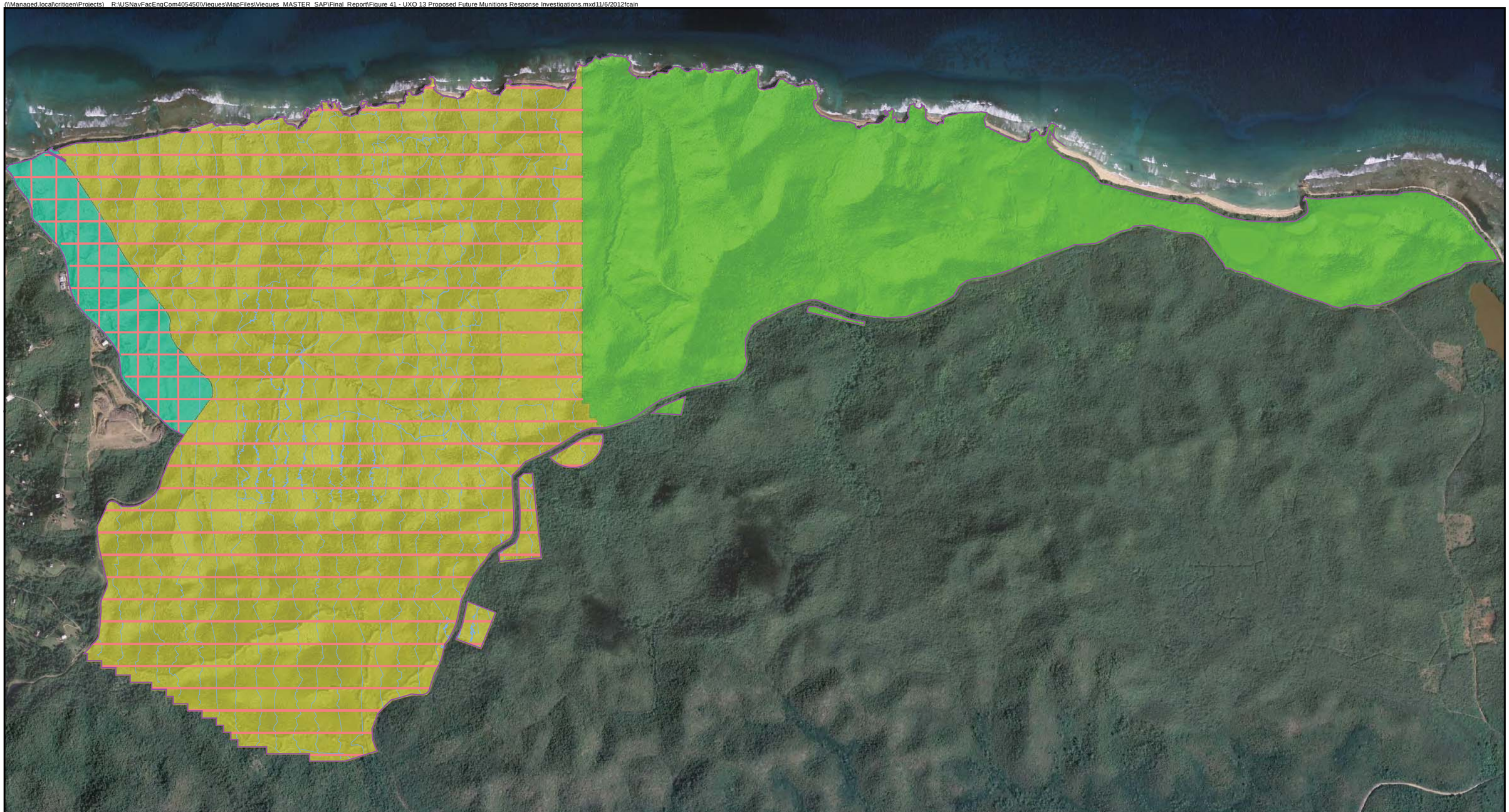
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 41 - UXO 13 Proposed Future Munitions Response Investigations.mxd11/6/2012fcain



Transect Walked During Site Insecption

Proposed Transects

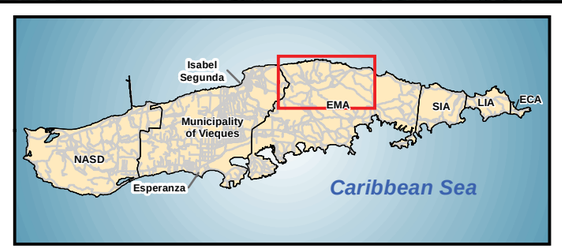
Area Proposed for Transect Investigation

Area proposed for NTCRA

Parcel C - Proposed Transect Investiation Using VSP

UXO 13 Boundary

2007 Aerial Imagery



N
W E
S

0 700 1,400
Feet

Figure 41
Proposed Future Munitions Response Investigations, UXO 13
Master Sampling Analysis Plan
Former VNTR
Vieques, Puerto Rico

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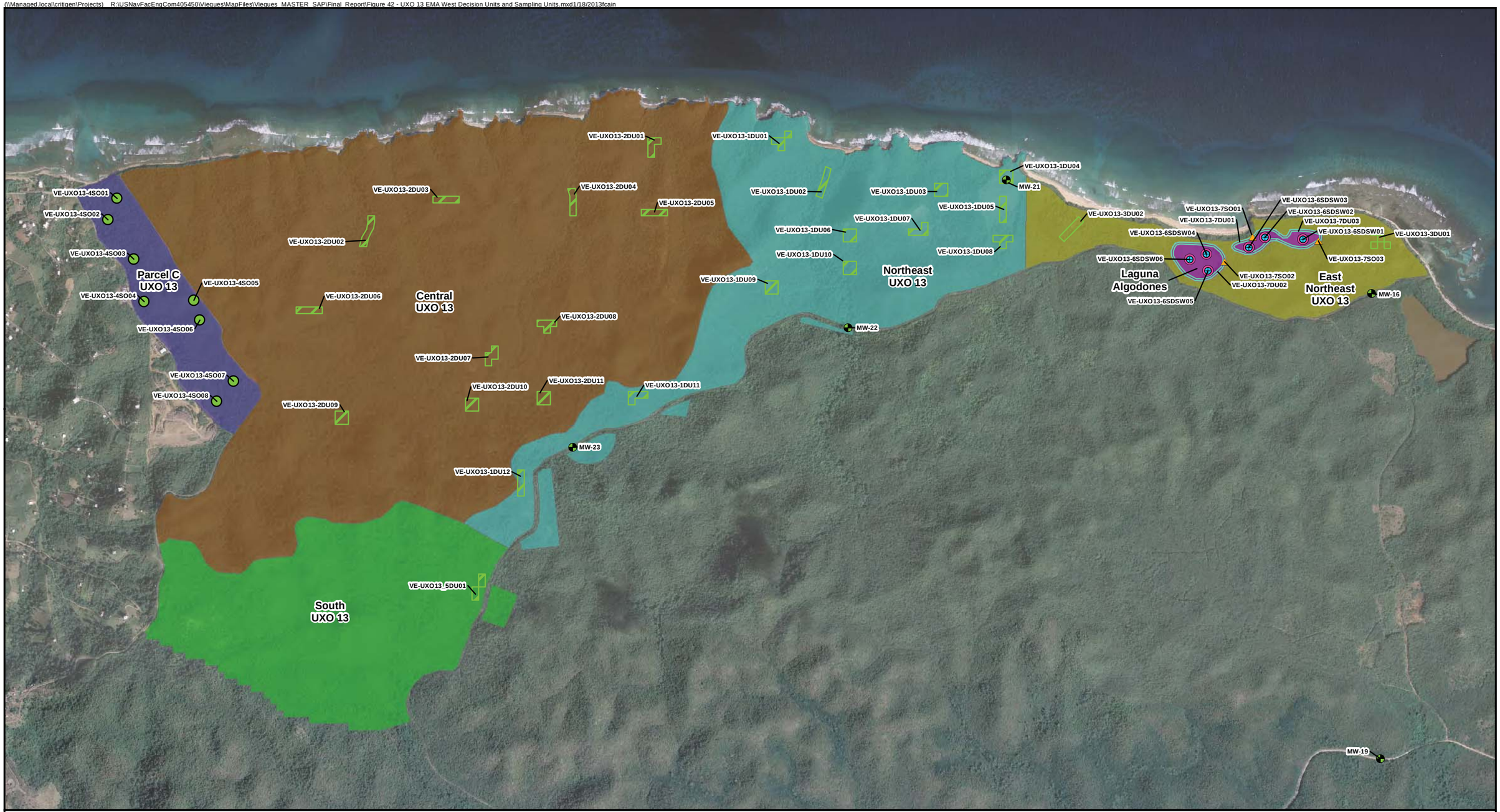
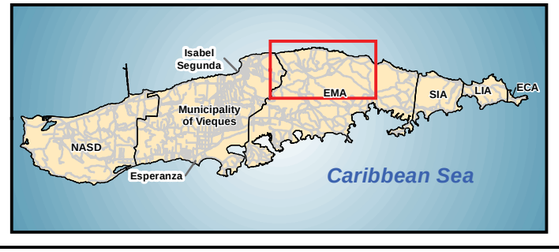
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 42 - UXO 13 EMA West Decision Units and Sampling Units.mxd1/18/2013fcain



Surface and Subsurface Soil Sample
Deep Surface Soil Sample
Proposed Surface Water Samples
Proposed Sediment Samples
Proposed Monitoring Well
Sample Unit (Interior)

Decision Unit
- Central UXO 13
- East Northeast UXO 13
- Laguna Algodones
- Northeast UXO 13
- Parcel C UXO 13
- South UXO 13
- Laguna Algodones Fringe



N
W E
S

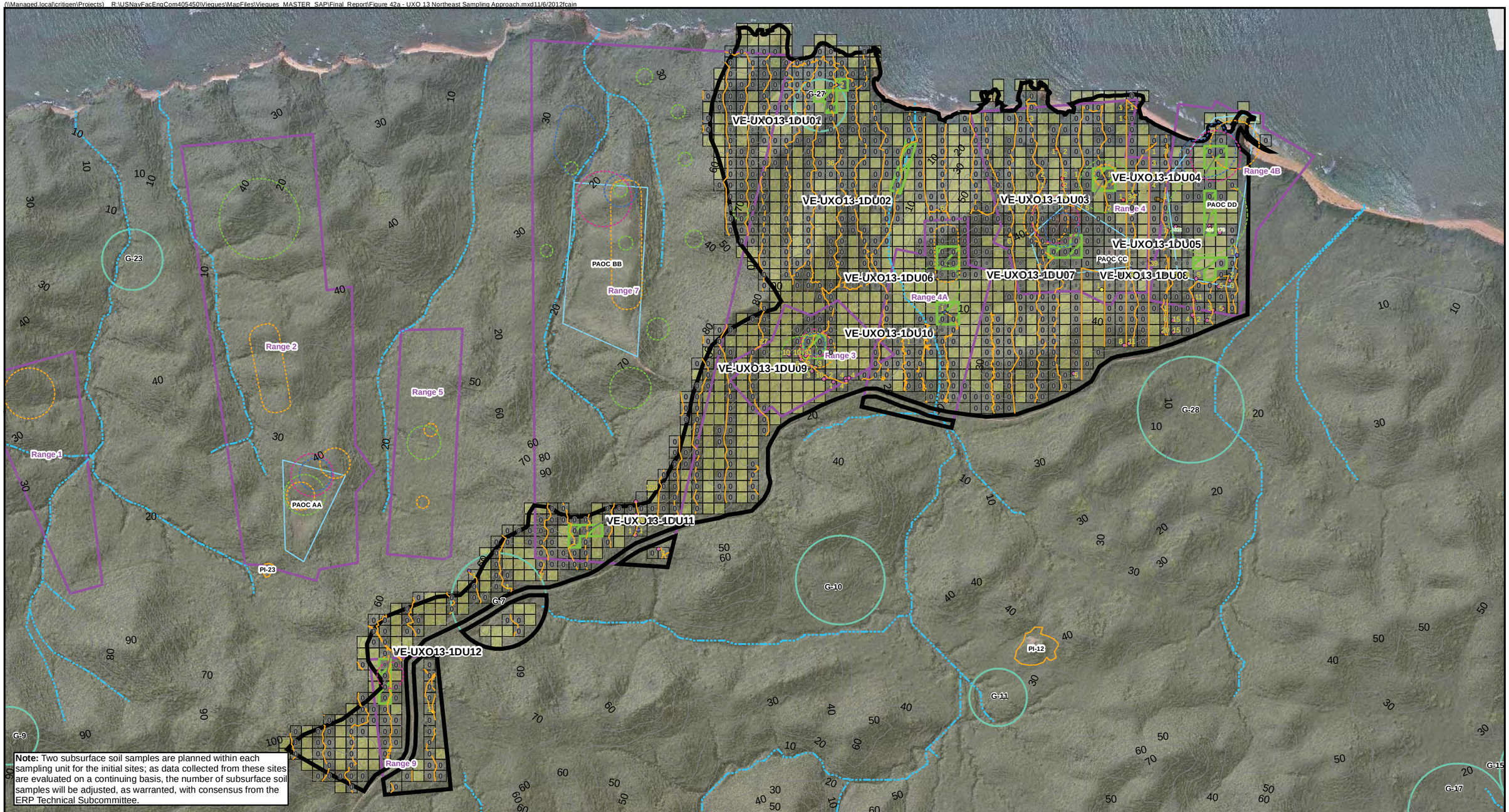
0 700 1,400
Feet

Figure 42
UXO 13 EMA West Decision Units and Sampling Units
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

2007 Aerial Imagery

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 42a - UXO 13 Northeast Sampling Approach.mxd11/6/2012fcain



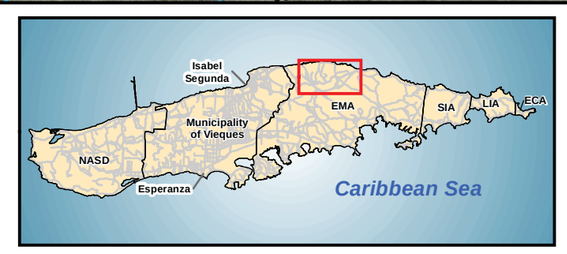
Sample Unit
Decision Unit
Flares-Pyrotechnics
Grenades
MEC Component
Projectiles / Mortars
Rockets / Guided Missiles
Scrap (Munitions Debris)

Transect -3 Foot Width was Investigated
Topographic Contours (10 Meter)
Stream
Gun Positions
Range
Photo Identified Area
Preliminary Area of Concern
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation

2005 Aerial Imagery
2005 Hillshade

Range Impact Areas
1962
1967
1983
1994

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)
1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 500 1,000
Feet

Figure 42a
UXO 13 Northeast Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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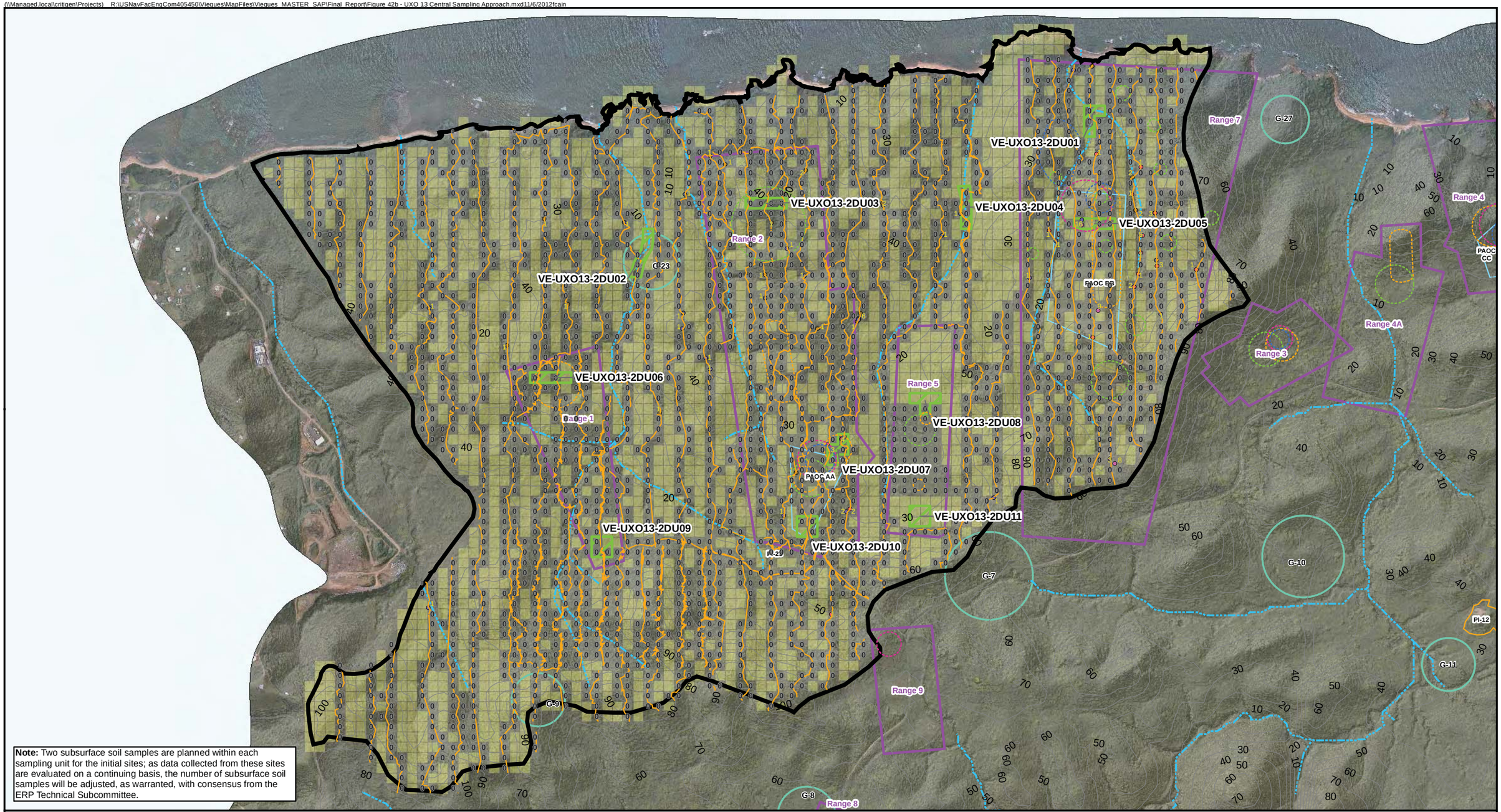
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 42b - UXO 13 Central Sampling Approach.mxd11/6/2012fcain



Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

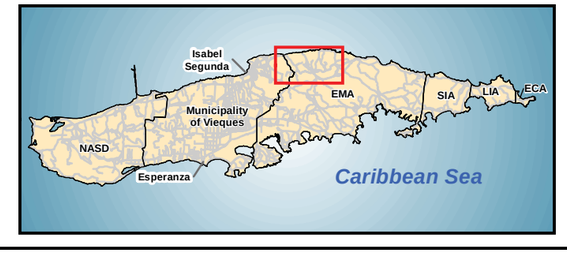
- Sample Unit
- Decision Unit
- Flares-Pyrotechnics
- Grenades
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)

- Transect -3 Foot Width was Investigated
- Topographic Contours (10 Meter)
- Stream
- Gun Positions
- Range
- Photo Identified Area
- Preliminary Area of Concern
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation

Range Impact Areas
- 1962
- 1967
- 1983
- 1994

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)
- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918

2005 Aerial Imagery
2005 Hillshade



N W E S

0 500 1,000 Feet

Figure 42b
UXO 13 Central Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 42c - UXO 13 East Northeast Sampling Approach.mxd11/6/2012fcain

Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Sample Unit
- Decision Unit
- Flares-Pyrotechnics
- Grenades
- MEC Component
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Transect -3 Foot Width was Investigated

- Topographic Contours (10 Meter)
- Stream
- Gun Positions
- Range
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Lagoon

Range Impact Areas
- 1962
- 1967
- 1983
- 1994

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)
- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918

2005 Aerial Imagery
2005 Hillshade

N W E S

0 200 400 Feet

Figure 42c
UXO 13 East Northeast Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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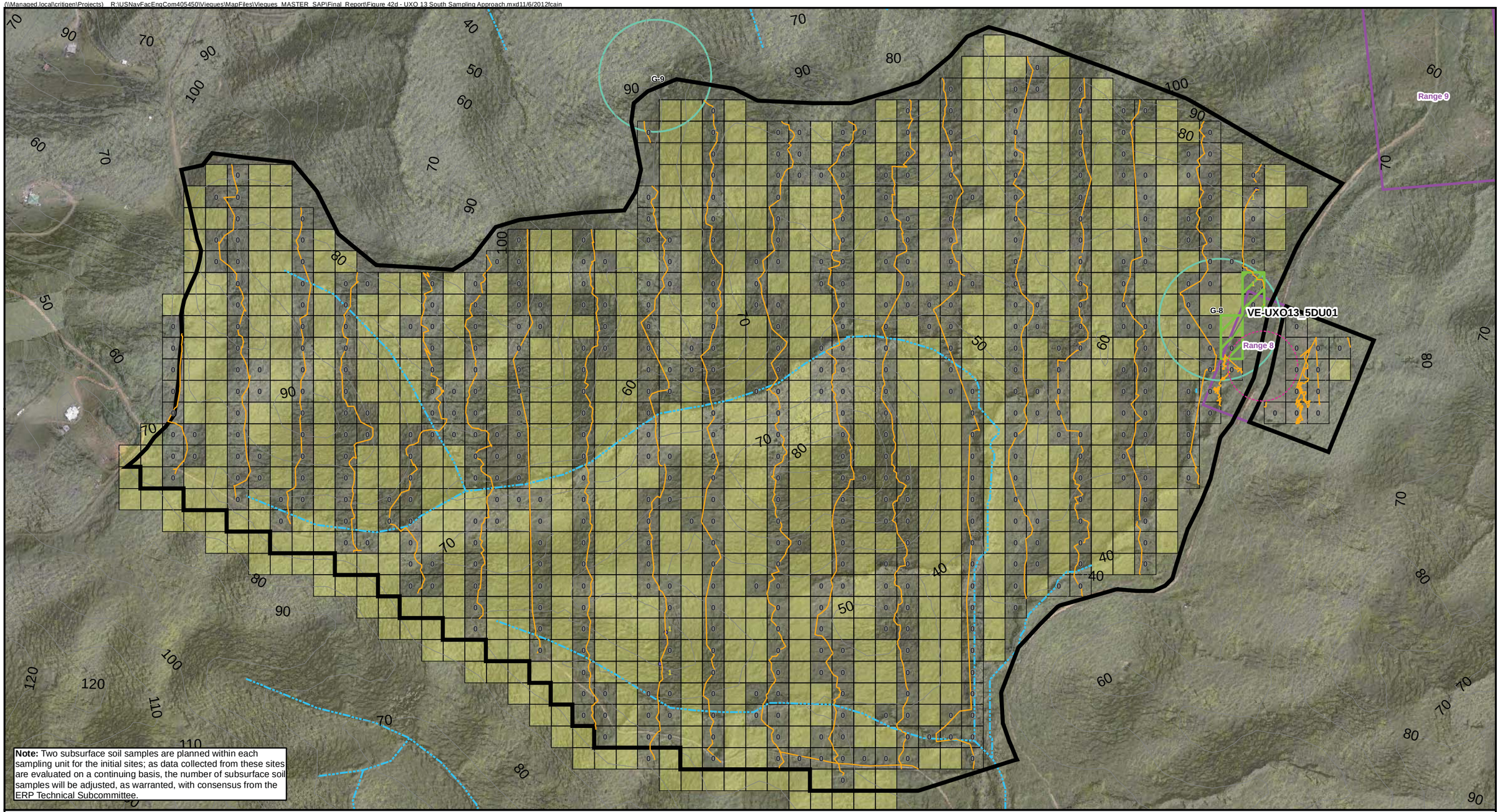
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 42d - UXO 13 South Sampling Approach.mxd11/6/2012fcain



Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

Sample Unit
Decision Unit
Flares-Pyrotechnics
Transect -3 Foot Width was Investigated
Topographic Contours (10 Meter)
Stream
Gun Positions

Range
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation

Range Impact Areas
1994

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)
1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

2005 Aerial Imagery
2005 Hillshade

N
W E
S

0 250 500
Feet

Figure 42d
UXO 13 South Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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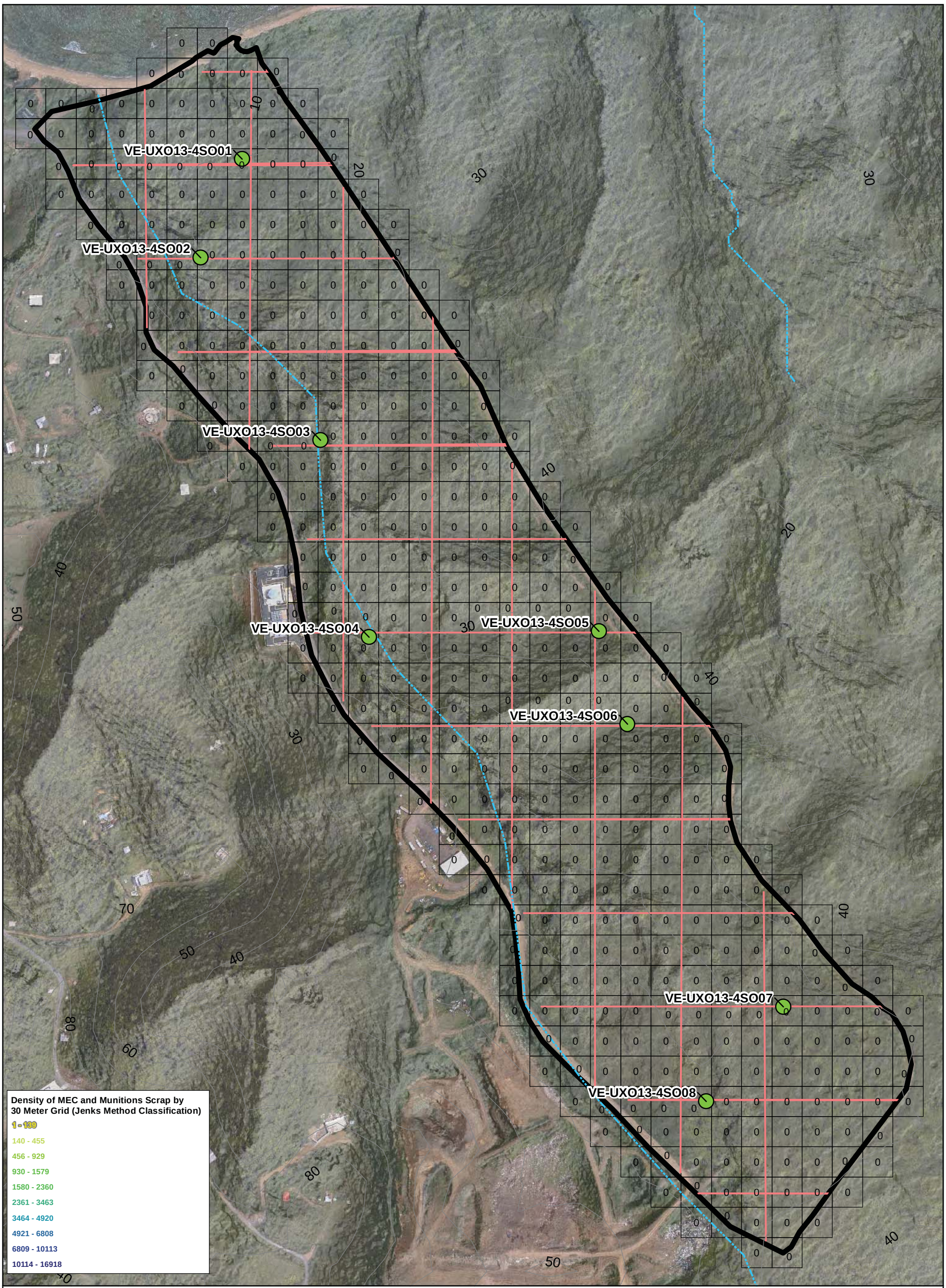
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 42e - UXO 13 Parcel C Sampling Approach.mxd11/6/2012fcain



Surface and Subsurface Soil Sample
Topographic Contours (10 Meter)
Stream
Proposed Transects
Grid (30 Meter)
Decision Unit - Parcel C (No MEC Investigation)

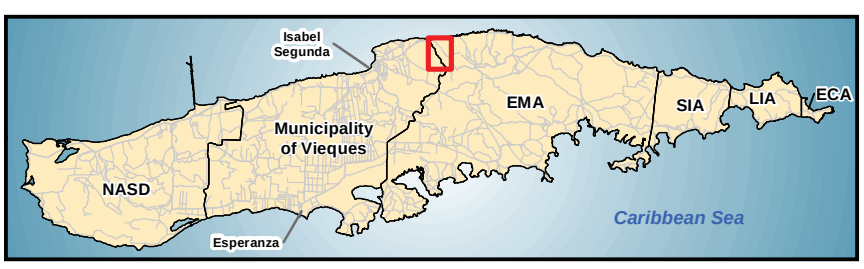


Figure 42e
UXO 13 Parcel C Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

N W E S

0 150 300 Feet

2005 Aerial Imagery

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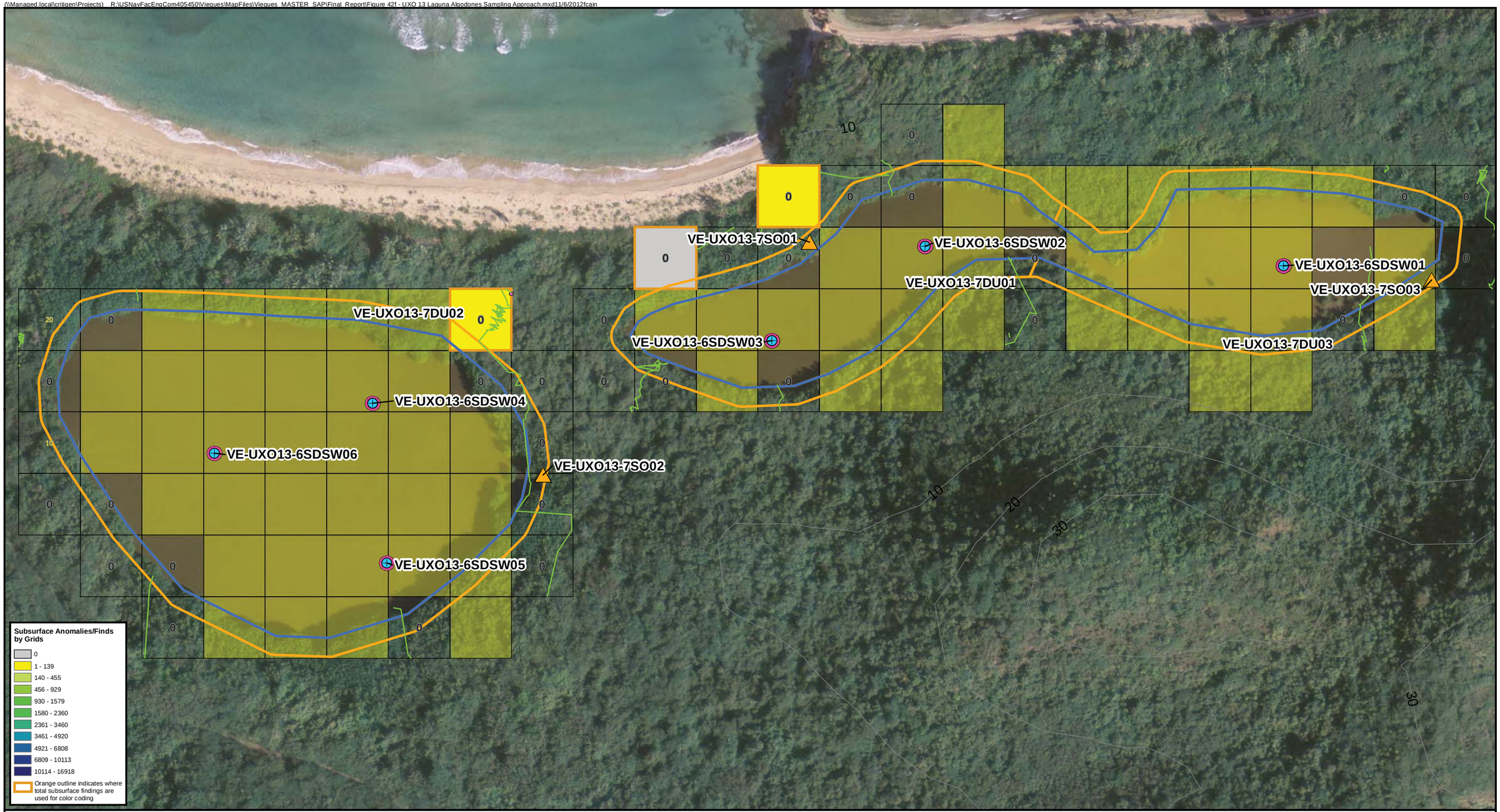
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 42f - UXO 13 Laguna Algodones Sampling Approach.mxd11/6/2012fcain

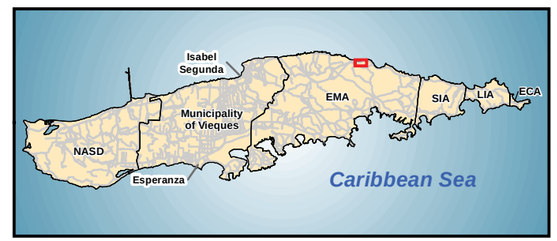


Proposed Surface Water Samples
Proposed Sediment Samples
Deep Surface Soil Sample
Lagoon
Lagoon Fringe
Scrap (Munitions Debris)
Transect -3 Foot Width was Investigated
Topographic Contours (10 Meter)

Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)
1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

2007 Aerial Imagery



N
W E
S

0 75 150
Feet

Figure 42f
UXO 13 Laguna Algodones Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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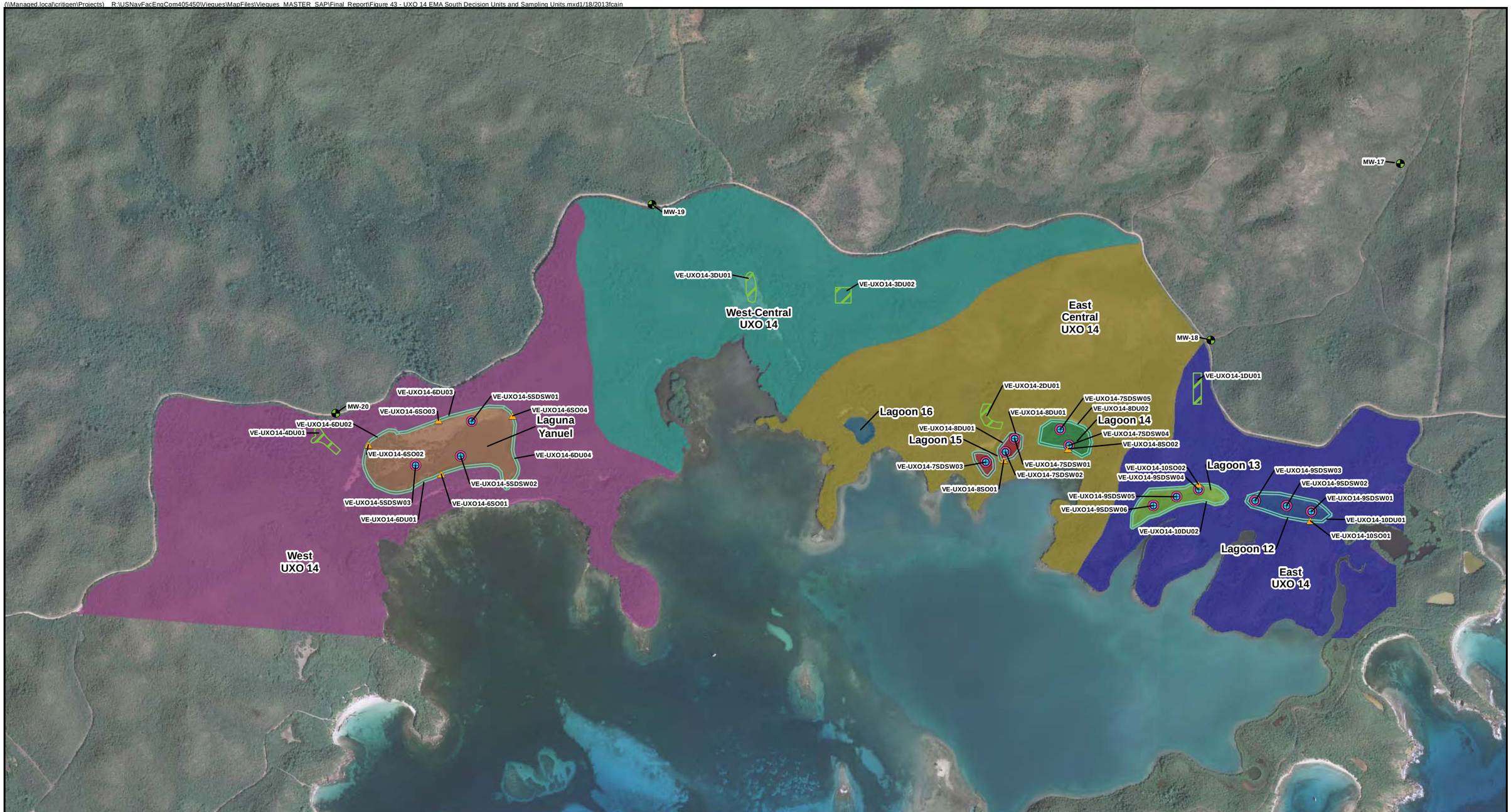
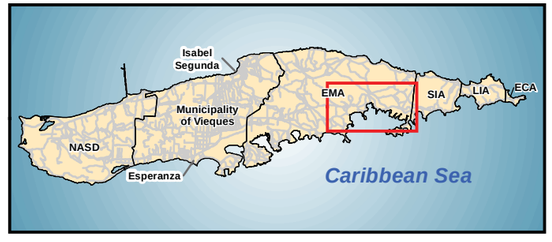
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 43 - UXO 14 EMA South Decision Units and Sampling Units.mxd1/18/2013fcain



- Deep Surface Soil Sample
- Proposed Surface Water Samples
- Proposed Sediment Samples
- Proposed Monitoring Well
- Sample Unit (Interior)
- Sample Unit (Lagoon Fringe)

Decision Unit

- East Central UXO 14
- East UXO 14
- Lagoon 11
- Lagoon 12
- Lagoon 13
- Lagoon 14
- Lagoon 15
- Lagoon 16
- Laguna Yanuel
- West UXO 14
- West-Central UXO 14



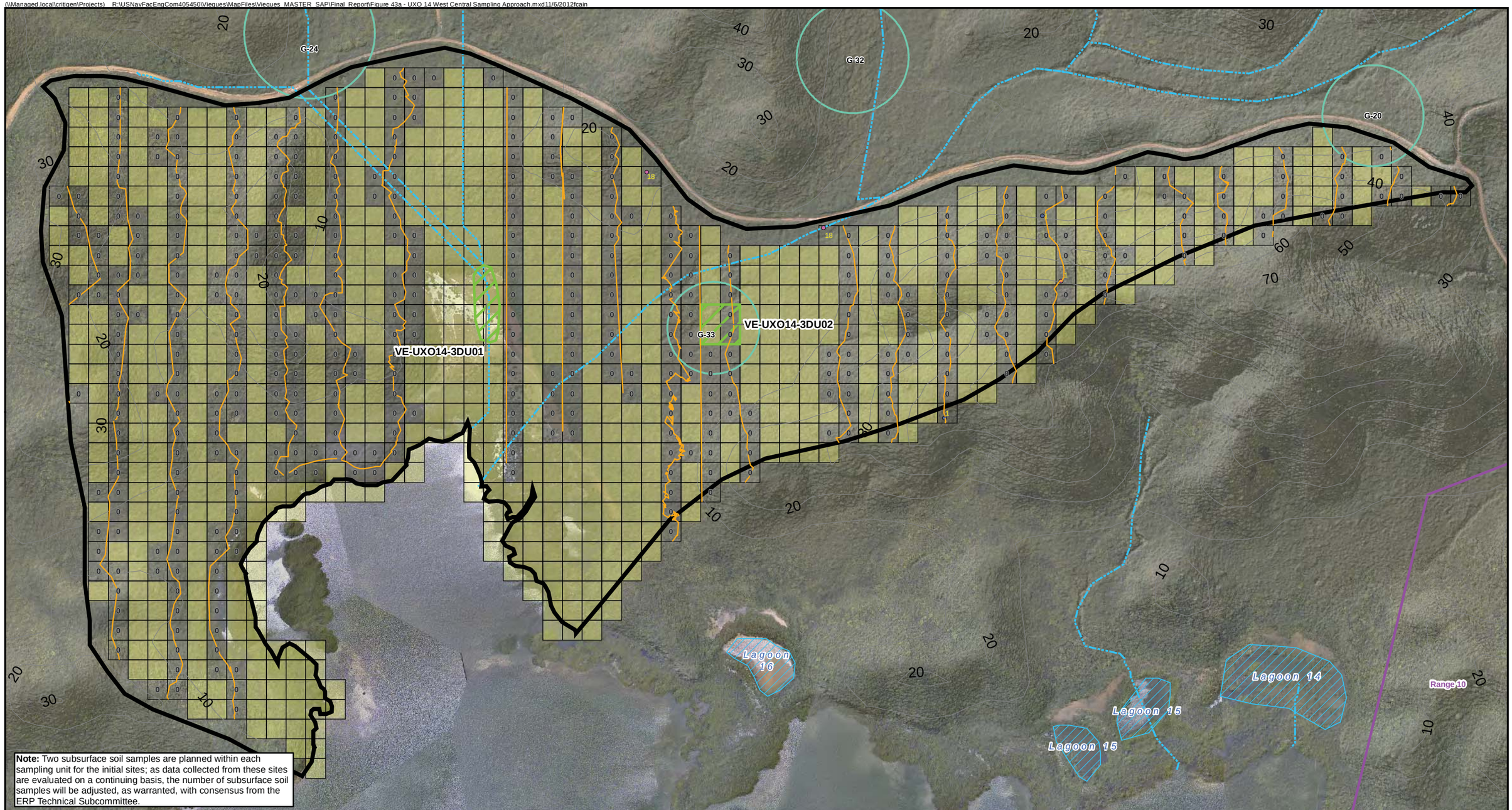
N
W E
S

0 600 1,200
Feet

Figure 43
UXO 14 EMA South Decision Units and Sampling Units
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

2007 Aerial Imagery

CH2MHILL

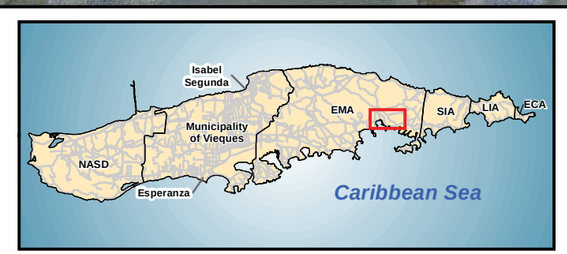


Sample Unit
Decision Unit
Projectiles / Mortars
Scrap (Munitions Debris)
Transect -3 Foot Width was Investigated
Topographic Contours (10 Meter)
Stream
Gun Positions
Range
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation
Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918



N
W E
S

0 250 500 Feet

Figure 43a
UXO 14 West Central Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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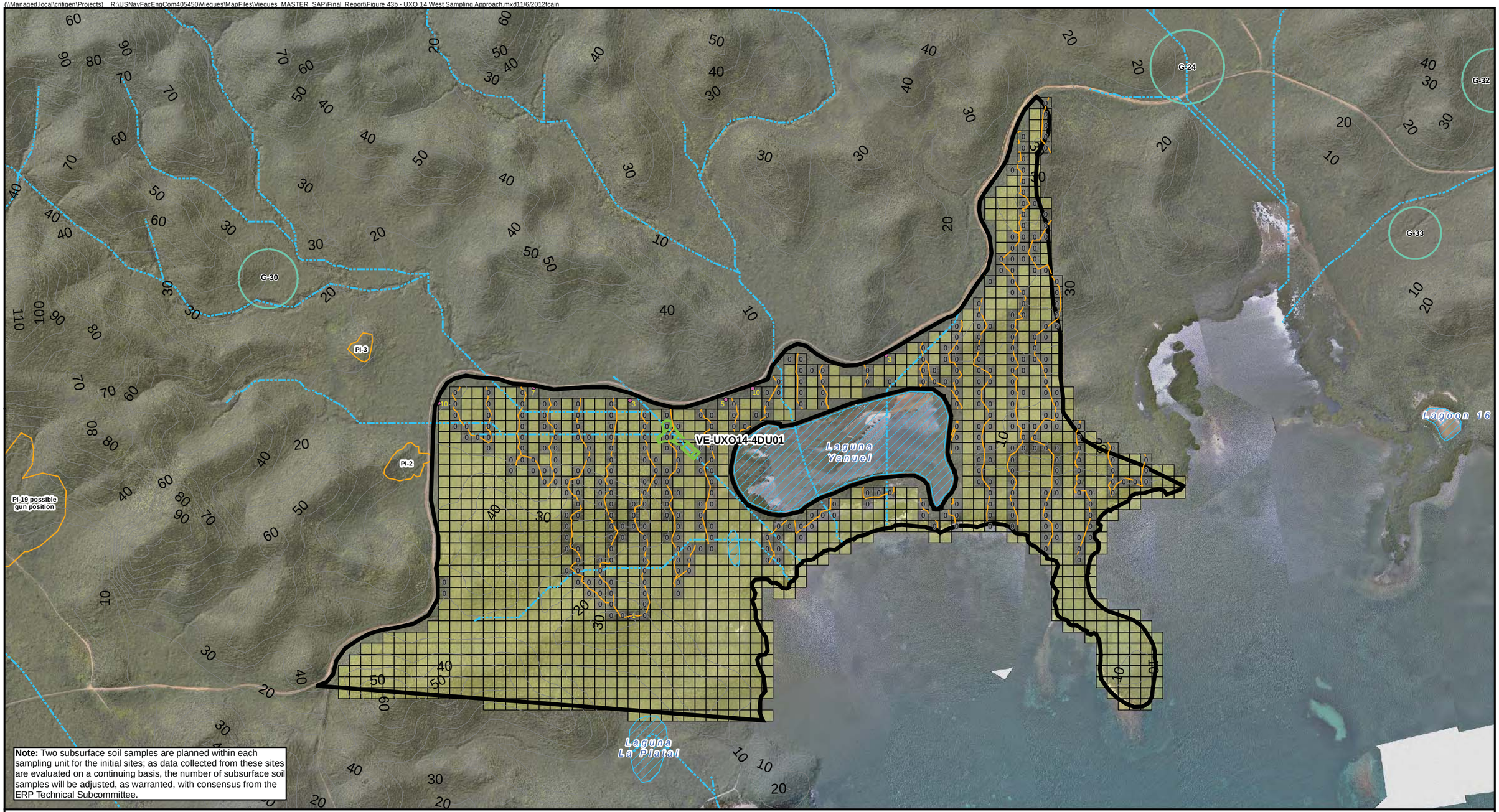
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 43b - UXO 14 West Sampling Approach.mxd11/6/2012fcain



Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Sample Unit
- Decision Unit
- Flares-Pyrotechnics
- Scrap (Munitions Debris)
- Transect -3 Foot Width was Investigated
- Topographic Contours (10 Meter)
- Stream
- Gun Positions
- Photo Identified Area
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918

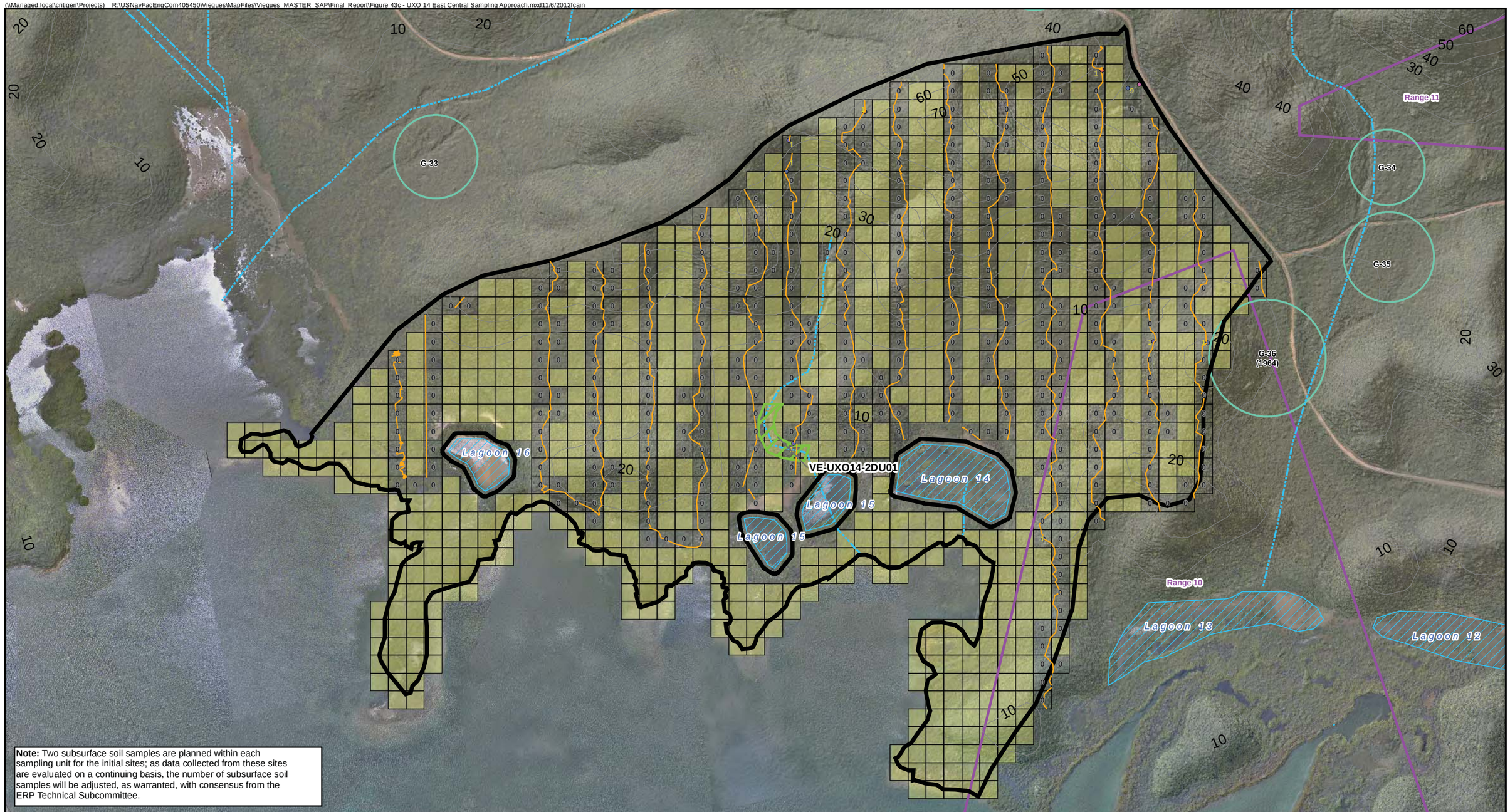
N W E S

0 500 1,000 Feet

Figure 43b
UXO 14 West Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 43c - UXO 14 East Central Sampling Approach.mxd11/6/2012fcain



Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Sample Unit
- Decision Unit
- Flares-Pyrotechnics
- Grenades
- Projectiles / Mortars
- Scrap (Munitions Debris)
- Transect -3 Foot Width was Investigated
- Topographic Contours (10 Meter)
- Stream
- Gun Positions
- Range
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

- 1 - 139
- 140 - 455
- 456 - 929
- 930 - 1579
- 1580 - 2360
- 2361 - 3463
- 3464 - 4920
- 4921 - 6808
- 6809 - 10113
- 10114 - 16918

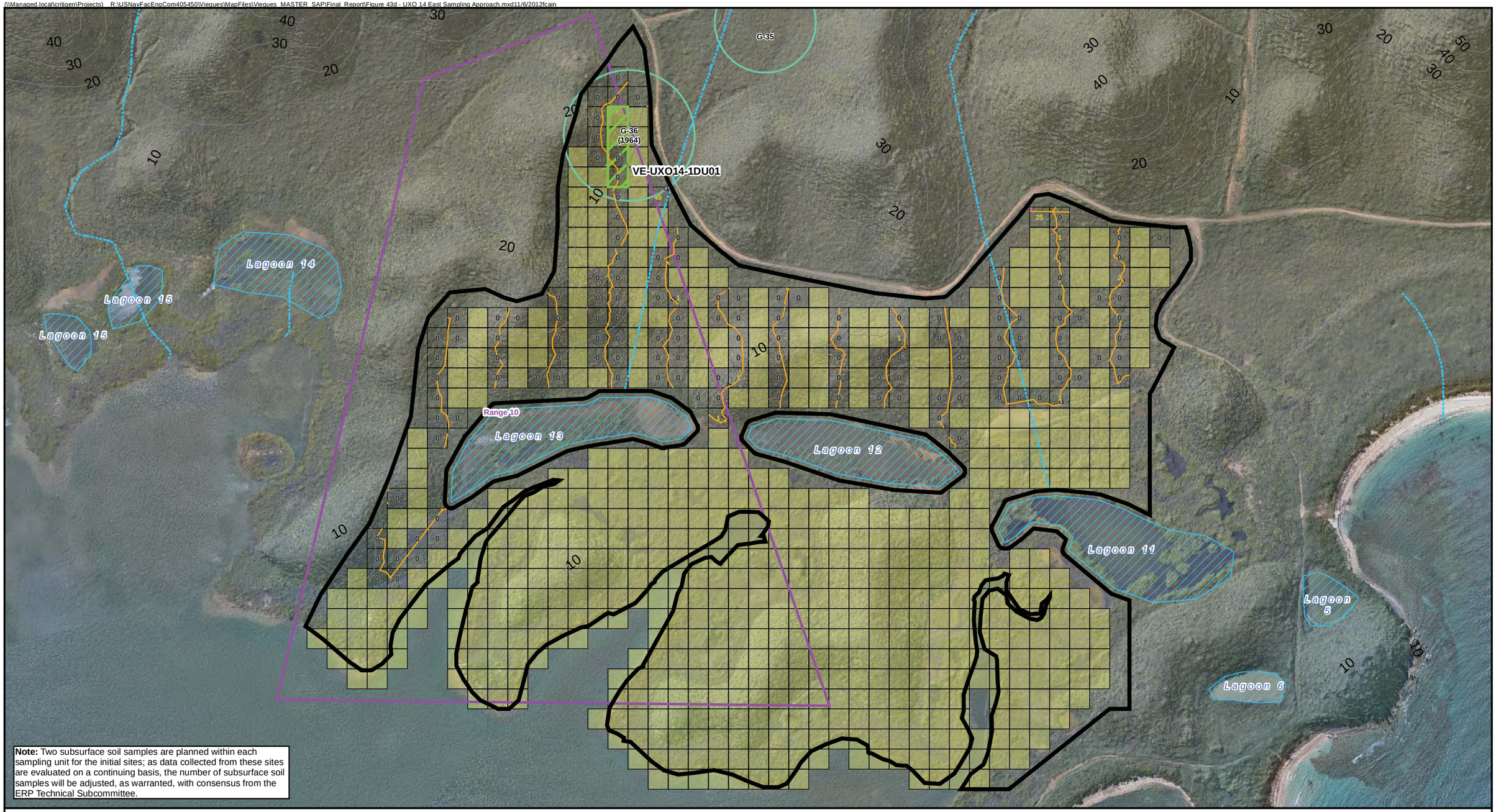
N W E S

0 250 500 Feet

Figure 43c
UXO 14 East Central Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 43d - UXO 14 East Sampling Approach.mxd11/6/2012fcain



Note: Two subsurface soil samples are planned within each sampling unit for the initial sites; as data collected from these sites are evaluated on a continuing basis, the number of subsurface soil samples will be adjusted, as warranted, with consensus from the ERP Technical Subcommittee.

- Sample Unit
- Decision Unit
- Flares-Pyrotechnics
- Projectiles / Mortars
- Rockets / Guided Missiles
- Scrap (Munitions Debris)
- Transect -3 Foot Width was Investigated
- Topographic Contours (10 Meter)
- Stream
- Gun Positions
- Range
- Grid (30 Meter)
- Yellow Shading Indicates No MEC Investigation
- Lagoon

2005 Aerial Imagery
2005 Hillshade

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

N
W E
S

0 250 500
Feet

Figure 43d
UXO 14 East Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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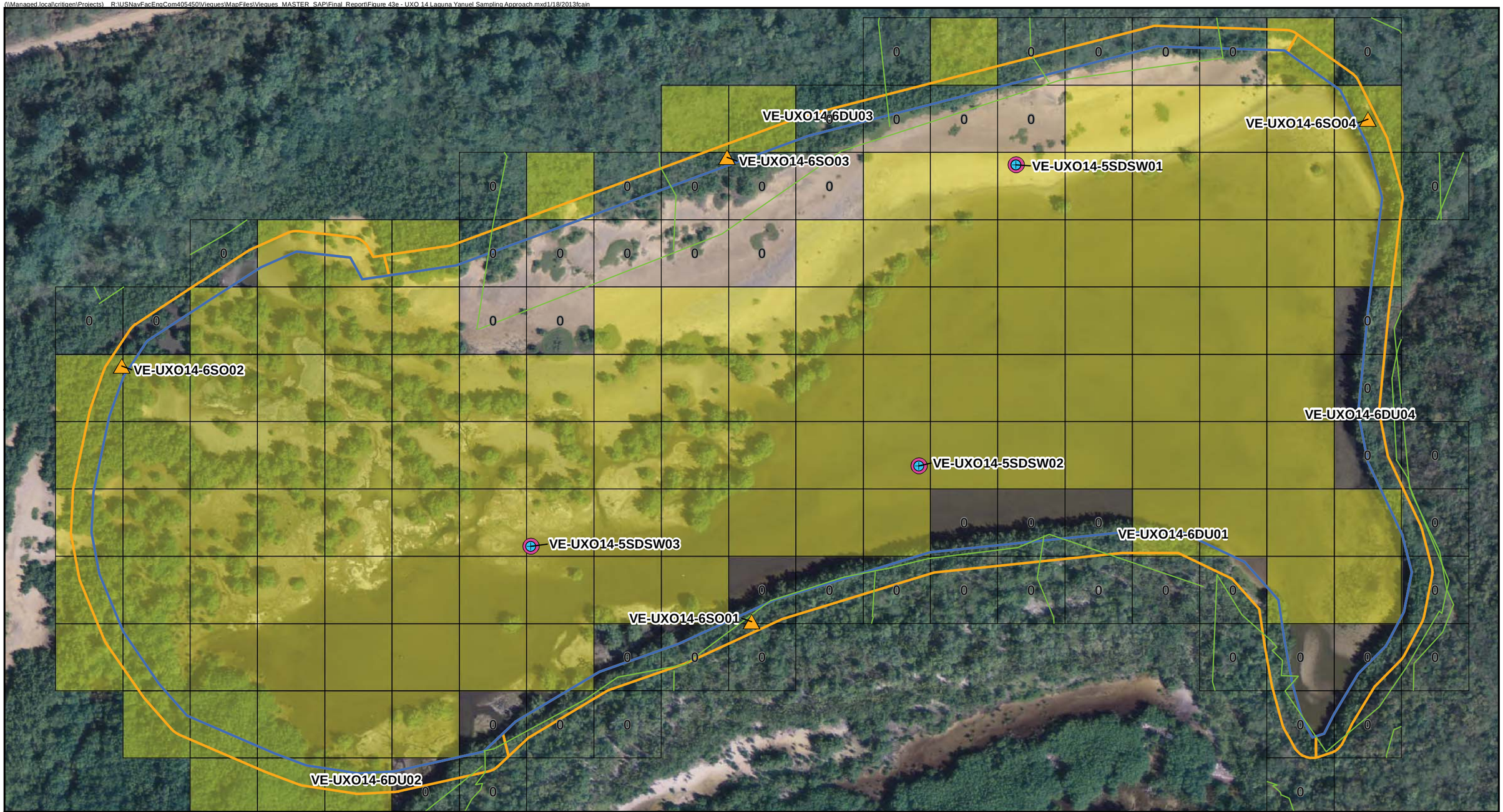
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 43e - UXO 14 Laguna Yanuel Sampling Approach.mxd1/18/2013fcain



Proposed Surface Water Samples
Proposed Sediment Samples
Deep Surface Soil Sample
Transect -3 Foot Width was Investigated
Lagoon
Lagoon Fringe
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation

2007 Aerial Imagery

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

N
W E
S

0 75 150
Feet

Figure 43e
UXO 14 Laguna Yanuel Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 43f - UXO 14 Lagoon 14 and 15 Sampling Approach.mxd11/6/2012fcain

Proposed Surface Water Samples
Proposed Sediment Samples
Deep Surface Soil Sample
Transect -3 Foot Width was Investigated
Lagoon
Lagoon Fringe
Topographic Contours (10 Meter)
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

2007 Aerial Imagery

N
W E
S

0 50 100
Feet

Figure 43f
UXO 14 Lagoon 14 and 15 Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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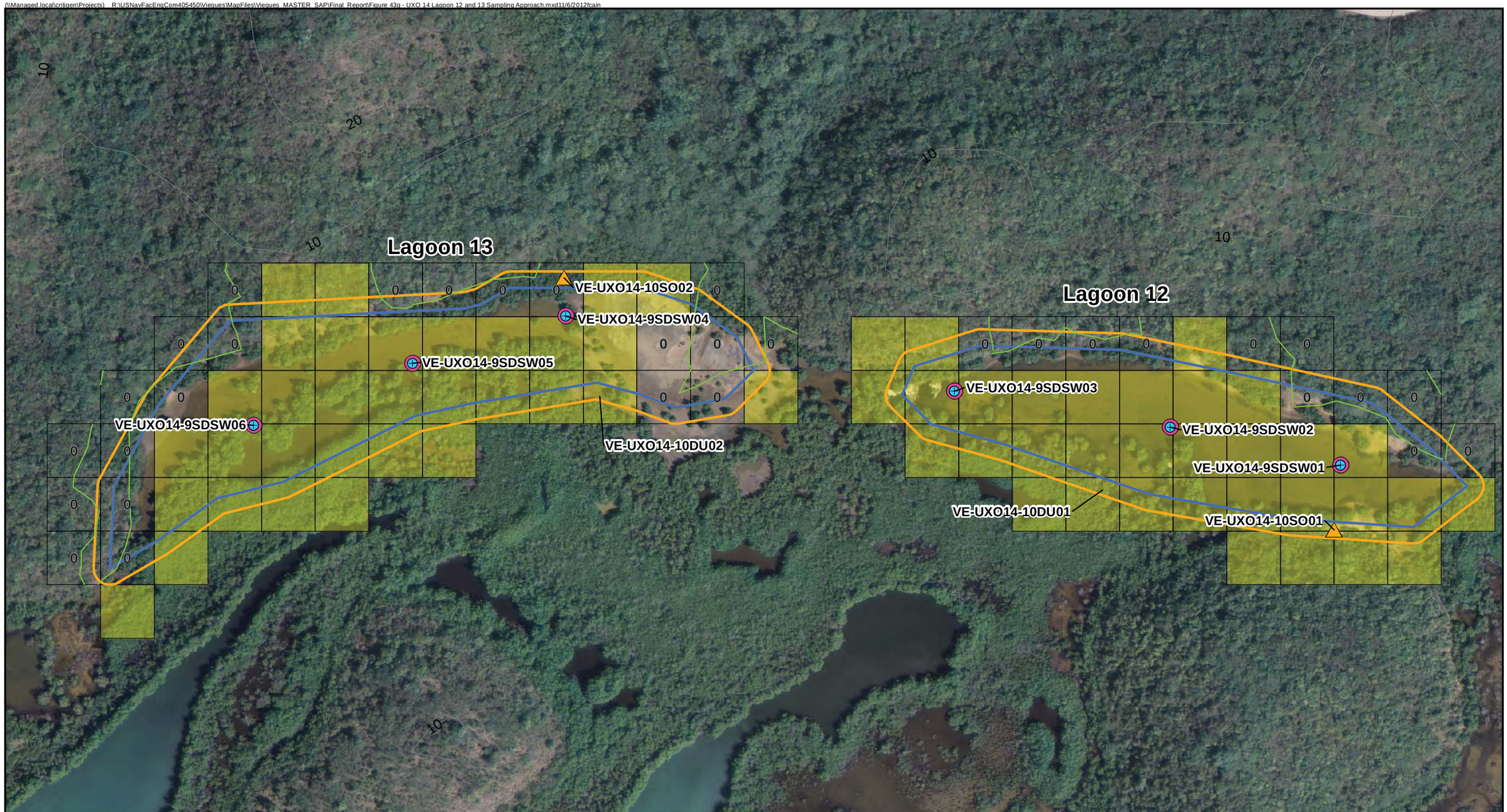
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 43g - UXO 14 Lagoon 12 and 13 Sampling Approach.mxd11/6/2012fcain

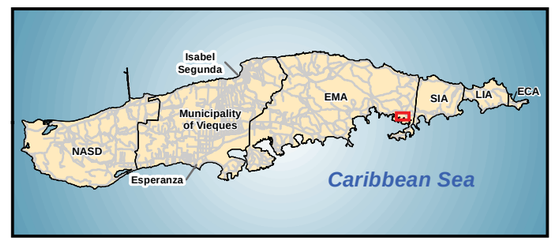


Proposed Surface Water Samples
Proposed Sediment Samples
Deep Surface Soil Sample
Transect -3 Foot Width was Investigated
Lagoon
Lagoon Fringe
Topographic Contours (10 Meter)
Grid (30 Meter)
Yellow Shading Indicates No MEC Investigation

Density of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

2007 Aerial Imagery



N
W E
S

0 87.5 175
Feet

Figure 43g
UXO 14 Lagoon 12 and 13 Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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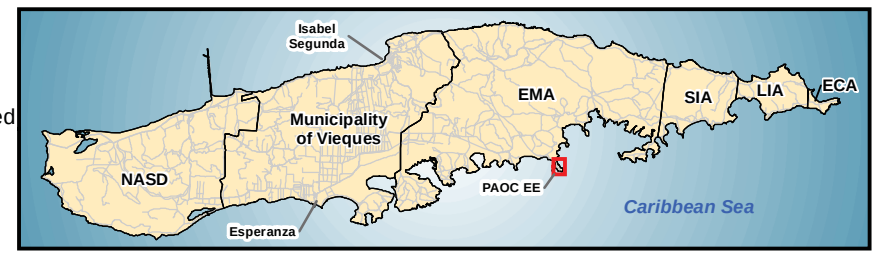
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 44 - UXO 17 – PAOC EE Anomalies.mxd11/6/2012fcain

Legend

- Anomaly – Excavated
- Anomaly – Not Excavated
- Anomaly Polygon – Not Excavated
- 30 Meter Grid
- PAOC EE

2007 Aerial Imagery



N
W E
S

0 75 150
Feet

Figure 44
PAOC EE Anomalies
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

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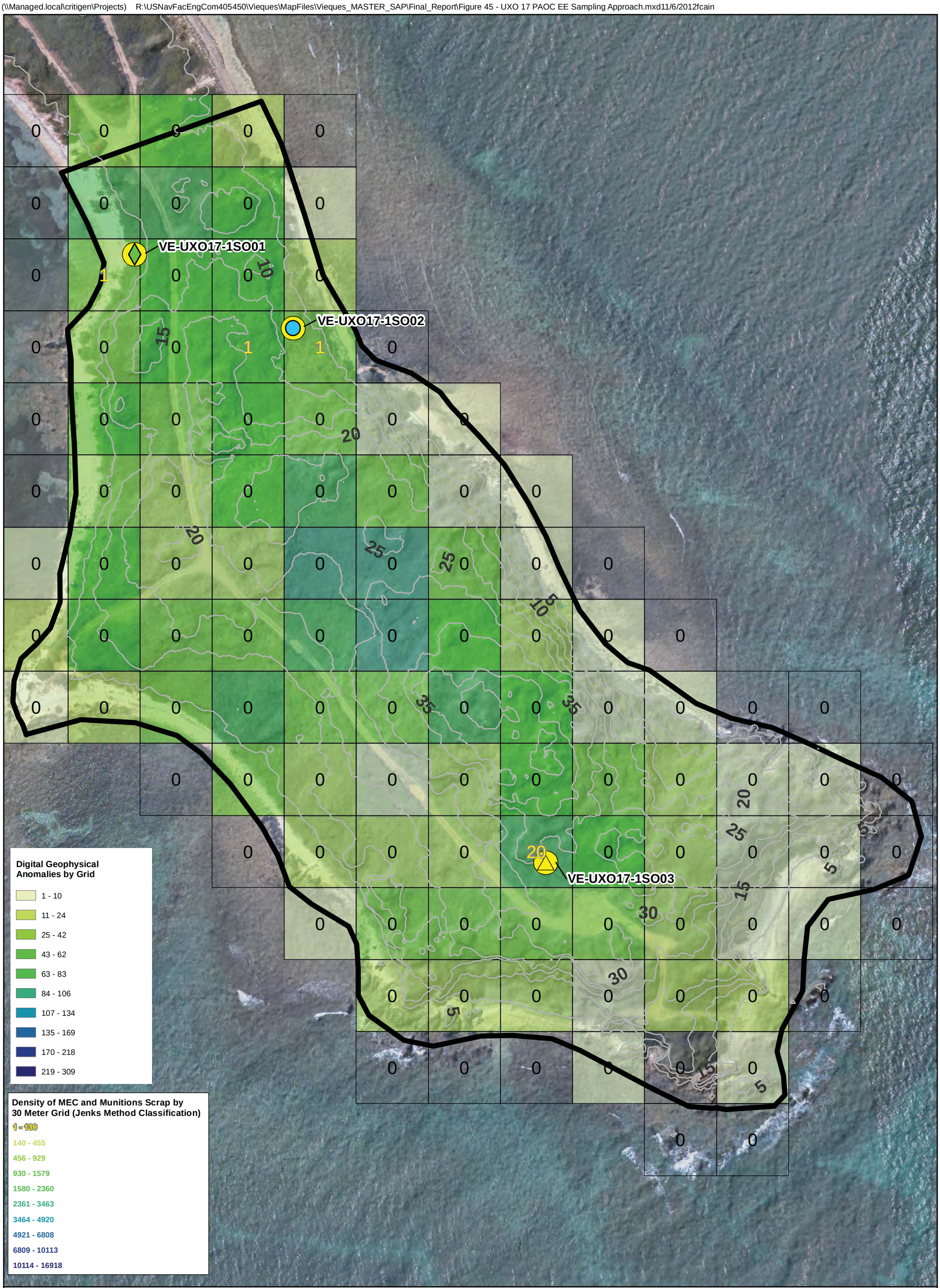
(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 45 - UXO 17 PAOC EE Sampling Approach.mxd11/6/2012fcain



40mm Projectile

Propellant

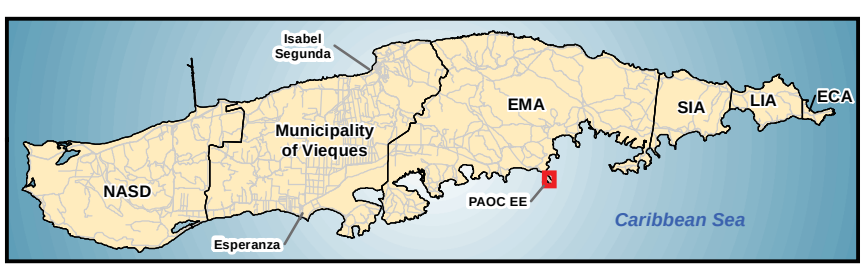
Small Arms Ammunition

Surface Soil Sample

Topographic Contour (5 foot interval)

Grid (30 Meter)

Decision Unit



N
W E
S

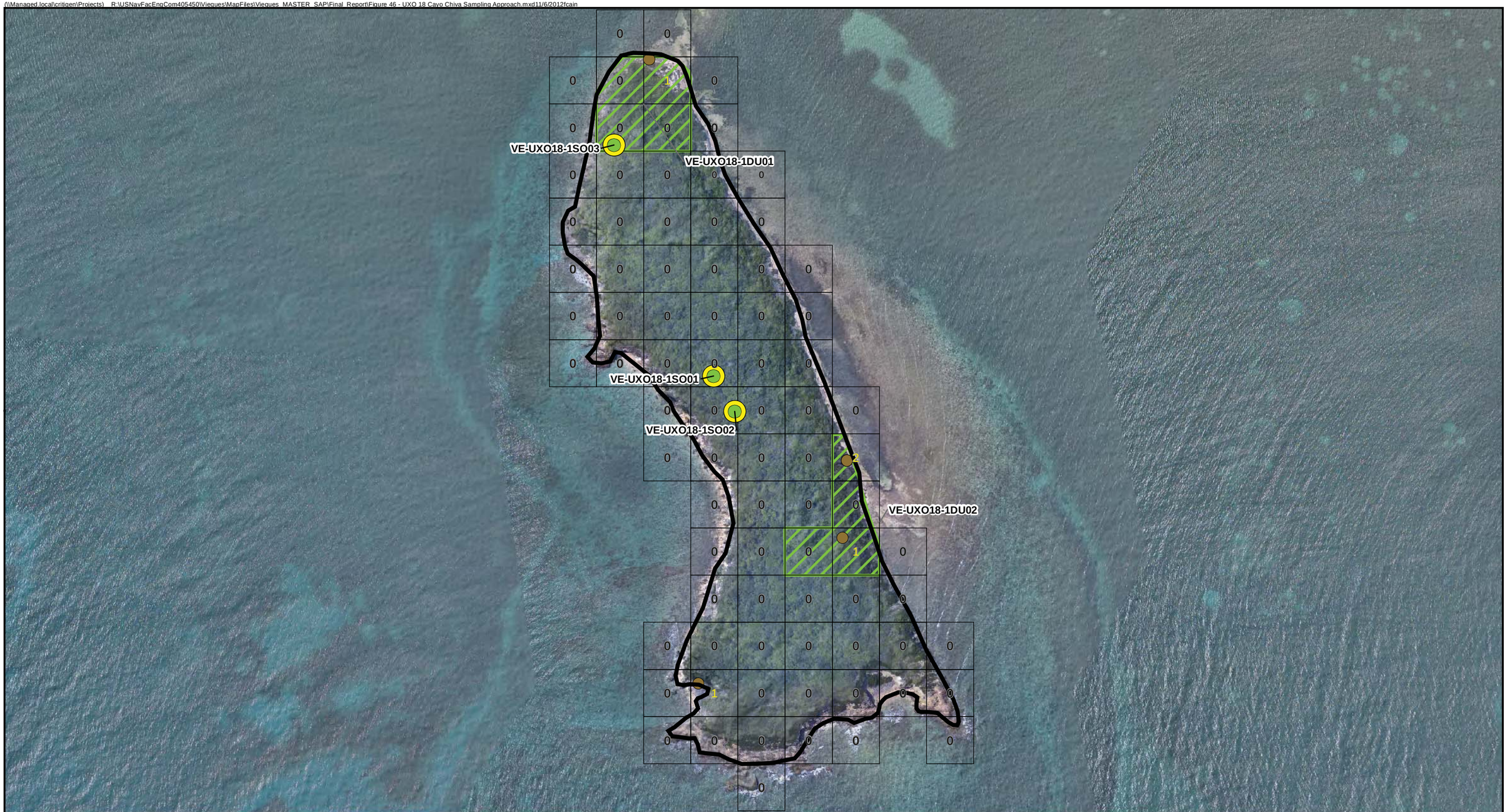
0 50 100
Feet

2005 Aerial Imagery

Figure 45
UXO 17 PAOC EE Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

(\\Managed.local\critigen\Projects) R:\USNavFacEngCom405450\Vieques\MapFiles\Vieques_MASTER_SAP\Final_Report\Figure 46 - UXO 18 Cayo Chiva Sampling Approach.mxd11/6/2012fcain



Surface Soil Sample
Smoke Canister Location
Decision Unit
Rockets / Guided Missiles
Grid (30 Meter)
Sample Unit

2005 Aerial Imagery
2005 Hillshade

Denisity of MEC and Munitions Scrap by 30 Meter Grid (Jenks Method Classification)

1 - 139
140 - 455
456 - 929
930 - 1579
1580 - 2360
2361 - 3463
3464 - 4920
4921 - 6808
6809 - 10113
10114 - 16918

N
W E
S

0 100 200
Feet

Figure 46
UXO 18 Cayo Chiva Sampling Approach
Master Sampling and Analysis Plan
Former VNTR
Vieques, Puerto Rico

CH2MHILL

Attachment B
DOD ELAP Letters

PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:

ALS Environmental-Kelso

1317 South 13th Avenue, Kelso, WA 98626

(Hereinafter called the Organization) and hereby declares that Organization has met the requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the DoD Quality Systems Manual for Environmental Laboratories Version 5.0 July 2013 and is accredited is accordance with the:

United States Department of Defense
Environmental Laboratory Accreditation Program
(DoD-ELAP)

This accreditation demonstrates technical competence for the defined scope:

Chemical and Environmental Testing

(As detailed in the supplement)

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Initial Accreditation Date:	*Issue Date:*	*Expiration Date:*
July 19, 2011	February 13, 2016	April 28, 2018
Revision Date:	*Accreditation No.:*	*Certificate No.:*
February 7, 2018	65188	L16-58-R4

Tracy Szerszen
President/Operations Manager

Perry Johnson Laboratory
Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjlabs.com

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

ALS Environmental-Kelso

1317 South 13th Avenue, Kelso, WA 98626

Contact Name: Carl Degner Phone: 360-577-7222

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 1631E	CVAFS	Mercury (Low level)
Aqueous	EPA 1664A	Gravimetry	Hexane Extractable Material (HEM)
Aqueous	EPA 1664A	Gravimetry	Total Petroleum Hydrocarbons (TPH)
Aqueous	EPA 180.1	Turbidimetry	Turbidity
Aqueous	EPA 2340B	Calculation by 6010	Hardness as CaCO3)
Aqueous	EPA 245.1	CVAA	Mercury
Aqueous	EPA 300.0	IC	Bromide
Aqueous	EPA 300.0	IC	Chloride
Aqueous	EPA 300.0	IC	Fluoride
Aqueous	EPA 300.0	IC	Nitrate as N
Aqueous	EPA 300.0	IC	Nitrite as N
Aqueous	EPA 300.0	IC	Sulfate
Aqueous	EPA 353.2	Colorimetry	Nitrate + Nitrite as N
Aqueous	EPA 537 MOD	HPLC/MS/MS	6:2 Fluorotelomersulfonate
Aqueous	EPA 537 MOD	HPLC/MS/MS	8:2 Fluorotelomersulfonate
Aqueous	EPA 537 MOD	HPLC/MS/MS	N-Ethylperfluorooctanesulfonamide
Aqueous	EPA 537 MOD	HPLC/MS/MS	N-Ethylperfluorooctanesulfonamidoethanol
Aqueous	EPA 537 MOD	HPLC/MS/MS	N-Methylperfluorooctanesulfonamide
Aqueous	EPA 537 MOD	HPLC/MS/MS	N-Methylperfluorooctanesulfonamidoethanol
Aqueous	EPA 537 MOD	HPLC/MS/MS	Perfluoroheptanesulfonate
Aqueous	EPA 537 MOD	HPLC/MS/MS	Perfluorooctane Sulfonamide
Aqueous	EPA 537 MOD	HPLC/MS/MS	Perfluorotetradecanoic acid
Aqueous	EPA 537 MOD	HPLC/MS/MS	Perfluorotridecanoic acid
Aqueous	EPA 7196A	Colorimetry	Chromium VI
Aqueous	EPA 7470A	CVAA	Mercury
Aqueous	EPA 8260C SIM	GC-MS	1,1,2,2-Tetrachloroethane
Aqueous	EPA 8260C SIM	GC-MS	1,1,2-Trichloroethane
Aqueous	EPA 8260C SIM	GC-MS	1,1-Dichloroethene
Aqueous	EPA 8260C SIM	GC-MS	1,2-Dibromoethane
Aqueous	EPA 8260C SIM	GC-MS	1,2-Dichloroethane
Aqueous	EPA 8260C SIM	GC-MS	1,3 Butadine
Aqueous	EPA 8260C SIM	GC-MS	1,4-Dichlorobenzene
Aqueous	EPA 8260C SIM	GC-MS	Bromodichloromethane
Aqueous	EPA 8260C SIM	GC-MS	Carbon Tetrachloride
Aqueous	EPA 8260C SIM	GC-MS	Chlorodibromomethane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

ALS Environmental-Kelso

1317 South 13th Avenue, Kelso, WA 98626

Contact Name: Carl Degner Phone: 360-577-7222

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 8260C SIM	GC-MS	Chloroform
Aqueous	EPA 8260C SIM	GC-MS	Chloromethane
Aqueous	EPA 8260C SIM	GC-MS	cis-1,2-Dichloroethene
Aqueous	EPA 8260C SIM	GC-MS	Dichloromethane (Methylene Chloride)
Aqueous	EPA 8260C SIM	GC-MS	Tetrachloroethene
Aqueous	EPA 8260C SIM	GC-MS	trans-1,2-Dichloroethene
Aqueous	EPA 8260C SIM	GC-MS	Trichloroethene
Aqueous	EPA 8260C SIM	GC-MS	Vinyl chloride
Aqueous	EPA 9020B	Titrimetry	Total Organic Halides (TOX)
Aqueous	EPA 9040C	Potentiometry	pH
Aqueous	EPA 9060A	UV-VIS Spectrophotometry	Total Organic Carbons (TOC)
Aqueous	SM 2130B	Turbidimetry	Turbidity
Aqueous	SM 2320B	Titrimetry	Total Alkalinity (as CaCO3)
Aqueous	SM 2510B	Potentiometry	Specific Conductance
Aqueous	SM 2540B	Gravimetry	Solids, Total
Aqueous	SM 2540C	Gravimetry	Solids, Total Dissolved
Aqueous	SM 2540D	Gravimetry	Solids, Total Suspended
Aqueous	SM 4500-CN- G	Colorimetry	Cyanide, Amenable
Aqueous	SM 4500-P-E	Colorimetry	ortho-phosphorous
Aqueous	SM 4500-S2 D	Titrimetry	Sulfide
Aqueous	SM 4500-CN E	Colorimetry	Total Cyanide
Aqueous	SM4500-NH3 G	Colorimetry	Ammonia
Aqueous	SM5220C	Titrimetry	Chemical Oxygen Demand (COD)
Aqueous	SM5310C	UV-VIS Spectrophotometry	Total Organic Carbons (TOC)
Aqueous	SOP-LCP-PFC	HPLC/MS/MS	6:2 Fluorotelomersulfonate
Aqueous	SOP-LCP-PFC	HPLC/MS/MS	8:2 Fluorotelomersulfonate
Aqueous	SOP-LCP-PFC	HPLC/MS/MS	N-Ethylperfluorooctanesulfonamide
Aqueous	SOP-LCP-PFC	HPLC/MS/MS	N-Ethylperfluorooctanesulfonamidoethanol
Aqueous	SOP-LCP-PFC	HPLC/MS/MS	N-Methylperfluorooctanesulfonamide
Aqueous	SOP-LCP-PFC	HPLC/MS/MS	N-Methylperfluorooctanesulfonamidoethanol
Aqueous	SOP-LCP-PFC	HPLC/MS/MS	Perfluoroheptanesulfonate
Aqueous	SOP-LCP-PFC	HPLC/MS/MS	Perfluorooctane Sulfonamide
Aqueous	SOP-LCP-PFC	HPLC/MS/MS	Perfluorotetradecanoic acid

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

ALS Environmental-Kelso
1317 South 13th Avenue, Kelso, WA 98626
Contact Name: Carl Degner Phone: 360-577-7222

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	SOP-LCP-PFC	HPLC/MS/MS	Perfluorotridecanoic acid
Drinking Water	EPA 504.1	GC-ECD	1,2-Dibromo-3-chloropropane (DBCP)
Drinking Water	EPA 504.1	GC-ECD	1,2-Dibromoethane (EDB)
Drinking Water	EPA 524.2	GC-MS	1,1,1,2-Tetrachloroethane
Drinking Water	EPA 524.2	GC-MS	1,1,1-Trichloroethane
Drinking Water	EPA 524.2	GC-MS	1,1,2,2-Tetrachloroethane
Drinking Water	EPA 524.2	GC-MS	1,1-Dichloroethane
Drinking Water	EPA 524.2	GC-MS	1,1-Dichloroethene
Drinking Water	EPA 524.2	GC-MS	1,1-Dichloropropene
Drinking Water	EPA 524.2	GC-MS	1,2,3-Trichlorobenzene
Drinking Water	EPA 524.2	GC-MS	1,2,3-Trichloropropane
Drinking Water	EPA 524.2	GC-MS	1,2,4-Trichlorobenzene
Drinking Water	EPA 524.2	GC-MS	1,2,4-Trimethylbenzene
Drinking Water	EPA 524.2	GC-MS	1,2-Dibromoethane (EDB)
Drinking Water	EPA 524.2	GC-MS	1,2-Dichlorobenzene
Drinking Water	EPA 524.2	GC-MS	1,2-Dichloroethane
Drinking Water	EPA 524.2	GC-MS	1,2-Dichloropropane
Drinking Water	EPA 524.2	GC-MS	1,3,5-Trimethylbenzene
Drinking Water	EPA 524.2	GC-MS	1,3-Dichlorobenzene
Drinking Water	EPA 524.2	GC-MS	1,3-Dichloropropane
Drinking Water	EPA 524.2	GC-MS	1,4-Dichlorobenzene
Drinking Water	EPA 524.2	GC-MS	2,2-Dichloropropane
Drinking Water	EPA 524.2	GC-MS	2-Chlorotoluene
Drinking Water	EPA 524.2	GC-MS	4-Chlorotoluene
Drinking Water	EPA 524.2	GC-MS	4-Isopropyltoluene
Drinking Water	EPA 524.2	GC-MS	Benzene
Drinking Water	EPA 524.2	GC-MS	Bromobenzene
Drinking Water	EPA 524.2	GC-MS	Bromochloromethane
Drinking Water	EPA 524.2	GC-MS	Bromodichloromethane
Drinking Water	EPA 524.2	GC-MS	Bromoform
Drinking Water	EPA 524.2	GC-MS	Bromomethane
Drinking Water	EPA 524.2	GC-MS	Carbon Tetrachloride
Drinking Water	EPA 524.2	GC-MS	Chlorobenzene
Drinking Water	EPA 524.2	GC-MS	Chlorodibromomethane
Drinking Water	EPA 524.2	GC-MS	Chloroethane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

ALS Environmental-Kelso

1317 South 13th Avenue, Kelso, WA 98626

Contact Name: Carl Degner Phone: 360-577-7222

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Drinking Water	EPA 524.2	GC-MS	Chloroform
Drinking Water	EPA 524.2	GC-MS	Chloromethane
Drinking Water	EPA 524.2	GC-MS	cis-1,2-Dichloroethene
Drinking Water	EPA 524.2	GC-MS	cis-1,3-Dichloropropene
Drinking Water	EPA 524.2	GC-MS	Dibromomethane
Drinking Water	EPA 524.2	GC-MS	Dichlorodifluoromethane
Drinking Water	EPA 524.2	GC-MS	Dichloromethane (Methylene Chloride)
Drinking Water	EPA 524.2	GC-MS	Ethylbenzene
Drinking Water	EPA 524.2	GC-MS	Hexachlorobutadiene
Drinking Water	EPA 524.2	GC-MS	Isopropylbenzene
Drinking Water	EPA 524.2	GC-MS	m+p-Xylene
Drinking Water	EPA 524.2	GC-MS	Naphthalene
Drinking Water	EPA 524.2	GC-MS	n-Butylbenzene
Drinking Water	EPA 524.2	GC-MS	n-Propylbenzene
Drinking Water	EPA 524.2	GC-MS	o-Xylene
Drinking Water	EPA 524.2	GC-MS	sec-Butylbenzene
Drinking Water	EPA 524.2	GC-MS	Styrene
Drinking Water	EPA 524.2	GC-MS	tert-butylbenzene
Drinking Water	EPA 524.2	GC-MS	Tetrachloroethene
Drinking Water	EPA 524.2	GC-MS	Toluene
Drinking Water	EPA 524.2	GC-MS	trans-1,2-Dichloroethene
Drinking Water	EPA 524.2	GC-MS	trans-1,3-Dichloropropene
Drinking Water	EPA 524.2	GC-MS	Trichloroethene
Drinking Water	EPA 524.2	GC-MS	Trichlorofluoromethane (Freon 11)
Drinking Water	EPA 524.2	GC-MS	Vinyl chloride
Drinking Water	EPA 524.2	GC-MS	Xylenes, total
Solid	ASTM D4129-92M, Lloyd Kahn	UV-VIS Spectrophotometry	Total Organic Carbons (TOC)
Solid	EPA 160.3M	Gravimetry	Solids, Total
Solid	EPA 1631E	CVFAS	Mercury (low level)
Solid	EPA 7471A, B	CVAA	Mercury
Solid	EPA 9045D	Potentiometry	pH
Solid	EPA 9056A	IC	Nitrate as N
Solid	EPA 9071A	Gravimetry	Hexane Extractable Material (HEM)
Solid	PSEP	Gravimetry	Particle Size

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ISO/IEC 17025:2005 and DoD-ELAP

ALS Environmental-Kelso
1317 South 13th Avenue, Kelso, WA 98626
Contact Name: Carl Degner Phone: 360-577-7222

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Drinking Water	EPA 537	HPLC/MS/MS	Perfluorobutanesulfonic Acid
Aqueous/Drinking Water	EPA 537	HPLC/MS/MS	Perfluoroheptanoic Acid
Aqueous/Drinking Water	EPA 537	HPLC/MS/MS	Perfluorohexanesulfonic Acid
Aqueous/Drinking Water	EPA 537	HPLC/MS/MS	Perfluorononanoic Acid
Aqueous/Drinking Water	EPA 537	HPLC/MS/MS	Perfluorooctanesulfonic Acid
Aqueous/Drinking Water	EPA 537	HPLC/MS/MS	Perfluorooctanoic Acid
Aqueous/Solid	ASTM D 1426-93B	Potentiometry	Nitrogen, Total Kjeldahl (TKN)
Aqueous/Solid	EPA 1020A	Physical Property	Ignitability
Aqueous/Solid	EPA 350.1	Colorimetry	Ammonia
Aqueous/Solid	EPA 365.3	Colorimetry	Total Phosphorus
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluorobutane sulfonate
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluorobutanoic acid
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluorodecane Sulfonate
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluorodecanoic acid
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluorododecanoic acid
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluoroheptanoic acid
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluorohexane sulfonate
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluorohexanoic acid
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluorononanoic acid
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluorooctane sulfonate
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluorooctanoic acid
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluoropentanoic acid
Aqueous/Solid	EPA 537 MOD	HPLC/MS/MS	Perfluoroundecanoic acid
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Aluminum
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Antimony
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Arsenic
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Barium
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Beryllium

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

ALS Environmental-Kelso
1317 South 13th Avenue, Kelso, WA 98626
Contact Name: Carl Degner Phone: 360-577-7222

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Boron
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Cadmium
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Calcium
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Chromium, total
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Cobalt
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Copper
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Iron
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Lead
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Magnesium
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Manganese
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Molybdenum
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Nickel
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Potassium
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Selenium
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Silver
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Sodium
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Strontium
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Thallium
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Tin
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Titanium
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Vanadium
Aqueous/Solid	EPA 6010B, C/200.7	ICP	Zinc
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Aluminum
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Antimony
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Arsenic
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Barium
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Beryllium
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Boron
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Cadmium
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Chromium, total
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Cobalt
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Copper
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Iron
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Lead
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Manganese

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

ALS Environmental-Kelso
1317 South 13th Avenue, Kelso, WA 98626
Contact Name: Carl Degner Phone: 360-577-7222

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Molybdenum
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Nickel
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Selenium
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Silver
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Strontium
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Thallium
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Tin
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Titanium
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Vanadium
Aqueous/Solid	EPA 6020, A/200.8	ICP-MS	Zinc
Aqueous/Solid	EPA 6850	HPLC/MS/MS	Perchlorate
Aqueous/Solid	EPA 7742	AA, Borohydride Reduction; GFAA	Selenium
Aqueous/Solid	EPA 8011	GC-ECD	Ethylene Dibromide
Aqueous/Solid	EPA 8011	GC-ECD	1,2-Dibrom-3-chloropropane
Aqueous/Solid	EPA 8015C/AK103-RRO	GC-FID	Residual Range Organics (RRO)
Aqueous/Solid	EPA 8015C; AK101-GRO; NWTPH-Gx	GC-FID	Gasoline Range Organics (GRO)
Aqueous/Solid	EPA 8015C; AK102-DRO; NWTPH-Dx	GC-FID	Diesel Range Organics (DRO)
Aqueous/Solid	EPA 8081A, B	GC-ECD	Aldrin
Aqueous/Solid	EPA 8081A, B	GC-ECD	Alpha-BHC
Aqueous/Solid	EPA 8081A, B	GC-ECD	alpha-Chlordane
Aqueous/Solid	EPA 8081A, B	GC-ECD	Chlordane (total)
Aqueous/Solid	EPA 8081A, B	GC-ECD	DDD (4,4)
Aqueous/Solid	EPA 8081A, B	GC-ECD	DDE (4,4)
Aqueous/Solid	EPA 8081A, B	GC-ECD	DDT (4,4)
Aqueous/Solid	EPA 8081A, B	GC-ECD	delta-BHC
Aqueous/Solid	EPA 8081A, B	GC-ECD	Dieldrin
Aqueous/Solid	EPA 8081A, B	GC-ECD	Endosulfan I
Aqueous/Solid	EPA 8081A, B	GC-ECD	Endosulfan II
Aqueous/Solid	EPA 8081A, B	GC-ECD	Endosulfan sulfate
Aqueous/Solid	EPA 8081A, B	GC-ECD	Endrin
Aqueous/Solid	EPA 8081A, B	GC-ECD	Endrin aldehyde
Aqueous/Solid	EPA 8081A, B	GC-ECD	Endrin ketone

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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8081A, B	GC-ECD	gamma-BHC
Aqueous/Solid	EPA 8081A, B	GC-ECD	gamma-Chlordane
Aqueous/Solid	EPA 8081A, B	GC-ECD	Heptachlor
Aqueous/Solid	EPA 8081A, B	GC-ECD	Heptachlor Epoxide (beta)
Aqueous/Solid	EPA 8081A, B	GC-ECD	Methoxychlor
Aqueous/Solid	EPA 8081A, B	GC-ECD	Toxaphene (total)
Aqueous/Solid	EPA 8081B	GC-ECD	2,4-DDD
Aqueous/Solid	EPA 8081B	GC-ECD	2,4-DDE
Aqueous/Solid	EPA 8081B	GC-ECD	2,4-DDT
Aqueous/Solid	EPA 8081B	GC-ECD	Chlorpyrifos
Aqueous/Solid	EPA 8081B	GC-ECD	cis-Nonachlor
Aqueous/Solid	EPA 8081B	GC-ECD	Hexachlorobenzene
Aqueous/Solid	EPA 8081B	GC-ECD	Hexachlorobutadiene
Aqueous/Solid	EPA 8081B	GC-ECD	Hexachloroethane
Aqueous/Solid	EPA 8081B	GC-ECD	Isodrin
Aqueous/Solid	EPA 8081B	GC-ECD	Mirex
Aqueous/Solid	EPA 8081B	GC-ECD	Oxychlordane
Aqueous/Solid	EPA 8081B	GC-ECD	trans-Nonachlor
Aqueous/Solid	EPA 8082A	GC-ECD	2,2’,3,3’,4,4’,5,5’,6-Nonachlorobiphenyl (PCB 206)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2’,3,3’,4,4’,5,6-Octachlorobiphenyl (PCB 195)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2',3,3',4,4',5,5',6,6' Decachlorobiphenyl (PCB 209)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2’,3,3’,4,4’,5-Heptachlorobiphenyl (PCB 170)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2’,3,3’,4,4’-Hexachlorobiphenyl (PCB 128)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2’,3,4,4’,5,5’-Heptachlorobiphenyl (PCB 180)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2’,3,4,4’,5’,6-Heptachlorobiphenyl (PCB 183)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2’,3,4,4’,5’-Hexachlorobiphenyl (PCB 138)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2’,3,4,4’,6,6’-Heptachlorobiphenyl (PCB 184)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2’,3,4’,5,5’,6-Heptachlorobiphenyl (PCB 187)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2’,3,4,5’-Pentachlorobiphenyl (PCB 87)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2’,3,4’,5-Pentachlorobiphenyl (PCB 90)

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ALS Environmental-Kelso

1317 South 13th Avenue, Kelso, WA 98626

Contact Name: Carl Degner Phone: 360-577-7222

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8082A	GC-ECD	2,2',3,5'-Tetrachlorobiphenyl (PCB 44)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2',4,4',5,5'-Hexachlorobiphenyl (PCB 153)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2',4,5,5'-Pentachlorobiphenyl (PCB 101)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2',5,6'-Tetrachlorbiphenyl (PCB 53)
Aqueous/Solid	EPA 8082A	GC-ECD	2,2',5-Trichlorobiphenyl (PCB 18)
Aqueous/Solid	EPA 8082A	GC-ECD	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)
Aqueous/Solid	EPA 8082A	GC-ECD	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)
Aqueous/Solid	EPA 8082A	GC-ECD	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)
Aqueous/Solid	EPA 8082A	GC-ECD	2,3,3',4,4',6-Hexachlorobiphenyl (PCB 158)
Aqueous/Solid	EPA 8082A	GC-ECD	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)
Aqueous/Solid	EPA 8082A	GC-ECD	2,3',4,4',5,5' Hexachlorobiphenyl (PCB 167)
Aqueous/Solid	EPA 8082A	GC-ECD	2,3',4,4',5',6-Hexachlorobiphenyl (PCB 168)
Aqueous/Solid	EPA 8082A	GC-ECD	2,3,4,4',5-Pentachlorobiphenyl (PCB 114)
Aqueous/Solid	EPA 8082A	GC-ECD	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)
Aqueous/Solid	EPA 8082A	GC-ECD	2,3',4,4',5-Pentachlorobiphenyl (PCB 123)
Aqueous/Solid	EPA 8082A	GC-ECD	2,3,4,4'-Tetrachlorobiphenyl (PCB 60)
Aqueous/Solid	EPA 8082A	GC-ECD	2,3',4,4'-Tetrachlorobiphenyl (PCB 66)
Aqueous/Solid	EPA 8082A	GC-ECD	2,4,4'-Trichlorobiphenyl (PCB 28)
Aqueous/Solid	EPA 8082A	GC-ECD	2,4'-Dichlorobiphenyl (PCB 8)
Aqueous/Solid	EPA 8082A	GC-ECD	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)
Aqueous/Solid	EPA 8082A	GC-ECD	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)
Aqueous/Solid	EPA 8082A	GC-ECD	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)
Aqueous/Solid	EPA 8082A	GC-ECD	3,4,4',5-Tetrachlorobiphenyl (PCB 81)
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor 1016
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor 1221
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor 1232
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor 1242
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor 1248
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor 1254
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor 1260
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor 1262
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor 1268
Aqueous/Solid	EPA 8260B, C	GC-MS	1,1,1,2-Tetrachloroethane
Aqueous/Solid	EPA 8260B, C	GC-MS	1,1,1-Trichloroethane

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ALS Environmental-Kelso
1317 South 13th Avenue, Kelso, WA 98626
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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8260B, C	GC-MS	1,1,2,2-Tetrachloroethane
Aqueous/Solid	EPA 8260B, C	GC-MS	1,1,2-Trichloroethane
Aqueous/Solid	EPA 8260B, C	GC-MS	1,1-Dichloroethane
Aqueous/Solid	EPA 8260B, C	GC-MS	1,2-Dibromoethane
Aqueous/Solid	EPA 8260B, C	GC-MS	1,2-Dichlorobenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	1,2-Dichloroethane
Aqueous/Solid	EPA 8260B, C	GC-MS	1,2-Dichloropropane
Aqueous/Solid	EPA 8260B, C	GC-MS	1,3,5-Trimethylbenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	1,3-Dichlorobenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	1,3-Dichloropropane
Aqueous/Solid	EPA 8260B, C	GC-MS	1,4-Dichlorobenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	1-phenylpropane
Aqueous/Solid	EPA 8260B, C	GC-MS	2,2-Dichloropropane
Aqueous/Solid	EPA 8260B, C	GC-MS	2-Butanone (MEK)
Aqueous/Solid	EPA 8260B, C	GC-MS	2-Chloroethylvinylether
Aqueous/Solid	EPA 8260B, C	GC-MS	2-Chlorotoluene
Aqueous/Solid	EPA 8260B, C	GC-MS	2-Hexanone
Aqueous/Solid	EPA 8260B, C	GC-MS	4-Chlorotoluene
Aqueous/Solid	EPA 8260B, C	GC-MS	4-Isopropyltoluene
Aqueous/Solid	EPA 8260B, C	GC-MS	4-Methyl-2-pentanone (MIBK)
Aqueous/Solid	EPA 8260B, C	GC-MS	Acetone
Aqueous/Solid	EPA 8260B, C	GC-MS	Acetonitrile
Aqueous/Solid	EPA 8260B, C	GC-MS	Acrolein
Aqueous/Solid	EPA 8260B, C	GC-MS	Acrylonitrile
Aqueous/Solid	EPA 8260B, C	GC-MS	Benzene
Aqueous/Solid	EPA 8260B, C	GC-MS	Bromobenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	Bromochloromethane
Aqueous/Solid	EPA 8260B, C	GC-MS	Bromodichloromethane
Aqueous/Solid	EPA 8260B, C	GC-MS	Bromoform
Aqueous/Solid	EPA 8260B, C	GC-MS	Bromomethane
Aqueous/Solid	EPA 8260B, C	GC-MS	Carbon disulfide
Aqueous/Solid	EPA 8260B, C	GC-MS	Carbon Tetrachloride
Aqueous/Solid	EPA 8260B, C	GC-MS	Chlorobenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	Chlorodibromomethane
Aqueous/Solid	EPA 8260B, C	GC-MS	Chloroethane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

ALS Environmental-Kelso
1317 South 13th Avenue, Kelso, WA 98626
Contact Name: Carl Degner Phone: 360-577-7222

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8260B, C	GC-MS	Chloroform
Aqueous/Solid	EPA 8260B, C	GC-MS	Chloromethane
Aqueous/Solid	EPA 8260B, C	GC-MS	cis-1,2-Dichloroethene
Aqueous/Solid	EPA 8260B, C	GC-MS	cis-1,3-Dichloropropene
Aqueous/Solid	EPA 8260B, C	GC-MS	Dibromomethane
Aqueous/Solid	EPA 8260B, C	GC-MS	Dichlorodifluoromethane
Aqueous/Solid	EPA 8260B, C	GC-MS	Dichloromethane (Methylene Chloride)
Aqueous/Solid	EPA 8260B, C	GC-MS	Di-isopropylether (DIPE)
Aqueous/Solid	EPA 8260B, C	GC-MS	DIPE
Aqueous/Solid	EPA 8260B, C	GC-MS	ETBE
Aqueous/Solid	EPA 8260B, C	GC-MS	Ethyl Benzene
Aqueous/Solid	EPA 8260B, C	GC-MS	Ethylbenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	Freon 11
Aqueous/Solid	EPA 8260B, C	GC-MS	Freon 113
Aqueous/Solid	EPA 8260B, C	GC-MS	Hexachlorobutadiene
Aqueous/Solid	EPA 8260B, C	GC-MS	Isopropylbenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	Methyl-tert-butylether (MTBE)
Aqueous/Solid	EPA 8260B, C	GC-MS	Naphthalene
Aqueous/Solid	EPA 8260B, C	GC-MS	n-Butylbenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	n-Propylbenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	sec-Butylbenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	Styrene
Aqueous/Solid	EPA 8260B, C	GC-MS	tert-amylmethylether (TAME)
Aqueous/Solid	EPA 8260B, C	GC-MS	tert-Butyl alcohol
Aqueous/Solid	EPA 8260B, C	GC-MS	tert-butylbenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	Tetrachloroethene
Aqueous/Solid	EPA 8260B, C	GC-MS	Toluene
Aqueous/Solid	EPA 8260B, C	GC-MS	trans-1,2-Dichloroethene
Aqueous/Solid	EPA 8260B, C	GC-MS	trans-1,3-Dichloropropene
Aqueous/Solid	EPA 8260B, C	GC-MS	Trichloroethene
Aqueous/Solid	EPA 8260B, C	GC-MS	Trichlorofluoromethane (Freon 11)
Aqueous/Solid	EPA 8260B, C	GC-MS	Vinyl acetate
Aqueous/Solid	EPA 8260B, C	GC-MS	Vinyl chloride
Aqueous/Solid	EPA 8260B, C	GC-MS	Xylene, total
Aqueous/Solid	EPA 8260B, C	GC-MS	1,1-Dichloroethene

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ALS Environmental-Kelso
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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8260B, C	GC-MS	1,1-Dichloropropene
Aqueous/Solid	EPA 8260B, C	GC-MS	1,2,3-Trichlorobenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	1,2,3-Trichloropropane
Aqueous/Solid	EPA 8260B, C	GC-MS	1,2,4-Trichlorobenzene
Aqueous/Solid	EPA 8260B, C	GC-MS	1,2,4-Trimethylbenzene
Aqueous/Solid	EPA 8270C, D	GC-MS	1,2,4-Trichlorobenzene
Aqueous/Solid	EPA 8270C, D	GC-MS	1,2-Dichlorobenzene
Aqueous/Solid	EPA 8270C, D	GC-MS	1,3-Dichlorobenzene
Aqueous/Solid	EPA 8270C, D	GC-MS	1,4-Dichlorobenzene
Aqueous/Solid	EPA 8270C, D	GC-MS	2,4,5-Trichlorophenol
Aqueous/Solid	EPA 8270C, D	GC-MS	2,4,6-Trichlorophenol
Aqueous/Solid	EPA 8270C, D	GC-MS	2,4-Dichlorophenol
Aqueous/Solid	EPA 8270C, D	GC-MS	2,4-Dimethylphenol
Aqueous/Solid	EPA 8270C, D	GC-MS	2,4-Dinitrophenol
Aqueous/Solid	EPA 8270C, D	GC-MS	2,4-Dinitrotoluene
Aqueous/Solid	EPA 8270C, D	GC-MS	2,6-Dinitrotoluene
Aqueous/Solid	EPA 8270C, D	GC-MS	2-Chloronaphthalene
Aqueous/Solid	EPA 8270C, D	GC-MS	2-Chlorophenol
Aqueous/Solid	EPA 8270C, D	GC-MS	2-Methyl-4,6-Dinitrophenol
Aqueous/Solid	EPA 8270C, D	GC-MS	2-Methylnaphthalene
Aqueous/Solid	EPA 8270C, D	GC-MS	2-Methylphenol
Aqueous/Solid	EPA 8270C, D	GC-MS	2-Nitroaniline
Aqueous/Solid	EPA 8270C, D	GC-MS	2-Nitrophenol
Aqueous/Solid	EPA 8270C, D	GC-MS	3,3-Dichlorobenzidine
Aqueous/Solid	EPA 8270C, D	GC-MS	3-Nitroaniline
Aqueous/Solid	EPA 8270C, D	GC-MS	4-Bromophenyl-phenylether
Aqueous/Solid	EPA 8270C, D	GC-MS	4-Chloro-3-methylphenol
Aqueous/Solid	EPA 8270C, D	GC-MS	4-Chloroaniline
Aqueous/Solid	EPA 8270C, D	GC-MS	4-Chlorophenyl-phenylether
Aqueous/Solid	EPA 8270C, D	GC-MS	4-Methylphenol (and/or 3-Methylphenol)
Aqueous/Solid	EPA 8270C, D	GC-MS	4-Nitroaniline
Aqueous/Solid	EPA 8270C, D	GC-MS	4-Nitrophenol
Aqueous/Solid	EPA 8270C, D	GC-MS	Acenaphthene
Aqueous/Solid	EPA 8270C, D	GC-MS	Acenaphthylene
Aqueous/Solid	EPA 8270C, D	GC-MS	Aniline

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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8270C, D	GC-MS	Anthracene
Aqueous/Solid	EPA 8270C, D	GC-MS	Benzidine
Aqueous/Solid	EPA 8270C, D	GC-MS	Benzo(a)anthracene
Aqueous/Solid	EPA 8270C, D	GC-MS	Benzo(a)pyrene
Aqueous/Solid	EPA 8270C, D	GC-MS	Benzo(b)fluoranthene
Aqueous/Solid	EPA 8270C, D	GC-MS	Benzo(g,h,i)perylene
Aqueous/Solid	EPA 8270C, D	GC-MS	Benzo(k)fluoranthene
Aqueous/Solid	EPA 8270C, D	GC-MS	Benzoic acid
Aqueous/Solid	EPA 8270C, D	GC-MS	Benzyl alcohol
Aqueous/Solid	EPA 8270C, D	GC-MS	bis(2-Chloroethoxy)methane
Aqueous/Solid	EPA 8270C, D	GC-MS	bis(2-Chloroethyl)ether
Aqueous/Solid	EPA 8270C, D	GC-MS	bis(2-Chloroisopropyl)ether
Aqueous/Solid	EPA 8270C, D	GC-MS	bis(2-ethylhexy)phthalate
Aqueous/Solid	EPA 8270C, D	GC-MS	Butyl benzyl phthalate
Aqueous/Solid	EPA 8270C, D	GC-MS	Carbazole
Aqueous/Solid	EPA 8270C, D	GC-MS	Chrysene
Aqueous/Solid	EPA 8270C, D	GC-MS	Dibenzo(a,h)anthracene
Aqueous/Solid	EPA 8270C, D	GC-MS	Dibenzofuran
Aqueous/Solid	EPA 8270C, D	GC-MS	Diethyl phthalate
Aqueous/Solid	EPA 8270C, D	GC-MS	Dimethylphthalate
Aqueous/Solid	EPA 8270C, D	GC-MS	di-n-butylphthalate
Aqueous/Solid	EPA 8270C, D	GC-MS	Di-n-octylphthalate
Aqueous/Solid	EPA 8270C, D	GC-MS	Fluoranthene
Aqueous/Solid	EPA 8270C, D	GC-MS	Fluorene
Aqueous/Solid	EPA 8270C, D	GC-MS	Hexachlorobenzene
Aqueous/Solid	EPA 8270C, D	GC-MS	Hexachlorobutadiene
Aqueous/Solid	EPA 8270C, D	GC-MS	Hexachlorocyclopentadiene
Aqueous/Solid	EPA 8270C, D	GC-MS	Hexachloroethane
Aqueous/Solid	EPA 8270C, D	GC-MS	Indeno(1,2,3, cd)pyrene
Aqueous/Solid	EPA 8270C, D	GC-MS	Isophorone
Aqueous/Solid	EPA 8270C, D	GC-MS	Naphthalene
Aqueous/Solid	EPA 8270C, D	GC-MS	Nitrobenzene
Aqueous/Solid	EPA 8270C, D	GC-MS	N-Nitrosodimethylamine
Aqueous/Solid	EPA 8270C, D	GC-MS	N-Nitroso-di-n-propylamine
Aqueous/Solid	EPA 8270C, D	GC-MS	N-Nitrosodiphenylamine

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ALS Environmental-Kelso
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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8270C, D	GC-MS	Pentachlorobenzene
Aqueous/Solid	EPA 8270C, D	GC-MS	Pentachlorophenol
Aqueous/Solid	EPA 8270C, D	GC-MS	Phenanthrene
Aqueous/Solid	EPA 8270C, D	GC-MS	Phenol
Aqueous/Solid	EPA 8270C, D	GC-MS	Pyrene
Aqueous/Solid	EPA 8270C, D	GC-MS	Pyridine
Aqueous/Solid	EPA 8270C, D	GC-MS	2,3,4,6-Tetrachlorophenol
Aqueous/Solid	EPA 8270C,D	GC-MS	1,2,4,5-Tetrachlorobenzene
Aqueous/Solid	EPA 8270D	GC-MS	1- Methylnaphthalene
Aqueous/Solid	EPA 8270 SIM	GC-MS	2-Methylnaphthalene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Acenaphthene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Acenaphthylene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Anthracene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Benzo(a)anthracene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Benzo(a)pyrene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Benzo(b)fluoranthene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Benzo(g,h,i)perylene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Benzo(k)fluoranthene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Chrysene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Dibenzo(a,h)anthracene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Fluoranthene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Fluorene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Indeno(1,2,3, cd)pyrene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Naphthalene
Aqueous/Solid	EPA 8270 SIM	GC-MS	p-Dioxane
Aqueous/Solid	EPA 8270 SIM	GC-MS	Phenanthrene
Aqueous/Solid	EPA 8270 SIM	GC-MS	Pyrene
Aqueous/Solid	EPA 9012B	Colorimetry	Total Cyanide
Aqueous/Solid	EPA 9030B	Distillation	Sulfide
Aqueous/Solid	EPA 9056A	IC	Bromide
Aqueous/Solid	EPA 9056A	IC	Chloride
Aqueous/Solid	EPA 9056A	IC	Fluoride
Aqueous/Solid	EPA 9056A	IC	Sulfate
Aqueous/Solid	NWTPH-Dx	GC-FID	Residual Range Organics
Aqueous/Solid	SOC-Butyl	GC-FPD	Di-n-butyltin

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

ALS Environmental-Kelso

1317 South 13th Avenue, Kelso, WA 98626

Contact Name: Carl Degner Phone: 360-577-7222

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	SOC-Butyl	GC-FPD	n-Butyltin
Aqueous/Solid	SOC-Butyl	GC-FPD	Tetra-n-butyltin
Aqueous/Solid	SOC-Butyl	GC-FPD	Tri-n-butyltin
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluorobutane sulfonate
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluorobutanoic acid
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluorodecane Sulfonate
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluorodecanoic acid
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluorododecanoic acid
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluoroheptanoic acid
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluorohexane sulfonate
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluorohexanoic acid
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluorononanoic acid
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluorooctane sulfonate
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluorooctanoic acid
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluoropentanoic acid
Aqueous/Solid	SOP-LCP-PFC	HPLC/MS/MS	Perfluoroundecanoic acid

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

ALS Environmental-Kelso

1317 South 13th Avenue, Kelso, WA 98626

Contact Name: Carl Degner Phone: 360-577-7222

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 1640	Reductive Metals Precipitation	Prep Method
Aqueous	EPA 3010A	Acid Digestion	Metals Digestion
Aqueous	EPA 3020A	Acid Digestion	Metals Digestion
Aqueous	EPA 3511	Microextraction	Extractable Prep
Aqueous	EPA 3520C	Continuous Liquid-Liquid Extraction	Extractable Prep
Aqueous	EPA 3535A	Solid Phase Extraction	Prep Method
Aqueous	EPA 5030B	Purge and Trap	Volatile Prep
Aqueous	SOP-MET-DIG	Acid Digestion	Metals Digestion
Solid	EPA 3050B	Acid Digestion	Metals Digestion
Solid	EPA 3060	Alkaline Digestion	Alkaline Digestion for Cr(VI) only
Solid	EPA 3541	Automated Soxhlet Extraction	Extractable Prep
Solid	EPA 3546	Microwave Extraction	Extractable Prep
Solid	EPA 3550B	Ultrasonic Extraction	Extractable Prep
Solid	EPA 5035A	Purge and Trap	Voc Organics
Solid	EPA 5050	Bomb Digestion	Prep Method
Solid	EPA 9013	Midi-Distillation	Cyanides
Solid	SOP-GEN-AVS	Acid Digestion	Simultaneously Extracted Metals
Aqueous/Solids	ASTM D3590-89	Digestion	TKN
Aqueous/Solids	EPA 1311	TCLP Extraction	Physical Extraction
Aqueous/Solids	EPA 3620C	Florisil Clean Up	Extractable Cleanup
Aqueous/Solids	EPA 3630C	Silica Gel Clean Up	Extractable Prep
Aqueous/Solids	EPA 3640A	Gel-Permeation Clean Up	Extractable Cleanup
Aqueous/Solids	EPA 3660	Sulfur Clean Up	Extractable Prep
Aqueous/Solids	EPA 3665A	Acid Clean Up	Extractable Cleanup

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

AGRICULTURE & PRIORITY POLLUTANTS LABORATORIES, INC. (APPL, INC.)
908 N. Temperance Ave.
Clovis, CA 93611
Contact: Diane Anderson Phone: 559-275-2175

ENVIRONMENTAL

Valid To: June 30, 2019 Certificate Number: 4064.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2009 TNI Environmental Testing Laboratory Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 5.1 of the DoD Quality Systems Manual for Environmental Laboratories) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

High Resolution Gas Chromatography/Mass Spectormetry, ICP-OES, ICP-Mass Spectrometry, Atomic Absorption Spectrometry, Gas Chromatography/ECD/FID, Liquid Chromatography- Mass Spectometry, High Performance Liquid Chromatography, Ion Chromatography, Titrimetry

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
PCB Congeners			
2,2',3,4,4',5,5'-Heptachlorobiphenyl (PCB 180)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,2',3,4,4',5'-Hexachlorobiphenyl (PCB 138)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,2',4,4',5,5'-Hexachlorobiphenyl (PCB 153)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,2',4,5,5'-Pentachlorobiphenyl (PCB 101)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,2',5,5'-Tetrachlorobiphenyl (PCB 52)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,3',4,4',5'-Pentachlorobiphenyl (PCB 123)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,4,4'-Trichlorobiphenyl (PCB 28)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,3'-Dichlorobiphenyl (PCB 6)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,2',3,3',4,4',5,6-Octachlorobiphenyl (PCB 195)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,2',3,5'-Tetrachlorobiphenyl (PCB 44)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,2',5-Trichlorobiphenyl (PCB 18)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,2',3,3',4,4'-Hexachlorobiphenyl (PCB 128)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,3',4,4'-Tetrachlorobiphenyl (PCB 66)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
Decachlorobiphenyl (PCB 209)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
3,4,4',5-Tetrachlorobiphenyl (PCB 81)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
1,2'-Dichlorobiphenyl (PCB 8)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,2',3,3',4,4',5-Heptachlorobiphenyl (PCB 170)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,2',3,4,5,5',6-Heptachlorobiphenyl (PCB 187)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (PCB 206)	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
PCB 129 + 138 + 163	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
PCB 153 + 168	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
PCB 156 + 157	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
PCB 180 + 193	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
PCB 20 + 28	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
PCB 90 + 101 + 113	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
PCBs, total	EPA 1668/1668A	EPA 1668/1668A	EPA 1668/1668A
Metals			
Aluminum	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Antimony	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
Arsenic	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Barium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Beryllium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Boron	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Cadmium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Calcium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Chromium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Cobalt	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Copper	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Iron	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Lead	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Magnesium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Manganese	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Mercury	EPA 245.1 EPA 7470A	EPA 7470A	EPA 7471A/7471B
Molybdenum	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Nickel	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Potassium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Selenium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Silver	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Sodium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Strontium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Thallium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Tin	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Titanium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Total Phosphorus	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
Vanadium	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Zinc	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B	EPA 6010B/6010C/6010D EPA 6020/6020A/6020B
Pesticides/Herbicides/PCBs/TPH/ Fumigants			
1,2,3-Trichloropropane	EPA 8011	----------	----------
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8011	----------	----------
1,2-Dibromomethane (EDB, Ethylene dibromide)	EPA 8011	----------	----------
DRO (Diesel Range Organics), C10-C28	EPA 8015B/8015C/8015D	EPA 8015B/8015C/8015D	EPA 8015B/8015C/8015D
RRO (Residual Range Organics), C25-C36	EPA 8015B/8015C/8015D	EPA 8015B/8015C/8015D	EPA 8015B/8015C/8015D
DRO (Diesel Range Organics), C10-C25	AK102	AK102	AK102
RRO (Residual Range Organics), C25-C36	AK103	AK103	AK103
MRH (Mid-range Hydrocarbons), C9-C18	KS-MRH/HRH	KS-MRH/HRH	KS-MRH/HRH
HRH (High-range Hydrocarbons), C19-C35	KS-MRH/HRH	KS-MRH/HRH	KS-MRH/HRH
GRO (Gasoline Range Organics), C6-C10	EPA 8015B/8015C/ 8015D	EPA 8015B/8015C/8015D	EPA 8015B/8015C/8015D
GRO (Gasoline Range Organics), C6-C10	AK101	AK101	AK101
GRO (Gasoline Range Organics), C6-C10	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
GRO (Gasoline Range Organics), C6-C10	AK101-MS	AK101-MS	AK101-MS
LRH (Low-Range Hydrocarbons), C5-C8	KS-LRH	KS-LRH	KS-LRH
Methane	RSK-175	RSK-175	----------
Ethane	RSK-175	RSK-175	----------
Ethene	RSK-175	RSK-175	----------
4,4'-DDD	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
4,4'-DDE	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
4,4'-DDT	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
a-BHC	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
a-Chlordane	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Aldrin	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
b-BHC	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Chlordane	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
d-BHC	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Dieldrin	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Endosulfan I	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Endosulfan II	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
Endosulfan sulfate	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Endrin	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Endrin aldehyde	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Endrin ketone	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
g-BHC (Lindane)	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
g-Chlordane	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Heptachlor	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Heptachlor epoxide	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Hexachlorobenzene	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Methoxychlor	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
Toxaphene	EPA 8081A/8081B	EPA 8081A/8081B	EPA 8081A/8081B
2,2',3,4,4',5,5'-Heptachlorobiphenyl (PCB 180)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,2',3,4,4',5'-Hexachlorobiphenyl (PCB 138)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,2',4,4',5,5'-Hexachlorobiphenyl (PCB 153)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,2',4,5,5'-Pentachlorobiphenyl (PCB 101)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,2',5,5'-Tetrachlorobiphenyl (PCB 52)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,3,4,4',5-Pentachlorobiphenyl (PCB 114)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,3',4,4',5'-Pentachlorobiphenyl (PCB 123)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
2,4,4'-Trichlorobiphenyl (PCB 28)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
3,4,4',5-Tetrachlorobiphenyl (PCB 81)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
Aroclor-1016/1242	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
Aroclor-1016 (PCB-1016)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
Aroclor-1221 (PCB-1221)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
Aroclor-1232 (PCB-1232)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
Aroclor-1242 (PCB-1242)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
Aroclor-1248 (PCB-1248)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
Aroclor-1254 (PCB-1254)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
Aroclor-1260 (PCB-1260)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
Aroclor-1262 (PCB-1262)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
Aroclor-1268 (PCB-1268)	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
PCB 129 + 138 + 163	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
PCB 153 + 168	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
PCB 156 + 157	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
PCB 180 + 193	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
PCB 20 + 28	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
PCB 90 + 101 + 113	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
PCBs, total	EPA 8082/8082A	EPA 8082/8082A	EPA 8082/8082A
Dalapon	EPA 8151/8151A	EPA 8151/8151A	EPA 8151/8151A
Dicamba	EPA 8151/8151A	EPA 8151/8151A	EPA 8151/8151A
Dichlorprop (2,4-DP)	EPA 8151/8151A	EPA 8151/8151A	EPA 8151/8151A
Dinoseb	EPA 8151/8151A	EPA 8151/8151A	EPA 8151/8151A
2,4-D	EPA 8151/8151A	EPA 8151/8151A	EPA 8151/8151A
2,4-DB	EPA 8151/8151A	EPA 8151/8151A	EPA 8151/8151A
MCPA	EPA 8151/8151A	EPA 8151/8151A	EPA 8151/8151A
MCPP	EPA 8151/8151A	EPA 8151/8151A	EPA 8151/8151A
Pentachlorophenol	EPA 8151/8151A	EPA 8151/8151A	EPA 8151/8151A
Silvex (2,4,5-TP)	EPA 8151/8151A	EPA 8151/8151A	EPA 8151/8151A
2,4,5-T	EPA 8151/8151A	EPA 8151/8151A	EPA 8151/8151A
Purgeable Organics (Volatiles-VOC)			
1,1,1,2-Tetrachloroethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,1,1-Trichloroethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,1,2,2-Tetrachloroethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,1,2-Trichloroethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,1,2-Trichlorotrifluoroethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,1-Dichloroethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,1-Dichloroethene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,1-Dichloropropene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,2,3-Trichlorobenzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,2,3-Trichloropropane	EPA 8260B/8260C EPA 8260B SIM/8260C SIM	EPA 8260B/8260C EPA 8260B SIM/8260C SIM	EPA 8260B/8260C EPA 8260B SIM/8260C SIM
1,2,4-Trichlorobenzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,2,4-Trimethylbenzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,2-Dibromo-3-chloropropane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,2-Dibromoethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,2-Dichlorobenzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,2-Dichloroethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,2-Dichloropropane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,3,5-Trimethylbenzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,3-Dichlorobenzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,3-Dichloropropane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
1,4-Dichlorobenzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
1,4-Dioxane	EPA 8260B/8260C/ EPA 8260B SIM/8260C SIM	EPA 8260B/8260C/ EPA 8260B SIM/8260C SIM	EPA 8260B/8260C/ EPA 8260B SIM/8260C SIM
2,2-Dichloropropane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
2-Butanone (Methyl ethyl ketone)	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
2-Chloroethyl vinyl ether	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
2-Chlorotoluene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
2-Hexanone	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
4-Chlorotoluene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
4-methyl-2-pentanone	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Acetone	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Acetonitrile	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Acrolein	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Acrylonitrile	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Benzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Bromobenzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Bromochloromethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Bromodichloromethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Bromoform	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Bromomethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Carbon disulfide	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Carbon tetrachloride	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Chlorobenzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Chloroethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Chloroform	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Chloromethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
cis-1,2-Dichloroethene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
cis-1,3-Dichloropropene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Cyclohexane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Dibromochloromethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Dibromomethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Dichlorodifluoromethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Ethyl benzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Ethyl tert-butyl ether (ETBE)	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Hexachlorobutadiene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Hexachloroethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Iodomethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Isopropyl ether (DIPE)	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Isopropylbenzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
m+p-Xylene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Methylacetate	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Methylcyclohexane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Methyl tert-butyl ether (MTBE)	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Methylene chloride (Dichloromethane)	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Naphthalene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
n-Butyl benzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
n-Propylbenzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
o-Xylene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
p-isopropyl toluene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
sec-Butyl benzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Styrene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
tert-Amyl methyl ether (TAME)	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
tert-Butyl alcohol (t-Butanol)	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
tert-Butyl benzene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
tert-Butyl ethyl ether (ETBE)	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Tetrachloroethene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Toluene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Total Xylenes	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
trans-1,2-Dichloroethene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
trans-1,3-Dichloropropene	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Trichloroethene	EPA 8260B/8260C EPA 8260B SIM/8260C SIM	EPA 8260B/8260C EPA 8260B SIM/8260C SIM	EPA 8260B/8260C EPA 8260B SIM/8260C SIM
Trichlorofluoromethane	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Vinyl acetate	EPA 8260B/8260C	EPA 8260B/8260C	EPA 8260B/8260C
Vinyl chloride	EPA 8260B/8260C EPA 8260B SIM/8260C SIM	EPA 8260B/8260C EPA 8260B SIM/8260C SIM	EPA 8260B/8260C EPA 8260B SIM/8260C SIM
Extractable Organics (semivolatiles-SVOC)			
1,1'-Biphenyl	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
1-Methylnaphthalene	EPA 8270C SIM/8270D SIM	EPA 8270C SIM/8270D SIM	EPA 8270C SIM/8270D SIM
1,2,4,5-Tetrachlorobenzene	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
1,2,4-Trichlorbenzene	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
1,2-Dichlorobenzene	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
1,3-Dichlorobenzene	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
1,4-Dichlorobenzene	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
1,4-Dioxane	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2-Methylnaphthalene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
2-(2-Methoxyethoxy)-ethanol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2,3,4,6-Tetrachlorophenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2,4,5-Trichlorophenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2,4,6-Trichlorophenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2,4-Dichlorophenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2,4-Dimethylphenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2,4-Dinitrophenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2,6-Dichlorophenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2-Chloronaphthalene	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2-Chlorophenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2-Methyl-4,6-Dinitrophenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2-Methylnaphthalene	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2-Methylphenol (o-Cresol)	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2-Nitroaniline	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
2-Nitrophenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
3, 4-Methylphenol (m+p-Cresol)	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
3,3'-Dichlorobenzidine	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
3-Nitroaniline	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
4-Bromophenyl phenyl ether	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
4-Chloro-3-methylphenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
4-Chloroaniline	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
4-Chlorophenyl phenylether	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
4-Methylphenol (p-Cresol)	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
4-Nitroaniline	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
4-Nitrophenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Acenaphthene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Acenaphthylene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Acetophenone	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Aniline	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Anthracene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Atrazine	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Benzaldehyde	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Benzidine	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Benzo(a)anthracene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Benzo(a)pyrene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Benzo(b)fluoranthene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Benzo(b+k)fluoranthene	EPA 8270C SIM/8270D SIM	EPA 8270C SIM/8270D SIM	EPA 8270C SIM/8270D SIM
Benzo(g,h,i)perylene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Benzo(k)fluoranthene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Benzoic acid	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Benzyl alcohol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Benzyl butyl phthalate	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Biphenyl	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
bis(2-Chloroethoxy) methane	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
bis(2-Chloroethyl) ether	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
bis(2-Chloroisopropyl) ether	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Butyl benzyl phthalate	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Caprolactam	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Carbazole	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Chrysene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Dibenz(a,h)anthracene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Dibenzofuran	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Diethyl phthalate	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Dimethyl phthalate	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
Di-n-butyl phthalate	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Di-n-octyl phthalate	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Fluoranthene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Fluorene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Hexachlorobenzene	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Hexachlorobutadiene	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Hexachlorocyclopentadiene	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Hexachloroehane	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Indeno(1,2,3-cd) pyrene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Isophorone	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Naphthalene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Nitrobenzene	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
N-nitrosodimethylamine	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
N-nitrosodi-n-propylamine	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
N-nitrosodiphenylamine	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Pentachlorophenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Phenanthrene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Phenol	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Pyrene	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM	EPA 8270C/8270D EPA 8270C SIM/8270D SIM
Pyridine	EPA 8270C/8270D	EPA 8270C/8270D	EPA 8270C/8270D
Dioxins/Furans			
1,2,3,4,6,7,8,9-OCDD	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
1,2,3,4,6,7,8,9-OCDF	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
1,2,3,4,6,7,8-Hpcdd	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
1,2,3,4,6,7,8-Hpcdf	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
1,2,3,4,7,8,9-Hpcdf	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
1,2,3,4,7,8-Hxcdd	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
1,2,3,4,7,8-Hxcdf	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
1,2,3,6,7,8-Hxcdd	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
1,2,3,6,7,8-Hxcdf	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
1,2,3,7,8,9-Hxcdd	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
1,2,3,7,8,9-Hxcdf	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
1,2,3,7,8-Pecdd	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
1,2,3,7,8-Pecdf	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
2,3,4,6,7,8-Hxcdf	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
2,3,4,7,8-Pecdf	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
2,3,7,8-TCDD	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
2,3,7,8-TCDF	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
Hpcdd, total	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
Hpcdf, total	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
Hxcdd, total	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
Hxcdf, total	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
PCDD + PCDF, total	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
PCDD, total	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
PCDF, total	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
Pecdd, total	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
Pecdf, total	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
TCDD, total	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
TCDF, total	EPA 8290/8290A	EPA 8290/8290A	EPA 8290/8290A
Energetics			
Nitroguanidine	EPA 8321A/8321B Mod.	EPA 8321A/8321B Mod.	EPA 8321A/8321B Mod.
Guanidine Nitrate	EPA 8321A/8321B Mod.	EPA 8321A/8321B Mod.	EPA 8321A/8321B Mod.
Perchlorate	EPA 6850	EPA 6850	EPA 6850
1,3,5-Trinitrobenzene	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
1,3-Dinitrobenzene	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
2,4,6-Trinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
2,4-Dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
2,6-Dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
2-Amino-4,6-dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
2-Nitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
3-Nitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
3,5 Dinitroaniline	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
4-Amino-2,6-dinitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
4-Nitrotoluene	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
Nitrobenzene	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
Nitroglycerin	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
Pentaerythritoltetranitrate (PETN)	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	EPA 8330A/8330B	EPA 8330A/8330B	EPA 8330A/8330B
Inorganics			
Ignitability	----------	----------	EPA 1030
pH / Corrosivity	EPA 9040C	EPA 9040C	EPA 9045C/D
Chromium VI	EPA 218.6/218.7	----------	----------
Chromium VI	EPA 7199	EPA 7199	EPA 7199
Chromium VI	EPA 7196A	EPA 7196A	EPA 7196A
Bromide	EPA 300.0	EPA 300.0	EPA 300.0
Chloride	EPA 300.0	EPA 300.0	EPA 300.0
Fluoride	EPA 300.0	EPA 300.0	EPA 300.0
Nitrate as N	EPA 300.0	EPA 300.0	EPA 300.0
Nitrite + Nitrate as N	EPA 300.0	EPA 300.0	EPA 300.0
Nitrite as N	EPA 300.0	EPA 300.0	EPA 300.0
Orthophosphate as P	EPA 300.0	EPA 300.0	EPA 300.0
Phosphate and Orthophosphate - as P	EPA 300.0	EPA 300.0	EPA 300.0
Sulfate	EPA 300.0	EPA 300.0	EPA 300.0
Bromide	EPA 9056/9056A	EPA 9056/9056A	EPA 9056/9056A

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
Chloride	EPA 9056/9056A	EPA 9056/9056A	EPA 9056/9056A
Fluoride	EPA 9056/9056A	EPA 9056/9056A	EPA 9056/9056A
Nitrate as N ($NO3^-$ as N)	EPA 9056/9056A	EPA 9056/9056A	EPA 9056/9056A
Nitrite + Nitrate as N	EPA 9056/9056A	EPA 9056/9056A	EPA 9056/9056A
Nitrite as N	EPA 9056/9056A	EPA 9056/9056A	EPA 9056/9056A
Sulfate	EPA 9056/9056A	EPA 9056/9056A	EPA 9056/9056A
Phosphate and Orthophosphate - as P	EPA 9056/9056A	EPA 9056/9056A	EPA 9056/9056A
Phosphate/Orthophosphate/Total Phosphorus	SM 4500 PE	SM 4500 PE	SM 4500 PE
Cyanide, total and Amenable	EPA 9010C EPA 9014 SM 4500CN B,C,E,G	EPA 9010C EPA 9014 SM 4500CN B,C,E,G	EPA 9010C EPA 9014 SM 4500CN B,C,E,G
Ammonia as N	EPA 350.1	EPA 350.1	EPA 350.1
Total Kheldahl Nitrogen	EPA 351.2	EPA 351.2	EPA 351.2
Nitrate as N	EPA 353.2	EPA 353.2	EPA 353.2
Nitriate + Nitrate as N	EPA 353.2	EPA 353.2	EPA 353.2
Nitrite as N	EPA 353.2	EPA 353.2	EPA 353.2
Nitrocellulose	EPA 353.2 Mod	EPA 353.2 Mod	EPA 353.2 Mod
Bicarbonate	SM 2320B	SM 2320B	SM 2320B
Carbonate	SM 2320B	SM 2320B	SM 2320B
Hydroxide	SM 2320B	SM 2320B	SM 2320B
Total Alkalinity (CaCO3)	SM 2320B	SM 2320B	SM 2320B
Specific conductance, Conductivity (25°C)	SM 2510B	SM 2510B	SM 2510B
Total Dissolved Solids (TDS)	EPA 160.1 SM 2540C	EPA 160.1 SM 2540C	EPA 160.1 SM 2540C
Non-Filterable Residue (TSS)	SM 2540D	SM 2540D	SM 2540D
Ferrous Iron	SM 3500-Fe Bc	SM 3500-Fe Bc	SM 3500-Fe Bc
Sulfide	SM 4500-S_2F	SM 4500-S_2F	SM 4500-S_2F
Total Organic Carbon (TOC)	----------	----------	WALKLEY-BLACK
Sample Preparation			
TCLP Extraction	----------	EPA 1311	EPA 1311
SPLP Extraction	----------	EPA 1312	EPA 1312
Acid digestion for metals analysis	EPA 3010A	EPA 3010A	----------
Microwave assisted acid digestion for metals analysis	EPA 3015A	EPA 3015A	----------
Acid digestion for metals analysis	----------	EPA 3050B	EPA 3050B
Microwave assisted acid digestion for metals analysis	----------	EPA 3051A	EPA 3051A
Alkaline digestion for hexavalent chromium	----------	EPA 3060A	EPA 3060A
Separatory funnel extraction	EPA 3510C	EPA 3510C	----------
Liquid-Liquid extraction	EPA 3520C	EPA 3520C	----------
Soxhlet extraction	----------	EPA 3540C	EPA 3540C
SPE extraction for explosives	EPA 3535A	EPA 3535A	----------
Ultrasonic extraction	----------	EPA 3550B Mod.	EPA 3550B Mod.
Silica gel cleanup	EPA 3630C	EPA 3630C	EPA 3630C

		Solid Hazardous Waste	
Parameter/Analyte	**Non-potable Water**	**Aqueous**	**Solid/Chemical**
Sulfur cleanup	EPA 3660B	EPA 3660B	EPA 3660B
Sulfuric acid - Permanganate cleanup	EPA 3665A Mod.	EPA 3665A Mod.	EPA 3665A Mod.
Purge and trap	EPA 5030B/5030C	EPA 5030B/5030C	EPA 5030B/5030C
Closed-system purge and trap extraction	EPA 5035/5035A	EPA 5035/5035A	EPA 5035/5035A
Mercury digestion	EPA 7470A	EPA 7470A	EPA 7471A/7471B
Incremental sampling	----------	EPA 8330B, Appendix A	EPA 8330B, Appendix A
Waste Extraction test (WET) (STLC)	----------	CCR Chapter 11, Article 5, Appendix II	CCR Chapter 11, Article 5, Appendix II

Parameter/Analyte	**Potable Water**
Metals	
Mercury	EPA 245.1
Inorganics	
Chromium VI	EPA 218.6/218.7
Bromide	EPA 300.0
Chloride	EPA 300.0
Fluoride	EPA 300.0
Nitrate as N	EPA 300.0
Nitrite + Nitrate as N	EPA 300.0
Nitrite as N	EPA 300.0
Orthophosphate as P	EPA 300.0
Phosphate	EPA 300.0
Sulfate	EPA 300.0
Phosphate/Orthophosphate/Total Phosphorus	SM 4500 PE
Cyanide, total and Amenable	SM 4500CN B,C,E,G
Ammonia as N	EPA 350.1
Total Kheldahl Nitrogen	EPA 351.2
Nitrate as N	EPA 353.2
Nitriate + Nitrate as N	EPA 353.2
Nitrite as N	EPA 353.2
Nitrocellulose	EPA 353.2 Mod.
Bicarbonate	SM 2320B
Carbonate	SM 2320B
Hydroxide	SM 2320B
Total Alkalinity (CaCO3)	SM 2320B
Specific conductance, Conductivity (25C)	SM 2510B
Total Dissolved Solids (TDS)	EPA 160.1
Ferrous Iron	SM 3500-Fe Bc
Sulfide	SM 4500-S_2F
Sample Preparation	
Mercury digestion	EPA 245.1

Accredited Laboratory

A2LA has accredited

AGRICULTURE & PRIORITY POLLUTANTS LABORATORIES, INC. (APPL, INC.)

Clovis, CA

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2009 TNI Environmental Testing Laboratory Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 5.1 of the DoD Quality System Manual for Environmental Laboratories (QSM), accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Presented this 9th day of August 2017.

Senior Director of Quality and Communications
For the Accreditation Council
Certificate Number 4064.01
Valid to June 30, 2019

*For the tests to which this accreditation applies, please refer to the laboratory's **Environmental Scope of Accreditation.***

Attachment C
Final Responses to Regulator Comments

Final Responses to EPA Comments on the Draft UXOs 2, 7, and 8 Remedial Investigation Master Sampling And Analysis Plan, Addendum 6 Dated May 2017

Atlantic Fleet Weapons Training Area – Vieques Former Vieques Naval Training Range Vieques, Puerto Rico

The following comments were prepared based on a review of the Draft UXOs 2, 7, and 8 Remedial Investigation, Master Sampling and Analysis Plan, Addendum 6, dated May 2017, for the Atlantic Fleet Weapons Training Area - Vieques, Former Vieques Naval Training Range, Vieques, Puerto Rico (hereinafter referred to as the SAP Addendum).

GENERAL COMMENTS

1. The SAP Addendum references Version 5.0 of the Department of Defense Quality Systems Manual (DoD QSM); however, a new version is available (Version 5.1, dated January 2017). Revise the SAP Addendum to clarify why the older version of the DoD QSM is referenced, or revise the SAP Addendum to reference the latest version of the DoD QSM.

Navy Response: SAP Worksheets #15, #24, and #28 have been updated to reflect DoD QSM v. 5.1. requirements.

2. It is unclear if the laboratory standard operating procedures (SOPs) have been provided for the analytical methods to be used in the SAP Addendum. Without these SOPs, the adequacy of the laboratory methods cannot be evaluated. Ensure that subsequent revisions of the SAP Addendum include and clearly reference each of the relevant laboratory-specific SOPs (i.e., those listed in Worksheet #23) as discussed in Section 3.2.1 of the Uniform Federal Policy for Quality Assurance Project Plans Manual, dated March 2005.

Navy Response: As has been done on all Vieques SAPs and SAP Addenda to date, laboratory-specific SOPs that are approved by the laboratory to share with the reviewing agency (i.e., EPA, PREQB, USFWS, and/or PRDNER) can be provided (via email) upon request but they will not be included in any version of the SAP or SAP Addenda because they contain proprietary and confidential information. There are two SOPs (picric acid via HPL8321 and perchlorate via HPL6850) that the laboratory has not approved to distribute, due to the heightened level of proprietary and confidential information they contain. Nonetheless, all of the laboratory's SOPs are adequate because the laboratory performing the analyses has received Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) accreditation, which includes a review of all analytical methods and associated SOPs.

3. It is noted that the East Vieques Terrestrial UXO Sites, Former Vieques Naval Training Range, Vieques, Puerto Rico was finalized in 2013; therefore, it is subject to be updated and resubmitted to EPA Region 2 for approval next year. QAPPs, whether Generic or Site Specific have a life of five years after which they need to be rewritten. EPA Region 2 prefers the use of the UFP QAPP Optimized Worksheets (Part 2A Revised) Located at: https://www.epa.gov/fedfac/assuring-quality-federal-cleanups. The Optimized Worksheets reduce the number of worksheets and provide more detailed and useful information to QAPPs.

Navy Response: As discussed at the August 2017 Technical Subcommittee Meeting, the Master SAP Addendum is the mechanism for revising any information in the Master SAP that warrants updating through time, such as changes to the conceptual site model. This mechanism is more efficient than updating the

Master SAP on an arbitrary time interval. However, as concurred upon at the meeting, each time a SAP addendum is prepared, the Master SAP will be reviewed and any information warranting updating will be included in the SAP addendum. To that end, it was concurred that for each Master SAP Addendum, the following will be added in the introductory text: "The East Vieques Master SAP was reviewed and updated information is provided in this SAP Addendum."

SPECIFIC COMMENTS

1. **SAP Worksheet #15-1:** Please confirm the follow RSLs; EPA's review identified the following values should be used:

Chemical	RSL Residential Soil Adjusted (ug/kg)	RSL Industrial Soil Adjusted (ug/kg)
2,4,6-Trinitrotoluene	2100	9600
Pentaerythritol tetranitrate	No change	57000
Aluminum	No change	110000
Chromium	12000	180000
Lead	No Value	800

Please be aware that EPA issued guidance in December 2016 that, among other things, identifies a range of target blood lead levels of 2 ug/dl - 8 ug/dl. Region 2 is currently developing a protocol for evaluating data for lead in soil that addresses the issues identified in this guidance. When that protocol is final, Region 2 will share this with the Navy.

Navy Response: It is assumed that in the above table the explosive RSLs are in µg/kg and the metal RSLs are in mg/kg. As such, the recommended values above should not be used for the following reasons:

- The 2,4,6-trinitrotoluene values provided in the table above are based on HQ=1; an HQ=0.1 is used for the Vieques cleanup program.
- The pentaerythritol tetranitrate (PETN) value used in the SAP is based on the non-carcinogenic value, which is a more-conservative approach than using the RSL provided in the table above.
- The aluminum value in the table above exceeds the theoretical maximum of 100 mg/kg, as defined in the Regional Screening Levels (RSLs) User's Guide (EPA, June 2017); therefore, the theoretical maximum is used as the screening level.
- The chromium values in the table above are for trivalent chromium rather than hexavalent chromium. Total chromium results will be used in conjunction with hexavalent chromium results to calculate trivalent chromium (assuming the data quality is sufficient to perform the calculation). The chromium information in Worksheet #15 has been updated to add trivalent chromium (calculated) and to better reflect which screening levels apply to which analytes.
- According to the EPA user guide on lead, 400 mg/kg is used for residential and 800 mg/kg is used for industrial.

EPA Follow-up Comment: Specific Comment 1, last bullet: EPA issued a directive in December 2016 that indicated that assessing lead in residential soils should take into account blood lead levels between 2 – 8 ug/dL. To comply with this directive, EPA Region 2 has developed a protocol to evaluate lead in residential soil that includes an initial screening against 200 mg/kg. Please revise the value in the table to reflect 200 mg/kg for residential soil. This directive is attached.

Navy Follow-up Response: While the Navy appreciates and is aware of the information provided in the comment, it is the Navy's understanding that the policy has not yet been formally promulgated. In addition, the 2016 OLEM Directive suggests that Regions can consider a range of values when managing sites, but

does not state that a BLL < 10 µg/dL must be used. Based on this, the protocol will be revised to indicate that the 10 µg/dL and 400 mg/kg will be retained as the official screening values, but will include evaluations of BLL<10 µg/dL and/or soil concentrations above 200 mg/kg in the uncertainty section of the HHRA.

NAVFAC headquarters policy does not provide for utilizing provisional values to make remedial action determinations for CERCLA sites. As stated in the 2016 Directive, the alternative values are based on "current scientific literature." As such, additional scientific information may determine different values are more appropriate, which may occur prior to the values in the 2016 Directive being promulgated.

However, as noted above, the Navy is willing to evaluate the alternative BLL and soil screening concentration in the uncertainty section of the HHRA, which will demonstrate lead evaluation done in accordance with the 2016 Directive recommendation. This evaluation will comprise:

- Screen the maximum lead concentration against 200 mg/kg
- If the maximum exceeds 200 mg/kg, consider if there is anything unique about source or distribution (e.g., hotspot, soil type differences, etc.)
- If the site-wide average exceeds 200 mg/kg, run the IEUBK using the site-wide average
- If the IEUBK exceeds 5 µg/dL, consider doing site-specific bioavailability evaluations or other site-specific evaluations

If/when the 2016 Directive's alternative values are formally adopted, then for sites where the current values were used to make remedial decisions involving lead, the historical evaluation can be used as a basis for determining whether the decisions warrant re-evaluation.

2. **SAP Addendum Worksheet #15, Reference Limits and Evaluation Table, Pages 7 to 8:** The Notes in Tables #15-1 and #15-2 state that shading represents instances where project action limits (PALs) are less than the laboratory limits of detection (LODs). However, the values that are shaded in these tables are the regional screening levels (RSLs) and/or the soil screening levels (SSLs). Footnote 2 states that specific identification of PALs by matrix is provided in Worksheet #11; however, this worksheet has not been included in the SAP Addendum. The Master Sampling and Analysis Plan – East Vieques Terrestrial UXO Sites, dated January 2013 (referred to as the Master SAP), states that the human health screening values for soil, sediment, and surface water are the current RSLs provided by EPA, and that ecological screening values (ESVs) for soil, sediment, and surface water are derived from multiple sources. Also, the Master SAP does not discuss SSLs in Worksheet #11. It is unclear from evaluating the SAP Addendum and the Master SAP if the PALs for this investigation are the RSLs, SSLs, or ESVs. It is also unclear if the PALs and laboratory limits for explosives in surface soil (SS) samples are the same for multi-incremental explosives samples (SMIs). Revise the SAP Addendum to clarify which values are to be used as the PALs, or incorporate a PAL column in these tables. If appropriate, revise the SAP Addendum to provide separate PALs and laboratory limits for SS explosives and SMI explosives samples. Also, revise the SAP Addendum to discuss the uncertainty in using the associated analytical results for cases where the PAL is less than the LOD.

   Navy Response: The genesis of this comment is unclear since the terminology, format, and context of PALs in this SAP addendum are the same that have been used for Vieques SAPs and addenda to date, all of which have been reviewed and approved by EPA. To clarify the use of the term PALs, the notes in Worksheet #15-1 and #15-2 tables have been revised to state, "Refer to Worksheet #11 in the Master SAP for specific identification of PALs by matrix. PALs in this context refer to the sets of screening levels shown on this table." The PALs for SS and SMI are the same. Please refer to Worksheet #37 in the Master SAP for data usability evaluation and requirements. Uncertainty associated with using analytical results for cases where the PAL is less than the LOD is discussed in the DQE report.

3. **SAP Addendum Worksheet #19, Field Sampling Requirements Table, Page 15:** This worksheet indicates that samples should be analyzed for pH as soon as possible. While it is understood that Method SW-846 9045D states that samples should be analyzed as soon as possible, a holding time for pH should be specified in the SAP Addendum (e.g., samples should be analyzed within one day of receipt by the laboratory). Revise the SAP Addendum to specify a holding time for pH analysis.

   Navy Response: Any specified holding time (e.g., 1 day) would be arbitrary. Traditional holding time for pH in soil is for immediate analysis which is not feasible due to transport time from the field to the analytical laboratory. "ASAP" is appropriate per the method. This has been the approach used in previous SAPs and addenda reviewed and approved by EPA.

4. **Worksheet #20:** Please clarify the total number of samples to the laboratory. It appears that the total for SMI samples should be 27 and for SS samples 25.

   Navy Response: After recounting the samples, SS was found to be correct at 28 and SMI was increased to 33. These numbers account for MS/MSD pairs and triplicates that are shown in pairings and not individually.

5. **SAP Addendum Worksheet #23, Analytical SOP References Table, Pages 19 to 20:** This worksheet indicates that laboratory SOP PRE3050B for acid digestion of sediments, sludges, and soils by EPA Method 3050B has been modified, but it is unclear how and why this SOP was altered. Also, the associated footnote ("4") is not defined. Revise the SAP Addendum to indicate how and why this SOP was modified.

   Navy Response: During development of the Master SAP, EPA requested that 10 g of incremental soil rather than the typical 1 g be digested. Footnote 4 has been added to say: "In accordance with EPA's request, APPL will digest 10 g of incremental soil for 6010/6020 rather than the typical 1 g. This is intended to provide a more-representative preparation."

6. **SAP Addendum Worksheet #23, Analytical SOP References Table, Pages 19 to 20:** This worksheet does not provide the procedure for determining the percent moisture for soil samples. Revise this worksheet to provide the procedure for determining percent moisture.

   Navy Response: Worksheet #23 has been updated to include the SOP for percent moisture determination.

7. **SAP Addendum Worksheets #28-4 and 28-5, Laboratory QC Samples Table, Pages 37 and 39:** The corrective action for failing post digestion spikes (PDS) is not consistent with the Master SAP. The Master SAP indicates that if the PDS exceeds the acceptance limits, associated samples should be analyzed by the method of standard additions. Revise the SAP Addendum to reconcile the corrective action for failing PDS results.

   Navy Response: Please see response to General Comment #1. The update to reflect DoD QSM v. 5.1 addresses the comment.

8. **Worksheet #30:** Please include the laboratory certification status in this worksheet.

   Navy Response: This information is presented in Footnote 2 of the Worksheet #23 table. The same footnote has been added to Worksheet #30.

Final Responses to PREQB Comments on the Draft UXOs 2, 7, and 8 Remedial Investigation Master Sampling And Analysis Plan, Addendum 6 Dated May 2017

Atlantic Fleet Weapons Training Area – Vieques Former Vieques Naval Training Range Vieques, Puerto Rico

The following document was reviewed and PREQB concurs with the information provided, with the exception of the following comments, as discussed below.

GENERAL COMMENTS

1. The Sampling and Analysis (SAP) Addendum (e.g., Worksheet #2 – Sampling and Analysis Plan Identifying Information) appropriately references the current Master Standard Operating Procedures, Protocols and Plans dated April 2010; however, observing that the 2017 revision of Master Standard Operating Procedures, Protocols and Plans is anticipated to be finalized in the near future, please note that PREQB prefers that the revised 2017 document supersede the April 2010 document upon it being finalized.

Navy Response: The Master Standard Operating Procedures, Protocols and Plans dated April 2010 will be updated to the most current version in the Final submittal of this SAP Addendum.

2. Please add three additional multi-incremental sampling (SMI) and deep surface samples at the following locations and analyze them for explosives, metals and wet chemistry parameters:

- Between VE-UXO2-1DU06 and VE-UXO2-1DU07 where multiple bombs were located north of PI-1;
- The area northwest of the road leading to Beach 12 where bombs were identified at several locations; and
- The area immediately east of VE-UXO2-1DU03 at the north-central portion of the Naval Gunfire Support Target Area on Turtle Beach where a high density of bombs and mortars are identified.

Navy Response: A collaborative effort among all agencies, using a ranking-based decision approach, was used to select the beaches and quantity of samples to be collected per beach, as outlined in Table 2 of the Master SAP. Locations of the sampling units were selected to represent the most conservative areas of the beach based on munitions type and quantity, drainage areas from ephemeral streams, etc. All of the agencies agreed that the sampling locations presented in the Master SAP represent the most conservative areas. No additional information has been collected since the Master SAP was approved and finalized that would suggest additional sample locations are warranted to meet the stated objective. This SAP Addendum was submitted primarily to provide the laboratory-specific worksheets.

PREQB Evaluation of Response: As agreed upon during discussions concerning UXO 2, 7, and 8 at the Technical Subcommittee meeting on August 3, 2017, PREQB continues to agree to defer the potential need for additional sample locations until the current scope is implemented, with a determination as to the need for adding or subtracting locations contingent upon regulatory review of that data. As a result, the sample locations requested in General Comment #2 of PREQB's July 2017 comments may be revisited at a later date.

Navy Follow-up Response: Comment noted.

3. The Master SAP references Department of Defense (DoD) Quality Systems Manual (QSM) v 5.0. Please update all worksheets to reflect DoD QSM v 5.1, dated January 2017.

Navy Response: SAP Worksheets #15, #24, and #28 have been updated to reflect DoD QSM v. 5.1 requirements.

PAGE-SPECIFIC COMMENTS

1. Figure ES-1: Please revise all deeper surface soil identifications from "SB" to "SO", as per SAP Worksheet 19.

Navy Response: Figure ES-1 has been edited as requested.

2. Worksheet #15-1, Reference Limits and Evaluation Table, Page 7:

a. Soil Screening Levels (SSLs) shown in Worksheet 15-1 as well as Worksheet 15-2 appear to be based upon a dilution attenuation factor (DAF) of 10 as the vast majority of the SSLs are 10x the values shown on the U.S. Environmental Protection Agency's generic Regional Soil Screening Summary Table. However, this does not appear to be appropriate since soil samples locations are nearshore (i.e., beaches) where groundwater is anticipated to be near the ground surface and minimal attenuation of constituents of interest leaching from soil will occur before entering groundwater. On this basis, PREQB requests that the SSLs shown on worksheets 15-1 and 15-2 be revised to reflect a DAF of 1.

Navy Response: No updates to the SSLs are warranted (other than to provide the most recent updated values) as the SSLs provided in Worksheet #15-1 and 15-2 have been accepted for this RI by the Technical Subcommittee (i.e., they are from the Final Master SAP). More importantly, the Navy feels that comparison of data from the beach environment to the SSLs is not relevant given that SSLs are based on drinking water standards, which is not appropriate for groundwater at beaches.

PREQB Evaluation of Response: PREQB agrees that comparison of data from the saltwater beach environment to SSLs as calculated based upon drinking water standards is not appropriate. A more appropriate comparison would be to base the SSLs presented in Worksheets 15-1 (explosives) and 15-2 (metals) upon National Recommended Ambient Water Quality Criterion established for consumption of organisms only or for protection of aquatic life for each analyte, whichever is lower. National Recommended Ambient Water Quality Criteria currently exist for two explosives (i.e., nitrobenzene and 2, 4-dinitroluene) and nearly all of the metals listed in Worksheet 15-2. On this basis and to provide a meaningful SSL for screening the data for the soil-groundwater-surface water pathway, please re-calculate the SSLs for the beaches using this approach. Also please use a dilution factor of 1 for reasons noted in the original comment.

Navy Follow-up Response: Given the nature of the beach environment and the significant dilution impact that would be imparted by the ocean, especially under constant wave action, comparison to leaching criteria would not provide meaningful results. Therefore, upon further consideration SSLs are not applicable and will be removed from the evaluation criteria.

b. The SSL for 2, 4, 6-Trinitrotoluene (TNT) and Pentaerythritol (PETN) appear to be incorrect. The SSL at a DAF of 1 for TNT and PETN are shown as 1.5 and 2.8 ug/kg, respectively. However, the May 2016 RSL table shows the SSL (DAF = 1) for TNT and PETN to be 5.7 and 5.8 ug/kg, respectively. Please clarify and revise as appropriate.

Navy Response: The footnotes on Worksheet #15-1 and #15-2 were edited to indicate RSLs consider HQ = 0.1 while SSLs consider HQ = 1.0 (where the SSL is based on the tapwater RSL) and DAF = 1. Further, all screening values have been updated to the most recent version of RSL table. Note: see Follow-up Response to comment 2a.

c. Please add that non-cancer Regional Screening Levels (RSLs) are adjusted to an HQ = 0.1 in footnote 2.

Navy Response: The second sentence of Footnote #2 has been edited to read: "Regional Screening Level (RSL) values are current as of June 2017 and are reflective of an HQ = 0.1."

3. Worksheet #15-2, Reference Limits and Evaluation Table, Page 8:

a. Lead has a Maximum Contaminant Level (MCL) based SSL of 14 mg/kg. Please revise the worksheet to include this SSL for lead.

Navy Response: The change has been made as requested and the PQL goal has been updated accordingly. Note: see Follow-up Response to comment 2a.

b. Please add that non-cancer RSLs are adjusted to an HQ = 0.1 in footnote 1.

Navy Response: The second sentence of Footnote #1 has been edited to read: "RSL values are current as of June 2017 and are reflective of an HQ = 0.1 for non-carcinogens."

4. Worksheet #18, Sampling Locations and Methods/SOP Requirement Table, Pages 13 and 14:

a. Samples from VE-UXO02-1DU03 appear to be in Playa Salinas del Sur Beach on Figure ES-1 and not Turtle Beach, as shown on this worksheet. Please clarify.

Navy Response: Sampling unit VE-UXO02-1DU03 is located in Turtle Beach. Note that sampling unit VE-UXO2-1DU02 is located in Playa Salinas del Sur Beach. Figure ES-1 has be revised to adjust the location of the label for sampling unit VE-UXO02-1DU03 for clarity.

b. Please clarify why deep surface soil samples are not included within the decision units VE-UXO07-1DU05 and VE-UXO08-1DU5 as deep surface soil samples are indicated in these decision units on Figures ES-2 and ES-5, respectively.

Navy Response: Worksheet #18 has been updated to include deep surface soil samples VE-UXO07-1SO05 and VE-UXO08-1SO05 for the aforementioned decision units.

PREQB Evaluation of Response: Although Worksheet #18 has been updated to include deep surface soil samples VE-UXO07-1SO05 and VE-UXO08-1SO05, it appears that these two locations are no longer depicted on Figures ES-2 and ES-5, respectively. Please add the deep surface soil sample locations to the figures.

Navy Response to Evaluation: The edits have been made as requested.

c. Please revise the deeper surface soil sample identifications for samples at VE-UXO07 from 1SO01 to 1SO03.

Navy Response: Worksheet #18 has been edited for the three rows listed as VE-UXO07-1SO01 in surface soil samples to VE-UXO07-1SO03 in deeper surface soil samples.

d. According to Figure ES-2, a deeper surface soil sample is being collected at VW-UXO07 at Beach 33. Please revise accordingly.

Navy Response: See response to Page-specific Comment 4b above.

e. According to Figure ES-5, a deeper surface soil sample is being collected at VW-UXO08 at Cayo Conejo. Please revise accordingly.

Navy Response: See response to Page-specific Comment 4b above.

f. Please revise the SMI soil sample identification for samples at VE-UXO08 from 1DU5 to 1DU05.

Navy Response: Edit has been made as requested.

5. SAP Worksheet #23, Analytical SOP References Table, Page 19: SOPs PRE3015A and PREMETALSIS are listed on this worksheet, but were listed as being used on SAP Worksheet #19. Please clarify and revise accordingly.

Navy Response: PREMETALSIS is used for preparation of incremental samples prior to digestion and was added to SMI samples for metals on Worksheet #19. SW-846 3015A and PRE3015A is an option for the laboratory and was added as a footnote #6 to Worksheet #19.

6. SAP Worksheet #28-0, Laboratory QC Samples Table, Page 29: The sample masses provided under Laboratory Preparation of a Multi-Incremental Sample are not consistent with SAP Worksheet #19 for metals, TOC, and pH. Please clarify and revise accordingly.

Navy Response: Worksheet #19 has been updated to match worksheet #28-0.

7. SAP Worksheet #28-7, Laboratory QC Samples Table, Page 43: Please revise the acceptance criteria for the laboratory replicate to measure RPD instead of %D.

Navy Response: The change has been made as requested.

8. Attachment A – DOD ELAP Letters: Please note that APPL, Inc. laboratory certification expires on June 30, 2017. An updated certification will likely be needed for this program.

Navy Response: A new DoD ELAP letter was issued to APPL, Inc. referencing DoD QSM v. 5.1. The letter has been added to Attachment A.

SUPPLEMENTAL COMMENTS

1. Worksheet #15-1, Reference Limits and Evaluation Table, Page 7: The Project Quantitation Limit (QL) Goal for Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) appears to be incorrectly listed as 195,000 µg/kg. The Project QL goal should be 5,000 µg/kg to reflect ½ of the Ecological Screening Value (ESV) for soil (10,000 µg/kg). Please update Worksheet #15-1 as appropriate.

Navy Response: The change was made as requested.

2. Worksheet #15-2, Reference Limits and Evaluation Table, Page 8:

a. The Project QL Goal for antimony appears to be incorrectly listed as 1.65 mg/kg. The Project QL Goal should be 1.55 mg/kg to reflect ½ of the Regional Screening Level (RSL) for soil (3.1 mg/kg).

Navy Response: The change was made as requested.

b. The Project QL Goal for manganese appears to be incorrectly listed as 110 mg/kg. The Project QL Goal should be 90 mg/kg to reflect ½ of the RSL for soil (180 mg/kg).

Navy Response: The change was made as requested.

Final Responses to PRDNER Comments on: Vieques NPL; UXOs 2, 7 and 8 Remedial Investigation Draft Master Sampling and Analysis Plan (SAP) Addendum 6; May 2017

Comments Made by PRDNER on July 13, 2017

PDF Pg. #	SAP Worksheet #	Document Text / Summary of Content [Section Heading (if Applicable) in Brackets]	PRDNER Comments	Navy Responses
20	2	[Sampling and Analysis Plan Identifying Information]: 8. The omitted SAP elements excluded and provide an explanation for their exclusion below: This addendum includes only those worksheets revised as a result of the procurement of an analytical laboratory. Worksheets from the Master SAP that were prepared for this project previously, but not included in this addendum, remain applicable and will be followed during the RI. Those worksheets are Worksheets #3, 4-14, 17, 21, 22, 27, 29, and 31-37. Please consult the Master SAP for the associated information.	Please clarify the status / applicability of SAP Worksheet #26 (Sample Handling System); there is no revised version of Worksheet #26 included in this addendum, but it is not listed as a worksheet that is not included but remains applicable per the Master SAP.	Worksheet #26 has been added to Worksheet #2 as one of the Worksheets not included.
67	Attachment A: DOD ELAP Letters	[SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005]: Agriculture & Priority Pollutants Laboratories, Inc. (APPL, INC.) ENVIRONMENTAL Valid To: June 30, 2017 Certificate Number: 4064.01	The accreditation included with the SAP addendum was valid to June 30, 2017. Please clarify whether A2LA or APPL, Inc., have provided an updated, valid accreditation, and if so, please provide that in a revised / updated draft of the addendum.	A new DoD ELAP letter was issued to APPL, Inc. referencing DoD QSM v. 5.1. The letter has been added to Attachment A.
81	Attachment A: DOD ELAP Letters	[Accredited Laboratory]: A2LA has accredited Agriculture & Priority Pollutants Laboratories, Inc. (APPL, INC.), Clovis, CA, for technical competence in the field of Environmental Testing… Certificate Number 4064.01 Valid to June 30, 2017	Please see previous comment.	Please see previous response.

Final Responses to USFWS Comments on the Draft UXOs 2, 7, and 8 Remedial Investigation Master Sampling And Analysis Plan, Addendum 6 Dated May 2017

Atlantic Fleet Weapons Training Area – Vieques Former Vieques Naval Training Range Vieques, Puerto Rico

Subsurface sampling should take into consideration the potential for the presence of sea turtle nests at the sampling locations. For this particular project, the Fish and Wildlife Service, Vieques NWR, will share available [information] on nest location in order assist the Navy in avoiding impacts to those nests. Please coordinate with Mike Barandiaran on this issue.

Navy Response: Coordination with Mike Barandiaran will be performed as requested during the investigation.