Public Summary: **Draft Record of Decision for Parcel G, Hunters Point Shipyard, San Francisco, California, August 29, 2008**

The Department of Navy (Navy) has prepared this draft record of decision (ROD) to address remaining contamination at Parcel G at Hunters Point Shipyard in San Francisco, California. The remedial action selected in this ROD is necessary to protect the public health, welfare, and the environment from actual or potential releases of contaminants from the site. The selected remedial action for Parcel G addresses metals (arsenic, lead, and manganese) and polycyclic aromatic hydrocarbons (PAH) in soil, volatile organic compound (VOC) vapors and several metals (chromium VI and nickel) from groundwater in the A-aquifer, and radionuclides in structures (such as buildings) and in soil.

The Navy considered the following remedial alternatives for contaminants in soil: (1) no action; (2) institutional controls (IC) and maintained landscaping; (3) ICs, limited excavation and off-site disposal; (4) ICs and covers; and (5) a combination of ICs, covers, excavation and disposal. The Navy considered the following remedial alternatives for contaminants in groundwater: (1) no action; (2) long-term monitoring and ICs; (3) *in situ* treatment of VOCs using biological compounds or zero-valent iron, monitoring and ICs; and (4) *in situ* treatment of VOCs and metals using biological compounds or zero-valent iron, monitoring and ICs. The Navy considered the following remedial alternatives for radiologically impacted soil or structures: (1) no action; and (2) surveying radiologically impacted areas that may include structures and former building sites, decontaminating (and demolishing if necessary) buildings, excavating storm drain and sanitary sewer lines and soils in impacted areas, and screening, separating, and disposing of radioactive sources and contaminated excavated soil at an off-site low-level radioactive waste facility. The Selected Remedy for Parcel G is Alternative S-5 (excavation, disposal, covers, and ICs) for soil; Alternative GW-4A&B (treatment, monitoring, and ICs) for groundwater; and Alternative R-2 (survey, decontamination, excavation, disposal, and release) for radiologically impacted structures and soil.

Information Repositories: A complete copy of the "Draft Record of Decision for Parcel G" dated August 29, 2008, is available to community members at:

San Francisco Main Library
100 Larkin Street
Government Information Center, 5th Floor
San Francisco, CA 94102
Phone: (415) 557-4500

Anna E. Waden Bayview Library
5075 Third Street
San Francisco, CA 94124
Phone: (415) 715-4100

The report is also available to community members on request to the Navy. For more information about environmental investigation and cleanup at Hunters Point Shipyard, contact Sarah Koppel, remedial project manager for the Navy, at:

Sarah Koppel
Department of the Navy
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, CA 92108-4310
Phone: (619) 532-0962
Fax: (619) 532-0995
E-mail: sarah.koppel@navy.mil

Draft

Record of Decision for Parcel G

Hunters Point Shipyard
San Francisco, California

August 29, 2008

Prepared by:
Department of the Navy
Base Realignment and Closure
Program Management Office West
San Diego, California

Prepared under:
Naval Facilities Engineering Command
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Contract Task Order 030

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ACRONYMS AND ABBREVIATIONS

§	Section
µg/L	Microgram per liter
ARAR	Applicable or relevant and appropriate requirement
ARIC	Area requiring institutional controls
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
COC	Chemical of concern
CSM	Conceptual site model
dpm	dose per minute
DTSC	Department of Toxic Substances Control
ELCR	Excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
FS	Feasibility study
GRA	General response action
HHRA	Human health risk assessment
HI	Hazard index
HPS	Hunters Point Shipyard
IC	Institutional control
LUC RD	Land use control remedial design
mg/kg	milligram per kilogram
NPL	National Priorities List
NRDL	Naval Radiological Defense Laboratory
O&M	Operation and maintenance
pCi/g	Picocuries per gram
PA	Preliminary assessment
PAH	Polycyclic aromatic hydrocarbon
PCE	Tetrachloroethene

RAB	Restoration Advisory Board
RAO	Remedial action objectives
RD	Remedial design
RI	Remedial investigation
RME	Reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SI	Site Inspection
SVE	Soil vapor extraction
TCE	Trichloroethene
TCRA	Time-critical removal action
TRC	Technical review committee
VOC	Volatile organic compound
Water Board	San Francisco Bay Regional Water Quality Control Board
ZVI	Zero-valent iron

1. DECLARATION

This Record of Decision (ROD) presents the Selected Remedy for Parcel G at Hunters Point Shipyard (HPS) in San Francisco, California. HPS was placed on the National Priorities List (NPL) in 1989 (U.S. Environmental Protection Agency [EPA] ID: CA71170090087). The remedy was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 (Title 42 *United States Code* Section 9601, et seq.), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Title 40 *Code of Federal Regulations* Part 300). This decision is based on information contained in the Administrative Record for the site. (A link to a site-specific Administrative Record Index will be provided in the draft final ROD.) Information not specifically summarized in this ROD or its references but contained in the Administrative Record[1] has been considered and is relevant to the selection of the remedy at Parcel G. Thus, the ROD is based on and relies on the entire Administrative Record file in making the decision.

The Department of the Navy, EPA, and the California Environmental Protection Agency's Department of Toxic Substances Control (DTSC) and the San Francisco Bay Regional Water Quality Control Board (Water Board) jointly selected the remedy for Parcel G. The Navy provides funding for site cleanups at HPS. The Federal Facility Agreement (FFA) for HPS documents how the Navy intends to meet and implement CERCLA in partnership with EPA, DTSC, and the Water Board.

Parcel D is one of six parcels (Parcels A through F) originally designated for environmental restoration. The Navy has divided the former Parcel D into four new parcels: Parcel G, Parcel D-1, Parcel D-2, and Parcel UC-1. Although previous documents focused on the overall Parcel D, referenced information from these documents are also relevant for Parcel G. Long-term uses in specified areas within Parcel G include educational/cultural use, mixed use, open space, and industrial reuse. Environmental investigations began at Parcel D, including Parcel G, in 1988. A Final Remedial Investigation (RI) Report was completed in 1997, and a Revised Final Feasibility Study (FS) Report was completed in 2007. This ROD documents the final remedial action for Parcel G and does not include or affect any other sites at the facility.

[1] **Bold blue text** identifies detailed site information available in the Administrative Record and listed in the References Table (Attachment D). This ROD is also available on CD whereby **bold blue text** serves as a hyperlink to reference information. The excerpts referenced by the hyperlinks are part of the ROD.

1.1 SELECTED REMEDY

The CERCLA remedial action selected in this ROD is necessary to protect the public health, welfare, and the environment from actual or potential releases of contaminants from the site. The selected remedial action for Parcel G addresses metals (arsenic, lead, and manganese) and polycyclic aromatic hydrocarbons (PAHs) in soil, volatile organic compound (VOC) vapors and several metals (chromium VI and nickel) from groundwater in the A-aquifer, and radionuclides in structures (such as buildings) and in soil. The remedy consists of excavation and off-site disposal, durable covers, and institutional controls (ICs) to address soil contamination; treatment of VOCs with biological substrate or zero-valent iron (ZVI), groundwater monitoring, and ICs to address groundwater contamination; and surveying, decontaminating, and removing radiologically impacted structures and soil.

The selected remedial action is protective of human health and the environment, complies with federal and state statutes and regulations that are applicable or relevant and appropriate to the remedial action, and is cost-effective. The selected remedial action uses permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable and satisfies the statutory preference for remedies employing treatment that reduces the toxicity, mobility, or volume of hazardous substances, pollutants or contaminants as a principal element. A statutory review will be conducted within 5 years after the initiation of remedial action to ensure that the remedy is protective of human health and the environment.

1.2 DATA CERTIFICATION CHECKLIST

The following information is included in Section 2 of this Record of Decision. Additional information can be found in the Administrative Record file for this site:

- Chemicals of concern (COC) and their concentrations (Sections 2.3 and 2.5).
- Baseline risk represented by the COCs (Section 2.5).
- Remediation goals established for COCs and the basis for these goals (Sections 2.5 and 2.7).
- Principle threat wastes (Section 2.6).
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater (Section 2.4).
- Potential land and groundwater use that will be available at the site as a result of the selected remedy (Section 2.9.3).

- Estimated capital costs, annual operation and maintenance (O&M), and total present-worth costs; discount rate; and the number of years over which the remedy cost estimate is projected (Table 6).

- Key factors that led to selecting the remedy (for example, a description of how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision) (Section 2.9.1).

If contamination posing an unacceptable risk to human health or the environment is discovered after execution of this ROD, the Navy will undertake all necessary actions to ensure continued protection of human health and the environment.

1.3 AUTHORIZING SIGNATURES

Base Realignment and Closure Environmental Coordinator Base Realignment and Closure Program Management Office West Department of the Navy	Date

EPA, DTSC, and the Water Board concur:

Chief, Superfund Federal Facility and Site Cleanup Branch U.S. Environmental Protection Agency	Date
Chief, Northern California Operations, Office of Military Facilities California Environmental Protection Agency Department of Toxic Substances Control	Date
Executive Officer California Environmental Protection Agency San Francisco Bay Regional Water Quality Control Board	Date

2. DECISION SUMMARY

2.1 SITE DESCRIPTION AND HISTORY

HPS is located in southeastern San Francisco on a peninsula that extends east into San Francisco Bay (see Figure 1). HPS consists of 866 acres: 420 acres on land and 446 acres under water in the San Francisco Bay. In 1940, the Navy obtained ownership of HPS for shipbuilding, repair, and maintenance activities. After World War II, activities at HPS shifted to submarine maintenance and repair. HPS was also the site of the Naval Radiological Defense Laboratory (NRDL). HPS was deactivated in 1974 and remained relatively unused until 1976. Between 1976 and 1986, the Navy leased most of HPS to Triple A Machine Shop, Inc., a private ship repair company. In 1987, the Navy resumed occupancy of HPS.

Because past shipyard operations left hazardous substances on site, HPS property was placed on the National Priorities List in 1989 pursuant to the CERCLA as amended by the SARA. In 1991, HPS was designated for closure pursuant to the Defense Base Closure and Realignment Act of 1990. Closure activities at HPS involve conducting environmental remediation and making the property available for nondefense use.

Parcel D, which includes about 98 acres in the central portion of the shipyard (see Figure 1), was formerly part of the industrial support area and was used for shipping, ship repair, and office and commercial activities. The docks at Parcel D were formerly part of the industrial production area. Portions of Parcel D were also used by NRDL.

Parcel G(1) is located within the central portion of the former 98-acre Parcel D; the rest of former Parcel D is divided into Parcel D-2, Parcel UC-1, and Parcel D-1 (the remainder of Parcel D) (see Figure 2). This division supports the potential early transfer of Parcel G to the City and County of San Francisco.

The original redevelopment plan developed by the San Francisco Redevelopment Agency divided Parcel G into redevelopment blocks, each with its own reuse. The expected long-term uses in the redevelopment plan included educational/cultural, mixed uses, open space, industrial, and industrial reuse. Parcel G includes the following redevelopment blocks: 29, 30A, 30B, 37, 38, 39, and DOS-1. Figures 3 and 4 present the redevelopment blocks and the associated **Installation Restoration (IR) sites**(2) and planned reuse for areas that are within Parcel G.

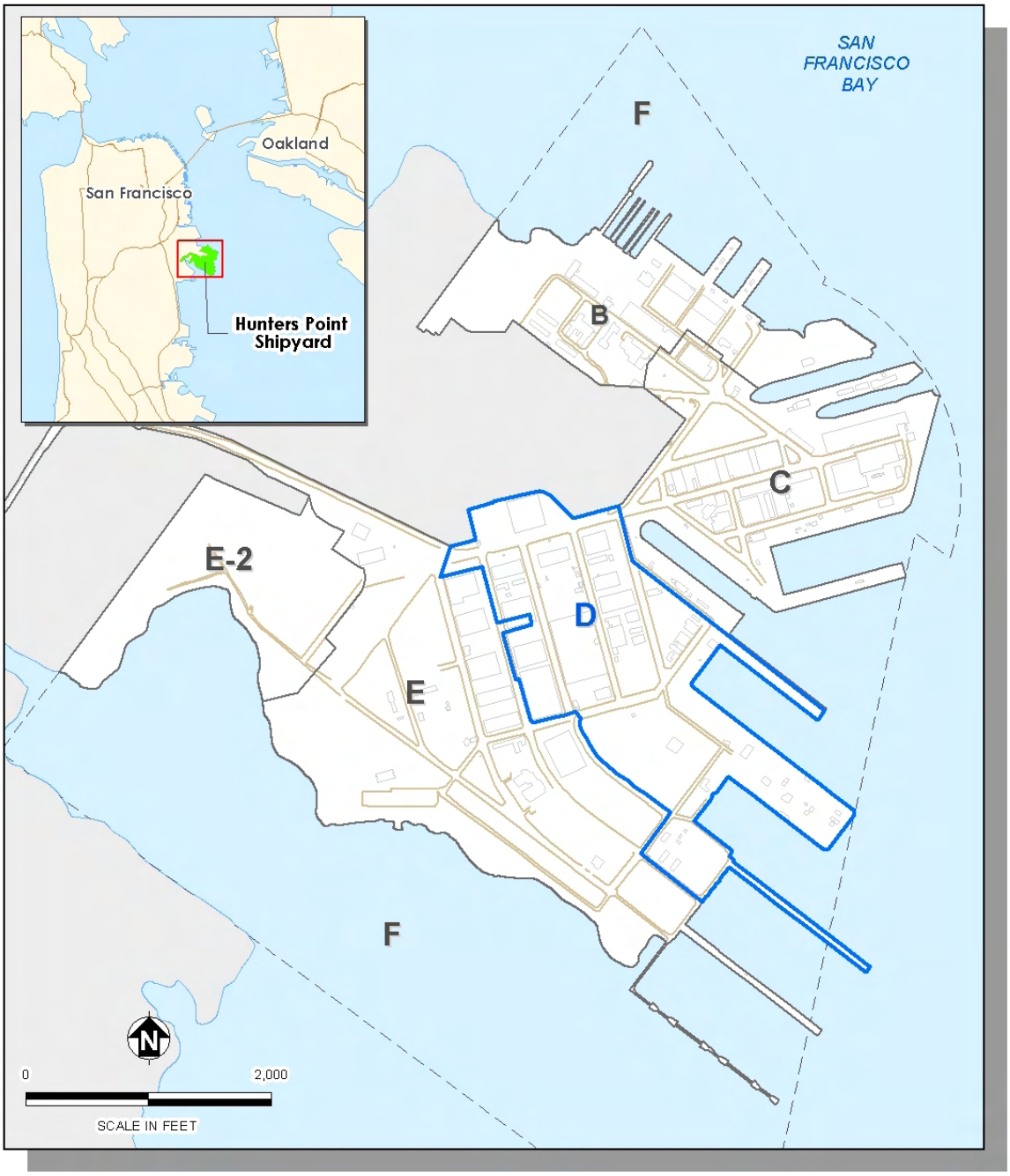

Figure 1. Facility Location Map

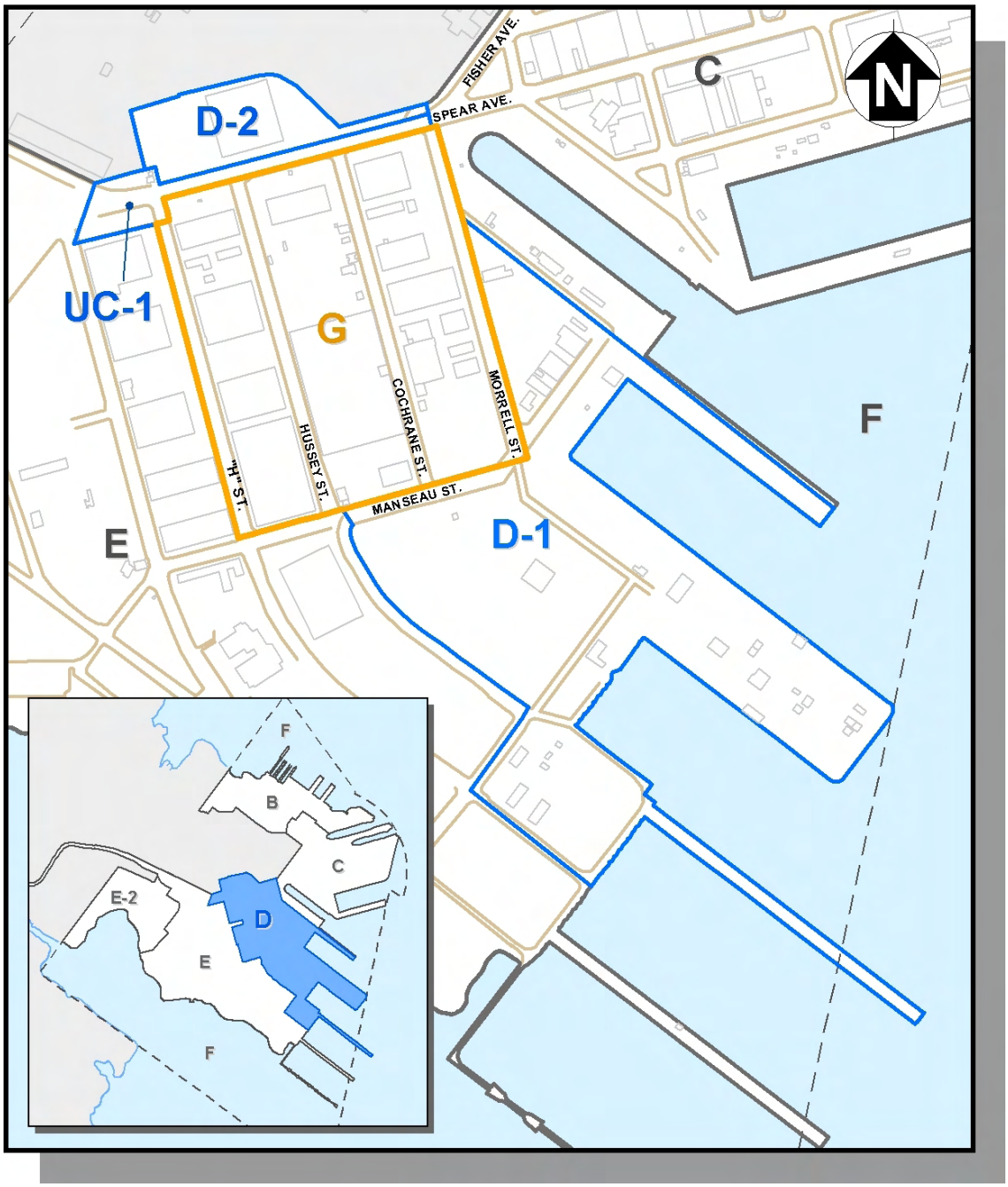

Figure 2. Parcel G Location Map

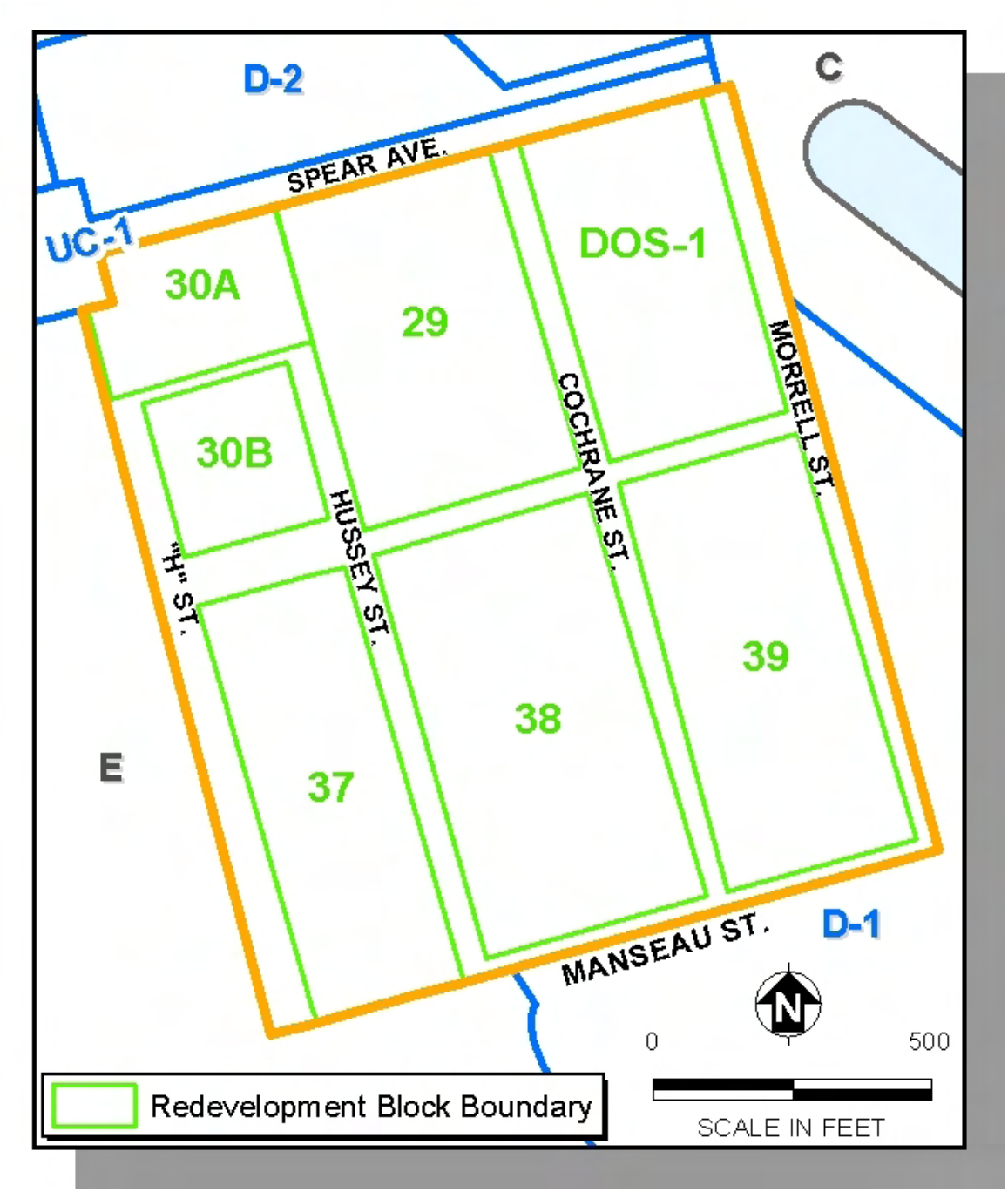

Figure 3. Redevelopment Blocks

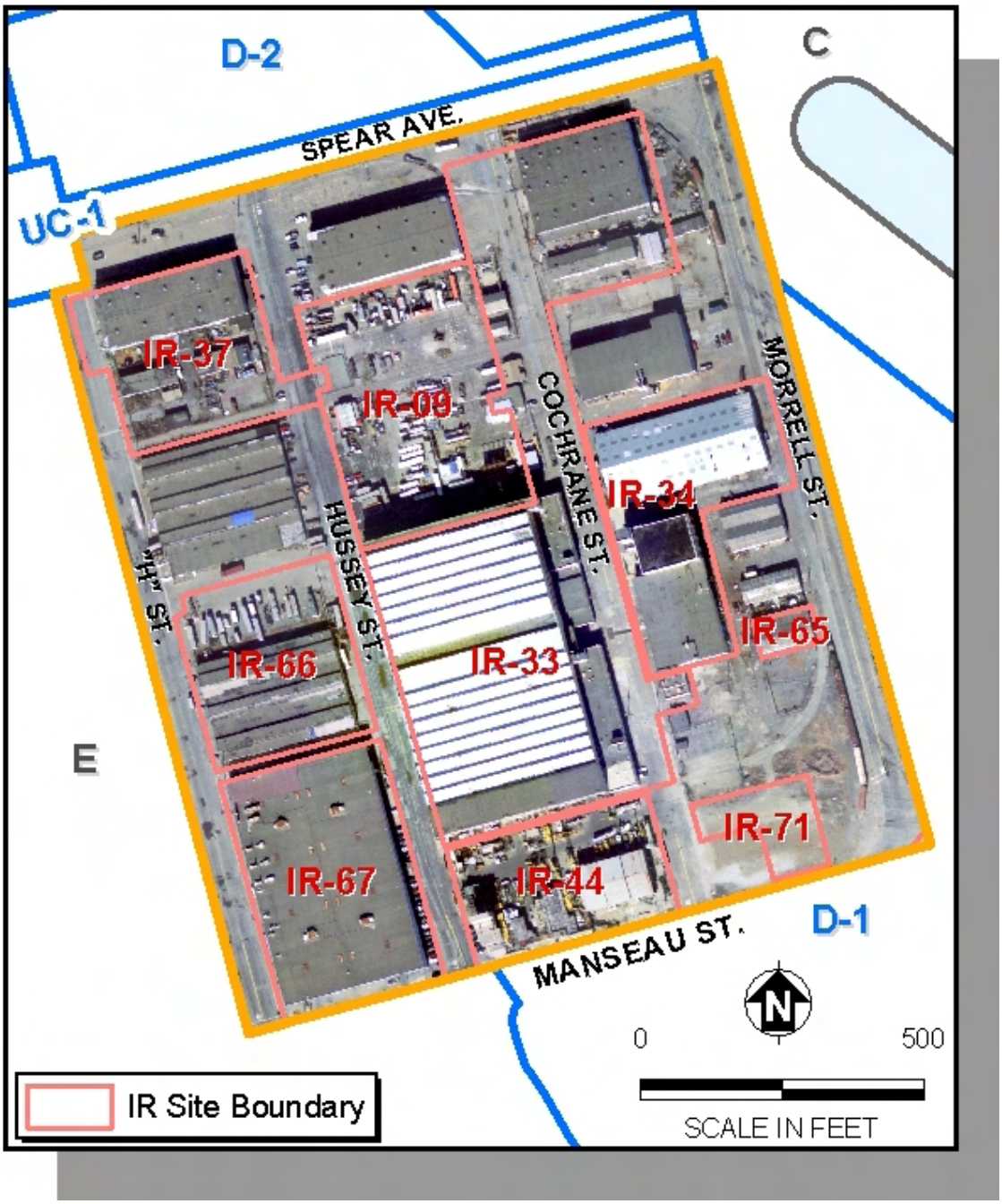

Figure 4. IR Sites

2.2 SITE CHARACTERISTICS

Parcel G consists of flat lowlands that were constructed by placing borrowed fill material from various sources, including serpentinite bedrock from the shipyard, construction- and demolition-derived fill, and dredged sediments with surface elevations between 0 to 10 feet above mean sea level. The serpentinite bedrock and serpentine bedrock-derived fill material consist of minerals that naturally contain asbestos and relatively high concentrations of arsenic, manganese, nickel, and other metals.

The **hydrostratigraphic units**(3) present at Parcel G are the same as at Parcel D: the A-aquifer, the aquitard zone, the B-aquifer, and a bedrock water-bearing zone. Groundwater beneath Parcel G includes the shallow A-aquifer and the deeper B-aquifer; groundwater is not currently used for any purpose at Parcel G. Groundwater in the A-aquifer is not suitable as a potential source of drinking water. Groundwater in the B-aquifer has a low potential as a future source of drinking water.

Groundwater flow patterns at Parcel G are complex because they are affected by (1) a groundwater sink located in adjacent Parcel E; (2) a groundwater mound located near the western boundary of Parcel G (beneath IR-33, IR-44, IR-66, and IR-67); (3) leaks of groundwater into former sanitary sewers or storm drains; (4) recharge from water supply lines; and (5) tides in the Bay. Most groundwater at Parcel G flows toward the Bay, except in the western portion of Parcel G, which historically has flowed away from the mound and toward the groundwater sink in Parcel E, where groundwater elevations are below mean sea level. The sink is believed to have been caused by leaks of groundwater into sanitary sewer lines, which were then pumped off site to the local publicly owned treatment works, thereby lowering groundwater levels in the area. Flow patterns continue to change now that the pumping has been discontinued and as sewer and storm drain lines are removed throughout HPS.

Parcel G ecology(4) is limited to those plant and animal species adapted to the industrial environment. Viable terrestrial habitat is inhibited at Parcel G because nearly all of the ground surface is paved or covered by structures. No threatened or endangered species are known to inhabit Parcel G or its immediate vicinity.

Nearly all of Parcel G is covered with buildings or pavement. A series of storm drains and sanitary sewer lines beneath the parcel have been recently removed. Figure 5 shows these site characteristics for Parcel G.

2.3 PREVIOUS INVESTIGATIONS

The sources of potential contamination at Parcel G are from metals and PAHs in soil, metals and VOCs in groundwater, and radiologically impacted structures and soil. Assessment of contamination and risk for Parcel G is based on the Final Revised FS Report for Parcel D, (November 30, 2007) including the revised human health risk assessment (HHRA), and the radiological addendum to the FS Report. The Revised FS Report for Parcel D considered new information associated with several cleanup actions completed within Parcel G and at other

Figure 5. Parcel G Site Features

adjacent parcels at HPS. Both the FS and HHRA activities are detailed in the Final Revised FS Report for Parcel D. The FS Report and radiological addendum (April 11, 2008) summarize the most recent information available on former Parcel D and provide the basis for the RODs for Parcel G and the other three parcels. Table 1 summarizes the previous studies, investigations, and removal actions conducted at Parcel D, including the area identified as Parcel G.

Table 1. Previous Investigations and Removal Actions

Previous Investigation/ Removal Action*	Date	Investigation/Removal Action Activities
Investigations and Studies		
Preliminary Assessment (PA)	1990	The PA for Parcel D involved record searches, interviews, and limited field investigations. The PA report concluded that portions of Parcel D, including areas within the new Parcel G, warranted further investigation because of the potential for contamination of soil and groundwater from past site activities.
Site Inspection (SI)	1994	Evaluated whether contamination was present and whether a release to the environment had occurred, evaluated each site for inclusion in the Navy's IR program, and eliminated sites that posed no significant threats to public health or the environment. Based on the results of the SI, all 12 sites within Parcel D, including utilities, were recommended for inclusion in RI activities.
Remedial Investigation	1988-1997	Site conditions were assessed through literature searches; interviews with former on-site employees; geophysical, radiological, and aerial map surveys; installation of soil borings and monitoring wells; and aquifer testing. The following **samples(5)** were collected: 418 surface soil, 1,938 subsurface soil, 429 A-aquifer groundwater samples, 9 B-aquifer groundwater samples, 7 bedrock water-bearing zone groundwater samples, 185 HydroPunch groundwater samples, 77 water and sediment samples (from utility lines, sumps, and floor drains), 8 sandblast samples, 1 asbestos sample, 29 test pit samples, 2 floor scrap samples, and 2 underground storage tank samples. Samples were analyzed for one or a combination of the following chemicals: metals, VOCs, semivolatile organic compounds, pesticides and polychlorinated biphenyls, and petroleum-related products. Based on the RI results, all of Parcel D (except for IR-48 and IR-66) was recommended for further evaluation in an FS.
Feasibility Study	1996-1997	Results and analyses in the RI Report were used to identify, screen, and evaluate remedial alternatives and to define areas for proposed remedial action. Three different cleanup scenarios and associated cleanup goals were considered: cleanup to the industrial land use scenario (10^{-5} excess lifetime cancer risk [ELCR]); cleanup to the industrial land use scenario (10^{-6} ELCR); and cleanup to the residential land use scenario (10^{-6} ELCR). Each scenario also considered cleanup of soils representing a hazard index (HI) greater than 1 and lead concentrations greater than 1,000 milligrams per kilogram (mg/kg). Areas exceeding different cleanup goals for each reuse scenario and cleanup level were delineated, risk drivers were identified, and the extent of the cleanup areas were defined. Twenty IR sites had soil cleanup areas for industrial use (9 IR sites in Parcel G), and 23 IR sites had soil cleanup areas for residential use (9 sites in Parcel G). All soil cleanup areas exceeding at least one of the various cleanup criteria under each reuse scenario were identified.

Table 1. Previous Investigations and Removal Actions (Continued)

Previous Investigation/ Removal Action*	Date	Investigation/Removal Action Activities
Investigations and Studies (Continued)		
Proposed Plan/Record of Decision	1997	The Proposed Plan invited the public to review and comment on the Preferred Alternative for addressing environmental contamination at Parcel D prior to the final remedy selection. The Draft ROD presented the following Selected Remedy: excavation and off-site disposal of soils based on the cleanup goals described in the proposed plan. Subsequent to the submittal of the draft ROD, the costs and environmental improvements associated with the selected soil remedy for Parcel D were reviewed by the Navy. Navy concerns about the level of risk reduction, cost effectiveness of the cleanup approach, and discussions with other members of the Base Realignment and Closure Cleanup Team resulted in further review of risk.
Risk Management Review (RMR) Process	1999	The RMR process was developed and conducted during a series of meetings held by the Navy and the regulatory agencies from January through April 1999. The process used various criteria and decision rules to reevaluate whether remedial actions were required at 19 of the 27 IR sites in Parcel D that were originally identified as requiring remedial actions for soil. After completion of the review, all sites fell into one of the following three categories: (1) sites that the team agreed no response action was required, (2) sites that the team agreed response action was required, and (3) sites that the team did not yet agree on the course of action. Based on the **RMR results**[6], the sites and chemicals requiring further evaluation and remedial action were revised.
Groundwater Data Gaps Investigation	2002	A data gaps investigation was completed to provide additional understanding of the groundwater conditions underlying the parcel. Groundwater samples were collected and analyzed for various chemicals (including metals and VOCs), and results were used to further define the nature and extent of contamination in groundwater.
Historical Radiological Assessment (HRA)	2004	The HRA evaluated and designated sites as radiologically-**impacted or non-impacted**[7]. A radiologically-impacted site is one that has the potential for radioactive contamination based on historical information, or is known to contain or have contained radioactive contamination. A non-impacted site is one, based on historical documentation or results of previous radiological survey information, where there is no reasonable possibility for residual radioactive contamination. Based on the results of the assessment, six buildings, one building site and the sewer and storm drains were identified as radiologically-impacted at Parcel G.
Revised Feasibility Study	2007	Existing RI data were combined with new data collected after completion of the 1996 RI Report. The revised FS considered new information associated with several cleanup actions completed within Parcel D and at other adjacent parcels at HPS. New information considered and incorporated into the revised FS included (1) the widespread presence of metals in soil across Parcel D, (2) quarterly monitoring of groundwater since 2004, (3) updates to toxicity criteria used in the 1997 HHRA, and (4) the findings from removal actions conducted to address chemicals identified by a RMR process and radiological contaminants that were identified by the HRA. Data were summarized and evaluated to refine the site conceptual model, further define the nature and extent of contamination, assess potential risks based on existing site conditions, and develop and evaluate revised alternatives. Data evaluation included (1) a comparison of new and existing data with updated screening criteria, (2) a revised evaluation of groundwater beneficial uses and exposure pathways, and (3) a revised assessment of potential risk posed by exposure to soil and groundwater at Parcel D. Revised remedial action objectives (RAO) were developed, which included a risk range rather than specific concentrations for contaminants. Remedial alternatives were developed and a detailed and comparative analysis of alternatives was performed.

Table 1. Previous Investigations and Removal Actions (Continued)

Previous Investigation/ Removal Action*	Date	Investigation/Removal Action Activities
Investigations and Studies (Continued)		
Radiological Addendum	2008	The primary purpose of this addendum was to provide decision makers with the information necessary to select a final remedy for radiologically impacted buildings, former building sites, outdoor areas, and soils and piping associated with remediated storm drains and sanitary sewers. This was accomplished through the development and evaluation of appropriate remedial alternatives. Building 401 and an additional site in Building 439 were found to require radiological remediation and were added to the areas to be remediated. After the screening of general response actions and process options two remedial alternatives were identified: no action, and a combination of surveys, decontamination, excavation, disposal, and release. The two alternatives were analyzed against the nine criteria and against each other.
Proposed Plan	2008	The Proposed Plan invited the public to review and comment on the Preferred Alternatives for addressing environmental contamination at Parcel D prior to the final remedy selection.
Removal Actions		
Phase I and II Underground Storage Tank Removal Action	1991-1993	Nine underground storage tanks were removed and one closed in place.
Sandblast Grit Removal Action	1991-1995	A total of 4,665 tons of discarded sandblast grit was removed throughout HPS.
Pickling and Plate Yard Removal Action	1994-1996	Contaminated equipment and residue were removed at IR-09.
Exploratory Excavation Removal Action	1996-1997	Stained soil, asphalt, and concrete were removed from three IR sites (IR-33, IR-37, and IR-70) within Parcel G.
Storm Drain Sediment Removal Action	1996-1997	A total of 1,200 tons of contaminated sediment was removed from storm drain lines and appurtenances.
Time-Critical Removal Action (TCRA)	2000-2001	A total of 81 cubic yards of soil was removed from several IR sites (IR-09, IR-37, and IR-65) within Parcel G.
Radiological Time-Critical Removal Action	2001-ongoing	In 2001, soil impacted by a cesium-137 spill was removed from Building 364 and the surrounding area. Additional radiological investigations and remediation is ongoing at radiologically impacted sites throughout Parcel G.
Storm Drain and Sanitary Sewer Removal Action	2007-ongoing	This removal action included radiological investigation and removal of storm drains and sanitary sewers, and is anticipated to be completed in 2008.

Notes:

* The documents listed are available in the Administrative Record and provide detailed information used to support remedy selection at Parcel G.

Although a number of removal actions have been completed within Parcel G, chemical contamination remains. Based on recent studies and investigations, the sources and extent of the remaining contamination in soil and groundwater have been well characterized. Industrial activities have resulted in elevated concentrations of **PAHs**$_{(8)}$ and **lead**$_{(9)}$ in soil (Figure 6). Elevated concentrations of metals other than lead, such as arsenic and manganese, may be related to the bedrock fill quarried to build the shipyard in the 1940s. The fill may have contained elevated concentrations of select metals from the bedrock. Therefore, the Navy has worked with the regulatory agencies to identify remedial alternatives that address metals in soil, regardless of their source.

The Navy also identified the former Pickling and Plate Yard (IR-09) within Parcel G as the source of the elevated concentrations of **chromium VI and possibly nickel**$_{(10)}$ in groundwater (Figure 7). Use of solvents during industrial operations also released **VOCs**$_{(11)}$ into groundwater (IR-71).

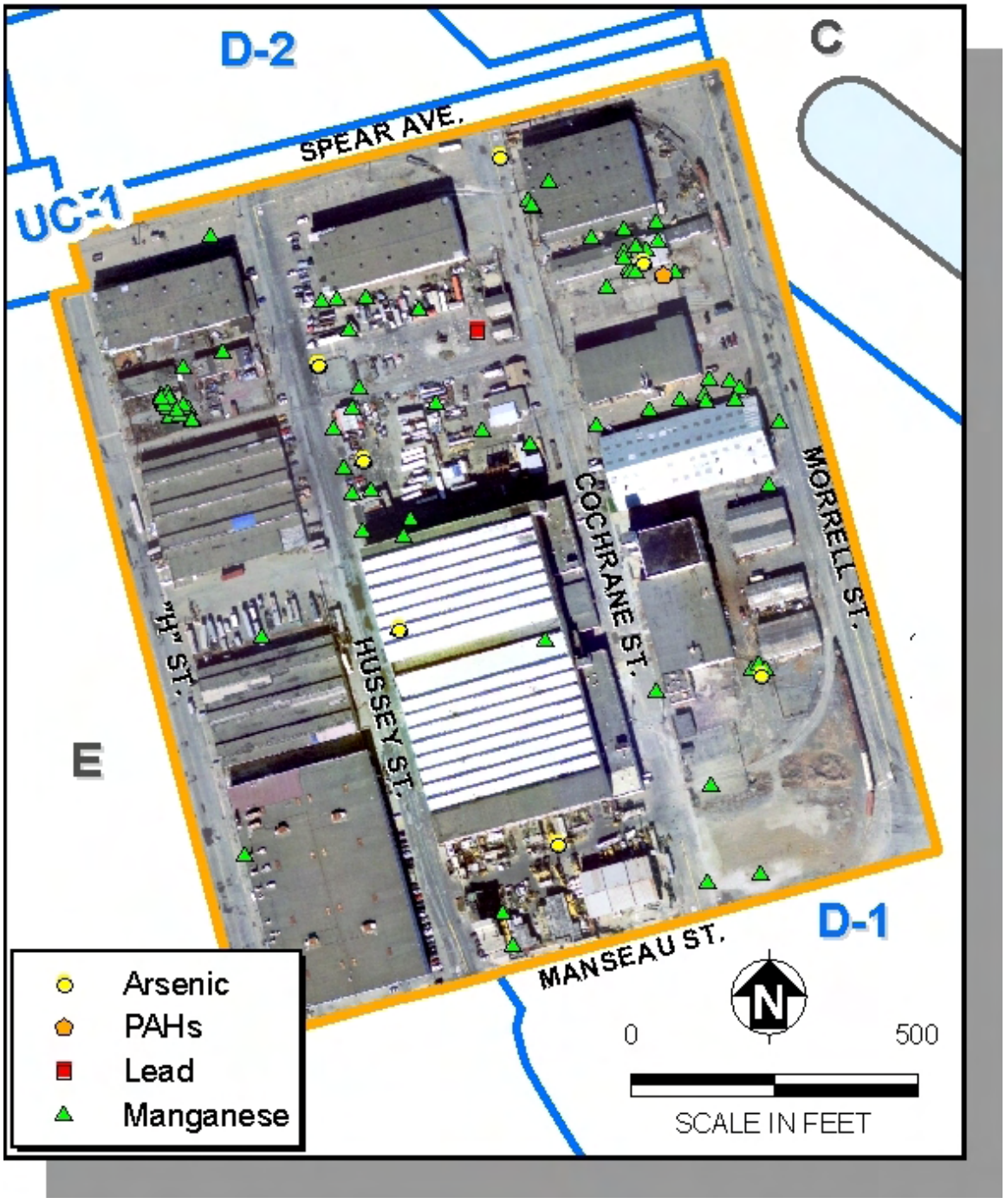

Figure 6. Chemicals in Soil Above Remedial Goals

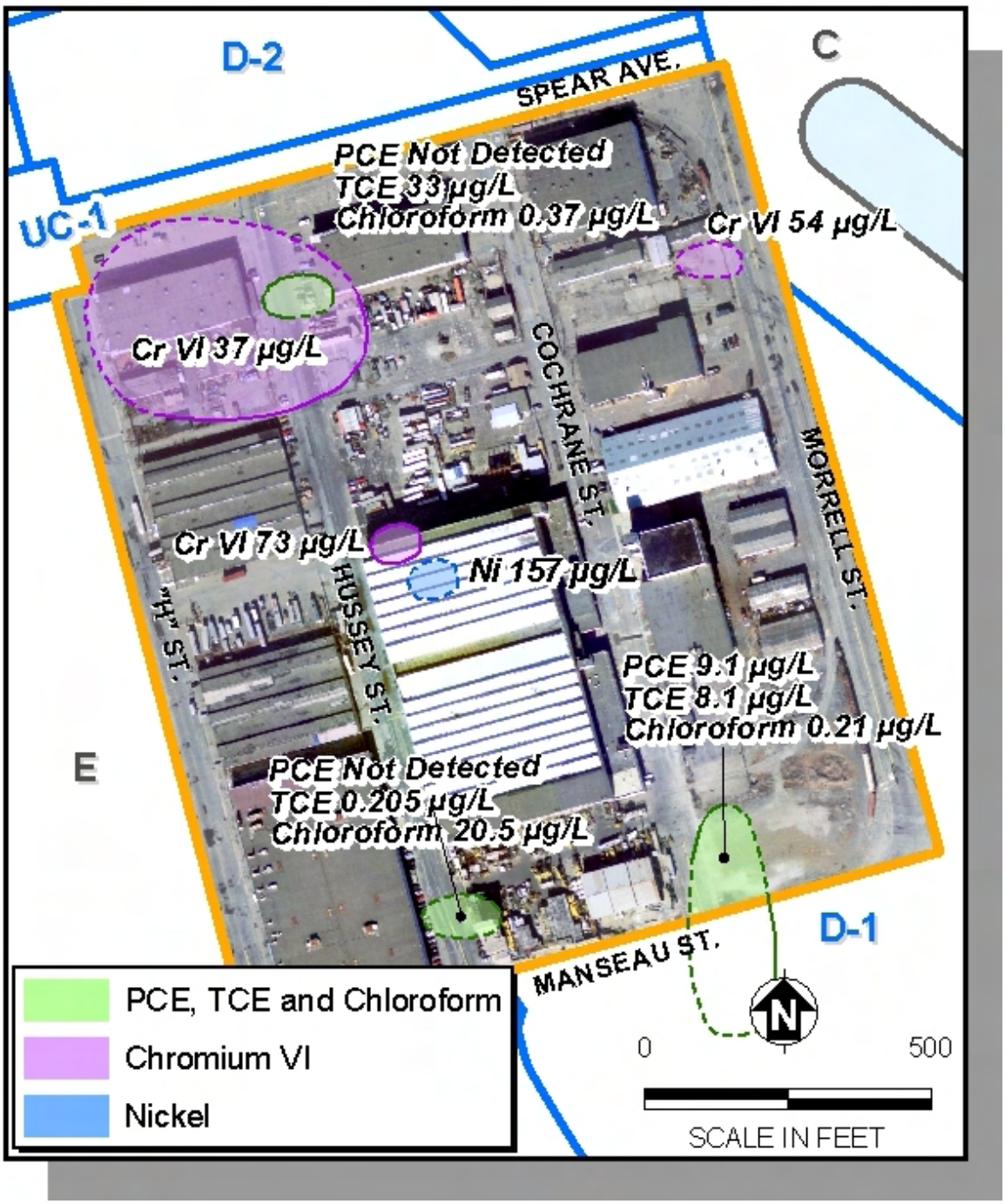

Figure 7. Chemicals in Groundwater Above Remedial Goals

The Navy identified **radiologically impacted sites**(12), including buildings, equipment, and infrastructure at Parcel D (including areas within Parcel G) associated with the former use of general radioactive materials and decontamination of ships used during atomic weapons testing in the South Pacific. Radiologically impacted buildings (351, 351A, 364, 365, 366/351B, 401, 408, and 411); former building sites (317); and storm drains and sanitary sewers are all of concern in Parcel G (Figure 8). In addition, a focused area in Building 439 was found to require remediation during the radiological investigation. The Navy continues to investigate and clean up radiological contamination throughout the shipyard as part of an ongoing time-critical removal action (TCRA). This TCRA is consistent with the cleanup actions described later in this ROD; however, the TCRA will not be a part of the remedial actions selected in this ROD. This ROD addresses any remaining remediation issues that will not be resolved by the TCRAs.

2.4 CURRENT AND POTENTIAL FUTURE SITE USES

The reuses defined in the redevelopment plan were evaluated by the following exposure scenarios: residential (mixed-use and research and development blocks), industrial (industrial and educational/cultural blocks), and recreational (open space block). The recent beneficial use evaluation for Parcel D recommends that the A-aquifer be considered for nonbeneficial use and the B-aquifer be designated as having low potential for **beneficial use**(13).

2.5 SUMMARY OF SITE RISKS

The source of potential contamination at Parcel G is mostly attributed to industrial activities by the Navy or other tenants, except for several metals such as arsenic, manganese, and nickel found at levels consistent with ambient concentrations in the local serpentine bedrock. Most of the contamination is from identified IR sites with associated spills and leaks. The primary fate and transport mechanisms include root uptake, wind suspension, volatilization, and the migration of contaminants via infiltration and percolation into subsurface soil and groundwater. A general conceptual site model (CSM) for Parcel G is provided on Figure 9. Based on the CSM, Parcel G was evaluated for potential risks to human health and the environment in the Revised FS Report and its radiological addendum. The risk assessment results can be applied by focusing on the redevelopment blocks within the parcel. Results of the HHRA are presented in Section 2.5.1.

During the RI, the Navy concluded that limited viable habitat is available for terrestrial wildlife at Parcel D (and thus also Parcel G) because most of the site is covered with pavement. Therefore, ecological risk associated with exposure to soil was not evaluated further. However, a screening evaluation of groundwater was conducted in the Revised FS Report to evaluate potential risks to aquatic wildlife in San Francisco Bay. Results of that evaluation are summarized in Section 2.5.2.

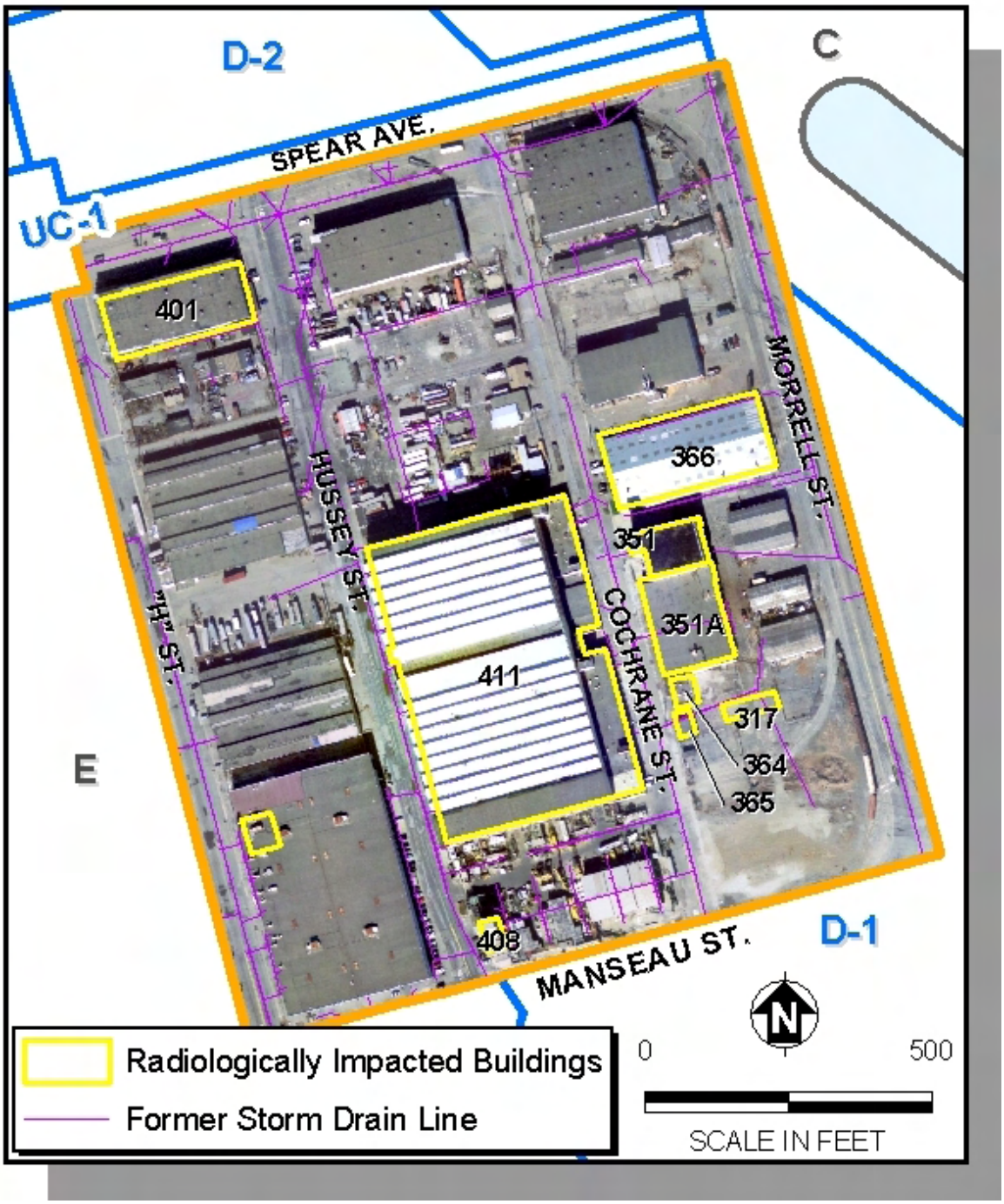

Figure 8. Radiologically Impacted Sites

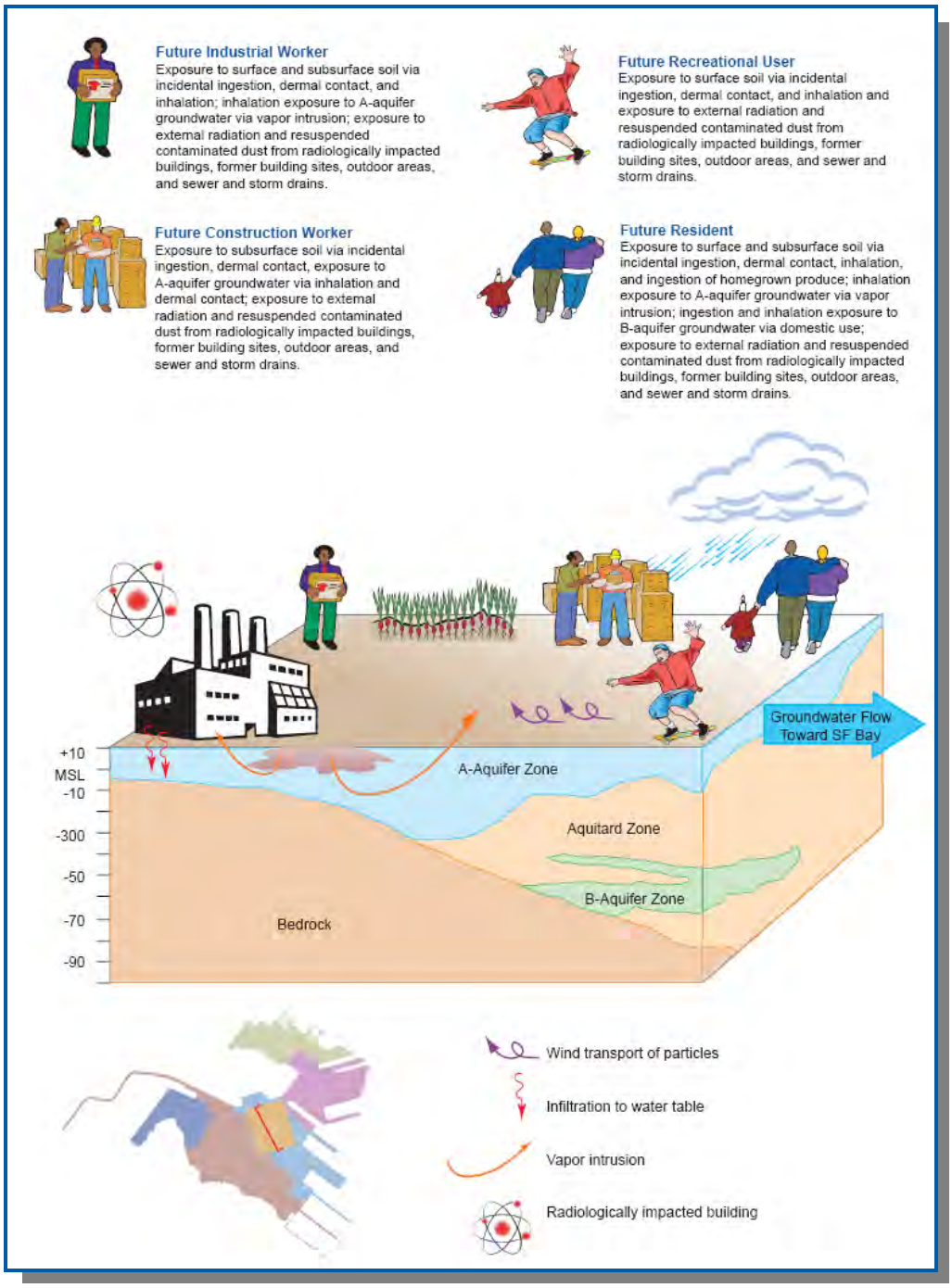

Figure 9. Conceptual Site Model

2.5.1 Human Health Risk Assessment

Based on a **human health CSM(14)**, a quantitative **HHRA(15)** was completed for Parcel D (including Parcel G) for exposure to surface soil, subsurface soil, groundwater, and vapor intrusion via groundwater. Potential **cancer risks and noncancer hazards(16)** were calculated based on reasonable maximum exposure (RME) assumptions recommended by EPA and DTSC. These assumptions are based on a reasonable maximum exposure rather than an average or medium-range exposure assumption, and provide a conservative and protective approach that estimates the highest health risks that are reasonably expected to occur at a site. Actual risks from exposures to chemicals in soil and groundwater at Parcel G are likely to be lower.

To help characterize cancer risk, the Navy adopted a conservative approach at Parcel G and evaluated action for risks greater than 10^{-6}. For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual between 10^{-4} (a 1 in 10,000 chance of developing cancer) and 10^{-6} (a 1 in 1,000,000 chance of developing cancer) using information on the relationship between dose and response. The 10^{-6} risk level is used as the point of departure for determining cleanup goals for alternatives when Applicable or Relevant and Appropriate Requirements (ARARs) are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure.

Both **total and incremental risks(17)** were evaluated for exposure to soil. For the total risk evaluation, all detected chemicals, including naturally occurring metals from the serpentine bedrock-derived fill material, were included as chemicals of potential concern regardless of their concentration. Only the essential nutrients calcium, magnesium, potassium, and sodium were not included as chemicals of potential concern. The total risk evaluation provides an estimate of the risks posed by chemicals at the site, including those present at concentrations at or below ambient levels. For the incremental risk evaluation, the above essential nutrients were excluded as soil chemicals of potential concern, as well as the detected metals with maximum measured concentrations below the Hunters Point ambient levels. The incremental risk evaluation provides an estimate of risks posed by metals present at the site that are above the estimated ambient levels.

Potential unacceptable risks include cancer risks and noncancer hazards for future receptors from exposure to soil or groundwater as discussed below. Potential unacceptable risk is defined as an excess lifetime cancer risk of greater than 1×10^{-6} or a segregated hazard index greater than 1 as calculated by the incremental risk evaluation.

Based on the **revised HHRA results(18)** for soil, chemical cancer risks are greater than 10^{-6} at Redevelopment Blocks 29, 30A, 38, and 39 within Parcel G (see Table 2). Noncancer hazards were less than 1 for all redevelopment blocks evaluated for industrial risk. Redevelopment Block 30A, evaluated against the more stringent residential exposure scenario, had a noncancer hazard above 1 (see Table 2).

The risk assessment for groundwater estimated cancer risks greater than 10^{-6} or noncancer hazards greater than 1 in distinct areas within all seven redevelopment blocks within Parcel G where data are available (see Table 2). Potential risks from groundwater are based on breathing VOC vapors in indoor air that may have migrated through the subsurface from groundwater in the A-aquifer. The COCs in groundwater from the vapor intrusion pathway are benzene, carbon tetrachloride, chloroform, methylene chloride, naphthalene, tetrachloroethene, trichloroethene, and xylenes. In addition, the HHRA results for groundwater show that the risk from exposure to the A-aquifer groundwater via dermal exposure and inhalation to the construction workers exceeds the cancer risk threshold of 10^{-6} in areas with elevated concentrations of the COCs. These COCs from this exposure pathway are arsenic, benzene, naphthalene, tetrachloroethene, and xylenes. The B-aquifer was evaluated for all chemicals of potential concern through the domestic use of groundwater pathway. No unacceptable risk was found from this exposure scenario; therefore, no COCs are associated with the B-aquifer.

Additionally, radiological risk was calculated based on estimated concentrations of radiological contamination at radiologically impacted sites, using preliminary remediation goals for each radionuclide of concern. Actual calculated risk will be based on field measurements following receipt of final status survey results for each impacted site. **Radiological risks(19)** for soil and building structures are greater than 10^{-6} at Redevelopment Blocks 30A, 38, and 39 (see Table 2). Total and incremental risks were also calculated for radionuclides with Radium-226, the only naturally occurring radionuclide that affected the incremental risk calculation. However, the background concentration of Radium-226 in building materials was assumed to be zero.

Potential risks were primarily based on exposure to metals (arsenic, lead, and manganese) and PAHs in soil, VOC vapors and several metals (chromium VI and nickel from groundwater in the A-aquifer, and radionuclides in structures (such as buildings) and soil. **Combined chemical and radiological risk(20)** was also summed to determine the overall potential risk to human health associated with a site.

Table 2. Cancer Risks and Noncancer Hazards

Parcel	Redevelopment Block	Exposure Scenario	Cancer Risk[a]		Noncancer HI
			Chemical	Radiological[b]	
Soil					
G	30B	Industrial	2×10^{-7}	NA	< 1
	37	Industrial	4×10^{-8}	not estimated[c]	< 1
	38	Industrial	4×10^{-5}	2×10^{-4}	< 1
	29	Industrial	3×10^{-5}	NA	< 1
	DOS-1	Recreational	4×10^{-6}	NA	< 1
	39	Recreational	1×10^{-4}	4×10^{-5}	< 1
	30A	Residential	2×10^{-7}	1×10^{-6}	6
Groundwater			**Exposure Area[d]**	**Maximum Cancer Risk**	**Noncancer Risk (Total RME HI)**
G	29, 30A, 30B, 37, 38, 39, and DOS-1	Industrial	IR-33 Plume, IR-09, and IR-71 Plumes	1×10^{-4}	9

Notes:

a Listed risk value is maximum in each redevelopment block.

b Radiological risk from ongoing sewer and storm drain removal across Parcels G, D-2, UC-1, and D-1 was assessed at 5E-6.

c Risk was not estimated in the radiological addendum for the Building 439 site at the time of the radiological addendum

d Maximum of the identified risk from all plumes

NA Not applicable; no radiologically impacted areas or buildings were located in this block.

The HHRA specifies the **assumptions and uncertainties**(21) inherent in the risk assessment process due to the number of samples collected or their location, the literature-based exposure and toxicity values used to calculate risk, and risk characterization across multiple media and exposure pathways. The effects of uncertainties are overestimation or underestimation of the actual cancer risk or HI. In general, the risk assessment process is based on the use of conservative (health-protective) assumptions that when combined, are intended to overestimate the actual risk.

2.5.2 Ecological Risk Assessment

As previously stated, the Navy concluded during the RI that limited viable habitat is available for terrestrial wildlife at Parcel D because most of the site is covered with pavement. Specifically, the RI concludes that "Parcels C and D are almost entirely paved except for small pockets of vegetation which are not considered suitable habitat for animal life." In addition, the shoreline habitat is not a concern for Parcel G because of its inland location. Therefore, ecological risk associated with exposure to soil was not evaluated further in the Revised FS Report.

The Navy completed a screening evaluation of **surface water quality**(22) to assess potential exposure by aquatic wildlife to groundwater as it interacts with the surface water of San Francisco Bay. Results of the screening evaluation indicated two metals (**chromium VI and nickel**(23)) in groundwater may pose a potential risk to aquatic wildlife. However, the current areas within Parcel G where chromium VI and nickel are present are approximately 1,100 and 1,500 feet to the nearest discharge point on the Bay. Groundwater monitoring data indicated metals migrate at a much slower rate than groundwater flows, thus discharge of metals to the Bay is not imminent.

Chemicals present in both the A-aquifer and the B-aquifer groundwater at Parcel G were evaluated to assess potential **environmental impacts to the Bay**(24). This evaluation was completed as part of the derivation of **trigger levels**(25) for chemicals that present a potential impact to the Bay. Based on the evaluation results, chromium VI and nickel in the A-aquifer were identified as COCs that originated in Parcel G.

Chromium VI(26) was identified as a COC because it was detected at concentrations consistently exceeding surface water criteria in both plumes and in individual wells in the A-aquifer. The locations of the elevated chromium VI concentrations are mostly near IR-09 where there was a known source of chromium from pickling and plating operations.

Nickel was identified as a COC because it was detected in a single well at concentrations consistently exceeding surface water criteria, and historical detections of nickel in an adjacent well also exceeded surface water criteria. These nickel concentrations indicate a localized area near IR-09 of nickel-impacted groundwater. The source of the nickel is not known.

2.5.3 Basis for Response Action

The response action selected in this ROD is necessary to protect the public health, welfare, or the environment from actual or potential releases of hazardous substances into the environment. The Navy, in partnership with EPA, DTSC, and the Water Board, considered all pertinent factors in accordance with CERCLA and NCP remedy selection criteria and determined remedial action is necessary to clean up **soil**(27), **groundwater**(28), and **radiologically impacted structures and soil**(29) at Parcel G. This determination was made because:

- Based on the HHRA results for soil, chemical cancer risks are greater than 10^{-6} at Redevelopment Blocks 29, 30A, 38, and 39 within Parcel G (see Table 2).
- Radiological risks for soil, building structures and sanitary/storm sewers are greater than 10^{-6} across Parcel G.
- Redevelopment Block 30A, evaluated against the more stringent residential exposure scenario, had a noncancer hazard above 1.
- The risk assessment for groundwater estimated cancer risks greater than 10^{-6} or noncancer hazards greater than 1 in distinct areas within all seven redevelopment blocks within Parcel G.
- Potential risks from groundwater are based on breathing VOC vapors in indoor air that may have migrated through the subsurface from groundwater in the A-aquifer.
- HHRA results for groundwater show that the risk from exposure to the A-aquifer groundwater via dermal exposure and inhalation to the construction workers exceeds the cancer risk threshold of 10^{-6} in areas with elevated concentrations of the COCs.

The concentrations of COCs for soil and groundwater requiring a response action are summarized in Table 3.

Table 3. Chemicals of Concern in Soil and Groundwater Requiring a Response Action

Exposure Scenario	Chemical of Concern	Soil		
		Maximum Detected Concentration	Remediation Goal	Frequency of Exceedance
Soil (mg/kg)				
Residential	Manganese	11,900	1,431	97/474
Recreational	Arsenic	47.2	11.1	8/299
	Benzo(a)pyrene	0.49	0.33	1/16
Industrial	Arsenic	47.2	11.1	8/299
	Benzo(a)pyrene	0.49	0.33	1/16
	Benzo(b)fluoranthene	1	1.76	0/26
	Lead	920	800	1/373
Construction Worker	Arsenic	47.2	11.1	8/299
	Benzo(a)pyrene	0.49	0.65	0/16
	Lead	920	800	1/373
	Manganese	11,900	6,889	6/474
Groundwater (µg/L)				
Residential – Vapor Intrusion	Chloroform	21	1.0	17/39
	Methylene Chloride	45	27	2/2
	Trichloroethene	72	2.9	19/30
Industrial – Vapor Intrusion	Benzene	650	0.63	10/13
	Carbon Tetrachloride	0.9	0.50	1/4
	Chloroform	21	1.2	17/39
	Naphthalene	ND	17	ND
	Tetrachloroethene	25	1.0	8/11
	Trichloroethene	72	4.8	17/30
	Xylene (total)	1,200	337	2/15
Construction Worker – Trench Exposure	Arsenic	76.3	40	2/64
	Benzene	650	17	5/13
	Naphthalene	ND	17	ND
	Tetrachloroethene	25	18	1/11
	Xylene (total)	1,200	861	2/15

Notes: ND = Naphthalene was not detected in Parcel G.

Radionuclides of concern$_{(30)}$ were identified by redevelopment block and by specific buildings within each block. There were a number of radiologically impacted buildings within Block 30A, Block 38, and particularly Block 39. Radionuclides of concern included cesium-137, cobalt-60, plutonium-239, radium-226, strontium-90, thorium-232, hydrogen-3 and uranium-235.

Figures 10 and 11 show the areas where remedial actions for soil and groundwater, respectively, would occur.

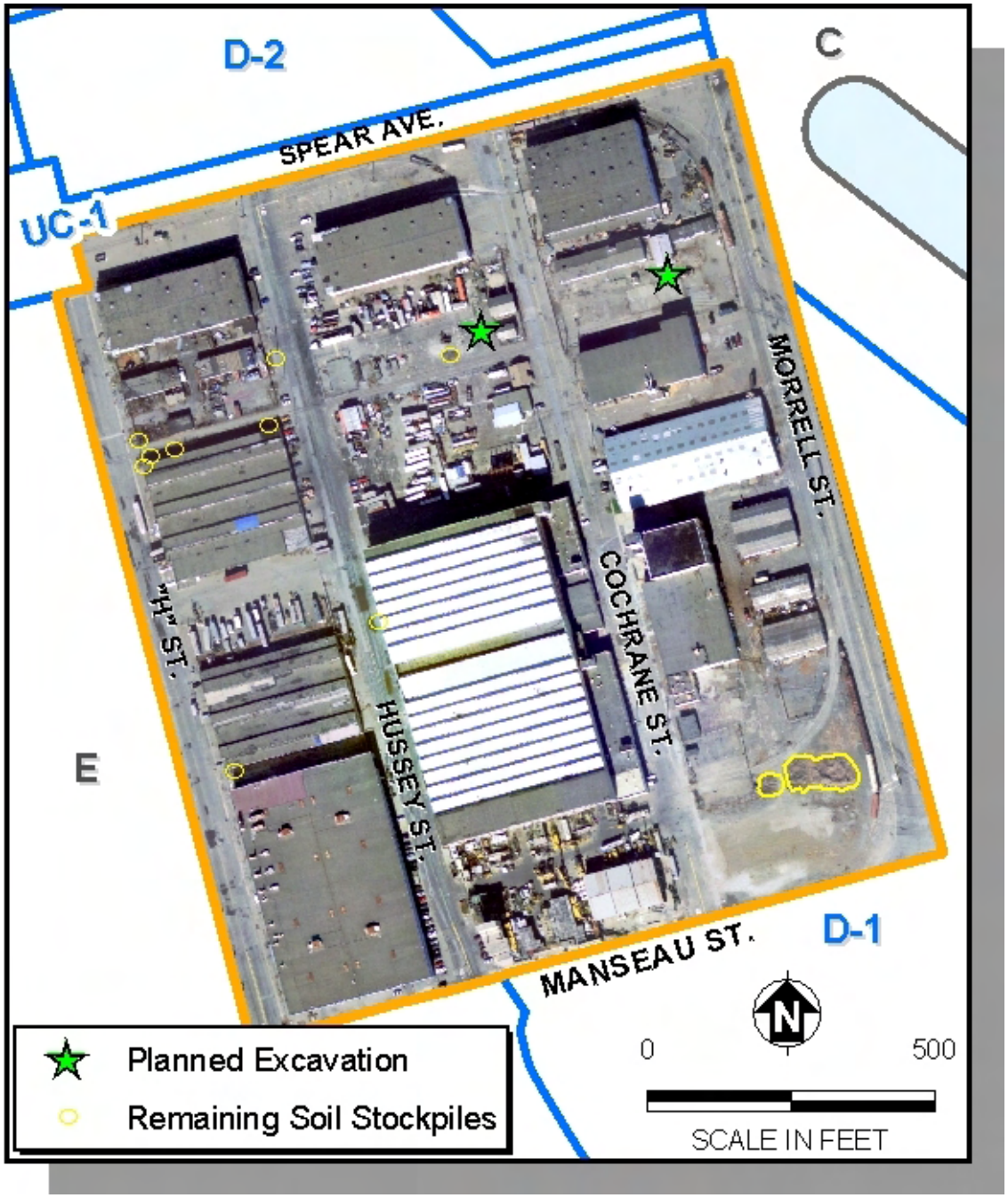

Figure 10. Planned Excavation Areas and Stockpiles

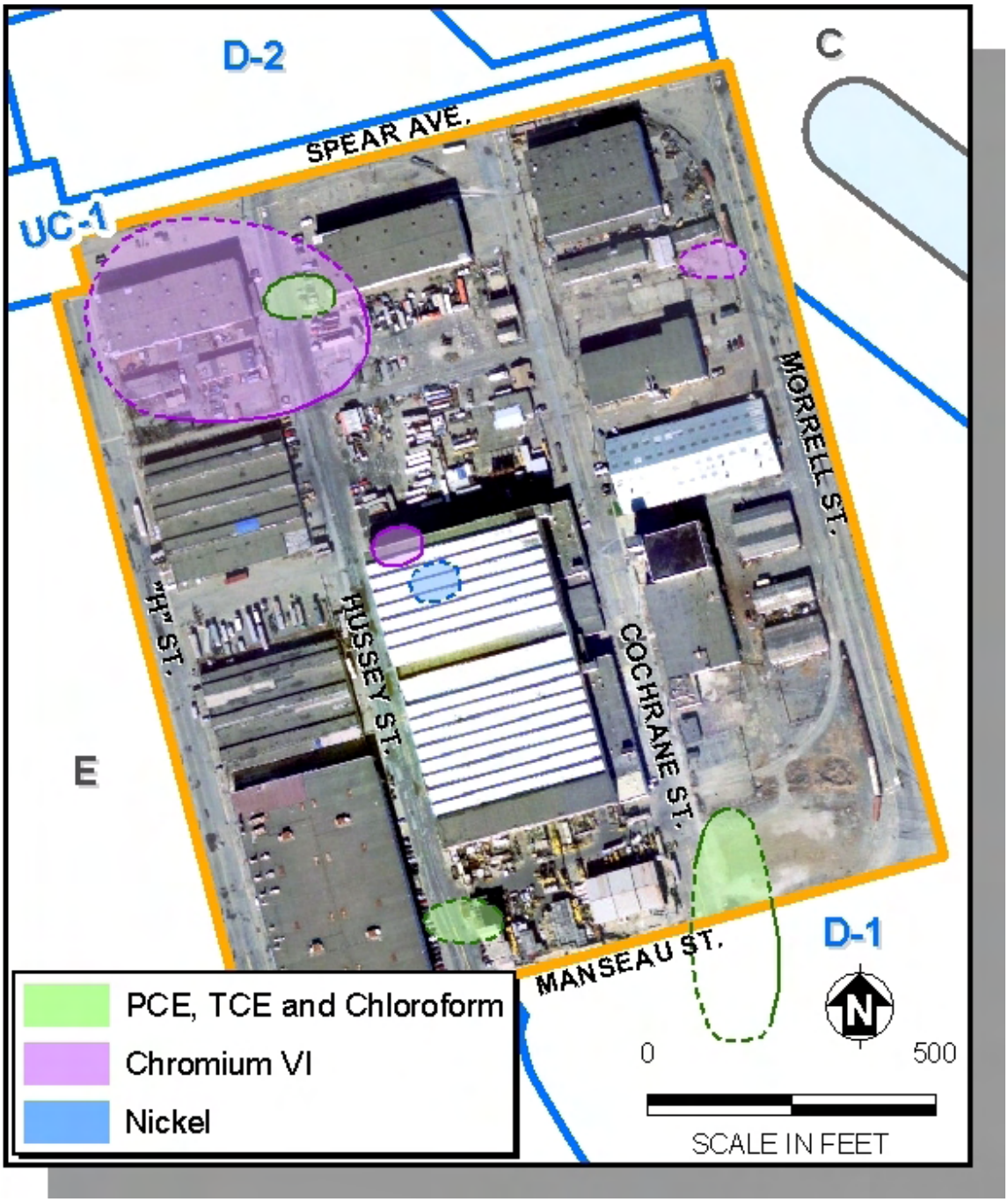

Figure 11. Planned Groundwater Remediation Areas

2.6 PRINCIPAL THREAT WASTE

Although a remedial response action is necessary (Section 2.5.3), there are no wastes in Parcel G that constitute a "principal threat." Principal threat wastes are hazardous or highly toxic source materials that result in ongoing contamination to surrounding media, generally cannot be reliably contained, or present a significant risk to human health or the environment should exposure occur. Although elevated concentrations of metals, PAHs, and radionuclides are present in soil and structures, the potential risks do not suggest there is a principal threat waste in soil at Parcel G. Contaminated groundwater is not generally considered to be source material unless it has the potential to be extremely mobile. Based on a review of the data, VOCs and metals in groundwater at Parcel G appear to be somewhat stable showing a minimal expansion of the associated plumes over time. In addition, a variety of processes occur in the subsurface that serve to reduce chemical concentrations in groundwater as groundwater migrates toward a discharge point such as the Bay. These processes include hydrodynamic dispersion, sorption, chemical and biological transformation, dilution in the tidal mixing zone, and dilution upon discharge to a surface water body. Therefore, VOCs (most significantly, tetrachloroethene [PCE], trichloroethene [TCE] and chloroform) and metals (chromium VI and nickel) in groundwater at Parcel G are not considered a principal threat waste.

2.7 REMEDIAL ACTION OBJECTIVES (RAOS)

RAOs are established based on attainment of regulatory requirements, standards, and guidance; contaminated media; COCs; potential receptors and exposure scenarios; and human health and ecological risks. Ultimately, the success of a remedial action is measured by its ability to meet the RAOs. Planned future land use is an important component in developing RAOs, and the RAOs for Parcel G are based on the San Francisco Redevelopment Agency's 1997 reuse plan. The RAOs for Parcel G were developed in conjunction with the regulatory agencies and are listed below by medium.

- **Soil RAOs:**
  1. Prevent exposure to organic and inorganic chemicals in soil at concentrations above remediation goals developed in the HHRA for the following exposure pathways:
     (a) Ingestion of, outdoor inhalation of, and dermal exposure to soil:
        - From 0 to 10 feet below ground surface (bgs) for residents in mixed-use redevelopment blocks
        - From 0 to 10 feet bgs for industrial workers in the educational/cultural and industrial blocks
        - From 0 to 2 feet bgs for recreational users in open space blocks
        - From 0 to 10 feet bgs for construction workers in all blocks

     (b) Ingestion of homegrown produce by residents in mixed-use blocks

2. Prevent exposure to VOCs in soil gas at concentrations that would pose unacceptable risk via indoor inhalation of vapors. The remediation goal for soil gas will correspond to a cancer risk of 10^{-6}; the numerical goal for each VOC will be established during the remedial design (RD).

- **Groundwater RAOs:**

1. Prevent exposure to VOCs in the A-aquifer groundwater at concentrations above remediation goals via indoor inhalation of vapors from groundwater.

2. Prevent direct exposure to the groundwater that may contain COCs through the domestic use pathway (for example, drinking water or showering).

3. Prevent or minimize exposure of construction workers to metals and VOCs in the A-aquifer groundwater at concentrations above remediation goals from dermal exposure and inhalation of vapors from groundwater.

4. Prevent or minimize migration to the surface water of San Francisco Bay of chromium VI and nickel in A-aquifer groundwater that would result in concentrations of chromium VI above 50 micrograms per liter (µg/L), and nickel above 96.5 µg/L, reaching the Bay.

- **Radiologically Impacted Soil and Structures RAOs:**

1. Prevent ingestion of, dermal contact with, or inhalation of radionuclides of concern in concentrations that exceed remediation goals.

2. Ensure that the increased lifetime cancer risk does not exceed 10^{-6} for future use scenarios.

Remediation goals for soil and groundwater and radiologically impacted sites are listed in Tables 4 and 5, respectively.

2.8 DESCRIPTION AND EVALUATION OF REMEDIAL ALTERNATIVES

To address contamination in soil and groundwater and radiologically impacted structures and soil, preliminary screening of **General Response Actions (GRAs)**(31) and process options was completed to refine the remedy selection process, as detailed in the Revised FS Report. Because the RAOs were developed based on the planned future land use, the GRAs were also developed considering the planned future land use of each redevelopment block. Five soil, four groundwater, and two radiological remedial approaches were retained as combinations of **preliminary remedial alternatives**(32) and were evaluated with respect to implementability, effectiveness, and relative cost (high/moderate/low). Detailed cost analysis was not performed as part of this preliminary screening.

Table 4. Preliminary Remediation Goals for Soil and Groundwater

Exposure Scenario	Chemical of Concern	Remediation Goal
Soil		
Residential	Manganese	1,431
Recreational	Arsenic	11.1
	Benzo(a)pyrene	0.33
Industrial	Arsenic	11.1
	Benzo(a)pyrene	0.33
	Benzo(b)fluoranthene	1.76
	Lead	800
Construction Worker	Arsenic	11.1
	Benzo(a)pyrene	0.65
	Lead	800
	Manganese	6,889
Groundwater		
Residential – Vapor Intrusion	Chloroform	1.0
	Methylene Chloride	27
	Trichloroethene	2.9
Industrial – Vapor Intrusion	Benzene	0.63
	Carbon Tetrachloride	0.50
	Chloroform	1.2
	Naphthalene	6.0
	Tetrachloroethene	1.0
	Trichloroethene	4.8
	Xylene (total)	337
Construction Worker – Trench Exposure	Arsenic	40
	Benzene	17
	Naphthalene	17
	Tetrachloroethene	18
	Xylene (total)	861

Notes:

Soil remediation goals are in milligrams per kilogram (mg/kg)

Groundwater remediation goals are in micrograms per liter (µg/L)

Soil gas remediation goals, once established, will be used to determine the vapor intrusion risk and the soil gas goals would replace the remediation goals for groundwater as the indicator for areas requiring vapor controls and for identifying areas that have achieved cleanup objectives and are below risk levels of concern.

Table 5. Preliminary Remediation Goals for Radionuclides

Radionuclide	Surfaces (dpm/100 cm^2)		Soil (pCi/g)		Water (pCi/L)
	Equipment Waste [a]	Structures	Construction Worker	Resident	
Cesium-137	5,000	5,000	0.113	0.113	119
Cobalt-60	5,000	5,000	0.0602	0.0361	100
Plutonium-239	100	100	14	2.59	15
Radium-226	100	100	1	1	5
Strontium-90	1,000	1,000	10.8	0.331	8
Thorium-232	1,000	36.5	19	1.69	15
Hydrogen-3	5,000	5,000	4.23	2.28	20,000
Uranium-235 + daughters	5,000	488	0.398	0.195	30

Notes:

a Limits removable surface activity are 20 percent of these values

dpm/cm^2 Disintegration per minute per square centimeter
pCi/g Picocurie per gram

Five remedial alternatives for soil (no action; ICs and maintained landscaping; excavation, disposal, maintained landscaping, and ICs; covers and ICs; and excavation, disposal, covers, and ICs), four remedial alternatives for groundwater (no action; long-term monitoring and ICs; in-situ treatment for VOCs, groundwater monitoring for metals and VOCs, and ICs; and in-situ treatment for VOCs and metals, groundwater monitoring, and ICs), and two remedial alternatives for radiologically impacted structures and soil (no action and survey, decontamination, excavation, disposal, and release) were retained for a detailed comparative analysis in accordance with the NCP.

2.8.1 Description of Remedial Alternatives

Table 6 provides the major components, details, and cost of each remedial alternative identified for soil, groundwater, and radiological impacted sites.

2.8.2 Comparative Analysis of Alternatives

A comparative analysis of alternatives with respect to the **nine evaluation criteria**(33) was completed and is provided below. Table 7 depicts a relative ranking of the alternatives.

Table 6. Remedial Alternatives

Remedial Alternative	Components	Details	Cost
Soil Remedial Alternatives			
S-1: No Action *No action for contaminated soil with no restriction on activities.*	▪ Existing soil	▪ No action	No cost
S-2: ICs and Maintained Landscaping *Impose ICs to limit land use and maintain landscaping of bare or disturbed areas with no cover.*	▪ ICs ▪ Maintained landscaping	▪ ICs, including proprietary controls, restrictive covenants, restricted land use, restricted activities, and prohibited activities, will be implemented to prevent exposure to areas where there is potential unacceptable risk posed by COCs in soil. Entire blocks would not be fenced, and areas within a block that are covered with a building footprint or existing cover (such as a parking lot) would not be fenced. ▪ Maintain landscaping for bare or minimally vegetated areas that have been disturbed by excavation or construction activities and not restored with a cover. ▪ Maintained landscaping would prevent exposure to asbestos that may be present in surface soil and transported by wind erosion.	Capital Cost: $155,000 Annual O&M Cost: $132,000 **Present-Worth Cost: $344,000[34]** Discount Rate: 3.1% Timeframe: 30 years Note: The costs presented are the proportion of the Parcel D FS costs allocated to Parcel G, based on land area (42%)
S-3: Excavation, Disposal, Maintained Landscaping, and ICs *Excavation of contaminated soil followed by off-site disposal, maintained landscaping, and ICs*	▪ Excavation of soils ▪ Off-site disposal ▪ Maintain landscaping ▪ ICs	▪ Excavate two areas within Parcel G where lead or PAHs exceed remediation goals. The two areas to be excavated are a total of approximately 168 cubic yards of soil. Assuming a 20-percent bulking during this removal, approximately 202 cubic yards of soil will be hauled off site for disposal. In addition, 325 cubic yards of existing soil stockpiles within Parcel G. ▪ Depth of excavations is the maximum depth for human health exposure scenarios based on the proposed planned reuse (2 feet for recreational areas; 10 feet for industrial and residential areas).	Capital Cost: $476,000 Annual O&M Cost: $122,000 **Present-Worth Cost: $706,000[35]** Discount Rate: 3.1% Timeframe: 30 years Note: The costs presented are the proportion of the Parcel D FS costs allocated to Parcel G, based on land area (42%) and volume of stockpiles (58%) at Parcel G.
S-4: Covers and ICs *Install physical barriers, such as covers, to block exposure pathways to contaminated soil, followed by ICs.*	▪ Install covers ▪ ICs	▪ Install durable covers that will not break, erode, or deteriorate such that the underlying soil becomes exposed. Existing asphalt and concrete surfaces and buildings may be used as covers as long as they meet the durability requirement. ▪ All asphalt covers will be sealed at the start of construction and maintained by resealing once every 10 years. ▪ Only ground outside of existing building footprints would be considered for covers. Such ground would be covered with a minimum of 4 inches of asphalt paving (industrial areas) or 2 feet of new soil (residential areas). ▪ Existing soil stockpiles would be hauled off site for disposal. ▪ Impose same ICs as those for Alternative S-2.	Capital Cost: $1,032,000 Annual O&M Cost: $588,000 **Present-Worth Cost: $1,952,000[36]** Discount Rate: 3.1% Timeframe: 30 years Note: The costs presented are the proportion of the Parcel D FS costs allocated to Parcel G, based on land area (42%) and volume of stockpiles (58%) at Parcel G.

Table 6. Remedial Alternatives (Continued)

Remedial Alternative	Components	Details	Cost
Soil Remedial Alternatives (Continued)			
S-5: Excavation, Disposal, Covers, and ICs *Excavation of contaminated soil followed by off-site disposal, covers, and ICs*	▪ Excavation of soil ▪ Off-site disposal ▪ Install covers ▪ ICs	▪ Excavate two areas within Parcel G where lead or PAHs exceed remediation goals. The two areas to be excavated are a total of approximately 168 cubic yards of soil. Assuming a 20-percent bulking during this removal, approximately 202 cubic yards of soil will be hauled off site for disposal. In addition, 325 cubic yards of existing soil stockpiles within Parcel G would also be hauled off site. ▪ Depth of excavations is the maximum depth for human health exposure scenarios based on the proposed planned reuse (2 feet for recreational areas; 10 feet for industrial and residential areas). ▪ Install durable covers that would be maintained to minimize breakage, erosion, or deterioration such that the underlying soil becomes exposed. Standard construction practices for roads, sidewalks, and buildings would likely be adequate to meet this performance standard. Other examples of covers could include a minimum 4 inches of asphalt (or 2 inches of asphalt over a 4- to 6-inch base) or a minimum 2 feet of clean imported soil. The covers must achieve a full cover over the entire parcel. The cover design, including details on how the cover will be finished at the seawalls, will be provided in the RD.	Capital Cost: $1,290,000 Annual O&M Cost: $599,000 **Present-Worth Cost: $2,555,000**[37] Discount Rate: 3.1% Timeframe: 30 years Note: The costs presented are the proportion of the Parcel D FS costs allocated to Parcel G, based on land area (42%) and volume of excavations (21%) and stockpiles (58%) at Parcel G.
S-5: Excavation, Disposal, Covers, and ICs *Excavation of contaminated soil followed by off-site disposal, covers, and ICs (Continued)*		▪ Existing asphalt and concrete surfaces and buildings may be used as covers as long as they meet the durability requirement ▪ All asphalt covers will be sealed at the start of construction and maintained to meet the performance standard of preventing exposure to soil and being durable. ▪ Only ground outside of existing building footprints would be considered for covers.	
Groundwater Remedial Alternatives			
GW-1: No Action *No action for contaminated groundwater with no restriction on activities.*	▪ Existing groundwater	▪ No action	No cost

Table 6. Remedial Alternatives (Continued)

Remedial Alternative	Components	Details	Cost
Groundwater Remedial Alternatives (Continued)			
GW-2: Long-Term Monitoring and ICs *Implement monitoring to assess migration of chemicals and ambient conditions, followed by ICs*	▪ Groundwater monitoring ▪ ICs	▪ Monitor VOCs at strategically located monitoring wells for 30 years to see if plumes are stable or mobile. Wells will be monitored quarterly during years 1 and 2. VOCs will be monitored semiannually during years 3 through 29. During year 30, VOCs will be monitored at all designated wells during eight monitoring events. ▪ Monitor metals at strategically located wells for 5 years to see if plumes are stable or mobile. Wells will be monitored quarterly during years 1 and 2. During years 3, 4, and 5, wells will be monitored semiannually simultaneous with VOC monitoring events. ▪ Impose same ICs as those for Alternative S-2.	Capital Cost: $280,000 Annual O&M Cost: $2,655,000 **Present-Worth Cost: $3,520,000**(38) Discount Rate: 3.1% Timeframe: 30 years Note: The costs are primarily associated with the plumes that originate in Parcel G; therefore, it is assumed that the costs associated with this remedial alternative are within the -30/+50 range assumed for the original Parcel D in the FS.
GW-3 (A&B): In-Situ Treatment for VOCs, Groundwater Monitoring for Metals and VOCs, and ICs *Treat groundwater with VOCs with organic compound or ZVI, followed by monitoring and ICs*	▪ Treatment ▪ Monitoring ▪ ICs ▪	▪ Perform in-situ pilot tests to confirm performance and support design and layout of the groundwater treatment system for VOCs. ▪ Treat groundwater with an in-situ injection of an organic compound (GW-3A) or ZVI (GW-3B) to create conditions where VOCs are reduced in groundwater. ▪ Monitor VOCs at strategically located monitoring wells for 30 years to see if plumes are stable or mobile. Wells will be monitored quarterly during years 1 and 2. VOCs will be monitored semiannually during years 3 through 29. During year 30, VOCs will be monitored at all designated wells during eight monitoring events. ▪ Monitor metals at strategically located wells for 5 years to see if plumes are stable or mobile. Wells will be monitored quarterly during years 1 and 2. During years 3, 4, and 5, wells will be monitored semiannually simultaneous with VOC monitoring events. ▪ Impose same ICs as those for Alternative S-2. ICs will remain in place until remedial goals are achieved.	Capital Cost: $690,000 (A&B)/$3,110,000 (A&B) Annual O&M Cost: $1,350,000 (both A&B) **Present-Worth Cost: $2,450,000/$5,350,000**(39) Discount Rate: 3.1% Timeframe: 30 years Note: The costs are primarily associated with the plumes that originate in Parcel G; therefore, it is assumed that the costs associated with this remedial alternative are within the -30/+50 range assumed for the original Parcel D in the FS.

Table 6. Remedial Alternatives (Continued)

Remedial Alternative	Components	Details	Cost
Groundwater Remedial Alternatives (Continued)			
GW-4 (A&B): In-Situ Treatment for VOCs and Metals, Groundwater Monitoring, and ICs *Treat groundwater with VOCs and metals with organic compound or ZVI, following by monitoring and ICs*	▪ Treatment ▪ Monitoring ▪ ICs ▪	▪ Perform in-situ pilot tests to confirm performance and support design and layout of the groundwater treatment system for VOCs and metals. ▪ Treat groundwater with an in-situ injection of an organic compound (GW-4A) or ZVI (GW-4B) to create conditions where both VOCs and metals concentrations are reduced in groundwater to remedial goals. ▪ Monitor VOCs at strategically located monitoring wells for 30 years to see if plumes are stable or mobile. Wells will be monitored quarterly during years 1 and 2. VOCs will be monitored semiannually during years 3 through 29. During year 30, VOCs will be monitored at all designated wells during eight monitoring events. ▪ Monitor metals at strategically located wells for 5 years to see if plumes are stable or mobile. Wells will be monitored quarterly during years 1 and 2. During years 3, 4, and 5, wells will be monitored semiannually simultaneous with VOC monitoring events. ▪ Impose same ICs as those for Alternative S-2. ICs will remain in place until remedial goals are achieved.	Capital Cost: $1,040,000 (GW-4A)/$6,320,000 (GW-4B) Annual O&M Cost: $1,350,000 (for both A&B) **Present-Worth Cost: $2,870,000/$9,200,000(40)** Discount Rate: 3.1% Timeframe: 30 years Note: The costs are primarily associated with the plumes that originate in Parcel G; therefore, it is assumed that the costs associated with this remedial alternative are within the -30/+50 range assumed for the original Parcel D in the FS.
Radiologically Impacted Structures and Soil Remedial Alternatives			
R-1: No Action *No action for radiologically impacted structures and soil with no restriction on activities.*	▪ Existing structures ▪ Existing soil	▪ No action	No cost
R-2: Survey, Decontamination, Excavation, Disposal, and Release *Survey existing structures, followed by excavation and off-site disposal of contaminated materials and soil*	▪ Survey ▪ Decontamination ▪ Excavation ▪ Disposal ▪ Release	▪ Survey structures, former building sites, and radiologically impacted areas. ▪ Decontaminate buildings. ▪ Excavate storm drain and sanitary sewer lines, and excavate at outdoor and radiologically impacted areas. ▪ Dispose of excavated materials and soils at off-site facilities. ▪ Conduct surveys to ensure that remediation goals are met for radiologically impacted sites scheduled for unrestricted release.	Capital Cost:: $15,200,000 Annual O&M Cost: None **Present-Worth Cost: $15,200,000(41)** Discount Rate: Not applicable Timeframe: Approximately 1 year Note: The costs presented are the proportion of the Parcel D FS costs that were allocated to Parcel G based on the number of radiological sites identified in Parcel G (50%)

Table 7. Relative Ranking of Remedial Alternatives

	Soil					Groundwater				Radiologically Impacted Structures and Soil	
CERCLA Criteria	**S-1 No Action**	**S-2 Institutional Controls and Maintained Landscaping**	**S-3 Excavation, Disposal, Maintained Landscaping, and ICs**	**S-4 Covers and ICs**	**S-5*** Excavation, Disposal, Covers, and ICs**	**GW-1 No Action**	**GW-2 Long-Term Monitoring and Institutional Controls**	**GW-3 (A&B) In-Situ Treatment for VOCs, Groundwater Monitoring for Metals and VOCs, and ICs**	**GW-4 (A&B)*** In-Situ Treatment for VOCs and Metals, Groundwater Monitoring, and ICs**	**R-1 No Action**	**R-2*** Survey, Decontamination, Excavation, Disposal, and Release**
Threshold Criteria											
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Compliance with ARARs	N/A	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	N/A	Yes
Balancing Criteria											
Long-Term Effectiveness and Permanence											
Reduction in Toxicity, Mobility, or Volume through Treatment											
Short-Term Effectiveness											
Implementability											
Present-Worth Cost ($M)	0	0.35	0.7	2	2.3	0	3.5	2.5 (GW-3A) 5.4 (GW-3B)	2.9 (GW-4A) 9.2 (GW-4B)	0	15
Modifying Criteria											
State Acceptance											
Community Acceptance											

Notes: Fill symbol by quarters from open (poor) to full (excellent). *** Indicates preferred alternative

Threshold Criteria

Overall Protection of Human Health and the Environment. The no-action alternatives for soil, groundwater, and radiologically impacted structures and soil do not achieve RAOs; therefore, they do not protect human health and the environment and are not considered further in this ROD. For soil, Alternatives S-2 through S-5 are protective of human health and the environment under the anticipated future land use of the site. For groundwater, Alternatives GW-2, GW-3A, GW-3B, GW-4A, and GW-4B are also protective of human health and the environment, although the degree of protection varies between the different alternatives. For radiologically impacted structures and soil, Alternative R-2 is protective of human health and the environment because it includes remediation that reduces exposure to radionuclides of concern.

Compliance with ARARs. ARARs do not apply to the no-action alternatives for soil, groundwater, and radiologically impacted structures and soil. For the remaining soil, groundwater, and radiological alternatives, a given alternative must either comply with ARARs or provide grounds for a waiver. Alternatives S-2 through S-5 comply with all pertinent ARARs. Alternatives GW-4A and GW-4B meet all of the pertinent ARARs. Alternatives GW-2, GW-3A, and GW-3B also meet all the pertinent ARARs, but with potentially less certainty. Alternative R-2 fulfills all pertinent ARARs related to radiologically impacted structures or soil.

Primary Balancing Criteria

Criteria Long-Term Effectiveness and Permanence. Alternative S-5 is rated the highest with respect to long-term effectiveness and permanence because it includes the effective and permanent remedies of removal and disposal off site from Alternatives S-3, and the parcel-wide covers and ICs from Alternative S-4. The long-term permanence is lower for Alternatives S-2 and S-4, which rely more heavily on ICs to meet the RAOs for the chemicals that are left in place, and higher for Alternatives S-3 and S-5, which include excavations that reduce the volume of on-site contaminants. Alternatives S-2 through S-5 would also provide long-term effectiveness in meeting the RAOs through reliance on continual enforcement of covenants to restrict use of property to maintain covers and access restrictions. Alternative S-3 provides long-term effectiveness and permanence for lead- and PAH-contaminated soil that is excavated, but relies on access restrictions for other COCs until ICs are implemented. Alternative S-4 provides a permanent cover prior to development, but does not permanently remove any contamination. Since no action will be taken under Alternative S-1, it does not provide a long-term effective or permanent solution to the soil risks present at the site.

Alternatives GW-4A and GW-4B would provide the highest level of long-term effectiveness and permanence, because COCs would be degraded or immobilized. Alternative GW-2 would provide a moderate level of effectiveness and permanence because groundwater plumes would be addressed only through ICs and monitoring to assess the potential migration of contaminants. Alternatives GW-3A and GW-3B would provide a higher level of long-term effectiveness and permanence than Alternative GW-2, because VOCs would be degraded or immobilized but metals would be addressed through ICs and monitoring, using the

plume-specific attenuation factors and the chemical-specific trigger levels for metals. All alternatives, except for Alternative GW-1 provide an adequate and reliable level of controls.

Alternative R-2 would provide excellent long-term effectiveness and performance for radiologically impacted sites. Alternative R-1 provides very little long-term effectiveness and performance because it includes no action.

Reduction in Toxicity, Mobility, or Volume through Treatment. None of the alternatives proposed for remediating soils at Parcel D include treatment as a GRA; therefore, all of the alternatives (S-1 through S-5) are rated poor with respect to reducing the mobility, toxicity, or volume through treatment.

Alternatives GW-4A and GW-4B are rated the highest because they both reduce the toxicity and volume of contaminants by active treatment of VOCs, and the chromium VI and nickel plumes. The treatment would also reduce the mobility of the chromium VI and nickel plumes by in-situ precipitation of metals from their dissolved phase. Mobility of these contaminants would be monitored and human health exposure would be eliminated through ICs. Alternatives GW-3A and GW-3B would reduce the toxicity or volume of VOC contaminants through treatment, but would monitor the mobility of metals contamination through the groundwater monitoring program and eliminate exposure through the use of ICs. Alternative GW-2 would not reduce the toxicity or volume of contaminants, and would also monitor the mobility of the contamination through the groundwater monitoring program and eliminate exposure through the use of ICs. Alternative GW-1 does not reduce the mobility, toxicity, or volume of contaminants in groundwater.

Alternatives R-1 and R-2 are both rated poor because they do not include treatment that would result in the destruction, transformation, or irreversible reduction in radionuclides of concern mobility.

Short-Term Effectiveness. Alternative S-1 has the least effect on the community, remedial workers, or the environment by the implementation because it includes no actions. Alternatives S-2 and S-4 introduce less risk to these receptors because they do not include excavation, hauling, and disposal of soil that contains contamination. Alternatives S-3 and S-5 include removing and hauling soils with contamination that would pose potential risk to these receptors, although this risk is considered low and mitigation measures would be implemented.

All of the alternatives scored well in terms of short-term effectiveness according to the criteria. Alternatives GW-3A, GW-3B, GW-4A, and GW-4B pose a slightly greater risk through use of active in-situ treatment compared with Alternative GW-2. Alternatives GW-2, GW-3A, GW-3B, GW-4A, and GW-4B all pose a very low risk to workers during implementation of the groundwater monitoring program. Alternative GW-2 may pose a slightly greater risk than Alternatives GW-3A, GW-3B, GW-4A, and GW-4B because they require active on-site remediation. Alternative GW-1 has an excellent short-term effectiveness rating as no remedial actions are conducted under this alternative.

Alternative R-1 has the least effect on the community, remedial workers, or the environment because it includes no actions; therefore, it would not disturb the radionuclides of concern. Alternative R-2 includes removing and hauling contaminated soil and building materials from the site. This alternative would pose a potential risk to the community, remedial workers, or the environment, although this risk is considered low and mitigation measures would be implemented.

Implementability. Distinction between the alternatives for implementability is minimal. Alternatives S-2 through S-4 require implementation of ICs. Installing covers (Alternative S-4) and excavating soil (Alternatives S-3 and S-5) are standard technologies that are easy to implement. Alternative S-1 does not involve remedial technologies or ICs and requires no implementation.

Alternatives GW-1 and GW-2 have the highest rating and are technically the easiest to implement. Alternative GW-2 would require the greater resources to conduct the long-term groundwater monitoring program; however, these resources are readily available. Alternatives GW-3A, GW-3B, GW-4A, and GW-4B are more complex to implement because of the injection treatment; however, this treatment is expected to be a one-time injection that would reduce the resources required for groundwater monitoring as compared to Alternative GW-2. Alternatives GW-3A and GW-4A may be easier to implement because the injected substrates are slow-release compounds that continue to degrade or precipitate COCs over time, which increases the potential to react with contaminants as they disperse in the aquifer.

Alternative R-2 requires the use of standard technologies that are easy to implement. Alternative R-1 does not involve remedial technologies and requires no implementation. Therefore, the distinction between these two alternatives regarding implementability is minimal.

Cost. Alternatives S-1 requires no action; therefore, no costs are associated with this alternative. Alternative S-2 is the least costly ($344,000) because it includes no active remediation prior to property transfer. Alternative S-3 has moderate cost (approximately $706,000), and Alternatives S-4 and S-5 that include the covers as a process option have the greatest cost (approximately $1.95 million and $2.26 million).

Alternative GW-1 is rated the highest because it has no associated cost because no actions would be taken. Alternative GW-3A has a moderate cost (approximately $2.45 million) because of in-situ treatment of VOCs and long-term monitoring of metals. Alternative GW-2 has slightly higher costs (approximately $3.52 million), most of which is for the 30 years of long-term monitoring. Alternatives GW-4A has a similar cost (approximately $2.87 million). Alternative GW-3B has the second highest capital cost because of the cost of the ZVI additive treatment for VOC plumes ($5.35 million). Alternative GW-4B has the highest capital cost because of the cost of the ZVI additive treatment for both VOC and metal plumes ($9.2 million).

Alternative R-1 requires no action; therefore, no costs are associated with this alternative. Alternative R-2 is costly ($15 million) but effectively addresses all radiologically impacted sites.

Modifying Criteria

State Acceptance. State involvement has been solicited throughout the CERCLA process. The State of California's acceptance of the Navy's selected remedial alternatives will be evaluated in responses to comments on the draft ROD.

Community Acceptance. Community acceptance is evaluated based on comments received from the public during the public comment period for the proposed plan. The proposed plan was presented to the community and discussed during a public meeting on July 30, 2008. Comments were also gathered during the public comment period from July 23 through August 22, 2008. Attachment B, the responsiveness summary, of this ROD addresses the public's comments and concerns about the selected remedial alternatives at Parcel G.

2.9 SELECTED REMEDY

2.9.1 Rationale for Selected Remedy

The Selected Remedy for Parcel G is Alternative S-5 (excavation, disposal, covers, and ICs) for soil; Alternative GW-4A&B (treatment, monitoring, and ICs) for groundwater; and Alternative R-2 (survey, decontamination, excavation, disposal, and release) for radiologically impacted structures and soil. The Selected Remedy provides the best balance of tradeoffs with respect to the nine criteria. The remedy for soil meets the RAOs by excavating and disposing of contaminated soils with lead and PAHs at concentrations exceeding remediation goals, thus removing the source of contamination. Additionally, the entire parcel will be covered to cut off potential exposure pathways to arsenic, manganese, and any remaining COCs in soils. The remedy for groundwater meets the RAOs by treating groundwater to reduce concentrations of VOCs and metals to below remediation goals, thus removing the source of contamination. Monitoring will be implemented as needed to confirm the treatment was successful for up to 30 years. The remedy for radiologically impacted sites meets the RAOs by identifying and decontaminating any impacted structures. Additionally, remaining contaminated materials, storm drains and sewers, and soils would be excavated and disposed of off site, thereby removing the source of contamination.

ICs, including restrictive covenants regulating restricted land use, restricted activities and prohibited activities, will be implemented to prevent exposure to areas where there is potential unacceptable risk posed by COCs in soil and groundwater. ICs will remain in place for soil in perpetuity and for groundwater until the remedial action taken allows for unrestricted use of the property.

2.9.2 Description of Selected Remedy

The Selected Remedy for soil consists of removing soil in selected areas where COCs exceed remediation goals and disposing of excavated soil at an off-site facility. Two areas are planned for excavation within Parcel G with a total of approximately 168 cubic yards of soil to be removed. Assuming a 20-percent bulking during this removal, approximately 202 cubic yards of

soil will be hauled off site for disposal. In addition, 325 cubic yards of existing soil stockpiles that may contain hazardous levels of contamination will be hauled off site for disposal as part of this alternative.

Across all of Parcel G, durable covers would be applied as physical barriers to cut off potential exposure to metals in soil. Existing asphalt and concrete surfaces (repaired as necessary to be durable) and buildings would act as covers. The type of new covers installed would be consistent with the redevelopment plan (for example, soil covers may be used for open space areas or asphalt for industrial areas). The cover design will be provided in the RD and will include plans for inspection and maintenance. Future landowners would need approval from the Navy and the regulatory agencies to modify the soil covers.

The Selected Remedy for groundwater consists of actively treating VOCs in groundwater using an injected biological substrate or ZVI to destroy the VOCs in the groundwater plumes at IR-09, IR-33, and IR-71 and minimize migration of metals in the groundwater plumes at IR-09 and IR-33, within Parcel G (see Figure 7). Groundwater would be monitored where concentrations of VOCs or metals were found to exceed cleanup goals until remediation is complete. The Navy's monitoring plan will be flexible to allow modifications as data are collected.

Soil gas surveys would be conducted at focused source area characterizations during the removal action phase and across the parcel after completion of the radiological removal actions and groundwater remediation to evaluate the potential for vapor intrusion, and, if needed, set remediation goals for soil gas, and assess the need for remediation or ICs (or a combination).

The Selected Remedy for radiologically impacted soil and structures consists of surveying radiologically impacted buildings and former building sites with documented radiological impacts for unrestricted release. Unrestricted release means that a property can be used for any residential or commercial purpose once regulatory requirements have been met. Decontamination would be performed and buildings would be dismantled if necessary. Remaining radiologically impacted storm drains and sanitary sewer lines throughout Parcel G would be removed and disposed of off site. (This action is already in progress as part of a TCRA.) The survey and removals would occur before any covers were installed as part of Alternative S-5. Buildings, former building sites, and excavated areas would be surveyed after cleanup is completed to ensure that no residual radioactivity is present at levels above the remediation goals.

Excavated soil, building materials, and drain material from radiologically impacted sites would be screened and radioactive sources and contaminated soil would be removed and disposed of at an off-site low-level radioactive waste facility.

Institutional Controls(42) (ICs) will be implemented to prevent exposure to areas where potential unacceptable risk is posed by COCs in soil and groundwater. ICs are legal and administrative mechanisms used to implement land use restrictions that are used to limit the exposure of future landowner(s) or user(s) of the property to hazardous substances present on the property, and to ensure the integrity of the remedial action. ICs are required on a property where

the selected remedial cleanup levels result in contamination remaining at the property above levels that allow for unlimited use and unrestricted exposure. ICs will remain in place unless the remedial action taken will allow for unlimited use of the property and unrestricted exposure. Implementation of ICs includes requirements for monitoring and inspections, and reporting to ensure compliance with land use or activity restrictions.

The Navy has determined that it will rely on proprietary controls in the form of environmental restrictive covenants as provided in the "Memorandum of Agreement Between the United States Department of the Navy and the California Department of Toxic Substances Control" and attached covenant models (Navy and DTSC 2000) (hereinafter referred to as the "Navy/DTSC MOA").

More specifically, land use and activity restrictions will be incorporated into two separate legal instruments as provided in the Navy/DTSC MOA:

1. Restrictive covenants included in one or more Quitclaim Deeds from the Navy to the property recipient.

2. Restrictive covenants included in one or more "Covenant to Restrict Use of Property" entered into by the Navy and DTSC as provided in the Navy/DTSC MOA and consistent with the substantive provisions of California Code of Regulations (Cal. Code Regs.) tit. 22 § 67391.1.

The "Covenant(s) to Restrict Use of Property" will incorporate the land use restrictions into environmental restrictive covenants that run with the land and that are enforceable by DTSC against future transferees. The Quitclaim Deed(s) will include the identical land use and activity restrictions in environmental restrictive covenants that run with the land and that will be enforceable by the Navy against future transferees.

The activity restrictions in the "Covenant(s) to Restrict Use of Property" and Deed(s) shall be implemented through the Parcel G Risk Management Plan ("Parcel G RMP") to be prepared by the City of San Francisco and approved by the Navy and FFA Signatories. The Parcel G RMP shall be attached to and incorporated by reference into the Covenant(s) to Restrict Use of Property and Deed(s) as an enforceable part thereof. It shall specify soil and groundwater management procedures for compliance with the remedy selected in the Parcel G ROD amendment. The Parcel G RMP shall identify the roles of local, state, and federal government in administering the Parcel G RMP and shall include, but not be limited to, procedures for any necessary sampling and analysis requirements, worker health and safety requirements, and any necessary site-specific construction and/or use approvals that may be required.

Land use restrictions will be applied to specified portions of the property and described in findings of suitability to transfer, findings of suitability for early transfer, "Covenant(s) to Restrict Use of Property" between the Navy and DTSC, and any Quitclaim Deed(s) conveying real property containing Parcel G at HPS.

Although the Navy may later transfer the procedural responsibilities for enforcement of land use restrictions to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for the integrity of the remedy.

Access

The Deed and Covenant shall provide that the Navy and FFA signatories and their authorized agents, employees, contractors and subcontractors shall have the right to enter upon HPS Parcel G to conduct investigations, tests, or surveys; inspect field activities; or construct, operate, and maintain any response or remedial action as required or necessary under the cleanup program, including but not limited to monitoring wells, pumping wells, treatment facilities, and cap/containment systems.

Implementation

The Navy shall address and describe institutional control implementation and maintenance actions including periodic inspections and reporting requirements in the preliminary and final RD reports to be developed and submitted to the FFA signatories for review pursuant to the FFA (see "Navy Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions" attached to January 16, 2004 Department of Defense memorandum titled "Comprehensive Environmental Response, Compensation and Liability Act [CERCLA] Record of Decision [ROD] and Post-ROD Policy"). The preliminary and final RD reports are primary documents as provided in Section 7.3 of the FFA.

Activity Restrictions that Apply throughout Parcel G

The following sections describe the institutional control objectives to be achieved through activity restrictions throughout Parcel G in order to ensure that any necessary measures to protect human health and the environment and the integrity of the remedy have been undertaken.

Restricted Activities

The following restricted activities throughout HPS Parcel G must be conducted in accordance with the "Covenant(s) to Restrict Use of Property", Quitclaim Deed(s), the Parcel G RMP, and if required, any other workplan or document approved in accordance with these referenced documents:

a. "Land disturbing activity" which includes but is not limited to: (1) excavation of soil, (2) construction of roads, utilities, facilities, structures, and appurtenances of any kind, (3) demolition or removal of "hardscape" (for example, concrete roadways, parking lots, foundations, and sidewalks), (4) any activity that involves movement of soil to the surface from below the surface of the land, and (5) any other activity that causes or facilitates the movement of known contaminated groundwater.

b. Alteration, disturbance, or removal of any component of a response or cleanup action (including but not limited to pump-and-treat facilities, shoreline protection, and soil cap/containment systems); groundwater extraction, injection, and monitoring wells and associated piping and equipment; or associated utilities.

c. Extraction of groundwater and installation of new groundwater wells.

d. Removal of or damage to security features (for example, locks on monitoring wells, survey monuments, fencing, signs, or monitoring equipment and associated pipelines and appurtenances).

Prohibited Activities

The following activities are prohibited throughout HPS Parcel G:

a. Growing vegetables or fruits in native soil for human consumption.

b. Use of groundwater.

Proposed Activity Restrictions Relating to VOC Vapors at Specific Locations within Parcel G

Any proposed construction of enclosed structures must be approved in accordance with the "Covenant(s) to Restrict Use of the Property," Quitclaim Deed(s), and the RMP for each parcel prior to the conduct of such activity within the area requiring institutional controls (ARIC) for VOC vapors to ensure that the risks of potential exposures to VOC vapors are reduced to acceptable levels that are adequately protective of human health. Initially, the ARIC will include all of Parcel G. This can be achieved through engineering controls or other design alternatives that meet the specifications set forth in the ROD, remedial design reports, land use control remedial design (LUC RD) report, and the RMP for each parcel. The ARIC may be modified as the soil contamination areas and groundwater contaminant plumes that are producing unacceptable vapor inhalation risks are reduced over time or in response to further soil, vapor, and groundwater sampling and analysis for VOCs that establishes that areas now included in the ARIC do not pose unacceptable potential exposure risk to VOC vapors.

Additional Land Use Restrictions for Areas Designated for Open Space, Educational/Cultural, and Industrial Reuse

The following restricted land uses for property areas designated for open space, educational/cultural, and industrial land uses in the San Francisco Redevelopment Agency's reuse plan must be reviewed and approved by the FFA Signatories in accordance with the "Covenants to Restrict Use of the Property," Quitclaim Deed(s), and the RMP for each parcel prior to use of the property for any of the restricted uses:

a. A residence, including any mobile home or factory built housing, constructed or installed for use as residential human habitation,

b. A hospital for humans,

c. A school for persons under 21 years of age, or

d. A daycare facility for children.

Attachment C provides the checklist for institutional controls.

2.9.3 Expected Outcomes of the Selected Remedy

For soil, the expected outcome is that excavation will remove contaminated soil that exceeds remediation goals for lead and PAHs. Residual risks from these and other COCs would be mitigated through the use of durable covers and access restrictions to restrict exposure. Following implementation of the remedy, the property will be suitable for the uses specified in the redevelopment plan.

The groundwater remedy is expected to achieve remediation goals by actively treating VOCs and metals in groundwater to restore the aquifer quality by reducing or immobilizing the mass of contaminants of concern in groundwater to levels that do not pose a threat to human health through the inhalation exposure pathway. Groundwater will be monitored for VOCs and metals quarterly for the first 2 years, while treatment is implemented and reacting with groundwater contaminants. Because of the relatively low concentrations of COCs and the expected success of the treatments, one treatment is anticipated to be successful. Three additional years of semiannual monitoring is planned to assess potential rebound of contaminants during seasonal fluctuations. Groundwater monitoring would cease after this period if goals and trigger levels are met. ICs will be put in place to prohibit occupancy of buildings or other enclosures where there is the potential for exposure resulting in unacceptable risk from the vapor intrusion pathway. ICs will also be in place to require engineering controls on all new buildings constructed in those areas within Parcel G where plumes may still present unacceptable risk for the vapor intrusion pathway, until risk levels are demonstrated to be acceptable. The Navy intends to permanently prohibit the use of groundwater at Parcel G through the use of ICs.

For radiological contamination, the remedy includes surveys, decontamination, excavation, and off-site disposal. The removal of contaminants from radiologically impacted buildings and former building sites with documented radiological impacts, and removal of potential radiologically impacted sanitary and storm sewers and soils, are expected to result in a reduction of the potential risks associated with exposure to radionuclides.

2.9.4 Statutory Determinations

In accordance with the NCP, the Selected Remedy meets the following statutory determinations.

- **Protection of Human Health and the Environment** – The Selected Remedy for soil will protect human health and the environment through excavation of contaminated soil, preventing exposure to remaining metals by installing durable covers, and the implementation of ICs. The Selected Remedy for groundwater will provide long-term protection by reducing concentrations of VOCs and metals through treatment.

- **Compliance with ARARs** – CERCLA § 121(d)(1) states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate. Chemical-specific ARARs are health- or risk-based numerical values or methods that, when applied to site-specific conditions, establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the environment. Location-specific ARARs are restrictions on the concentrations of hazardous substances or on conducting activities solely because they are in specific locations. Specific locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats. Action-specific ARARs are technology- or activity-based requirements or limitations for remedial activities. These requirements are triggered by the particular remedial activities conducted at the site. The remedial alternatives selected by the Navy will meet all chemical-, location-, and action-specific ARARs. The ARARs that will be met by the preferred alternatives are summarized in Attachment A.

- **Cost-Effectiveness** – The Selected Remedy would provide overall protectiveness proportional to their costs and are therefore considered cost-effective.

- **Utilization of Permanent Solution and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable** – The Navy has determined that the Selected Remedy represents the maximum extent practicable to which permanent solutions and alternative treatment technologies can be used in a cost-effective manner. Of all of the alternatives that were considered protective of human health and the environment and that complied with ARARs, the Selected Remedy would provide the best balance of tradeoffs amongst long-term effectiveness and permanence, implementability, short-term effectiveness, and cost. The Selected Remedy is expected to be permanent and effective over the long-term land use.

- **Preference for Treatment as a Principal Element** – The Selected Remedy for soil does not satisfy the statutory preference for treatment as a principal element of the remedy. The soil remedy will not reduce the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants through treatment. The Selected Remedy for groundwater satisfies the statutory preference for treatment as a principal element of the remedy; that is, it reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment. The Selected Remedy for radiologically impacted soil and remediation of radiologically impacted building materials does not include treatment as a principal element of the remedy; therefore, there is no reduction in the toxicity, mobility, or volume of radionuclides in contaminated soil or building materials.

- **Five-Year Review Requirements** – Because the Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unrestricted use, a statutory review will be conducted every 5 years after the remedial action is initiated to ensure the remedy is protective of human health and the environment.

2.10 COMMUNITY PARTICIPATION

Community participation at HPS includes a Restoration Advisory Board (RAB), public meetings, public information repositories, newsletters and fact sheets, public notices, and an IR Program website. The Community Involvement Plan for HPS provides detailed information on community participation for the IR Program and documents interests, issues, and concerns raised by the community regarding ongoing investigation and cleanup activities at HPS.

In the late 1980s, the Navy formed a technical review committee (TRC) consisting of the Navy, community members, and regulatory agency representatives. The TRC met to discuss environmental issues pertaining to HPS. In 1993, pursuant to the Defense Environmental Restoration Program, Title 10 United States Code § 2705(d), the Navy formed the RAB, which replaced the TRC. The RAB consists of members of the Navy, the community, and the regulatory agencies. RAB meetings are held on the fourth Thursday of every month and are open to the public to provide opportunity for public comment and input. Documents and relevant information relied upon in the remedy selection process will be made available for public review in the public information repositories listed below or on the **IR Program website**[43].

San Francisco Main Library
100 Larkin Street
Government Information Center, 5th Floor
San Francisco, California 94102
Phone: (415) 557-4500

Anne E. Waden Bayview Library
5075 Third Street
San Francisco, California 94124
Phone: (415) 715-4100

For access to the Administrative Record or additional information on the IR Program contact:

Mr. Keith Forman
Hunters Point Shipyard BRAC Environmental Coordinator
Base Realignment and Closure Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310
Phone: (619) 532-0913
e-mail: keith.s.forman@navy.mil

In accordance with CERCLA §§ 113 and 117, the Navy provided a public comment period from July 23, 2008, to August 22, 2008, for the proposed remedial action described in the Proposed Plan for Parcels G, D, D-2, and UC-1. A public meeting to present the Proposed Plan was held at 6:30 to 8:00 p.m. on July 30, 2008. Public notice of the meeting and availability of documents was placed in the *San Francisco Examiner* on July 27, 2008.

3. RESPONSIVENESS SUMMARY

The responsiveness summary is the third component of a ROD; its purpose is to summarize information about the views of the public and support agency on both the remedial alternatives and general concerns about the site submitted during the public comment period. It documents in the record how public comments were integrated into the decision-making process. The participants in the public meeting, held on July 30, 2008, included community members, RAB members, and representatives of the Navy, EPA, DTSC, and the Water Board. Questions and concerns received during the meeting were addressed at the meeting and are documented in the **meeting transcript** (link to the transcript of meeting to be provided in the draft final ROD). Responses to comments provided at the meeting and received during the public comment period by the Navy, EPA, DTSC, or the Water Board are included in the responsiveness summary (Attachment B).