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Explosives Safety Submission
Munitions Response Program Remedial Investigation in Investigation Area K
Former Mare Island Naval Shipyard
Vallejo, California

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Acronyms and Abbreviations

BEM	Buried Explosion Module
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DDESB	Department of Defense Explosives Safety Board
DFOWs	definable features of work
DoD	U.S. Department of Defense
DON	Department of the Navy
EM	Engineer Manual
EOD	Explosive Ordnance Disposal
ERRG	Engineering/Remediation Resources Group, Inc.
ESQD	explosive safety quantity-distance
ESS	Explosives Safety Submission
EZs	exclusion zones
FRP	Fleet Reserve Piers
GPS	global positioning system
GSV	geophysical systems verification
HAZWOPER	Hazardous Waste Operations and Emergency Response
IA K	Investigation Area K
ISOs	industry standard objects
IU	investigation unit
IVS	instrument verification strip
km^2	square kilometers
MC	munitions constituents
MDAS	material documented as safe
MDEH	material documented as an explosive hazard
MEC	munitions and explosives of concern
MFD-H	maximum fragment distance-horizontal
MGFD	munitions with the greatest fragmentation distance
mm	millimeter

Acronyms and Abbreviations *(continued)*

MPPEH	material potentially presenting an explosive hazard
MRP	Munitions Response Program
NEW	net explosive weight
NOSSA	Naval Ordnance Safety and Security Activity
OSHA	Occupational Safety and Health Administration
PMA	production manufacturing area
PETN	pentaerythritol tetranitrate
QA	quality assurance
QC	quality control
RDX	Royal Demolition Explosive
RI	remedial investigation
ROV	remotely operated vehicle
RPM	Remedial Project Manager
SAIC	Science Applications International Corporation
SSA	South Shore Area
SUXOS	Senior Unexploded Ordnance Supervisor
TNT	trinitrotoluene
TP	Technical Paper
USACE	U.S. Army Corps of Engineers
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
VFM	vertical fluxgate magnetometer
Weston	Weston Solutions, Inc.

1. Background

This Explosives Safety Submission (ESS) has been prepared to support the remedial investigation (RI) of munitions and explosives of concern (MEC), which will be conducted under the Munitions Response Program (MRP), for portions of several offshore Unexploded Ordnance (UXO) sites at the former Mare Island Naval Shipyard. Engineering/Remediation Resources Group, Inc. (ERRG) and Science Applications International Corporation (SAIC) prepared this ESS in accordance with Instruction 8020.15C, "Explosive Safety Review, Oversight, and Verification of Munitions Response" (Naval Ordnance Safety and Security Activity [NOSSA], 2009) for the Department of the Navy (DON) under Contract No. N62473-09-D-2615, Delivery Order No. 0003.

1.1. Project Manager

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1.2. Munitions Response Site Identifier and Description

Mare Island is a closed DON Installation, and portions are currently being transferred under BRAC. Investigation Area K (IA K), a portion of the offshore area of Mare Island seaward of the mean high water line, is under DON ownership pending the completion of required environmental response actions, including the investigation of potential MEC.

In Fiscal Year 2009, the DON identified portions of IA K as sites to be considered for further MEC investigation. The RI will be conducted at the Fleet Reserve Piers (FRP) (within UXO Site 10), Pier 34 (within UXO Site 6, a portion of the Production Manufacturing Area [PMA] Offshore Area), and Pier 35 (within UXO Site 11, a portion of the South Shore Area [SSA] Offshore Area). The RI sites will include the three piers, plus a 50-foot buffer zone around each pier in all directions.

In general, the FRP is located in North Mare Island Strait between the Highway 37 Causeway (Sears Point Road) to the north and the Former North Building Ways to the south. The FRP is generally L-shaped, with the short segment extending east from the shoreline perpendicular to North Mare Island Strait and the long segment running south parallel to North Mare Island Strait. The FRP RI site has an area of 10.56 acres (0.04 square kilometers [km^2]).

The PMA is located on a 75-acre upland site at the southeast end of Mare Island along South Mare Island Strait. Pier 34 is located in the offshore area adjacent to the PMA to the east of Dike 14. Pier 34 is straight, with half of the structure abutting the shoreline and the other half extending seaward at the junction of South Mare Island Strait and Carquinez Strait. The Pier 34 RI site has an area of 2.70 acres (0.01 km^2).

The SSA is located on the southern end of Mare Island along Carquinez Strait and includes nearshore mudflats. Pier 35 is located in the offshore areas adjacent to the SSA between Dike 12 and Dike 14. Pier 35 is L-shaped and has a short edge extending from a riprap jetty and a long edge running parallel to Carquinez Strait. The Pier 35 RI site has an area of 2.72 acres (0.01 km^2).

In addition to these specific UXO sites, Dredge Spoil Pond 7S is located in the upland area on the southern end of Mare Island to the west of Dike 12. This pond was used during the 1940s, 1950s, and 1960s for the deposition of dredge sediments that originated from the Carquinez Strait and the lower Mare Island Strait berth and pier areas. Other dredge spoil ponds are located in the upland areas on the western side of Mare Island. These ponds were created between 1914 and 1965 from dredge spoils generated by maintenance dredging of waterways along Mare Island Strait. Although they are not included in the offshore RI, the dredge spoil ponds provide information on the types of MEC potentially present at the RI sites.

1.3. Regional Maps

The three RI sites within IA K are shown on Figure 1-1 on the following page.

1.4. Scope of the Munitions Response

The three RI sites require further investigation because they were not included in previous geophysical and validation surveys for some nearshore mudflat and wetlands portions of IA K. The RI will include a geophysical survey, intrusive investigation, and sediment sampling for munitions constituents (MC).

1.5. History of MEC Use

Historical practices at Mare Island may have resulted in a release of MEC to IA K. MEC, including large- (6 to 16 inches) and medium-caliber (20 to 40 millimeter [mm]) projectiles, fuzes, primers, grenades, and other items, have been found along the shoreline and intertidal areas of IA K.

Ammunition was manufactured, stored, and handled at Mare Island throughout most of its history. These activities occurred mostly in the southeastern portion of Mare Island to provide a sufficient distance from the shipyard and residential areas. Development of the munitions storage area began in 1857, when the DON constructed the first ammunition magazine and loading wharf.

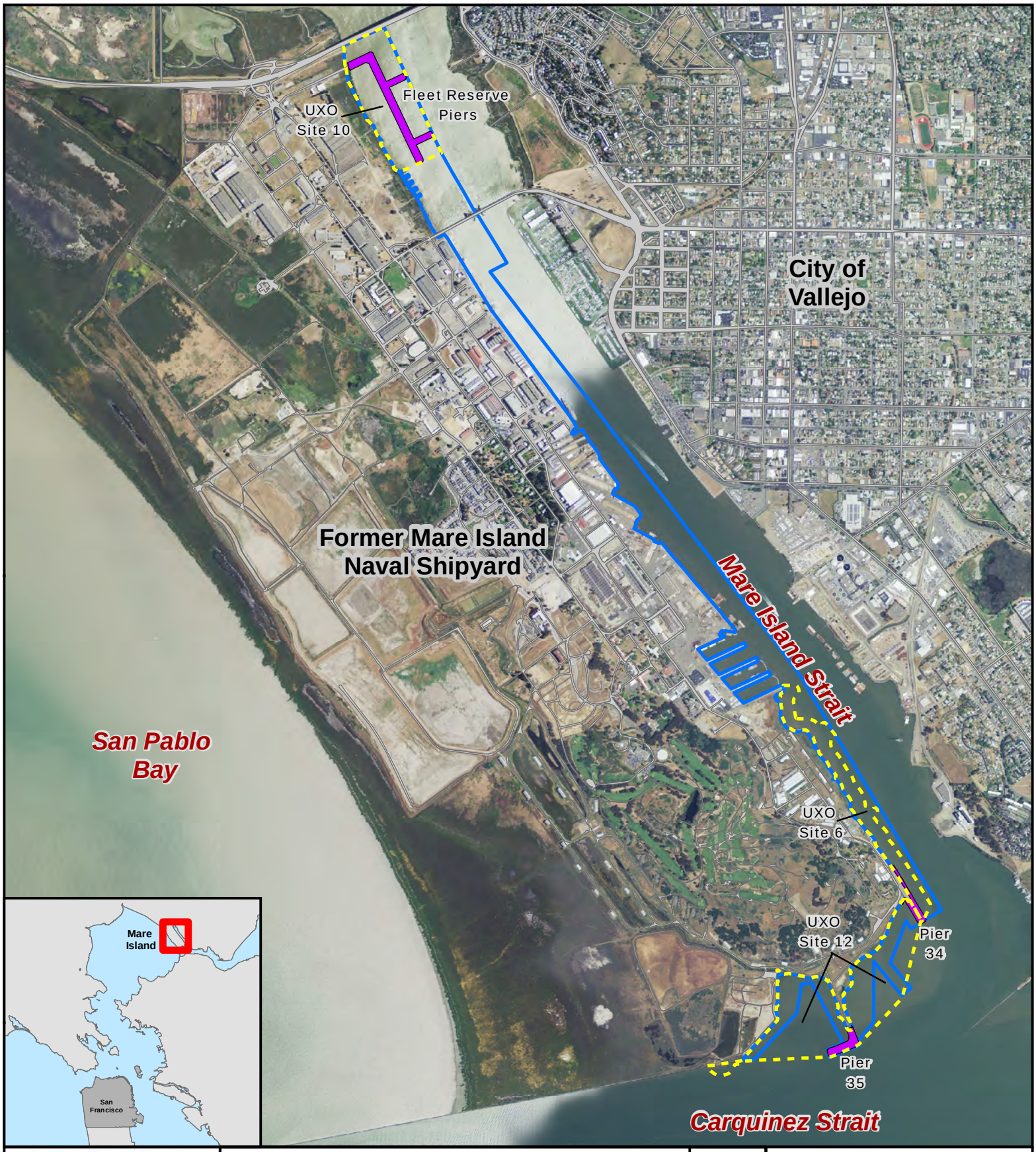

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FIGURE 1-1. RI Sites Within Investigation Area K.

Investigation Area K
UXO Site Boundary
RI Site

0 2,000 4,000 Feet
0 500 1,000 Meters

Notes:
Projection: CA State Plane, Zone 2
Units: Feet
Datum: NAD83
Orthophoto: NAIP 2009
Created by: C. Calabretta
Date created: November 29, 2012

File: MINS_UXO_Site_Locations.mdx

Later development included additional magazines, ordnance production facilities, and ordnance-handling piers. In 1936, the ordnance manufacturing area was upgraded to a Naval Ammunition Depot. In 1957, Naval Ammunition Depot operations merged with the Naval Magazine Port Chicago, located across the Carquinez Strait at Bay Point, near Concord, California. The consolidated installation was named Naval Weapons Station Concord. As a result, the area of munitions storage and maintenance operations at Mare Island was commonly referred to as the "Concord Annex."

In 1973, ordnance production in the Concord Annex ended, and many of the buildings and warehouses were subsequently used to store inert materials or were converted to office space. Unwanted ordnance was disposed of in a variety of ways at the Concord Annex. Some items were burned, and others were buried ashore or disposed of in the water from the seawalls, piers, and vessels near the Concord Annex.

Specific information on the history of MEC use at areas of Mare Island that are adjacent to or otherwise relevant to the RI sites in IA K is provided below.

FRP. Review of historical records did not identify specific documentation of munitions being discovered, offloaded, or discarded at the FRP (SulTech, 2006; Oneida Total Integrated Enterprises, 2010). However, the California Department of Toxic Substances Control recommended further MEC investigations in these areas.

PMA. Conventional ordnance production, storage, handling, and disposal at the PMA began in 1857 and continued until the facility was closed in 1973. The DON identified the following types of ordnance as being processed at the site: gun ammunition (20-mm through 16-inch), pyrotechnics, propellants, and rocket and small arms ammunition (Weston Solutions, Inc. [Weston], 2002). Bulk explosive compounds, such as black powder, smokeless powder, ammonium picrate (Explosive D), trinitrotoluene (TNT), trinitrophenylmethylnitramine, Royal Demolition Explosive, and high melting explosive, were also reportedly processed at the PMA. Although specific information about processing could not be found, it was reported that black powder munitions were emptied and refilled while ships were repaired at the nearby shipyard during the late 1800s and the loading of ammonium picrate (Explosive D) into projectiles was being implemented by the beginning of World War I (Weston, 2002).

SSA. The SSA was a munitions storage and handling complex in active use from the early 1930s to 1996.

1.6. Previous Studies of the Extent of MEC or MPPEH Contamination

Although the DON has conducted limited intrusive investigations in the nearshore and mudflat areas adjacent to the PMA and SSA (Environmental Chemical Corporation, 2010), no investigations have taken place offshore in IA K. However, between 1998 and 2001, geophysical surveys and follow-on intrusive investigations were conducted in several dredge spoil ponds containing sediments that came from the Mare Island and Carquinez Straits where IA K is now located. In total, 1,903 live munitions items were

recovered, 1,528 of which contained high explosives. A complete list of these items can be found in Section 3.1.

1.7. Justification for NFA Decision

Not applicable.

2. Project Dates

2.1. Project Dates

The RI fieldwork associated with this ESS is expected to begin in October 2013 and be completed by November 2013. A report documenting the results of the RI will be prepared after site geophysical surveys, intrusive investigation, and sampling and analysis of MC have been completed.

3. Types of MEC and MPPEH

Mare Island and Carquinez Straits were routinely dredged over the years. The dredge slurry was pumped through a system of pipes across Mare Island and subsequently deposited in a series of dredge spoil ponds. If unwanted or unsafe munitions items were thrown overboard in the berth and pier areas, then they may have been carried with the slurry and deposited in the ponds (Weston, 2001). Some munitions items were discovered in the dredge ponds during the previous investigations discussed in Section 1.6. This ESS posits that because the MEC and material potentially presenting an explosive hazard (MPPEH) discovered in the dredge spoil ponds originated in the straits, it is logical to assume that these same MEC and MPPEH items are likely to be present in IA K.

3.1. Types and Quantities of MEC and MPPEH

The following table lists MEC items recovered from Mare Island dredge ponds.

MEC recovered from IR05 and Dredge Spoil Pond 7S (2007 munitions response actions)[1]	
20-mm HE projectile	Bomb fuze booster
20-mm round	Gun primer
37-mm projectile fuze	M1 bomb fuze
40-mm anti-aircraft projectile	M4 detonator
40-mm anti-aircraft round	M14 bomb detonator
1.1-inch anti-aircraft round	M103 bomb fuze
3-inch Scoville powder train time fuze	M103 bomb fuze booster
7.2-inch mousetrap anti-submarine rocket	M123 bomb fuze
16-inch projectile base fuze	M126 bomb fuze
1-pound projectile	MK 29 5-inch projectile fuze
AN/M112 bomb fuze	MK 50 5-inch projectile fuze
AN/M115 bomb fuze	MK 131 hedgehog fuze
AN/M116 bomb fuze	MK 149 rocket fuze

MEC recovered from Dredge Spoil Pond 7S (1998–2001 intrusive investigation action)[1]	
20-mm anti-aircraft rounds/projectiles	1.1-inch anti-aircraft projectiles
40-mm anti-aircraft rounds/projectiles	3-inch/50-caliber anti-aircraft projectile
MEC recovered in the dredge spoils ponds (1998–2001)[2]	
Schenkel fuze	20-mm HEI round
Hotchiss fuze	20-mm HE projectile
Borman fuze	20-mm HEI projectile
VT proximity fuze with booster	20-mm cartridge case with propellant
Smokeless powder (lb)	40-mm HE round
Practice bomb with spotting charge - BDU 33	40-mm armor-piercing round
MK 14 primer	40-mm HE projectile
MK 15 primer	40-mm cartridge case with propellant
MK 19 primer	81-mm M1 mortar round
MK 21 primer	3-inch/50-caliber HE projectile
MK 21 fuze	3-inch/50-caliber HE projectile with VT proximity fuze
MK 22 primer	3-inch/50-caliber cartridge case with propellant
MK 50 fuze	3.5-inch Bazooka rocket motor
1.1-inch HE round	1-pound Hotchkiss HE projectile
1.1-inch HE projectile	3-pound Hotchkiss HE projectile
Bulk 20-mm fuze/HE filler pellets	6-pound Hotchkiss HE projectile
20-mm HE round	8.5-pound British practice bomb

Notes:

1. Weston, 2009. "Revised Draft Final Munitions Response Action Work Plan, Installation Restoration Site 05 and Dredge Pond 7S, Mare Island, Vallejo, California." September.
2. Weston, 2001. "Unexploded Ordnance Intrusive Investigation, Dredge Spoils Ponds, Mare Island, Vallejo, California." Final Summary Report. December 7.

3.2. Munitions with the Greatest Fragmentation Distance

Among the above MEC types that were dredged from the Mare Island and Carquinez Straits where IA K is now located, the 3-inch/50-caliber MK 27 projectile had the greatest maximum fragment distance-horizontal (MFD-H) and was selected as the primary munition with the greatest fragmentation distance (MGFD). Two other MEC items recovered ashore, which have hazardous fragment distance-horizontal distances greater than the primary MGFD, were selected as contingency MGFDs.

Table 3-1. Primary and Contingency MGFDs for IA K

MGFD Type	Munitions Item	MFD-H (feet)[1]
Primary	3-inch/50-caliber HE MK 27 projectile	1,823
Contingency 1	8-inch common MK 14 projectile[2]	3,327
Contingency 2	16-inch MK 14 projectile[3]	5,578

Notes:

1. From Fragmentation Data Review Forms, updated April 16, 2013.
2. Discovered in the PMA during 1998 through 2000 intrusive investigations. The report did not identify the 8-inch projectile by Mk/Mod. Rather than select, as the first contingency, the Army 8-inch M103, which has a greater MFD-H (3,727 feet) and a greater HFD (389 feet) than the Navy 8-inch common MK 14 projectile, the latter was selected because the Navy round was more likely to have been present at Mare Island.
3. Discovered in the PMA during 1998 through 2000 intrusive investigations, it represents the largest MEC item found in previous investigations adjacent to IA K.

If the MEC response team identifies a MEC item with a greater fragmentation distance than the selected MGFD or contingency MGFDs during the course of the MRP RI, the RPM will (1) direct all munitions response personnel to immediately cease operations, and (2) adjust the MFD-H in accordance with Department of Defense (DoD) Explosives Safety Board (DDESB) Technical Paper (TP)-16 (DDESB, 2009). Operations will then continue following the amended ESS only after authorization to do so is received from NOSSA.

If while executing a munitions response, the MEC response team identifies a MEC item that has a greater fragmentation distance than the selected MGFD, but less than or equal to one of the contingency MGFDs, the RPM will (1) select a new MGFD from among the contingency MGFDs that has a fragmentation distance equal to or greater than the newly identified MEC item, (2) implement the increased protection required by the selected contingency MGFD, and (3) notify NOSSA (N4) of the change in MGFD. If the RPM wants to insert the newly identified MEC item between MEC items already identified as the primary or contingency MGFDs, the project manager may submit a corrected ESS to NOSSA (N4) who shall provide the project manager with exclusion zones (EZs) for the new MGFD using DDESB guidance. The change in MGFD will be documented in the After Action Report.

3.3. Maximum Credible Event

No non-fragmenting MEC or MPPEH is known or suspected to be present at IA K; therefore, the maximum credible event is not applicable to this ESS, and all appropriate explosives safety quantity-distance (ESQD) safety arcs and EZs will be determined by the MGFD.

3.4. Explosive Soil and Contaminated Buildings

IA K includes only areas seaward of the mean high water line; therefore, explosive soil and contaminated buildings are not included as part of this ESS.

4. MEC and MPPEH Migration

4.1. MEC and MPPEH Migration

MEC and MPPEH have the potential to migrate within IA K because of naturally occurring phenomena (e.g., flooding, erosion, tides, dredging, wave action, etc.) and because the area is flat or sloped and is covered by mud, silt, and water. A munitions mobility study found that any MEC and/or MPPEH that has been dropped, thrown, or discarded into the water can either sink to the bottom or be moved with tidal change, which is significant within IA K (Sea Engineering, Inc., 2009). Heavy MEC and MPPEH items (50 to 60 pounds) will sink at the location where they are dropped or thrown. Lighter MEC and MPPEH items can move with tides, erosion, and wave actions. The locations of all identified MEC or MPPEH will be recorded with a global positioning system (GPS) device during the geophysical survey.

5. Detection Techniques

5.1. Detection Equipment, Methods, and Standards

The remotely operated vehicle (ROV) selected for use during the RI was chosen based on its ability to provide effective coverage under site-specific conditions. The ROV will be a track-mounted, bottom-crawling device (i.e., crawler) and will carry an array of vertical fluxgate magnetometers (VFMs) for digital geophysical mapping. The crawler will also be equipped with navigation and video/sonar equipment to determine locations and avoid obstructions, respectively. This detection equipment is the best technology available for completing the RI activities and achieving the goal of detecting target items down a maximum expected depth of 2 feet below the sediment surface.

When fully configured, the crawler, which has tank-like tracks, is expected to be able to traverse the various types of seabed terrain and debris anticipated in the three RI sites (the FRP, Pier 34, and Pier 35). The path of the crawler will be precisely controlled along preplanned survey lines using a combination of manual (i.e., joystick controlled) and automatic (i.e., autopilot) navigation to achieve the desired survey coverage. Navigating the crawler directly on the seafloor in this manner instead of using a towed senor will largely avoid the problem of drifting off planned survey lines due to water currents and the influence of turning momentum, which often results in reduced coverage or coverage gaps.

The specific crawler that will be used during the RI is the C-Talon, which is manufactured by QinetiQ North America. The C-Talon crawler is 22.5 inches wide, 34 inches long, and 24 inches high and weighs approximately 120 pounds out of the water. It is controlled remotely through a cable tether and carries a suite of sensors and instrumentation for communications, navigation, and data collection. A pan, tilt, and zoom video camera in a weather-tight underwater housing will be used as visual reference for the operator in all directions while the crawler is operated out of water. While underwater, a forward-looking, high-frequency imaging sonar will be used to detect obstacles at a range of up to 15 feet.

The VFMs (provided by Innovatum, Ltd of London, England) are passive sensors to be deployed as an array of four units held at a fixed separation distance (e.g., 1.5 feet) within a rigid framework. The VFM and deployment orientation were chosen because this type of array configuration is expected to be better at detecting and isolating metallic objects (anomalies) located directly under the sensor versus anomalies horizontal to the sensor (i.e., rebar in pilings). Using the VFM array, the crawler is capable of collecting geophysical data along a survey lane, achieving a nominal swath width of 3.3 feet or greater depending on sensor spacing.

5.2. Navigational Equipment, Methods, and Standards

Geodetic accuracy and repeatability (i.e., consistency in position over time) of the crawler VFM system will be critical to obtaining defensible data from the geophysical survey, as well as ensuring the operational success and efficiency of the subsequent intrusive investigation of sediments at the RI sites. As a result, highly accurate positioning capabilities must be established and maintained throughout all fieldwork activities.

Precision positioning and navigation of the crawler will use one of two approaches depending upon the operational environment. For operations out of the water, a real-time kinematic GPS, with a high-end receiver communicating with a shoreside base station, will be used to provide precision positioning of the unit. When working underwater, an acoustic ultra-short baseline positioning system will be used to provide precision positioning of the unit in real time relative to a topside GPS receiver communicating with the shoreside base station. Navigation control software will be used to position the crawler from these GPS inputs. An updated monument in the SSA will be used as the absolute reference position for the GPS system under both approaches. The positioning of the geophysical data acquired by the crawler system is expected to be accurate to a maximum error of 6.6 feet. The geophysical systems verification (GSV) process, which consists of both the instrument verification strip (IVS) and a blind seeding program, will confirm final positional accuracy of the system.

5.3. Equipment Checkout

All equipment will be inspected daily. The crawler system will go through a series of pre-deployment inspections and checks, much like an aircraft, and maintenance time is included as part of the planned daily site activities. Support systems, such as the status of on-board batteries and topside backups, will be inspected during the pre-deployment checks. All critical spare parts will be available on site as part of the standard compliment of parts mobilized with the crawler system. The detection capabilities and subsea positioning accuracy of the crawler system will be tested and confirmed at the beginning and end of each survey day using a predetermined GSV process to verify that the instruments are operating properly under site conditions. The daily checkout will include running the crawler system and its sensor over the IVS.

The IVS will consist of a group of six industry standard objects (ISOs): two small (1-inch by 4-inch), two medium (2-inch by 8-inch), and two large (4-inch by 16-inch). These ISOs will be placed in a straight

line on the seafloor and surveyed using the crawler system. Each ISO will be laid horizontally upon the sediment surface so as to be accessible by the crawler. The ISOs will be spaced at least 10 feet apart to allow for the sensor signal to return to the background levels between items. Accurate geographic coordinates for the ISOs will be obtained by using reliable GPS technology independent from the crawler navigation. The crawler system will then survey the IVS, and the resulting detection and positioning data will be compared to the known properties and location of each ISO.

The IVS must be located in an area that is representative of the RI site conditions but also free of metallic clutter. The location of this area must also be convenient for daily survey operations, preferably along the path to and from the site where the equipment will be stored overnight. Prior to the start of geophysical survey, a brief magnetometer survey using the crawler system will be performed outside of the RI sites to select an appropriate location for the IVS. Magnetometer data collected during the GSV location survey will be used in conjunction with existing bathymetry and sidescan sonar data to select the most appropriate location for the IVS. Additional IVS locations may be established as needed to minimize the travel time for daily checks.

The IVS is not intended to be blind to the sensor operator. The lane to be surveyed will be clearly marked so that the sensor platform will pass directly over the targets, thus providing accurate measurements of peak signal.

5.4. Data Collection and Storage

Geophysical data processing and analysis will be performed using Geosoft's Oasis® montaj geophysical software suite. The collected data will be initially stored on the data acquisition system hard drive for each geophysical survey and will be transferred via portable storage media to the analyst's computer at the end of each survey day.

Using the geophysical data processing software (Oasis® montaj), magnetic anomalies (i.e., distortions in the local magnetic field) will be identified either manually or automatically in the geophysical data set based on a predetermined threshold for spikes in the magnetic return compared to the baseline magnetic signature of the site. These anomalies will represent the ferrous (i.e., iron-containing) metal objects that have been detected. The geophysical data processing software has been specifically developed to conduct this type of analysis to identify targets for further investigation. The final output from this data processing step is a target list in ASCII format that includes the magnetic signature (i.e., magnitude of the magnetic return) and position of each anomaly of interest.

6. Response Actions

This section discusses the primary and secondary munitions response techniques that will be implemented during the MRP RI at IA K, including details related to the handling, storage, and disposal of MEC.

6.1. Response Technique

The primary munitions response technique at Mare Island will involve the use of a 6-inch suction hose and magnet to recover MEC. The hose and magnet will be mounted on a pole deployed from a barge-mounted crane. The pole will be instrumented with precision-positioning equipment (DredgePack©) for reacquiring target locations. The crawler will remotely monitor the hose and suction head with its support equipment placed aboard the barge. The barge will be repositioned by a shallow draft vessel (e.g., pontoon boat) and will be moored to the pier or anchored a short distance away from the pier depending on water depth and obstacle conditions within that particular portion of the RI site. All munitions response work, including suction sampling, barge positioning, recovery of MEC to the surface, short-term MEC storage on the barge, and transfer of MEC onto the pier, will occur within the 50-foot buffer zone around the pier at each RI site.

Intrusive investigation will occur at locations within the RI sites with the highest density of anomalies, thus representing the greatest chance of encountering actual MEC. The criteria for identifying high-density anomaly areas will be qualitative based on the relative distribution of anomalies across the entire RI site, as determined during the geophysical data mapping. Once a high-density anomaly area is identified, the general area will be designated as an investigation unit (IU). The precise location of the IU will be selected in the field by the geophysics lead, the onsite field manager, and the Navy's quality assurance (QA) officer based on the anomaly densities and characteristics observed in the geophysical data set. The goal will be to bring detected anomalies to the surface either through suction sampling or magnetic lifting. Detected anomalies which are too large for the suction hose or cannot be lifted by the 500-pound-capacity magnet will remain on the seafloor. There will be no decision tree for selecting individual anomalies for removal.

All three RI sites are considered to have an approximately equal potential for containing MEC. Thus, each site will receive the same level of effort for intrusive investigation. As such, one IU will be selected for intrusive investigation from each of the three RI sites. The shape and size of each IU will depend on the perimeter of the high-density anomaly area that it is targeting but will be roughly square (e.g., 4 meters by 5 meters) or rectangular (e.g., 2 meters by 10 meters). The sampling depth for each IU is based on the ability to find and remove detected anomalies, which will be no deeper than the vertical detection capabilities of the survey instrument (approximately 2 feet).

Suction sampling to retrieve anomalies from within an IU will be performed using a Venturi-type system wherein fluid pressure through a constricted opening creates the suction effect for a separate, attached hose. The benefit of using this type of suction system, as opposed to a typical vacuum style pump, is that any items captured by the suction hose can be directed to and retained in a separate holding cell without being drawn toward the pump machinery. For the intrusive investigation, the Venturi hose capturing anomalies will be underwater at all times while the hydraulic machinery driving the suction will be located on the deck of the barge or support vessel away from any potential MEC. The suction hose connected to the inlet of the suction system will be directed by a positioning beam to specific locations identified in the geophysical

survey. Suction will be applied until the excavation of sediment down to a depth of 2 feet has been achieved. A ring of water jet nozzles will be fitted to the suction head to break up sediments as necessary. The excavated material (~1 to 2 gallons of sediment) will pass into a sieving basket that will be hanging in the water column from a barge-mounted crane. The sieving basket will be constructed of 3/4-inch aluminum mesh designed to retain all objects larger than 1 inch. The excavated sediment surrounding the anomaly will pass through the mesh and fall to the seafloor. This process will be repeated until all identified anomalies in the IU have been excavated. Contingencies for items too large to pass through the hose are discussed in Section 6.8.

Various sensors will be mounted on the crawler to help direct excavation of sediment and recovery of anomalies. The submersible VFMs mounted to the crawler will help rapidly reacquire the targets identified in the geophysical data. Underwater video cameras will provide visual information about positioning and activity of the suction head when visibility allows, while a high-resolution, forward-facing sonar profiler will provide the same function when visibility is poor, as is expected. The excavation area will be reinspected with the VFM to confirm the anomaly was removed. If an anomaly remains (e.g., too large for the hose), a magnet capable of lifting 500 pounds will be attached to the pole and deployed into the excavation area to recover the anomaly and bring it to the surface.

The barge and crane suspending the sampling equipment will be positioned as close as feasibly possible to the intrusive sampling location with the intent of keeping the sampling system fully submerged. During intrusive sampling, the water column will be the primary engineering control for preventing fragments from surfacing in the event of an unintentional detonation. As identified in the water burial medium Buried Explosion Module (BEM) printouts in Appendix B, minimum operating depths of 2.7 feet for the primary MGFD, 6.3 feet for the Contingency 1 MGFD, and 15.2 feet for the Contingency 2 MGFD are required to have a 0-foot surface EZ.

Once the sieving basket has been brought aboard the barge, UXO technicians will investigate the contents. When the sieve breaks the surface, the EZs identified in Table 6-1.1 will be in effect for that IU. To get a clear picture of items in the sieving basket, sediment removal may be necessary and will take place using a high-velocity, low-pressure wash from a 3-inch-diameter fire hose connected to a pump on the deck of the barge. Once on deck and after washing has taken place, the UXO technicians will classify recovered anomalies for further handling. If the sieving basket is found to be devoid of any MEC or MPPEH, and all recovered items are simply scrap, the basket will be emptied onto the pier into an appropriate container for debris. If any MEC or MPPEH is identified, these items will be separated out and packaged accordingly for transportation to a designated disposition area (storage magazine or demolition range, whichever is appropriate). The established EZ will remain in place until MEC and/or MPPEH is transported to the disposition area. If MEC is recovered that is larger than the current EZ allows, the basket will be lowered back into the water until the proper EZ can be established.

6.2. Exclusion Zones

6.2.1. Exclusion Zone Distances

The EZs for the primary and contingency MGFDs identified in Table 3-1 are shown in Tables 6-1.1 and 6-1.2.

For exposure scenarios involving underwater detonation (Table 6-1.2), the K13000 distance is the cube root of the net explosive weight (NEW) multiplied by 13,000. The K13000/50 distance is the K13000 distance divided by 50 and is used for unintentional detonation distances. The K13000/15 distance is the K13000 distance divided by 15 and is used for intentional detonation distances. No activities requiring the K13000/15 distance will occur during the RI, and these distances are provided only for informational purposes. The formula for calculating the minimum safe distance for personnel in and/or under the water was provided by NOSSA.

Prior to the start of the underwater investigation, a request for a Notice to Mariners will be filed with the U.S. Coast Guard to alert the public of operations.

Table 6-1.1. EZs for Personnel Aboard Vessels in the Mare Island and Carquinez Straits or Ashore on Mare Island

MGFDs		EZs (feet)				
		Fragmentation Effects		Blast Overpressure Effects in Air		
Description	NEW (lb)(1)	HFD	MFD	K328	K40	K24
3-inch/50-caliber HE MK 27 projectile	0.740(2)	180(2)	1,823(2)	297(2)	36(2)	22(2)
8-inch common MK 14 projectile	9.274(3)	330(3)	3,327(3)	689(3)	84(3)	50(3)
16-inch MK 14 projectile	130.535(4)	604(4)	5,578(4)	1,664(4)	203(4)	122(4)

Notes:

1. NEW equals TNT-equivalent weight from appropriate Fragmentation Data Review Form.
2. From Fragmentation Data Review Form, 3-inch/50-caliber HE MK 27 projectile. Database revision date April 16, 2013.
3. From Fragmentation Data Review Form, 8-inch common MK 14 projectile. Database revision date April 16, 2013.
4. From Fragmentation Data Review Form, 16-inch MK 14 projectile. Database revision date April 16, 2013.

Table 6-1.2. EZs for Swimmers in the Mare Island and Carquinez Straits

MGFDs		EZs (feet)[2]	
		Blast Overpressure Effects in Water	
Description	NEW (lb)[1]	K13000/15	K13000/50
3-inch/50-caliber HE MK 27 projectile	0.74	784	235
8-inch common MK 14 projectile	9.27	1,821	546
16-inch MK 14 projectile	130.54	4,396	1,319

Notes:

1. TNT equivalent weight.
2. Calculated using $D=KW^{1/3}$ with W equaling the NEW (TNT equivalent) of a single MGFD.

6.2.2. Controlling EZs

Controlling EZs provide the appropriate ESQD from the operation to the exposed site for the operation being conducted. These are the minimum distances and will be strictly enforced. For this project, ESQDs are established relative to the entire RI site boundaries (i.e., the pier plus 50-foot buffer) under the assumption that munitions operations may occur anywhere within this boundary. No munitions operations will occur outside of this boundary. A small boat operated by onsite personnel will provide security around the barges and/or piers to keep commercial and recreational boaters from entering the EZ or to notify UXO personnel to cease operations when the EZ is breached.

Table 6-2. Controlling EZs for FRP, Pier 34, and Pier 35

Operation	Sited As	ES	Basis	ESQD (feet)
Mechanized operations[1] Primary MGFD	Unintentional detonation	UXO team	K40 of the Primary MGFD	36[2]
Mechanized operations [1] Primary MGFD	Unintentional detonation	Public and nonessential personnel on land or on support vessels/barges	HFD of the Primary MGFD	180[2]
Mechanized operations [1] Primary MGFD	Unintentional detonation	Public and nonessential personnel in and/or under the water	K13000/50 of the MGFD	235[5]
Mechanized operations [1] Contingency 1 MGFD	Unintentional detonation	UXO team	K40 of the Contingency 1 MGFD	84[3]
Mechanized operations [1] Contingency 1 MGFD	Unintentional detonation	Public and nonessential personnel on land or on support vessels/barges	HFD of the Contingency 1 MGFD	330[3]
Mechanized operations [1] Contingency 1 MGFD	Unintentional detonation	Public and nonessential personnel in and/or under the water	K13000/50 of the Contingency 1 MGFD	546[5]

Table 6-2. Controlling EZs for FRP, Pier 34, and Pier 35 *(continued)*

Operation	Sited As	ES	Basis	ESQD (feet)
Mechanized operations [1] Contingency 2 MGFD	Unintentional detonation	UXO team	K40 of the Contingency 2 MGFD	203[4]
Mechanized operations [1] Contingency 2 MGFD	Unintentional detonation	Public and nonessential personnel on land or on support vessels/barges	HFD of the Contingency 2 MGFD	604[4]
Mechanized operations [1] Contingency 2 MGFD	Unintentional detonation	Public and nonessential personnel in and/or under the water	K13000/50 of the Contingency 2 MGFD	1,319[5]
Barge/Pier – recovery and transfer of MEC/MPPEH prior to land transport Primary MGFD (1 item)	Unintentional detonation	Public and nonessential personnel	HFD of the Primary MGFD	180[2]
Barge/Pier – recovery and transfer of MEC/MPPEH prior to land transport Contingency 1 MGFD (1 item)	Unintentional detonation	Public and nonessential personnel	HFD of the Contingency 1 MGFD	330[3]
Barge/Pier – recovery and transfer of MEC/MPPEH prior to land transport Contingency 2 MGFD (1 item)	Unintentional detonation	Public and nonessential personnel	HFD of the Contingency 2 MGFD	604[4]
Barge/Pier – recovery and transfer of MEC/MPPEH prior to land transport NEW = 3.7 lbs (5 Primary MGFDs)	Unintentional detonation	Public and nonessential personnel	HFD of the NEW	395[6]
Barge/Pier – recovery and transfer of MEC/MPPEH prior to land transport NEW = 7.4 lbs (10 Primary MGFDs)	Unintentional detonation	Public and nonessential personnel	HFD of the NEW	450[6]
Barge/Pier – recovery and transfer of MEC/MPPEH prior to land transport NEW = 50 lbs (67 Primary MGFDs; 4 Contingency 1 MGFDs)	Unintentional detonation	Public and nonessential personnel	HFD of the NEW	601[6]

Notes:

1. Mechanized operations involve underwater removal of MEC/MPPEH through suction sampling conducted from a support barge and capturing MEC/MPPEH in an underwater sieving basket.
2. From Fragmentation Data Review Form, 3-inch/50-caliber HE MK 27 projectile. Database revision date April 16, 2013.
3. From Fragmentation Data Review Form, 8-inch common MK 14 projectile. Database revision date April 16, 2013.
4. From Fragmentation Data Review Form, 16-inch MK 14 projectile. Database revision date April 16, 2013.
5. Calculated using the equation $D=KW^{1/3}$ with W equaling the NEW of a single MGFD.
6. HFD obtained from NAVSEA OP 5, Table 7-9, using the following equation: HFD = 291+[79.2 x ln(NEW)].

6.2.3. MRS Encumbrance by Potential Explosion Sites

No potential explosion sites encumber any part of the FRP, Pier 34, and Pier 35.

6.2.4. EZ Access Protocol

Access to EZs at IA K is limited to essential personnel and authorized visitors. The UXO Safety Officer (UXOSO) will conduct an operational risk management assessment prior to initiating MEC investigation. In addition, the UXOSO will determine the maximum number of persons (essential personnel and authorized visitors) that can be in the EZ at one time. The ratio of UXO-qualified escorts to visitors will be determined by the UXOSO based on this site-specific operational risk analysis.

Based on the risk posed by the munitions response operation underway, the UXOSO may determine that access to the EZs is unsafe for visitors. However, every effort will be made to accommodate the authorized visitor's needs. With concurrence from the Navy RPM, the UXOSO will grant access to authorized visitors. Access to the EZs will be based on the operational risk analysis of the scheduled MEC operations and the availability of escorts, as well as a demonstrated visitor need and subsequent completion of visitor safety briefings. Persons requiring access to the EZs must demonstrate a legitimate need for access and obtain written authorization from the RPM and the UXOSO. Persons requesting access must submit their request to the RPM and UXOSO prior to the proposed date of the site visit. This advance notice will allow time for the UXOSO to support the visit request by assigning a qualified escort, conducting an operational risk analysis on the operations planned for the date of the site visit, and preparing a visitor site-specific safety briefing for the planned operations.

Prior to entry into the EZ, all authorized visitors will receive a site-specific safety briefing describing the specific hazards and safety procedures to be followed within the EZ for operations underway that work day. Each authorized visitor must acknowledge receipt of this briefing in writing. A UXO-qualified person assigned to the project will escort authorized visitors to the EZ at all times. Any authorized visitor that violates the established safety procedures will be immediately escorted out of the EZ and/or site for their own protection and to protect essential personnel working at the site. Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) training will not be required for authorized visitors given they will be escorted by UXO-qualified personnel.

6.3. MEC and MPPEH Hazard Classification, Storage, and Transportation

All recovered MEC and MPPEH items shall be handled, transported, and stored as Hazard Division 1.1 and appropriate compatibility group L. Any UXO will be stored as unserviceable ammunitions and will be handled in accordance with Instruction Number 8020.8B, "Department of Defense Ammunition and Explosive Hazard Classification Procedures" (Naval Sea Systems Command, 1998). All discovered MEC and MPPEH will be stored in the existing explosives storage magazine (Magazine A-180) on Mare Island, and scheduled demolition operations will be performed for final disposition following the end of the project.

Magazine A-180 has an approved storage capacity of 1,000 pounds NEW, Class 1 Division 1. Items that are determined to be fuzed and show evidence of having been subjected to the actions required for arming (e.g., rifling marks on a fuzed projectile) may constitute a hazard and will be considered unsafe to move. Pyrotechnic items that could pose a spontaneous combustion hazard in storage may also be categorized as unsafe to move. Items determined unsafe to move will be managed as described in Section 8.1. Transportation of MEC and explosives on site will comply with all federal, state, and local regulations. Permits, other than county explosive handling permits, are not required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

6.4. MEC and MPPEH Disposition Processes

The following paragraphs describe the disposal of MEC and MPPEH found during the intrusive investigation of magnetic anomalies within IA K, including operational risk management and contingency plans.

During barge operations, the Senior UXO Supervisor (SUXOS) will examine any uncovered item to determine whether it may pose an explosive hazard. The items will be classified as MEC, MPPEH, or debris. Once classified, all MEC/MPPEH items will be transported, one at a time and as soon as possible, from the barge onto the pier and transferred to the ERRG SUXOS for proper land transportation and storage. This transfer will not occur until a transport vehicle is available on the pier ready to receive the items. If the appropriate ESQD for recovery and transfer operations (as dictated by the size and quantity of MEC/MPPEH items recovered at one time) is found to encumber access of the Mare Island Causeway during operations at the FRP, the recovery and transfer location will be relocated to the southernmost point on the pier to remove the encumbrance. Contingency items that are too large to be retrieved (i.e., 16-inch MK 14 projectile) will be left in place and their condition noted.

All inspection, certification, and disposition procedures will be followed, including two inspections of all MPPEH by UXO-qualified personnel prior to removal. All MPPEH items certified as presenting no explosive hazard will be reclassified as material documented as safe (MDAS) in accordance with OP 5, Section 13-15 (NAVSEA, 2009). A Disposal Turn-in Document DD Form 1348-1 (series), or a local form included in the approved Work Plan, will be used to document MDAS. Under the direction of the ERRG SUXOS, MPPEH will be segregated into material documented as an explosive hazard (MDEH) and MDAS. MDAS will be locked and sealed in containers for transfer to a qualified recycler. MDEH will be disposed of by demolition using the same process described for MEC.

The disposal of recovered MEC items will be performed after all site activities have been completed. Any donor explosives required for the disposal will be provided just-in-time, and only the anticipated quantity of explosives needed for the disposal activities will be accepted. No donor explosives will be stored in Magazine A-180 or anywhere else at the RI site.

Qualified UXO technicians will complete all disposal operations during daylight hours after the appropriate notifications to local emergency services agencies. Disposal (i.e., detonation) of recovered MEC items will occur at Ordnance Disposal Range No. 2, which is site-approved for the disposal of recovered MEC with an established 1,250-foot ESQD arc that is controlled by DON and is restricted by fencing and gates (Naval Ordnance Center, 1994). Since the untamped MFD-H for each MGFD exceeds the sited ESQD arc for Ordnance Disposal Range No. 2 of 1,250 feet, all detonations will be tamped using the soil type and soil depths specified in the Buried Explosion Module (BEM) printouts included in Appendix B. These BEM printouts also specify the donor charge weights. Donor charges will be commercial cast boosters. These boosters are a mix of TNT and Royal Demolition Explosive (RDX), or pentaerythritol tetranitrate (PETN), and have a detonation rate of 24,000 feet per second and a pressure of 200 KB, which are comparable to Composition B.

6.5. Explosive Soil

No known explosive contaminated soil is present within the IA K RI sites.

6.6. Contaminated Buildings

No buildings are present within the IA K RI sites.

6.7. Operational Risk Management

The inherent risks associated with the RI activities are the possibility of inadvertent detonation of MEC items and the resulting fragmentation and blast overpressure hazards to site workers and the public. The public will be protected from fragments and blast overpressure by the established EZ.

Table 6-3 presents a hazard analysis matrix describing each of the potentially hazardous tasks to be performed with the corresponding hazard mitigation measures to be implemented.

Table 6-3. Hazard Analysis Matrix for UXO Sites FRP, Pier 34, and 35

Process Step	Hazard	Triggering Event	Initial Risk Index	Hazard Mitigation	Final Risk Index
1	DGM survey	MEC reacts to impact or movement during DGM survey	C/II/3	▪ SUXOS/Geophysical Survey Manager to monitor underwater video camera feed from crawler to ensure MEC is not inadvertently contacted ▪ UXOSO daily observation of field activities	D/II/4
2	ROV anomaly intrusive investigation	MEC reacts to impact or movement during excavation of anomalies	C/IV/5	▪ Initial mechanized excavation beside anomaly; and ▪ UXOSO daily observation of field activities	D/IV/5
3	MEC/MPPEH inspection and accountability	MEC/MPPEH misidentification	C/II/3	▪ 100% inspection of MEC and MPPEH by UXO discoverer, UXO Team Leader, and SUXOS ▪ 100% inspection of MDAS by SUXOS or UXO Quality Control Specialist (UXOQCS) ▪ MEC not positively identified will not be scheduled for treatment ▪ MEC/MDEH accountability inspected by UXOQCS weekly ▪ MDAS segregated by “Demilitarization Required” or “No Demilitarization Required” ▪ MEC/MDEH stored, handled, and documented in accordance with OP-5 ▪ Demilitarization completed using a licensed contractor ▪ Storage containers for MDAS have lockable lids to prevent unauthorized additions of MEC/MDEH ▪ UXOSO daily observation of field activities	D/IV/5

Table 6-3. Hazard Analysis Matrix for FRP, Pier 34, and Pier 35 *(continued)*

Process Step	Hazard	Triggering Event	Initial Risk Index	Hazard Mitigation	Final Risk Index
4	Loading of MEC into vehicle	MEC reacts to impact from dropping, banging, or mishandling	C/II/3	▪ Inspect vehicle IAW DD Form 626 (pre-load) ▪ Personnel are trained to prevent rough handling ▪ Keep secure grip on containers ▪ Ensure all storage area doors are open as far as possible ▪ Do not slide or throw containers into vehicle ▪ Only carry one container at a time ▪ Do not climb into vehicle while carrying MEC ▪ Keep storage bunker clear of tripping hazards ▪ UXOSO observes all loading of MEC and MDEH and stops operation if unsafe conditions are spotted	D/IV/5
5	Transportation of MEC to storage magazine or demolition range	MEC reacts to impact, friction, or movement during transportation	C/II/3	▪ Inspect vehicle IAW DD Form 626 (post-load) ▪ Transport MEC in closed containers with packing material ▪ Limit vehicle occupancy to driver and two passengers ▪ Ensure containers do not have protruding nails or other hazards that could damage MEC ▪ Do not transport in passenger compartment ▪ Bed of vehicle has non-sparking surface ▪ Secure MEC in vehicle to prevent movement (tie downs, sandbags, etc.) ▪ UXOSO observes all transportation of MEC and MDEH and stops operation if unsafe conditions are spotted	D/IV/5

Table 6-3. Hazard Analysis Matrix for FRP, Pier 34, and Pier 35 *(continued)*

Process Step	Hazard	Triggering Event	Initial Risk Index	Hazard Mitigation	Final Risk Index
5	Transportation of MEC to storage magazine or demolition range	Vehicle involved in accident	C/II/3	▪ Set parking brake and chock vehicle at unmarked loading areas or on uneven surfaces ▪ Conspicuously display placards required by Department of Transportation regulations ▪ Transportation will not take place if electrical storm <5 miles ▪ Follow planned route ▪ Drive speed limits ▪ Have qualified driver ▪ Drive defensively ▪ Vehicle inspected prior to use	D/IV/5
		Vehicle catches on fire	C/II/3	▪ No other flammable material in transportation compartment ▪ Do not refuel vehicle while loaded with MEC ▪ Two 10 B/C fire extinguishers (minimum) are mounted to the vehicle and readily accessible ▪ Driver and passenger(s) trained to use fire extinguishers to fight fires ▪ Emergency services on site or standby	D/IV/5
6	Receipt, handling, and holding of donor charges	Donor charges react to impact, heat, friction, or electrostatic discharge	C/II/3	▪ Same-day donor charge delivery ▪ Detonators stored separately from main charge in ATF-approved day box ▪ All personnel wearing cotton clothing ▪ Demolition operations will not take place if electrical storm <5 miles from the site	D/II/4
7	MEC treatment	MEC and donor charges react to impact, heat, friction, or electrostatic discharge	C/II/3	▪ All demolition personnel trained; 1,250-foot EZ established; Demolition personnel wearing cotton clothing ▪ Demolition operations suspended during electrical storms	D/II/4

6.8. Contingencies

Larger anomalies will not pass through the suction hose and will be left on the seafloor. If geophysical analyses or sonar imagery suggests the anomalies possess MEC-like characteristics (or clearly not), the observation will be noted in the field log. If the suction hose becomes jammed, as indicated by a reduced pumping rate, the system will be shut down and the line cleared as needed. Diving may be performed on an emergency basis to retrieve/untangle the crawler or excavation equipment, as needed. Any diving operations will be conducted in accordance with Consolidated Engineer Manual (EM) 385-1-1, Section 30, "Diving Operations" (U.S. Army Corps of Engineers [USACE], 2008), as well as the SAIC dive plan (SAIC, 2011), which is assembled based on guidance from the Corporate SAIC "Diving Policy and Safety Manual."

7. Quality Control and Quality Assurance

7.1. QC Implementation

An extensive quality control (QC) program will be applied to the RI field operations. In general, QC will be monitored through definable features of work (DFOWs) using a multiple-phase control process. The DFOWs for this project are divided into activities relating to mobilization, geophysical survey, intrusive investigation, MEC/MPPEH management, and demobilization. Mobilization will consist of activities such as preparing project plans, verifying personnel qualifications, coordinating site access, renting, setting up and checking out equipment, and establishing survey lanes. The overall geophysical survey phase will consist of the GSV location survey, the daily GSV process, geophysical data acquisition, and geophysical data processing and interpretation. The overall intrusive investigation phase will consist of target site selection and intrusive sampling using the suction hose. The MEC management phase will consist of all activities related to MEC identification, transport, storage, and treatment. The MPPEH management phase will consist of all activities related to MPPEH inspection, certification, and disposal. Demobilization will consist of the breakdown of all survey and sampling equipment and departure from the site. If a DFOW has not achieved the level of quality established in the work plans for this project, work will not proceed until the nonconformance has been corrected or the work will be redone as required.

During the geophysical survey operations, the Geophysical Survey Manager will be responsible for the quality of the work being performed. He or she will oversee the daily checkout of instruments (i.e., the GSV process) and ensure work is being performed in accordance with all project plans. A key QC component of the geophysical survey will be instrument validation through a blind seeding program. The blind seeding program will be conducted twice daily as part of the overall GSV process (see Section 5.3), with the goal of providing ongoing monitoring of data quality and verification that objects capable of producing detectable signals are being detected and located as expected. The blind seeding program will involve seeding the survey area with magnetic targets (i.e., seeds) at locations that are unknown to the data acquisition and processing teams. The seeds will consist of the same small, medium, and large sizes of ISOs found to be detectable on the IVS. Detection of the seeds by the crawler system at known positions

during survey operations will confirm that the geophysical and navigation equipment is functioning properly and the resulting data are suitable for meeting project data quality objectives. The failure to detect a seeded target will allow the project team to recognize that problems exist with the survey equipment and provide a means to identify root causes and undertake corrective action while still in the field.

During the intrusive investigation and MEC/MPPEH management operations, an extensive QC program will be implemented by the UXOQCS. The UXOQCS will establish and monitor the intrusive investigation QC acceptance criteria in accordance with requirements established in the work plan. The Geophysical Survey Manager will be responsible for continuously observing the suction sampling activities to ensure the required sampling depth (2 feet) is achieved and all identified anomalies are removed from each IU, as possible. The SUXOS will be responsible for continuously observing the suction to identify all MEC and MPPEH items and ensure conformance to this ESS.

The following table lists the QC methods and pass/fail criteria for the RI DFOWs.

Operation	Standard	Audit	Pass/Fail Criteria	Corrective Action
Mobilization	Established survey lanes conform to the work plan	Geophysical Survey Manager verifies survey lane locations daily using a GPS system	All survey lanes are located within the RI site boundaries	Do not proceed with the geophysical survey until survey lane locations are correct
Geophysical survey	Data collection conforms to the manufacturers' listed instrument capabilities and the work plan data quality objectives	Daily GSV process, including daily IVS and blind seeding program for instrument validation	Objects capable of producing detectable signals are being detected and located as per the listed instrument capabilities	Repair or replace nonfunctioning instruments or equipment; recollect all data acquired with nonvalidated equipment from point where last seed item was detected
Intrusive investigation	Suction sampling and anomaly removal conforms to the standards established in the work plan	Geophysical Survey Manager and SUXOS continuously observe intrusive investigation activities	Suction sampling is accomplished to the required depth (2 feet) and 100 percent of anomalies identified in the geophysical data set are excavated from the IU as possible	Repair or replace non-functioning sampling equipment; repeat suction sampling for IUs that do not conform with project objectives
MEC/MPPEH management	Conforms to work plan and ESS	100 percent oversight by the UXOQCS	Zero deviation from approved plans and procedures	Stop work until the nonconformance has been corrected or re-do the nonconforming work
Demobilization	All proposed RI work is completed prior to departing site	100 percent oversight by the RPM	Zero deviation from approved plans and procedures	Re-do the nonconforming work

7.2. QA Implementation

The DON will develop a QA plan to independently assess the quality of project work. An independent third-party contractor will implement the plan. The third-party contractor will provide regular oversight of all anomaly clearance field operations and perform a final QA inspection of cleared areas prior to the start of intrusive investigation.

8. Technical Support

This section describes the qualifications, available technical support, and physical security measures for UXO technicians employed during the MRP RI for FRP, Pier 34, and 35 in the IA K.

8.1. Explosive Ordnance Disposal

If a munitions item is encountered that cannot safely be handled or identified, explosive ordnance disposal (EOD) assistance from the 60th Civil Engineer Squadron based at Travis Air Force Base or EODMU ELEVEN Detachment Fallon will be obtained.

8.2. UXO Contractor

The qualifications of all UXO technicians performing MEC-related functions will meet or exceed the requirements of DDESB TP18 (DDESB, 2004) for their respective jobs. The qualifications of all UXO divers will meet or exceed the requirements of USACE EM 385-1-1 (USACE, 2008). All employees performing intrusive investigation activities will have completed the 40-hour HAZWOPER training mandated by OSHA, including annual 8-hour refresher training. The SUXOS will also have received HAZWOPER supervisory training. All technicians will have a current medical exam meeting the standards in Title 29 Code of Federal Regulations Section 1910.120. Documentation showing the employees have been trained, found qualified, and are certified to perform their assigned tasks will be available for review.

8.3. Physical Security

Because Mare Island is open to the general public, all access roads entering the EZ will be secured during operations using temporary road barricades. These barricades will consist of Type I barricades or orange traffic cones. Each barricade will be adorned with a warning sign reading “Road Closed” and will provide a contact name and number to call to obtain access to the site. These barricades will be placed across North Pier Street for the FRP; Railroad Avenue, Tyler Road, and Murphy Lane for Pier 34; and Jennings Road for Pier 35. Specific locations of the road barricades will depend on which ESQD is being used at a given time, and the barricades will be moved if operations require expansion of the EZ. Locations of the road barricades for the Primary MGFD ESQD are shown in Appendix C, Figures C-1 through C-3.

During survey operations, a small boat operated by onsite personnel will provide security around the barges and/or piers to keep commercial and recreational boaters from entering the EZ. All survey equipment and potential munitions items will be stored in locked containers when not in use or under

direct observation by qualified personnel to prevent any handling, damage, or otherwise tampering by unauthorized personnel.

9. Environmental, Ecological, Cultural, and/or Other Considerations

This section provides the regulatory statute, phase, and oversight applicable to the MRP RI for the IA K and discusses the environmental, ecological, cultural, and waste disposal considerations applicable to the project.

9.1. Regulatory Statute, Phase, and Oversight

The DON is conducting the proposed munitions response action as an RI under the MRP. Proper planning of the RI is important to ensure that data obtained are appropriate to evaluate likely remedial alternatives during the feasibility study phase of CERCLA, if warranted. The regulatory agencies providing oversight for the proposed action include the California Department of Toxic Substances Control (Janet Naito, Project Manager), the U.S. Environmental Protection Agency (Carolyn d'Almeida, Project Manager), the San Francisco Bay Regional Water Quality Control Board (Elizabeth Wells, Project Manager), the U.S. Fish and Wildlife Service (James Browning, Senior Biologist), the California Department of Fish and Wildlife (Tami Nakahara, Environmental Scientist), and the Restoration Advisory Board (Myrna Hayes, Community Chairperson).

There are no legally binding dates for actions to occur at this time.

9.2. Environmental, Ecological, Cultural, and Other Considerations

The MEC and MPPEH management procedures implemented at the IA K will consider the presence of several species of special conservation status known to occur in the area, including federal- and state-listed and candidate species such as the California brown pelican (*Pelecanus occidentalis californicus*) and least tern (*Sterna antillarum browni*); see the "Final Work Plan for the Remedial Investigation at Investigation Area K, Former Mare Island Naval Shipyard, Vallejo, California" (Tetra Tech EM, Inc., 2008) for a complete list of species.

Mare Island is also home to marine mammals, including the Eastern Pacific harbor seal (*Phoca vitulina richardsi*) and the California sea lion (*Zalophus californianus*), both of which are classified as endangered and otherwise protected under the federal Marine Mammal Protection Act of 1972.

If any listed species are observed in the study area during survey operations, every effort will be made to avoid contact or interaction with them and, under no circumstances, will they be harassed. Marine mammals in particular will be allowed to vacate the area naturally before MEC and MPPEH handling activities proceed.

No other environmental permitting, cultural (e.g., tribal or religious), historical (e.g., historical registry), or other legal requirements will impact the proposed munitions response actions.

The MEC storage facility (Magazine A-180) and the MEC treatment facility (Ordnance Disposal Range No. 2) will be operated in accordance with the requirements of the "Engineering Evaluation/Cost Analysis and Removal Action Work Plan for the Operation of Mare Island Ordnance Storage and Treatment Facilities" (Weston, 2004). Signature of the 2004 work plan constituted approval by state and federal regulatory agencies (in lieu of the Resource Conservation and Recovery Act Part A/B permitting process) to continue use of the established MEC storage and treatment facilities until all MEC actions on Mare Island have been completed.

9.3. Non-Explosive Soil

Sediment encountered during the geophysical survey and intrusive investigations is not expected to be contaminated with MC at concentrations that present an explosive hazard. Because all intrusive activities will be performed underwater with recovered anomalies brought to the surface in a permeable sieving basket, no sediment will be intentionally recovered during the intrusive investigation. Any residual sediment present on recovered anomalies will be removed during the low-pressure washing process performed by the UXO technicians during the MEC/MPPEH identification activities. These residual sediments will be returned to their approximate original location.

10. Residual Risk Management

This section describes the management of residual MEC risk within the FRP, Pier 34, and Pier 35 in IA K.

10.1. Land Use Controls

The FRP, Pier 34, and Pier 35 as well as the offshore area of IA K, are currently under DON control. Once all required actions have been completed to facilitate transfer of the property to the City of Vallejo, restrictions appropriate for the MEC-related history of the site will be developed and implemented during the Record of Decision phase of the CERCLA process. Although no engineering controls are anticipated, institutional controls may be required by regulatory agencies and may include the following:

- Deed restrictions limiting allowable reuse of the property, such as prohibiting residences, schools, daycare centers, or hospitals (property is currently slated for recreational and wildlife preserve reuses).
- Restrictions on excavations or other soil disturbance unless approved by the regulatory agencies and performed with UXO support.
- Implementation of an education and awareness program, including informational signage, to educate the public on the munitions hazard and the steps to follow should a suspected munitions item be encountered.

10.2. Long-Term Management

Periodic long-term monitoring of the site will be implemented to minimize the chance of the public encountering any remaining munitions items.

11. Safety Education Program

11.1. Safety Education Program

Access to the FRP, Pier 34, and Pier 35 areas in the offshore area of the IA K is under DON control. A safety education program likely will be implemented to ensure that all persons who may enter the site in the future are aware of the potential hazards associated with possible remaining munitions. The education program will place emphasis on potential future passive use by recreational visitors. Informational signage to educate the public on potential munitions hazards, and to instruct them on the steps to follow should they encounter a suspected munitions item, will be provided as part of the land and water use controls for the site.

12. Stakeholder Involvement

12.1. Stakeholder Involvement

All potential stakeholders will be involved throughout the planning stages of the RI through the review of work plan documents. These stakeholders include the regulatory agencies providing oversight identified in Section 9.1.

13. References

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Weston, 2009. "Revised Draft Final Munitions Response Action Work Plan, Installation Restoration Site 05 and Dredge Pond 7S, Mare Island, Vallejo, California." September.

Appendix A. Signature Page

Signature Page

NAVFAC Project	BRAC PMO Project
Project Name:	Project Name: **Remedial Investigation of Investigation Area K, Munitions Response Program, Former Mare Island Naval Shipyard**
Explosive Safety Officer of UXO Contractor Safety Officer	**Explosive Safety Officer of UXO Contractor Safety Officer**
Signature	Signature
Printed Name Date	Printed Name: David O. Williams Date: 4/9/2013
Public Works Office Planning Department	**PMO Planning Department**
Signature	Signature
Printed Name Date	Printed Name: PATRICIA MCFADDEN Date: 4/9/13
Remedial Project Manager	**Remedial Project Manager**
Signature	Signature
Printed Name Date	Printed Name: HEATHER WOOTHWICK Date: 4/17/13

Appendix B. Fragmentation Data Review Forms and Buried Explosion Module Results

Fragmentation Data Review Form

Database Revision Date 3/1/2013

Category:	Surface-Launched HE Rounds
Munition:	3 in/50 HE Mk 27
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	
Date Record Created:	7/20/2011
Record Created By:	SDH
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	0.74
Diameter (in):	2.9700
Cylindrical Case Weight (lb):	5.43900
Maximum Fragment Weight (Intentional) (lb):	0.2171
Design Fragment Weight (95%) (Unintentional) (lb):	0.0512
Critical Fragment Velocity (fps):	3107

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	180
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1823
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1375

Overpressure Distances

TNT Equivalent (Pressure):	1
TNT Equivalent Weight - Pressure (lbs):	0.740
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	16
Public Traffic Route Distance (2.3 psi); K24 Distance:	22
Inhabited Building Distance (1.2 psi), K40 Distance:	36
Intentional MSD (0.0655 psi), K328 Distance:	297

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1
TNT Equivalent Weight - Impulse (lbs):	0.740
Kinetic Energy 10^6 (lb-ft^2/s^2):	1.0481

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	24
Expected Max. Throw Distance (ft):	125
Minimum Separation Distance (ft):	200

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	200.000
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	6.52	3.72
Mild Steel:	1.25	0.70
Hard Steel:	1.02	0.58
Aluminum:	2.47	1.44
LEXAN:	6.95	4.89
Plexi-glass:	5.34	3.34
Bullet Resist Glass:	4.65	2.77

Item Notes

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.

Fragmentation Data Review Form

Database Revision Date 3/1/2013

Category:	Surface-Launched HE Rounds
Munition:	8 in Common Mk 14
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Extremely Heavy Case

DODIC:	
Date Record Created:	11/15/2010
Record Created By:	SDH
Last Date Record Updated:	3/31/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Explosive D
Explosive Weight (lb):	10.91
Diameter (in):	7.9770
Cylindrical Case Weight (lb):	151.94900
Maximum Fragment Weight (Intentional) (lb):	4.0270
Design Fragment Weight (95%) (Unintentional) (lb):	1.2066
Critical Fragment Velocity (fps):	2439

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	330
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	3327
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2405

Overpressure Distances

TNT Equivalent (Pressure):	0.85
TNT Equivalent Weight - Pressure (lbs):	9.274
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	38
Public Traffic Route Distance (2.3 psi); K24 Distance:	50
Inhabited Building Distance (1.2 psi), K40 Distance:	84
Intentional MSD (0.0655 psi), K328 Distance:	689

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.81
TNT Equivalent Weight - Impulse (lbs):	8.837
Kinetic Energy 10^6 (lb-ft^2/s^2):	7.0947

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	13.09	7.21
Mild Steel:	2.43	1.27
Hard Steel:	1.99	1.04
Aluminum:	4.54	2.47
LEXAN:	10.81	7.26
Plexi-glass:	9.60	5.65
Bullet Resist Glass:	9.03	5.02

Item Notes

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Fragmentation Data Review Form

Database Revision Date 3/1/2013

Category:	Surface-Launched HE Rounds
Munition:	16 in Mk 14 Projectile
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Extremely Heavy Case

DODIC:	
Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Explosive D
Explosive Weight (lb):	153.57
Diameter (in):	16.0000
Cylindrical Case Weight (lb):	1576.05300
Maximum Fragment Weight (Intentional) (lb):	15.1260
Design Fragment Weight (95%) (Unintentional) (lb):	2.4110
Critical Fragment Velocity (fps):	2394

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	604
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	5578
MFD-V [Maximum Fragment Distance, Vertical] (ft):	3947

Overpressure Distances

TNT Equivalent (Pressure):	0.85
TNT Equivalent Weight - Pressure (lbs):	130.535
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	91
Public Traffic Route Distance (2.3 psi); K24 Distance:	122
Inhabited Building Distance (1.2 psi), K40 Distance:	203
Intentional MSD (0.0655 psi), K328 Distance:	1664

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.81
TNT Equivalent Weight - Impulse (lbs):	124.392
Kinetic Energy 10^6 (lb-ft²/s²):	43.3567

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	26.75	13.15
Mild Steel:	5.03	2.43
Hard Steel:	4.13	1.99
Aluminum:	8.97	4.53
LEXAN:	16.96	10.84
Plexi-glass:	17.46	9.63
Bullet Resist Glass:	17.57	9.07

Item Notes

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BURIED EXPLOSION MODULE

(Version 6.3.1)

Based on DDESB Technical Paper 16 Revision 4, EARTHEX software, and NSWCDD/TR-92/196

(ENGLISH UNITS)

SELECT BURIAL MEDIUM	Water	**SELECT ITEM DESCRIPTION**	3 in/50 HE Mk 27
If underwater, ignore soil type	Dry Sand		

USER INPUTS

ENTER TOTAL NUMBER OF ITEMS	1
ENTER TOTAL WEIGHT OF ALL DONOR CHARGES (lbs)	0.00
ENTER DONOR CHARGE EXPLOSIVE TYPE	

VALUES USED IN BEM CALCULATIONS

SINGLE ITEM NEW (lbs)	0.74
ITEM DIAMETER (in)	2.970
SINGLE ITEM MAXIMUM FRAGMENT WEIGHT (lbs)	0.2171
FRAGMENT WEIGHT USED IN CALCULATIONS (lbs)	0.2171
SINGLE ITEM MAXIMUM FRAGMENT VELOCITY (ft/s)	2,703
FRAGMENT VELOCITY USED IN CALCULATIONS (ft/s)	2,703
TOTAL TNT WEIGHT USED (lbs)	0.74
WEIGHT USED IN UNDEX WEIGHT CALCULATIONS (lbs)	0.89
WEIGHT USED IN UNDEX VELOCITY CALCULATIONS (lbs)	0.59

USER INPUTS

ENTER DEPTH OF WATER (ft)	2.70
ENTER HORIZONTAL RANGE (for pressure calculation) (ft)	100

BURIED EXPLOSION MODULE OUTPUTS

UNDERWATER

NO CRATER

0

FRAGMENT EXIT VELOCITY (ft/s)	17.3	MIN. FRAGMENT LAUNCH ANGLE (°)	89.0
MAXIMUM FRAGMENT DISTANCE - HORIZONTAL (ft)	0.0		

Distance at which pressure is 0.066 psi = Blast Withdrawal Distance (buried/undex) (ft)				43.9	
Open Air Withdrawal Distance, K328 (ft)	296.7	Fragment Hazard Distance (ft)		0.0	See Note 2
		Pressure at Fragment Hazard Distance	(psi)	-N/A-	See Note 3
			(dB)	-N/A-	See Note 3
		Fragment Hazard Distance = max (MFD-H, Soil Ejecta Distance)			
		Pressure at Range Entered	(psi)	0.0000	See Note 4
			(dB)	0.0	See Note 4

Note 2: Water too deep--no fragments expected

Note 3: No overpressure is produced at this depth

Note 4: No overpressure is produced at this depth

BURIED EXPLOSION MODULE

(Version 6.3.1)

Based on DDESB Technical Paper 16 Revision 4, EARTHEX software, and NSWCDD/TR-92/196

(ENGLISH UNITS)

SELECT BURIAL MEDIUM	Water	**SELECT ITEM DESCRIPTION**	
If underwater, ignore soil type	Dry Sand		8 in Common Mk 14

USER INPUTS

ENTER TOTAL NUMBER OF ITEMS	1
ENTER TOTAL WEIGHT OF ALL DONOR CHARGES (lbs)	0.00
ENTER DONOR CHARGE EXPLOSIVE TYPE	

VALUES USED IN BEM CALCULATIONS

SINGLE ITEM NEW (lbs)	10.91
ITEM DIAMETER (in)	7.977
SINGLE ITEM MAXIMUM FRAGMENT WEIGHT (lbs)	4.0270
FRAGMENT WEIGHT USED IN CALCULATIONS (lbs)	4.0270
SINGLE ITEM MAXIMUM FRAGMENT VELOCITY (ft/s)	2,122
FRAGMENT VELOCITY USED IN CALCULATIONS (ft/s)	2,122
TOTAL TNT WEIGHT USED (lbs)	9.27
WEIGHT USED IN UNDEX WEIGHT CALCULATIONS (lbs)	11.13
WEIGHT USED IN UNDEX VELOCITY CALCULATIONS (lbs)	5.76

USER INPUTS

ENTER DEPTH OF WATER (ft)	6.30
ENTER HORIZONTAL RANGE (for pressure calculation) (ft)	100

BURIED EXPLOSION MODULE OUTPUTS

UNDERWATER

NO CRATER

0

FRAGMENT EXIT VELOCITY (ft/s)	13.0	MIN. FRAGMENT LAUNCH ANGLE (°)	89.0
MAXIMUM FRAGMENT DISTANCE - HORIZONTAL (ft)	0.0		

Distance at which pressure is 0.066 psi = Blast Withdrawal Distance (buried/undex) (ft)			101.4	
Open Air Withdrawal Distance, K328 (ft)	689.1	Fragment Hazard Distance (ft)	0.0	See Note 2
		Pressure at Fragment Hazard Distance (psi)	-N/A-	See Note 3
		Pressure at Fragment Hazard Distance (dB)	-N/A-	See Note 3
		Fragment Hazard Distance = max (MFD-H, Soil Ejecta Distance)		
		Pressure at Range Entered (psi)	0.0000	See Note 4
		Pressure at Range Entered (dB)	0.0	See Note 4

Note 2: Water too deep--no fragments expected

Note 3: No overpressure is produced at this depth

Note 4: No overpressure is produced at this depth

BURIED EXPLOSION MODULE

(Version 6.3.1)

Based on DDESB Technical Paper 16 Revision 4, EARTHEX software, and NSWCDD/TR-92/196

(ENGLISH UNITS)

SELECT BURIAL MEDIUM	Water	**SELECT ITEM DESCRIPTION**	
If underwater, ignore soil type	Dry Sand		16 in Mk 14 Projectile

USER INPUTS

ENTER TOTAL NUMBER OF ITEMS	1
ENTER TOTAL WEIGHT OF ALL DONOR CHARGES (lbs)	0.00
ENTER DONOR CHARGE EXPLOSIVE TYPE	

VALUES USED IN BEM CALCULATIONS

SINGLE ITEM NEW (lbs)	153.57
ITEM DIAMETER (in)	16.000
SINGLE ITEM MAXIMUM FRAGMENT WEIGHT (lbs)	15.1260
FRAGMENT WEIGHT USED IN CALCULATIONS (lbs)	15.1260
SINGLE ITEM MAXIMUM FRAGMENT VELOCITY (ft/s)	2,083
FRAGMENT VELOCITY USED IN CALCULATIONS (ft/s)	2,083
TOTAL TNT WEIGHT USED (lbs)	130.54
WEIGHT USED IN UNDEX WEIGHT CALCULATIONS (lbs)	156.64
WEIGHT USED IN UNDEX VELOCITY CALCULATIONS (lbs)	79.63

USER INPUTS

ENTER DEPTH OF WATER (ft)	15.20
ENTER HORIZONTAL RANGE (for pressure calculation) (ft)	100

BURIED EXPLOSION MODULE OUTPUTS

UNDERWATER

NO CRATER

0

FRAGMENT EXIT VELOCITY (ft/s)	12.9	MIN. FRAGMENT LAUNCH ANGLE (°)	89.0
MAXIMUM FRAGMENT DISTANCE - HORIZONTAL (ft)	0.0		

Distance at which pressure is 0.066 psi = Blast Withdrawal Distance (buried/undex) (ft)			245.0	
Open Air Withdrawal Distance, K328 (ft)	1,663.9	Fragment Hazard Distance (ft)	0.0	See Note 2
		Pressure at Fragment Hazard Distance (psi)	-N/A-	See Note 3
		Pressure at Fragment Hazard Distance (dB)	-N/A-	See Note 3
		Fragment Hazard Distance = max (MFD-H, Soil Ejecta Distance)		
		Pressure at Range Entered (psi)	0.0000	See Note 4
		Pressure at Range Entered (dB)	0.0	See Note 4

Note 2: Water too deep--no fragments expected

Note 3: No overpressure is produced at this depth

Note 4: No overpressure is produced at this depth

BURIED EXPLOSION MODULE

(Version 6.3.3)

Based on DDESB Technical Paper 16 Revision 4, EARTHEX software, and NSWCDD/TR-92/196

(ENGLISH UNITS)

SELECT BURIAL MEDIUM	Soil	SELECT ITEM DESCRIPTION	3 in/50 HE Mk 27
SELECT SOIL TYPE	Wet Clay		

(See TP 16, Revision 4 for soil details)

USER INPUTS

ENTER TOTAL NUMBER OF ITEMS	1
ENTER TOTAL WEIGHT OF ALL DONOR CHARGES (lbs)	1.50
ENTER DONOR CHARGE EXPLOSIVE TYPE	Composition B

VALUES USED IN BEM CALCULATIONS

SINGLE ITEM NEW (lbs)	0.74
ITEM DIAMETER (in)	2.970
SINGLE ITEM MAXIMUM FRAGMENT WEIGHT (lbs)	0.2171
FRAGMENT WEIGHT USED IN CALCULATIONS (lbs)	0.2171
SINGLE ITEM MAXIMUM FRAGMENT VELOCITY (ft/s)	3,107
FRAGMENT VELOCITY USED IN CALCULATIONS (ft/s)	3,107
TOTAL TNT WEIGHT USED (lbs)	2.48

USER INPUTS

ENTER DEPTH OF BURIAL (ft)	1.10
ENTER HORIZONTAL RANGE (for pressure calculation) (ft)	100

BURIED EXPLOSION MODULE OUTPUTS

CRATER OR CAMOUFLET?

CRATER

TRUE CRATER RADIUS (ft)	3
MAXIMUM SOIL EJECTA DISTANCE (ft)	124

FRAGMENT EXIT VELOCITY (ft/s)	993.6	MIN. FRAGMENT LAUNCH ANGLE (°)	20.2
MAXIMUM FRAGMENT DISTANCE - HORIZONTAL (ft)	1,242.4		

Distance at which pressure is 0.066 psi = Blast Withdrawal Distance (buried/undex) (ft)			133.6	
Open Air Withdrawal Distance, K328 (ft)	444.0	Fragment Hazard Distance (ft)	1,242.4	
		Pressure at Fragment Hazard Distance (psi)	0.0052	See Note 3
		Pressure at Fragment Hazard Distance (dB)	125.1	See Note 3
		Fragment Hazard Distance = max (MFD-H, Soil Ejecta Distance)		
		Pressure at Range Entered (psi)	0.0910	
		Pressure at Range Entered (dB)	149.9	

Note 3: Frag Hazard Range Out of Limits -- Extrapolated - Ref. TP 16 pg 6-9

BURIED EXPLOSION MODULE

(Version 6.3.3)

Based on DDESB Technical Paper 16 Revision 4, EARTHEX software, and NSWCDD/TR-92/196

(ENGLISH UNITS)

SELECT BURIAL MEDIUM	Soil	SELECT ITEM DESCRIPTION	8 in Common Mk 14
SELECT SOIL TYPE	Wet Clay		

(See TP 16, Revision 4 for soil details)

USER INPUTS

ENTER TOTAL NUMBER OF ITEMS	1
ENTER TOTAL WEIGHT OF ALL DONOR CHARGES (lbs)	3.00
ENTER DONOR CHARGE EXPLOSIVE TYPE	Composition B

VALUES USED IN BEM CALCULATIONS

SINGLE ITEM NEW (lbs)	10.91
ITEM DIAMETER (in)	7.977
SINGLE ITEM MAXIMUM FRAGMENT WEIGHT (lbs)	4.0270
FRAGMENT WEIGHT USED IN CALCULATIONS (lbs)	4.0270
SINGLE ITEM MAXIMUM FRAGMENT VELOCITY (ft/s)	2,439
FRAGMENT VELOCITY USED IN CALCULATIONS (ft/s)	2,439
TOTAL TNT WEIGHT USED (lbs)	12.75

USER INPUTS

ENTER DEPTH OF BURIAL (ft)	5.40
ENTER HORIZONTAL RANGE (for pressure calculation) (ft)	100

BURIED EXPLOSION MODULE OUTPUTS

CRATER OR CAMOUFLET?

CRATER

TRUE CRATER RADIUS (ft)	6
MAXIMUM SOIL EJECTA DISTANCE (ft)	223

FRAGMENT EXIT VELOCITY (ft/s)	294.4	MIN. FRAGMENT LAUNCH ANGLE (°)	42.3
MAXIMUM FRAGMENT DISTANCE - HORIZONTAL (ft)	1,151.4		

Distance at which pressure is 0.066 psi = Blast Withdrawal Distance (buried/undex) (ft)			14.0	
Open Air Withdrawal Distance, K328 (ft)	766.3	Fragment Hazard Distance (ft)	1,151.4	
		Pressure at Fragment Hazard Distance (psi)	0.0004	See Note 3
		Pressure at Fragment Hazard Distance (dB)	103.6	See Note 3
		Fragment Hazard Distance = max (MFD-H, Soil Ejecta Distance)		
		Pressure at Range Entered (psi)	0.0070	See Note 4
		Pressure at Range Entered (dB)	127.7	See Note 4

Note 3: Frag Hazard Range Out of Limits -- Extrapolated - Ref. TP 16 pg 6-9

Note 4: Range Entered Out of Limits -- Extrapolated - Ref. TP 16 pg 6-9

BURIED EXPLOSION MODULE

(Version 6.3.3)

Based on DDESB Technical Paper 16 Revision 4, EARTHEX software, and NSWCDD/TR-92/196

(ENGLISH UNITS)

SELECT BURIAL MEDIUM	Soil	SELECT ITEM DESCRIPTION	16 in Mk 14 Projectile
SELECT SOIL TYPE	Wet Clay		

(See TP 16, Revision 4 for soil details)

USER INPUTS

ENTER TOTAL NUMBER OF ITEMS	1
ENTER TOTAL WEIGHT OF ALL DONOR CHARGES (lbs)	5.00
ENTER DONOR CHARGE EXPLOSIVE TYPE	Composition B

VALUES USED IN BEM CALCULATIONS

SINGLE ITEM NEW (lbs)	153.57
ITEM DIAMETER (in)	16.000
SINGLE ITEM MAXIMUM FRAGMENT WEIGHT (lbs)	15.1260
FRAGMENT WEIGHT USED IN CALCULATIONS (lbs)	15.1260
SINGLE ITEM MAXIMUM FRAGMENT VELOCITY (ft/s)	2,394
FRAGMENT VELOCITY USED IN CALCULATIONS (ft/s)	2,394
TOTAL TNT WEIGHT USED (lbs)	136.33

USER INPUTS

ENTER DEPTH OF BURIAL (ft)	9.90
ENTER HORIZONTAL RANGE (for pressure calculation) (ft)	100

BURIED EXPLOSION MODULE OUTPUTS

CRATER OR CAMOUFLET?

CRATER

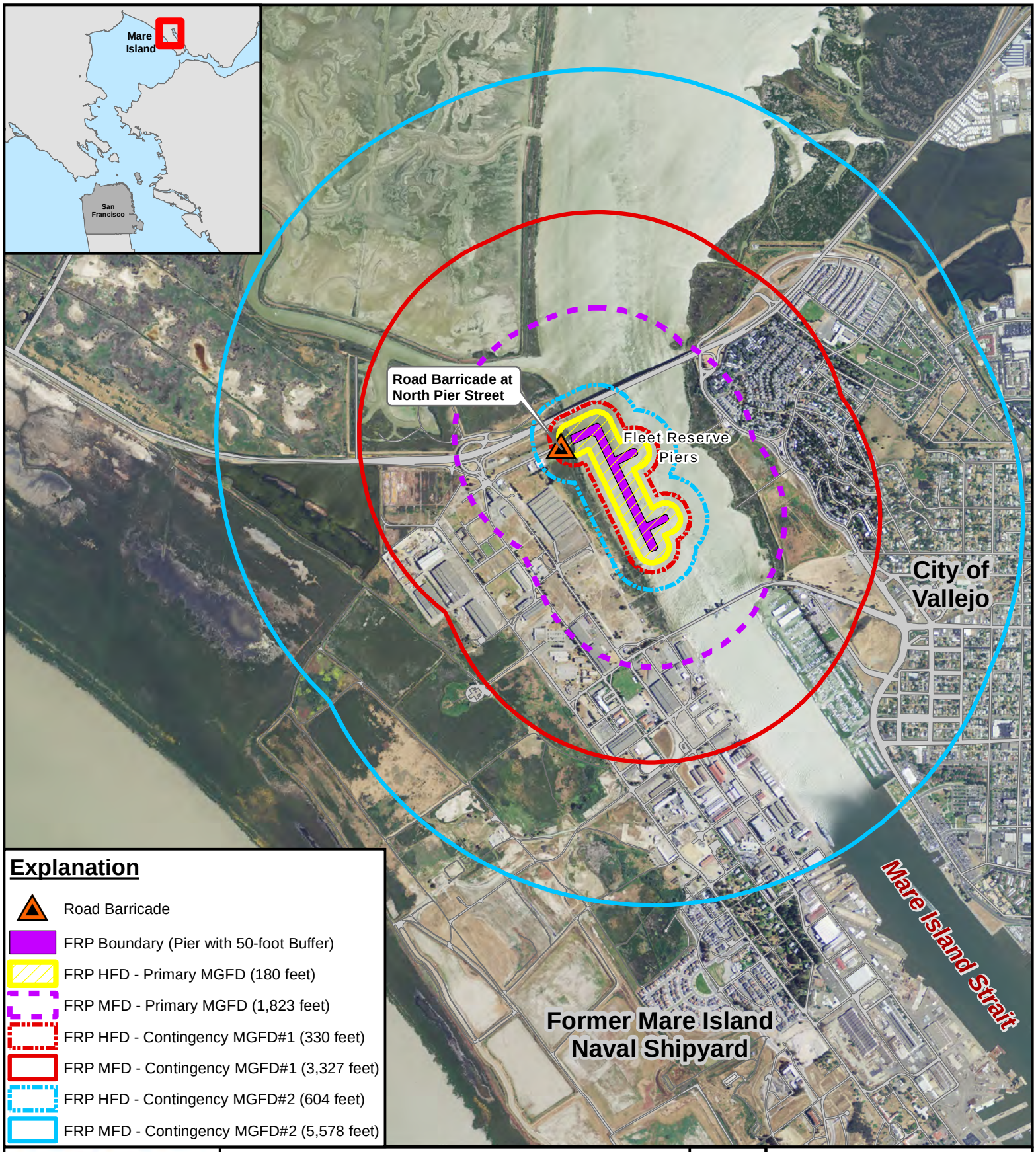
TRUE CRATER RADIUS (ft)	13
MAXIMUM SOIL EJECTA DISTANCE (ft)	440

FRAGMENT EXIT VELOCITY (ft/s)	197.8	MIN. FRAGMENT LAUNCH ANGLE (°)	37.8
MAXIMUM FRAGMENT DISTANCE - HORIZONTAL (ft)	855.3		

Distance at which pressure is 0.066 psi = Blast Withdrawal Distance (buried/undex) (ft)			63.6	
Open Air Withdrawal Distance, K328 (ft)	1,688.1	Fragment Hazard Distance (ft)	855.3	
		Pressure at Fragment Hazard Distance (psi)	0.0034	See Note 3
		Pressure at Fragment Hazard Distance (dB)	121.4	See Note 3
		Fragment Hazard Distance = max (MFD-H, Soil Ejecta Distance)		
		Pressure at Range Entered (psi)	0.0392	
		Pressure at Range Entered (dB)	142.6	

Note 3: Frag Hazard Range Out of Limits -- Extrapolated - Ref. TP 16 pg 6-9

Appendix C. ESQD Maps



SAIC

Science Applications International Corporation
221 Third Street
Newport, RI 02840
401-874-4210
www.saic-marinesciences.com

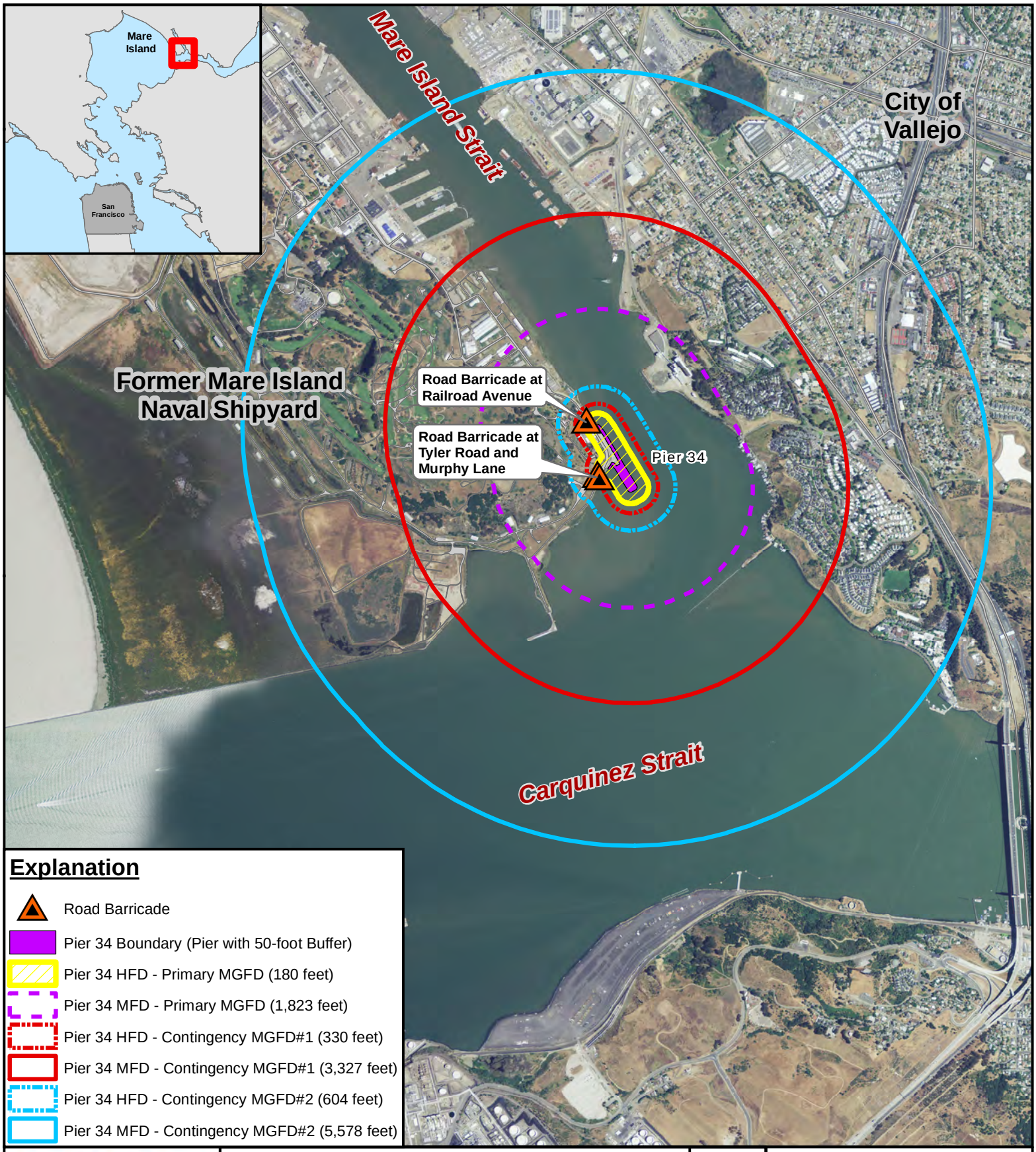
FIGURE C-1. Explosive Safety Arcs for the FRP Based on MGFDs (one item).

0 1,500 3,000 Feet

0 300 600 Meters

Notes:
Projection: CA State Plane, Zone 2
Units: Feet
Datum: NAD83
Orthophoto: NAIP 2009
Created by: C. Calabretta
Date created: July 17, 2013

File: MINS_Exclusion_Zones_FRP_v3.mxd



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221 Third Street
Newport, RI 02840
401-874-4210
www.saic-marinesciences.com

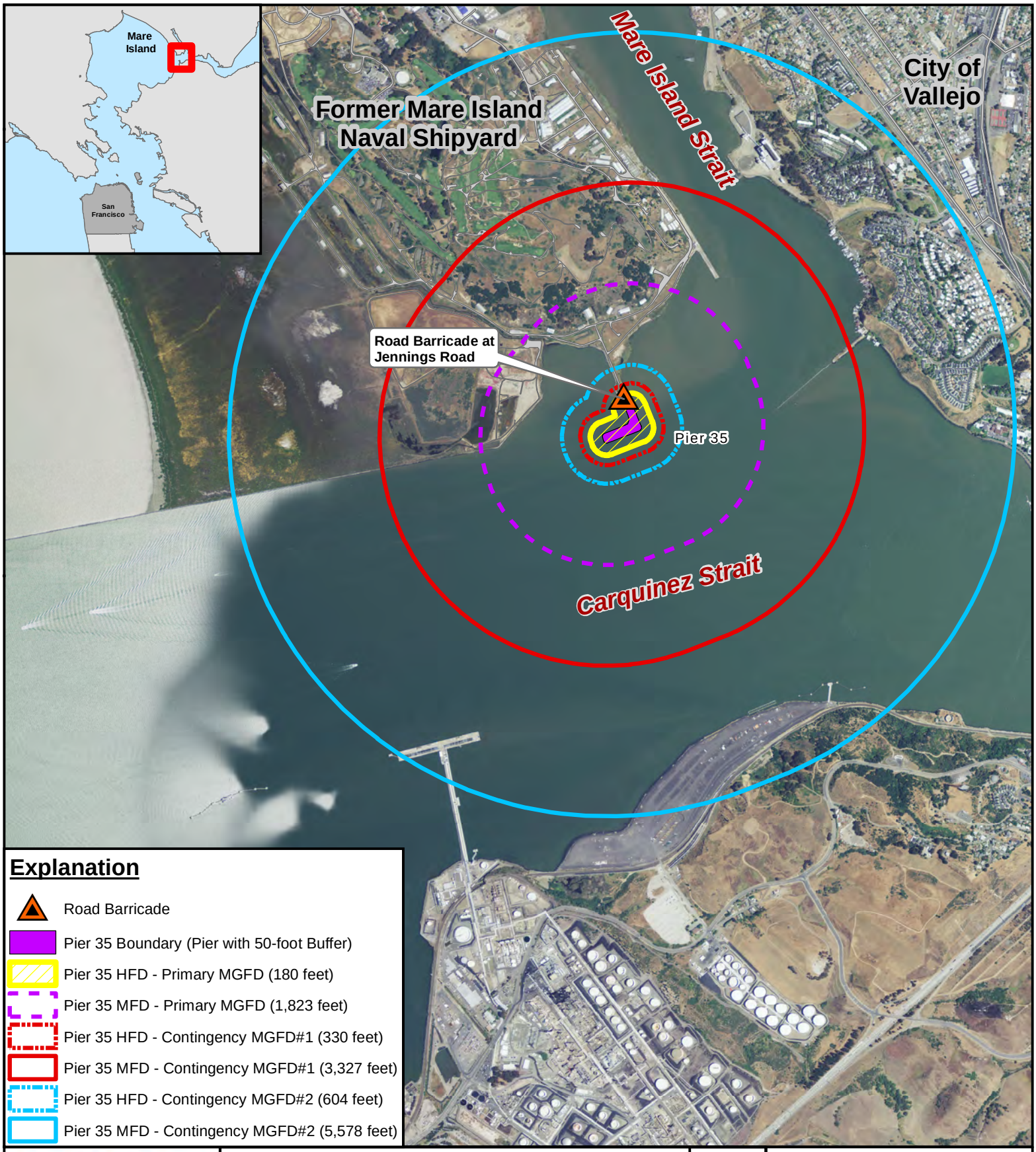
FIGURE C-2. Explosive Safety Arcs for Pier 34 Based on MGFDs (one item).

0 1,500 3,000 Feet

0 300 600 Meters

Notes:
Projection: CA State Plane, Zone 2
Units: Feet
Datum: NAD83
Orthophoto: NAIP 2009
Created by: C. Calabretta
Date created: July 17, 2013

File: MINS_Exclusion_Zones_Pier34_v3.mxd



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Newport, RI 02840
401-874-4210
www.saic-marinesciences.com

FIGURE C-3. Explosive Safety Arcs for Pier 35 Based on MGFDs (one item).

0 1,500 3,000 Feet

0 300 600 Meters

Notes:
Projection: CA State Plane, Zone 2
Units: Feet
Datum: NAD83
Orthophoto: NAIP 2009
Created by: C. Calabretta
Date created: July 17, 2013

File: MINS_Exclusion_Zones_Pier35_v3.mxd

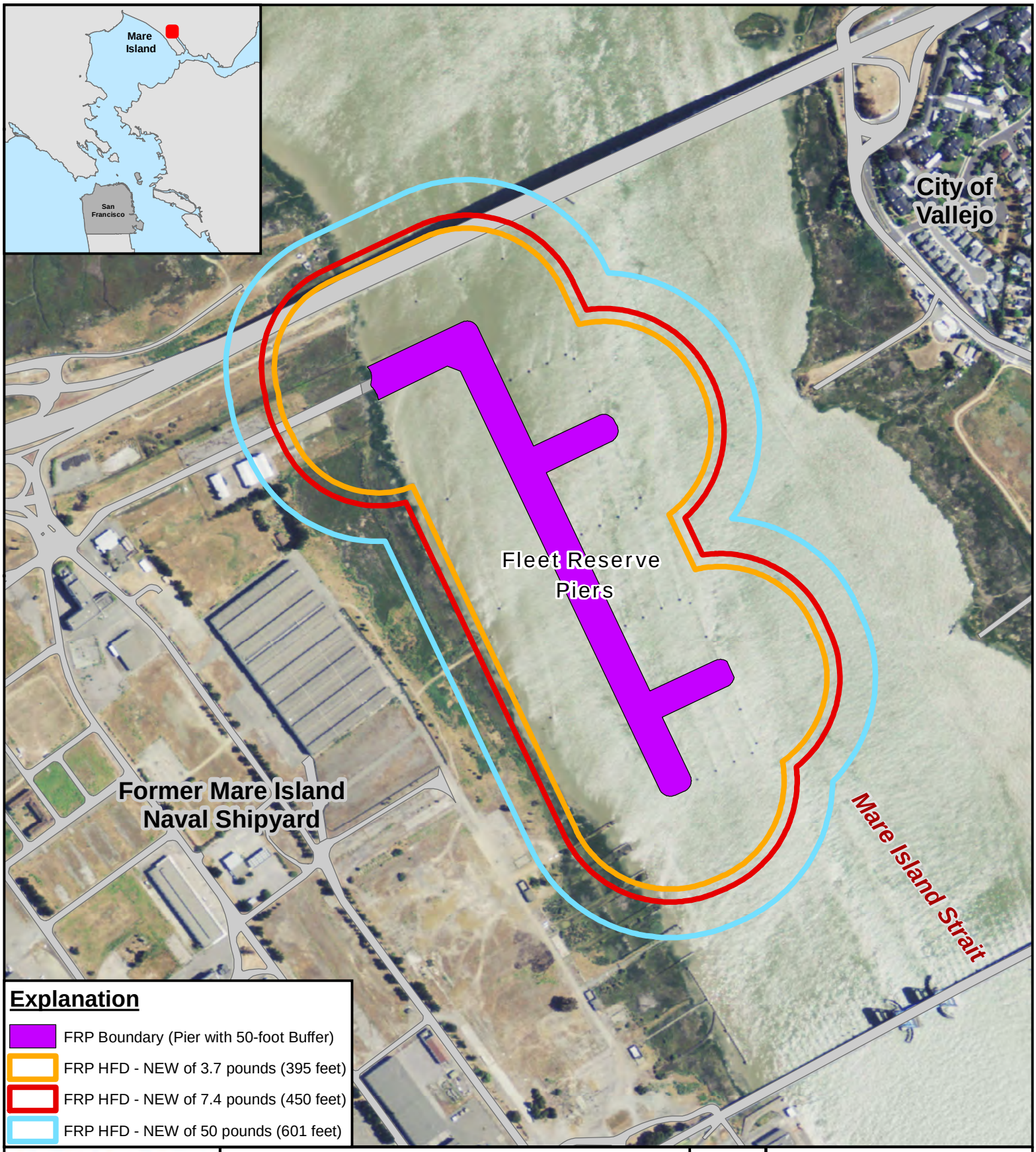

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FIGURE C-4. Explosive Safety Arcs for the FRP Based on NEW (multiple items).

0 400 800 Feet

0 100 200 Meters

Notes:
Projection: CA State Plane, Zone 2
Units: Feet
Datum: NAD83
Orthophoto: NAIP 2009
Created by: C. Calabretta
Date created: July 18, 2013

File: MINS_Exclusion_Zones_FRP_v5.mxd

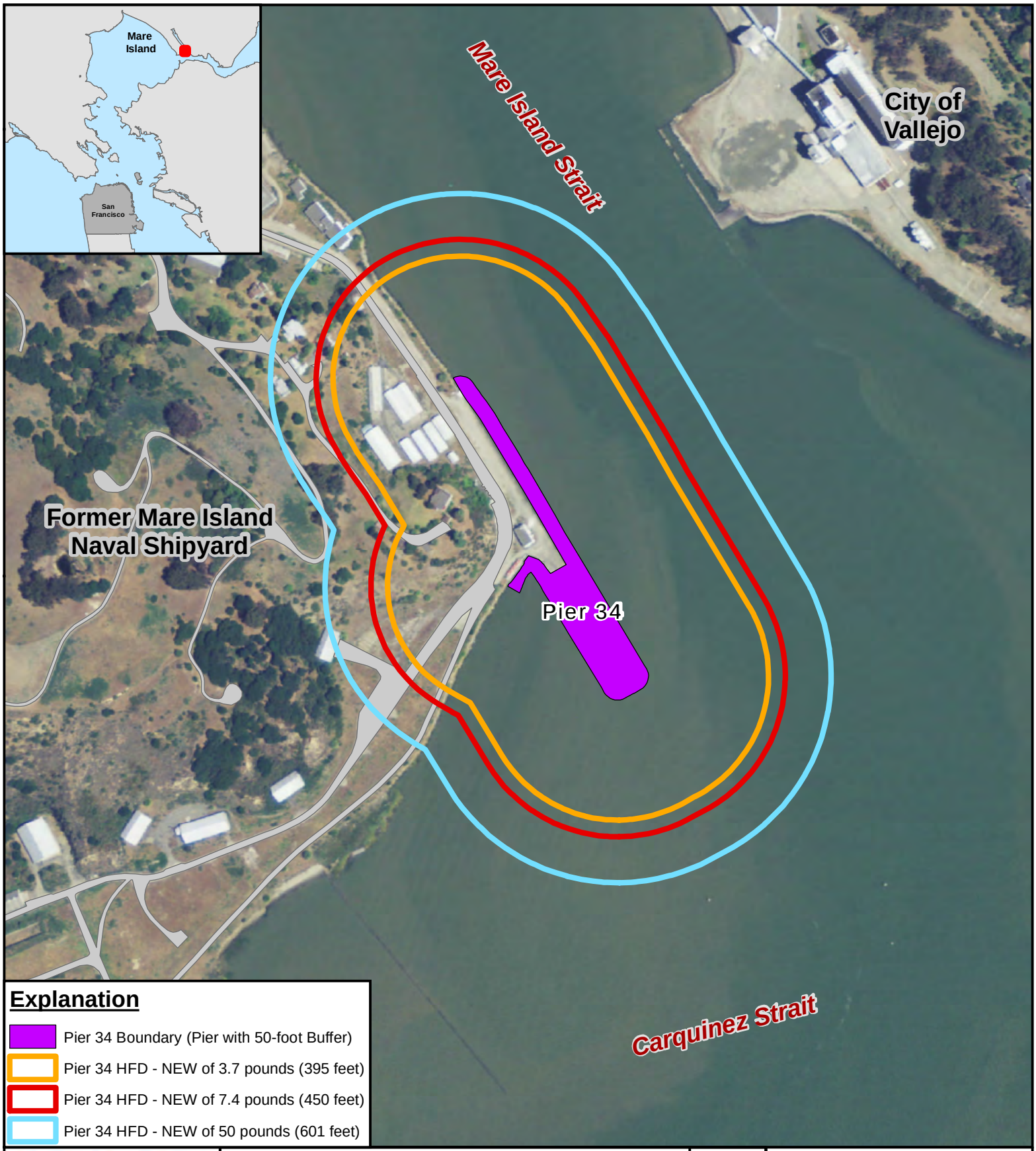

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FIGURE C-5. Explosive Safety Arcs for Pier 34 Based on NEW (multiple items).

0 300 600 Feet

0 100 200 Meters

Notes:
Projection: CA State Plane, Zone 2
Units: Feet
Datum: NAD83
Orthophoto: NAIP 2009
Created by: C. Calabretta
Date created: July 18, 2013

File: MINS_Exclusion_Zones_Pier34_v5.mxd

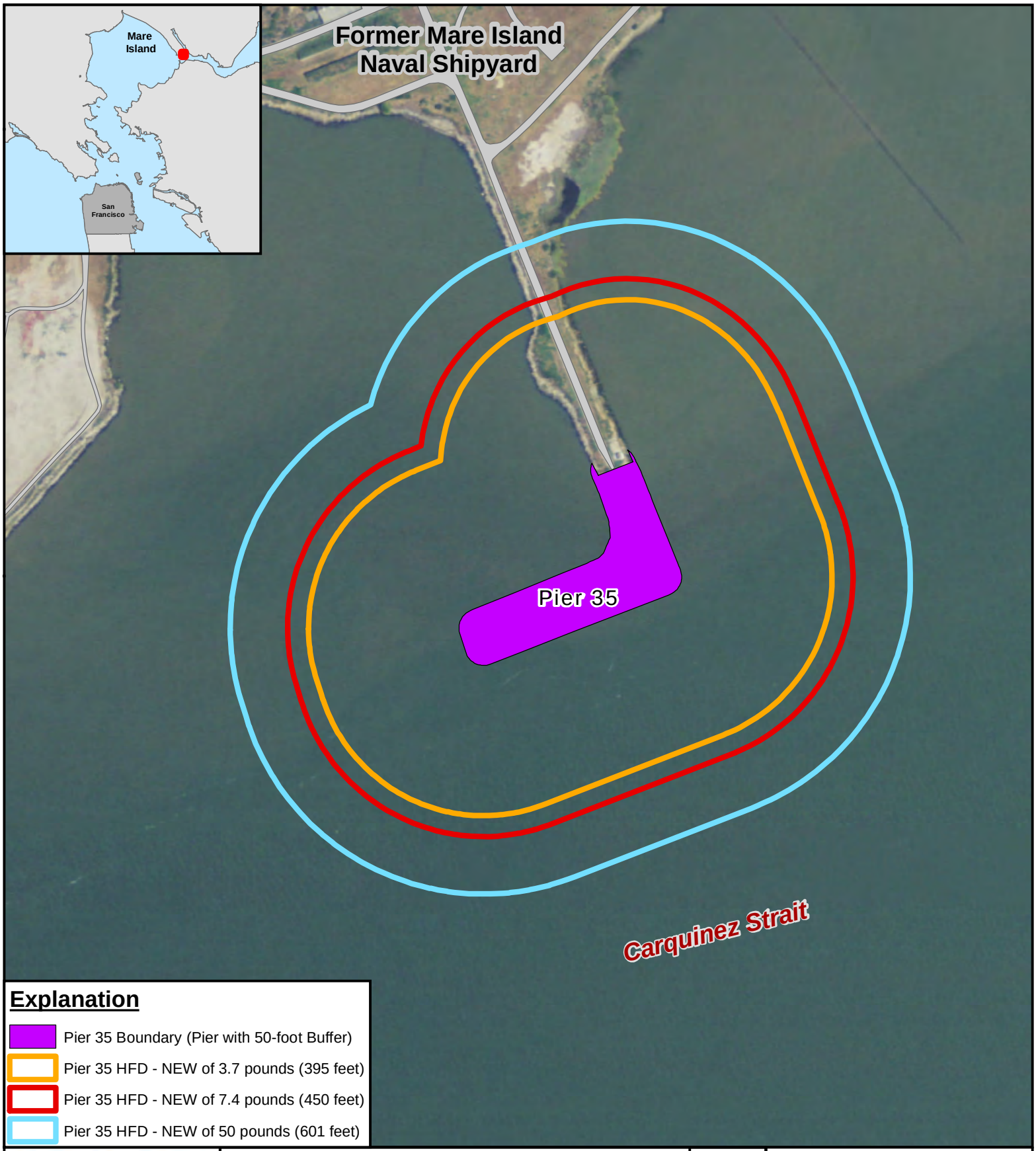

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FIGURE C-6. Explosive Safety Arcs for Pier 35 Based on NEW (multiple items).

0 250 500 Feet

0 50 100 Meters

Notes:
Projection: CA State Plane, Zone 2
Units: Feet
Datum: NAD83
Orthophoto: NAIP 2009
Created by: C. Calabretta
Date created: July 18, 2013

File: MINS_Exclusion_Zones_Pier35_v5.mxd

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Figure C-7. Magazine A-180 and Ordnance Disposal Range No. 2 with a 1,250-foot ESQD.

0 500 1,000 Feet

0 150 300 Meters

Notes:
Projection: CA State Plane, Zone 2
Units: Feet
Datum: NAD83
Orthophoto: NAIP 2009
Created by: C. Calabretta
Date created: November 12, 2012

File: MINS_A180_MDR2_EZ1250.mxd

Appendix D. Supporting Documentation

- Site Approval Change Request for Magazine A-180 – Ser N71/5590, January 29, 1997.
- Site Approval Request to Increase Net Explosive Weight for Existing Ordnance Disposal Range No. 2 – Ser 09F1JP/P1-212, October 5, 1994.
- Site Approval Request to Increase Net Explosive Weight for Existing Ordnance Disposal Range No. 2 – Ser N71/5857, November 4, 1994.
- Request for Modification to Site Approval to Allow Use of Buried Explosive Module in TP-16 – Ser N54-Je/9160, March 3, 2008.

DEPARTMENT OF THE NAVY
NAVAL ORDNANCE CENTER
PARKLAGUT HALL BOOG 0-105
23 STRAUSS AVENUE
INDIAN HEAD MD 20640-5555

8020
OPR N711
Ser N71/5590
29 Jan 97

FIRST ENDORSEMENT on SUPSHIP Portsmouth ltr 8020 Ser 120/272 of 18 Dec 96

From: Commander, Naval Ordnance Center
To: Supervisor of Shipbuilding, Conversion, and Repair, USN, Portsmouth, Director, SSPORTS Environmental Detachment, Vallejo, CA

Subj: SITE APPROVAL CHANGE REQUEST FOR MAGAZINE A-180, MARE ISLAND, VALLEJO, CALIFORNIA

1. Forwarded for continuing action.

2. This project, to reduce the explosives limit of torpedo Magazine A-180 to allow storage of C/D 1.1 explosives in support of removal of buried ordnance, has been reviewed with respect to and meets the explosives safety criteria of reference (a).

3. The new limit for Magazine A-180 is 1,000 pounds net explosives weight (NEW) C/D 1.1 material for dud-fired/unserviceable ammunition.

RICHARD T. ADAMS
By direction

Copy to:
NAVORDCEN ESSOPAC (Code 004)
ENGFLDACT West (Code 20)

REQUEST FOR PROJECT SITE APPROVAL/EXPLOSIVES SAFETY CERTIFICATION NAVFAC 11010/31 (REV. 4-87)

PART I

INSTRUCTIONS ON REVERSE AND NAVFACINST 11010.44E

SECTION A

1. To: COMMANDER, WESTERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND

2. From: COMMANDER, MARE ISLAND NAVAL SHIPYARD

3. Program Year:	4. Cost ($000):	5. Type Funding:	6. Activity UIC:	7. Date:
95	N/A	N/A	N00221	9-13-94

8. Category Code and Project Title: ORDNANCE DISPOSAL RANGE 148-20

9. Project Number: N/A

10. Type of Project:
- ☐ New Construction
- ☐ Change Use
- ☐ Addition to Existing Facility
- ☐ Major Modification to Existing Facility
- ☐ Relocation of Structure
- ☐ Maintenance and/or Repairs
- ☐ Repair By Replacement
- ☒ Other

11. Type of Request:
- ☐ Site Approval
- ☒ Explosives Safety Certification
- ☐ Resubmittal

12. Project Description:
Convert existing approved demolition training range No. 2 (Ordnance demolition) to an ordnance disposal range with a maximum NEW of 25 pounds. Existing ESQD Arc will not change.

13. 5 Sets of Project Maps Attached

14. 5 Sets Part II Division(s) A Attached

SECTION B

1. Name/Code/Phone No. of Reviewer: June Packinham, Code 09FNP, DSN 494-3767

2. Date Received: 27 SEP 94

3. Evaluation:

4. EFD Action: (check appropriate box(es))
- ☐ Site Approved
- ☐ Site Disapproved
- ☐ Returned
- ☐ Additional Data
- ☐ Requires NAVFACHQ Approval
- ☒ Explosives Safety
- ☐ Airfield Safety
- ☐ Electromagnetic Radiation Safety

5. Date Appraised/Forwarding: 9-30-94

6. Signature of Approving/Forwarding Official:

SECTION C

1. Name and Code of Reviewer:

2. Date Received:

3. Safety Review Requested: (check appropriate box(es))
☐ NAVSEA ☐ CNO ☐ DDESB ☐ SPAWAR ☐ NAVAIR ☐ OTHER

4. Date:

5. Date of Safety Certification: NAVSEA ___ CNO ___ DDESB ___ SPAWAR ___ NAVAIR ___ OTHER ___

SECTION D

1. Approvals:
- ☐ Site Approved
- ☐ Site Disapproved
- ☐ Deferred/Returned
- ☐ Explosives Safety Certification Approved
- ☐ Explosives Safety Certification DISAPPROVED
- ☐ Interim Construction Waiver Approved

2. Certification Identification:

3. Remarks:

4. Other Approvals Required:
- ☐ Airfield Safety Waiver Required
- ☐ Final Explosives Safety Review Required

5. Approving Official:

6. Date:

ENCL 1

REQUEST FOR PROJECT SITE APPROVAL/EXPLOSIVES SAFETY CERTIFICATION NAVFAC 11010/31 (REV. 4-87)

PART II DIVISION A—EXPLOSIVES SAFETY

INSTRUCTIONS ON REVERSE AND NAVFACINST 11010.44E

1. NEW/Class/Division/ESQD arcs* of project: Convert the existing site approved demolition training range (Demolition Range #2) to a disposal range with a maximum limit of 25 pounds NEW for use by Navy Explosive Ordnance Disposal personnel in support of Mare Island unexploded ordnance removal operations.

2. CNO Waivers and Exemptions: None

3. Personnel (numbers)

☐ No Change

	Proposed	Existing
Military:	0	0
Civilian:	0	0
Contractor:	0	0
Other:	0	0
Total:	0	0

4. Facility Number/Type

	Personnel	NEW	Class/Division	Distance*
Disposal Range	0	25 pounds maximum*	1.1, 1.2 (except (18) frag material), 1.3, and 1.4	1250 feet

* Actual quantities will be kept as small as possible to mitigate noise impact on surrounding communities.

5. Siting Rationale: The range will be used for the treatment, by open burning/open detonation, of recovered unexploded ordnance materials. The range is a Class D detonation site generating a 1250 foot ESQD arc per OP 5 Volume 1, Table 13-1 Note 4.

The range is exempt from Federal, State, and local permit requirements in support of on-site response actions persuant to Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Sections 300.120(c) and 300.400(e) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 CFR Part 300).

There are no IBD, PTR, or IM arc interfaces. No structures of any type are located in the immediate range area.

*Distances from project. Specify IB, (Inhabited Building); L, (Limited); IM, (Intermagazine); PTR, (Public Transportation Route); B (Barricaded); UB, (Unbarricaded)

6. Point of Contact: John Randell, Mare Island Naval Shipyard Code 106.4

7. Telephone Number: Commercial (707) 646-6430, DSN 253-6430

8. Prepared By: CDR R. J. WESTBERG, JR.

9. Date: SEP 16 1994

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, WEST
NAVAL FACILITIES ENGINEERING COMMAND
900 COMMODORE DRIVE
SAN BRUNO, CALIFORNIA 94066-2402

IN REPLY REFER TO:

11010
Ser 09F1JP/P1-212
OCT - 5 1994

From: Commanding Officer, Engineering Field Activity, West
To: Commander, Department of Defense Explosive Safety Board
Via: Commander, Naval Ordnance Center (N711)

Subj: SITE APPROVAL REQUEST TO INCREASE NET EXPLOSIVE WEIGHT FOR EXISTING ORDNANCE DISPOSAL RANGE NO. 2, NAVAL SHIPYARD, MARE ISLAND

Ref: (a) OPNAVINST 8020.8J
(b) NAVFACINST 11010.44E
(c) NAVSEA OP-5, Vol. 1 (Fifth Rev)

Encl: (1) NAVFAC Form 11010/31 (w/Part II, Div.A)
(2) Site Data Sketch dtd 27 Sep 94
(3) Station Map

1. In compliance with references (a), (b) and (c), enclosures (1) and (2) are forwarded to obtain site plan approval and final explosive safety review. Enclosure (3) is provided as additional information.

2. Site approval is requested to increase the Net Explosive Weight (NEW) of Disposal Range No. 2 from 5 pounds of Class 1.1 to 25 pounds of Class 1.1, 1.2 (except (18) frag material), 1.3, and 1.4 material. This is not a change in function nor does it increase or change the existing Explosive Safety Quantity Distance (ESQD) arc already approved for this range. The range will be used for the treatment, by open burning/open detonation, of recovered unexploded ordnance materials. The range is a Class D detonation site.

3. The existing site is compatible with related, planned, and existing facilities and land use. There is no cost associated with this project.

5. By copy of this letter, Naval Sea Support Center, Pacific is requested to comment directly to Naval Ordnance Command.

K. Y. PARSONS
By direction

Copy to:
NAVSEACENPAC (w/encls)
NAVSHIPYD Mare Island (Code 106.4) (w/encls (1) and (2))

C-861

DEPARTMENT OF THE NAVY
NAVAL ORDNANCE CENTER
FARRAGUT HALL BLDG D-323
23 STRAUSS AVENUE
INDIAN HEAD MD 20640-5555

8020
OPR N711
Ser N71/5857
4 Nov 94

FIRST ENDORSEMENT on EFA West ltr 11010 Ser 09F1JP/P1-212
of 5 Oct 94

From: Commander, Naval Ordnance Center
To: Commanding Officer, Engineering Field Activity West, Naval Facilities Engineering Command

Subj: SITE APPROVAL REQUEST TO INCREASE NET EXPLOSIVE WEIGHT FOR EXISTING ORDNANCE DISPOSAL RANGE NO. 2, NAVAL SHIPYARD, MARE ISLAND

1. Readdressed and returned for continuing action.

2. This project has been reviewed with respect to and meets the explosives safety criteria of reference (c). Accordingly, the project is granted both explosives safety site and final safety approvals. The following stipulations must be satisfied:

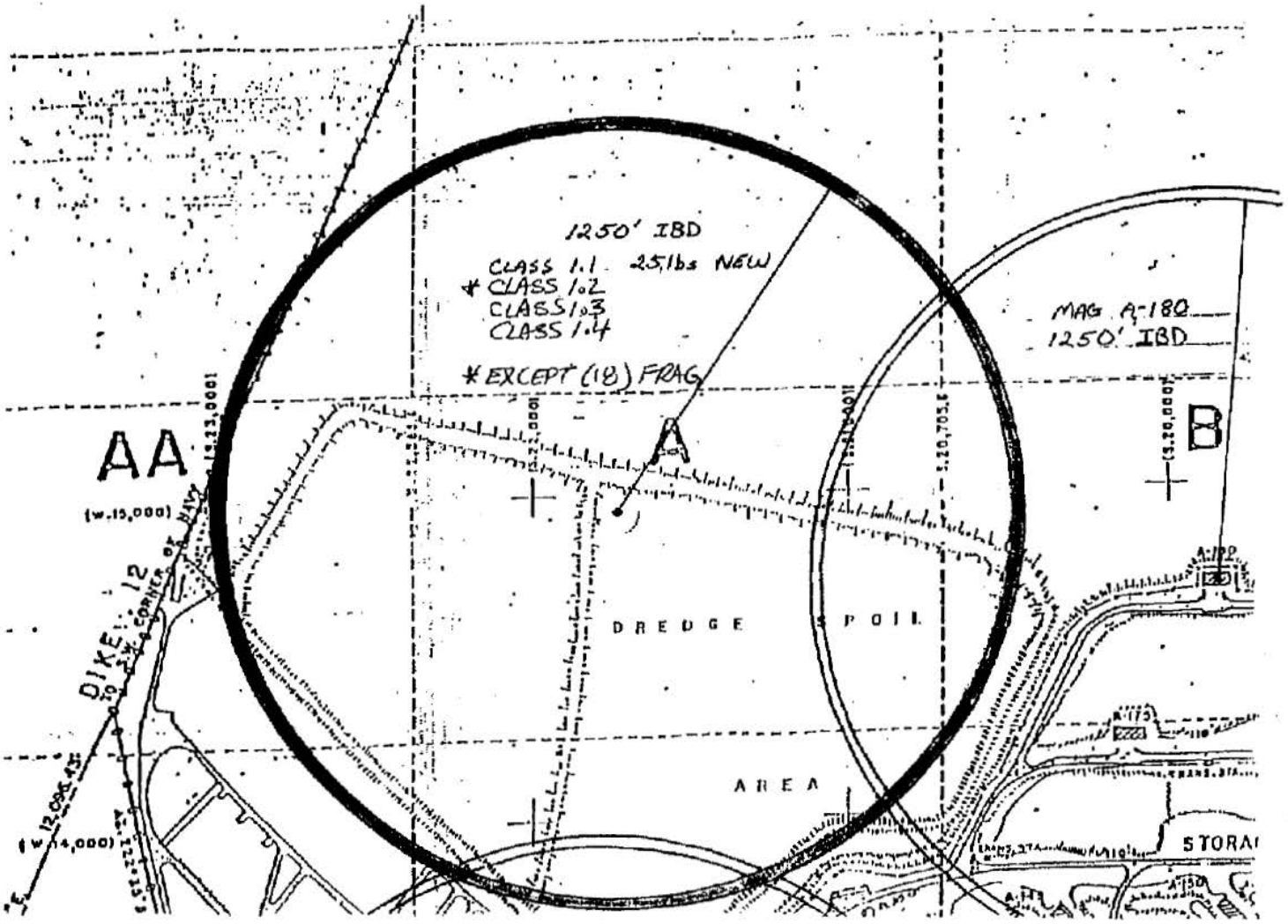
a. The revised explosive limit for Ordnance Disposal Range No. 2 is 25 pounds net explosive weight (NEW) of all classes/divisions (C/D) of explosives except C/D 1.2 (18), which may not be disposed of on the range.

b. All other provisions of existing approvals for this range remain in effect.

EDWARD W. KRATOVIL
By direction

Copy to:
NAVSEACENPAC (Code 950)
NAVSHIPYD Mare Island (Code 106.4)

C-861


1250' IBD
CLASS 1.1 25,lbs NEW
* CLASS 1.2
CLASS 1.3
CLASS 1.4
* EXCEPT (18) FRAG
MAG A-180
1250' IBD
AA
A
B
DREDGE SPOIL
AREA
DIKE 12
(W.15,000)
(W.14,000)
STORA

DEPARTMENT OF THE NAVY
NAVAL ORDNANCE SAFETY AND SECURITY ACTIVITY
FARRAGUT HALL
3817 STRAUSS AVENUE, SUITE 108
INDIAN HEAD, MD 20640-5151

8020
Ser N54-JE/9160
03 Mar 08

From: Commanding Officer, Naval Ordnance Safety and Security Activity
To: Base Realignment and Closure Program Management Office, West (BPMOW.MSB)

Subj: REQUEST FOR MODIFICATION TO SITE APPROVAL TO ALLOW USE OF BURIED EXPLOSION MODULE IN TP-16 AT FORMER NAVAL SHIPYARD, MARE ISLAND [T-138]

Ref: (a) DDESB memo DDESB-KO of 14 Jul 98

Encl: (1) DDESB memo DDESB-PE of 01 Nov 07
(2) Buried Explosion Module Printout, DDESB TP-16 dtd 24 Jul 08

1. Enclosure (1), which provides final safety approval to modify the site approval granted by reference (a), at the former Naval Shipyard (NAVSHIPYD), Mare Island, is forwarded for continuing action. The approval is based on the following conditions:

a. The current approved surface detonation limit of 25 pounds net explosives weight (NEW) of any Class/Division (C/D) material, that does not have a known fragment distance greater than 1,250 feet, remains unchanged.

b. There is an immediate need for treating a 7.2-inch Rocket (Mouse Trap), also known as a Hedgehog 7.2-inch Anti-Submarine Weapon, having a NEW of 31 pounds of C/D 1.1, with a long-term need for treating potential unknown items.

c. The use of Department of Defense Explosives Safety Board (DDESB)-approved engineering controls to mitigate blast overpressure and/or hazardous fragments resulting from intentional detonation operations of the 7.2-inch Rocket (Mousetrap) on Range 2 are authorized. Specifically, enclosure (2) requires that six feet of earth cover be applied for tamping, to reduce overpressure to 0.066 psi at 40 feet and the maximum fragment distance to 408 feet.

d. The use of enclosure (2) for items other than the 7.2-inch Rocket (Mousetrap) will require that specific information

Subj: REQUEST FOR MODIFICATION TO SITE APPROVAL TO ALLOW USE OF BURIED EXPLOSION MODULE IN TP-16 AT FORMER NAVAL SHIPYARD, MARE ISLAND [T-138]

be submitted to the Naval Ordnance Safety and Security Activity (NOSSA)/N54 for concurrence, prior to initiating the treatment plan.

e. Recovered munitions and explosives of concern (MEC), to include demolition debris, will be inspected and certified free of explosive hazards, prior to release for off-site recycling and further demilitarization.

f. An amendment to the original Explosives Safety Submission (ESS) shall be submitted to the DDESB, via NOSSA N53, to account for the discovery of the 7.2-inch rocket.

2. If changes occur during or after completion of this effort that could increase explosive hazards to site workers or the public, due to the presence of military munitions at the site, an amendment to this ESS must be submitted through NOSSA, to the DDESB, for review and approval.

3. The NOSSA point-of-contact for this project is Mr. Jim Elligson, N546, at DSN: 354-4966, at Commercial: (301) 744-4966, or at E-mail: jim.elligson@navy.mil.

Gary A. Hogue

GARY A. HOGUE
By direction

Copy to:
CNO (N411; N453)
COMNAVFACENGCOM (ENV3)
NOSSA ESSOPAC (N5P)

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22331-0600

DDESB-PE

NOV 0 1 2007

MEMORANDUM FOR COMMANDING OFFICER, NAVAL ORDNANCE SAFETY AND SECURITY ACTIVITY (ATTENTION: CODE N54)

SUBJECT: DDESB Approval of Request for Modification to Site Approval to Allow Use of Buried Explosion Module in TP-16 at Former Naval Shipyard, Mare Island [N00221/T-138]

References: (a) Naval Ordnance Safety and Security Activity (NOSSA) ltr 8020 Ser N54-TD/7292 of 14 August 2007, First Endorsement on BRAC PMO WEST ltr 5090 Ser BPMOW.MSB/0708 of 24 July 2007, Subject: Request for Modification to Site Approval to Allow Use of Buried Explosion Module in TP-16 at Former Naval Shipyard, Mare Island [N00221/T-138]

(b) DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards, 5 October 2004

(c) DDESB-KO Memorandum of 14 July 1998, Subject: Unexploded Ordnance Removal in the Dredge Spoils at the Former Mare Island Naval Shipyard

The Department of Defense Explosives Safety Board (DDESB) Staff has reviewed the subject site approval forwarded by reference (a), against the requirements of reference (b). Based on the information provided, approval is granted to modify the site approval granted by reference (c) at Former Naval Shipyard, Mare Island. This approval is based on the following:

a. The use of DDESB approved engineering controls to mitigate blast overpressure and/or hazardous fragments resulting from intentional detonation operations on Range 2 of the 7.2-inch Rocket (Mouse Trap) are authorized provided the Navy ensures; overpressure is $\leq$0.066 psi and the maximum fragment distance are contained within the authorized inhabited building distance of 1,250 feet.

b. The Navy must notify and provide the proposed engineering controls to the DDESB if weapons are recovered with a net explosive weight or a maximum fragment distance exceeding those of the 7.2-inch Rocket prior to disposal.

c. All other requirements established via reference (c) remain in effect.

ENC(1)

A copy of the complete site plan package and this approval letter must be maintained as a permanent record at the installation of origin. Master planning documents and installation drawings must be updated to reflect this site plan.

The point of contact for this action is Mr. Tony Dunay, (703) 325-3513, DSN 221-3513, E-mail address: tony.dunay@ddesb.osd.mil.

JL CHAPELLO FOR
CURTIS M. BOWLING
Chairman
DDESB

BURIED EXPLOSION MODULE

(Version 6.0)

Based on DDESB Technical Paper 16 Revision 3, EARTHEX software, and NSWCDD/TR-92/196 (ENGLISH UNITS)

SELECT BURIAL MEDIUM	Soil	SELECT ITEM DESCRIPTION	
SELECT SOIL TYPE *(See TP 16, Revision 3 for soil details)*	Dry Sandy Clay	7.2" Rocket (Mousetrap)	

	2.592
	1,993.00
	3.60
ENTER TOTAL NUMBER OF ITEMS	1
ENTER TOTAL WEIGHT OF ALL BOOSTERS (lbs)	5.00
SINGLE ITEM NEW (lbs)	31.00
SINGLE ITEM MAXIMUM FRAGMENT WEIGHT (lbs)	2.5915
FRAGMENT WEIGHT USED IN CALCULATIONS (lbs)	2.5915
SINGLE ITEM MAXIMUM FRAGMENT VELOCITY (ft/s)	8,051
FRAGMENT VELOCITY USED IN CALCULATIONS (ft/s)	8,051
TOTAL TNT WEIGHT USED (lbs)	36.00
ENTER DEPTH OF BURIAL (ft)	8.00
ENTER HORIZONTAL RANGE (for pressure calculation) (ft)	3,027

CRATER OR CAMOUFLET?
CRATER

TRUE CRATER RADIUS (ft)	8.45
MAXIMUM SOIL EJECTA RANGE (ft)	420

FRAGMENT EXIT VELOCITY (ft/s)	227.3	FRAGMENT LAUNCH ANGLE (°)	43.4
MAXIMUM FRAGMENT RANGE (ft)	1,042.4		

*Range at which pressure is 0.066 psi=	Blast Withdrawal Distance (buried/undex) (ft)*		12.3	
Open Air Withdrawal Distance, K328 (ft) 1,083.0	Fragment Hazard Range (ft)		1,042.4	
	Pressure at Fragment Hazard Range	(psi)	0.0004	****
		(dB)	103.3	
	Pressure at Range Entered	(psi)	0.0001	***
		(dB)	92.8	

***Range entered out of limits--extrapolated
****Hazard range out of limits--extrapolated