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AFTER ACTION REPORT FOR THE NON-TIME-CRITICAL REMOVAL ACTION PRODUCTION MANUFACTURING AREA AND SOUTH SHORE AREA

Former Mare Island Naval Shipyard,
Vallejo, California

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ABBREVIATIONS AND ACRONYMS

Battelle	Battelle Memorial Institute
DDESB	Department of Defense Explosives Safety Board
DGM	digital geophysical mapping
DMM	discarded military munitions
DON	Department of the Navy
EODMU 11 DET FALLON	Explosive Ordnance Disposal Mobile Unit 11 Detachment Fallon
GPO	geophysical prove-out
ISR-JV	Integrated Solutions for Remediation, JV
IVS	instrument verification strip
MDAS	material documented as safe
MEC	munitions and explosives of concern
MINS	Mare Island Naval Shipyard
MPPEH	material potentially presenting an explosive hazard
NAD	Naval Ammunition Depot
NOSSA	Naval Ordnance Safety and Security Activity
NTCRA	non-time-critical removal action
NWS	Naval Weapons Station
PIKA/PIRNIE	PIKA International, Inc./Malcolm Pirnie, Inc. Joint Venture
PMA	Production Manufacturing Area
QA	quality assurance
QC	quality control
SSA	South Shore Area
SSPORTS	Supervisor of Shipbuilding, Conversion and Repair, Portsmouth, Virginia Environmental Detachment, Vallejo, California
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
WESTON	Weston Solutions, Inc.

1. DESCRIPTION OF THE MUNITIONS RESPONSE SITE

This After Action Report describes the results of the Non-Time-Critical Removal Action (NTCRA) performed at the Production Manufacturing Area (PMA) and South Shore Area (SSA) at the former Mare Island Naval Shipyard (MINS). The former MINS is located in Solano County approximately 25 miles northeast of San Francisco in Vallejo, California (Figure 6-1). The PMA and SSA consist of 114 acres located on the south end of Mare Island (Figure 6-2).

The former MINS was established in 1854 and operated until it was closed in 1996 after 142 years of service. The primary mission of the former MINS was to build, maintain, and repair Navy ships and submarines. Originally, the entire southern portion of MINS was referred to as the ordnance facility. The ordnance facility included areas currently known as the Upland Magazine Area, the Western Magazine Area, Installation Restoration Site 05, as well as the PMA and SSA. The ordnance facility served a critical role as a munitions storage and production facility from 1857 to 1975. After closure of the ordnance facility in 1975, the area was used for miscellaneous non-munitions related activities, including container refurbishment, office space, and general shipyard storage.

The PMA begins at the base of the upland hills to the west and extends eastward to the Mare Island Strait (Figure 6-2). The shoreline was extended during the early 1900s using upland fill to provide additional space for the manufacturing and processing of ordnance material. The PMA was built on the upland fill material and currently contains numerous buildings, structures, and utilities. The SSA is bounded by the Carquinez Strait shoreline to the south and the upland hills to the north. It has a relatively flat topography. The growth of the SSA occurred in several stages between 1930 and 1947. Rock and soil taken from the upland hills area were used to expand the shoreline into the Carquinez Strait. Similar to the PMA, the SSA currently contains buildings, structures, utilities and has metallic debris both on, and below, the ground surface. The PMA and SSA are restricted areas not readily accessible to the public. The sites are secured by a combination of natural barriers and a gate on the only access road.

The purpose of the ordnance facility in the early years was to store and process the ammunition used aboard naval ships. Black powder munitions were emptied and refilled while ships were being repaired at MINS. Facilities for loading gun-cotton were built in the 1890s and the loading

of projectiles with ammonium picrate (Explosive D) into projectiles was implemented by the beginning of World War I.

The ordnance facility was redesignated as the Naval Ammunition Depot (NAD) in 1936 when ammunition manufacturing operations were initiated at the buildings located in the PMA. Many of the existing PMA production buildings were constructed during the period between 1936 and the beginning of World War II. Ordnance was received, maintained, refurbished, demilitarized, subjected to quality assurance testing, and loaded on and off ships at the PMA and SSA portions of the NAD. The SSA was used for the storage of general shipyard items as well as for the storage and handling of munitions.

Control of the NAD was transferred to Concord Naval Weapons Station (NWS) in 1957 and the NAD was renamed the Concord NWS Annex. Responsibilities for conventional ordnance production, storage, handling, and disposal operations continued until the Concord NWS Annex was closed in 1975 and control was transferred back to MINS. Portions of the NAD were utilized for general storage by MINS and by Concord NWS for the refurbishment of empty ammunition containers until the closure of MINS in 1996.

A wide variety of munition items have been detected and removed from portions of the PMA and SSA, including propellants, munitions items filled with high explosives, small arms ammunition, fuzes, primers and minor to medium caliber gun ammunition. The adjacent Upland Magazine Area was determined to have no further concern relating to the presence of unexploded ordnance (UXO) following the UXO Intrusive Investigation (Supervisor of Shipbuilding, Conversion and Repair, Portsmouth, Virginia Environmental Detachment Vallejo, California [SSPORTS], 1997). The presence of munition items in the natural undisturbed soil near the foothills of the Upland Magazine Area, including those areas comprising the former ordnance facility housing area (OTIE-TN&A, 2009), is considered unlikely in view of the site history and the nature of the hard and rocky upland soil. The remaining portions of the former ordnance facility, including the Western Magazine Area and Installation Restoration Site 05, were completed during separate investigations through the U.S. Department of the Navy (DON) Environmental Services Cooperative Agreement with the City of Vallejo (Weston Solutions, Inc. [WESTON], 2013).

The following munitions assessments and actions were completed prior to the 2012 to 2013 NTCRA at the PMA and SSA:

- ***Emergency Response Actions (1990-1995)***—Seven separate emergency munitions actions were completed by Mare Island based Explosive Ordnance Disposal Mobile Unit Nine between August 1990 and May 1995 at five locations in the PMA and SSA to mitigate the immediate hazard posed by the presence of buried munitions and explosives of concern (MEC) items discovered during facility maintenance activities (MINS, 1996). Encountered MEC items included two Mk 58 Marine Markers, a 4-inch/50 caliber Mk 6 Mod 6 armor-piercing projectile, two 4-inch Mk 16 Mod 6 common projectiles, two 6-inch projectiles, a Hotchkiss 1-pounder projectile, an 8-inch black powder loaded common projectile, and numerous 20-millimeter, 40-millimeter, and 3-inch/50 caliber anti-aircraft rounds.
- ***Ordnance Preliminary Assessment (1995)***—The Mare Island Ordnance Preliminary Assessment describes the history of ordnance activities at Mare Island and identifies seven sites as potential ordnance areas of concern (PRC Environmental Management, Inc., 1995). The report concluded that the PMA and SSA were areas of potential concern and recommended further investigation to assess whether buried munitions were present.
- ***Unexploded Ordnance Site Investigation (1995-1997)***—The UXO Site Investigation (SI) at the former MINS was performed to establish the magnitude and extent of ordnance contamination in areas suspected to contain ordnance based on experience and historical evidence (SSPORTS, 1997). The SI geophysical surveys were conducted using a Geometrics G-858 gradiometer system augmented by handheld Mk 26 magnetometers. The SSA geophysical survey covered 59 acres around storage magazines, operating buildings, and along roads, rail lines, and shoreline areas, and identified 1,093 magnetic anomalies representing possible buried ordnance material. The PMA geophysical survey completed within the former production facility covered 56 acres and identified 1,326 anomalies (SSPORTS, 1997).
- ***Unexploded Ordnance Intrusive Investigation of the South Shore Area (1997-1999)***—The intrusive investigation at the SSA was performed between August 1997 and May 1999. All of the 1,093 anomalies identified in the 59-acre SSA during the UXO SI were investigated to determine if they represented an explosives hazard. A total of 1,824 MEC

items, over 26,000 MDAS items, 156,753 rounds of small arms ammunition and 688,419 pounds of scrap metal were recovered (Roy F. Weston, Inc., 2003). None of the MEC items showed evidence of having been fired and all were classified as discarded military munitions (DMM).

- ***Unexploded Ordnance Intrusive Investigation of the Production Manufacturing Area (1998-2000)***—The PMA intrusive investigation was performed between February 1998 and June 2000. All of the 1,326 anomalies identified in the 56-acre PMA during the UXO SI were investigated. A total of 265 MEC items were recovered during the investigation, including 3-inch, 4-inch, 6-inch, and 8-inch projectiles dating to the late 19th century. A total of 2,352 material documented as safe (MDAS) items, including five 16-inch/45 caliber projectiles, numerous small arms cartridges, and 1,906,618 pounds of other non-hazardous scrap materials were also recovered (Roy F. Weston, Inc., 2002). None of the MEC items showed evidence of having been fired and all were classified as DMM.
- ***Geophysical Investigation of the Production Manufacturing Area and South Shore Area (2006)***—A digital geophysical mapping (DGM) survey of all accessible areas within both the PMA and SSA was completed in 2006 (WESTON, 2008). The DGM survey included the crawl space of Buildings A223 and A224 in the PMA and Building A163 in the SSA. The survey identified a total of 13,956 geophysical anomaly locations in the PMA and 14,329 geophysical anomaly locations in the SSA, as well as 543 geophysical anomaly locations beneath the three buildings. The anomalies were classified in areas as either Category A sectors (located within areas considered most likely to contain additional MEC) or Category B sectors (located in areas where the likelihood of additional MEC is low) based on previous MEC removal actions and an evaluation of historical records and photographs. This anomaly location classification allowed excavation of the anomaly locations to be prioritized, maximizing the use of available assets and funding.

The DON Base Realignment and Closure Program Management Office West completed a NTCRA at the PMA and SSA between May 2012 and July 2013. The NTCRA was performed as a combined effort by Battelle Memorial Institute (Battelle) and Integrated Solutions for Remediation, JV (ISR-JV). This After Action Report describes only those actions completed by

ISR-JV in accordance with the Final Sampling and Analysis Plan for the PMA and SSA (Battelle, 2012a), and Final Addendum 1 (ISR-JV, 2012). Actions completed by Battelle will be reported in a separate After Action Report.

The NTCRA included the following munitions actions:

- Establishment of an instrument verification strip (IVS) to validate DGM and handheld survey instruments and anomaly selection techniques
- The DGM survey of areas deemed inaccessible during the 2006 DGM survey (DGM data gap areas) to identify anomaly locations representing potential MEC items
- A "mag and flag" clearance of any remaining DGM data gap areas (where the use of DGM survey equipment was not practical) using handheld geophysical instruments
- Reacquisition and excavation of all (100 percent) of the DGM and "mag and flag" anomaly locations within Category A Sectors (those considered to have the highest probability of containing MEC based on historical data)
- Reacquisition and excavation of a minimum 20 percent of the DGM anomaly locations within the remaining Category B Sectors (those considered to have a lesser probability of containing MEC)
- Reacquisition and excavation of all the remaining unexcavated Category B Sector anomaly locations within 25 feet of anomaly locations with recovered MEC or MDAS items (step-outs)
- Soil sampling for munitions constituents
- Temporary storage and final disposition of recovered MEC and MDAS items, small arms ammunition, and inert scrap metal
- Associated quality control (QC) and quality assurance (QA) measures to ensure compliance with the data quality objectives specified in the Final Sampling and Analysis Plan (Battelle, 2012a) and Final Sampling and Analysis Plan Addendum 1 (ISR-JV, 2012)
- Preparation of this After Action Report

2. REQUEST TO CANCEL EZ/SITE APPROVAL ESTABLISHED BY EXPLOSIVE SAFETY SUBMISSION

Exclusion zones established during the PMA and SSA NTCRA are documented in the Explosives Safety Submission (Battelle, 2011), Explosives Safety Submission Amendment 1 Version 2 (Battelle, 2012b), Explosives Safety Submission Amendment 1 Correction 1 (Battelle, 2012c), and Explosives Safety Submission Amendment 2 (Battelle, 2013). The final exclusion zones established for munitions response work at the PMA and SSA and approved by the Department of Defense Explosives Safety Board (DDESB) (2013) may be cancelled.

Site approvals for the Mare Island munitions storage facility, Building A180 (Naval Ordnance Safety and Security Activity [NOSSA], 2013) and the munitions treatment facility, Ordnance Disposal Range No. 2 (Naval Ordnance Center, 1994) should also be maintained to support ongoing Mare Island MEC clearance activities.

3. SUMMARY OF MEC/MPPEH FOUND

A summary of MEC items recovered from the PMA and SSA during the 2012 to 2013 NTCRA is listed in Table 3-1. A summary of recovered MDAS items is listed in Table 3-2. None of the recovered MEC items had been fired; all were classified as DMM that had apparently been either inadvertently lost or intentionally discarded (ISR-JV, 2013).

Table 3-1
Summary of Recovered Munitions and Explosives of Concern Items
Production Manufacturing Area and South Shore Area

Item Description	Quantity			
	PMA	SSA	IA-K	Total
Mk 6 Depth Charge	0	0	1	1
20-millimeter projectile/round	12	31	16	59
40-millimeter projectile/round	1	2	4	7
1.1-inch projectile/round	3	3	4	10
4-inch armor-piercing projectile	1	0	0	1
4-inch common projectile	1	1	0	2
5-inch projectile	1	0	0	1
3-inch/50 caliber projectile	0	2	0	2
Gun primer	64	142	147	353
Projectile base fuze	10	25	16	51
1-pounder high explosive projectile	2	4	2	8
1-pounder armor-piercing high explosive projectile	0	1	0	1
1-pounder case	0	2	1	3
3-pounder projectile	1	0	0	1
6-pounder projectile	2	0	0	2
Pyrotechnics/components	0	13	6	19
Broderick fuze	0	0	1	1
Schenkl percussion fuze	1	12	128	141
Bormann time fuze	0	35	78	113
Water cap time fuze	0	30	47	77
Hotchkiss fuze	1	7	14	22
Point detonating fuze	4	16	0	20
Mk 26 fuze	0	1	0	1
Mk 27 fuze	0	1	0	1
Mk 50 mechanical time fuze	0	0	1	1
Fuze component	1	3	0	4
Powder train time fuze	0	1	0	1
Kropp Model 1895 powder train time fuze	0	1	0	1
Semple base fuze	5	6	24	35

Table 3-1 (Continued)
Summary of Recovered Munitions and Explosives of Concern Items
Production Manufacturing Area and South Shore Area

Item Description	Quantity			
	PMA	**SSA**	**IA-K**	**Total**
Projectile fuze	4	4	17	25
Base detonating fuze	0	2	0	2
Nose fuze	0	1	1	2
Detonator	0	1	0	1
Sea mine detonator	0	0	2	2
Sea mine fuze	0	2	2	4
Cannon friction igniter	0	8	2	10
Booster cup	1	1	0	2
Propellant (pounds)	1.6	22.5	0	24.1
Bulk high explosive (pounds)	0.25	0	0	0.25
Small arms ammunition	759	16,836	8,748	26,343
Total Munitions and Explosives of Concern Items (excludes pounds of propellant/bulk high explosives, and small arms ammunition)	**115**	**358**	**514**	**987**

Table 3-2
Summary of Recovered MDAS Items
Production Manufacturing Area and South Shore Area

Item Description	Quantity			
	PMA	SSA	IA-K	Total
20-millimeter round/components	42	4,541	113	4,696
1.1-inch cartridge case	7	220	8	235
37-millimeter cartridge case	0	1	0	1
40-millimeter round/components	11	117	5	133
57-millimeter cartridge case	1	0	0	1
75-millimeter cartridge case	0	1	0	1
3-inch cartridge case	1	6	0	7
3-inch projectile	0	1	0	1
4-inch cartridge case	1	0	0	1
4-inch projectile	1	0	0	1
105-millimeter cartridge case	1	1	0	2
5-inch cartridge case	0	1	0	1
5-inch projectile	0	1	0	1
6-inch cartridge case	0	1	0	1
1-pounder cartridge case	6	21	2	29
3-pounder cartridge case	3	4	0	7
6-pounder cartridge case	2	0	0	2
Gun primer	304	3,326	217	3,847
Powder train time fuze/component	0	1	1	2
Fuze well plug	13	19	0	32
Fuze adapter	0	1	0	1
Projectile base fuze	2	1	1	4
Bomb fuze well plug	0	1	0	1
Powder can/component	10	187	3	200
Projectile closure plug	1	165	0	166
Grenade fuze	2	0	0	2
Projectile base plate	4	28	0	32
Fuze/component	5	0	4	9
Schenkl percussion fuze	0	0	2	2
Water-cap time fuze	0	52	230	282
Bormann time fuze	0	0	7	7
Dye marker	0	2	1	3
Projectile nose cap	34	11	8	53
Projectile nose closure plug	1	4	0	5
Rotating band frag	3	0	0	3
Bomb lug	2	0	0	2

Table 3-2 (Continued)
Summary of Recovered Material Documented as Safe Items
Production Manufacturing Area and South Shore Area

Item Description	Quantity			
	PMA	SSA	IA-K	Total
Hotchkiss fuze	0	2	0	2
Bormann fuze	0	10	0	10
Fuze plug	6	6	13	25
Projectile fuze cover	18	46	0	64
Hand grenade fuze	0	1	0	1
Fuze igniter	0	1	0	1
Sea mine component	0	1	0	1
Sea mine detonator component	0	0	1	1
Pyrotechnic flare cases	1	25	12	38
Slap fin flare	0	1	0	1
Burster adapter	0	1	0	01
Cannon ball	0	1	2	3
Mk 19 Mod 1 cartridge case	0	1	0	1
Igniter	2	1	0	3
Fuze safety clip	1	0	0	1
LUU2-V candle component	0	1	1	2
Illuminating candle can	0	1	0	1
12-inch Mk VI propellant charge can	0	1	0	1
Grape shot	1	1	0	2
Smoke signal can	1	0	0	1
Incendiary bomblet nose weight	0	1	0	1
.30 caliber ammunition stripper clip	0	1	0	1
.50 caliber ammunition link	0	1	0	1
Ammunition transportation can	0	14	0	14
Expended small arms ammunition	216	3,878	71	4,165
Total Material Documented as Safe Items (excludes expended small arms ammunition)	**487**	**8,832**	**631**	**9,950**

MEC items, propellant, and bulk high explosives recovered by ISR-JV were temporarily stored in Building A180 pending onsite thermal treatment. The thermal treatment of all MEC items, propellant, and bulk high explosives was completed at Ordnance Disposal Range No. 2 located on Mare Island in two separate events; the first on October 5, 2012 and the second on July 25, 2013 (ISR-JV, 2013).

Live small arms ammunition item recovered by ISR-JV were temporarily stored in Building A180 pending transfer for offsite disposition. The items were packaged into two 55-gallon drums and transported on July 29, 2013 to Lewiston, Idaho for demilitarization. On August 14, 2013 the items were certified as destroyed by Timberline Environmental Services, Inc. (ISR-JV, 2013).

MDAS items and expended small arms ammunition recovered by ISR-JV were temporarily stored in Building A169 pending transfer for offsite disposition. MDAS items and expended small arms ammunition were packaged in seven 55-gallon steel drums and transported to Cold Springs, California for demilitarization. On August 14, 2013, the items were certified as destroyed by Timberline Environmental Services, Inc. (ISR-JV, 2013).

4. EFFECTIVENESS AND LIMITATIONS OF TECHNOLOGY

The following sections describe the excavation activities and technologies used during the PMA and SSA NTCRA. The discussion focuses on the relative effectiveness of the methods and limitations of the technologies used.

4.1 INSTRUMENT VERIFICATION

An IVS was used to monitor and verify geophysical instrument functionality each day through the use of a Geophysical System Verification process, combining the use of an IVS with blind seeding. Geophysical System Verification is an industry-accepted alternative to the traditional Geophysical Prove-Out (GPO) process, capitalizing on the known performance of the geophysical sensors and their predictable response to industry standard objects.

The IVS was established adjacent to the SSA in similar soil conditions. Industry standard objects ranging in size from ½-inch diameter by 3-inch to 8-inch diameter by 18-inch steel pipe were used as seeds in the IVS. The seeds were buried at a horizontal attitude at depths between seven and ten times their diameters. The larger seeds, 6-inch and 10-inch diameter seeds, were buried at 4 feet.

Handheld geophysical instruments (Schonstedt GA-52C Magnetic Locators and Vallon VMH3CS metal detectors) were used to facilitate the identification and removal of MEC and material potentially presenting an explosive hazard during the DGM anomaly excavation process. These handheld geophysical instruments were also used to conduct the “mag and flag” surveys to locate anomaly locations in DGM data gap areas not accessible with the EM61-MK2 system. The handheld instruments were tested and adjusted to detect all seed items in the IVS at the start of the project. The resulting standard instrument settings, based on the lowest settings required to detect all seed items, were used throughout the project. The targets were reacquired daily during operational tests performed before and after each use to verify the instrument readings were not significantly different.

A single coil Geonics EM61-MK2 system, arranged in either a litter-carry or a lowered cart configuration, was used to survey the majority of DGM data gap areas (handheld geophysical instruments were used in inaccessible areas). The EM61-MK2 system was also “proved-out” at

the IVS before and after each use to demonstrate it was capable of meeting the project data quality objectives.

4.2 DATA GAP SURVEYS

Because of accessibility issues or concerns regarding the disturbance of critical habitat, 3.28 acres in the PMA and SSA were not surveyed during the 2006 DGM surveys (WESTON, 2008). A total of 3.22 acres of the data gap areas were surveyed utilizing DGM, Geonics EM61-MK2 mated with a Trimble Real-Time Kinematic Global Positioning System. A total of 3,670 geophysical anomaly locations were identified in portions of Category A and Category B sectors not included in the 2006 DGM Survey of the PMA and SSA. A total of 3,608 DGM data gap anomaly locations were selected for excavation; 100 percent of the anomaly locations in Category A sectors and 20 percent of the anomaly locations in Category B sectors.

The remaining 0.16 acres of the data gap areas were located along the outer shoreline. These areas were surveyed with hand-held instruments, Schonstedt GA-52 Magnetic Locators and Vallon VMH3CS metal detectors, using a classical "mag and flag" process. A total of 518 anomaly locations were identified during the "mag and flag" surveys in Category A sectors along the nearshore. All "mag and flag" anomaly locations were excavated.

4.3 ANOMALY EXCAVATION

The PMA and SSA NTCRA was a dual effort completed by Battelle and ISR-JV. Because the DON chose two contractors to perform the NTCRA, each contractor was assigned areas of responsibility based on a 200-foot grid. A total of 11,844 anomaly locations were assigned to ISR-JV for excavation. At the completion of the NTCRA ISR-JV excavated 18,375 anomaly locations, including the 2006 DGM Survey GPO site, MEC/MDAS step-out anomaly locations, additional accessible nearshore anomaly locations, disposal pit locations, and data gaps anomaly locations. Figures 6-5, 6-6, and 6-7 show the anomaly locations excavated and type of item recovered by contractor in the PMA and SSA.

The anomaly excavation process began with the reacquisition and flagging of selected anomaly locations using a Real-Time Kinematic Global Positioning System receiver. Anomaly locations were excavated using hand tools, assisted by the use of a small excavator to remove overburden

where determined appropriate by the Senior UXO Supervisor and UXO Safety Officer. The final excavations and all excavated soil were verified to be clear of munitions items using handheld geophysical instruments prior to backfilling. Each anomaly location was cleared to a maximum radius of two feet and a maximum depth four feet; excavations were continued beyond four feet with DON concurrence only when MEC or MDAS items were suspected at a deeper depth. Screening for low-level radiological items was also completed at the surface and at each one foot depth increment as required by the work documents.

4.3.1 MEC/MDAS Step-Out Anomalies

When MEC/MDAS items were recovered from an anomaly location, all remaining unexcavated anomaly locations within a 25-foot radius were excavated as step-outs (Battelle, 2012a). Step-out excavations were performed as a repetitive process until all anomaly locations within a 25-foot radius of every anomaly location where MEC or MDAS was recovered were excavated. A total of 1,893 anomaly locations were excavated based on the 25-foot radius step-out requirement; 71 anomaly locations in the PMA and 1,822 anomaly locations in the SSA.

4.3.2 Disposal Pits

The DGM data gap survey characteristics and linear nature of the anomaly location in Grid AE010 in the SSA appeared to represent a potential utility corridor. Excavation in this area of the grid revealed a disposal pit for large caliber propellant containers. Based on the large amount of MPPEH items recovered from this area, the 2006 DGM Survey was reviewed for areas with similar data characteristics. Ten areas with similar DGM data characteristics (five in the PMA and five in the SSA) were identified.

Each of the ten areas identified as potential disposal pits was assigned an anomaly location and excavated. The five areas identified in the PMA were not disposal pits. Instead these locations contained pieces of reinforced concrete foundations, utilities, railroad tracks, and concrete vaults which exhibited a geophysical signature similar to those of a disposal pit. A disposal pit area was later encountered during excavation of a previously selected anomaly location in Grid AD028 of the PMA. The five areas identified in the SSA were all disposal pits, including two additional areas in Grid AE010, and one area each in Grids AE011, AF011, and AI015. The disposal pit

area in Grid AH010/11 was previously known. Disposal pit areas are shown on Figures 6-3 and 6-4 for the PMA and SSA, respectively.

4.3.3 Shoreline Tidal Area Anomalies

A visual survey was conducted along the nearshore of the PMA and SSA to identify potential visible anomalies along the shoreline at low tides. The SSA shoreline area was walked on February 5, 2013 at tides ranging from 0.016 feet mean lower low water (MLLW) to 0.114 feet MLLW. The PMA shoreline area was walked on February 6, 2013 at tides ranging from -0.40 feet MLLW to -0.017 feet MLLW. Locations where MEC and MDAS items were recovered during the visual survey of the PMA are shown on Figure 6-3. Munitions debris (gun ammunition primers, cartridge cases, and propellant charge cans), metal debris, and drums were observed during the visual survey along the SSA shoreline. These locations shown on Figure 6-4 were not addressed during the NTCRA (see Section 6.2).

Although the primary purpose of the survey was to identify and remove visible munitions items in the tidal area, the shoreline survey also assisted in documenting areas off the PMA and SSA shorelines within IA-K, which were accessible at MLLW tide levels. Based on the accessible shoreline and MLLW data, a total of 870 shoreline anomaly locations (334 in IA-K off the PMA shoreline and 536 in IA-K off the SSA shoreline) not planned for excavation in the AM were excavated.

4.3.4 Geophysical Prove-Out Site

During the 2006 DGM Survey, a GPO site supporting the survey effort was installed in an area of the SSA that was not cleared of existing anomalies. Although the GPO site was surveyed and data collected and processed, the selection of anomalies other than those representing seed items was not completed. As part of the NTCRA, ISR-JV identified 140 anomaly locations in this area in addition to the 32 GPO seed items. All 172 anomaly locations were excavated and encountered items were removed and processed in the same manner as performed at the remainder of the PMA and SSA.

4.3.5 Large Shoreline Items

While excavating shoreline tidal area anomaly locations on August 2, 2012, UXO Technicians identified a Mk 6 depth charge in IA-K grid AB009. Although able to confirm the item had no hydrostatic fuze or booster, they were not able to determine the presence or absence of an explosive filler. Because the published filler for the item encountered (300 pounds of trinitrotoluene) exceeded the Explosive Safety Submission primary and contingency munitions with the greatest fragmentation distance, SSA work was halted pending preparation and approval of an Explosive Safety Submission amendment to expand the shoreline exclusion zone. The depth charge was subsequently removed and transported to Fallon Naval Air Station, Nevada for disposal by Explosive Ordnance Disposal Mobile Unit 11 Detachment Fallon (EODMU 11 DET FALLON) personnel. Based on the reported size of the detonation that occurred during disposal on August 13, 2012, EODMU 11 DET FALLON concluded that the item was fully loaded. The recovered depth charge was discovered partially buried in silt near the bottom edge of shoreline riprap.

UXO Technicians observed another suspect shoreline item at low tide on August 29, 2012 in PMA grid AH022. Based on the item's size, spherical shape, and the presence of what appeared to be the remnants of "horns", the item was tentatively identified as a Mk 3 Army sea mine dating to the World War II era. Because fusing could not be confirmed, the item was not considered safe to move. Further inspections, including measurement and x-ray analysis, by EODMU 11 DET FALLON personnel on November 13 and 14, 2012 determined that the item was not a munitions item. The item was removed in early February 2013 and was subsequently identified to be a large crane hook weight. The item was broken apart and sent to a local recycler.

4.4 MUNITIONS CONSTITUENT SAMPLING

Soil samples were collected from six representative locations in the SSA where MEC, MDAS, and/or small arms ammunition were recovered. Soil samples were analyzed for metals by U.S. Environmental Protection Agency Method 6010B/7471A and explosives by U.S Environmental Protection Agency Method 8330. All detected metals constituents were reported below background levels for Mare Island. There were no detections reported for explosives constituents. Soil sample analysis was performed by Curtis and Tompkins, Ltd, which

is certified by the Department of Defense Environmental Laboratory Accreditation Program to perform the analysis.

5. SUMMARY OF QUALITY CONTROL AND QUALITY ASSURANCE REPORTS

This section describes the QC and QA measures that ensured compliance with data quality objectives for the geophysical survey and anomaly excavation activities. Additional details of the project QC and QA activities are provided in the NTCRA Completion Report (ISR-JV, 2013).

5.1 CONTRACTOR QUALITY CONTROL

Daily reports were prepared to document each day's activities. The Project QC Manager consulted with the Project Geophysicist and the UXO QC Specialist (UXOQCS) on all QC issues relating to the NTCRA. Any necessary corrective actions were noted in the daily reports. A checklist for munitions operations was prepared daily by the UXOQCS to document the daily inspections.

5.1.1 DGM Data Gap Surveys

QC processes relating to DGM survey equipment included function tests, repeat line tests, positional accuracy tests, and bi-directional navigation tests. The QC processes for the handheld geophysical instruments (Schonstedt and Vallon) included the daily reacquisition of targets at the IVS to verify the ability of the instruments to detect targets. No QC failures were noted during the data gap surveys.

The UXOQCS planted blind QC seed items in the 3.38 acre DGM data gap areas at a density of one seed per 10,000 square feet. A total of 25 QC seeds were buried: 20 in areas surveyed using the EM61-MK2 and five in the "mag and flag" survey areas. All 25 (100 percent) of the QC seeds were detected and each anomaly location was excavated.

5.1.2 Anomaly Excavation

QC functions performed by the UXOQCS during the anomaly excavation process included:

- Daily DGM anomaly reacquisition accuracy checks.
- Daily handheld geophysical instrument accuracy checks.
- Instrument-aided QC verification surveys at a minimum 10 percent of anomaly excavation locations which included surveys of excavated soil to verify metallic objects

were removed (or evaluated and determined not to represent a munitions hazard) prior to backfilling. A total of 2,546 anomaly locations were QC verified of the 18,375 anomaly locations excavated.

- Placement and tracking of blind seeds in the DGM data gap areas to verify the DGM survey, "mag and flag" survey, and excavation processes. All blind seeds were recovered from the "mag and flag" area surveyed.

5.1.3 Non-Compliance Notices

Construction contract non-compliance notices were initiated by ISR-JV for two deficiencies during performance of the NTCRA. Both deficiencies were noted in process and corrected by ISR-JV.

As previously discussed in Section 4.2, areas of the PMA and SSA not included in the 2006 DGM survey were geophysically surveyed during the NTCRA. During project review of the combined ISR-JV and Battelle excavation results, an area in SSA grids AI014 and AI015 was identified that had not been adequately delineated during the initial data gap surveys. A non-compliance notice was initiated on July 8, 2013 by ISR-JV and the area was resurveyed utilizing DGM techniques; Geonics EM61-MK2 mated with a Trimble Real-Time Kinematic Global Positioning System. There were no additional remaining data gap areas identified.

As part of the step-out excavation process, all anomaly locations within a 25-foot radius of a recovered MEC/MDAS location were to be selected for excavation (Battelle, 2012a). Because the database included only the selected anomaly locations for excavation from the DGM data gap areas (100 percent in Category A sectors and 20 percent in Category B sectors), 80 percent of the Category B sector anomaly locations from the data gap areas were not included in the initial 25-foot radius step-out assessment. A non-compliance notice was initiated on July 8, 2013 by ISR-JV and an additional 24 Category B anomaly locations within a 25-foot radius of a recovered MEC/MDAS location were selected for excavation. The anomaly locations selected for excavation included 21 locations in DGM data gap areas of the PMA and 3 locations in DGM data gap areas of the SSA. All data relating to the selection of anomaly locations in the 25-foot radius step-out areas were reassessed and no remaining issues were noted.

5.2 DON QUALITY ASSURANCE

A QA site audit was performed by the NOSSA, and oversight of field operations was provided by the independent DON QA contractor, PIKA International, Inc./Malcolm Pirnie, Inc. Joint Venture (PIKA/PIRNIE).

5.2.1 Independent Oversight of Anomaly Excavation Activities

PIKA/PIRNIE was contracted by the DON to provide independent oversight of anomaly excavation field activities. PIKA/PIRNIE representatives conducted frequent site visits to observe all aspects of the PMA and SSA NTCRA process and provided regular reports to the DON Project Manager. There were no discrepancies noted by PIKA/PIRNIE during their inspections.

5.2.2 DGM Data Gap Survey Quality Assurance Assessments

A PIKA/PIRNIE representative supported the DGM and "mag and flag" data gap survey efforts by planting blind QA seed items in the DGM data gap areas. All (100 percent) of the six QA seeds were detected and selected for excavation; five in the DGM survey areas and one in the "mag and flag" survey areas.

5.2.3 NOSSA Audit

A QA audit of the PMA and SSA NTCRA project was completed by a NOSSA representative on July 25, 2012. The audit included an overall evaluation of the anomaly excavation process, including a review of all project plans, documentation, and training records, and the observation of site field operations and DGM surveys. The NOSSA audit report (NOSSA, 2012) rated ISR-JV's compliance with explosives safety and environmental criteria as "Satisfactory", and listed several minor findings. None of the audit findings were related to safety issues.

6. MAPS

6.1 AREAS FROM WHICH MEC AND/OR MPPEH WAS REMOVED

Figures 6-1 and 6-2 show the locations of Mare Island and the PMA and SSA. Figures 6-3 and 6-4 show the locations of items recovered during the visual survey, locations of disposal pits, and locations of unresolved areas for the PMA and SSA, respectively. Figures 6-5, 6-6, and 6-7 show the excavation results for both Battelle and ISR-JV.

6.2 AREAS WITHIN RESPONSE AREA WHERE RESPONSE ACTIONS WERE NOT PERFORMED AND THE RATIONALE FOR NOT ADDRESSING THOSE AREAS

Response actions were not completed to the specifications of the WP at several areas within the PMA and SSA. Any further action within these areas will be completed at a later date:

- Grids AG023, AG024, and AH023—Numerous anomaly locations were excavated in PMA Grids AG023, AG024, and AH023 (Figure 6-5). Because the Former Pier 3 structure was apparently demolished in place in this area, the large volume of concrete debris prevented several locations from being cleared of geophysical anomalies. These anomaly locations not cleared of potential munition items during the NTCRA were documented as "Hole not Cleared". These areas have been deemed inaccessible as discussed with the BCT during the 30 May 2013 and 25 July 2013 meetings. Therefore, further removal action is not warranted.
- Grid AB009—A single loaded Mk 6 depth charge was recovered from SSA Grid AB009 at the edge of the shoreline in the riprap (Figure 6-7). Additional munitions items may exist in the riprap, but further investigation in the riprap was deferred pending determination of a safe method to remove the rock overburden.
- Grid AF008—All accessible dye cans and primers/fuzes located at the "Oven/Primer Burn Pit" area in SSA Grid AF008 (Figure 6-4) were removed during the NTCRA. However, the effective recovery of items in this area was limited by tidal action that caused frequent flooding of the excavation and by the dynamic nature of the tidal area sediments.
- Grid AF011—Numerous MDAS items (12-inch powder cans) were recovered from the disposal pit encountered in SSA Grid AF011 (Figure 6-4) while excavating Category B

sector step-out anomaly locations within the Battelle grid. Excavation of the disposal pit was not completed because of project funding constraints. This disposal pit will be addressed in another project (Figure 6-4).

- Grids AH010/AH011—A long-reach excavator was used to recover munitions and other items located between the SSA shoreline and the lower-low tide line in Grids AH010-AH011 Disposal Pit (Figure 6-4). Similar to Grid AF008, the effective recovery of items in this area was limited by tidal action that caused frequent flooding of the excavation and by the dynamic nature of the tidal area sediments.
- Nearshore Anomaly Locations with Water Infiltration—Excavation of anomaly locations along the shoreline were performed at low-low tides to maximize the quantity of locations accessible. Although every effort was made to reach selected near shore anomaly locations, many locations would immediately fill with water when attempting to perform the excavation. These anomaly locations not cleared of potential munition items during the NTCRA were documented as "Hole not Cleared". These areas have been deemed inaccessible as discussed with the BCT during the 30 May 2013 and 25 July 2013 meetings. Therefore, further removal action is not warranted.
- Inaccessible Anomaly Locations—A total of five selected nearshore anomalies in the PMA and 29 selected nearshore anomalies in the SSA were inaccessible at low-low tides because the locations were always underwater or immediately filled with water during excavation attempts at low-low tides. These unexcavated anomaly locations, documented as "Inaccessible", are shown on Figures 6-5, 6-6, and 6-7. No further action in these areas is warranted.
- Southwest SSA Shoreline Surface Contamination—Munitions debris (gun ammunition primers, cartridge cases, and propellant charge cans), metal debris, and drums were observed at several locations during the February 2013 visual shoreline survey of the accessible portions of the SSA shoreline. Removal of these additional items (Figure 6-4) will be addressed in another project.

6.3 KNOWN OR REASONABLY ANTICIPATED END USE OF EACH AREA

Figure 6-8 shows the planned reuses for the PMA and SSA site (City of Vallejo, 2008).

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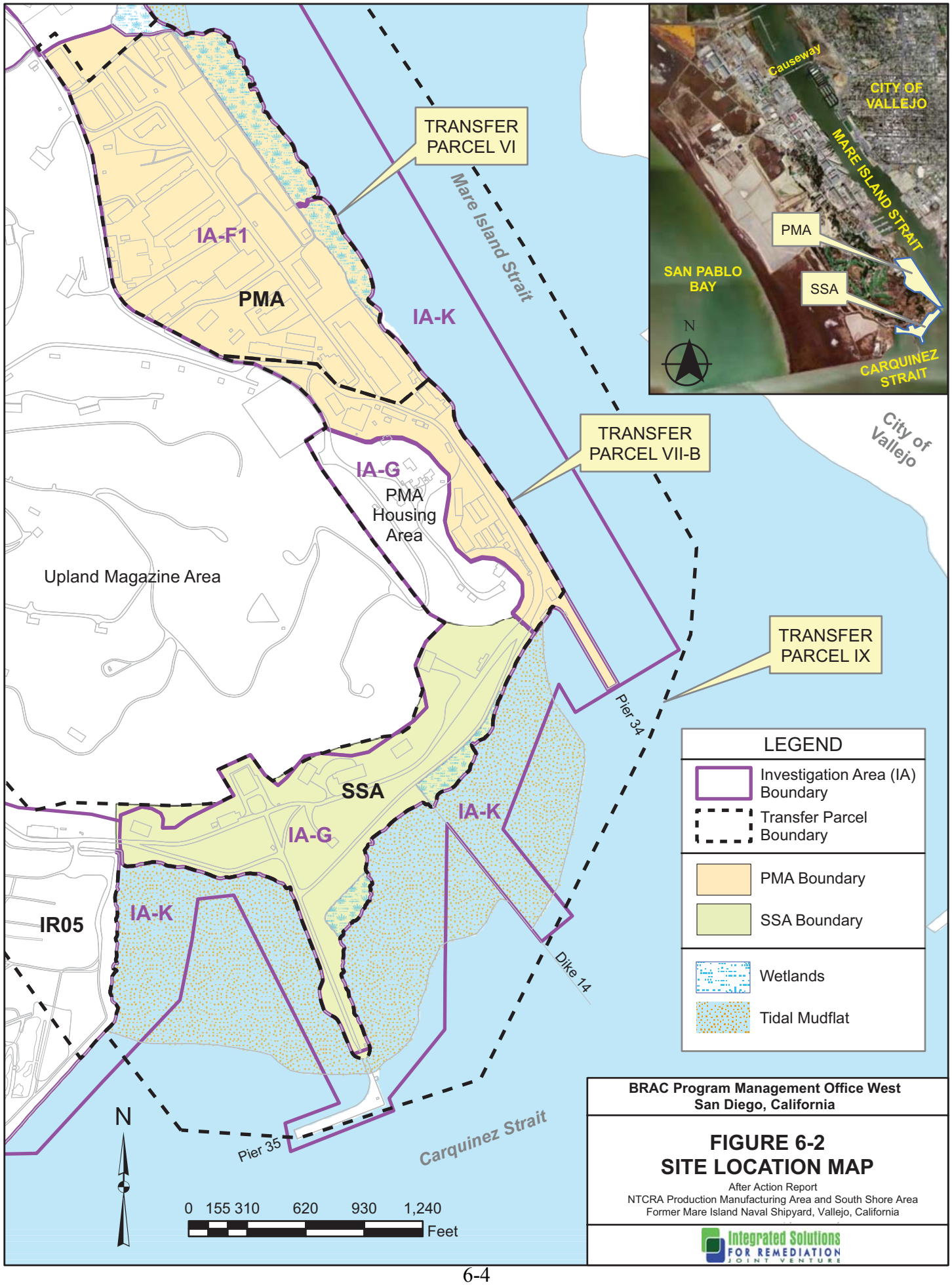
FIGURE 6-1
MARE ISLAND LOCATION MAP

After Action Report
NTCRA Production Manufacturing Area and South Shore Area
Former Mare Island Naval Shipyard, Vallejo, California

Integrated Solutions FOR REMEDIATION JOINT VENTURE


TRANSFER PARCEL VI
Mare Island Strait
IA-F1
PMA
IA-K
IA-G
PMA Housing Area
TRANSFER PARCEL VII-B
Upland Magazine Area
TRANSFER PARCEL IX
Pier 34
SSA
IA-G
IA-K
IA-K
IR05
Dike 14
Pier 35
Carquinez Strait
City of Vallejo
Causeway
CITY OF VALLEJO
MARE ISLAND STRAIT
PMA
SSA
SAN PABLO BAY
CARQUINEZ STRAIT
N
LEGEND
Investigation Area (IA) Boundary
Transfer Parcel Boundary
PMA Boundary
SSA Boundary
Wetlands
Tidal Mudflat
N
0 155 310 620 930 1,240
Feet
BRAC Program Management Office West
San Diego, California
FIGURE 6-2
SITE LOCATION MAP
After Action Report
NTCRA Production Manufacturing Area and South Shore Area
Former Mare Island Naval Shipyard, Vallejo, California
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San Diego, California

FIGURE 6-3
PMA DISPOSAL PITS AND VISUAL ANOMALY LOCATIONS

After Action Report
NTCRA Production Manufacturing Area and South Shore Area
Former Mare Island Naval Shipyard, Vallejo, California

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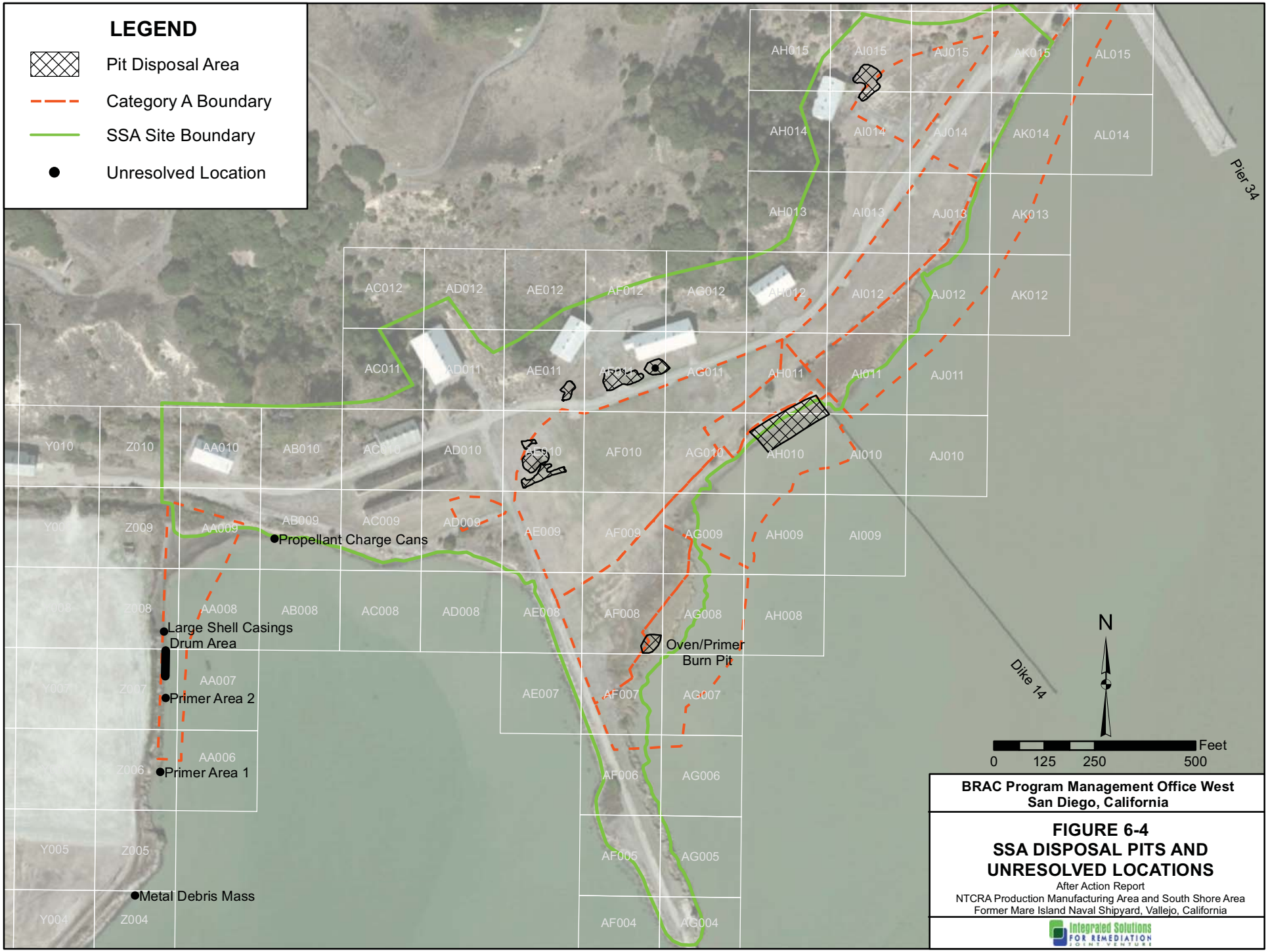
LEGEND
Pit Disposal Area
Category A Boundary
SSA Site Boundary
Unresolved Location
Propellant Charge Cans
Large Shell Casings
Drum Area
Primer Area 2
Primer Area 1
Metal Debris Mass
Oven/Primer
Burn Pit
Pier 34
Dike 14
N
Feet
0
125
250
500
BRAC Program Management Office West
San Diego, California
FIGURE 6-4
SSA DISPOSAL PITS AND
UNRESOLVED LOCATIONS
After Action Report
NTCRA Production Manufacturing Area and South Shore Area
Former Mare Island Naval Shipyard, Vallejo, California
Integrated Solutions
FOR REMEDIATION
JOINT VENTURE

Legend

- PMA/SSA Boundary
- Coastal Salt Marsh
- Grid
- Cat A Boundary
- non-picked Cat B anomalies

WESTON

- MEC (DMM)
- MDAS
- Live Small Arms
- Expended Small Arms
- Inaccessible
- Debris
- Blind QC Seed
- Blind QA Seed
- GPO Seed
- MK6 Depth Charge

Battelle

- MEC (DMM)
- MDAS
- MDEH
- Live Small Arms
- Expended Small Arms
- Debris
- No Contact
- Mag and Dig Area (Battelle)

N

0 75 150 225
Feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping,

BRAC Program Management Office West
San Diego, California

FIGURE 6-5
PRODUCTION MANUFACTURING AREA (NORTH)
EXCAVATION RESULTS

After Action Report
NTCRA Production Manufacturing Area and South Shore Area
Former Mare Island Naval Shipyard, Vallejo, California

Created by: curtisf
Created on: 3/7/2014

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Legend

- PMA/SSA Boundary
- Coastal Salt Marsh
- Grid
- Cat A Boundary
- non-picked Cat B anomalies

WESTON

- MEC (DMM)
- MDAS
- Live Small Arms
- Expended Small Arms
- Inaccessible
- Debris
- Blind QC Seed
- Blind QA Seed
- GPO Seed
- MK6 Depth Charge

Battelle

- MEC (DMM)
- MDAS
- MDEH
- Live Small Arms
- Expended Small Arms
- Debris
- No Contact
- Mag and Dig Area (Battelle)

N

0 75 150 225
Feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping,

BRAC Program Management Office West
San Diego, California

FIGURE 6-6
PRODUCTION MANUFACTURING AREA (SOUTH)
EXCAVATION RESULTS

After Action Report
NTCRA Production Manufacturing Area and South Shore Area
Former Mare Island Naval Shipyard, Vallejo, California

Created by: curtisf
Created on: 3/7/2014

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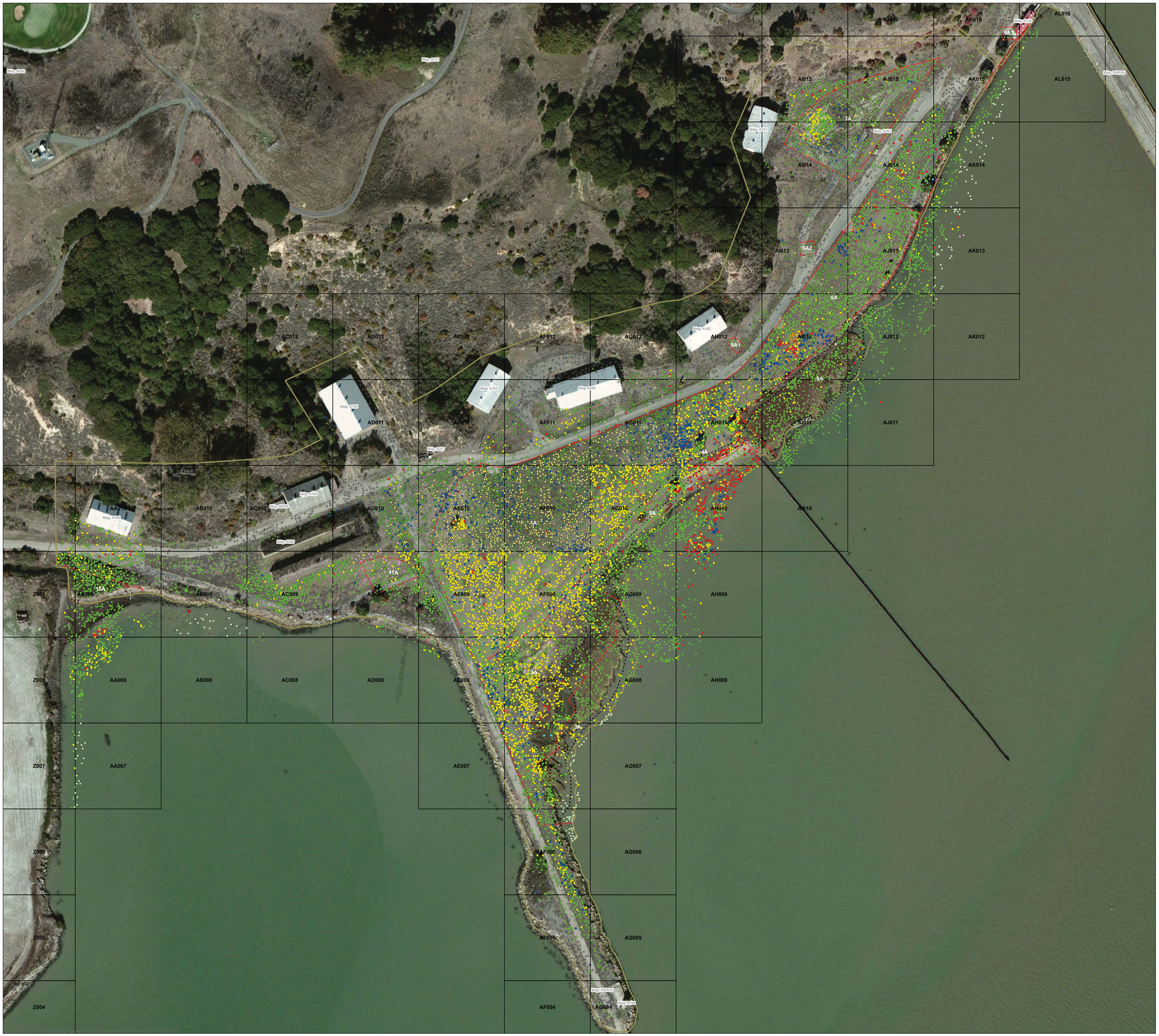

Legend

- PMA/SSA Boundary
- Coastal Salt Marsh
- Grid
- Cat A Boundary
- non-picked Cat B anomalies

WESTON

- MEC (DMM)
- MDAS
- Live Small Arms
- Expended Small Arms
- Inaccessible
- Debris
- Blind QC Seed
- Blind QA Seed
- GPO Seed
- MK6 Depth Charge

Battelle

- MEC (DMM)
- MDAS
- MDEH
- Live Small Arms
- Expended Small Arms
- Debris
- No Contact
- Mag and Dig Area (Battelle)

N

0 75 150 225
Feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping,

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San Diego, California

FIGURE 6-7
SOUTH SHORE AREA EXCAVATION RESULTS

After Action Report
NTCRA Production Manufacturing Area and South Shore Area
Former Mare Island Naval Shipyard, Vallejo, California

Created by: curtisf
Created on: 3/7/2014

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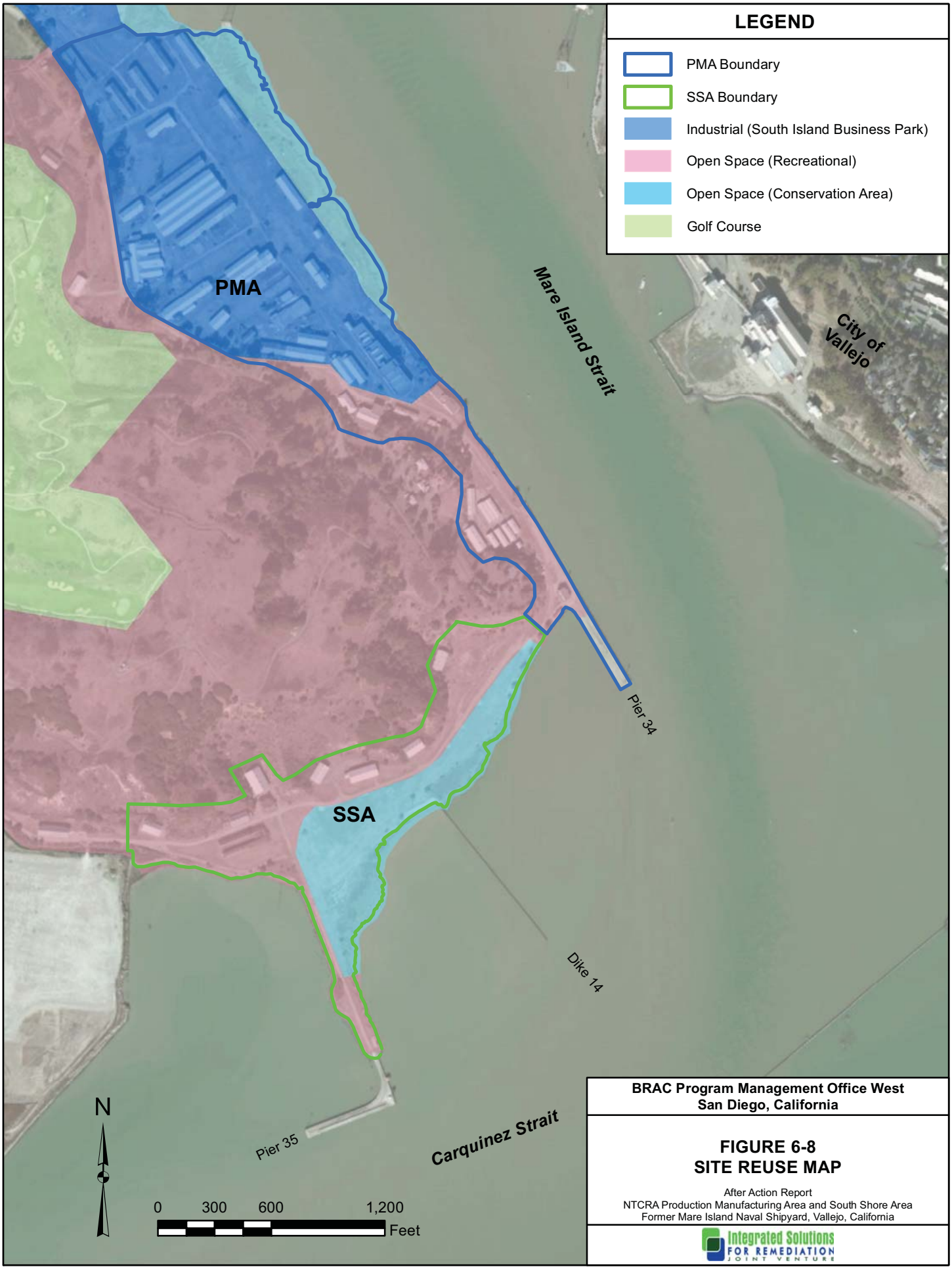

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San Diego, California

FIGURE 6-8
SITE REUSE MAP

After Action Report
NTCRA Production Manufacturing Area and South Shore Area
Former Mare Island Naval Shipyard, Vallejo, California

Integrated Solutions FOR REMEDIATION JOINT VENTURE

7. SUMMARY OF LAND USE CONTROLS

Public access to the PMA and SSA site is currently prohibited and the site remains the property of the DON. The planned reuses for the site, as specified in the Mare Island Specific Plan (City of Vallejo, 2008), include a light industrial development (commercial), a recreation area (public access), and several wildlife preserve areas (limited public access) as shown on Figure 6-8. Current access controls will remain in place until final site control measures have been developed, in coordination with regulatory agencies, to enable property transfer to the City of Vallejo.

The current response action has mitigated the immediate and likely routes of exposure to MEC within the PMA and SSA. However, because all detected geophysical anomalies were not excavated, and based on past uses and history of encountered MEC, institutional controls are considered to be appropriate within portions of the sites where MEC items have been encountered. Because planning efforts to support the transfer from government ownership are still underway, institutional controls have not yet been finalized. Appropriate institutional controls may include, but are not necessarily limited to: deed restrictions, notification of State of California oversight agency and/or City of Vallejo representatives and Underground Service Alert prior to excavation, as well as education measures to inform site workers and the public of potential remaining munitions hazards.

8. PROVISIONS FOR LONG-TERM MANAGEMENT

The provisions for long-term management, including maintenance, monitoring, record-keeping, and five-year reviews, have not yet been determined. The provisions will be developed by the DON, in consultation with regulatory agencies, prior to transfer of the site from the government.

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