Draft

Radiological Data Evaluation Findings Report for Parcels B and G Soil

Former Hunters Point Naval Shipyard
San Francisco, California

September 2017

Department of the Navy
Naval Facilities Engineering Command
Base Realignment and Closure
Program Management Office West

Executive Summary

This report summarizes background information and data evaluation activities conducted on the historical radiological data collected by Tetra Tech EC, Inc. (TtEC) at the former Hunters Point Naval Shipyard (HPNS), San Francisco, California, and findings from the evaluation of soil sample data from Parcels B and G. HPNS is divided into parcels, which are further broken down into subparcels or work areas. Separate reports will be provided for interior building surfaces and for soil collected from other parcels at HPNS. This report is limited to the soil data at Parcels B and G. Other parcels and HPNS buildings will be addressed in future reports.

Radiological data collection and removal actions have been previously conducted by contractors[1] at these parcels using Department of the Navy (Navy) and regulatory agency-approved plans based on the Historical Radiological Assessment (HRA) (NAVSEA, 2004) and release criteria documented in the Action Memorandum (Navy, 2006), followed by recommendations for radiological release. There have been various concerns raised regarding the integrity of the data collected during the prior radiological investigation and removal actions at HPNS. Specifically, there are allegations of fraudulent representations of data by TtEC.

The first evidence of soil sample data manipulation and falsification is summarized in the Investigation Conclusion, Anomalous Soil Samples report (TtEC, 2014). TtEC conducted an investigation after Radiological Affairs Support Office (RASO) noted that the final systematic soil sample results from a building site survey unit in Parcel E appeared to be representative of two different data populations, indicating that the soil samples had not been collected where they were purported to have been collected. This report concluded that in addition to this survey unit, 15 survey units and 4 trench units in Parcels C and E had a high probability that the soil samples were not representative of the respective survey units. Seven other locations were identified for further evaluation. TtEC concluded that the persons listed as the sample collectors, either by themselves or in conjunction with others, collected soil samples in areas outside the designated survey units. TtEC implemented a series of corrective actions and considered the action items closed, stating that "TtEC had not had a reoccurrence of the type of anomalous soil sample results that led to this investigation, indicating that the corrective actions have addressed the problem." Ultimately, TtEC conducted rework at each of the survey units identified. However, in the following years, former workers at HPNS alleged additional and more widespread data manipulation and falsification.

Allegations of soil data manipulation and falsification made by former TtEC workers include the following:

- When sufficiently low levels of contamination were not obtained, soil samples were collected from a different area known to have lower radioactivity, and reported as having come from the location being investigated.
- Samples and analytical results were discarded when the results were above the release criteria.
- Instead of collecting soil samples from locations predetermined to have higher gamma scan readings, samples would be collected from nearby soil and represented as having come from the original location.

[1] This term refers to contractors who performed prior work at HPNS and who do not have any involvement in this evaluation. Further, the references herein to work and actions performed at HPNS by other contractors that are the subject of this evaluation are meant to pertain to prior work, including, but not limited to investigation, data gathering, and remediation. The members of the team conducting this evaluation had no involvement in the prior work of other contractors, and this evaluation relies solely on available information and documentation.

- When sufficiently low levels of contamination were not obtained, soil sample collection sites were moved 5 to 10 feet in another direction and a new sample was obtained. The new sample was represented as having been obtained from the original location.
- Chain-of-custody forms were falsified to support the false sample collection information.
- During the screening of overburden soil, actual towed array speeds were greater than allowed speeds, thereby reducing the probability of radiation detection.
- Handheld detectors were used improperly, which may have led to increasing the detection limit of the scanning devices.
- Onsite soil sample results were reviewed and shipment of samples to the offsite lab was blocked if there was a high chance that the release criteria would be exceeded.

In response to the concerns, the Navy assembled a Technical Team (a group of technical experts) to conduct an evaluation of the previous data in light of the claims made. The Technical Team includes representatives from the Navy, United States Environmental Protection Agency, California Department of Toxic Substances Control, California Department of Public Health, the City of San Francisco, and Oregon State University. An independent, third-party team of nationally recognized experts has been contracted to support the Technical Team and perform the evaluation and confirmation investigation. This team includes Battelle, Cabrera Services, CH2M, Perma-Fix Environmental Services, and SC&A Environmental Services and Consulting. Oak Ridge Associated Universities and Argonne National Laboratory have been contracted to provide independent review of reports.

The objective of this evaluation is to review the historical radiological data collected by TtEC at HPNS, assess the potential for data falsification or manipulation, and recommend follow-up data collection to validate previous decisions regarding the property condition. The evaluation process for soil included developing databases; establishing a list of primary radionuclides to evaluate; running statistical and logic tests to identify inconsistencies in soil data; performing graphical data reviews to identify anomalies or unusual trends; identifying historically significant sites to identify where potential contamination could be present and manipulation or falsification of data could have underestimated site conditions; identifying sites based on allegations; developing a form to standardize the assessment and document the data evaluation results for every survey unit; and conducting and documenting data reviews.

Soil sample data from trench units (excavated areas created during removal of storm drains and sanitary sewer lines), fill units (excavated material from trench units that was used as backfill), and current buildings and former building sites (survey units where soil was collected in surrounding areas or in crawl spaces) were evaluated. Based solely on a review of the data previously collected by TtEC and the findings of the data evaluations, recommendations are provided for no further action[2], reanalysis of archived samples, confirmation sampling, or physical inspection of archived samples. These recommendations are defined as follows:

- **No Further Action** – No further evaluation of the data is recommended during this phase of the project as it did not appear that data manipulation or falsification by TtEC had occurred. This designation is not meant to apply beyond the evaluation of the data and does not preclude other actions that may be taken by the Navy.
- **Reanalysis of Archived Samples** – Reanalysis of the archived soil samples (samples collected by TtEC that may be available in onsite storage) collected as initial systematic sample data at an offsite

[2] No further evaluation of the data is recommended during this phase of the project as it did not appear from the scope of this data evaluation that data manipulation or falsification by TtEC had occurred. This designation is not meant to apply beyond the evaluation of the data and does not preclude other actions that may be taken by the Navy.

laboratory is recommended. The evaluation indicated evidence of potential data manipulation or falsification given the methods used to review the data. The purpose for the reanalysis is to a) compare the initial systematic sample results to the release criteria to see if the results may reveal that the release criteria were met and remediation was not required[3] even though final systematic sample results were potentially manipulated and falsified, or b) provide offsite laboratory results to document current site conditions.

- **Confirmation Sampling** – Collection of additional data (surveys, scans, or soil samples) is recommended during this phase of the project. The evaluation indicated evidence of potential data manipulation or falsification based upon the methods used to review the data. The available data are suspect and additional data are needed to document current site conditions. Task-specific plans will be provided detailing the extent of the confirmation sampling activities.
- **Physical Inspection of Archived Samples** – Physical inspection of archived soil samples (samples collected by TtEC that may be available in onsite storage) is recommended during this phase of the project. The evaluation indicated evidence of potential data manipulation or falsification based upon the methods used to review the data. The purpose of the physical inspection of the samples is to determine whether the physical soil characteristics are what would be expected given the sample's collection location. This comparison will help determine whether data have been manipulated or falsified.

The following sections summarize the findings and recommendations of the soil data evaluation for Parcels B and G.

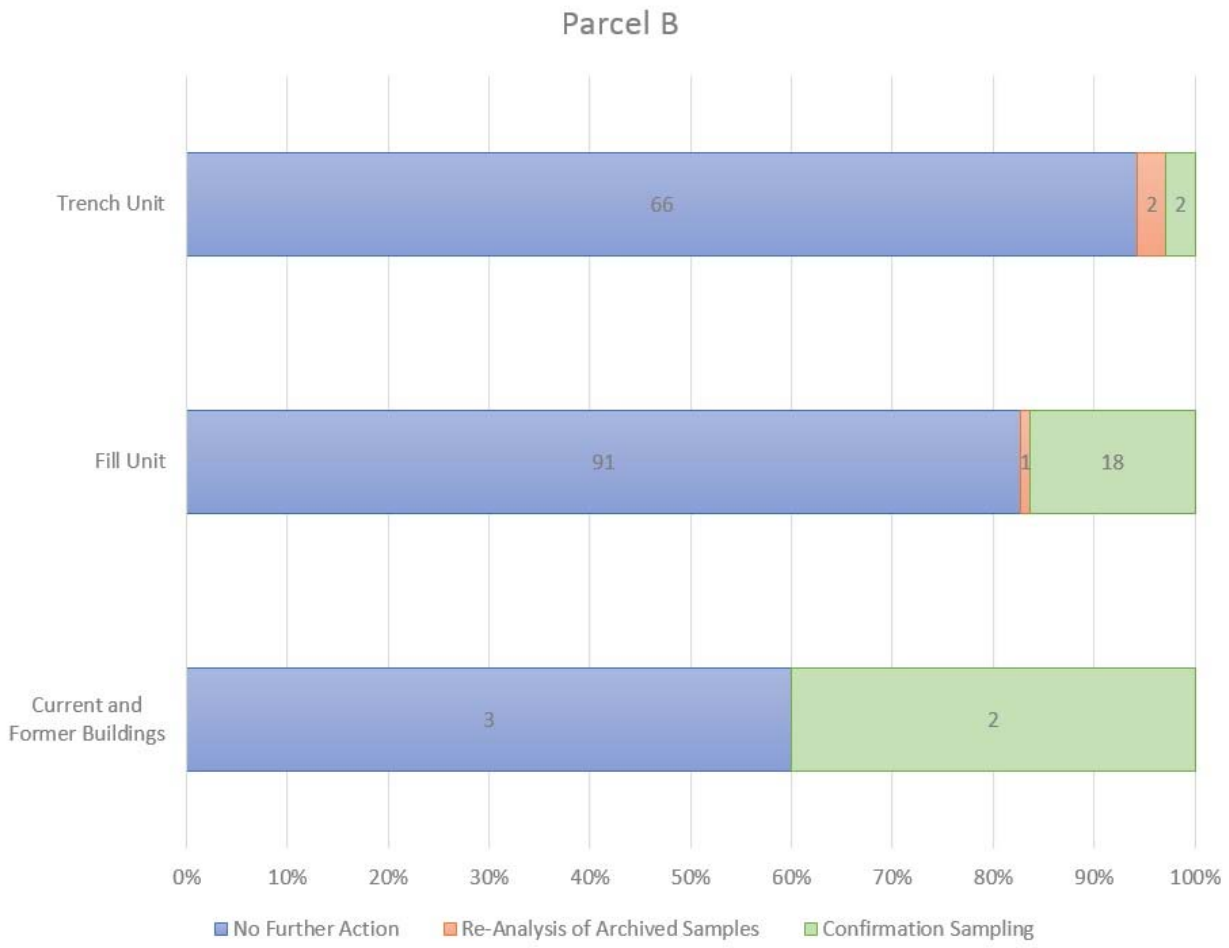
Parcel B

The areas evaluated in Parcel B included 70 trench units, 110 fill units, and 5 current and former building sites with 17 soil survey units. More than 8,000 soil samples were collected from these areas from 2005 through 2010. Based solely on a review of the data previously collected by TtEC and the findings of the data evaluations, the following recommendations are provided:

- Trench units - There was no evidence of potential data manipulation or falsification identified at 66 of the 70 trench units evaluated; therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at the remaining four trench units. Reanalysis of archived samples is recommended at two trench units, and confirmation sampling is recommended at two trench units.
- Fill units - There was no evidence of potential data manipulation or falsification identified at 91 of the 110 fill units evaluated; therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at the remaining 19 fill units used as backfill for 17 trench survey units. Reanalysis of archived samples is recommended at 1 fill unit, and confirmation sampling is recommended for the other 18 fill units. Of the 18 fill units, 17 were recommended for confirmation sampling based on evidence of biased sample collection at locations to potentially avoid the highest gamma scan measurements.

[3] Ra-226 results were reported by the onsite laboratory using a screening method based on the 186 keV energy peak. The offsite laboratory analyzed Ra-226 using a definitive method, allowing the soil samples to equilibrate (21-day in-growth) and reported concentrations using the 609 keV energy peak for Bi-214. Comparisons between the onsite laboratory screening results and the offsite laboratory definitive results for Ra-226 demonstrate the onsite laboratory results were consistently biased high. The Ra-226 analytical results from the onsite laboratory resulted in false exceedances of the release criteria, which resulted in the initiation of remediation. Remediation may have been avoided had soil samples been allowed to equilibrate (21-day in-growth) and decisions had been based on the more reliable Bi-214 analysis using the 609 keV energy peak. The screening method used by the onsite laboratory was selected to allow for rapid decision making during field investigations and to prevent health and safety concerns associated with large open excavations.

- Current and Former Building Sites - There was no evidence of potential data manipulation or falsification identified at 3 of the 5 buildings evaluated (9 out of 17 survey units); therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at the other 2 buildings (8 out of 17 survey units), and confirmation sampling is recommended.



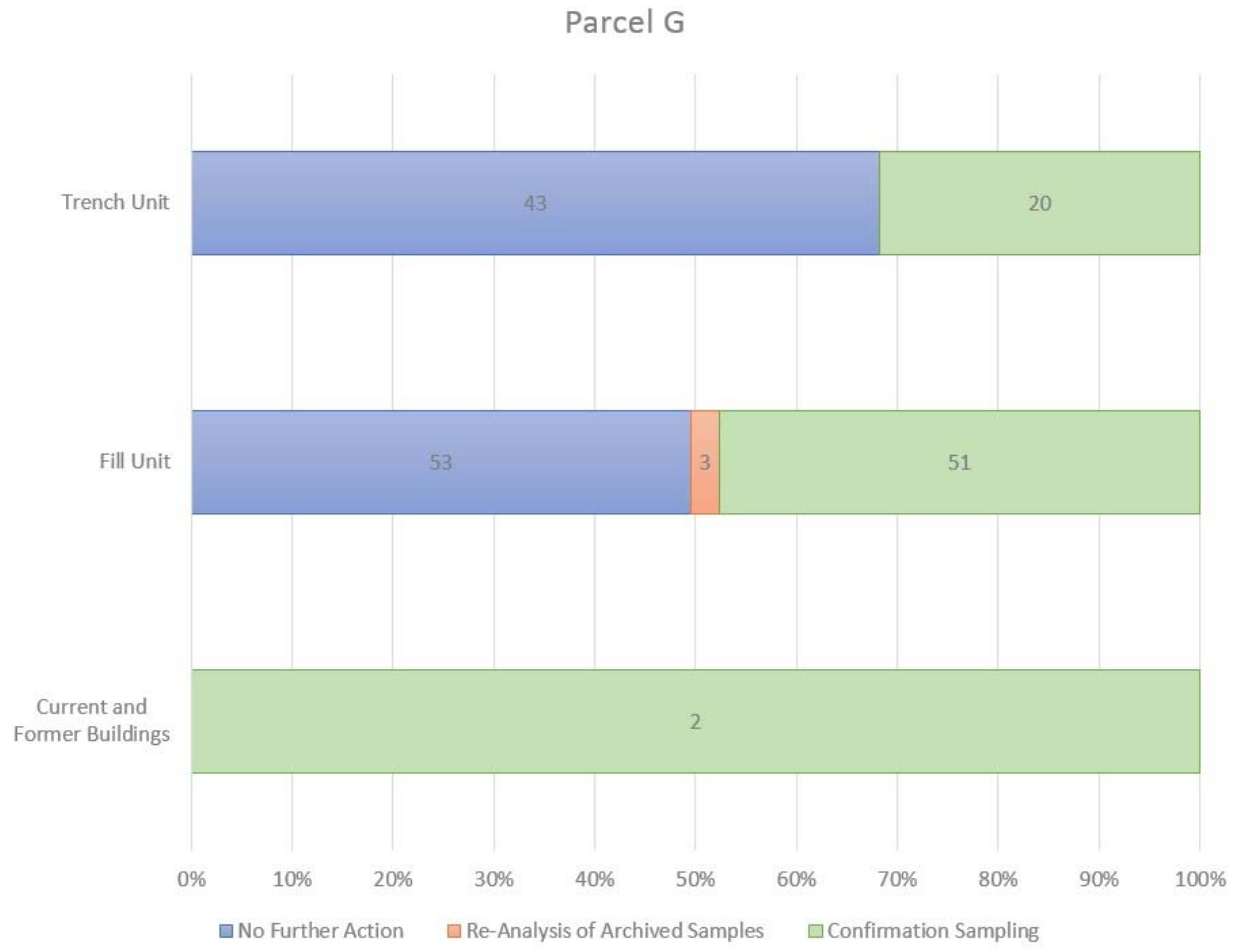
Parcel G

The areas evaluated in Parcel G included 63 trench units, 107 fill units, and 2 current and former building sites with 32 soil survey units. More than 12,000 soil samples were collected from these areas from 2002 through 2011. Based solely on a review of the data previously collected by TtEC and the findings of the data evaluations, the following recommendations are provided:

- Trench units - There was no evidence of potential data manipulation or falsification identified at 43 of the 63 trench units evaluated; therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at the remaining 20 trench units, and confirmation sampling is recommended.
- Fill units - There was no evidence of potential data manipulation or falsification identified at 53 of the 107 fill units evaluated; therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at the remaining 54 fill units used as backfill for 28 trench survey units. Reanalysis of archived samples is recommended at 3 fill units, and confirmation sampling is recommended for the other 51 fill units. Of the 51 fill units, 46 were recommended for

confirmation sampling based on evidence of biased sample collection at locations to potentially avoid the highest gamma scan measurements.

- Current and Former Building Sites - There was evidence of potential data manipulation or falsification at the 2 buildings (25 out of 32 survey units) evaluated, and confirmation sampling is recommended.



Assumptions and Uncertainties

The following assumptions and uncertainties are associated with this evaluation:

- This evaluation is based solely on available data. The procedures were developed to identify the potential for manipulation or falsification of soil samples previously collected by TtEC at HPNS. This evaluation should be used to identify recommended sampling locations and as a tool to help determine where additional data should be collected.
- Evidence of potential data manipulation and falsification was discovered during the Navy's soil data evaluation of Parcels B and G. Because it is impossible to determine whether every instance of potential data manipulation or falsification has been identified, the Navy recommends additional surveys and sampling beyond the areas with evidence of data manipulation. Additional soil sampling locations will be selected in coordination with the regulatory agencies.

- Data quality related to TtEC's laboratory analytical methods and procedures were not evaluated. Data quality has been assessed and approved by the Navy and regulatory agencies in previous reports submitted by TtEC.

Contents

Executive Summary ..... **iii**
Parcel B v
Parcel G vi
Assumptions and Uncertainties vii

1 Introduction **1-1**
1.1 Objective 1-1
1.2 Scope of Data Evaluation 1-1
1.3 Assumptions and Uncertainties 1-2

2 Radiological History **2-1**
2.1 Storm Drain and Sanitary Sewer Line Investigation 2-1
2.2 Current and Former Building Soil Investigation 2-3
2.3 Release Criteria 2-3
2.4 Anomalous Soil Samples Report 2-4
2.5 Former Worker Allegations 2-4

3 Data Evaluation Activities **3-1**

4 Findings and Recommendations **4-1**
4.1 Parcel B 4-2
4.1.1 Trench Units 4-2
4.1.2 Fill Units 4-4
4.1.3 Current and Former Building Sites 4-7
4.2 Parcel G 4-12
4.2.1 Trench Units 4-12
4.2.2 Fill Units 4-22
4.2.3 Current and Former Building Sites 4-30
4.3 Conclusions and Recommendations 4-33

5 References **5-1**

Table

2-1 Release Criteria

Figures

1-1 HPNS and Parcel Locations
1-2 Scope of Data Evaluation

2-1 Parcel B Current and Former Building Site Locations and Survey Units
2-2 Parcel G Current and Former Building Site Locations and Survey Units

3-1 FRED Soil Sample Summary
3-2 Historically Significant Sites

4-1 Areas Evaluated in Parcel B
4-2 Parcel B Trench Unit Recommendations
4-3 Parcel B Fill Unit Recommendations
4-4 Parcel B Current and Former Building Site Survey Unit Recommendations

4-5 Areas Evaluated in Parcel G
4-6 Parcel G Trench Unit Recommendations
4-7 Parcel G Fill Unit Recommendations
4-8 Parcel G Current and Former Building Site Survey Unit Recommendations

Appendices

A K-S Test Results
B Example Data Evaluation Form
C Data Evaluation Forms

Acronyms and Abbreviations

Ac	actinium
Am	americium
Bi	bismuth
Co	cobalt
COC	chain-of-custody
cpm	count(s) per minute
Cs	cesium
CSR	construction summary report
ES	excavated soil unit
Eu	europium
FRED	Final Radiological Evaluation Database
FSSR	final status survey results
G-RAM	general radioactive material
H	tritium
HPNS	Hunters Point Naval Shipyard
HRA	historical radiological assessment
K	potassium
K-S	Kolmogorov-Smirnov
K-W	Kruskal-Wallis
keV	kiloelectron volt
LLRW	low-level radioactive waste
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
mrem/yr	millirem per year
Navy	Department of the Navy
NORM	naturally occurring radioactive material
NRDL	Navy Radiological Defense Laboratory
NWT	New World Technology, Inc.
OB	overburden unit
Pb	lead
pCi/g	picocurie per gram
Pu	plutonium
Ra	radium
RACR	removal action completion report
RASO	Radiological Affairs Support Office
ROC	radionuclide of concern
RSY	radiological screening yard
Sr	strontium
SUPR	survey unit project report
SU	survey unit
Th	thorium
TtEC	Tetra Tech EC, Inc.

TU	trench survey unit or trench unit
U	uranium
UC	utility corridor
USEPA	United States Environmental Protection Agency

SECTION 1

Introduction

This report summarizes background information and data evaluation activities conducted on the historical radiological data collected by Tetra Tech EC, Inc. (TtEC) at the former Hunters Point Naval Shipyard (HPNS), San Francisco, California, and findings from the evaluation of soil sample data from Parcels B and G. HPNS encompasses approximately 934 acres, including approximately 491 acres on land, at the point of a high, rocky 2-mile-long peninsula projecting southeastward into the San Francisco Bay. HPNS is divided into parcels, which are further broken down into subparcels or work areas. The potential radiologically impacted sites identified in the Historical Radiological Assessment (HRA) (NAVSEA, 2004) included in this evaluation are located within Parcels B, C, D-2, E, and G, and utility corridor (UC)-1, UC-2, and UC-3 (**Figure 1-1**). Separate reports will be provided for interior building surfaces and for soil collected from other parcels at HPNS. This report is limited to the soil data at Parcels B and G. Other parcels and HPNS buildings will be addressed in future reports.

Radiological data collection and removal actions have been previously conducted by contractors[1] at these parcels using Department of the Navy (Navy) and regulatory agency-approved plans based on the HRA (NAVSEA, 2004) and release criteria documented in the Action Memorandum (Navy, 2006), followed by recommendations for radiological release. There have been various concerns raised regarding the integrity of the data collected during the prior radiological investigation and removal actions at HPNS. Specifically, there are allegations of fraudulent representations of data by TtEC.

In response to the concerns, the Navy assembled a Technical Team (a group of technical experts) to conduct an evaluation of the previous data in light of the claims made. The Technical Team includes representatives from the Navy, United States Environmental Protection Agency (USEPA), California Department of Toxic Substances Control, California Department of Public Health, the City of San Francisco, and Oregon State University. An independent, third-party team of nationally recognized experts has been contracted to support the Technical Team and perform the evaluation and confirmation investigation. This team includes Battelle, Cabrera Services, CH2M, Perma-Fix Environmental Services, and SC&A Environmental Services and Consulting. Oak Ridge Associated Universities and Argonne National Laboratory have been contracted to provide independent review of reports.

1.1 Objective

The objective of this evaluation is to review and assess the historical radiological data collected by TtEC at HPNS and recommend follow-up data collection needed to validate decisions regarding current property condition. Based on the findings from the evaluation, recommendations are made herein for next steps.

1.2 Scope of Data Evaluation

This evaluation was conducted to evaluate the historical radiological data collected by TtEC at HPNS and determine whether, when, and how follow-up data should be collected to validate decisions regarding the current property condition. The radiological data previously collected by TtEC in support of the investigation and remediation of the sanitary sewer line and utility corridor, and current and former

[1] This term refers to contractors who performed prior work at HPNS and who do not have any involvement in this evaluation. Further, the references herein to work and actions performed at HPNS by other contractors that are the subject of this evaluation are meant to pertain to prior work, including, but not limited to investigation, data gathering, and remediation. The members of the team conducting this evaluation had no involvement in the prior work of other contractors, and this evaluation relies solely on available information and documentation.

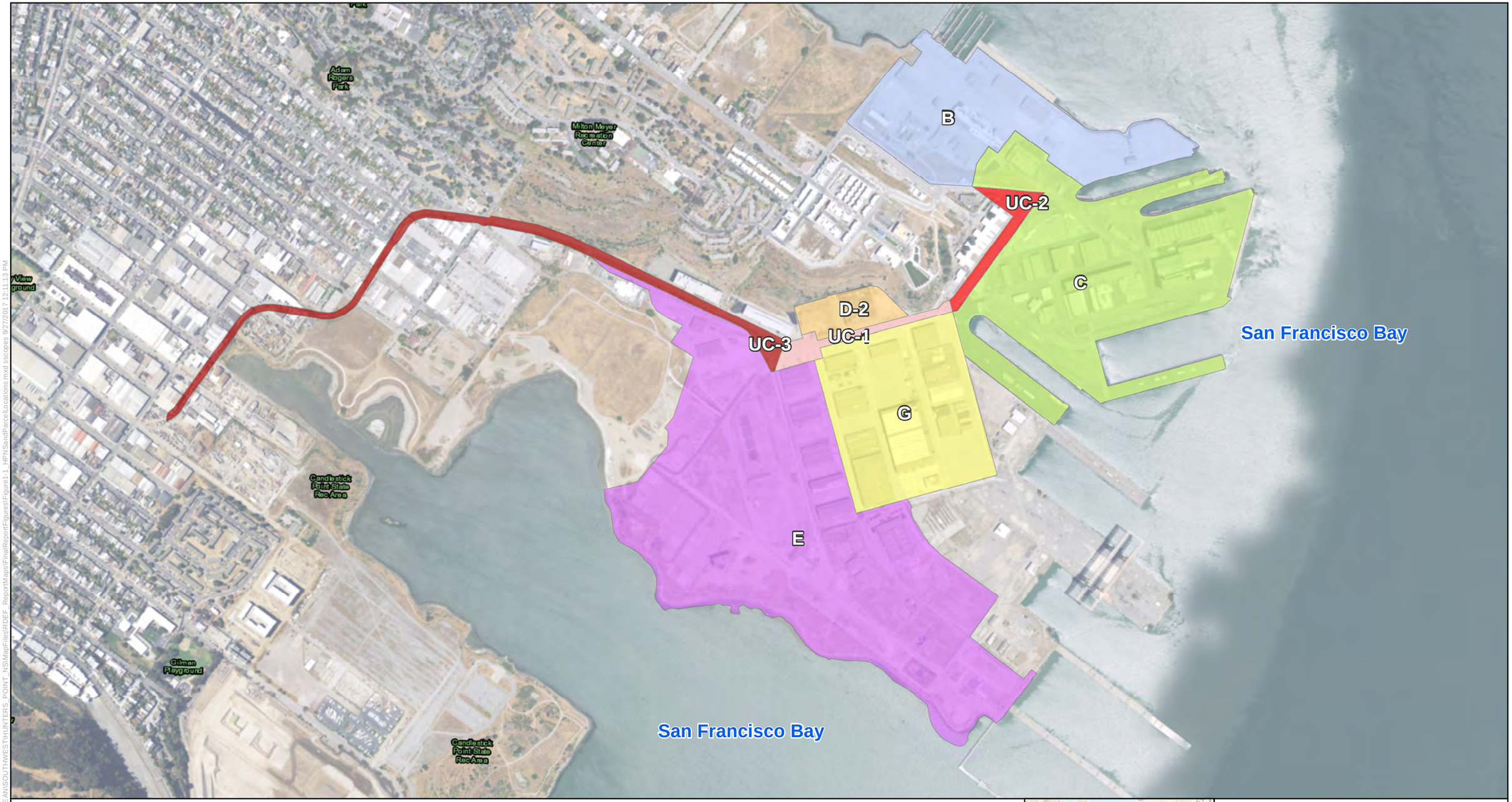
building sites include approximately 50,000 soil samples (equivalent to more than 900,000 analytical results) collected from more than 300 trench units, more than 500 fill units, more than 25 current and former building sites, and 11 survey units at the North Pier.

Figure 1-2 presents the areas evaluated by TtEC and defines the scope of the data evaluation.

1.3 Assumptions and Uncertainties

The following assumptions and uncertainties are associated with this evaluation:

- This evaluation is based solely on available data. The procedures were developed to identify the potential for manipulation or falsification of soil samples previously collected by TtEC at HPNS. This evaluation should be used to identify recommended sampling locations and as a tool to help determine where additional data should be collected.
- Evidence of potential data manipulation and falsification was discovered during the Navy's soil data evaluation of Parcels B and G. Because it is impossible to determine whether every instance of potential data manipulation or falsification has been identified, the Navy recommends additional surveys and sampling beyond the areas with evidence of data manipulation. Additional soil sampling locations will be selected in coordination with the regulatory agencies.
- Data quality related to TtEC's laboratory analytical methods and procedures were not evaluated. Data quality has been assessed and approved by the Navy and regulatory agencies in previous reports submitted by TtEC.



Legend:

PARCEL

- B
- C
- D-2
- E
- G
- UC-1
- UC-2
- UC-3

BASE MAP SOURCE:
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 400 800 1,600 Feet

1 inch = 800 feet

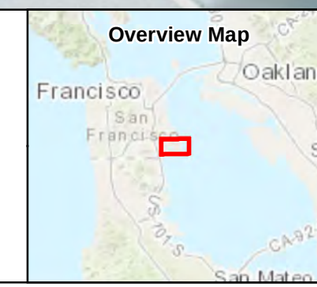
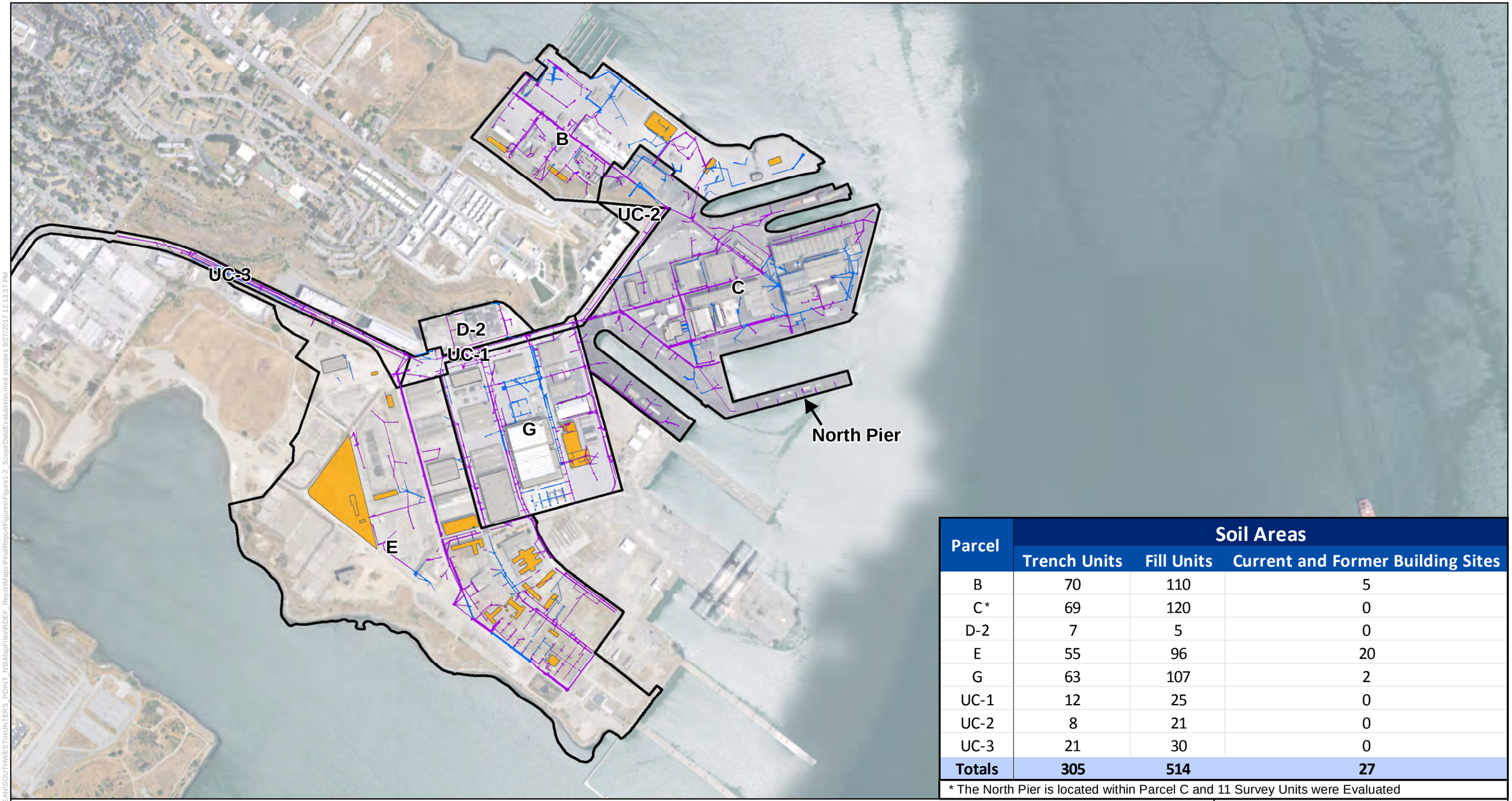


Figure 1-1
HPNS and Parcel Locations
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Brookside\GIS_SHAREENB\G00_Proj\N\Navy\CLEAN\SOUTHWEST\HUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReportFigures\Figure1-1_HPNSandParcelLocations.mxd ascopes 9/27/2017 12:11:12 PM



Parcel	Soil Areas		
	Trench Units	Fill Units	Current and Former Building Sites
B	70	110	5
C*	69	120	0
D-2	7	5	0
E	55	96	20
G	63	107	2
UC-1	12	25	0
UC-2	8	21	0
UC-3	21	30	0
Totals	**305**	**514**	**27**

* The North Pier is located within Parcel C and 11 Survey Units were Evaluated

Legend:

- Trench Unit
- Trench and Fill Unit
- Current and Former Building Site
- Parcel

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 400 800 1,600 Feet

1 inch = 800 feet

Figure 1-2
Scope of Data Evaluation
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Brookside\GIS_SHARE\NB\00_Proj\NNavy\CLEAN\SOUTHWEST\HUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReport\Figures\Figure1-2_ScopeDataEvaluation.mxd sscorpse 9/27/2017 12:13:37 PM

SECTION 2

Radiological History

As part of the environmental investigations being performed to facilitate transfer of HPNS, the Navy prepared an HRA that documents the history of radiological materials at HPNS. The HRA is presented in two volumes. Volume I (NAVSEA, 2000) addresses radioactivity associated with the Naval Nuclear Propulsion Program and concludes that berthing of nuclear-powered ships at HPNS or work done on these ships resulted in no adverse effects on the human population or the environment. Volume II (NAVSEA, 2004) presents the history of general radioactive material (G-RAM) at HPNS in three primary operational areas:

- Use of G-RAM at HPNS by the naval shipyard and Triple A.
- Decontamination activities associated with ships that participated in atomic weapons testing, including Operation Crossroads.
- Radiological activities associated with the Radiation Safety Section/Radiation Laboratory Navy Radiological Defense Laboratory (NRDL).

In response to the HRA, an Action Memorandum for a time-critical removal action was prepared by the Navy in 2006, proposing removal actions to substantially eliminate identified pathways of receptor exposure to radioactive contamination for surrounding populations and nearby ecosystems, such as nearby wetlands and the San Francisco Bay (Navy, 2006). Areas with low-level radioactive contaminants addressed through radiological removal actions by TtEC include the following:

- Storm drains and sanitary sewer lines and associated surrounding soil (more than 28 miles of trench lines and 300,000 cubic yards of soil were investigated and removed or used as backfill).
- Soil associated with current and former building sites.

This section presents a description of the investigations and cleanup that TtEC was contracted to perform and is based on available documents reviewed and approved by the Navy and regulatory agencies. This section includes a summary of the Investigation Conclusion, Anomalous Soil Samples report (TtEC, 2014) in which soil data falsification was first documented, and a summary of former worker allegations of additional wrongdoing.

2.1 Storm Drain and Sanitary Sewer Line Investigation

The Navy initiated the basewide removal action of the storm drains and sanitary sewer systems in 2006 as a part of the time-critical removal action to address potential radiological materials in soil, debris, and structures at HPNS (Navy, 2006). Cesium (Cs)-137, radium (Ra)-226, and strontium (Sr)-90 are the radionuclides of concern (ROCs) for the storm and sanitary sewer system (NAVSEA, 2004). As outlined in the *Project Work Plan Revision 4, Base-Wide Storm Drain and Sanitary Sewer Removal, Hunters Point Shipyard, San Francisco, California* (Storm Drain Work Plan) (TtEC, 2010c), the storm drains and sanitary sewer systems were removed parcel by parcel or specified area. The storm drains and sewer lines were considered radiologically impacted because of the possibility that radioactive waste materials had been disposed of in sinks and drains. The soil immediately below the lines was considered impacted to account for potential leakage, and the soil above the lines was considered impacted to account for undocumented repairs to the lines that may have mixed contaminated soil from leakage areas with overlying soil.

The storm drain and sewer line removal action included excavation of soil, removal of pipelines, plugging of open sewer or storm drain lines left in place during the removal process, ex situ radiological screening and sampling of the pipeline, and performance of Final Status Surveys of the excavated soils

and exposed excavation of trench surfaces. Excavated soil overlying storm drains and sanitary sewer lines was to be "removed to a minimum of 1 foot below and to the sides of each storm drain and sanitary sewer pipeline."

Excavated soil was transported to a radiological screening yard (RSY) pad for radiological surveys to determine whether the soil could be reused as backfill or required disposal. The soil was placed on screening pads in lifts, not exceeding 6 inches in height and up to 1,000 square meters in area. The radiological survey of excavated soil consisted of a high-density gamma surface scan, supported by global positioning system equipment. An investigation level for scan surveys was established to identify elevated levels of radioactivity. If the investigation level was exceeded, biased samples were collected at locations where elevated levels of radioactivity were identified, and soil characterized by laboratory analytical results above the release criteria was removed.

A minimum of 18 systematic soil samples were then collected from excavated soil on each screening pad based on a random starting point. Following radiological clearance for unrestricted use, soil excavated from areas within Installation Restoration Program sites was stockpiled and sampled for the site-specific chemicals of concern and either reused for trench backfill or disposed of as chemically contaminated waste. Radiologically cleared soil excavated from non-Installation Restoration Program sites (sites where chemical contamination had not been identified) was stockpiled separately and used as backfill without chemical testing.

After transporting excavated soil to the RSY pads, the piping was removed. The interior surfaces of the piping were radiologically characterized using a combination of static and scan measurements for total radioactivity and swipe sampling for removable radioactivity. If a sufficient quantity of solid material was present in the pipeline, solid/sediment samples were collected and analyzed for radiological contamination. At this stage, nearly all radioactive contamination is expected to have been removed. Surveying and sampling of the soil above and below the piping was a conservative measure implemented by the Navy.

After removal of piping and soil at least 1 foot beneath the piping, the trench was divided into sections such that the sum of the trench sidewalls and bottom was less than 1,000 square meters in area. This area is called a trench survey unit. Final Status Surveys for the excavated pipeline trench survey units included 100 percent gamma radiation scan surveys to identify elevated levels of radioactivity prior to systematic and biased soil sample collection. A minimum of 18 soil samples were located within each trench survey unit. The samples were analyzed by gamma spectroscopy at the onsite laboratory, with 10 percent of the samples sent to the offsite laboratory for quality control verification. Additionally, 10 percent of the samples were analyzed for Sr-90 by the onsite laboratory. If Cs-137 results from the onsite laboratory were at or above the release criteria, isotopic plutonium, isotopic uranium, and Sr-90 were also analyzed by the offsite laboratory. Analytical results for Ra-226 were reported by the onsite laboratory using a screening method based on the 186 kiloelectron volt (keV) energy peak. The offsite laboratory analyzed Ra-226 using a definitive method, allowing the soil samples to equilibrate (21-day in-growth) and reported concentrations using the 609 keV energy peak for Bi-214. The screening method used by the onsite laboratory was selected to allow for rapid decision making during field investigations and to prevent health and safety concerns associated with large open excavations.

Three types of survey units were established: trench, overburden, and excavated soil (TtEC, 2011). Overburden survey units were specific to Parcel B and included overburden soil, which was defined as soils from excavations not in the immediate 1-foot vicinity of sewer or storm drain piping. Peripheral soils, also specific to Parcel B, were within the 1-foot vicinity of sewer or storm drain piping. This soil was stockpiled separately and surveyed on RSY pads. If peripheral soil was identified as low-level radioactive waste (LLRW), it was disposed of, and the trench segment where the peripheral soil originated was sampled in 3-foot intervals to determine the extent of potential contamination. For excavations in other parcels, excavated soil (including overburden and peripheral soil) was placed on RSY pads and referred

to as excavated soil units. To obtain radiological release, a single survey unit at HPNS was the sum of a trench unit (TU) that was excavated and the overburden or excavated soil units that were used to backfill the trench. For the evaluations detailed in this report, excavation units and overburden units will often be referred to as "fill" units.

The results of the storm drain and sanitary sewer line investigation activities performed by TtEC were documented in Survey Unit Project Reports (SUPRs). SUPRs were included as attachments in parcel-specific Removal Action Completion Reports (RACRs) or in Radiological Construction Summary Reports (CSRs).

2.2 Current and Former Building Soil Investigation

Two current and three former building sites where TtEC collected soil sample data are in Parcel B (**Figure 2-1**). Current Buildings 103 and 130 were divided into seven survey units (Survey Units [SUs] A through G) and two survey units (SUs 8 and 17), respectively. Former Building Sites 114, 142, and 157 were divided into two survey units (SUs 1 and 2), two survey units (SUs 1 and 2), and three survey units (SUs 5, 6, and 7), respectively.

One current and one former building site where TtEC collected soil sample data are located in Parcel G (**Figure 2-2**). Current Building 351A was divided into 20 survey units (SUs A through P, R, S, T, and U) and the Former Building 317/364/365 Site was divided into 12 survey units (SUs 20 through 31).

A brief description of the radiological investigations prior to any work performed by TtEC, a summary of the Final Status Survey performed by TtEC, specifically the soil sampling activities, and the recommendations based on this data evaluation are presented in **Section 4**.

2.3 Release Criteria

Release criteria for all ROCs except Ra-226 are based on USEPA release criteria for soil. For Ra-226, the release criterion agreed to by the Navy and regulatory agencies is 1 picocurie per gram (pCi/g) above the background activity. The background activity was calculated for several areas in HPNS to account for variations in soil type. The "background" was calculated as the arithmetic mean of 18 samples collected in an area free of potential contamination. The background activity used for Parcels B and G is 0.485 pCi/g unless noted otherwise. For soil in the United States, the expected Ra-226 activity is 1 pCi/g and can range from 0.2 to 4 pCi/g (DoD, 2009). Therefore, the HPNS background value for Ra-226 is conservative.

Table 2-1 summarizes the release criteria established by the Action Memorandum (Navy, 2006).

Table 2-1. Release Criteria

	Soil (pCi/g)			
Radionuclide	**Outdoor Worker (pCi/g)**	**Residual Dose (mrem/yr)**	**Residential (pCi/g)**	**Residual Dose (mrem/yr)**
Cesium-137	0.113	0.2142	0.113	0.2561
Radium-226	1.0	6.342	1.0	14.59
Strontium-90	10.8	0.1931	0.331	1.648

TtEC. 2011. *Survey Unit Project Reports Abstract, Sanitary Sewer and Storm Drain Removal Project, Hunters Point Shipyard, San Francisco, California, Revision 3.* July 7.

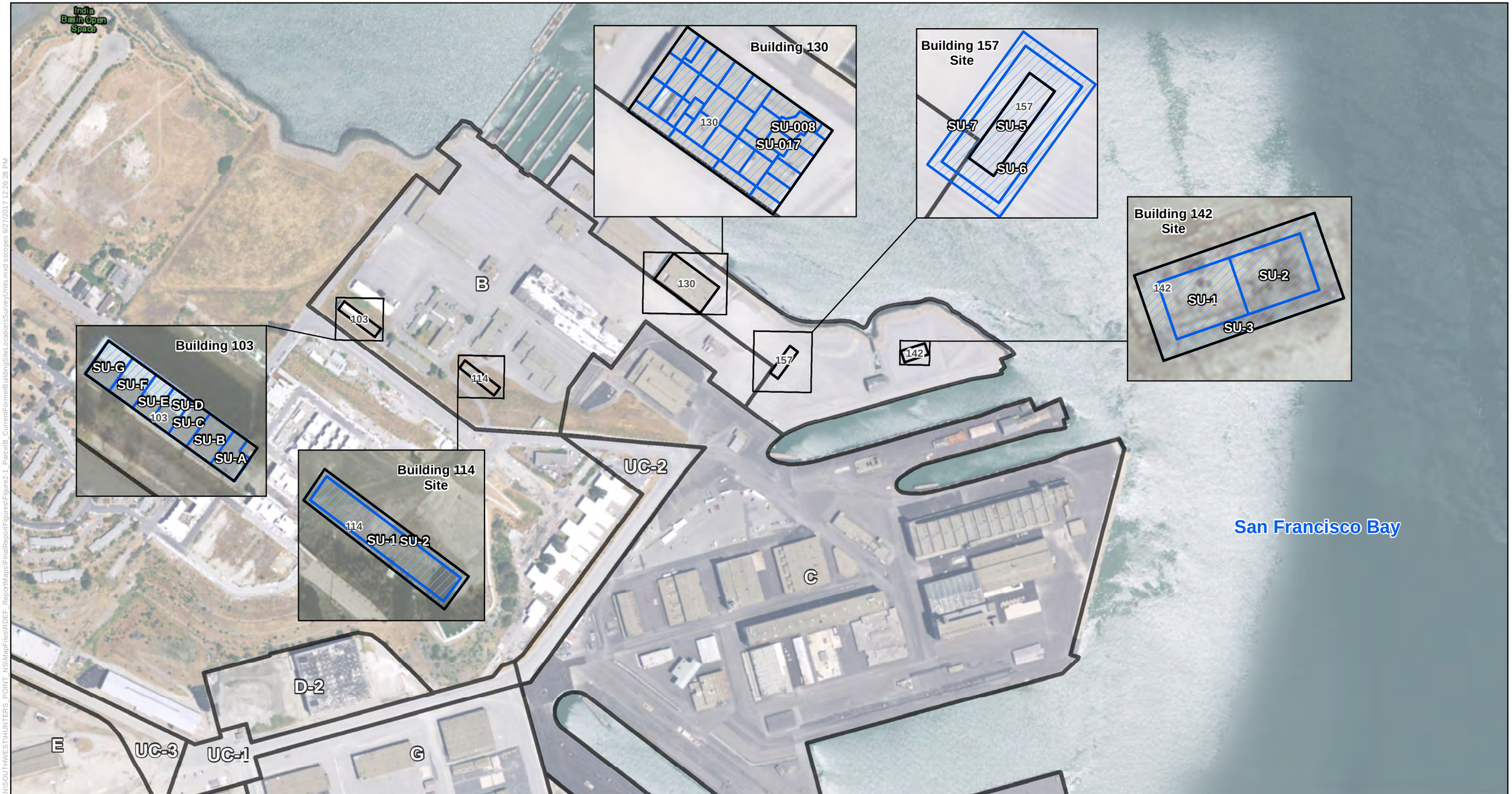
2.4 Anomalous Soil Samples Report

The first evidence of soil sample data manipulation and falsification is summarized in the Investigation Conclusion, Anomalous Soil Samples report (TtEC, 2014). TtEC conducted an investigation after Radiological Affairs Support Office (RASO) noted that the final systematic soil sample results from a building site survey unit in Parcel E appeared to be representative of two different data populations, indicating that the soil samples had not been collected where they were purported to have been collected. This report concluded that in addition to this survey unit, 15 survey units and 4 trench units in Parcels C and E had a high probability that the soil samples were not representative of the respective survey units. Seven other locations were identified for further evaluation. TtEC concluded that the persons listed as the sample collectors, either by themselves or in conjunction with others, collected soil samples in areas outside the designated survey units. TtEC implemented a series of corrective actions and considered the action items closed, stating that "TtEC had not had a reoccurrence of the type of anomalous soil sample results that led to this investigation, indicating that the corrective actions have addressed the problem." Ultimately, TtEC conducted rework at each of the survey units identified. However, in the following years, former workers at HPNS alleged additional and more widespread data manipulation and falsification.

2.5 Former Worker Allegations

Allegations of soil data manipulation and falsification made by former TtEC workers include the following:

- When sufficiently low levels of contamination were not obtained, soil samples were collected from a different area known to have lower radioactivity, and reported as having come from the location being investigated.
- Samples and analytical results were discarded when the results were above the release criteria.
- Instead of collecting soil samples from locations predetermined to have higher gamma scan readings, samples would be collected from nearby soil and represented as having come from the original location.
- When sufficiently low levels of contamination were not obtained, soil sample collection sites were moved 5 to 10 feet in another direction, and a new sample was obtained. The new sample was represented as having been obtained from the original location.
- Chain-of-custody (COC) forms were falsified to support the false sample collection information.
- During the screening of overburden soil, actual towed array speeds were greater than allowed speeds, thereby reducing the probability of radiation detection.
- Handheld detectors were used improperly, which may have led to increasing the detection limit of the scanning devices.
- Onsite soil sample results were reviewed and shipment of samples to the offsite lab was blocked if there was a high chance that the release criteria would be exceeded.



Legend:

- Parcels
- Current and Former Building Sites
- Survey Units where soil samples were collected

BASE MAP SOURCE:
Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

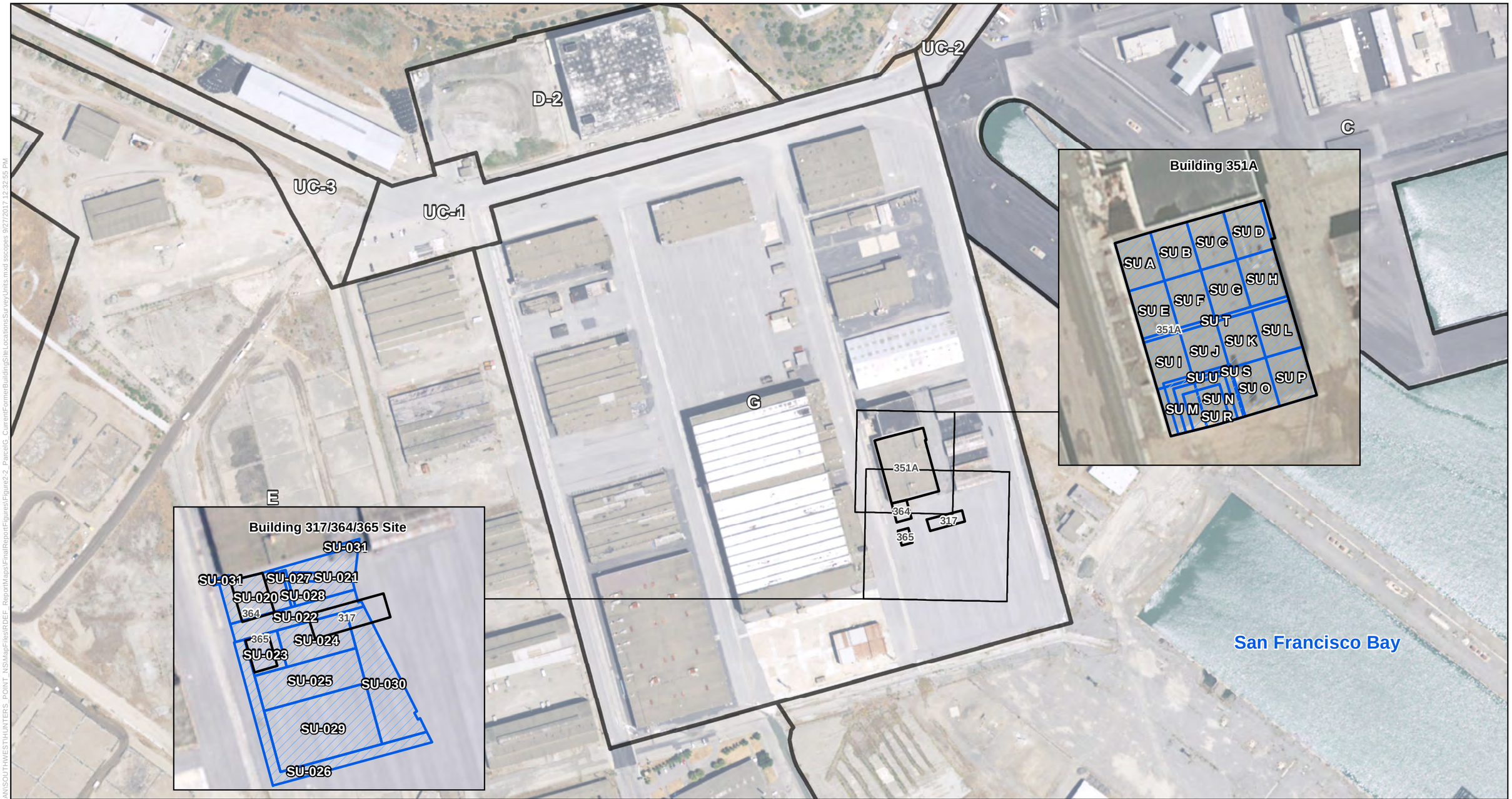
N

0 200 400 800 Feet

1 inch = 400 feet

Figure 2-1
Parcel B Current and Former Building Site Locations and Survey Units
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Brookside\GIS_SHARE\NBG\00_Proj\NNavy\CLEAN\SOUTHWEST\HUNTERS_POINT_NSM\MapFiles\RDEF_ReportMaps\FinalReport\Figures\Figure2-1_ParcelB_CurrentFormerBuildingSiteLocationsSurveyUnits.mxd sscopes 9/27/2017 12:26:28 PM



Legend:

- Parcels
- Current and Former Building Sites
- Survey Units where soil samples were collected

BASE MAP SOURCE:
Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 100 200 400 Feet

1 inch = 100 feet

Figure 2-2
Parcel G Current and Former Building Site Locations and Survey Units
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Brookside\GIS_SHARE\ENGGIS\0_Proj\N\Navy\CLEANUP\SOUTHWEST\HUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReport\Figures\Figure2-2_ParcelG_CurrentFormerBuildingSiteLocationsSurveyUnits.mxd sscopes 9/27/2017 12:39:55 PM

SECTION 3

Data Evaluation Activities

The evaluation was conducted to (1) identify anomalies (unusual or suspect data) that suggest the possibility of prior data manipulation or falsification; (2) perform detailed reviews to further evaluate anomalous data; and (3) recommend additional data collection to confirm existing data, or replace potentially manipulated or falsified data. This evaluation process included developing databases, establishing a list of primary radionuclides to evaluate, and developing a form to standardize the assessment and document the data evaluation results. This section describes the purpose and approach of each element of the data evaluation and identifies how suspect data were flagged:

- **Final Radiological Evaluation Database (FRED) for Soil**
  - Purpose – To base the data evaluation on an electronic soil sample database that is consistent with data provided in the final written reports by TtEC (for example, SUPRs, final status survey results [FSSRs], RACRs, CSRs).
  - Approach – Identified incorrect and missing data in TtEC's database, filled data gaps using optical character recognition to extract soil data from printed versions of draft and final reports, and hand-entered data from older reports. A quality control review was conducted to confirm the accuracy and completeness of the electronic files. Soil sample data from the sanitary sewer line and current and former building site investigations were categorized by the reason the data were originally collected. For example, the final set of systematic samples as reported in the SUPRs were collected to represent the radiological conditions for the entire survey unit at the end of the project and were designated as "FSS-SYS" in FRED, and are also referred to as "FSS" and "Final Systematic" in this evaluation. Other systematic samples (collected prior to the final systematic samples) that describe radiological conditions for the entire survey unit at different times were designated as "SYS_1" and "SYS_2" in FRED, and are also referred to as "Characterization" samples in the evaluations. Biased samples that were collected to determine the limits of soil exceeding the release criteria or to confirm the successful removal of soil exceeding the release criteria, were designated as "FSS-BIAS" and "RAS" in FRED, and are also referred to as "Confirmatory" and "Bias" in this evaluation. The number of analytical results and soil samples included in the FRED is included on **Figure 3-1**.
- **Primary Radionuclides to Evaluate**
  - Purpose – To focus the presentation and interpretation of results on potential contaminants and the naturally occurring radioactive material (NORM) that can be used to help identify suspect data.
  - Approach – Used naturally occurring radionuclides that are not contaminants as the primary radionuclides to evaluate because they are universally present in nearly all soil and their level of radioactivity varies by soil type, which enabled the team to "fingerprint" the soil and identify soil samples that may have been switched. Naturally occurring radionuclides are expected to have detectable levels of radioactivity in soil samples. Through discussions with the team, the following primary radionuclides were identified for evaluation:
    - Bismuth (Bi)-214, a Ra-226 daughter product often used as surrogate for Ra-226
    - Potassium (K)-40
    - Actinium (Ac)-228, a thorium (Th)-232 daughter product often used as a surrogate for Th- 232

  - Other naturally occurring radionuclides (including Th-232 progeny Bi-212 and lead (Pb)-212, and Ra-226 and progeny Pb-214) were evaluated when additional information was needed. ROCs not identified as primary radionuclides for this evaluation include Sr-90 and Cs-137, which are present in soil from fallout as a result of nuclear testing. Sr-90 was only analyzed in 10 percent of the soil samples, limiting its usefulness in the evaluation. Cs-137 is only discussed in the evaluation if exceedances of the release criterion in soil were reported.

- **Statistical Tests**
  - Purpose – To identify statistical inconsistencies in the soil data.
  - Approach – Several statistical tests (Kolmogorov-Smirnov [K-S], Peacock, Kruskal-Wallis [K-W], Benford's Law, Repeated Numbers, Hierarchical Cluster Analysis) were run using six data sets (final systematic data for onsite laboratory, offsite laboratory, and combined onsite and offsite laboratory; pre-remediation systematic data for onsite laboratory, offsite laboratory, and combined onsite and offsite laboratory) to identify groups of soil data statistically different from the data collected within a specific parcel. The data were grouped by survey unit[1], and the results for each survey unit were compared to all other survey units within the same parcel. The data were also grouped by collection date, and the results for each collection date were compared to all other days that samples were collected within the parcel. Because only 10 percent of the soil samples were required to be sent to the offsite laboratory for analysis, the K- S test results for the Final Status Survey data from the onsite and offsite laboratory were combined for the primary radionuclides listed above, to allow for enough data for comparison. K-S test results are included in **Appendix A**. The results from the other statistical tests were available for review during the evaluation as needed.
  - How data were flagged as unusual or suspect – A trench, overburden, excavation soil unit, or current and former building survey unit was flagged if the distribution of sample results (for example, mean and standard deviation) for a given radionuclide collected within the respective unit was significantly different from data collected for all other respective units within a Parcel, and if the distribution of sample results for samples collected on a single day was significantly different from the data collected during all other days when samples were collected in a Parcel.
- **Logic Tests**
  - Purpose – To identify inconsistencies in the prior collection, handling, and processing of individual soil samples.
  - Approach – Logic tests were developed using the gamma spectrometry data available in the reports (SUPRs, FSSRs, RACRs, and CSRs) to identify anomalies in how soil samples were previously processed. Available data include sample collection dates, sample analysis dates, and sample masses reported by the onsite laboratory. It is expected that final systematic soil samples would have been collected as a group on the same day, would have been the final set of samples collected, would have been analyzed as a group within 2 working days, would have been collected before they were counted by the onsite laboratory, and would have been counted by the onsite laboratory within 2 weeks of sample collection to meet production schedules. It is expected that the sample mass reported by the onsite laboratory would have matched the sample mass reported by the offsite laboratory.

[1] For the evaluation of trench units, the data for one trench unit was compared against the data for all other trench units within a parcel. For the evaluation of fill units, fill units were grouped by the survey unit they were associated with as presented in the SUPRs, and comparisons were made on a survey unit basis. Additionally, based on the number of data points in Parcel D-2, the trench and fill unit data for Parcels B and D-2 were combined. For the evaluation of current and former building sites, based on the number of data points in Parcels B and G, the data were combined.

  - How data were flagged as unusual or suspect – Gamma spectrometry data were flagged if final systematic soil samples were collected over multiple days, were collected before a set of confirmatory/bias samples, were analyzed over a period spanning more than 2 working days, were analyzed before they were collected, or were analyzed by the onsite laboratory more than 2 weeks after sample collection. Data were flagged if the sample mass reported by the onsite laboratory was inconsistent with the sample mass reported by the offsite laboratory.

- **Graphical Data Review**
  - Purpose – To identify anomalies or unusual trends in the soil data by visually interpreting graphical representations of the data.
  - Approach – Plots of the data were generated to provide tools for visual identification of inconsistencies, outliers, and trends within a given data set. Time-series plots were generated to present sample results as a function of collection date. Time-series plots included all soil data collected for a given unit. Box plots were generated to present the statistical distribution of data. Normal quantile plots were generated to identify whether all the data in the given data set were from a normally distributed population. Plots were generated for the naturally occurring, non-contaminant radionuclides Ac-228, Bi-214, and K-40, and separate box and normal quantile plots were generated for each sample type (bias, characterization, final systematic). Plots were also generated for Cs-137 if the reported soil concentrations exceeded the release criteria.
  - How data were flagged as unusual or suspect – Data were flagged if sample results for naturally occurring radionuclides were at or below zero; if final systematic samples indicated the potential for multiple data populations (e.g., potentially two or more soil types); and if the distribution of bias, characterization, and/or final systematic soil sample data within a data set were inconsistent, unusual, or not expected. Unique cases were noted if encountered.
- **Historically Significant Sites**
  - Purpose – To identify areas where potential contamination was more likely and manipulation or falsification of data would have underestimated site conditions to the greatest extent.
  - Approach – A map was generated to identify buildings designated as impacted in the HRA and sites where a known radiological cleanup was performed that were located in the vicinity of the trench survey unit data being evaluated (**Figure 3-2**).
  - How data were flagged as unusual or suspect – A trench or survey unit was flagged if it was adjacent to or downstream from a known radiological cleanup site or radiologically impacted building. Fill units were flagged if the soil used to create the fill unit originated from a trench unit that was adjacent or downstream from a known radiological cleanup site or radiologically impacted building.
- **Sites Based on Allegations**
  - Purpose – To identify sites based on allegations of data manipulation or falsification.
  - Approach – A list of TtEC employees and subcontractors potentially associated with allegations of data manipulation or falsification was provided by the Navy based on worker allegations, and the list was compared to available sample collection documents (SUPRs, FSSRs, RACRs, and CSRs). Available COC records are in the process of review to identify potential discrepancies such as sample times, dates relinquished, sampler names, and sampler signatures.
  - How data were flagged as unusual or suspect – Data were flagged if the name of a worker on the list provided by the Navy matched the name provided in available sample collection documentation. In most cases, the SUPR provided the name of the worker who performed the

gamma scan and gamma static measurements. Although a direct correlation could not be made, it was assumed that the worker who performed the gamma scan and gamma static measurements was involved with sample collection. Data will be further scrutinized if the COCs[2] indicate that the time sampled listed is after the sample was relinquished, the COC was relinquished by someone other than the sampler, uniform time internals, samplers listed as collecting samples at multiple locations at the same time, and signatures.

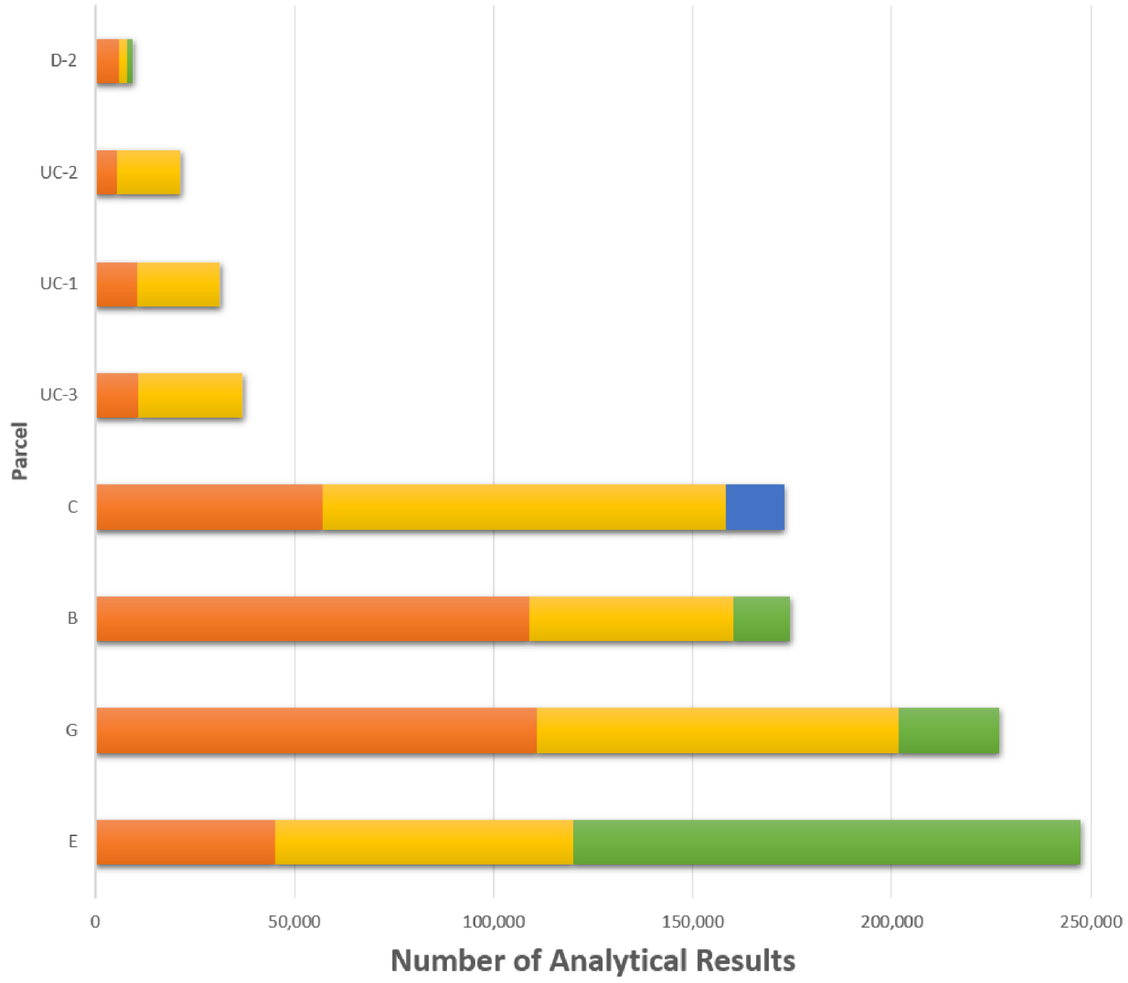
To address the flags discussed above, additional methods of evaluation were conducted, including database review, review of adjacent trench and survey units, and review of historical reports. The review of the database was performed to further investigate logic test results and other anomalies as needed. If the database review could not explain unusual trends, a comparison was performed against data collected from adjacent trench and survey units. Although it may not be true in all instances, it is expected that geographically localized results would be consistent. Historical reports, including SUPRs, FSSRs, RACRs, and CSRs, were reviewed to document observations regarding investigation activities, gamma static and scan measurements, the relationship between reported onsite and offsite laboratory data, and excavation and backfill activities. For trench unit evaluations, the disposition of soil excavated from the trench and fill units that were used to backfill the trench, were documented. For fill unit evaluations, the trench unit where the fill unit was used to backfill and the trench units from which soil was used to create the fill unit, were documented.

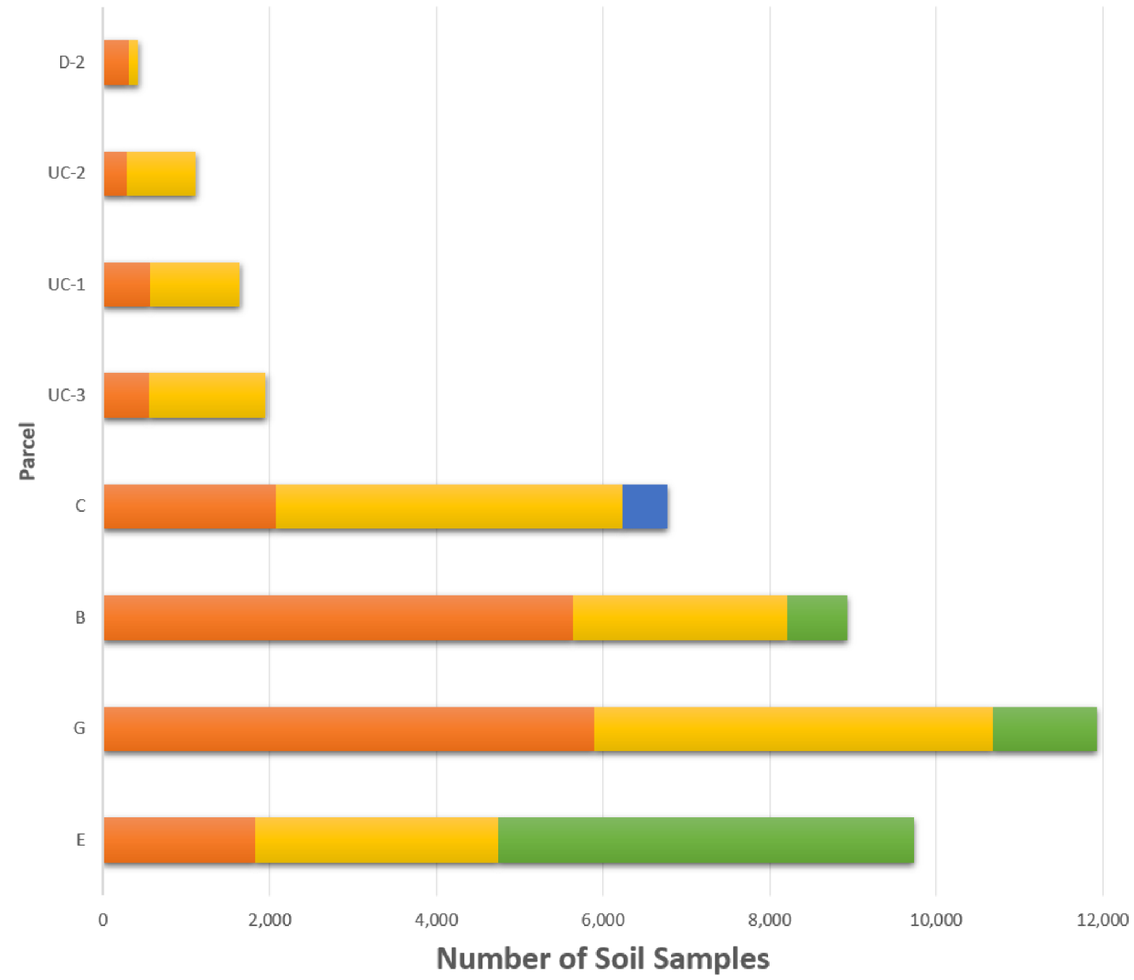
To document the data evaluation, findings, and recommended path forward, an evaluation form was developed. An example data evaluation form is included as **Appendix B**. There are three sections on the form, as follows:

- Section I identifies unusual, suspect, or anomalous data; lists the flags from the K-S and logic tests; and presents observations from time-series plots, historically significant sites, and allegations.
- Section II documents the review of the box and normal quantile plots, additional database review, adjacent survey or trench unit review, and review of historical reports.
- Section III summarizes the conclusions and recommendations.

An evaluation was performed for each trench unit, fill unit, and the current and former building site survey units by health physicists. The evaluation was reviewed by senior health physicists, Navy Base Realignment and Closure, and RASO. The time-series, box, and normal quantile plots and a location map are included at the end of each form.

[2] COCs were collected from the archived samples located at HPNS and include COCs by TtEC ranging from 2009 through 2016. An inventory and evaluation of the available COCs is currently being conducted and was not complete at the time of this report. The COCs will be evaluated and incorporated into this evaluation.





Legend:

- Trench Unit
- Fill Unit
- Current and Former Building Site
- North Pier

Figure 3-1
FRED Soil Sample Summary
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Brnoiside\GIS_SHARE\ENBG\00_Proj\NNavy\CLEAN\SOUTHWEST\HUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReport\Figures\Figure3-1_FREDSoilSampleSummary.mxd scopes 9/19/2017 4:00:53 PM

Parcel	Known Radiological Cleanup Site	Impacted Buildings
B		103, 113, 113A, 114, 130, 140, 142, 146, 157
C		203, 211, 214, 224, 241, 253, 271, 272
D-2		813
E	500, 503, 506, 507, 508, 509, 510, 510A, 517, 520, 521, 529, 701, 704, 707 Triangle Area, 707, 708, IR Site 04	406, 414, 807, 810
G	"Peanut Spill"	317, 351, 351A, 364, 365, 366, 401, 408, 411, 439
UC-1		819
Near UC-3		815, 820, 821, 830

Legend:

- Known Radiological Cleanup Sites
- Impacted Building
- Trench Unit
- Parcel

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

Feet
0 400 800 1,600
1 inch = 800 feet

Figure 3-2
Historically Significant Sites
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

R:\ENBG\00_Proj\Navy\CLEANSOUTHWESTHUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReportFigures\Figure3-2_HistoricallySignificantSites.mxd mbrown19 9/28/2017 2:10:32 PM

SECTION 4

Findings and Recommendations

A summary of findings and recommendations for each parcel for trench units, fill units, and current and former building sites is provided in the following sections. Based solely on a review of the data previously collected by TtEC and the findings of the data evaluations, recommendations are provided for no further action, reanalysis of archived samples, confirmation sampling, or physical inspection of archived samples. These recommendations are defined as follows:

- **No Further Action** – No further evaluation of the data is recommended during this phase of the project as it did not appear that data manipulation or falsification by TtEC had occurred. This designation is not meant to apply beyond the evaluation of the data and does not preclude other actions that may be taken by the Navy.
- **Reanalysis of Archived Samples** – Reanalysis of the archived soil samples (samples collected by TtEC that may be available in onsite storage) collected as initial systematic sample data at an offsite laboratory is recommended. The evaluation indicated evidence of potential data manipulation or falsification given the methods used to review the data. The purpose for the reanalysis is to a) compare the initial systematic sample results to the release criteria to see if the results may reveal that the release criteria were met and remediation was not required[1] even though final systematic sample results were potentially manipulated and falsified, or b) provide offsite laboratory results to document current site conditions.
- **Confirmation Sampling** – Collection of additional data (surveys, scans, or soil samples) is recommended during this phase of the project. The evaluation indicated evidence of potential data manipulation or falsification based upon the methods used to review the data. The available data are suspect and additional data are needed to document current site conditions. Task-specific plans will be provided detailing the extent of the confirmation sampling activities.
- **Physical Inspection of Archived Samples** – Physical inspection of archived soil samples (samples collected by TtEC that may be available in onsite storage) is recommended during this phase of the project. The evaluation indicated evidence of potential data manipulation or falsification based upon the methods to review the data. The purpose of the physical inspection of the samples is to determine whether the physical soil characteristics are what would be expected given the sample's collection location. This comparison will help determine whether data have been manipulated or falsified.

Much of the evaluation of Parcels B and G focused on soil samples collected from storm drain and sanitary sewer line excavations. These drain lines were considered impacted because of the potential for radioactive waste disposal into sinks and drains. If this occurred, radioactive material was likely contained within the piping, and the piping was excavated, removed and disposed of as LLRW. The soil excavated during drain line removal was analyzed for radionuclides because soil beneath the piping may have been contaminated if the piping leaked, and soil above the piping may have been contaminated if the drain lines were repaired or replaced in an area where leakage occurred. Contamination from

[1] Analytical results for Ra-226 were reported by the onsite laboratory using a screening method based on the 186 keV energy peak. The offsite laboratory analyzed Ra-226 using a definitive method, allowing the soil samples to equilibrate (21-day in-growth) and reported concentrations using the 609 keV energy peak for Bi-214. Comparisons between the onsite laboratory screening results and the offsite laboratory definitive results for Ra-226 demonstrate the onsite laboratory results were consistently biased high. The Ra-226 analytical results from the onsite laboratory resulted in false exceedances of the release criteria, which resulted in the initiation of remediation. Remediation may have been avoided had soil samples been allowed to equilibrate (21-day in-growth) and decisions had been based on the more reliable Bi-214 analysis using the 609 keV energy peak. The screening method used by the onsite laboratory was selected to allow for rapid decision making during field investigations and to prevent health and safety concerns associated with large open excavations.

leakage or drain line repair should be relatively rare, yet the release criteria for Ra-226 was exceeded many times in soil samples collected from the excavated soil and trench sidewalls. After carefully examining the analytical data and the conceptual model for soil contamination, it is concluded that the upper range of naturally occurring Ra-226 exceeds the release criteria. Therefore, cleanup will be hampered without an understanding that naturally occurring Ra-226 may exceed the release criterion without being indicative of contamination.

4.1 Parcel B

The areas evaluated in Parcel B included 70 trench units, 110 fill units, and 17 current and former building soil survey units. Analytical results for more than 8,000 soil samples were evaluated. The areas evaluated in Parcel B are presented on **Figure 4-1** and consist of samples collected from 2005 through 2010.

4.1.1 Trench Units

There were 70 trench units evaluated in Parcel B. Based upon the scope of this evaluation, there was no evidence of potential data manipulation or falsification at 66 trench units; therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at four trench units. Reanalysis of archived samples is recommended at two trench units, and confirmation sampling is recommended at two trench units. The results of the Parcel B trench unit evaluation are presented on **Figure 4-2**. The data evaluation forms documenting the findings are provided in **Appendix C**.

The following text summarizes the evaluations of the four trench units where evidence of potential data manipulation or falsification was found.

4.1.1.1 Recommended for Reanalysis of Archived Samples

Trench Unit 59

Trench Survey Unit 59 is the net sum of TU 59 and a volume of import fill material, which was used for backfill. One characterization sample result exceeded the release criterion for Ra-226; however, the extent of remediation and amount of soil removed from TU 59 was not specified. A total of 48 samples was collected from TU 59: 18 characterization samples, 22 biased samples to confirm successful removal of soil with concentrations of Ra-226 above the release criterion, and 18 final systematic samples.

Data from TU 59 were flagged as unusual or suspect for the following reasons:

- Logic tests identified inconsistencies related to the processing of samples from TU 59.
- TU 59 is downstream from a radiologically impacted building.

Anomalies were identified during investigation of the reported sample masses. Two final systematic samples collected from TU 59 were sent to the offsite laboratory for confirmation. Both samples were received by the offsite laboratory on the same date and the sample mass reported by the onsite laboratory was consistent with the sample mass reported by the offsite laboratory for one of those samples. However, for the other sample, the offsite laboratory reported a sample mass that was 176 grams less than the sample mass reported by the onsite laboratory. The difference in sample mass could have potentially affected the reported concentration for that sample or indicate that a different soil sample was submitted to the offsite laboratory. Soil samples are typically analyzed in sealed cans.

The results of the evaluation indicate that one sample result from TU 59 is suspect. Therefore, it is recommended that the archived suspect sample be reweighed and reanalyzed by an independent, certified laboratory, to document current site conditions.

Trench Unit 132

Trench Survey Unit 132 is the net sum of TU 132 and a volume of import fill material, which was used for backfill. Approximately 1 cubic yard of soil was removed from TU 132 based on 1 characterization sample result exceeding the release criterion for Ra-226. A total of 39 samples was collected: 18 characterization samples, 3 biased samples to confirm successful removal of soil with concentrations of Ra-226 above the release criterion, and 18 final systematic samples.

Data from TU 132 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the TU 132 final systematic data and other final systematic data collected from Parcels B and D-2.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from TU 132.
- TU 132 is downstream from a radiologically impacted building.
- At least one worker who collected data at TU 132 was mentioned in one or more allegations of wrongdoing.

Final systematic samples display characteristics inconsistent with characterization samples because the average Ac-228, Bi-214, and K-40 concentrations of the final systematic results were significantly lower than concentrations in the characterization samples. Additionally, concentrations of Th-232 progeny (Ac-228, Bi-212, and Pb-212), Cs-137, and K-40 were statistically different from all the other trench units in Parcel B. The final systematic sample results from TU 132 were compared to final systematic sample results from adjacent trench units (TU 8 and TU 9) to identify potential similarities in results from geographically similar soils; however, inconsistencies were observed in the data from the adjacent trench units.

The results of the evaluation indicate that the final systematic sample results from TU 132 are suspect. However, the Ra-226 concentrations of initial systematic samples were likely overestimated by the onsite laboratory, and these data were not flagged as unusual or suspect. It is recommended that the archived set of initial systematic samples be reanalyzed to determine whether the reported results were overestimated and remediation was not required.

4.1.1.2 Recommended for Confirmation Sampling

Trench Unit 57

Trench Survey Unit 57 is the net sum of TU 57, excavated soil from OBs 177, 206, 219, 222, and 223, and a volume of import fill material, which was used for backfill. Pieces of the piping removed from TU 57 indicated the presence of Cs-137 at concentrations exceeding the release criteria; however, no elevated Cs-137 concentrations were reported in soil sample results. Additionally, pieces of piping removed from TU 57 indicated the presence of Ra-226 at concentrations exceeding the release criteria. Approximately 28 cubic yards of soil were removed from TU 57 based on a subset of bias and characterization sample results exceeding the release criterion for Ra-226. A total of 139 samples was collected from TU 57: 54 characterization samples, 67 biased samples to confirm the successful removal of soil with concentrations of Ra-226 above the release criterion (a subset [54] of these biased samples was collected to also confirm the successful removal of soil with concentrations of Cs-137 above the release criterion), and 18 final systematic samples.

Data from TU 57 were flagged as unusual or suspect for the following reasons:

- Logic tests identified inconsistencies related to the processing of samples from TU 57.

- Graphical data review identified anomalies or unusual trends in the soil sample data collected from TU 57.

Three final systematic samples were collected and analyzed prior to the collection of the remaining subset (15) of final systematic samples. No explanation is provided in available documentation for these reported procedures.

The results of the evaluation indicate that the 15 final systematic sample results from TU 57 are suspect because they were reportedly collected after the first 3 samples were collected and analyzed, providing an opportunity for falsification by replacing samples. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 130

Trench Survey Unit 130 is the net sum of TU 130 and a volume of import fill material, which was used for backfill. Approximately 8 cubic yards of soil were removed from TU 130 based on a subset of characterization sample results exceeding the release criteria. A total of 69 samples was collected from TU 130: 36 characterization samples, 15 biased samples to confirm the successful removal of soil with concentrations of Ra-226 above the release criterion, and 18 final systematic samples.

Data from TU 130 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the TU 130 final systematic data and other final systematic data collected from Parcels B and D-2.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from TU 130.
- TU 130 is downstream from a radiologically impacted building.
- At least one worker who collected data at TU 130 was mentioned in one or more allegations of wrongdoing.

Final systematic samples display characteristics inconsistent with characterization samples, which is indicative of at least two different data populations. Ac-228, Bi-214, and K-40 concentrations of final systematic samples are higher than the Ac-228, Bi-214, and K-40 concentrations of the first set of characterization samples. Furthermore, the Bi-214 final systematic sample results display an unusually low sample variance. Additionally, concentrations of K-40 were statistically different from concentrations in all the other trench units in Parcels B and D-2.

The results of the evaluation indicate that the final systematic sample results from TU 130 are suspect because at least two different data populations may indicate soil sample switching. Therefore, confirmation sampling and analysis by an independent, certified laboratory are recommended to document current site conditions. Because characterization and final systematic sample results are suspect, reanalysis of archived samples is not appropriate.

4.1.2 Fill Units

There were 110 fill units evaluated in Parcel B. Based upon the scope of this evaluation, there was no evidence of potential data manipulation or falsification at 91 fill units; therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at 19 fill units used as backfill for 17 trench survey units. Reanalysis of archived samples is recommended at 1 fill unit, and confirmation sampling is recommended for the other 18 fill units. Of the 18 fill units, 17 were recommended for confirmation sampling based on evidence of biased sample collection at locations to potentially avoid the highest gamma scan measurements. The results of the Parcel B fill unit evaluation

are presented on **Figure 4-3**. The data evaluation forms documenting findings are provided in **Appendix C**.

The following text summarizes the evaluations of the 19 fill units where evidence of potential data manipulation or falsification was found.

4.1.2.1 Recommended for Reanalysis of Archived Samples

Overburden Unit 196

Overburden Unit (OB) 196 was used to backfill TU 50A. Soil used to create OB 196 originated from TU 49, TU 50A, and TU 53. No remediation was performed at OB 196, and 1 biased sample and a set of 18 final systematic samples were collected. No justification was provided in the available documentation for collection of the biased sample.

Data from OB 196 were flagged as unusual or suspect for the following reasons:

- Graphical data review identified anomalies or unusual trends in the soil sample data collected from OB 196.
- Soil used to create OB 72 originated from trench units downstream from a radiologically impacted building.

The final systematic samples displayed characteristics that indicated the potential for two different data populations in the data set, where one subset included Bi-214 concentrations that were significantly lower than the Bi-214 concentrations of the other subset. Four of the 18 final systematic samples and the one biased sample reported significantly higher concentrations of Bi-214. These results are inconsistent with the Ra-226 concentrations and concentrations of radionuclides in the Ra-226 decay series. There were insufficient offsite laboratory data to confirm these results.

The evaluation indicates that results from a subset of the final systematic samples from OB 196 are suspect. The current site conditions may not be accurately represented by the original set of final systematic sample results. It is recommended that the archived samples with unusual sample results be reanalyzed by an independent, certified laboratory to document current site conditions.

4.1.2.2 Recommended for Confirmation Sampling

Overburden Unit 72

OB 72 was used to backfill TU 21. Soil used to create OB 72 originated from TU 11, TU 13, TU 14, TU 20, and TU 21. No remediation was performed at OB 72, and a set of 18 final systematic samples was collected.

Data from OB 72 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the OB 72 final systematic data and other overburden units used to backfill TU 21 and other final systematic data collected from Parcels B and D-2.
- Logic tests identified inconsistencies related to the processing of samples from OB 72.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from OB 72.
- Soil used to create OB 72 originated from trench units downstream from a radiologically impacted building.

One final systematic sample result was inconsistent with the rest of the final systematic sample results, in that the reported Ac-228, Bi-214, and K-40 concentrations for the one sample was significantly lower

than the Ac-228, Bi-214, and K-40 concentrations for the rest of the data set. There were insufficient offsite laboratory data to confirm these results.

The results of the evaluation indicate that the final systematic sample results are suspect, and confirmation sampling and analysis by an independent, certified laboratory are recommended to document current site conditions.

Overburden Unit 138

OB 138 was used to backfill TU 33. Soil used to create OB 138 originated from TU 33. Elevated gamma scan measurements were reported; however, no elevated concentrations in soil were reported. A total of 32 samples was collected from OB 138: 14 biased samples to identify potential elevated radionuclide concentrations in soil and a set of 18 final systematic samples.

Data from OB 138 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the OB 138 final systematic data and other overburden units used to backfill TU 33 and other final systematic data collected from Parcels B and D-2.
- Logic tests identified inconsistencies related to the processing of samples from OB 138.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from OB 138.

The final systematic samples display characteristics inconsistent with final systematic sample results from other fill units in Parcels B and D-2 because the Bi-214 and K-40 final systematic sample results display an unusually low sample variance. Furthermore, final systematic and bias sample results display characteristics indicative of multiple data populations because the average K-40 concentration of final systematic samples is significantly lower than the average K-40 concentration of bias samples.

The results of the evaluation indicate that the final systematic sample results are suspect, and confirmation sampling and analysis by an independent, certified laboratory are recommended to document current site conditions.

4.1.2.3 Recommended for Confirmation Sampling Based on Evidence of Biased Sample Collection at Locations to Potentially Avoid Highest Gamma Scan Measurements

The gamma scan for 16 OBs and 1 excavated soil unit identified several measurements above the investigation level, which prompted the collection of biased soil samples in addition to the standard 18 final systematic samples. However, none of these biased sample results identified activity above the release criteria for any ROC. In some cases, remediation was performed; however, this was only the case when elevated characterization sample results were identified. In all cases, the biased samples collected in response to elevated gamma scan measurements did not identify activity above the release criteria for any ROC. The concern is that the biased samples were not collected at the locations of the highest gamma scan measurement. This narrative is consistent with the allegation that biased samples were collected in areas to avoid potentially elevated soil sample results, but this allegation cannot be confirmed based on this evaluation. Therefore, confirmation sampling and analysis by an independent, certified laboratory are recommended to document current site conditions at the following fill units:

- OB 35
- OB 55
- OB 102
- OB 114
- OB 138 (also included in previous data manipulation or falsification section)
- OB 140

- OB 145
- OB 148
- OB 150
- OB 177
- OB 186
- OB 188
- OB 190
- OB 194
- OB 211
- OB 212
- ES 335

4.1.3 Current and Former Building Sites

There are 5 buildings (2 current buildings and 3 former building sites) divided into 17 survey units, where soil sampling was performed in Parcel B. Based upon the scope of this evaluation, there was no evidence of potential manipulation or falsification at three buildings (the Building 114 Site consisting of two survey units, Building 130 consisting of two survey units, and the Building 142 Site consisting of three survey units), and no further action is recommended. Based upon the scope of this evaluation, there was evidence of potential data manipulation or falsification at two buildings (Building 103 consisting of seven survey units and one of the three survey units at the Building 157 Site), and confirmation sampling is recommended.

The evaluation of the data from these buildings was performed similarly to the evaluation of data from the storm drain and sanitary sewer line investigation. The results of the Parcel B current and former building site survey unit evaluation are presented on **Figure 4-4**. The data evaluation forms documenting the findings are provided in **Appendix C**.

The following text summarizes the evaluations of the two buildings in Parcel B where evidence of potential data manipulation or falsification was found.

4.1.3.1 Recommended for Confirmation Sampling

Building 103, Survey Units A, B, C, D, E, F, and G

Building 103 was previously used as submarine barracks and a decontamination center for Operation Crossroads personnel (NAVSEA, 2004). The NRDL consolidated most of its facilities in 1955 and surveyed its formerly used buildings for free release for HPNS use and control. One of those buildings was Building 103. NRDL release letters confirmed that the buildings were surveyed and released for unrestricted use in 1955, with the exception of the drain lines inside the building. However, existing Atomic Energy Commission guidelines required all NRDL buildings to be thoroughly surveyed and decontaminated prior to abandonment or release for unrestricted use (TtEC, 2010a). In 2002, New World Technology, Inc. (NWT) performed a Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) Class 3 survey of Building 103, and no elevated readings were identified.

The Navy later considered the previous survey insufficient, and in 2008, TtEC was directed by the Navy to reorganize the building into Class 1 and Class 2 SUs and perform a Final Status Survey using MARSSIM guidance (DoD et al., 2000; TtEC, 2010a). The RASO and the Navy identified Cs-137, plutonium (Pu)-239, Sr-90, and Ra-226 as ROCs. Building 103 was divided into interior survey units and survey units with soil in the crawl space of the building. The investigation activities associated with the Class 1 and Class 2 survey units inside of Building 103 is under evaluation and will be reported separately.

Soil inside the crawl space area was divided into seven Class 1 survey units. The seven survey units were designated as SUs A, B, C, D, E, F, and G. The area of each survey unit was between 75 and 100 square

meters, which is smaller than the upper limit of 1,000 square meters used for the storm drain and sanitary storm line investigation. Gamma scan and gamma static measurements and a minimum of 20 soil samples were collected from all seven of the survey units. Each sample was analyzed at the onsite laboratory by gamma spectroscopy, and at least 10 percent of the samples were also analyzed at the offsite laboratory. Ten percent of the samples were also analyzed for Sr-90 and Pu-239 at either the onsite or offsite laboratory.

Additionally, the storm drain and sanitary sewer lines associated with Building 103 were removed by TtEC as a part of the storm drain and sanitary sewer line investigation. The investigation and removal resulted in one trench survey unit (TU 131), and the results were reported by TtEC, separately, in the SUPR for TU 131.

The results of the evaluation indicate that the final systematic sample results from Building 103 SUs A, B, C, D, E, F, and G are suspect, and confirmation sampling and analysis by an independent, certified laboratory are recommended to document current site conditions. No records were provided in the FSSR or RACR describing any of the following:

- Disposition of remediated soil from SUs A, B, C, D, and F
- Post-remediation gamma scan surveys of SUs A, B, C, D, and F to confirm successful remediation
- Remedial activities performed for SUs E and G

The following text summarizes the observations and findings from SUs A, B, C, D, E, F, and G.

Survey Unit A

Approximately 22 cubic yards of soil were removed from SU A based on a subset of characterization samples with concentrations exceeding the release criterion for Ra-226. A total of 53 samples was collected from SU A: 20 characterization samples, 13 biased samples to confirm successful removal of soil with concentrations of Ra-226 above the release criterion, and 20 final systematic samples.

Data from SU A were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the SU A final systematic data and other building survey unit final systematic soil data collected from Parcels B and G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from SU A.
- Building 103 is a radiologically impacted building as identified in the HRA (NAVSEA, 2004).

Final systematic samples display characteristics inconsistent with characterization and bias samples because the sample variance of Bi-214 and K-40 in final systematic samples is smaller than the sample variance of Bi-214 and K-40 in characterization and bias samples. Furthermore, the average Bi-214 and K-40 concentrations from final systematic samples are greater than the average Bi-214 and K-40 concentrations from characterization samples. Additionally, concentrations of Cs-137, K-40, and Th-232 progeny (Pb-212) were statistically different from all the other building survey unit soil data from Parcels B and G. The final systematic sample results from SU A were compared to final systematic sample results from other Building 103 survey unit soil data (SUs B through G) and adjacent TUs 20 and 131 to identify potential similarities in results from geographically similar soils; however, inconsistencies were observed, and sample results from Building 103 SUs B through G are suspect.

Survey Unit B

Approximately 3 cubic yards of soil were removed from SU B based on one characterization sample with a concentration exceeding the release criterion for Ra-226. A total of 44 samples was collected from SU B: 20 characterization samples, 4 biased samples to confirm successful removal of soil with concentrations of Ra-226 above the release criterion, and 20 final systematic samples.

Data from SU B were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the SU B final systematic data and other building and former building site survey unit final systematic data collected from Parcels B and G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from SU B.
- Building 103 is a radiologically impacted building as identified in the HRA (NAVSEA, 2004).

Final systematic samples display characteristics inconsistent with characterization samples because the average Ac-228 and K-40 concentrations from final systematic samples are greater than the average K-40 concentration from characterization samples. Additionally, concentrations of Ra-226 were statistically different from all other building survey unit soil data in Parcels B and G. The final systematic sample results from SU B were compared to final systematic sample results from other Building 103 survey unit soil data (SUs A and C through G) and adjacent TUs 20 and 131 to identify potential similarities in results from geographically similar soils; however, inconsistencies were observed, and sample results from Building 103 SUs A and C through G are suspect.

Survey Unit C

Approximately 12 cubic yards of soil were removed from SU C based on a subset of characterization and bias samples with concentrations exceeding the release criterion for Ra-226. A total of 48 samples was collected from SU C: 20 characterization samples, 8 biased samples to confirm successful removal of soil with concentrations of Ra-226 above the release criterion, and 20 final systematic samples.

Data from SU C were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the SU C final systematic data and other building and former building site survey unit final systematic data collected from Parcels B and G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from SU C.
- Building 103 is a radiologically impacted building as identified in the HRA (NAVSEA, 2004).

Final systematic samples display characteristics inconsistent with characterization samples because the average Ac-228 and K-40 concentrations from final systematic samples are greater than the average Ac-228 and K-40 concentrations from characterization samples. Additionally, concentrations of Cs-137, K-40, and Th-232 progeny (Pb-212) were statistically different from all the other building survey unit soil data from Parcels B and G. The final systematic sample results from SU C were compared to final systematic sample results from other Building 103 survey unit soil data (SUs A, B, and D through G) to identify potential similarities in results from geographically similar soils; however, inconsistencies were observed, and sample results from Building 103 SUs A, B, and D through G are suspect.

Survey Unit D

Approximately 8 cubic yards of soil were removed from SU D based on one characterization sample with concentrations exceeding the release criterion for Ra-226. A total of 44 samples was collected from SU D: 20 characterization samples, 4 biased samples to confirm successful removal of soil with concentrations of Ra-226 above the release criterion, and 20 final systematic samples.

Data from SU D were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the SU D final systematic data and other building and former building site survey unit final systematic data collected from Parcels B and G.

- Graphical data review identified anomalies or unusual trends in the soil sample data collected from SU D.
- Building 103 is a radiologically impacted building as identified in the HRA (NAVSEA, 2004).

Final systematic samples display characteristics inconsistent with characterization samples because the average Ac-228 and K-40 concentrations from final systematic samples are greater than the average Ac-228 and K-40 concentrations from characterization samples. Furthermore, final systematic samples display characteristics indicative of multiple data populations, where one subset included Ac-228 and K-40 concentrations that were significantly lower than the Ac-228 and K-40 concentrations of the other subset. Additionally, concentrations of Ra-226 progeny (Pb-214) and Th-232 progeny (Pb-212) were statistically different from all the other building survey unit soil data from Parcel B. The final systematic sample results from SU D were compared to final systematic sample results from other Building 103 survey unit soil data (SUs A through C, and E through G) to identify potential similarities in results from geographically similar soils; however, inconsistencies were observed, and sample results from Building 103 SUs A, B, C, and E through G are suspect.

Survey Unit E

No narrative is provided for the remedial activities at SU E, and 20 final systematic samples were collected from SU E.

Data from SU E were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the SU E final systematic data and other building and former building site survey unit final systematic data collected from Parcels B and G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from SU E.
- Building 103 is a radiologically impacted building as identified in the HRA (NAVSEA, 2004).

Final systematic samples display characteristics that are indicative of multiple data populations, where one subset included Ac-228, Bi-214, and K-40 concentrations that were significantly lower than the Ac-228, Bi-214, and K-40 concentrations of the other subset. Additionally, concentrations of K-40, Ra-226 progeny (Pb-214), and Th-232 progeny (Ac-228 and Pb-212) were statistically different from all the other building survey unit soil data from Parcels B and G. The final systematic sample results from SU E were compared to final systematic sample results from other Building 103 survey unit soil data (SUs D and F) to identify potential similarities in results from geographically similar soils; however, inconsistencies were observed, and sample results from Building 103 SUs D and F are suspect.

Survey Unit F

Approximately 10 cubic yards of soil were removed from SU F based on a subset of characterization samples with concentrations exceeding the release criterion for Ra-226. A total of 69 samples was collected from SU F: 40 characterization samples, 9 biased samples to confirm successful removal of soil with concentrations of Ra-226 above the release criterion, and 20 final systematic samples.

Data from SU F were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the SU F final systematic data and other building and former building site survey unit final systematic data collected from Parcels B and G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from SU F.
- Building 103 is a radiologically impacted building as identified in the HRA (NAVSEA, 2004).

Final systematic samples display characteristics inconsistent with characterization samples because the average Ac-228, Bi-214, and K-40 concentrations from final systematic samples are greater than the average Ac-228, Bi-214, and K-40 concentrations from characterization samples. Furthermore, final systematic samples display characteristics indicative of multiple data populations, where one subset included Ac-228 and K-40 concentrations that were significantly lower than the Ac-228 and K-40 concentrations of the other subset. Additionally, concentrations of Cs-137, K-40, and Th-232 progeny (Pb-212) were statistically different from all the other building survey unit soil data from Parcels B and G. The final systematic sample results from SU F were compared to final systematic sample results from other Building 103 survey unit soil data (SUs E and G) to identify potential similarities in results from geographically similar soils. Although no inconsistencies were observed, sample results from Building 103 SUs E and G are suspect.

Survey Unit G

No narrative is provided for the remedial activities at SU G, and 20 final systematic samples were collected from SU G.

Data from SU G were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the SU G final systematic data and other building and former building site survey unit final systematic data collected from Parcels B and G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from SU G.
- Building 103 is a radiologically impacted building as identified in the HRA (NAVSEA, 2004).

Final systematic samples display characteristics indicative of multiple data populations, where one subset included Ac-228, Bi-214, and K-40 concentrations that were significantly lower than the Ac-228, Bi-214, and K-40 concentrations of the other subset. Additionally, concentrations of K-40 and Th-232 progeny (Ac-228 and Pb-212) were statistically different from all the other building survey unit soil data from Parcels B and G. The final systematic sample results from SU G were compared to final systematic sample results from other Building 103 survey unit soil data (SUs A through F) to identify potential similarities in results from geographically similar soils. Although no inconsistencies were observed, sample results from Building 103 SUs A through F are suspect.

Former Building 157 Site, Survey Unit 6

The Building 157 Site is the location of former Building 157, which was demolished in 2006 (TtEC, 2010e). Former Building 157 was previously used as the Shipyard Industrial Laboratory, a sound laboratory, a metals testing center (Radiography), a metal shop, and for nondestructive testing (NAVSEA, 2004). The HRA indicated that no previous surveys were performed at the Building 157 Site; however, the HRA indicated the potential for radioactive contamination from the use of former Building 157 by NRDL personnel. As identified in the HRA, the ROCs for the Building 157 Site were Cs-137, cobalt (Co)-60, and Ra-226.

TtEC was contracted by the Navy to perform a Final Status Survey using MARSSIM guidance (DoD et al., 2000). The Building 157 Site was initially divided into two Class 1 survey units (SU 1 and SU 2) and one Class 2 survey unit (SU 3) (TtEC, 2010e). Initial Final Status Survey soil samples were collected from each survey unit and analyzed at the onsite laboratory. Several samples from the Class 2 survey unit had elevated Cs-137 concentrations above the release criteria; thus, the designation of SU 3 was changed from Class 2 to Class 1, and a new Class 2 survey unit (SU 4) was established extending outward from the original boundary of SU 3.

Further soil sampling in SUs 1, 2, 3, and 4 indicated elevated Ra-226 and Cs-137 concentrations. The Building 157 Site FSSR indicated that each SU was remediated successfully, which led to the

reorganization of the SUs. SUs 1 and 2 were combined into Class 1 SU 5, and SUs 3 and 4 were combined into Class 1 SU 6. A new Class 2 survey unit (SU 7) was established extending 4 meters outward from SU 6. Gamma scan and gamma static measurements and 20 soil samples were collected from SUs 5, 6, and 7. Each sample was analyzed at the onsite laboratory by gamma spectroscopy. Because the soil sample results from SUs 5, 6, and 7 represent current radiological conditions at the Building 157 Site, the evaluations described in this report are focused on these three survey units.

Additionally, the storm drains and sanitary sewer lines associated with Building 157 were removed by TtEC as a part of the storm drain and sanitary sewer line investigation. The investigation and removal resulted in two trench survey units (TUs 50 and 50A), and the results were reported by TtEC, separately, in the SUPR for the respective trench unit.

The results of the evaluation indicated no further action during this data evaluation phase was recommended for SUs 5 and 7; however, the final systematic sample results from the Building 157 Site SU 6 are suspect, and confirmation sampling and analysis by an independent, certified laboratory are recommended to document current site conditions.

This following text summarizes the findings from the evaluation of SU 6.

There were 19 final systematic samples collected from SU 6. There were no characterization or bias samples directly associated with SU 6; however, SUs 3 and 4 had 133 samples that can be considered characterization and biased samples for SU 6. Remediation occurred in SUs 3 and 4 prior to SU reorganization because of samples with concentrations exceeding the release criterion for Cs-137 and Ra-226.

Data from SU 6 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the SU 6 final systematic data and other building and former building site survey unit final systematic data collected from Parcels B and G.
- Logic tests identified inconsistencies related to the processing of samples from SU 6.
- Building 157 is a radiologically impacted building as identified in the HRA (NAVSEA, 2004).

The results of the evaluation indicate that the data from SU 6 are suspect. One sample was analyzed 45 days after all other samples from SU 6 were analyzed, and no explanation was provided in the Building 157 Site FSSR. Additionally, the gamma scan results are not documented in the Building 157 Site FSSR, and the gamma background data selected for the Former Building 157 Site are not representative.

4.2 Parcel G

The areas evaluated in Parcel G included 63 trench units, 107 fill units, and 2 current and former building sites with 32 soil survey units. Analytical results for more than 12,000 soil samples were evaluated. The areas evaluated in Parcel G are presented on **Figure 4-5** and consist of samples collected from 2002 through 2011.

4.2.1 Trench Units

There were 63 trench units evaluated in Parcel G. Based upon the scope of this evaluation, there was no evidence of potential data manipulation or falsification at 43 trench units; therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at 20 trench units and confirmation sampling is recommended. The results of the Parcel G trench unit evaluation are presented on **Figure 4-6**. The data evaluation forms documenting the findings are provided in **Appendix C**.

The following text summarizes the evaluations of the 20 trench units where evidence of potential data manipulation or falsification was found.

4.2.1.1 Recommended for Confirmation Sampling

Trench Unit 66

Trench Survey Unit 66 is the net sum of TU 66 and excavated soil from ES 3, 4, and 7, which was used for backfill. Pieces of piping removed from TU 66 indicated the presence of Cs-137 at concentrations exceeding the release criteria; however, no elevated Cs-137 concentrations were reported in soil sample results. Additionally, one piece of piping removed from TU 66 indicated the presence of Ra-226 at concentrations exceeding the release criteria; however, no elevated Ra-226 concentrations were reported in soil sample results. No remediation was performed, and 109 samples were collected from TU 66: 91 biased samples to identify potential elevated Ra-226 and Cs-137 concentrations in soil and a set of 18 final systematic samples.

Data from TU 66 were flagged as unusual or suspect for the following reasons:

- Logic tests identified inconsistencies related to the processing of samples from TU 66.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from TU 66.
- At least one worker who collected data at TU 66 was mentioned in one or more allegations of wrongdoing.

A subset of 10 final systematic samples was collected and analyzed prior to the collection of the remaining 8 final systematic samples (for a total of 18). The process of collecting a subset of samples, analyzing this subset of samples, collecting the remaining samples, and then analyzing the remaining samples was inconsistent with the process used to investigate other trench units. No explanation is provided in available documentation for applying this process at TU 66.

The results of the evaluation indicate that the eight final systematic sample results from TU 66 are suspect because they were reportedly collected after the first 10 samples were collected and analyzed, providing an opportunity for falsification by replacing samples. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 70

Trench Survey Unit 70 is the net sum of TU 70, excavated soil from ES 5, 8, 11, 14, and 15, and a volume of import fill material, which was used for backfill. No remediation was performed at TU 70, and a set of 18 final systematic samples was collected.

Data from TU 70 were flagged as unusual or suspect for the following reasons:

- Logic tests identified inconsistencies related to the processing of samples from TU 70.
- TU 70 is located directly adjacent to a radiologically impacted building.
- At least one worker who collected data at TU 70 was mentioned in one or more allegations of wrongdoing.

A subset of 13 final systematic samples was collected and analyzed prior to the collection of the remaining 5 final systematic samples (for a total of 18). The process of collecting a subset of samples, analyzing this subset of samples, collecting the remaining samples, and then analyzing the remaining samples was inconsistent with the process used to investigate other trench units. No explanation is provided in available documentation for applying this process at TU 70.

The results of the evaluation indicate that the five final systematic sample results from TU 70 are suspect because they were reportedly collected after five other final systematic samples were collected and analyzed, providing an opportunity for falsification by replacing samples. Therefore, it is

recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 77

Trench Survey Unit 77 is the net sum of TU 77 and a volume of import fill material, which was used for backfill. Approximately 445 cubic yards of soil were removed from TU 77 based on a subset of characterization and bias sample results exceeding the release criterion for Ra-226. A total of 345 samples was collected from TU 77: 162 characterization samples, 15 biased samples to identify potential elevated Ra-226 concentrations in soil, 150 biased samples to confirm the successful removal of soil with concentrations of Ra-226 above the release criterion, and a set of 18 final systematic samples.

Data from TU 77 were flagged as unusual or suspect for the following reasons:

- Logic tests identified inconsistencies related to the processing of samples from TU 77.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from TU 77.
- TU 77 is located downstream from a radiologically impacted building.

The SUPR for TU 77 stated that the gamma scan data did not exceed the investigation level (7,048 cpm). However, the gamma scan range reported in the SUPR for TU 81 was 3,700 to 7,400 cpm. Although some remediation occurred at the trench unit, the gamma scan was performed after the remediation was completed. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 81

Trench Survey Unit 81 is the net sum of TU 81, excavated soil from ES 43 and 92, and a volume of import fill material, which was used for backfill. Approximately 218 cubic yards of soil were removed from TU 81 based on a subset of characterization and bias sample results exceeding the release criterion for Ra-226. Additionally, one biased sample result exceeded the release criterion for Cs-137, which also contributed to the removal of 17 of the 218 cubic yards of soil removed from TU 81. A total of 222 samples was collected from TU 81: 36 characterization samples, 81 biased samples to identify potential elevated Ra-226 concentrations in soil, 87 biased samples to confirm the successful removal of soil with concentrations of Ra-226 above the release criterion (a subset [four] of these biased samples was collected to also confirm the successful removal of soil with concentrations of Cs-137 above the release criterion), and a set of 18 final systematic samples.

Data from TU 81 were flagged as unusual or suspect for the following reasons:

- Logic tests identified inconsistencies related to the processing of samples from TU 81.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from TU 81.
- At least one worker who collected data at TU 81 was mentioned in one or more allegations of wrongdoing.

The SUPR for TU 81 stated that the gamma scan data did not exceed the investigation level (9,894 counts per minute [cpm]). However, the gamma scan range reported in the SUPR for TU 81 was 3,000 to 14,000 cpm. Although some remediation occurred at the trench unit, the gamma scan was performed after the remediation was completed. The reported results provided in the SUPR is an indication that

the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 84

Trench Survey Unit 84 is the net sum of TU 84 and a volume of import fill material, which was used for backfill. Approximately 1,021 cubic yards of soil were removed from TU 84 based on a subset of characterization and bias samples exceeding the release criterion for Ra-226. Additionally, one biased sample result exceeded the release criterion for Cs-137, which also contributed to the removal of 5.5 of the 1,021 cubic yards of soil removed from TU 84. A total of 293 samples was collected from TU 84: 108 characterization samples, 97 biased samples to identify potential elevated Ra-226 concentrations, 70 bias samples to confirm the successful removal of soil with concentrations of Ra-226 above the release criterion (a subset [two] of these biased samples was collected to also confirm successful removal of soil with concentrations of Cs-137 above the release criterion), and a set of 18 final systematic samples. During the remediation at TU 84, TU 84 was divided into two additional trench units, TU 114 and TU 119.

Data from TU 84 were flagged as unusual or suspect for the following reasons:

- Logic tests identified inconsistencies related to the processing of samples from TU 84.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from TU 84.

A subset of 15 final systematic samples was collected and analyzed prior to the collection of the remaining 3 final systematic samples (for a total of 18). The process of collecting a subset of samples, analyzing this subset of samples, collecting the remaining samples, and then analyzing the remaining samples was inconsistent with the process used to investigate other trench units. No explanation is provided in available documentation for applying this process at TU 84.

This unusual sample collection procedure is reflected in the final systematic sample results. Final systematic samples displayed characteristics that indicated the potential for two different data populations in the data set, where one subset included Ac-228, Bi-214, and K-40 concentrations that were significantly lower than the Ac-228, Bi-214, and K-40 concentrations of the other subset. Additionally, concentrations K-40 were statistically different from all the other trench units in Parcel G. The final systematic sample results from TU 84 were compared to final systematic sample results from adjacent trench units (TU 85, TU 199, and TU 151) to identify potential similarities in results from geographically similar soils; however, inconsistencies were observed in data from adjacent trench units.

The results of the evaluation indicate that the final systematic sample results from TU 84 are suspect. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 86

Trench Survey Unit 86 is the net sum of TU 86 and a volume of import fill material, which was used for backfill. The two sediment samples collected from the two manholes removed from TU 86 showed elevated Cs-137 concentrations exceeding the release criterion; however, no elevated Cs-137 concentrations were reported in soil sample results. Approximately 75 cubic yards of soil were removed from TU 86 based on a subset of characterization and bias sample results exceeding the release criterion for Ra-226. A total of 175 samples was collected from TU 86: 54 characterization samples, 46 biased samples to identify potential elevated Cs-137 concentrations in soil, 57 biased samples to confirm the

successful removal of soil with concentrations of Ra-226 above the release criterion, and a set of 18 final systematic sample results.

Data from TU 86 were flagged as unusual or suspect for the following reasons:

- Graphical data review identified anomalies or unusual trends in soil sample data collected from TU 86.
- At least one worker who collected data at TU 86 was mentioned in one or more allegations of wrongdoing.

Final systematic samples displayed characteristics that indicated the potential for two different data populations in the data set, where one subset included Ac-228, Bi-214, and K-40 concentrations that were significantly lower than the Ac-228, Bi-214, and K-40 concentrations of the other subset. Furthermore, the sample variance of Ac-228, Bi-214, and K-40 concentrations from final systematic samples was unusually small. The final systematic sample results from TU 86 were compared to final systematic sample results from adjacent trench units (TU 87 and TU 151) to identify potential similarities in results from geographically similar soils; however, inconsistencies were observed in data from adjacent trench units. Additionally, the SUPR for TU 86 stated that "measurements above the investigation level were identified during the performance of gamma scans in TU 86. As discussed below, additional characterization samples were collected in the areas where the investigation level was exceeded." However, there is no direct indication in the text of the SUPR that confirms the collection of these additional characterization samples.

The results of the evaluation indicate that the final systematic sample results from TU 86 are suspect. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 90

Trench Survey Unit 90 is the net sum of TU 90 and a volume of import fill material, which was used for backfill. No remediation was performed at TU 90, and a set of 18 final systematic samples was collected.

Data from TU 90 were flagged as unusual or suspect for the following reason:

- At least one worker who collected data at TU 90 was mentioned in one or more allegations of wrongdoing.

The SUPR for TU 90 stated that the gamma scan data did not exceed the investigation level (7,048 cpm). However, the gamma scan range provided in the SUPR for TU 90 was 2,660 to 7,640 cpm. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 94

Trench Survey Unit 94 is the net sum of TU 94 and a volume of import fill material, which was used for backfill. No remediation was performed at TU 94, and a set of 18 final systematic samples was collected.

Data from TU 94 were flagged as unusual or suspect for the following reason:

- Logic tests identified inconsistencies related to the processing of samples from TU 70.

The SUPR for TU 94 states the gamma scan results exceeded the investigation level and additional surveys were performed, but no information on additional surveys or bias samples is provided in the SUPR. Furthermore, the SUPR for TU 94 states the gamma scan was performed after the final systematic samples were collected. The Parcel G RACR states some of the soil removed from TU 94 was

dispositioned as LLRW, meaning contamination was likely present in the trench. This is consistent with the allegation areas of elevated activity were avoided during subsequent investigations. Therefore, confirmation sampling and analysis by an independent, certified laboratory are recommended to document current site conditions.

Trench Unit 95

Trench Survey Unit 95 is the net sum of TU 95, excavated soil from ES 32, 35, 36, and 107, which was used for backfill. Pieces of piping and one manhole removed from TU 95 indicated the presence of Cs-137 at concentrations exceeding the release criteria; however, no elevated Cs-137 concentrations were reported in soil sample results. No remediation was performed, and 94 samples were collected from TU 95: 76 biased samples to identify potential elevated Cs-137 concentrations in soil and a set of 18 final systematic samples.

Data from TU 95 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the TU 95 final systematic data and other final systematic data collected from Parcel G.
- Logic tests identified inconsistencies related to the processing of samples from TU 95.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from TU 95.
- TU 95 is located near a known radiation cleanup and downstream from a radiologically impacted building.
- At least one worker who collected data at TU 95 was mentioned in one or more allegations of wrongdoing.

The SUPR for TU 95 stated that the gamma scan data did not exceed the investigation level (7,048 cpm). However, the gamma scan range reported in the SUPR for TU 95 was 2,640 to 8,210 cpm. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 105

Trench Survey Unit 105 is the net sum of TU 105, excavated soil from ES 113 and 131, and a volume of import fill material, which was used for backfill. Approximately 35 cubic yards of soil were removed from TU 105 based on a subset of characterization and bias sample results exceeding the release criterion for Ra-226. A total of 80 samples was collected from TU 105: 36 characterization samples, 14 biased samples to identify potential elevated Ra-226 concentrations in soil, 12 biased samples to confirm successful removal of soil with concentrations of Ra-226 above the release criterion, and a set of 18 final systematic samples.

Data from TU 105 were flagged as unusual or suspect for the following reason:

- Logic tests identified inconsistencies related to the processing of samples from TU 105.

The SUPR for TU 105 stated that the gamma scan data did not exceed the investigation level (7,048 cpm). However, the gamma scan range reported in the SUPR for TU 105 was 2,510 to 7,200 cpm. Although some remediation occurred at the trench unit, the gamma scan was performed after the remediation was completed. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that

confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 109

Trench Survey Unit 109 is the net sum of TU 109, excavated soil from ES 119, 120, 121, and 129, and a volume of import fill material, which was used for backfill. Approximately 5 cubic yards of soil were removed from TU 109 based on one characterization sample result exceeding the release criterion for Ra-226. A total of 47 samples was collected from TU 109: 18 characterization samples, 8 biased samples to identify potential elevated Ra-226 concentrations, 3 biased samples to confirm the successful removal of soil with concentrations of Ra-226 above the release criterion, and a set of 18 final systematic samples.

Data from TU 109 were flagged as unusual or suspect for the following reason:

- TU 109 is located directly adjacent to a radiologically impacted building.

The SUPR for TU 109 stated that the gamma scan data did not exceed the investigation level (7,048 cpm). However, the gamma scan range provided in the SUPR for TU 109 was 2,890 to 7,450 cpm. Although some remediation occurred at the trench unit, the gamma scan was performed after the remediation was completed. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 110

Trench Survey Unit 110 is the net sum of TU 110, excavated soil from ES 122, 124, 125, and 127, which was used for backfill. Approximately 83 cubic yards of soil were removed from TU 110 based on a subset of characterization and bias samples exceeding the release criterion for Ra-226. A total of 138 samples was collected from TU 110: 72 characterization samples, 21 biased samples to identify potential elevated Ra-226 concentrations, 27 biased samples to confirm successful removal of soil with concentrations of Ra-226 above the release criterion, and a set of 18 final systematic samples.

Data from TU 110 were flagged as unusual or suspect for the following reason:

- TU 110 is located directly adjacent to a radiologically impacted building.

The SUPR for TU 110 stated that the gamma scan data did not exceed the investigation level (7,050 cpm). However, the gamma scan range provided in the SUPR for TU 110 was 2,720 to 8,100 cpm. Although some remediation occurred at the trench unit, the gamma scan was performed after the remediation was completed. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 112

Trench Survey Unit 112 is the net sum of TU 112, excavated soil from ES 117, 118, and 132, and a volume of import fill material, which was used for backfill. No remediation was performed at TU 112, and a set of 18 final systematic samples was collected.

Data from TU 112 were flagged as unusual or suspect for the following reason:

- At least one worker who collected data at TU 112 was mentioned in one or more allegations of wrongdoing.

The SUPR for TU 112 stated that the gamma scan data did not exceed the investigation level (7,050 cpm). However, the gamma scan range provided in the SUPR for TU 112 was 2,810 to 16,100 cpm.

The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 113

Trench Survey Unit 113 is the net sum of TU 113, excavated soil from ES 115 and 116, and a volume of import fill, which was used for backfill. No remediation was performed at TU 113, and a set of 18 final systematic samples was collected.

Data from TU 113 were flagged as unusual or suspect for the following reason:

- At least one worker who collected data at TU 113 was mentioned in one or more allegations of wrongdoing.

The SUPR for TU 113 stated that the gamma scan data did not exceed the investigation level (7,048 cpm). However, the gamma scan range reported in the SUPR for TU 113 was 3,640 to 8,140 cpm. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 114

Trench Survey Unit 114 is the net sum of TU 114, excavated soil from ES 229, and a volume of import fill material, which was used for backfill. Approximately 217 cubic yards of soil were removed based on a subset of characterization and bias samples exceeding the release criterion for Ra-226. A total of 192 samples was collected from TU 114: 108 characterization samples, 66 biased samples to confirm the successful removal of soil with concentrations of Ra-226 above the release criterion, and a set of 18 final systematic samples.

Data from TU 114 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the TU 114 final systematic data and other final systematic data collected from Parcel G.
- Graphical data review identified anomalies or unusual trends in soil sample data collected from TU 114.

The SUPR for TU 114 stated that the gamma scan data did not exceed the investigation level (7,100 cpm). However, the gamma scan range provided in the SUPR for TU 114 was 3,350 to 8,760 cpm. Although some remediation occurred at the trench unit, the gamma scan was performed after the remediation was completed. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 120

Trench Survey Unit 120 is the net sum of TU 120, excavated soil from ES 155 and 158, and a volume of import fill material, which was used for backfill. No remediation was performed at TU 120, and a set of 18 final systematic samples was collected.

Data from TU 120 were flagged as unusual or suspect for the following reasons:

- Graphical data review identified anomalies or unusual trends in soil sample data collected from TU 120.
- At least one worker who collected data at TU 120 was mentioned in one or more allegations of wrongdoing.

The SUPR for TU 120 stated that the gamma scan data did not exceed the investigation level (7,048 cpm). However, the gamma scan range provided in the SUPR for TU 120 was 3,210 to 8,130 cpm. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 122

Trench Survey Unit 122 is the net sum of TU 122, excavated soil from ES 152, and a volume of import fill material, which was used for backfill. One sediment sample collected from one of the manholes removed from TU 122 showed elevated Cs-137 concentrations exceeding the release criterion. Approximately 1 cubic yard of soil was removed from TU 122 based on a subset of biased sample results exceeding the release criterion for Cs-137. A total of 205 samples was collected from TU 122: 187 biased samples to identify potential elevated Cs-137 concentrations in soil, and a set of 18 final systematic sample results.

Data from TU 122 were flagged as unusual or suspect for the following reasons:

- Graphical data review identified anomalies or unusual trends in soil sample data collected from TU 122.
- At least one worker who collected data at TU 122 was mentioned in one or more allegations of wrongdoing.

Final systematic samples displayed characteristics that indicated the potential for two different data populations in the data set, where one subset included Ac-228, Bi-214, and K-40 concentrations that were significantly lower than the Ac-228, Bi-214, and K-40 concentrations of the other subset. The final systematic sample results from TU 122 were compared to final systematic sample results from adjacent trench units (TU 89, TU 121, TU 123, and TU 139) to identify potential similarities in results from geographically similar soils; however, inconsistencies were observed in data from adjacent trench units.

The SUPR for TU 122 stated that the gamma scan data did not exceed the investigation level (7,048 cpm). However, the gamma scan range provided in the SUPR for TU 122 was 2,100 to 7,300 cpm. Although some remediation occurred at the trench unit, the gamma scan was performed after the remediation was completed. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present.

The results of the evaluation indicate that the final systematic sample results from TU 122 are suspect, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 123

Trench Survey Unit 123 is the net sum of TU 123, excavated soil from ES 162, and a volume of import fill, which was used for backfill. Approximately 21 cubic yards of soil were removed from TU 123 based on a subset of characterization and bias sample results exceeding the release criterion for Ra-226. A total of 72 samples was collected from TU 123: 36 characterization samples, 18 biased samples to confirm the successful removal of soil with concentrations of Ra-226 above the release criterion, and a set of 18 final systematic samples.

Data from TU 123 were flagged as unusual or suspect for the following reasons:

- Graphical data review identified anomalies or unusual trends in soil sample data collected from TU 123.
- TU 123 is located directly adjacent to a radiologically impacted building.
- At least one worker who collected data at TU 123 was mentioned in one or more allegations of wrongdoing.

Final systematic samples displayed characteristics that indicated the potential for two different data populations in the data set, where one subset included Ac-228, Bi-214, and K-40 concentrations that were significantly lower than the Ac-228, Bi-214, and K-40 concentrations of the other subset. The final systematic sample results from TU 123 were compared to final systematic sample results from adjacent trench units (TU 74, TU 75, TU 83, TU 122, TU 124, TU 146 and TU 147) to identify potential similarities in results from geographically similar soils; however, inconsistencies were observed in data from adjacent trench units, and sample results from TU 122 are suspect.

The SUPR for TU 123 stated that the gamma scan data did not exceed the investigation level (7,048 cpm). However, the gamma scan range provided in the SUPR for TU 123 was 2,580 to 12,000 cpm. Although some remediation occurred at the trench unit, the gamma scan was performed after the remediation was completed. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present.

The results of the evaluation indicate that the final systematic sample results from TU 123 are suspect, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 129

Trench Survey Unit 129 is the net sum of TU 129 and a volume of import fill material, which was used for backfill. Approximately 73 cubic yards of soil were removed from TU 129 based on a subset of characterization and bias sample results exceeding the release criterion for Ra-226. Additionally, one characterization sample result exceeded the release criterion for Cs-137, which also contributed to the removal of 10 of the 73 cubic yards of soil removed from TU 129. A total of 72 samples was collected from TU 129: 18 characterization samples, 36 biased samples to confirm successful removal of soil with concentrations of Ra-226 above the release criterion (a subset [12] of these biased samples was collected to also confirm successful removal of soil with concentrations of Cs-137 above the release criterion), and a set of 18 final systematic samples.

Data from TU 129 were flagged as unusual or suspect for the following reasons:

- Graphical data review identified anomalies or unusual trends in the soil sample data collected from TU 129.
- At least one worker who collected data at TU 129 was mentioned in one or more allegations of wrongdoing.

The SUPR for TU 129 stated that the gamma scan data did not exceed the investigation level (9,894 cpm). However, the gamma scan range reported in the SUPR for TU 129 was 2,000 to 14,780 cpm. Although some remediation occurred at the trench unit, the gamma scan was performed after the remediation was completed. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Trench Unit 153

Trench Survey Unit 153 is the net sum of TU 153, excavated soil from ES 175 and 225, and a volume of import fill material, which was used for backfill. Approximately 22 cubic yards of soil were removed from TU 153 based on a subset of characterization and bias sample results exceeding the release criterion for Cs-137. A total of 84 samples was collected from TU 153: 54 characterization samples, 12 biased samples to confirm the successful removal of soil with concentrations of Cs-137 above the release criterion, and a set of 18 final systematic samples.

Data from TU 153 were flagged as unusual or suspect for the following reasons:

- Graphical data review identified anomalies or unusual trends in soil sample data collected from TU 153.
- TU 153 is located directly adjacent to a radiologically impacted building.
- At least one worker who collected data at TU 153 was mentioned in one or more allegations of wrongdoing.

The SUPR for TU 153 stated that the gamma scan data did not exceed the investigation level (7,100 cpm). However, the gamma scan range provided in the SUPR for TU 153 was 3,300 to 8,450 cpm. Although some remediation occurred at the trench unit, the gamma scan was performed after the remediation was completed. The reported results provided in the SUPR is an indication that the survey activity apparently failed to respond to elevated gamma scan results. Therefore, locations with scan measurements that exceeded the investigation level are likely still present, and it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

4.2.2 Fill Units

There were 107 fill units evaluated in Parcel G. Based upon the scope of this evaluation, there was no evidence of potential data manipulation or falsification at 53 fill units; therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at 54 fill units used as backfill for 28 trench survey units. Reanalysis of archived samples is recommended at 3 fill units and confirmation sampling is recommended for the other 51 fill units. Of the 51 fill units, 46 were recommended for confirmation sampling based on evidence of biased sample collection at locations to potentially avoid highest gamma scan measurements. The results of the Parcel G fill unit evaluation are presented on **Figure 4-7**. The data evaluation forms documenting findings are provided in **Appendix C**.

The following text summarizes the evaluations of the 54 fill units where evidence of potential data manipulation or falsification was found.

4.2.2.1 Recommended for Reanalysis of Archived Samples

Excavated Soil Unit 6

Excavated Soil Unit (ES) 6 was used to backfill TU 69. Soil used to create ES 6 originated from TU 66, TU 69, and TU 70. Elevated gamma scan measurements were reported, which prompted the collection of biased samples. Approximately 18 cubic yards of soil were removed from ES 6 based on a subset of characterization sample results exceeding the release criterion for Ra-226. A total of 70 samples was collected from ES 6: 36 characterization samples, 16 biased samples to identify potential elevated radionuclide concentrations in soil, and a set of 18 final systematic samples.

Data from ES 6 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the ES 6 final systematic data and other excavated soil units used to backfill TU 69 and other final systematic data collected from Parcel G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from ES 6.
- Soil used to create ES 6 originated from trench units immediately adjacent and downstream from a radiologically impacted building.

The results of the evaluation indicated that one final systematic sample result exhibited an unusually high K-40 concentration and is suspect. However, the Ra-226 concentrations of the initial set of characterization sample results from ES 6 were likely overestimated by the onsite laboratory, and these data were not flagged as unusual or suspect. It is recommended that the initial set of characterization samples be reanalyzed to determine whether the reported results were overestimated and remediation was not required.

Excavated Soil Unit 12

ES 12 was used to backfill TU 68. Soil used to create ES 6 originated from TU 68 and TU 69. Elevated gamma scan measurements were reported, which prompted the collection of biased samples. The SUPR for TU 68 indicated that one characterization sample result exceeded the release criterion for Ra-226; however, the amount of soil removed from ES 12 was not provided in the SUPR. A total of 39 samples was collected from ES 12: 18 characterization samples, 3 biased samples to identify potential elevated Ra-226 concentrations in soil, and a set of 18 final systematic samples.

Data from ES 12 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the ES 12 final systematic data and other excavated soil units used to backfill TU 68 and other final systematic data collected from Parcel G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from ES 12.
- Soil used to create ES 12 originated from trench units downstream from a radiologically impacted building.

Three final systematic sample results were inconsistent with the rest of the final systematic sample results, in that the reported Ac-228, Bi-214, and K-40 concentrations for these three samples were significantly lower than the Ac-228, Bi-214, and K-40 concentrations for the rest of the data set. There were insufficient offsite laboratory data to confirm these results.

The results of the evaluation indicate that at least three final systematic sample results from ES 12 are suspect. However, the Ra-226 concentrations of the initial set of characterization sample results from ES 12 were likely overestimated by the onsite laboratory, and these data were not flagged as unusual or

suspect. It is recommended that the initial set of characterization samples be reanalyzed to determine whether the reported values were overestimated and remediation was not required.

Excavated Soil Unit 13

ES 13 was used to backfill TU 68. Soil used to create ES 13 originated from TU 68, TU 69, and TU 70. Elevated gamma scan measurements were reported, which prompted the collection of biased samples. The SUPR for TU 68 indicated that a subset of characterization samples exceeded the release criterion for Ra-226 and one of those samples in the subset also exceeded the release criterion for Cs-137; however, the amount of soil removed from ES 13 was not provided in the SUPR. A total of 54 samples was collected from ES 13: 18 characterization samples, 18 biased samples to identify potential elevated radionuclide concentrations in soil, and a set of 18 final systematic samples.

Data from ES 13 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the ES 13 final systematic data and other excavated soil units used to backfill TU 68 and other final systematic data collected from Parcel G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from ES 13.
- Soil used to create ES 6 originated from trench units immediately adjacent and downstream from a radiologically impacted building.

Two final systematic sample results were inconsistent with the rest of the final systematic sample results, in that the reported K-40 concentration of one of these samples was unusually high, and the reported Ac-228 and Bi-214 concentrations of the other sample were unusually low. There were insufficient offsite laboratory data to confirm these results.

The results of the evaluation indicate that at least two final systematic sample results from ES 13 are suspect. However, the Ra-226 concentrations of the initial set of characterization sample results from ES 13 were likely overestimated by the onsite laboratory, and these data were not flagged as unusual or suspect. It is recommended that the initial set of characterization samples be reanalyzed to determine whether the reported values were overestimated and remediation was not required.

4.2.2.2 Recommended for Confirmation Sampling

Excavated Soil Unit 15

ES 15 was used to backfill TU 70. Soil used to create ES 15 originated from TU 70 and TU 73. Elevated gamma scan measurements were reported, which prompted the collection of biased samples. Approximately 101 cubic yards of soil were removed from ES 15 based on a subset of bias and characterization samples exceeding the release criterion for Ra-226. A total of 49 samples was collected from ES 15: 18 characterization samples, 13 biased samples to identify potential elevated radionuclide concentrations in soil, and a set of 18 final systematic samples.

Data from ES 15 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the ES 15 final systematic data and other excavated soil units used to backfill TU 70 and other final systematic data collected from Parcel G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from ES 15.
- Soil used to create ES 15 originated from a trench unit immediately adjacent of a radiologically impacted building.

The final systematic samples display characteristics inconsistent with characterization sample results because the final systematic Ac-228 and Bi-214 samples results display a lower statistical mean and lower variability compared to the characterization Ac-228 and Bi-214 sample results. The final systematic sample results do not appear to be representative of soil from ES 15.

The results of the evaluation indicate that the final systematic sample results from ES 15 are suspect. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Excavated Soil Unit 109

ES 109 was used to backfill TU 104. Soil used to create ES 109 originated from TU 103 and TU 104. Text in the SUPR for TU 104 indicated that no gamma scan measurements above the investigation level were observed and no biased samples were collected; however, the gamma scan data provided in the SUPR for TU 104 indicated that one measurement did exceed the investigation level and sample results for a biased sample were provided in the SUPR for TU 104. No remediation was performed, and 19 samples were collected from ES 109: 1 biased sample and a set of 18 final systematic samples.

Data from ES 109 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the ES 109 final systematic data and other excavated soil units used to backfill TU 104 and other final systematic data collected from Parcel G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from ES 109.

The final systematic sample results from ES 109 were inconsistent with sample results from the origin trench units (TU 103 and TU 104) because the K-40 sample results from ES 109 exhibited a lower variability that than the K-40 sample results from TU 103 and TU 104. The difference in distributions of K-40 results indicate the potential for sample results from ES 109 to not be reflective of the soil removed from TU 103 and TU 104. Furthermore, four sets of samples, including samples from ES 109, ES 110, ES 114, and ES 116 were collected on the same day, July 2, 2008. This is unusual for sample data from HPNS.

The results of the evaluation indicate that the final systematic sample results from ES 109 are suspect. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Excavated Soil Unit 110

ES 110 was used to backfill TU 104. Soil used to create ES 110 originated from TU 103 and TU 104. No remediation was performed at ES 110, and a set of 18 final systematic samples was collected.

Data from ES 110 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the ES 110 final systematic data and other excavated soil units used to backfill TU 104 and other final systematic data collected from Parcel G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from ES 110.

The final systematic sample results from ES 110 were inconsistent with sample results from the origin trench units (TU 103 and TU 104) because the K-40 sample results from ES 110 exhibited a lower variability that than the K-40 sample results from TU 103 and TU 104. The difference in distributions of K-40 results indicate the potential for sample results from ES 110 to not be reflective of the soil removed from TU 103 and TU 104. Furthermore, four sets of samples, including samples from ES 109, ES 110,

ES 114, and ES 116 were collected on the same day, July 2, 2008. This is unusual for sample data from HPNS.

The results of the evaluation indicate that the final systematic sample results from ES 110 are suspect. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Excavated Soil Unit 113

ES 113 was used to backfill TU 104. Soil used to create ES 113 originated from TU 103 and TU 104. Elevated gamma scan measurements were reported, which prompted the collection of biased samples. The SUPR for TU 104 indicated that a subset of biased samples results and one characterization sample result exceeded the release criterion for Ra-226; however, the amount of soil removed from ES 113 was not provided in the SUPR. A total of 45 samples was collected from ES 133: 18 characterization samples, 9 biased samples to identify potential elevated radionuclide concentrations in soil, and a set of 18 final systematic samples.

Data from ES 113 were flagged as unusual or suspect for the following reason:

- Statistical tests identified significant differences between the ES 113 final systematic data and other excavated soil units used to backfill TU 104 and other final systematic data collected from Parcel G.

The final systematic sample results from ES 113 were inconsistent with sample results from the origin trench units (TU 103 and TU 104) because the K-40 sample results from ES 113 exhibited a lower variability that than the K-40 sample results from TU 103 and TU 104. The difference in distributions of K-40 results indicate the potential for sample results from ES 113 to not be reflective of the soil removed from TU 103 and TU 104. Additionally, the SUPR for TU 104 reported that a subset of bias and one characterization sample exceeded the release criterion for Ra-226. The contamination was located in one corner of the RSY pad; however, no additional samples were collected to further delineate the extent of contamination. Furthermore, the SUPR reported that the contaminated soils were bounded by six existing sample points and remediation was performed within this bounded area. However, the shape of the area of remediated soil was unusual and did not match the expected area to be removed based on the data provided in the SUPR.

The results of the evaluation indicated that the sample results from ES 113 are suspect. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Excavated Soil Unit 114

ES 114 was used to backfill TU 104. Soil used to create ES 114 originated from TU 104 and TU 105. No remediation was performed at ES 114, and a set of 18 final systematic samples was collected.

Data from ES 114 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the ES 114 final systematic data and other excavated soil units used to backfill TU 104 and other final systematic data collected from Parcel G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from ES 114.

The final systematic sample results from ES 114 were inconsistent with sample results from the origin trench units (TU 104 and TU 105) because the K-40 sample results from ES 114 exhibited a lower variability that than the K-40 sample results from TU 104 and TU 105. The difference in distributions of K-40 results indicate the potential for sample results from ES 114 to not be reflective of the soil removed from TU 104 and TU 105. Furthermore, four sets of samples, including samples from ES 109, ES 110,

ES 114, and ES 116 were collected on the same day, July 2, 2008. This is unusual for sample data from HPNS.

The results of the evaluation indicate that the final systematic sample results from ES 114 are suspect. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Excavated Soil Unit 126

ES 126 was used to backfill TU 111. Soil used to create ES 126 originated from TU 110, TU 111, and TU 112. Elevated gamma scan measurements were reported, which prompted the collection of biased samples. Approximately 9 cubic yards of soil were removed from ES 126 based on one characterization sample results exceeding the release criterion for Ra-226. A total of 44 samples was collected from ES 126: 18 characterization samples, 8 biased samples to identify potential elevated radionuclide concentrations in soil, and a set of 18 final systematic samples.

Data from ES 126 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the ES 126 final systematic data and other excavated soil units used to backfill TU 111 and other final systematic data collected from Parcel G.
- Logic tests identified inconsistencies related to the processing of samples from ES 126.

The final systematic samples display characteristics inconsistent with characterization sample results because the final systematic Ac-228, Bi-214, and K-40 sample results display a lower statistical mean and lower variability compared to the characterization Ac-228, Bi-214, and K-40 sample results. Only 9 cubic yards of soil were removed from one corner of the RSY pad for ES 126, and the change in final systematic sample data distributions is not expected based on the removal of this amount of soil.

The results of the evaluation indicate that the final systematic sample results from ES 126 are suspect. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Excavated Soil Unit 131

ES 131 was used to backfill TU 105. Soil used to create ES 131 originated from TU 105, TU 111, and TU 112. The SUPR for TU 105 stated that soil removed from TU 105 was not used for backfill; however, soil from TU 105 was present in ES 131 and was then used to backfill TU 105. Elevated gamma scan measurements were reported, which prompted the collection of biased samples. The SUPR for TU 105 indicated that a subset of characterization sample results and one biased sample results exceeded the release criterion for Ra-226; however, the amount of soil removed from ES 131 was not provided in the SUPR. A total of 116 samples was collected from ES 131: 54 characterization samples, 44 biased samples to identify potential elevated radionuclide concentrations in soil, and a set of 18 final systematic samples.

Data from ES 131 were flagged as unusual or suspect for the following reason:

- Graphical data review identified anomalies or unusual trends in the soil sample data collected from ES 131.

The final systematic sample results from ES 131 were inconsistent with sample results from the origin trench units (TU 105 and TU 112) because the K-40 sample results from ES 131 exhibited a lower variability and lower average activity that than the K-40 sample results from TU 105 and TU 112. The difference in distributions of K-40 results indicate the potential for sample results from ES 110 to not be reflective of the soil removed from TU 105 and TU 112.

The results of the evaluation indicate that the final systematic sample results from ES 131 are suspect. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Excavated Soil Unit 175

ES 175 was used to backfill TU 153. None of the available documentation provided information about the soil used to create ES 175; however, the text in the SUPR for TU 153 suggests that the soil used to create ES 175 originated from TU 153. Because sample results from TU 153 exceeded the release criterion for Cs-137, biased samples were collected. The SUPR for TU 153 indicated that one characterization sample exceeded the release criterion for Cs-137; however, the amount of soil removed from ES 175 was not provided in the SUPR. A total of 54 samples was collected from ES 175: 18 characterization samples, 18 biased samples to identify potential elevated radionuclide concentrations in soil, and a set of 18 final systematic samples.

Data from ES 175 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the ES 175 final systematic data and other excavated soil units used to backfill TU 153 and other final systematic data collected from Parcel G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from ES 175.

Concentrations of Cs-137, Ra-226 progeny (Bi-214 and Pb-214) and Th-232 progeny from ES 175 and fill units used to backfill TU 153 were statistically different from other final systematic data collected from Parcel G. Additionally, a subset of the biased samples appears to be arranged in a systematic grid instead of at biased locations.

The results of the evaluation indicate that the final systematic sample results from ES 175 are suspect. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Excavated Soil Unit 225

ES 225 was used to backfill TU 153. Soil used to create ES 225 originated from TU 153. Elevated gamma scan measurements were reported; however, no elevated soil concentrations were reported. A total of 20 samples was collected from ES 225: 2 biased samples to identify potential elevated radionuclide concentrations in soil and a set of 18 final systematic samples.

Data from ES 225 were flagged as unusual or suspect for the following reasons:

- Statistical tests identified significant differences between the ES 225 final systematic data and other overburden units used to backfill TU 153 and other final systematic data collected from Parcel G.
- Graphical data review identified anomalies or unusual trends in the soil sample data collected from ES 225.
- Soil used to create ES 225 originated from trench units immediately adjacent and downstream from a radiologically impacted building and a known radiological cleanup.

Concentrations of Cs-137, Ra-226 progeny (Bi-214 and Pb-214) and Th-232 progeny from ES 175 and fill units used to backfill TU 153 were statistically different from other final systematic data collected from Parcel G. Two biased samples were collected from ES 225 based on elevated gamma scan measurements. Elevated gamma scan measurements were also reported for ES 175 and 18 biased samples were collected from ES 175. There is no explanation for the discrepancy in number of biased samples collected.

The results of the evaluation indicate that the final systematic sample results from ES 225 are suspect. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Recommended for Confirmation Sampling Based on Evidence of Biased Sample Collection at Locations to Potentially Avoid Highest Gamma Scan Measurements

The gamma scan for 46 ESs in Parcel G identified several measurements above the investigation level, which prompted the collection of biased soil samples in addition to the standard 18 final systematic samples. However, none of these biased sample results identified activity above the release criteria for any ROC. In some cases, remediation was performed; however, this was only the case when elevated characterization sample results were identified. In all cases, the biased samples collected in response to elevated gamma scan measurements did not identify activity above the release criteria for any ROC. The concern is that the biased samples were not collected at the locations of the highest gamma scan measurement. This narrative is consistent with the allegation that biased samples were collected in areas to avoid potentially elevated soil sample results, but this allegation cannot be determined based on this evaluation. Therefore, confirmation sampling and analysis by an independent, certified laboratory are recommended to document current site conditions at the following fill units:

- ES 1
- ES 3
- ES 4
- ES 7
- ES 14
- ES 20
- ES 22
- ES 23
- ES 26
- ES 28
- ES 29
- ES 30
- ES 31
- ES 45
- ES 47
- ES 50
- ES 51
- ES 52
- ES 53
- ES 54
- ES 55
- ES 57
- ES 60
- ES 61
- ES 63
- ES 64
- ES 65
- ES 67
- ES 92
- ES 109 (also included in previous data manipulation or falsification section)
- ES 115

- ES 123
- ES 128
- ES 131 (also included in previous data manipulation or falsification section)
- ES 132
- ES 145
- ES 146
- ES 148
- ES 152
- ES 155
- ES 162
- ES 166
- ES 175 (also included in previous data manipulation or falsification section)
- ES 225 (also included in previous data manipulation or falsification section)
- ES 471
- ES 472

4.2.3 Current and Former Building Sites

There are 2 buildings (1 current and 1 former building site) divided into 32 survey units, where soil sampling was performed in Parcel G. Based upon the scope of this evaluation, there was evidence of potential data manipulation or falsification at both buildings (Building 351A consisting of 20 survey units and 5 of 12 survey units at the Building 317/364/365 Site) and confirmation sampling is recommended.

The evaluation of the data from these buildings was performed similarly to the evaluation of data from the storm drain and sanitary sewer line investigation. The results of the Parcel G current and former building site survey unit evaluation are presented on **Figure 4-8**. The data evaluation forms documenting the findings are provided in **Appendix C**.

The following text summarizes the evaluations of the two buildings in Parcel G where evidence of potential data manipulation or falsification was found.

4.2.3.1 Recommended for Confirmation Sampling

Building 351A Survey Units A through P, R, S, T, and U

Building 351A was previously used by the NRDL Chemical Technology Division, Applied Research Branch, Nuclear and Physical Chemistry Branch, Chemical and Physics Branch, and Analytical and Standards Branch (NAVSEA, 2004). Additionally, the HRA indicated that Building 351A was used as an instrument repair and calibration laboratory and radiography shop (NAVSEA, 2004; TtEC, 2010b). The NRDL consolidated most of its facilities in 1955 and surveyed its formerly used buildings for free release for HPNS use and control. One of those buildings was Building 351A. NRDL release letters confirmed that the buildings were surveyed and released for unrestricted use in 1955, with the exception of the drain lines inside the building. However, existing Atomic Energy Commission guidelines required all NRDL buildings to be thoroughly surveyed and decontaminated prior to abandonment or release for unrestricted use (TtEC, 2010a). Additional previous radiological investigations at Building 351A were reported, with the most recent preformed in 2002 by NWT. The Navy contracted NWT to perform a MARSSIM Class 3 survey of Building 351A and elevated readings were identified at floor areas and in the drain piping. The drain pipes from the building drained to a central line located in the crawl space of the building. All piping was reportedly removed from the crawl space area and additional surveys by NWT were performed. The Navy considered the Class 3 Survey performed by NWT to be insufficient and determined that additional investigations were required.

TtEC was contracted by the Navy to perform a scoping survey of the ventilation system and retrieve archived samples collected from the crawl space for reanalysis. All but one of the archived samples were found and the samples were repackaged and reanalyzed at the onsite laboratory. The only sample that was not found indicated the presence of elevated Cs-137 concentrations during its initial analysis and based on this missing sample, the Navy decided that remediation of the affected area was necessary. TtEC performed a scoping survey of the ventilation system but the surveys did not indicate the presence of elevated measurements. In 2008, TtEC was contracted to perform a Final Status Survey based on MARSSIM guidelines (DoD et al., 2000) of Building 351A (TtEC, 2010b). As identified in the HRA, ROCs for Building 351A were Cs-137, Pu-239, Ra-226, Sr-90 and Th-232. In order to perform the Final Status Survey, Building 351A was initially divided into 44 Class 1 interior survey units on the main floor, 16 Class 1 survey units and a single Class 2 survey unit in the crawl space, and one Class 1 survey unit for the trench area from which the main sewer line was removed. Following asbestos abatement and remediation, there were 40 Class 1 survey units on the main floor, 17 Class 1 and one Class 2 survey unit in the crawl space, and one Class 1 survey unit for the trench area. Although the Building 351A FSSR states that there were 17 Class 1 survey units and one Class 2 survey unit in the crawl space, figures and analytical data included in the FSSR indicate that there were 18 Class 1 survey units and one Class 2 survey unit. Soil sampling was only performed in the crawl space at the 18 Class 1 survey units (SUs A through P, R, and S), the one Class 2 survey unit (SU U) and the trench area (SU T). The investigation activities associated with the survey units making up the interior surfaces on the main floor of Building 351A is under evaluation and will be reported separately. Gamma scan and gamma static measurements and a minimum of 16 soil samples were collected from the crawl space survey units. Each sample was analyzed by gamma spectroscopy at the onsite laboratory, and 20 percent of these samples were analyzed for Sr-90, Th-232, and Pu-239 at the onsite laboratory. Ten percent of the samples analyzed at the onsite laboratory, by analysis, were analyzed at the offsite laboratory.

The results of the evaluation indicate that the final systematic sample results from Survey Units A through P, R, S, T and U in Building 351A are suspect. There is a specific allegation that soil samples collected from Building 351A were collected from a location with a known lower concentration. A review of the FSSR for Building 351A indicates that the recorded intervals between reported soil sample collection times are potentially inaccurate. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

Building 317/364/365 Site Survey Units 21, 28, 29, 30, and 31

The Building 317/364/365 Site is the location of demolished, former Buildings 317, 364, and 365 (TtEC, 2010d). The three former buildings were included as one site because of similar historical use. Former Building 317 was noted as demolished in the HRA (NAVSEA, 2004) but Former Buildings 364 and 365 were demolished as a part of the Final Status Survey performed by TtEC (TtEC, 2010d). Former Building 317 was previously used by the NRDL as temporary animal quarters. Former Building 364 was previously used by the NRDL as an animal irradiation facility, Liquid Radioactive Waste Collection Facility, hot cell, Research Animal Facility, storage building, isotope processing and decontamination studies and general research laboratory. After closure of HPNS, Building 364 was leased to a laboratory company. Former Building 365 was previously used as a personnel decontamination facility, change house, storage building and the NRDL small animal facility.

The HRA indicated that surveys have been performed at Former Building 317, Former Building 364, and Former Building 365. In 2002, NWT performed a survey of the Building 317 Site. The HRA indicated Cs-137 was found at concentrations exceeding the release criterion but the site was remediated and resurveyed. The Building 317 Site was located near a previous remedial action identified in the HRA, known as the “peanut spill.” The peanut spill was included in the survey of the Building 317 Site performed by NWT. The HRA indicated that the spill was successfully remediated in 2001, but a post remediation FSS of the excavation boundaries was never performed (NAVSEA, 2004; TtEC, 2010d). The

HRA reported historical investigations at the Building 364 Site, the most recent performed in 2002 by NWT, when Cs-137 was detected on building surfaces, piping the crawlspace of the building, and piping outside of the building. The HRA indicated the areas were remediated and resurveyed but alpha and beta contamination remained in a single room. The HRA indicated historical surveys at the Building 365 Site, with the most recent performed in 2002 by NWT. The Former Building 365 was also used as a sample storage facility by Navy contractors during investigations at HPNS, but available documentation indicates no sample processing was performed in the Building.

TtEC was contracted by the Navy to perform a Final Status Survey using MARSSIM guidance (DoD et al., 2000) of the Building 317/364/365 Site. Because of the site-specific use of radioactive materials at Former Buildings 317, 364, and 365, ROCs for the Building 317/364/365 Site were survey unit specific. The HRA identified Cs-137, Pu-239, Ra-226, Sr-90, and uranium (U)-235 as ROCs for Former Buildings 317 and 365 and the Building 317/364/365 Site FSSR indicated these ROCs were applicable to Survey Units (SU) 23, 24, 25, 26, 29, and 30 (NAVSEA, 2004; TtEC, 2010d). The HRA identified Cs-137, Co-60, Pu-239, Ra-226, Sr-90, and U-235 as ROCs for Former Building 364 and the Building 317/364/365 Site FSSR indicated these ROCs were applicable to SUs 20, 21, 22, 27, and 31 (NAVSEA, 2004; TtEC, 2010d). The Building 317/364/365 Site FSSR also indicated that the Navy directed that samples be analyzed for all ROCs listed in Table 1 of the Action Memorandum (Navy, 2006) for the excavation of the liquid waste transfer system located within SU 28 (TtEC, 2010d). The ROCs applicable to SU 28 included ROCs for Former Building 364 and americium (Am)-241, europium (Eu)-152, Eu-154, Th-232, and tritium (H)-3.

The Building 317/364/365 Site was initially divided into seven Class 1 survey units (SUs 20, 21, 22, 23, 24, 25, and 27) and one Class 2 survey unit (SU 26), with the understanding that a final Class 2 survey unit (SU 28) would be established encompassing SUs 20, 21, and 22 after remediation was completed. Following gamma scan surveys and biased sampling identifying contamination near SU 25, two new Class 1 survey units (SUs 29 and 30) and SU 26 was rearranged to form a buffer that was 2 meters wide around SUs 23, 25, 29, and 30. Following remediation of SU 20 and 21, a new Class 2 survey unit (SU 31) was established as a buffer for SU 20 and SU 21. Gamma scan and static measurements and a minimum of 18 samples were collected from each SU. Each sample was analyzed at the onsite laboratory by gamma spectroscopy and 20 percent of the samples were analyzed for Sr-90 at the onsite laboratory. At SUs where U-235 and Pu-239 were listed as ROCs, 10 percent of the samples were analyzed for these isotopes at the onsite laboratory. If elevated Cs-137 or Am-241 concentrations were identified, additional samples were analyzed for Sr-90 and Pu-239. Ten percent of all samples analyzed by the onsite laboratory, by analysis, were analyzed at the offsite laboratory and additionally, a minimum of 10 percent of Final Status Survey samples were analyzed at the offsite laboratory.

Additionally, the storm drains and sanitary sewer lines in the vicinity of the Building 317/364/365 Site were removed by TtEC as a part of the storm drain and sanitary sewer line investigation. The investigation and removal resulted in the two trench survey units (TUs 117 and 153) and the results were reported by TtEC, separately, in the SUPR for the respective trench survey unit. Trench Survey Unit 117 bounded SUs 21 and 22 to the east and the work performed did not identify elevated concentrations above the release criterion for any ROC. Therefore, TU 117 was used as a buffer for SUs 21 and 22. Trench Survey Unit 153 encompassed SU 22 and since the backfill of this trench survey unit included previously cleared excavated soils and import fill material, no additional sampling was performed at SU 22.

The results of the evaluation indicate that the final systematic sample results from Survey Units 21, 28, 29, 30, and 31 are suspect. Based on the available gamma scan data, it appears that a 100 percent scan of these survey units may not have been completed. Therefore, it is recommended that confirmation sampling and analysis by an independent, certified laboratory be performed to document current site conditions.

4.3 Conclusions and Recommendations

This evaluation of Parcels B and G soil data found evidence that manipulation and falsification was not limited to the survey units addressed by TtEC in their Investigation Conclusion, Anomalous Soil Samples report (TtEC, 2014). In the following years, former workers at HPNS alleged additional and more widespread data manipulation and falsification.

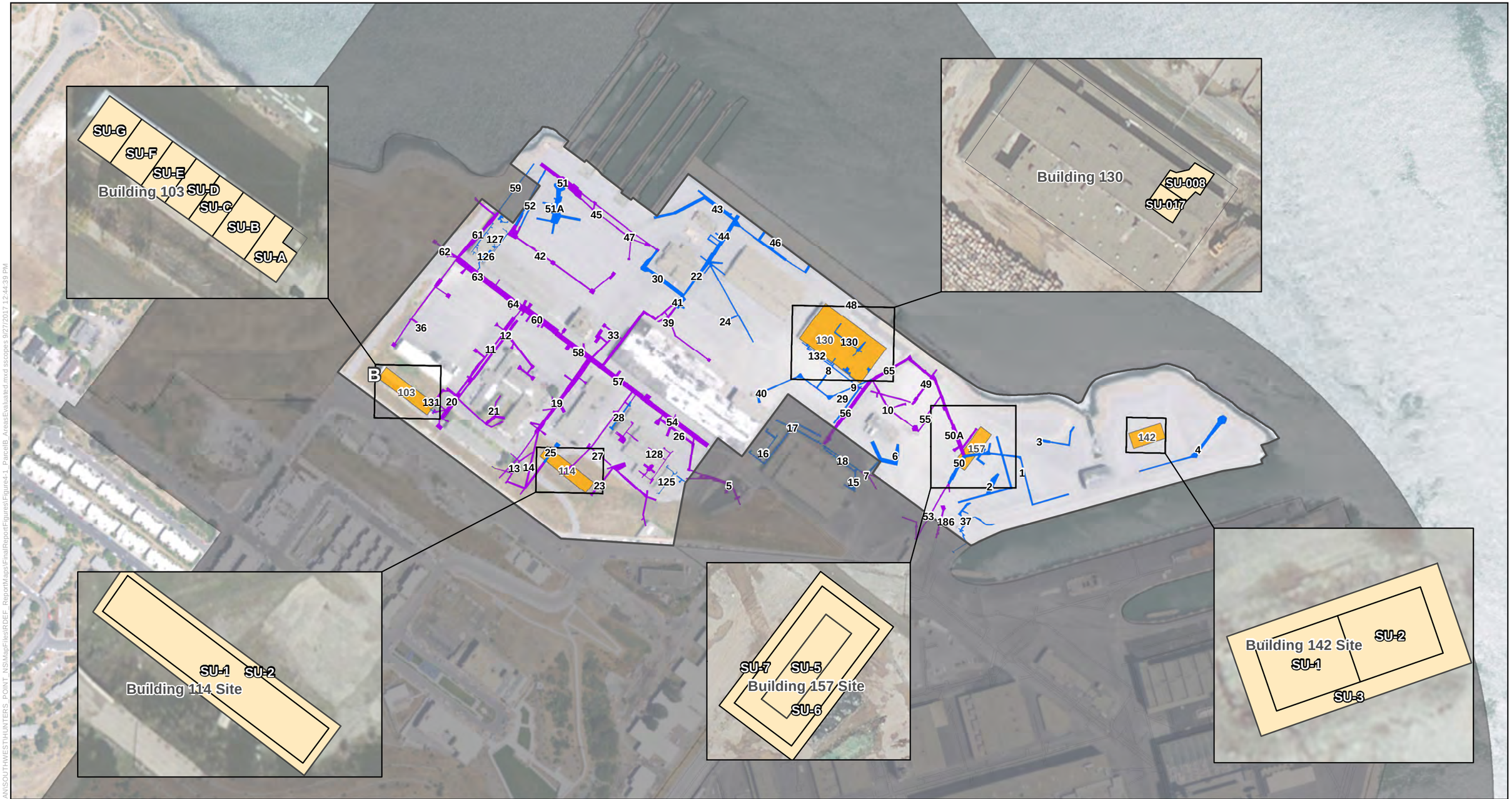
The areas evaluated in Parcel B included 70 trench units, 110 fill units, and 5 current and former building sites with 17 soil survey units. More than 8,000 soil samples were collected from these areas from 2005 through 2010. Based solely on a review of the data previously collected by TtEC and the findings of the data evaluations, the following recommendations are provided:

- Trench units - There was no evidence of potential data manipulation or falsification identified at 66 of the 70 trench units evaluated; therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at the remaining four trench units. Reanalysis of archived samples is recommended at two trench units, and confirmation sampling is recommended at two trench units.
- Fill units - There was no evidence of potential data manipulation or falsification identified at 91 of the 110 fill units evaluated; therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at the remaining 19 fill units used as backfill for 17 trench survey units. Reanalysis of archived samples is recommended at 1 fill unit and confirmation sampling is recommended for the other 18 fill units. Of the 18 fill units, 17 were recommended for confirmation sampling based on evidence of biased sample collection at locations to potentially avoid the highest gamma scan measurements.
- Current and Former Building Sites - There was no evidence of potential data manipulation or falsification identified at 3 of the 5 buildings evaluated (9 out of 17 survey units); therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at the other 2 buildings (8 out of 17 survey units), and confirmation sampling is recommended.

The areas evaluated in Parcel G included 63 trench units, 107 fill units, and 2 current and former building sites with 32 soil survey units. More than 12,000 soil samples were collected from these areas from 2002 through 2011. Based solely on a review of the data previously collected by TtEC and the findings of the data evaluations, the following recommendations are provided:

- Trench units - There was no evidence of potential data manipulation or falsification identified at 43 of the 63 trench units evaluated; therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at the remaining 20 trench units and confirmation sampling is recommended.
- Fill units - There was no evidence of potential data manipulation or falsification identified at 53 of the 107 fill units evaluated; therefore, no further action is recommended. There was evidence of potential data manipulation or falsification at the remaining 54 fill units used as backfill for 28 trench survey units. Reanalysis of archived samples is recommended at 3 fill units and confirmation sampling is recommended for the other 51 fill units. Of the 51 fill units, 46 were recommended for confirmation sampling based on evidence of biased sample collection at locations to potentially avoid the highest gamma scan measurements.
- Current and Former Building Sites - There was evidence of potential data manipulation or falsification at the 2 buildings (25 out of 32 survey units) evaluated and confirmation sampling is recommended.

Because the Navy cannot provide assurance that the evaluation identified every instance of data manipulation or falsification, it is recommended that the Navy and regulatory agencies work collaboratively to initiate a sample collection program to confirm protectiveness of human health and the environment. The sampling program should be based on the findings of this report and consider that naturally occurring Ra-226 may exceed the release criterion without being indicative of site-related contamination.



Legend:

- Trench Unit
- Trench and Fill Unit
- Current and Former Building
- Survey Unit
- Parcel B

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

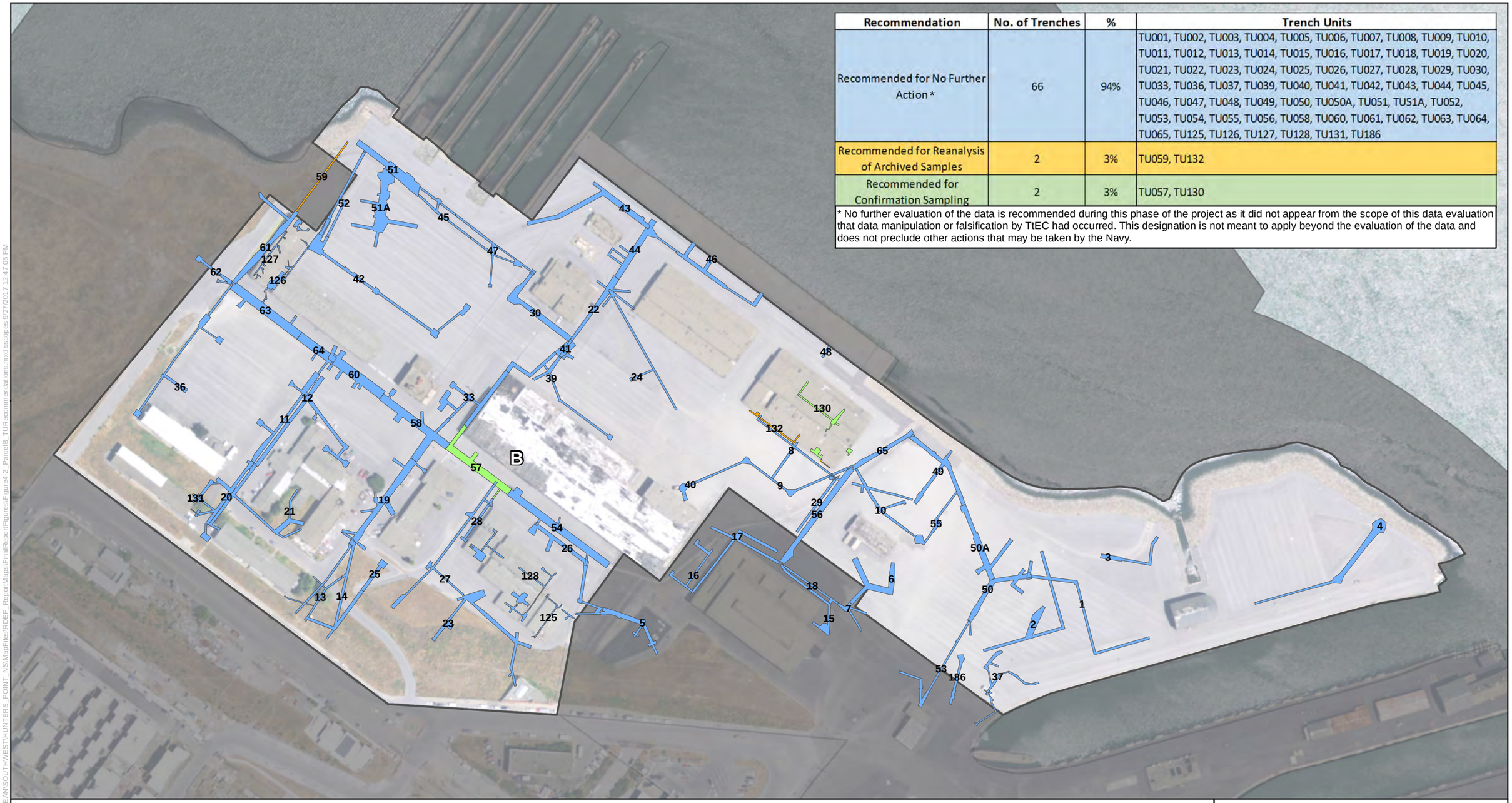
N

0 150 300 600 Feet

1 inch = 300 feet

Figure 4-1
Areas Evaluated in Parcel B
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Brnoclsrde\GIS_SHARE\ENBG\00_Proj\NNavy\CLEANSOUTHWESTHUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReport\Figures\Figure4-1_ParcelB_AreasEvaluated.mxd sscopes 9/27/2017 12:44:39 PM



Recommendation	No. of Trenches	%	Trench Units
Recommended for No Further Action *	66	94%	TU001, TU002, TU003, TU004, TU005, TU006, TU007, TU008, TU009, TU010, TU011, TU012, TU013, TU014, TU015, TU016, TU017, TU018, TU019, TU020, TU021, TU022, TU023, TU024, TU025, TU026, TU027, TU028, TU029, TU030, TU033, TU036, TU037, TU039, TU040, TU041, TU042, TU043, TU044, TU045, TU046, TU047, TU048, TU049, TU050, TU050A, TU051, TU51A, TU052, TU053, TU054, TU055, TU056, TU058, TU060, TU061, TU062, TU063, TU064, TU065, TU125, TU126, TU127, TU128, TU131, TU186
Recommended for Reanalysis of Archived Samples	2	3%	TU059, TU132
Recommended for Confirmation Sampling	2	3%	TU057, TU130

* No further evaluation of the data is recommended during this phase of the project as it did not appear from the scope of this data evaluation that data manipulation or falsification by TtEC had occurred. This designation is not meant to apply beyond the evaluation of the data and does not preclude other actions that may be taken by the Navy.

Legend:

- Recommended for No Further Action
- Recommended for Re-Analysis of Archived Samples
- Recommended for Confirmation Sampling
- Parcel B

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

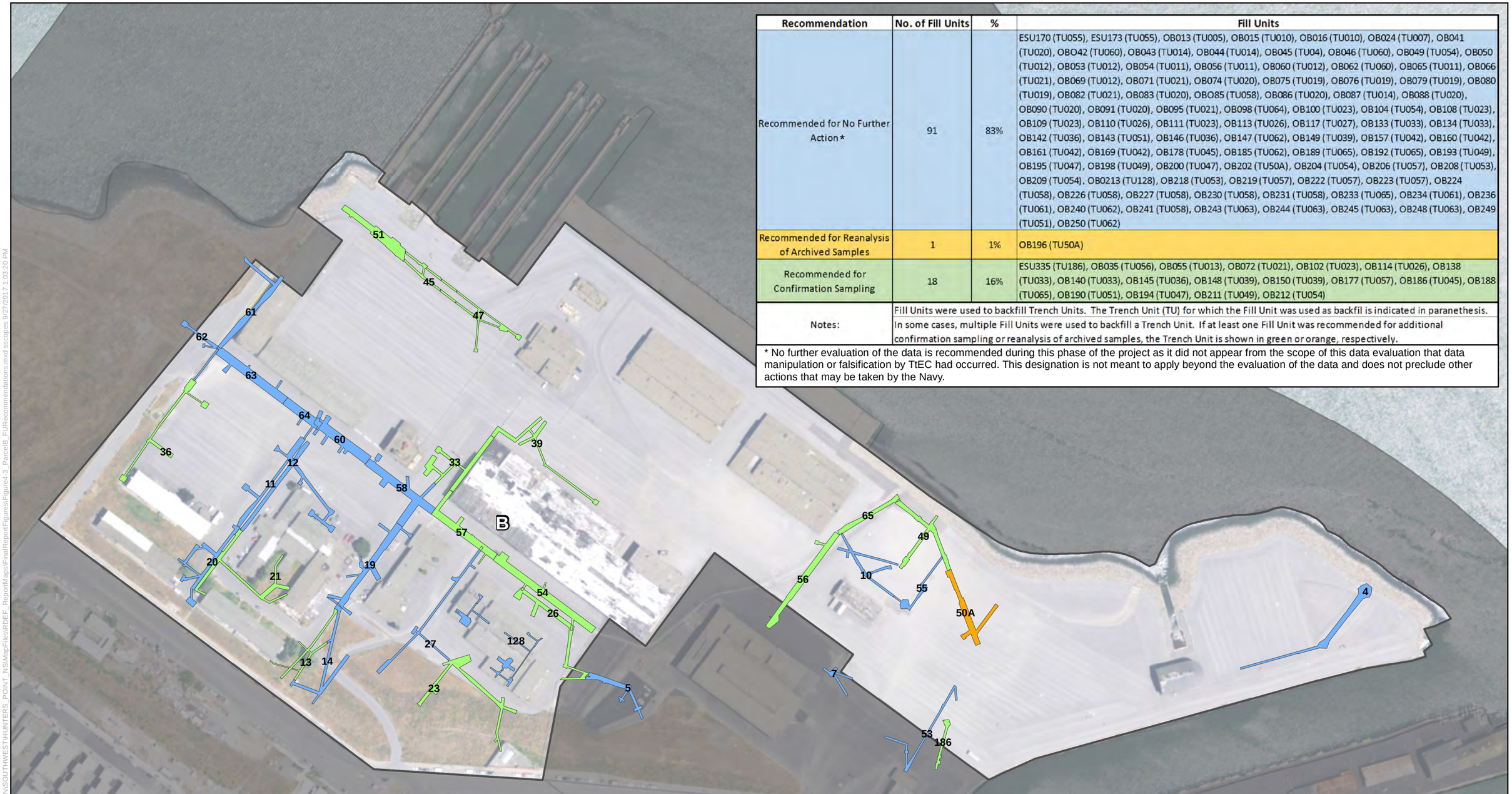
N

0 100 200 400 Feet

1 inch = 200 feet

Figure 4-2
Parcel B Trench Unit Recommendations
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Brookside\GIS_SHARE\ENB\G00_Proj\NNavy\CLEANUP\SOUTHWEST\HUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReport\Figures\Figure4-2_ParcelB_TU\Recommendations.mxd sscopes 9/27/2017 12:47:05 PM



Recommendation	No. of Fill Units	%	Fill Units
Recommended for No Further Action*	91	83%	ESU170 (TU055), ESU173 (TU055), OB013 (TU005), OB015 (TU010), OB016 (TU010), OB024 (TU007), OB041 (TU020), OBO42 (TU060), OB043 (TU014), OB044 (TU014), OB045 (TU04), OB046 (TU060), OB049 (TU054), OB050 (TU012), OB053 (TU012), OB054 (TU011), OB056 (TU011), OB060 (TU012), OB062 (TU060), OB065 (TU011), OB066 (TU021), OB069 (TU012), OB071 (TU021), OB074 (TU020), OB075 (TU019), OB076 (TU019), OB079 (TU019), OB080 (TU019), OB082 (TU021), OB083 (TU020), OBO85 (TU058), OB086 (TU020), OB087 (TU014), OB088 (TU020), OB090 (TU020), OB091 (TU020), OB095 (TU021), OB098 (TU064), OB100 (TU023), OB104 (TU054), OB108 (TU023), OB109 (TU023), OB110 (TU026), OB111 (TU023), OB113 (TU026), OB117 (TU027), OB133 (TU033), OB134 (TU033), OB142 (TU036), OB143 (TU051), OB146 (TU036), OB147 (TU062), OB149 (TU039), OB157 (TU042), OB160 (TU042), OB161 (TU042), OB169 (TU042), OB178 (TU045), OB185 (TU062), OB189 (TU065), OB192 (TU065), OB193 (TU049), OB195 (TU047), OB198 (TU049), OB200 (TU047), OB202 (TU50A), OB204 (TU054), OB206 (TU057), OB208 (TU053), OB209 (TU054), OB0213 (TU128), OB218 (TU053), OB219 (TU057), OB222 (TU057), OB223 (TU057), OB224 (TU058), OB226 (TU058), OB227 (TU058), OB230 (TU058), OB231 (TU058), OB233 (TU065), OB234 (TU061), OB236 (TU061), OB240 (TU062), OB241 (TU058), OB243 (TU063), OB244 (TU063), OB245 (TU063), OB248 (TU063), OB249 (TU051), OB250 (TU062)
Recommended for Reanalysis of Archived Samples	1	1%	OB196 (TU50A)
Recommended for Confirmation Sampling	18	16%	ESU335 (TU186), OB035 (TU056), OB055 (TU013), OB072 (TU021), OB102 (TU023), OB114 (TU026), OB138 (TU033), OB140 (TU033), OB145 (TU036), OB148 (TU039), OB150 (TU039), OB177 (TU057), OB186 (TU045), OB188 (TU065), OB190 (TU051), OB194 (TU047), OB211 (TU049), OB212 (TU054)
Notes:	Fill Units were used to backfill Trench Units. The Trench Unit (TU) for which the Fill Unit was used as backfil is indicated in paranethesis. In some cases, multiple Fill Units were used to backfill a Trench Unit. If at least one Fill Unit was recommended for additional confirmation sampling or reanalysis of archived samples, the Trench Unit is shown in green or orange, respectively.		

* No further evaluation of the data is recommended during this phase of the project as it did not appear from the scope of this data evaluation that data manipulation or falsification by TtEC had occurred. This designation is not meant to apply beyond the evaluation of the data and does not preclude other actions that may be taken by the Navy.

Legend:

- Recommended for No Further Action
- Recommended for Re-Analysis of Archived Samples
- Recommended for Confirmation Sampling
- Parcel B

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 100 200 400 Feet

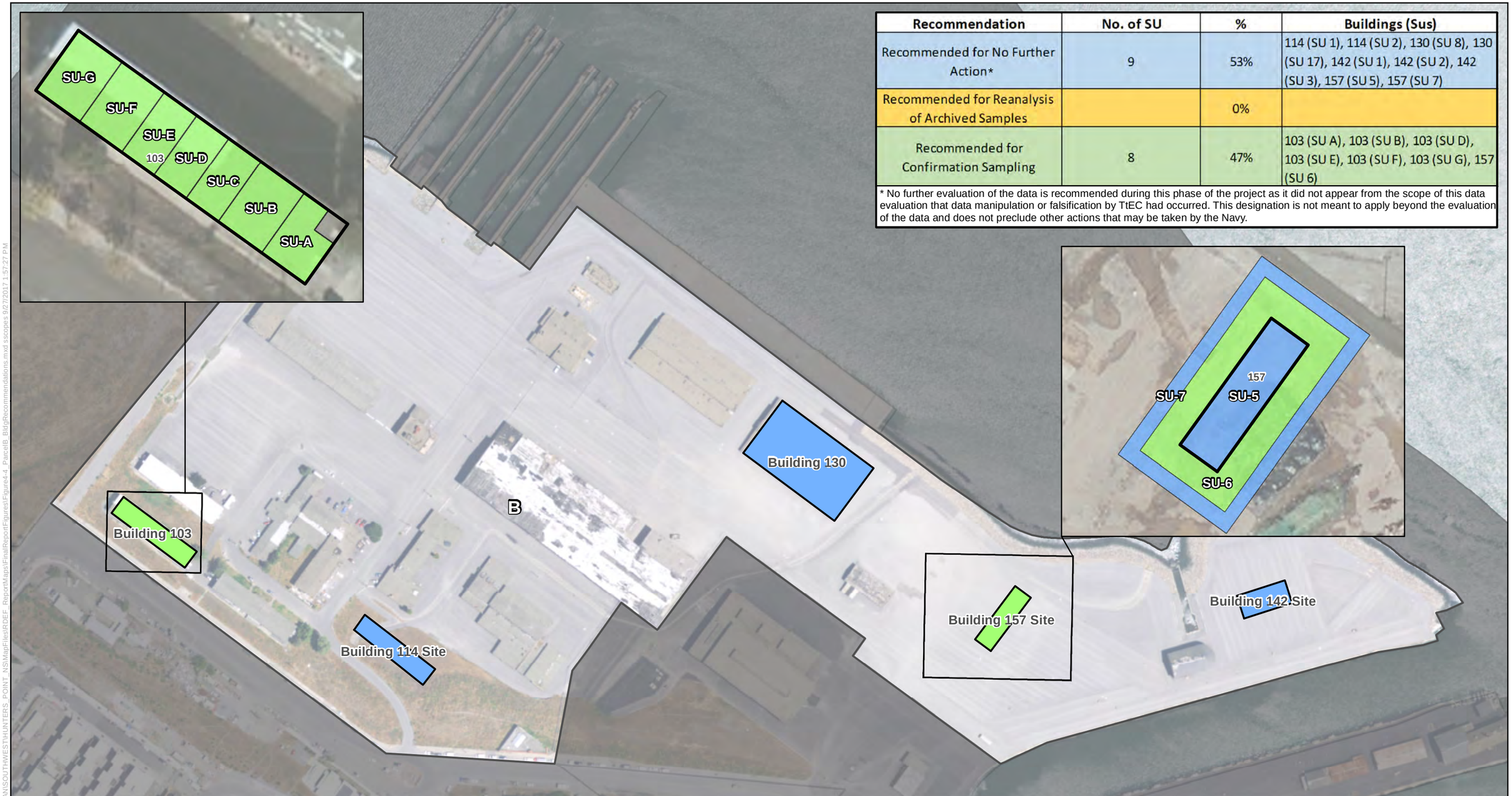
1 inch = 200 feet

Figure 4-3
Parcel B Fill Unit Recommendations
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Brookside\GIS_SHARE\NBG\00_Proj\N\Navy\CLEAN\SOUTHWEST\HUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReport\Figures\Figure4-3_ParcelB_FU\Recommendations.mxd scopes 9/27/2017 1:03:20 PM

Recommendation	No. of SU	%	Buildings (Sus)
Recommended for No Further Action*	9	53%	114 (SU 1), 114 (SU 2), 130 (SU 8), 130 (SU 17), 142 (SU 1), 142 (SU 2), 142 (SU 3), 157 (SU 5), 157 (SU 7)
Recommended for Reanalysis of Archived Samples		0%	
Recommended for Confirmation Sampling	8	47%	103 (SU A), 103 (SU B), 103 (SU D), 103 (SU E), 103 (SU F), 103 (SU G), 157 (SU 6)

* No further evaluation of the data is recommended during this phase of the project as it did not appear from the scope of this data evaluation that data manipulation or falsification by TtEC had occurred. This designation is not meant to apply beyond the evaluation of the data and does not preclude other actions that may be taken by the Navy.



Legend:

- Recommended for No Further Action
- Recommended for Additional Confirmation Sampling
- Parcel B

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 100 200 400 Feet

1 inch = 200 feet

Figure 4-4
Parcel B Current and Former Building Site Survey Unit Recommendations
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Brookside\GIS_SHAREENBG\00_Proj\N\Navy\CLEAN\SOUTHWEST\HUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReportFigures\Figures\Figure4-4_ParcelB_BldgRecommendations.mxd scopes 9/27/2017 1:57:27 PM

Legend:

- Trench Unit
- Trench and Fill Unit
- Current and Former Building
- Survey Unit
- Parcel G

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

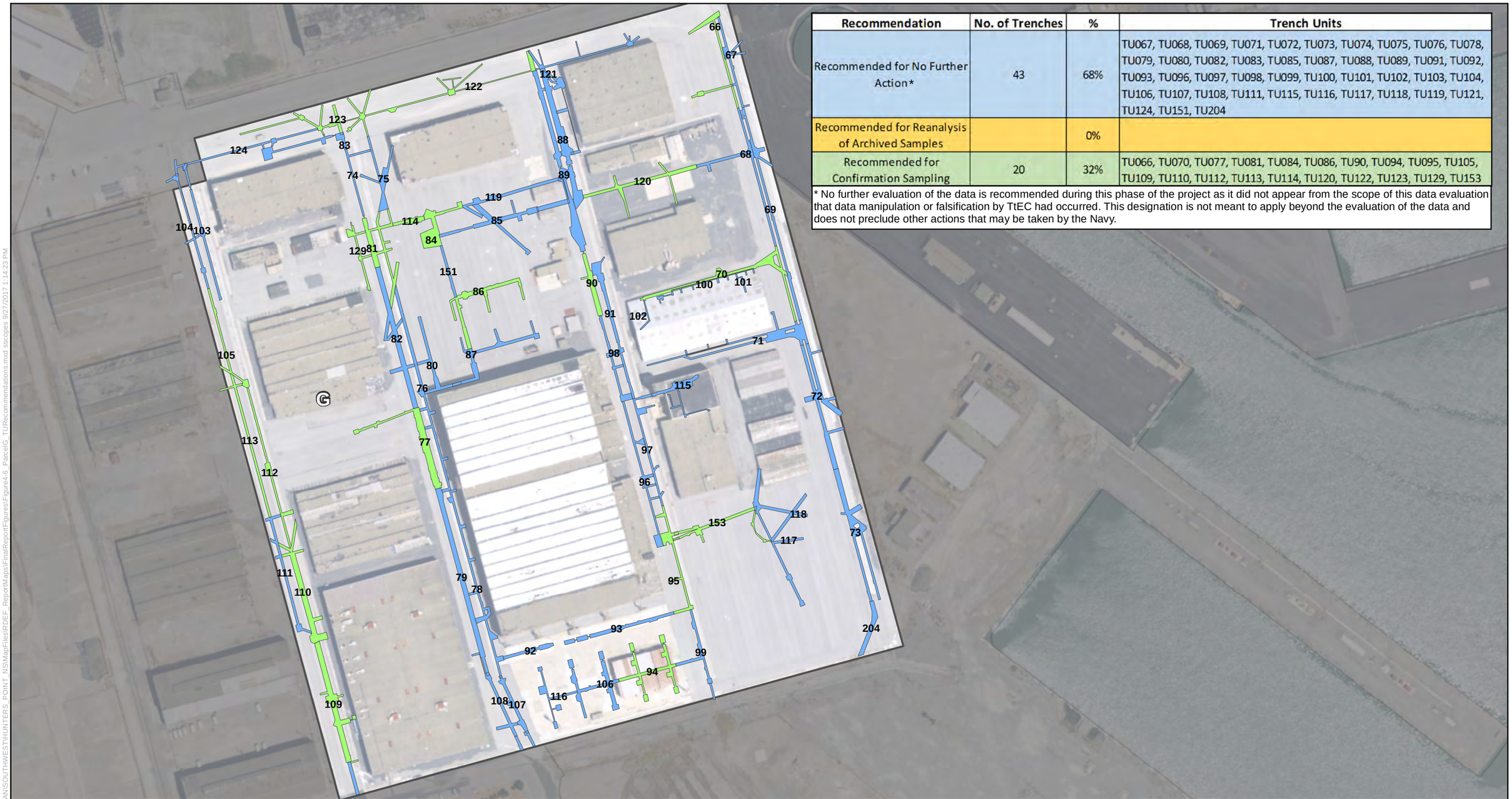
N

0 100 200 400 Feet

1 inch = 200 feet

Figure 4-5
Areas Evaluated in Parcel G
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Brooksidegis\GIS_SHARE\ENBG\00_Proj\NNavy\CLEAN\SOUTHWEST\HUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReport\Figures\Figure4-5_ParcelG_AreasEvaluated.mxd sscopes 9/27/2017 1:09:33 PM



Recommendation	No. of Trenches	%	Trench Units
Recommended for No Further Action*	43	68%	TU067, TU068, TU069, TU071, TU072, TU073, TU074, TU075, TU076, TU078, TU079, TU080, TU082, TU083, TU085, TU087, TU088, TU089, TU091, TU092, TU093, TU096, TU097, TU098, TU099, TU100, TU101, TU102, TU103, TU104, TU106, TU107, TU108, TU111, TU115, TU116, TU117, TU118, TU119, TU121, TU124, TU151, TU204
Recommended for Reanalysis of Archived Samples		0%	
Recommended for Confirmation Sampling	20	32%	TU066, TU070, TU077, TU081, TU084, TU086, TU90, TU094, TU095, TU105, TU109, TU110, TU112, TU113, TU114, TU120, TU122, TU123, TU129, TU153

* No further evaluation of the data is recommended during this phase of the project as it did not appear from the scope of this data evaluation that data manipulation or falsification by TtEC had occurred. This designation is not meant to apply beyond the evaluation of the data and does not preclude other actions that may be taken by the Navy.

Legend:

- Recommended for No Further Action
- Recommended for Confirmation Sampling
- Parcel G

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

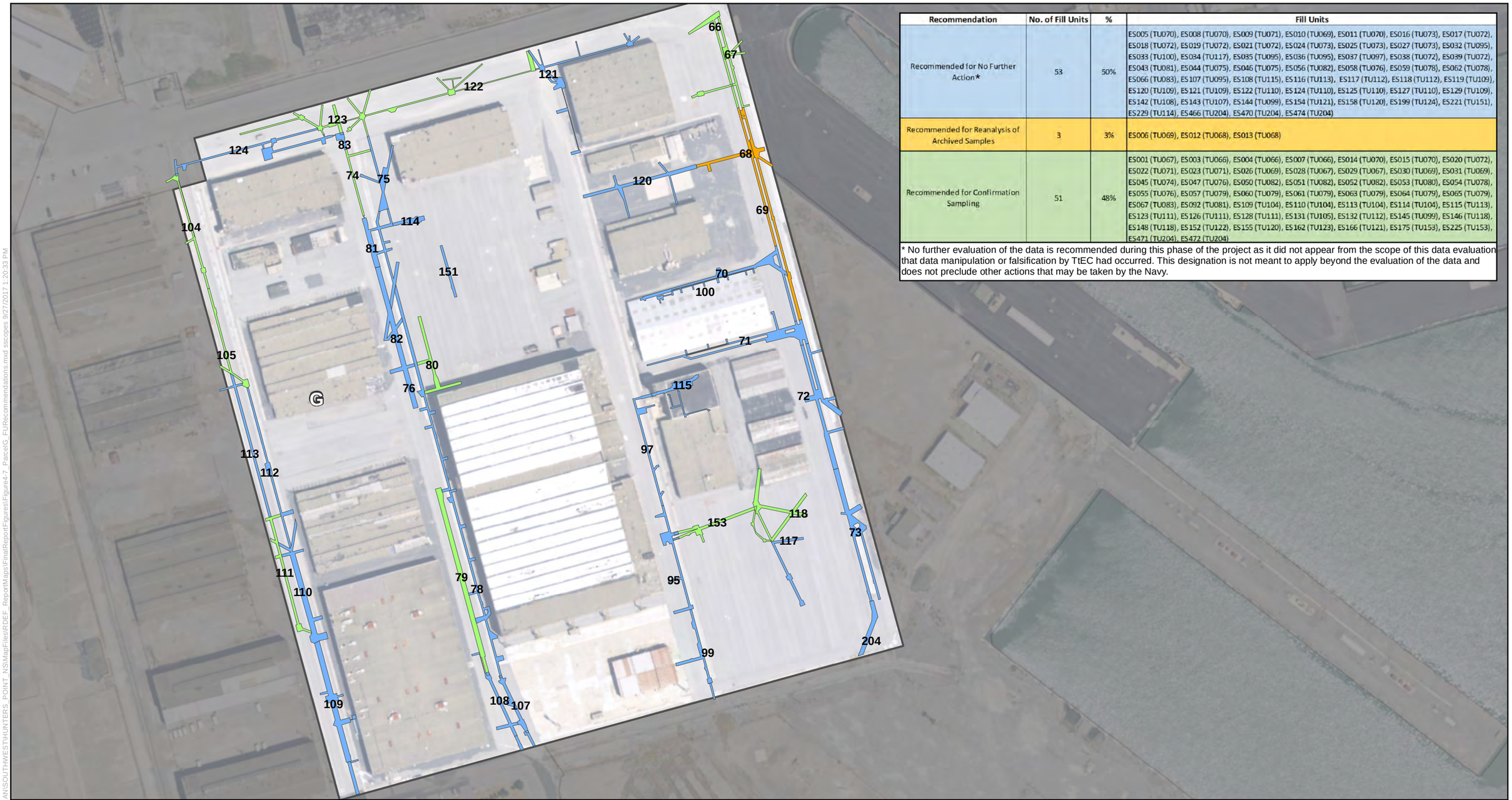
N

0 100 200 400 Feet

1 inch = 200 feet

Figure 4-6
Parcel G Trench Unit Recommendations
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Broolside\GIS_SHARE\ENG\G00_Proj\NNavy\CLEAN\SOUTHWEST\HUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReportFigures\Figure4-6_ParcelG_TURecommendations.mxd scopes 9/27/2017 1:14:23 PM



Recommendation	No. of Fill Units	%	Fill Units
Recommended for No Further Action*	53	50%	ES005 (TU070), ES008 (TU070), ES009 (TU071), ES010 (TU069), ES011 (TU070), ES016 (TU073), ES017 (TU072), ES018 (TU072), ES019 (TU072), ES021 (TU072), ES024 (TU073), ES025 (TU073), ES027 (TU073), ES032 (TU095), ES033 (TU100), ES034 (TU117), ES035 (TU095), ES036 (TU095), ES037 (TU097), ES038 (TU072), ES039 (TU072), ES043 (TU081), ES044 (TU075), ES046 (TU075), ES056 (TU082), ES058 (TU076), ES059 (TU078), ES062 (TU078), ES066 (TU083), ES107 (TU095), ES108 (TU115), ES116 (TU113), ES117 (TU112), ES118 (TU112), ES119 (TU109), ES120 (TU109), ES121 (TU109), ES122 (TU110), ES124 (TU110), ES125 (TU110), ES127 (TU110), ES129 (TU109), ES142 (TU108), ES143 (TU107), ES144 (TU099), ES154 (TU121), ES158 (TU120), ES199 (TU124), ES221 (TU151), ES229 (TU114), ES466 (TU204), ES470 (TU204), ES474 (TU204)
Recommended for Reanalysis of Archived Samples	3	3%	ES006 (TU069), ES012 (TU068), ES013 (TU068)
Recommended for Confirmation Sampling	51	48%	ES001 (TU067), ES003 (TU066), ES004 (TU066), ES007 (TU066), ES014 (TU070), ES015 (TU070), ES020 (TU072), ES022 (TU071), ES023 (TU071), ES026 (TU069), ES028 (TU067), ES029 (TU067), ES030 (TU069), ES031 (TU069), ES045 (TU074), ES047 (TU076), ES050 (TU082), ES051 (TU082), ES052 (TU082), ES053 (TU080), ES054 (TU078), ES055 (TU076), ES057 (TU079), ES060 (TU079), ES061 (TU079), ES063 (TU079), ES064 (TU079), ES065 (TU079), ES067 (TU083), ES092 (TU081), ES109 (TU104), ES110 (TU104), ES113 (TU104), ES114 (TU104), ES115 (TU113), ES123 (TU111), ES126 (TU111), ES128 (TU111), ES131 (TU105), ES132 (TU112), ES145 (TU099), ES146 (TU118), ES148 (TU118), ES152 (TU122), ES155 (TU120), ES162 (TU123), ES166 (TU121), ES175 (TU153), ES225 (TU153), ES471 (TU204), ES472 (TU204)

* No further evaluation of the data is recommended during this phase of the project as it did not appear from the scope of this data evaluation that data manipulation or falsification by TtEC had occurred. This designation is not meant to apply beyond the evaluation of the data and does not preclude other actions that may be taken by the Navy.

Legend:

- Recommended for No Further Action
- Recommended for Re-Analysis of Archived Samples
- Recommended for Confirmation Sampling
- Parcel G

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 100 200 400 Feet

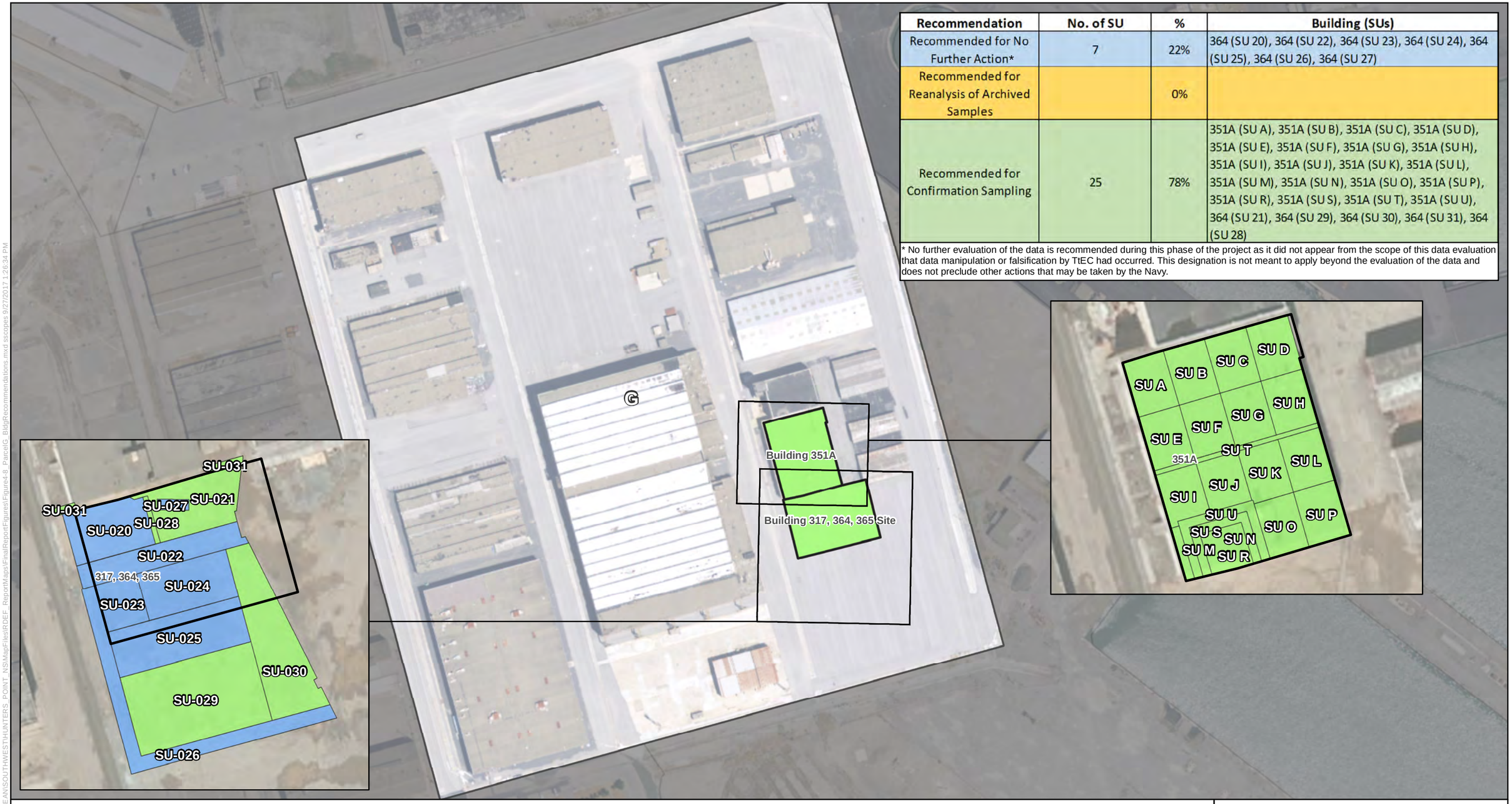
1 inch = 200 feet

Figure 4-7
Parcel G Fill Unit Recommendations
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Broadside\GIS_SHARE\ENG\G00_Proj\NNavy\CLEANUP\SOUTHWEST\HUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReportFigures\Figure4-7_ParcelG_FU\Recommendations.mxd scopes 9/27/2017 1:20:33 PM

Recommendation	No. of SU	%	Building (SUs)
Recommended for No Further Action*	7	22%	364 (SU 20), 364 (SU 22), 364 (SU 23), 364 (SU 24), 364 (SU 25), 364 (SU 26), 364 (SU 27)
Recommended for Reanalysis of Archived Samples		0%	
Recommended for Confirmation Sampling	25	78%	351A (SU A), 351A (SU B), 351A (SU C), 351A (SU D), 351A (SU E), 351A (SU F), 351A (SU G), 351A (SU H), 351A (SU I), 351A (SU J), 351A (SU K), 351A (SU L), 351A (SU M), 351A (SU N), 351A (SU O), 351A (SU P), 351A (SU R), 351A (SU S), 351A (SU T), 351A (SU U), 364 (SU 21), 364 (SU 29), 364 (SU 30), 364 (SU 31), 364 (SU 28)

* No further evaluation of the data is recommended during this phase of the project as it did not appear from the scope of this data evaluation that data manipulation or falsification by TtEC had occurred. This designation is not meant to apply beyond the evaluation of the data and does not preclude other actions that may be taken by the Navy.



Legend:

- Parcel G
- Recommended for No Further Action
- Recommended for Confirmation Sampling

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 100 200 400 Feet

1 inch = 200 feet

Figure 4-8
Parcel G Current and Former Building Site Survey Unit Recommendations
Radiological Data Evaluation Findings Report
Former Hunters Point Naval Shipyard
San Francisco, California

\\Broolside\GIS_SHARE\ENG\100_Proj\NNavy\CLEANUP\SOUTHWEST\HUNTERS_POINT_NS\MapFiles\RDEF_ReportMaps\FinalReportFigures\Figure4-8_ParcelG_BldgRecommendations.mxd scopes 9/27/2017 1:26:34 PM

SECTION 5

References

Naval Sea Systems Command (NAVSEA). 2000. *Historical Radiological Assessment, Hunters Point Annex, Volume 1, Naval Nuclear Propulsion Program, 1966-1995.* August.

NAVSEA. 2004. *Historical Radiological Assessment, Volume II, Use of General Radioactive Materials, 1939-2003*. August 31.

Department of Defense (DoD), Department of Energy, Nuclear Regulatory Commission, and U.S. Environmental Protection Agency. 2000. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).* NUREG-1575. August.

DoD, Department of Energy, Nuclear Regulatory Commission, and U.S. Environmental Protection Agency. 2009. *Multi-Agency Radiation Survey and Assessment of Materials and Equipment (MARSAME).* NUREG-1575 Supplement 1. January.

Navy. 2006. *Hunters Point Naval Shipyard Final Base-wide Removal Action Memo, Action Memorandum.* April 21.

Tetra Tech EC, Inc. (TtEC). 2010a. *Final Status Survey Results Building 103, Hunters Point Shipyard, San Francisco, California.* June 1.

TtEC. 2010b. *Final Status Survey Results, Building 351A, Hunters Point Shipyard, San Francisco, California.* July 26.

TtEC. 2010c. *Project Work Plan Revision 4, Base-wide Storm Drain and Sanitary Sewer Removal, Hunters Point Shipyard, San Francisco, California*. July 30.

TtEC. 2010d. *Final Status Survey Results Buildings 317/364/365 Site, Hunters Point Shipyard, San Francisco, California.* October 13.

TtEC. 2010e. *Final Status Survey Results Building 157 Site, Hunters Point Shipyard, San Francisco, California.* November 17.

TtEC. 2011. *Survey Unit Project Reports, Abstract Revision 3, Sanitary Sewer and Storm Drain Removal Project, Hunters Point Shipyard, San Francisco, California*. July 7.

TtEC. 2014. *Investigation Conclusion, Anomalous Soil Samples at Hunters Point Naval Shipyard Revision 1, Hunters Point Naval Shipyard, San Francisco, California.* April.

Appendix A
K-S Test Results

Appendix A – K-S Test Results is provided as a separate PDF on the enclosed CD-ROM.

Appendix B
Example Data Evaluation Form

Data Evaluation Documentation and Findings

Parcel:		Unit:	

Section I: Reason For Evaluation (Summary of Flagged Data):											
1) K-S Test: Pass/Fail?										Pass ☐	Fail ☐
Units Evaluation Flags											
Ac-228	Bi-212	Bi-214	Cs-137	K-40	Pb-212	Pb-214	Ra-226	Total			
Days Evaluation Flags											
Ac-228	Bi-212	Bi-214	Cs-137	K-40	Pb-212	Pb-214	Ra-226	Total			
2) Logic Tests: Pass/Fail?										Pass ☐	Fail ☐
Logic Test 1: Were FSS samples collected on the same day? **Observation:**										Yes ☐	No ☐
Logic Test 2: Were FSS samples collected on the same day or after confirmatory/biased samples were collected? **Observation:**										Yes ☐	No ☐
Logic Test 3: Were samples collected before they were counted? **Observation:**										Yes ☐	No ☐
Logic Test 4: Were all FSS samples analyzed within 2 working days? **Observation:**										Yes ☐	No ☐
Logic Test 5: Were samples counted within 2 weeks of sample collection? **Observation:**										Yes ☐	No ☐
Logic Test 6: Is the mass of the sample reported by the onsite lab the same as the mass reported by the offsite lab? **Observation:**										Yes ☐	No ☐
3) Time Series Plots: Pass/Fail?										Pass ☐	Fail ☐
Bi-214	Anomalies or unusual trends identified?									No ☐	Yes ☐
	Notes:										
Ac-228	Anomalies or unusual trends identified?									No ☐	Yes ☐
	Notes:										
K-40	Anomalies or unusual trends identified?									No ☐	Yes ☐
	Notes:										
4) Historically Significant Site Location: Yes/No?										No ☐	Yes ☐
Was a known radiation cleanup performed at (or near) this site? If yes, where?										No ☐	Yes ☐
Is the sewer line connected to or downstream from a radiologically-impacted building? If yes, which building?										No ☐	Yes ☐
5) Allegation: Yes/No?										No ☐	Yes ☐
If yes, description:											

Data Evaluation Documentation and Findings

Parcel:		Unit:	

Section II: Evaluations Performed			
1) Other Statistics Results		Pass ☐	Fail ☐
Box Plots	Anomalies or unusual trends identified?	No ☐	Yes ☐
	Notes:		
Normal Quantile Plots	Anomalies or unusual trends identified?	No ☐	Yes ☐
	Notes:		
2) Additional Database Review Performed?		No ☐	Yes ☐
Review objectives:			
Observations:			
3) Adjacent Survey/Trench Unit Review		Pass ☐	Fail ☐
List of Adjacent Units:			
Was a review of adjacent unit's data performed?			
Anomalies or unusual trends identified?		No ☐	Yes ☐
Notes:			
4) SUPR or FSSR Review Performed?			
Summary of Excavation Survey / Sampling Activities			
Gamma Static Data Observations:			
Gamma Scan Data Observations:			
List of Excavation Survey / Overburden Units Used for Backfill			
Onsite / Offsite Lab Data Comparison:			
Scan / Static Surveyor Name:			
Sampler / Surveyor Name:			
5) RACR or CSR Review Performed?			
List of Excavation Survey / Overburden Units Created from Excavation:			

Section III: Conclusions and Recommendations
Summary of Findings:

Data Evaluation Documentation and Findings

Parcel:		Unit:	

Section III: Conclusions and Recommendations			
☐ **No Further Action**	☐ **Reanalyze Archived Samples**	☐ **Confirmation Sampling**	☐ **Physical Inspection of Archived Samples**
☐ **Other Recommendations:**			
Additional Information Required:			

Completed by: _____ **Date:** _____

Reviewed by: _____ **Date:** _____

Approved by: _____ **Date:** _____

Acronyms:

Ac	Actinium (e.g., Ac-228)
B	Former Building (or other site) Surface Soil Survey Unit
Bi	Bismuth (e.g., Bi-214)
Cs	Cesium (e.g., Cs-137)
CSR	Construction Summary Report
ES	Excavation Survey Unit
FSS	Final Status Survey
FSSR	Final Status Survey Report
K	Potassium (e.g., K-40)
OB	Overburden Unit
Pb	Lead (e.g., Pb-212)
Ra	Radium (e.g., Ra-226)
RACR	Remedial Action Completion Report
S	Sewer or Storm Drain Removal Survey Unit
SUPR	Survey Unit Progress Report
TU	Trench Unit

Data Evaluation Documentation and Findings

Parcel:		Unit:	

Time-Series Plots

Data Evaluation Documentation and Findings

Parcel:		Unit:	

Box Plots

Data Evaluation Documentation and Findings

Parcel:		Unit:	

Normal Quantile Plots

Data Evaluation Documentation and Findings

Parcel:		**Unit:**	

Map

Appendix C
Data Evaluation Forms

Appendix C – Data Evaluation Forms is provided as a separate PDF on the enclosed CD-ROM.