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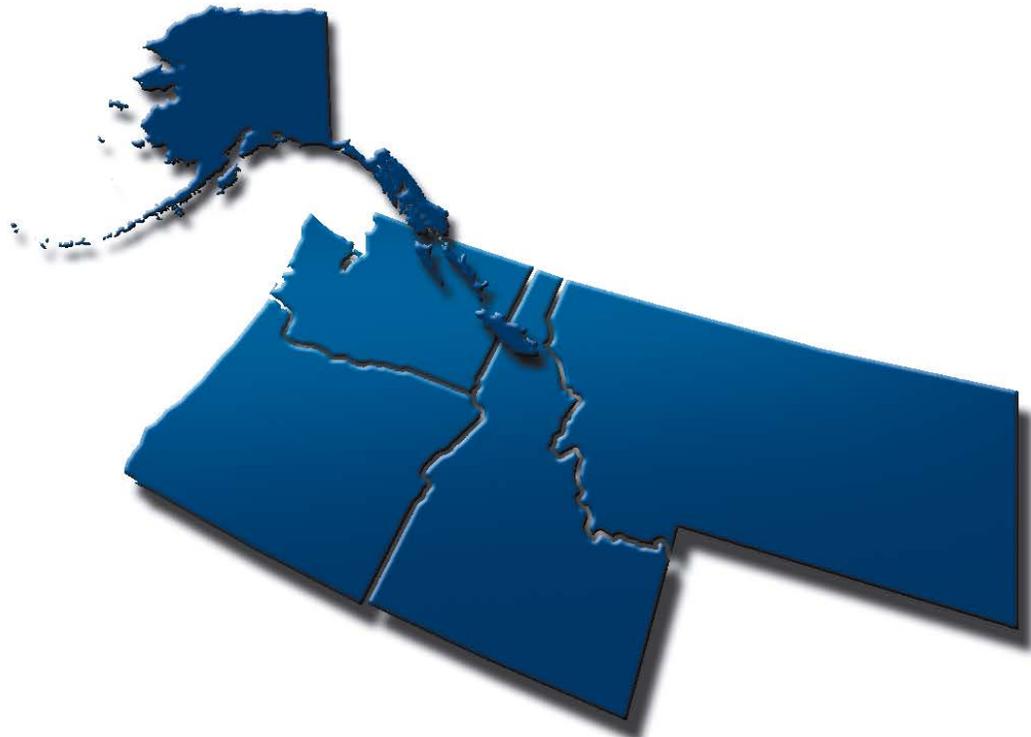
Preliminary Assessment Report

Former Naval Station Puget Sound

Seattle, Washington

Department of the Navy
Naval Facilities Engineering Command
Northwest

1101 Tautog Circle
Silverdale, WA 98315



**FINAL
RADIOLOGICAL PRELIMINARY ASSESSMENT REPORT
FORMER NAVAL STATION PUGET SOUND, SEATTLE, WASHINGTON**

**Prepared by
URS Group, Inc.
Seattle, Washington**

**Prepared for
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Silverdale, Washington**

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PLATE

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ACRONYMS AND ABBREVIATIONS

A&R	assembly and repair
AEC	Atomic Energy Commission
AOPC	area of potential concern
BCP	BRAC Cleanup Plan
bgs	below ground surface
BRAC	Base Realignment and Closure
CB	catch basin
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CFR	Code of Federal Regulations
CRA	Community Reporting Area
Cs-137	cesium-137
CSM	conceptual site model
DCGL	Derived Contamination Guideline Level
°F	degrees Fahrenheit
DERP	Defense Environmental Restoration Program
DIA	U.S. Defense Intelligence Agency
DoC	Department of Commerce
DoD	Department of Defense
DoI	Department of the Interior
DoH	Washington State Department of Health
dpm	disintegrations per minute
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
FOSL	Finding of Suitability to Lease
FOST	Finding of Suitability to Transfer
G-RAM	general radioactive material
GWS	gamma walkover survey
Hanford	Hanford Nuclear Reservation
HRA	historical radiological assessment
H-3	tritium
IAS	initial assessment study
IR	Installation Restoration
keV	kiloelectron-volts
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
mrem	millirem
msl	mean sea level

ACRONYMS AND ABBREVIATIONS (Continued)

MTCA	Model Toxics Control Act
NACIP	Navy Assessment and Control of Installation Pollutants
NARTU	Naval Air Reserve Training Unit
NAS	Naval Air Station
NAVFAC NW	Naval Facilities Engineering Command Northwest
NAVSEA	Naval Sea Systems Command
NAVSTA PS	Naval Station Puget Sound
Navy	U.S. Department of the Navy
NCP	National Oil and Hazardous Pollution Contingency Plan
NEPA	National Environmental Policy Act
NERP	Navy Environmental Restoration Program
NOAA	National Oceanic and Atmospheric Administration
NNPP	Naval Nuclear Propulsion Program
NPL	National Priorities List
NRC	U.S. Nuclear Regulatory Commission
NVOO	Nevada Operations Office
O&R	overhaul and repair
PA	preliminary assessment
PCBs	polychlorinated biphenyls
pCi	picocurie
PMO	Project Management Office
PROC	potential radionuclide of concern
Pu-239	plutonium-239
Ra-226	radium-226
RASO	U.S. Navy Radiological Affairs Support Office
RASP	Radioactive Affairs Support Program
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
SARA	Superfund Amendments and Reauthorization Act
SEPA	State Environmental Policy Act
SI	site inspection
Site	former Naval Station Puget Sound
Sr-90	strontium-90
TCRA	time-critical removal action
Th-232	thorium-232
URS	URS Group Inc.

GLOSSARY

Air: Atmosphere that may become a migration pathway for resuspension and disposal of radioactive contamination and contaminated media.

Alpha particle: A positively charged particle ejected spontaneously from the nuclei of some radioactive elements. Alpha particles can be stopped by a thin sheet of paper.

Aquifer: An underground layer of permeable rock, sand, or gravel that yields water.

Area of Potential Concern: An area that has, or historically had, potential G-RAM contamination based on the site operating history or known contamination detected during previous radiation surveys. Areas of potential concern include sites where radioactive materials were used or stored; sites where known spills, discharges, or other instances involving radioactive materials have occurred; and sites where radioactive materials might have been disposed of or buried.

Atomic Energy Commission (AEC): Federal agency created in 1946 to manage the development, use, and control of nuclear energy for military and civilian applications. Agency was succeeded by the Energy Research and Development Administration (now part of the U.S. Department of Energy) and the U.S. Nuclear Regulatory Commission.

Background radiation: Ionizing radiation constantly present in the environment that is emitted by natural and artificial sources.

Base Realignment and Closure (BRAC): A process created by the Defense Base Realignment and Closure Act of 1990 to increase Department of Defense efficiency via realignment and closure of certain military installations.

Beta particle: A charged particle emitted from a nucleus during radioactive decay with a mass equal to 1/1837 that of a proton. Negatively charged beta particles are electrons, and positively charged particles are positrons. Beta particles can be stopped by a thin sheet of plastic.

Characterization survey: A site assessment generally performed by a scoping survey after radioactive contamination has been confirmed in an area of potential concern. The survey determines the extent of contamination and identifies and defines the extent of radionuclides of concern. It includes in-depth surveys, sampling, monitoring, and analysis necessary to develop, analyze, and select appropriate cleanup techniques.

Commodity item: An item that could be bought or sold.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA):

Passed in 1980, it created the legal mechanism for cleaning up abandoned or uncontrolled hazardous waste sites.

Contaminated media: Materials at an area of potential concern that contain, or are suspected of containing, radioactive contamination or to which radioactive contamination may have migrated.

Contamination potential: The possibility for residual radioactive contamination at an area of potential concern that has been determined by a professional evaluation of historical information, previous survey results, and site reconnaissance.

Curie (Ci): A unit of measure of the amount of radioactivity equal to 3.7×10^{10} disintegrations per second or 2.22×10^{12} disintegrations per minute.

Decontamination: The reduction or removal of radioactive material from a structure, object, or person, which is accomplished by treating the surface to remove or decrease the contamination or by letting the material decrease as a result of radioactive decay.

Dose: The amount of energy absorbed by a person exposed to radiation.

Drainage system: Sanitary sewers, facility storm drain systems, or septic systems and leach fields. This category can include sediments in a water body where drainage to the water body occurs.

Final status survey: Assessment performed after historical documentation or previous investigations or remediation indicates that radioactive contamination has been removed from an area of potential concern. The survey verifies that an area of potential concern complies with applicable release criteria by taking appropriate samples and measurements that define the radiological condition of the site.

Gamma radiation: High-energy, short-wave-length electromagnetic radiation emitted from the nucleus of an atom. Gamma radiation frequently accompanies the emission of alpha and beta particles and always accompanies fission. Gamma rays are stopped by shielding with heavy materials such as lead.

General radioactive material (G-RAM): All general radioactive materials used by the Navy or Marine Corps that are not associated with the Naval Nuclear Propulsion Program. Examples of G-RAM include radioactive materials such as gauges with dial markings painted using luminous radium paint, commodity items such as electron tubes, exit signs, and smoke detectors containing radioactive materials, and small radioactive sources used for medical equipment and for calibration and testing of radiation detection instruments.

Groundwater: Waters contained in subsurface materials and aquifers.

Half-life: Time required for a population of atoms of a given radionuclide to decrease through radioactive decay to exactly one-half of the original number of atoms. No operation, either chemical or physical, can change the decay rate of a radioactive substance. Half-lives range from much less than 1 microsecond to more than 1 billion years. The longer the half-life, the more stable the nuclide. After one half-life, half of the original atoms will remain; after two half-lives, one fourth (or $1/2$ of $1/2$) will remain; and so on.

Hazardous material: Any substance or material (biological, chemical, radiological, and/or physical), which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.

Hazardous substance: Any material that poses a threat to human health and/or the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive.

High (assessment rating): Result of a contamination assessment indicating that evidence of contamination in the medium or migration pathway has been identified.

Investigation: The gathering of data or information to identify potential radiation areas.

Known-Continued Access (contamination potential): Low levels of contamination exist, but the contamination is contained in a system, is fixed on building surfaces, or is in generally inaccessible areas.

Known-Restricted Access (contamination potential): Radioactive contamination is known to exist at levels that could be hazardous without protective clothing, respiratory protection, or radiation monitoring.

Likely (contamination potential): Residual radioactive contamination is expected but has not been confirmed.

Low (assessment rating): Result of an assessment of a contaminated medium or migration pathway indicating that the contamination potential is remote.

Media: Types of materials at an area of potential concern that may contain or are suspected of containing radioactive contamination or to which radioactive contamination may migrate.

Micro (μ): A prefix used to denote one-millionth (10^{-6}).

Migration pathway: Media or transport mechanisms that allow radioactive contamination to spread in the immediate vicinity of the contaminated media.

Milli (m): A prefix used to denote one-thousandth (10^{-3}).

Moderate (assessment rating): Result of an assessment of a contaminated medium or migration pathway indicating that the potential for contamination exists but has not been fully assessed.

Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM):

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): More commonly called the National Contingency Plan, it is the federal government's plan for responding to both oil spills and releases of hazardous substances (including radioactive materials). The NCP is part of the National Response System, under which federal departments and agencies help state and local officials protect public health and the environment during hazardous materials emergencies.

National Priorities List (NPL): A list of sites where releases and potential releases of hazardous substances, pollutants, and contaminants appear to pose the greatest threat to public health, welfare, and the environment under the Superfund program.

Naval Sea Systems Command (NAVSEA): Senior Navy command assigned responsibility for providing oversight of the Navy and Marine Corps G-RAM programs.

Department of the Navy Environmental Restoration Program (ER Program): The purpose of the ER Program is to reduce the risk to human health and the environment due to legacy waste disposal operations and hazardous substance spills at active and BRAC installations.

Naval Nuclear Propulsion Program (NNPP): A joint Navy and U.S. Department of Energy program to design, build, operate, maintain, and oversee the operation of naval nuclear-powered ships and associated support facilities.

None (assessment rating): Result of an assessment of a potentially contaminated medium or migration pathway indicating that evidence of contamination has not been found or known contamination has been removed and surveys indicate that the medium or migration pathway meets the release criteria.

Nuclear Regulatory Commission (NRC): The federal agency that oversees and authorizes the use of byproduct, source, and special nuclear materials.

Nuclide: Any known isotope, either stable or unstable, of any element. A single element can have isotopes, but when referring to isotopes of more than one element, the proper term is nuclide.

Pico (p): A prefix used to denote one-trillionth (10^{-12}).

Radioactive Affairs Support Program (RASP): Established by NAVSEA to implement the responsibilities for G-RAM.

Radiography: The process of examining a person, animal, object, or structure behind or below a surface without injury or incursion using a radioactive source or a machine source of ionizing radiation.

Radioisotope: An unstable isotope of an element that decays or disintegrates spontaneously, emitting radiation. These elements have an unstable nucleus, characterized by excess energy available to be imparted either to a newly created radiation particle within the nucleus or via internal conversion. Approximately 3,700 natural and artificial radioisotopes have been identified.

Radiological Affairs Support Office (RASO): The Naval Sea Systems Command Detachment located in Yorktown, Virginia, that provides technical support to the Navy for the management and control of G-RAM.

Radioluminescence: Luminescence produced by the bombardment of radiant energy such as x-rays, radioactive waves, or alpha particles on a material such as a phosphor.

Radioluminescent device: An item containing radioluminescent material that allows the device to be seen in the dark. These devices were commonly used by the Navy and sometimes contained radium-226, strontium-90, tritium, or promethium-147.

Radioluminescent paint: A paint containing a radioisotope that interacts with a phosphor to produce radioluminescence. The paint was commonly applied to devices that needed to be seen in areas without natural or artificial lighting.

Radionuclide: An unstable nuclide or isotope.

Radium: A radioactive metallic element with atomic number 88. As found in nature, the most common isotope has a mass number of 226. Radium-226 is part of the naturally occurring uranium decay chain.

Record of Decision: A public document that contains site history, site description, site characteristics, community participation, enforcement activities, past and present activities,

contaminated media, contaminants present, scope and role of response action, and the remedy selected for cleanup of a Superfund site.

Reference background area: A reference area with similar physical, chemical, geological, radiological, and biological characteristics as the area to be surveyed that has not been potentially contaminated by site activities. Readings are taken in this area to use for comparison with readings taken during radiological surveys.

Release criterion: A regulatory limit established for decontamination of residual radioactive contamination. The term may be expressed as a quantification of radioactivity, dose, or exposure risk.

Roentgen: A unit of exposure for x-rays or gamma rays.

Roentgen equivalent man (rem): A measure of radiation dose that is an estimate of the potential biological damage resulting from radiation exposure.

Scoping survey: A survey to identify radionuclide contaminants, relative radionuclide ratios and general radiation levels, and the extent of contamination. These surveys usually include minimal surface scans, sampling, and dose rate assessments.

Source: A small device containing radioactive material. The device may be used in research and industrial processes and may be sealed or unsealed. Sealed sources are often part of specialized industrial devices that measure quantities such as the moisture content of soil or the density or thickness of materials (radiography or NDT). Sources are usually enclosed in a housing that prevents the escape of the radioactive materials. They are often referred to as “radioactive sources” or “sealed sources.”

Structure: Something built or constructed above the surface or contained within subsurface media.

Subsurface soil and media: Solid materials and media found below the surface soils.

Superfund Amendments and Reauthorization Act (SARA): Amending CERCLA on October 17, 1986, SARA reflected EPA’s experience in administering the complex Superfund program during its first 6 years and made several important changes and additions to the program. SARA also required EPA to revise the Hazard Ranking System to ensure that it accurately assessed the relative degree of risk to human health and the environment posed by uncontrolled hazardous waste sites that may be placed on the National Priorities List.

Surface soil: The top layer of soil (0 to 6 inches below ground surface), fill, gravel, waste piles, concrete, or asphalt that is available for direct exposure, growing plants, resuspension of particles for inhalation, and mixing from human disturbances.

Surface water: Waters found in streams, rivers, lakes, and oceans, as well as coastal tidal waters.

Tritium: A radioactive isotope of hydrogen with a nucleus containing one proton and two neutrons. Naturally occurring tritium is produced in the atmosphere at fairly low concentrations by interaction of the atmosphere with cosmic rays. Tritium has a half-life to 12.32 years and decays into helium-3.

Unknown (contamination potential): Residual radioactive contamination potentially exists, but no clear indication of possible contamination levels or contaminants has been established.

Unlikely (contamination potential): Residual radioactive contamination is not expected, but investigation may be warranted.

U.S. Environmental Protection Agency (EPA): The lead federal regulatory agency under CERCLA for cleanup of hazardous waste sites on the National Priorities List.

Wetland: A type of sensitive environment sufficiently inundated or saturated by surface water or groundwater to support vegetation adapted for life under saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

1.0 EXECUTIVE SUMMARY

1.1 PURPOSE OF PRELIMINARY ASSESSMENT

Naval Facilities Engineering Command Northwest (NAVFAC NW) is conducting a radiological preliminary assessment/site inspection (PA/SI) of the property transferred under the Base Realignment and Closure Act (BRAC) at former Naval Station Puget Sound (NAVSTA PS). The objective of the PA/SI is to assess the potential for radiological contamination at the former NAVSTA PS resulting from historical naval operations.

This report presents the results of the PA portion of the PA/SI process. It summarizes information that was discovered during archival research and interviews with individuals familiar with the activities at former NAVSTA PS.

The PA was conducted under CERCLA and considered the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) for guidance.

1.2 SITE BACKGROUND

Originally named Naval Air Station (NAS) Seattle, portions of NSPS were built in 1925 on land donated by King County. During World War II, NAS Seattle supported air transport and ship outfitting of personnel for the Alaskan and Western Pacific theaters of operation. After the war, NAS Seattle was designated a Naval Reserve Air Station. From 1945 to 1970, the station maintained naval reserve squadrons for supplementing active duty forces, both in the continental United States and abroad. Aviation activities officially ceased on June 30, 1970, and NAS Seattle was decommissioned.

After the 1970 decommissioning, the Navy facility was designated as Naval Support Activity, Seattle and the Navy subsequently rented buildings to approximately eight federal and institutional tenants. Between 1970 and 1977, the Navy divided the property into three parts, conveying considerable portions that had supported air operations (runways and adjacent structures) to the National Oceanic and Atmospheric Administration (NOAA) (approximately 100 acres) and the City of Seattle (City) (approximately 165 acres). The remainder of the property (approximately 150 acres) was retained by the U.S. Department of the Navy (Navy).

In April 1982, the Navy retained property was designated Naval Station Seattle. In October 1986, Naval Station Seattle was designated Naval Station Puget Sound (NAVSTA PS) as a result of the station's decreasing support role in the Pacific fleet activities.

A major part of the mission at NAVSTA PS was aircraft overhaul and repair, which included painting of aircraft instrumentation with radioluminescent paint, engine overhaul, welding shops, machine shops, and other activities of potential concern related to radiological contamination. In addition, in the late 1960s the University of Washington Laboratory of Radiation Ecology conducted research at NAVSTA PS to evaluate the uptake of radioactivity by hermit crabs from exposure to contaminated coral grit resulting from the atmospheric nuclear weapons testing program.

In June 1991, the BRAC Commission announced the closure of former NAVSTA PS. In accordance with the recommendations of the 1991 commission, NAVSTA PS was closed in September 1995.

As part of the BRAC process, the Navy retained parcels were transferred from the Navy to NOAA, the City, and other entities between 1998 and 2000.

In 2009, radium contamination that was attributed to painting of aircraft instrumentation with radioluminescent paint was discovered at two buildings at the former NAVSTA PS. In 2010, the Navy conducted a radiological remedial investigation (RI) to determine the extent and magnitude of radioactive contamination. A time critical removal action was conducted in 2013-2015 which has remediated all known site radioactive contamination. In 2013, the Navy also began the PA/SI process resulting in the preparation of this report.

1.3 PRELIMINARY ASSESSMENT METHODOLOGY

The PA process consists of archival document reviews and interviews with persons knowledgeable of radiological operations at NAVSTA PS. The project team used a preliminary conceptual site model (CSM) based on information known at the time to help focus the PA historical research efforts. As information regarding the use of radionuclides at former NAVSTA PS is obtained, the CSM is revised or expanded to encompass the information, which in turn can identify additional information sources. The preliminary CSM is included in this PA report.

Historical document research was conducted at information repositories nationwide, and two related interviews were conducted with a former NAVSTA PS civilian employee and a scientist familiar with radiological experimentation conducted at NAVSTA PS. Data compiled during the PA were organized into an electronic database containing relevant documents, maps, site photos, building construction drawings, correspondence, etc.

1.4 REGULATORY INVOLVEMENT

The U.S. Nuclear Regulatory Commission and its predecessor agency, the U.S. Atomic Energy Commission, did not issue a license for radioactive materials at NAVSTA PS. No evidence was found suggesting that there was a Navy permit for the use of radioactive materials at NAVSTA PS, or that there was a radioactive materials license under the Agreement State Program. Washington State became an Agreement State in 1966. In 1987 the Navy received a Masters Materials License from the NRC granting the authority to train, inspect and certify persons who handle and manage radioactive materials from cradle-to-grave. Historical regulatory and agency involvement at NAVSTA PS included oversight by the following federal, state, and local entities:

- The Navy initially provided guidance for the use of radium at all Naval shore facilities under the *General Safety Rules, Section No. 9, Safe Handling of Radioactive Luminous Compounds* (January 1942).
- By the 1970s, the Radiological Affairs Support Office (RASO) was in place to inspect all Naval shore facilities with general radioactive materials (G-RAM) and to respond to the discovery of radiological contamination.
- In the 1980s, the Navy established the Installation Restoration (IR) Program to implement the requirements of the Defense Environmental Restoration Program and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in the process of closing the station under the Base Realignment and Closure Program.
- NAVFAC NW manages the IR Program to identify, investigate, and clean up or control releases of hazardous substances and to reduce the risk to human health and the environment due to past waste disposal operations and hazardous materials spills on Navy and Marine Corps property. RASO provided technical expertise to NAVFAC NW for G-RAM issues associated with IR sites.
- The U.S. Environmental Protection Agency regulatory involvement at NAVSTA PS involved assessment and cleanup under the Resource Conservation and Recovery Act, portions of the CERCLA process, and environmental impact statements for the transfer of property due to mission changes and base closure.
- The Washington State Department of Ecology (Ecology) governed the cleanup at NAVSTA PS in the 1990s for restoration of the site under the Model Toxics Control Act prior to closure and transfer. Ecology also regulated aspects of the NAVSTA PS transfer under the Washington State Environmental Policy Act,

which also requires that the environmental impacts of cleanup actions be examined and any adverse impacts be mitigated. Ecology was responsible for oversight during the radiological remedial investigation, the time critical remedial actions, and is also responsible for any future remedial activities required.

- The Washington State Department of Health (DoH) was responsible for implementation of U.S. NRC program requirements for overseeing and authorizing the use of radioactive material and x-ray machines in the state of Washington under the Agreement State Program. The DOH also provides technical support to Ecology.

Small quantities of radioactive materials, below levels requiring licensing, were used in commodity items through NAVSTA PS. These commodity items containing small quantities of radioactive materials used at NAVSTA PS possibly included smoke detectors, exit signs, deck markers, electron tubes, radiation survey instruments, thoriated welding rods, and radioluminescent dials, gauges, knobs and switches. Some of these items were manufactured under a general license.

1.5 SUMMARY AND CONCLUSIONS OF PRELIMINARY ASSESSMENT

The Radiological PA verified historical operations involving the use of radioluminescent paint in two buildings (Buildings 2 and 27) and identified other areas of potential concern (AOPCs) at NAVSTA PS. In addition to radioluminescent painting operations, other activities that may have been sources of contamination include welding shops, aircraft wash facilities, engine overhaul shops, waste disposal practices, and laboratory-scale testing that evaluated the effects of residual radiation on biota. Note that this section presents a summary, and Section 6.0 and tables in Appendix C describe the findings in more detail.

Eleven AOPCs identified at the former NAVSTA PS that have or may have had the potential to contain radiological contaminants include:

- Building 2 - overhaul and repair shop
- Building 11 - public works repair shops
- Building 15 - greenhouse (previously existing)
- Building 27 - seaplane hangar overhaul and repair shop
- Building 30 - Naval Reserve hangar

- Structure 120 - sludge pit at southeast corner of Building 2
- Building 283 – plane washing shed (previously existing) including an existing oil/water separator
- Building 308 – welding shop
- Sanitary sewer system
- Storm drain system (including downgradient Lake Washington sediment)
- NE NOAA Drive

Additionally, four offsite areas may have had the potential to contain radiological contaminants:

- Storm drain pipe to the east and northeast of Building 2
- Areas on NOAA and City of Seattle property where dredged sediment from the vicinity of the existing NOAA pier may have been placed
- Trash burn and disposal areas
- Historical Radium Cleanup Site

A detailed site map showing the locations of current and former buildings within the Site is included as Plate 1.

Based on the information assembled and reviewed during this PA, no further action is recommended for Buildings 2, 11, 27, 308, and the sanitary sewer system as explained in Section 6. However, the following additional activities are recommended:

- Radiological investigations of surface and subsurface soil in the location of former Building 15
- Radiological investigations of surface and subsurface soil in the unpaved areas surrounding Building 30
- Limited radiological inspection of the former instrument repair shop area located inside Building 30

- Collection of additional sludge samples from certain accessible storm drain locations that have not been previously sampled; locations in the roads east and south of Building 2, offsite locations east and northeast of Building 2, locations east and north of Building 30, and the oil/water separator northeast of former Building 283.
- Collection of sediment samples from Lake Washington in the vicinity of five storm drain outfalls that discharge water originating on the Site; four located within boundaries of the Site and one outfall near the western end of the NOAA pier.
- Notification to owners of adjacent property regarding information found during this PA.
- Recommendation for placement of an institutional control on a portion NOAA Drive within property boundary to ensure future excavations are conducted with proper health, safety and disposal requirements.

The work plan for the SI will provide detailed descriptions of the additional investigations planned for these sites at former NAVSTA PS. This work plan will consist of a sampling and analyses plan, quality assurance project plan, and radiation protection plan. An SI report will follow SI activities that are determined to be necessary to fill information data gaps identified during the PA.

2.0 INTRODUCTION

The U.S. Department of the Navy (Navy) is conducting a radiological preliminary assessment/site inspection (PA/SI) of the property transferred under Base Realignment and Closure (BRAC) at former Naval Station Puget Sound (NAVSTA PS), or “the Site”. The objective of the PA/SI is to assess the potential for radiological contamination at NAVSTA PS resulting from previous naval operations in areas of the BRAC transferred property. In 2009, the City of Seattle observed evidence of historical radium painting facilities on as-built drawings for Building 27 during a hangar renovation project, and contamination was subsequently confirmed by a screening-level survey. The Navy initiated the radiological RI (Shaw E&I 2011) in response to the 2009 discovery to identify the extent of contamination in areas of recently discovered or suspected radiological contamination. This radiological RI confirmed that radiological contamination was also present in Building 2; near the exterior of Buildings 2, 12, and 27; and in catch basins south of Building 27. The radiological contamination near the exterior of Building 12 was identified during the radiological RI when the gamma walkover survey (GWS) was expanded to include these unpaved areas because of their proximity to Buildings 2 and 27 (Shaw E&I 2001). No information documenting the use of radiological materials within Building 12 was discovered during this PA.

After the radiological RI, the Navy conducted a time-critical removal action (TCRA) (Navy 2013) to clean up the identified contaminated areas, including the central portion of Building 2; the “south shed” of Building 27; catch basins south of Building 27; and soil adjacent to areas of Buildings 2, 12, and 27. This PA/SI is being conducted to evaluate the potential for radiological contamination resulting from previous operations that may have occurred within these and other areas of the Site.

During the PA, information relevant to radiological activities, including the historical uses or disposal of G-RAM, at NAVSTA PS was compiled, organized, and analyzed. This PA report presents the results of these activities. The information presented in this PA report forms the basis for the recommended SI activities that will be described in the SI work plan. This project is being conducted by Naval Facilities Engineering Command Northwest (NAVFAC NW) located in Silverdale, Washington, in collaboration with the Radiological Affairs Support Office (RASO) located in Yorktown, Virginia.

2.1 PRELIMINARY ASSESSMENT PURPOSE

The purpose of this PA is to locate and review available, applicable resources pertaining to the radiological history of the Site to identify areas of potential concern (AOPCs) within the Site that have or may have had the potential to contain radiological contamination based on previous

operations or investigations. To designate a site as an AOPC, this PA report defines the extent of past radiological operations, assesses the likelihood of potential contamination and potential migration pathways, and recommends future actions. This information can be used to recommend environmental sampling as part of the subsequent SI activities and possible removal actions within the context of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process.

2.2 PROJECT SCOPE

The PA is a detailed investigation conducted to collect, organize, and present information about former radiological operations at NAVSTA PS. The PA was performed in accordance with the following:

- CERCLA, Sections 104 and 121
- National Oil and Hazardous Substances Pollution Contingency Plan (NCP), in Code of Federal Regulations, Title 40, Part 300 (40 CFR 300)
- Federal Facilities Remedial Preliminary Assessment Summary Guide (EPA 2005)
- MARSSIM guidance (NRC, EPA, DoE, and DoD 2000).

Tasks conducted for this PA report included the following:

- Held scoping and progress meetings to develop and refine the PA approach
- Performed site reconnaissance to determine the current state of some facilities or areas where radiological operations potentially occurred
- Researched historical and more recent site-related documents at various data repositories, such as:
 - Textual documents (orders, recorded oral histories, correspondence, general Navy subject reports, site-specific reports, and books)
 - Databases (i.e., Naval Installation Restoration Information Solution, Environmental Document Management System)
 - Aerial photos

- Construction documents (base maps, permits, construction plans, and as-built drawings)
- Site evaluation data (site reports, sampling data, regulatory and compliance documents)
- Waste disposal manifests
- Published public notices to locate people with knowledge of radiological operations at NAVSTA PS. Conducted interviews with people who responded to the public notices.
- Developed a conceptual site model (CSM) to summarize potential radiological sources, migration pathways, exposure routes, and receptors, which is included in Appendix A
- Compiled an electronic database of reference documents obtained during the archival research, which is included in Appendix B
- Created a chronological account of changes to the Pontiac Bay shoreline and located storm drain outfalls in the northern portion of the study area to assess areas of potential radiological contamination in lake sediment near the outfalls.
- Evaluated data and performed the following actions consistent with CERCLA and MARSSIM guidance (NRC, EPA, DoE, and DoD 2000):
 - Identify potential, likely, or known sources of radioactive material and radiological contamination based on existing or derived information
 - Identify sites that need further action as opposed to those posing no risk to human health or the environment from radiological operations
 - Assess the likelihood of contamination migration
 - Provide information useful in scoping and characterization surveys, such as the field work for the subsequent SI
 - Identify AOPCs.
 - Provide recommendations for further actions, if necessary

The findings and conclusions of the PA are documented in this report in accordance with the EPA guidance, as well as, the Navy Environmental Restoration Program (NERP) Manual (Navy 2006). The objective of the planned SI is to investigate areas with possible radiological contamination identified during this PA.

2.3 REGULATORY BACKGROUND

The information in this PA report is presented pursuant to the Navy's Installation Restoration (IR) Program. Specific to military facilities, the IR Program identifies, investigates, and restores sites with hazardous substances to reduce the risk to human health and the environment. The IR Program functions in accordance with CERCLA and the Superfund Amendments and Reauthorization Act of 1986 (SARA) as directed by Executive Order 12316 of August 20, 1981, which requires the U.S. Department of Defense (DoD) to comply with CERCLA.

The Navy instituted the Navy Assessment and Control of Installation Pollutants (NACIP) Program in the mid-1980s to ensure compliance with CERCLA. The first step in the NACIP Program was to conduct an initial assessment study (IAS) of a facility to assess potential contamination by hazardous materials, including radioactivity. The first environmental study of former NAVSTA PS was a PA completed by the Navy in 1988 (NEESA 1988), which recommended further investigation for petroleum and other chemical contamination. NAVSTA PS was never placed on the National Priorities List (NPL). Per Executive Order 12580, the DoD is delegated as the lead agency responsible for compliance with CERCLA and SARA when it is the sole contributor or a co-contributor to contamination on or off its properties.

Prior to the property transfer of the Navy property to the City of Seattle and other entities, environmental investigation findings did not identify radioactive contamination as a potential concern. Findings from these investigations were relied upon for leasing and subsequent property transfers. The Navy executed a master lease with the City of Seattle 1996 after completing a Finding of Suitability to Lease (FOSL). The Navy completed a Finding of Suitability to Transfer (FOST) in 1998 with subsequent revisions through 2000. Radiological contamination was not identified prior to 2009.

Potential radiological contamination was identified in 2009, and under the authority of CERCLA, the DoD (i.e., the Navy) began assessing the Site for radiological impacts, following the requirements of the NCP (40 CFR 300). The Navy was the appropriate entity for the site assessment because the deed from the United States of America to the City stated that "...any remedial action found to be necessary to protect human health and the environment with respect to any hazardous substance stored, disposed of, or released on the herein described property prior to the date of transfer shall be conducted by the United States."

Because CERCLA defines radionuclides as hazardous substances, radionuclides are included in the CERCLA process to investigate, characterize, and remediate contamination. The radionuclides defined as CERCLA hazardous substances are listed in 40 CFR 302.4, Appendix B. The potential radionuclides of concern (PROCs) for NAVSTA PS based on the radiological RI and the PA are identified on this list include Ra-226, Cs-137, Sr-90, Th-232, and Pu-239.

This PA Report follows CERCLA. MARSSIM was used as guidance for conducting this PA. The U.S. Environmental Protection Agency (EPA), the DoD, the U.S. Department of Energy (DoE), and the Nuclear Regulatory Commission (NRC) developed MARSSIM which provides guidance for investigating surface contamination at radiologically impacted sites (NRC, EPA, DoE, and DoD 2000). Developed to be consistent with CERCLA, MARSSIM uses a multi-phased approach to address radiological contamination issues similar to CERCLA's multi-phased approach. Section 6.0 of this PA report provides the current status of each AOPC with the appropriate recommendation.

Historical investigations at NAVSTA PS included involvement by Navy and state entities under the following acts and programs.

- Navy: Naval Sea Systems Command (NAVSEA) RASO, Base Realignment and Closure (BRAC) Project Management Office (PMO) West, and NAVFAC NW
 - Radioactive Affairs Support Program (RASP)
 - BRAC Program
 - IR Program
 - CERCLA
 - NCP
 - SARA
 - Resource Conservation and Recovery Act (RCRA)
 - National Environmental Policy Act (NEPA)
- Washington Department of Ecology (Ecology)
 - Model Toxics Control Act (MTCA)
 - Washington State Environmental Policy Act (SEPA)
- Washington Department of Health (DoH)
 - Radioactive material license (contractor)

The NRC and its predecessor agency, the U.S. Atomic Energy Commission (AEC), did not issue a license for radioactive materials at the Site.

2.3.1 U.S. Department of the Navy Involvement

Commander, Naval Air Training Bases

The Navy initially provided guidance for the use of radium at all Naval shore facilities under the *General Safety Rules, Section No. 9, Safe Handling of Radioactive Luminous Compounds* (Navy 1942).

Radiological Affairs Support Office

By the 1970s, RASO was in place to inspect Naval shore facilities with G-RAM and to respond to the discovery of radiological contamination. RASO provided technical expertise to the Navy for site work involving G-RAM issues. Note that radioactive materials (i.e., aircraft instruments marked with radioluminescent paint containing radium) now considered to be G-RAM were used at the Site prior to the existence of RASO and the G-RAM program.

Base Realignment and Closure Project Management Office West (BRAC PMO West)

BRAC PMO West provides all services necessary to realign, close and dispose of Department of the Navy BRAC properties.

Naval Facilities Engineering Command Northwest (NAVFAC NW)

In the 1980s, the Navy established the IR Program to implement the requirements of the Defense Environmental Restoration Program (DERP) and CERCLA in the process of closing the station under BRAC. NAVFAC NW manages the IR Program to identify, investigate, and clean up or control releases of hazardous substances and to reduce the risk to human health and the environment due to past waste disposal operations and hazardous materials spills on Navy and Marine Corps property.

NAVFAC NW managed investigations under the CERCLA process. From 1988 to 1995, the Navy conducted PAs, SIs, RIs, and cleanup actions as steps in the closure and transfer of NAVSTA PS. These steps, common to the CERCLA process, were also summarized in an environmental baseline survey (URS 1994c) conducted in accordance with DoD assessment procedures defined by the Community Environmental Response Facilitation Act (CERFA). NAVSTA PS was not assigned a Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) identification number. However, CERCLA 120(h) states that the federal government is responsible for remedial actions found to be necessary to protect human health and the environment in regards to hazardous substances that were present at the Site prior to the date of property transfer.

NAVSTA PS held EPA Hazardous Waste Activity Permits WA 769033071 and WA 6170023430 (NEESA 1988) for hazardous waste generation at Buildings 67 and 407 as required under RCRA. Building 67 was used as a motor vehicle garage or transportation facility during Navy ownership. Building 407 is an open walled covered storage structure that may have been used for temporary waste collection during Navy ownership. Radiological materials are not regulated under EPA Hazardous Waste Activity Permits and this PA discovered no evidence that waste generation or storage activities at these locations included radiological materials.

From November 1993 to October 1997, the Navy prepared and distributed an Environmental Impact Statement (EIS) prepared under NEPA to analyze the environmental impacts of the proposed disposal and reuse of the facilities and land at the former NAVSTA PS. The final EIS, which was distributed in October 1997, identified the actions that would be necessary to mitigate impacts associated with reuse and redevelopment. The final EIS stated that the Navy would include appropriate restrictive covenants in the deeds for parcels where hazardous substances remained and for the historic properties in accordance with applicable federal and state laws. The Navy did not identify any radiological contamination at the Site and issued a Record of Decision (ROD) in December 1997 (DoD and DON 1997).

2.3.2 Washington State Department of Ecology Involvement

In the 1990s, Ecology governed the cleanup at NAVSTA PS for restoration of the Site under MTCA prior to closure and transfer. The actions at the Site included remediation of soils contaminated with petroleum, pesticides, polychlorinated biphenyls (PCBs), and metals to meet levels specified by MTCA. At that time, it was not known that there was a potential source of radiological contamination during the cleanup actions under MTCA.

Ecology also regulated aspects of the NAVSTA PS transfer under State Environmental Policy Act (SEPA), which also requires that the environmental impacts of cleanup actions be examined and any adverse impacts be mitigated. Ecology required the Navy to submit a SEPA checklist and supporting documentation for cleanup actions prior to base closure and transfer.

2.3.3 Washington Department of Health Involvement

The DoH is Washington's radiation safety regulator and supported Ecology during the oversight of the radiological RI and TCRA in and around Buildings 2, 12, 27, and Pump House 116 since 2010. During the radiological RI and TCRA, DoH inspected remediation operations at the Site on multiple occasions as authorized under Washington State Radioactive Materials License Numbers RECIP-215 for the RI and L0244-1 for the TCRA.

2.4 REPORT ORGANIZATION

This PA report is generally organized following CERCLA while considering MARSSIM (NRC, EPA, DoE, and DoD 2000), as well as the *Federal Facilities Remedial Preliminary Assessment Summary Guide* (EPA 2005).

The figures are provided at the end of the section in which they are first mentioned in the text. The tables are provided after the figures at the end of the section in which they are first mentioned. Plate 1 is provided after the reference list (Section 8.0). The reference documents listed in Section 8.0 can be accessed by clicking on the associated link in the master reference index provided in Appendix B of the electronic version of this report provided on a DVD inside the back cover of this report.

3.0 PROPERTY DESCRIPTION

For over 75 years, the Navy owned and managed operations at the former naval facility located on the western shoreline of Lake Washington in Seattle, Washington. The physical location, historical name changes, and evolution of site topography are described in this section. In addition, the environmental setting, adjacent population, and land use of former NAVSTA PS are discussed to promote an understanding of the potential contamination migration pathways and associated exposed receptors.

3.1 PHYSICAL CHARACTERISTICS

3.1.1 Station Historical Titles

Former NAVSTA PS has been known by many names through its history but has always been informally known to the Seattle community as “Sand Point.” The official names began with the first lease of the property from King County for use as an air station and have evolved as follows (Stuhaug 1992):

- December 30, 1922 – Naval Air Reserve Station, Seattle
- November 22, 1928 – Naval Air Station, Seattle
- October 1, 1931 – Naval Air Reserve Station, Seattle
- July 1, 1937 – Naval Air Station, Seattle
- July 1, 1970 – Naval Support Activity, Seattle
- April 1, 1982 – Naval Station, Seattle
- October 10, 1986 – Naval Station, Puget Sound

For simplicity in this PA, the Site, which is a subset of the entire base and includes only the BRAC-transferred properties, is referred to as former NAVSTA PS, instead of the various titles listed above, regardless of the timeframe being discussed.

3.1.2 Site Location

Former NAVSTA PS is located in Section 2, Township 25 North, Range 4 East, Willamette Meridian. It is located in King County, Washington, with the following geographic coordinates: 47°37'00" north latitude and 122°15'00" west longitude. Former NAVSTA PS is located approximately 6 miles northeast of downtown Seattle in the Sand Point neighborhood on the western shore of Lake Washington within what is now known as Warren G. Magnuson Park (Magnuson Park). The street address is 7400 NE 74th Street, Seattle, Washington.

From the 1920s into the 1970s, NAVSTA PS encompassed the majority of the Sand Point peninsula that is situated within the northeastern portion of Seattle. In the 1970s, approximately 413 acres of land was ceded to NOAA and the City of Seattle. This portion of former NAVSTA PS was not transferred under BRAC. Because these properties were transferred prior to 1986, any additional environmental clean-up required in these areas would be handled under the Formerly Used Defense Site (FUDS) Programs, which is managed by the US Army Corps of Engineers. The portion of former NAVSTA PS that was transferred after 1986 is referred to as the study area and is the subject property of this PA report (Figure 3-1). This study area consists of the nine parcels that were transferred under BRAC from 1998 to 2003 and covers approximately 150 acres. Property lines are approximate and are based on King County tax assessor records and land transfer deeds that are overlain on geographic information system (GIS) data provided by the City of Seattle.

The locations of current and former buildings are shown on a detailed site map (Plate 1), which is provided in a plastic sleeve after Section 8.0.

3.1.3 Topography

The original topography of the Sand Point area consisted of a low-lying, gently undulating forested area located between Lake Washington and a topographic high known as the View Ridge area of Seattle to the west. The higher, drier areas of Sand Point contained second-growth stands of evergreens, while the lower areas were occupied by Mud Lake and wetlands (EDAW 1993). The first major change in the topography of the Site was the construction of the Lake Washington Ship Canal which dropped the water level in Lake Washington by approximately 8 feet, eliminating sandy beaches along Pontiac Bay at the north end of the Site (Jones & Jones 1975).

In 1921 and 1922, development of the first runway began, that consisted of ground clearance in the northwestern portion of the Site. In the course of the development of the naval facilities after 1926, hills and knolls were leveled, and the earth was used as fill for Pontiac Bay, the wetlands, and Mud Lake (Jones & Jones 1975). Station personnel conducted significant grading of the Site in 1930 and 1931 (Hutchison 1931). Mud Lake existed until it was filled during 1939 through 1940 for the expansion of the main runway (Chrzastowski 1983).

Today the Site is relatively flat, with some hills on the southeastern edge. The southeastern portion of the site has a 0 to 5 percent slope to the west and is about 21 feet above mean sea level (msl) (NEESA 1988). The southwestern portion of the Site has a more varying terrain. The western portion of the Site slopes from 0 to 30 percent. The highest elevation at former NAVSTA PS is 95.7 feet above msl at the southwestern edge (URS 1993).

3.2 ENVIRONMENTAL SETTING

3.2.1 Geology

Former NAVSTA PS is located in a structural downfold between the Cascade and Olympic Mountain ranges called the Puget Trough. Most of the natural topography and waterways in the Puget Trough are the result of a 3,000-foot-thick glacier that scoured the area between 13,000 and 15,000 years ago. Glacial till made up of unsorted, non-stratified materials including clay, silt, sand, and boulders is the parent material found on site.

Surface soils at NAVSTA PS consist of Indianola loamy sand deposits formed from sandy glacial outwash as the glaciers approached and receded from the area (SCS 1992). Initially surface topography at the Site ranged from 1 to 30 percent slopes. However, because significant construction has taken place at NAVSTA PS, much of the Site has been leveled by filling the low-lying areas with material available on site. As indicated by historical photos, discussions with Sand Point personnel, Seattle earthquake maps, and lithological studies of the area, it is known that surficial soils at the north end of the Site are composed predominantly of fill (Washington Surveying and Rating Bureau 1966). The large area north of Building 2 that was formerly occupied by Pontiac Bay was filled as development at the Site progressed. Figure 3-2 shows the location of the Pontiac Bay shorelines from 1931 until the present based on historical drawings and aerial photos. In addition, the presence of lake-bottom peat was indicated by the gradual settlement of the earth-filled portion of Pontiac Bay (Chrzastowski 1983).

A review of soil boring logs produced for the radiological RI for NAVSTA PS (Shaw E&I 2011) indicates that soils in the vicinity of Buildings 2 and 27 typically consist of a silty sand from the ground surface to between 1 and 3 feet below ground surface (bgs) that is underlain by a dense clay at several locations, ranging in thickness from 1 to 2 feet. At several locations interbedded sand was observed in this clay. The available borings extend to maximum depths that range from 2.5 to 5 feet bgs.

3.2.2 Hydrogeology

Shallow groundwater at NAVSTA PS occurs primarily within the relatively permeable, interglacial deposits contained by the low-permeability till units that underlie the Site. The continuity of these units beneath NAVSTA PS has not been defined. Groundwater flow is generally from the uplands area west of the Site eastward toward Lake Washington (URS 1993). Lake Washington is the discharge water body for shallow groundwater from the Site, where groundwater is typically found approximately 3 feet bgs (NEESA 1988). During the RI, groundwater was observed at a depth of 5 feet bgs in soil borings installed in the vicinity of Buildings 2 and 27 (Shaw E&I 2011).

NAVSTA PS obtained its domestic water from the City of Seattle, which drew water from the Cedar and Tolt River reservoirs. Records show that the installation did not use groundwater for potable or domestic water service (URS 1993).

3.2.3 Hydrology

Former NAVSTA PS is bordered by Lake Washington to the north and east. There are no perennial streams or freshwater bodies within the boundaries of the Site. The nearest stream, Thornton Creek, is approximately ¼ mile northwest of the Site. Pontiac Bay, located at the northern shore of the Site, was partially filled with earth in the early 1930s (Jones & Jones 1975).

Lake Washington is approximately 22 miles long and ranges in width from 1 to 4 miles, with a maximum depth of 210 feet. The level of Lake Washington is maintained at 21 feet above the lower low msl of Puget Sound by the Hiram M. Chittenden Locks, which are administered and operated by the U.S. Army Corps of Engineers (URS 1993). The lake is classified as a Class A water body by Washington State, which requires water quality to meet or exceed the requirements for substantially all of the following uses: anadromous salmon migration, rearing, spawning, and harvesting; fishing; aesthetic enjoyment and contact swimming; water supply (domestic, industrial, and agricultural); and commerce and navigation. Most of the lake's shoreline in the vicinity of the Site is occupied by residential property and recreational park lands (URS 1994c).

The storm drain system at NAVSTA PS discharges directly into Lake Washington at several outfalls on the northern shore of the peninsula. The locations of these storm drain lines are shown on Figure 3-3. Runoff from impervious surfaces at the Site is routed through this storm drain system into Lake Washington. Site restoration activities conducted by the Seattle Department of Parks and Recreation have restored both the lacustrine and the palustrine systems of wetlands in the southeastern portion of former NAVSTA PS, significantly improving the water storage capacity in this location (SCS 1992).

3.2.4 Climate

The climate in the Seattle area is a mid-latitude west coast marine type with high precipitation and many overcast days. The Olympic Mountains located to the west, protect the area from intense winter storms present on the northern Pacific Ocean, while the Cascade Mountain range to the east protects the area from the extreme cold winter temperatures common to eastern Washington (SCS 1992).

The prevailing wind direction is from the south or southwest during the fall and winter, gradually shifting to west and northwest during the late spring and summer. The average prevailing wind seldom exceeds 20 miles per hour. Winds during winter storms can range from 20 to 100 miles per hour (SCS 1992).

Climate data for Seattle, based on 1961 to 1990 normals, show a mean annual temperature of 52 degrees Fahrenheit (°F), with a low mean monthly temperature of 36°F in January, and a high mean monthly temperature of 73°F in August. The mean annual precipitation from these data is 34 inches per year, with the average wettest month being 5.4 inches in January (U.S. Climate Data 2014).

3.2.5 Environmentally Sensitive Areas

There are no environmentally sensitive areas identified on the Site by the King County iMAP Map Set (King County 2014).

3.3 ADJACENT POPULATION

The City of Seattle reports population data by Community Reporting Areas (CRAs), which were established in 2004 as a standard, citywide geography for reporting purposes. The most recent population data available were compiled for the 2010 census. Three CRAs border the Site:

- Laurelhurst/Sand Point CRA with a total 2010 population of 10,479 over 1,404 acres
- Ravenna/Bryant CRA with a total 2010 population of 24,187 over 1,635 acres
- Wedgewood/View Ridge CRA with a total 2010 population of 14,837 over 1,503 acres

Combined, these three areas of Seattle contain an average population density of 10.9 people per acre.

3.4 CURRENT AND FUTURE LAND USE

Current and future land use at the Site consists of mixed use by the following organizations:

- Recreational use by the City of Seattle Department of Parks and Recreation, Arena Sports, and the Magnuson Athletic Club

- Educational use by the Sandpoint Waldorf School
- Medical use by the University of Washington Pediatric Dentistry Clinic, Harborview Medical Center, and Washington Dental Services
- Housing use by the University of Washington, the Solid Ground Low Income Housing Institute, and Harmony House teen housing
- Homeless person rehabilitation activities by the Seattle Conservation Corps

A large portion of the Site has been designated as the Sand Point Historic District, which will require the preservation of many of the existing structures (Seattle Department of Parks and Recreation 2011).

The Seattle Department of Parks and Recreation provides facilities for the Magnuson Community Center, Tennis Club, Mountaineers Club, Sailing Center, The Brig, and its own office space in Building 30. The main hangar area of Building 27 is an indoor multisport facility, which is operated by Arena Sports and open to the public. Building 2 is mostly vacant, with the exception of the hangar portion that is used for storage by the City of Seattle Department of Parks and Recreation, and a north wing that houses offices and workshops for the job training program of the Seattle Conservation Corps. The Sandpoint Waldorf School occupies the southern portion of Building 11. The southern portion of the Site is occupied predominantly by housing units. The former and current uses of structures at NAVSTA PS are listed in Table C-2 in Appendix C.

3.5 ADJACENT LAND USE

The Site is bounded by urban residential areas within the Seattle city limits consisting of the View Ridge neighborhood to the west and the Windermere neighborhood to the south. Facilities of NOAA's Western Regional Center and Magnuson Park are constructed on former NAVSTA PS land situated east of the Site. Lake Washington borders the Site to the north.

Path: \\ur Seattle\GIS\Projects\NAV\WAG\USON\DO 76\MXDs\Figure 3-1 Study Area_PAReport.mxd Date Saved: 4/29/2015 8:02:52 AM



Legend

 Site Boundary

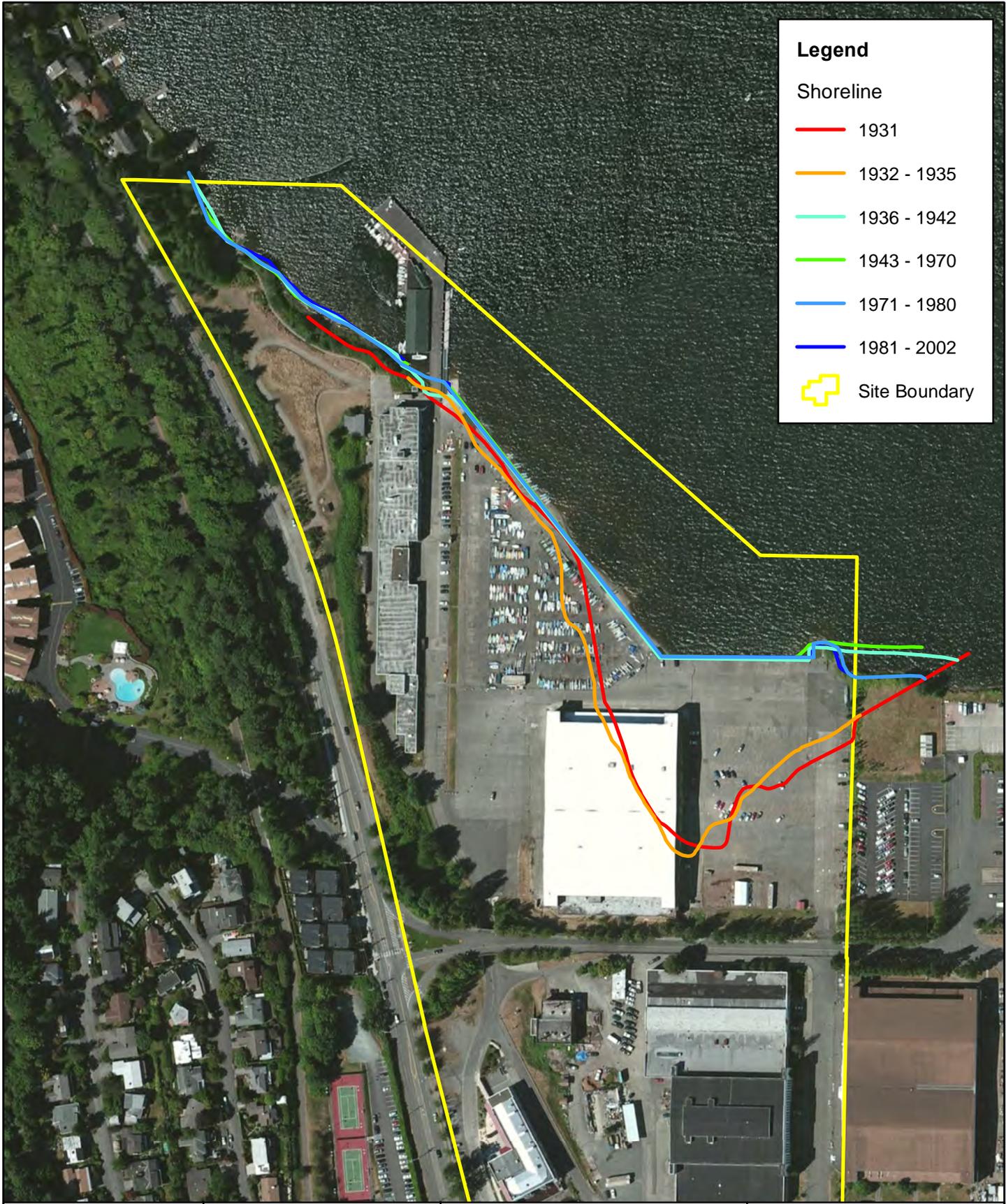
U.S. NAVY


0 350 700

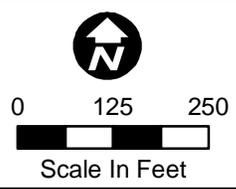
Scale In Feet

Figure 3-1
Study Area
Naval Station Puget Sound
After Initial Land Transfers to
NOAA and the City of Seattle

Delivery Order 0076
NAVSTA PS
Seattle, Washington
PA Report

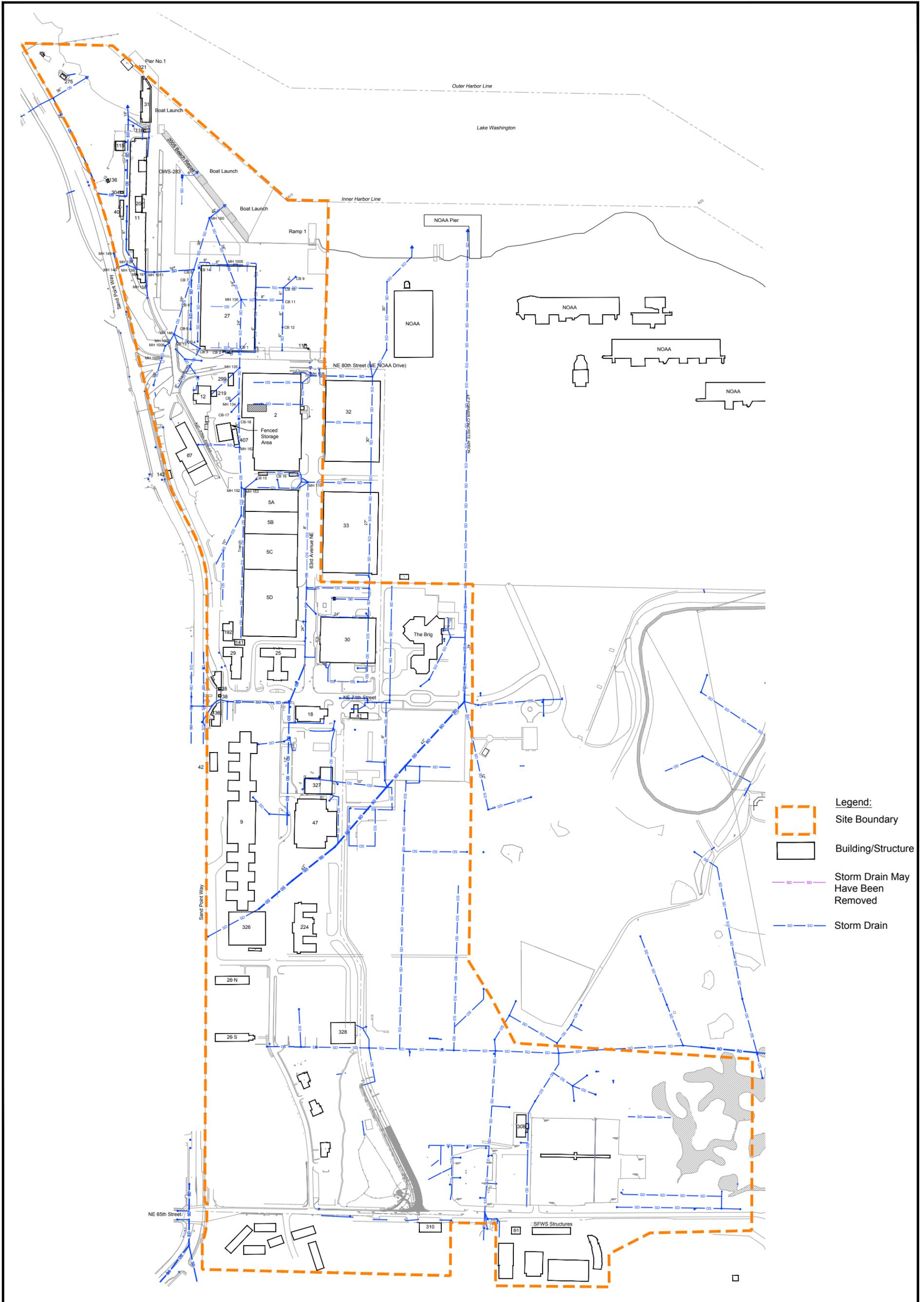


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**Figure 3-2
Former and Current
Shorelines of Pontiac Bay**

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Seattle, Washington
PA Report



- Legend:**
- Site Boundary
 - Building/Structure
 - Storm Drain May Have Been Removed
 - Storm Drain

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Figure 3-3
Storm Drain System at
the Former NAVSTA Site

Delivery Order 0076
 NAVSTA PS
 Seattle, WA
 PA Report

4.0 RADIOLOGICAL PRELIMINARY ASSESSMENT METHODOLOGY

This section describes the process used to conduct this PA and prepare this PA report. The PA methodology follows CERCLA and the *Federal Facilities Remedial Preliminary Assessment Summary Guide* (EPA 2005) and included the following significant tasks:

- Scoping and progress meetings
- Site reconnaissance
- Historical document research
- Personal interviews
- Development of a CSM
- Creation of an electronic database of references
- Data evaluation and reporting

Each of the tasks required to complete the PA is described in the following subsections. The MARSSIM guidance was also consulted as a guidance document.

Prior to the Navy initiating the PA for the BRAC-transferred parcels, the City of Seattle identified the presence of low-level radiological contamination in Building 27. The Navy subsequently conducted a radiological RI to identify the extent of contamination in areas of recently discovered or suspected low-level radiological contamination. The radiological RI confirmed that low-level radiological contamination was present in Building 2 and 27; near the exterior of Buildings 2, 12, and 27; and in catch basins south of Building 27 (Shaw E&I 2011). A TCRA was performed in Buildings 2 and 27 and near the exterior of building 27 to remove radiological contamination identified by the radiological RI. The Navy initiated the PA so that the historical information for the entirety of the nine BRAC-transferred parcels (the Site) could be reviewed to identify AOPCs with regard to potential radiological contamination from historical operations at the Site.

4.1 SCOPING AND PROGRESS MEETINGS

Meetings were held with NAVFAC NW, RASO, and URS Group (URS) to discuss the PA methodology, potential radiological sources, the preliminary findings of the PA, further actions for PA research, and the strategy for the SI.

A scoping/kickoff meeting for the PA was held on November 18, 2013, to finalize the study area, discuss the initial aerial photos and site maps reviewed, prepare a list of radiological sources as an initial step toward the CSM that was used during document research, and provide an update on the community involvement plan. General goals and the project schedule for the PA were also discussed.

On December 12, 2013, team members joined a teleconference call to discuss the process for historical document review, the dates of the visits to the data repositories, and the method to be used to document the references. A preliminary CSM with a list of items of interest (Appendix A, Table A-1) was discussed and used as a preliminary CSM to assist reviewers during the document review process.

The following spring, a meeting was held on March 26, 2014, to discuss the preliminary results of the PA and the initial SI strategy. The PA topics covered during the meeting included a review of radiological sources potentially present at former NAVSTA PS, the repositories contacted and visited for document review, the documents/maps/photos identified during research and compiled into a database, and a time-lapse sequence of aerial photos/maps verifying the changes in the shoreline in the study area shoreline over the last 82 years. The initial SI topics covered during the meeting included initial SI sampling locations based on the PA findings, tiered methods of sampling during the SI, and contamination migration pathways through the storm drain system. The responses to questions listed in MARSSIM that are “useful for the HSA investigation” were discussed at this meeting (Table 4-1).

4.2 SITE RECONNAISSANCE

URS conducted site visits to visually assess the site conditions and validate the findings of the archival research:

- March 21, 2014 – Inspected the conditions of Pontiac Bay shoreline at the Site, confirmed the presence of manholes and catch basins identified on historical construction drawings, photographed grassy areas from the 1940s timeframe that are still present today.
- June 3, 2014 – Inspected the former welding shop areas in Buildings 11 and 40, the former sludge drying beds at Building 207, the location of former Building 17 (now removed), and trash burning and disposal areas near the eastern shoreline of Magnuson Park.
- September 24, 2014 – Inspected the area north of former Building 17 for the presence of manhole 1024, the storm drain outfalls north of Building 27, and the shoreline restoration performed by the City of Seattle north of Buildings 11 and 27.
- October 2, 2014 – Confirmed that manhole 1024 near former Building 17 and the former hazardous waste storage yard is no longer present.

- October 15, 2014 – Determined available access to the original surfaces of the former welding and instrument shops in Building 30 for possible sampling during the SI.

4.3 HISTORICAL DOCUMENT RESEARCH

Documents related to former NAVSTA PS with emphasis on storage, use, or disposal of radiological materials were found at several repositories and reviewed. Recent documents related to the TCRA at the Site are also included in this task. Documents were sought at repositories that included governmental agencies, nongovernmental agencies, educational institutions, databases, websites, etc. that had or may have had documents of interest. URS contacted data repositories known to have naval facility documentation from previous PAs, and NAVFAC NW and RASO personnel provided input about other data repositories likely to have information about NAVSTA PS. Additional data repositories were contacted during the historical research phase, based on the recommendations of archivists and researchers at the initial data repositories visited. The repositories that URS contacted are indicated in Table 4-2. The repositories that had relevant information are listed first followed by the repositories that had no relevant information.

Data repositories were contacted by email, often with follow-up phone calls, inquiring about historical documents, aerial photos, as-built drawings, and other materials related to the use or storage of radiological materials at NAVSTA PS between 1920 and 1997. It was made clear to the repositories that information for former NAVSTA might also be found under the following titles:

- “Naval Station Puget Sound”
- “Sandpoint Naval Air Station”
- “Magnuson Park”
- “Sand Point”
- “Sandpoint”
- “Sand Point Naval Air Station”
- “Naval Air Station Seattle”
- “NAS Seattle”

The majority of the data repositories visited were in the local Seattle area. Other data repositories were located in the Washington, D.C., area or provided documents for review via the Internet. The repositories at which URS reviewed documents on site are identified in Table 4-2. The general types of documents reviewed are listed in Section 4.6.

4.4 PERSONAL INTERVIEWS

Interviewing former employees or individuals with knowledge of radiological activities at the Site is an important step to gain relevant information for the PA. During the document review for this PA, a list of personnel with knowledge of radiological operations at NAVSTA PS was compiled for potential interviews. The personnel were past employees of NAVSTA PS, the Washington State Office of Radiation Protection, and former health physicists with RASO who had visited the site (Table 4-3).

The whereabouts and contact information for personnel listed in Table 4-3 were researched using Internet sources such as “Archive.com” and the Google[®] search engine. Successful contact was not made with any personnel in Table 4-3 because of a lack of contact information or because they were deceased.

In addition to names generated during the PA archival research, a public notice was published in the *Seattle Times* (June 16 to 22, 2014) and *Navy Times* (August 18, 2014) newspapers. The public notice requested that people, such as former employees, with knowledge of radiological material use at former NAVSTA PS contact the URS project manager. These published notices are included in Appendix D. Two people with knowledge of operations possibly related to the use of radiological materials at NAVSTA PS responded to the *Seattle Times* notice and contacted the URS project manager for an interview. There were no responses to the *Navy Times* notice. Two people were interviewed at the former NAVSTA PS on July 2, 2014:

- a former NAVSTA PS employee who worked in the public works department for 28 years
- a former University of Washington research associate who helped set up a study of plutonium-contaminated sediment in the greenhouse on NAVSTA PS

URS staff met the former NAVSTA employee and the former University of Washington research associate at the former NAVSTA PS to conduct the interviews. The purpose of the interviews was explained to both interviewees. They each provided information on their former position or connection to NAVSTA PS and their knowledge of radiological operations at NAVSTA PS. Information on operations that may have involved radiological material was elicited by means of discussion and specific questions. Information obtained during the interviews was transcribed in separate documents which are included in Appendix E with the interviewees' permission.

4.5 CONCEPTUAL SITE MODEL

A preliminary CSM and list of items of interest was developed at the beginning of the PA process to identify potential contaminant sources and relevant historical documents to be reviewed. The preliminary CSM is provided as Table A-1 in Appendix A. As the PA progressed the CSM was updated to identify current exposure scenarios. The list of potential receptors was limited to those typically found in the PAOCs identified by the PA and the current use of the structures containing these PAOCs. This updated CSM is used to support the recommendations for additional surveys and sampling during the SI. The updated CSM, which is provided as Figure A-1 in Appendix A, includes the following components:

- Sources of contamination
- Release mechanisms
- Primary media
- Migration pathways
- Exposure media
- Exposure routes
- Human and ecological receptors

The sources of contamination are historical operations where radionuclides were used, including the following:

- Confirmed removal and re-application of radioluminescent paints on aircraft instrument dials
- Potential use of thoriated welding rods in welding shops
- Confirmed use of radiologically-contaminated coral grit during experiments conducted by the University of Washington Laboratory of Radiation Ecology

The potential release mechanisms of radiological contaminants include the following:

- Disposal into the sinks or storm drain system
- Disposal onto the ground surface
- Spills and splashes on floors and walls

The primary media that could have become contaminated after an initial release include the following:

- Storm water and wastewater
- Associated pipes and catch basins of the storm drain system

- Surface media (i.e., surface soil)
- Structure surfaces in buildings

The identified contaminant migration pathways include flow through the storm drain system to Lake Washington, as well as infiltration from a surface medium (ground surface) into subsurface media. A potential migration pathway is groundwater transport to the surface water of Lake Washington.

Exposure media include the primary media where receptors can come into direct contact with released contaminants or secondary media that are impacted by contaminants that have followed migration pathways away from the primary media. The primary exposure media include structures and surface soil. The secondary exposure media include surface water and sediments in Lake Washington, as well as groundwater and subsurface soils exposed during ground-disturbing construction projects.

Exposure routes for human and ecological receptors include ingestion, inhalation, dermal contact, and external radiation. Exposure routes for human and ecological receptors include ingestion, inhalation, dermal contact, and external radiation. Exposure pathways for each receptor are identified as complete if they consist of the four elements of a complete exposure pathway (USEPA 1989):

- A source and mechanism of chemical release
- A retention or transport medium (e.g., soil)
- A point of potential human contact with the affected medium
- A means of entry into the body (e.g., ingestion) at the contact point

Complete yet insignificant pathways are pathways that may exist (have all four elements) but the risk of exposure by the pathway is very low. Incomplete pathways do not have all four elements listed above.

The human receptors identified at the Site that are subjected to complete exposure pathways include indoor workers, outdoor workers, recreational beach users, and recreational park users.

Ecological receptors identified at the Site that are subjected to complete exposure pathways include terrestrial, aquatic, and riparian biota.

4.6 ELECTRONIC DATABASE

The electronic database consists of an index of references and a folder containing relevant documents. The index, which was created in Microsoft Excel and is called "Master Reference Index.xlsx," contains links to the actual reference documents in a folder named "Compiled

References.” This database, which contains approximately 700 entries served as both a list of material reviewed and a compilation of relevant documents. All reviewed files that potentially contained relevant information were recorded in the database, even if they contained no relevant information. Relevant documents ranging in size from 1 page to hundreds of pages were saved in the database. Most of the documents were scanned, and some were already in an electronic format. For each document reviewed, information was entered into the database to allow sorting and a focused analysis of the 466 documents gathered during the PA. The fields of the master reference index included the following:

- Preliminary Assessment Reference
- Document Title or Subject
- Building Number
- Document Year
- Document Date
- Primary Author Name
- Document Type
- Description or Reason for Inclusion/Exclusion
- Reviewed by
- Date Reviewed
- Portion of Document Scanned or Photographed
- Camera Photo Number
- Document Number or Initially Assigned File Name and Link
- File Name and Link
- Repository
- Document Locator Information or Catalog Number

Many fields of the database are self-explanatory (i.e., building number, year, reviewer, etc.). The “Document Type” field is included for sorting by several types of information according to the following entry options:

- Aerial Photo (AP)
- Still Photo (SP)
- Construction Drawing (CD)
- Book (Book)
- Correspondence (Corr)
- Orders (Ord)
- Interview (Int)
- Permit (Per)
- Publication (Pub)
- Site Report (SR)

- Table (Tbl)
- Site Map (SM)
- Website (WS)
- Guidance/Regulation (GR)

The “Description or Reason for Inclusion/Exclusion” field lists the document’s relevance to radiological operations at NAVSTA PS that justified its inclusion in or exclusion from the database.

The “File Name and Link” field was developed with a naming convention to convey multiple facets of information about each document with a reasonable file name length. Hyperlinks to the source documents were inserted to enable a database user to open up and review documents with a single mouse click from the master reference index.

The file naming convention consisted of three parts: (1) document type abbreviation, (2) year, and (3) title/subject. The document type abbreviations are included in parentheses with the different types of documents listed above. For example, a file named “SM-1953-Master Shore Station Development Plan General Development Plan” would be a site map from 1953 of the development plan for NAVSTA PS. Clicking on the hyperlinked file name would open the image shown on Figure 4-1.

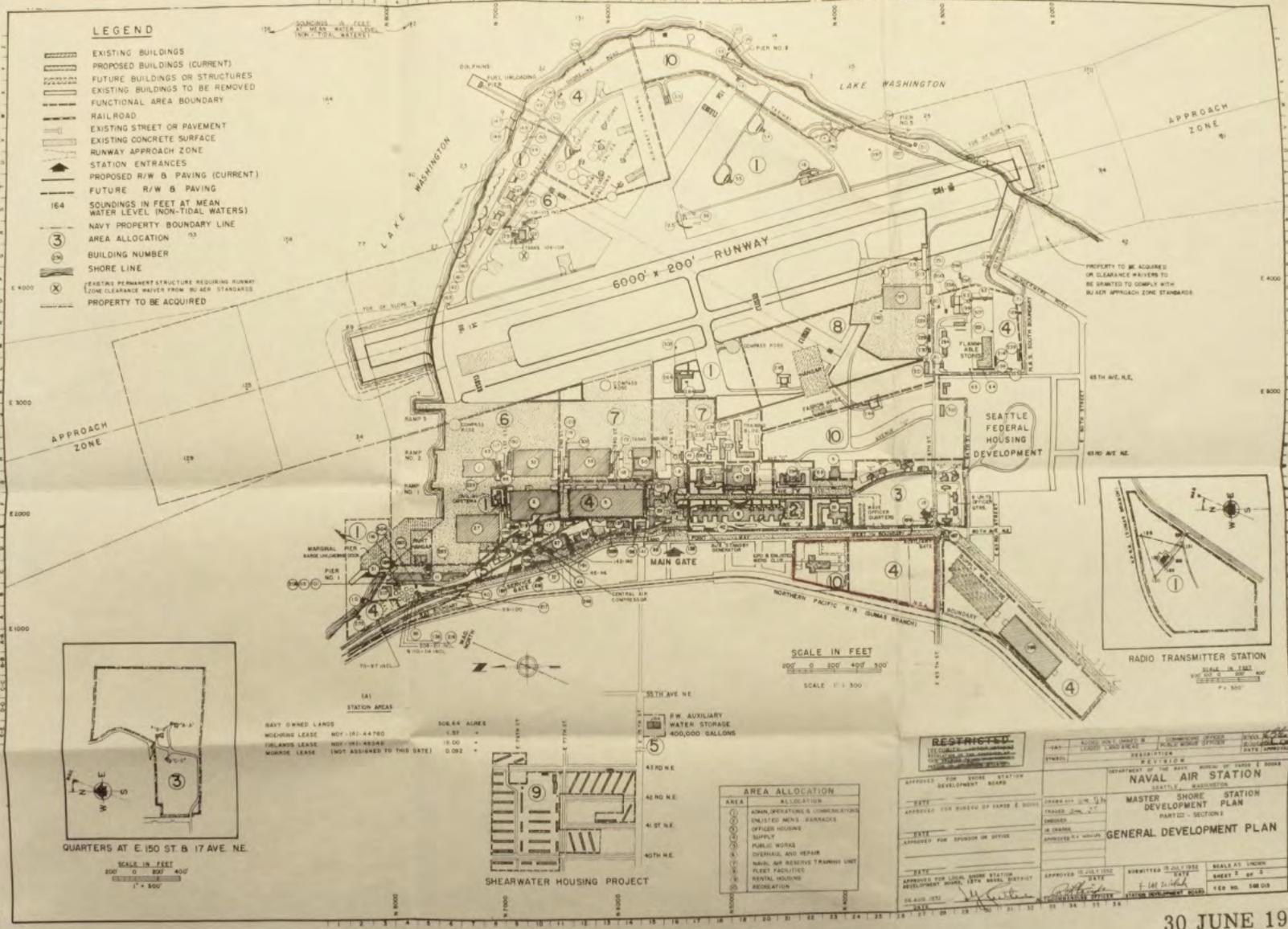
4.7 DATA EVALUATION AND REPORTING

Information gathered during the PA was reviewed and evaluated to identify AOPCs that may have the potential for radiological contamination based on historical activities. Table C-1 (Appendix C) lists current and former buildings at the Site and summarizes the year(s) built, related radiological surveys, historical names, current use, location on the site map, square footage, and the potential radiological concerns related to the structure based on information gathered during the PA. Structures with potential radiological contamination are highlighted in green in Table C-1, with the reasons for concern described in the column “Potential Radiological Concerns Related to Building/Structure.” The former and current uses/names of structures at NAVSTA PS are listed in Table C-2.

Areas that have or may have had only standard safety devices that contain generally licensed radioactive material, such as smoke detectors or exit signs, were not identified as an AOPC if the area has no other radiological history.

Areas in buildings (i.e., parachute rooms) may have at one time contained personnel markers, deck clocks, instruments with radium markings, or other G-RAM devices. Areas associated with possible G-RAM-containing items such as these were not identified as AOPCs unless there was evidence of radiological contamination.

13-3-2



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Figure 4-1
Master Shore Station Development Plan for NAVSTA PS

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 NAVSTA PS
 Seattle, Washington
 PA Report

Table 4-1
Responses to MARSSIM Questions Useful for Preliminary Assessment

Question	Response
Was the site ever licensed for the manufacture, use, or distribution of radioactive materials under Agreement State Regulations, NRC licenses, or Armed Services permits, or for the use of 91B material?	No evidence found.
Did the site ever have permits to dispose of, or incinerate, radioactive material on site?	No evidence found.
Is there evidence of such activities?	Only use of radium paint. Discarded radium gauges and dials removed from the ground and properly disposed of in 1976.
Has the site ever had deep wells for injection or permits for such?	No evidence found.
Did the site ever have permits to perform research with radiation-generating devices or radioactive materials except medical or dental x-ray machines?	No evidence found.
As a part of the site's radioactive materials license, were there ever any Soil Moisture Density Gauges (Americium-Beryllium or Plutonium-Beryllium sources) or Radioactive Thickness Monitoring Gauges stored or disposed of on site?	Not applicable.
Was the site used to create radioactive material(s) by activation?	No evidence found.
Were radioactive sources stored at the site?	Records were obtained that document the presence of radium paint storage in Buildings 2 and 27. In 1976 during the technical assistance visit by RASO, 14 radioluminescent deck clocks and one radioluminescent depth gauge were found in Building 5B.
Is there evidence that the site was involved in the Manhattan Project or any Manhattan Engineering District (MED) activities (1942–1946)?	No evidence found.
Was the site ever involved in the support of nuclear weapons testing (1945–1962)?	No evidence found.
Were any facilities on the site used as a weapons storage area? Was weapons maintenance ever performed at the site?	No evidence found.
Was there ever any decontamination, maintenance, or storage of radioactively contaminated ships, vehicles, or planes performed on site?	No records found; however there is a plane wash structure.
Is there a record of any aircraft accident at or near the site (e.g., depleted uranium counterbalances, thorium alloys, radium dials)?	There are records of approximately 109 airplane crashes in Lake Washington. Unknown number related to Naval Air Station Seattle (former NAVSTA Puget Sound). Some have been recovered. It is likely that some of these airplanes had instrumentation with radioluminescent dials.

Table 4-1 (Continued)
Responses to MARSSIM Questions Useful for Preliminary Assessment

Question	Response
Was there ever any radiopharmaceutical manufacturing, storage, transfer, or disposal on site?	No evidence found.
Was animal research ever performed at the site?	No evidence found.
Were uranium, thorium, or radium compounds used in manufacturing, research, or testing at the site, or were these compounds stored at the site?	Radium was used for painting gauges and dials.
Has the site ever been involved in the processing or production of naturally occurring radioactive material (e.g., radium, fertilizers, phosphorus compounds, vanadium compounds, refractory materials, or precious metals) or mining, milling, processing, or production of uranium?	No evidence found.
Were coal or coal products used on site?	No evidence found.
If yes, did combustion of these substances leave ash or ash residues on site?	Not applicable.
If yes, are runoff or production ponds on site?	Not applicable.
Was there ever any on-site disposal of material known to be high in naturally occurring radioactive materials (e.g., monazite sands used in sandblasting)?	No evidence found.
Did the site process pipe from the oil and gas industries?	No evidence found.
Is there any reason to expect that the site may be contaminated with radioactive material (other than previously listed)?	No evidence other than for radium.

**Table 4-2
 Data Repositories Contacted and/or Visited for Radiological PA Document Review**

Data Repository	Location
Contacted Repositories With Information Relevant to Radiological Operations at NAVSTA PS	
Environmental Data Resources, Inc.	Internet
Washington Department of Natural Resources	Olympia, WA
Museum of History and Industry ^a	Seattle, WA
National Archives and Records Administration ^a	Seattle, WA
National Archives and Records Administration ^a	College Park, MD
NAVFAC NW files	Silverdale, WA
Naval History and Heritage Command ^a	Washington, D.C.
NOAA Western Regional Center ^a	Seattle, WA
Radiological Affairs Support Office ^a	Yorktown, VA
Seattle Department of Planning and Development ^a	Seattle, WA
Seattle Municipal Archives ^a	Seattle, WA
Seattle Department of Parks and Recreation ^a	Seattle, WA
Seattle Public Library, Central Branch ^a	Seattle, WA
Seattle Public Library, Northeast Branch ^a	Seattle, WA
University of Washington, Special Collections ^a	Seattle, WA
University of Washington, Map Room ^a	Seattle, WA
U.S. Army Corps of Engineers ^a	Seattle, WA
U.S. Ecology Washington	Richland, WA
U.S. Department of Agriculture	Beltsville, MD
U.S. Geological Survey	Internet
Naval Installation Restoration Information Solution, Environmental Document Management System Database	Internet
Various websites	Internet
Contacted Repositories With No Information Relevant to Radiological Operations at NAVSTA PS	
Puget Sound Regional Archives	Seattle, WA
Naval Aviation Museum	Pensacola, FL
Naval Reserve Command	New Orleans, LA
Naval Reserve Command	Washington, D.C.
Naval Air Systems Command	Patuxent River, MD
Navy Museum Northwest	Keyport, WA
Puget Sound Navy Museum	Bremerton, WA
U.S. Navy Seabee Museum	Port Hueneme, CA
National Archives and Records Administration	San Bruno, CA
U.S. Naval Academy Museum	Annapolis, MD
BRAC Project Management Office West (duplication of NAVFAC NW documentation)	San Diego, CA

^aDocuments were reviewed at this repository.

**Table 4-3
 Potential Interviewees Identified During the Radiological PA Document Review**

Interviewee	Position or Affiliation
John Swinney	Radium Painting Technician at NAVSTA PS
Harold Greenwood	Radium Painting Technician at NAVSTA PS
Vivian Vandermay	Assembly and Repair Department (Hangar No. 2) and Secretary to NAVSTA PS Commanding Officer
Catherine Wharton	Author of Historical Overviews of NAVSTA PS
Lee Gronemeyer	Washington State, Office of Radiation Protection
Bob Will	Washington State, Office of Radiation Protection
Fred Combs	RASO Health Physicist (TAVs to NAVSTA PS)
Neil Jordan	RASO Health Physicist (TAVs to NAVSTA PS)
Mr. Boughner	Head, Environmental Engineering Section, Seattle Branch WESNAVFAC ENGCOM
Mr. G. White	Environmental Engineering Section, Seattle Branch, WESTNAVFACENGCOM
Gary Grayson	Public Works
Jerry Von Fossen	Housing Office
Cecil Caudle	Director of Public Works
David Desotel	Public Works
Bruce Ford	Carpenter and Pesticide Technician
Gerald Jordan	Aviation Mechanic
Carol Ravano	Environmental Engineer
Walter Warren	Environmental Coordinator
Ralph Baltzo	Radiation Safety Officer, University of Washington
Dale Williams	NAVSTA PS Public Works
Bill Perry	NAVSTA PS Public Works

5.0 HISTORY AND CURRENT USE

This section summarizes the 70 years that NAVSTA PS operated as an active or reserve naval facility. During its operation, it played a valuable role in supporting the Pacific Fleet during World War II and subsequent conflicts up until its closure in 1995. On June 19, 1920, the King County commissioners offered 268 acres of land at Sand Point to the Navy for development as a military airfield. Because the Navy could not accept the land without an act of Congress, it took until July 13, 1922, for the Navy to take possession of the site (Wilma 2000).

NAVSTA PS was fully developed in the late 1930s and early 1940s, and saw the height of its operations during World War II. The station continued operations with reserve missions and a support roll for 5 decades after the war. Brief descriptions and highlights of the years and types of operations in the history of NAVSTA PS are provided in the following subsections. A table listing the current and former structures at the Site is included as Table C-1 (in Appendix C).

5.1 ACQUISITION OF SAND POINT AND CONSTRUCTION OF EARLY FACILITIES (1923–1935)

After the initial acquisition of land at Sand Point by the Navy, development of NAVSTA PS progressed slowly until the mid-1930s. Initial construction was limited to runway improvements, frame hangars, and barracks. Buildings 2 through 9 were built at this time; of these, only Buildings 2, 5, and 9 remain. The Sand Point landscape was leveled and Pontiac Bay and Mud Lake were filled to accommodate the runways, aircraft parking, and buildings. During its first years, Sand Point primarily served as a reserve base to train Navy and Marine Corps personnel, but in 1935 it was classified as an active base (EDAW 1993).

Highlights in the development of NAVSTA PS during this period included the following events, as chronicled in the base history (Johnson 1944; Stuhaug 1992):

- **April 6, 1923:** First hangar completed for two planes (one Army and one University of Washington ROTC), five JN (Curtiss) training planes and one DeHavill and observation plane for Navy Research operating from NAVSTA PS.
- **April 7, 1924:** Four Douglas world cruisers departed Sand Point for an around-the-world flight.
- **September 28, 1924:** Three of the four original Douglas world cruisers arrived at Sand Point to complete the first around-the-world flight.

- **May 11, 1925:** Single Naval Reserve unit is authorized to be based at the new Sand Point Air Station, as shown in Figure 5-1 (planes assigned; began developing shops and hangar space).
- **November 17, 1925:** First commanding officer (Lt. Commander John H. Campman).
- **March 8, 1926:** Secretary of the Navy Curtis Wilbur signed a letter notifying King County of final acceptance of its long-offered land gift by donation; actual area was 413 acres.
- **1929:** Expansion/construction of runway, construction of Building 2, Naval Reserve Squadron VN 15 RD 13 consisting of OS2Cs (Curtiss Helldivers) and SF2s (Grumman Scouts) based at NAVSTA PS.
- **October 17, 1929:** A Soviet Tupolev ANT-4 landed at Sand Point as part of a goodwill tour.
- **1930:** Construction of the new barracks (Building 9) is completed.
- **1931:** Operations were confined to training the Naval Reserve and basing Naval Aviation units temporarily.
- **1935:** Seventeen buildings were located on the station; Patrol Squadron VP-12 attached to the aircraft base force arrived equipped with PBV aircraft.

A list of aircraft that were present at NAVSTA PS based on information in reviewed documents is presented as Table 5-1.

5.2 PREPARATION FOR AND NAVAL OPERATIONS DURING WORLD WAR II (1936–1945)

Many of the major buildings at NAVSTA PS were built in the late 1930s prior to World War II, including Building 27 (1937), as shown in the upper right-hand corner of Figure 5-2. Buildings 2, 5, 7, 12, and 17 located south of Building 27 are also visible in this figure. An addition that doubled the area of Building 2 was completed in 1941, resulting in the expanded configuration of the instrument shop in that building. The south shed, which also contained an instrument shop, was added to Building 27 in 1944.

During World War II, NAVSTA PS supported fleet air operations and air transport of personnel for the Alaskan and Western Pacific theaters of operation. The base reached the height of its activity with 4,625 Navy and Marine personnel and 2,834 civilian employees (EDAW 1993). The station remained one of the major overhaul stations on the Pacific Coast.

Highlights in the development of NAVSTA PS during this period included the following events, as chronicled in the base histories (Johnson 1944; Stuhaug 1992):

- **1936:** Basing of two-engine biplane flying boat and VMS-9R O2C-Curtis Helldivers.
- **1937:** Preliminary training of aviation cadets of the Naval Reserve, basing for one Naval Reserve squadron, one Marine Reserve squadron, and one Marine service company.
 - Furnishing facilities for major overhaul of planes and engines for Naval Reserve aircraft.
 - Two six-plane squadrons stationed at NAVSTA PS.
- **1938:** V5-16R – single-engine biplanes on station, year-round cadet training began.
 - Hosted Patrol Squadrons 16, 17, 19, 20, and 21 (six seaplanes each, 30 total).
 - Plan for overhaul and repair (O&R) of aircraft accessories from propellers to sparkplugs as soon as shops are set up (Radford 1938).
- **1939:** The primary mission at this time was to procure and train the officers and men of the 13th Naval District; the secondary mission was to maintain and operate a base of naval and Marine Corps reserve aviation units, providing facilities in the way of maintenance, large-scale O&R, housing, messing, berthing, supply, and training.
 - Received SBC4s single-engine biplanes on station
 - 600 to 700 men stationed at Sand Point; visiting squadrons could bring number to 1,000.
 - Construction of steel hangars; 34 buildings in the area at the end of the year.

- **1940:** NAVSTA PS tripled its repair facilities, quadrupled its supply and storage facilities, and doubled its personnel (EDAW 1993). The mission included the U.S. Marine Reserve Scouting Squadron Nine, Marine Reserve Service Squadron Three, and Naval Reserve Scouting Squadron Sixteen based at NAVSTA PS.
- **1941:** NAVSTA PS was now capable of accommodating four 12-plane patrol squadrons and two carrier air groups plus accompanying staff, as well as a Class A trade school for 800 enlisted men.
 - Trade schools offering courses for aviation metal smiths and machinists.
 - Land-based air field completed: five asphalt runways offering a choice of eight directions as shown on Figure 5-3.
- **1942:** Assembly and repair (A&R) shops in Hangar 2 in full operation, including carrier planes, PBYS, other patrol aircraft: OJ-10, OJ-2, SF-1, JF-3, and SBC-4.
 - NAVSTA PS headquarters for all naval air activities 13th District.
 - Patrol Wing Four departs Seattle and now stationed at Kodiak.
 - Decommissioning of Naval Reserve Air Base with that mission moved to Pasco, Washington.
- **1943:** Authorization to maintain a squadron and build a hangar. Squadron VR-5 commissioned and NAVSTA PS designated as separate command of the Naval Air Center.
 - Torpedo bombers from Air Group 10 training at NAVSTA PS.
- **1944:** Operating personnel of approximately 1,800 officers and enlisted personnel at station, transient military personnel bring total to approximately 5,600, and approximately 1,350 civilians working in A&R shops.
 - Carriers bound for Bremerton would fly their planes to Sand Point: F6Fs, SBDs, and TBFs.
 - Air groups returning to NAVSTA PS: Air Groups 1, 12, 13, 15, 25, 50, and 60; Aleutians VPB 61 and 62, PB4 Patrol Squadrons and Empire Express Squadrons VPB 139 and 135 of Air Wing 4.

- **1945:** The A&R Department was the largest on the station. It functioned as a Class A aviation overhaul base that included major repairs, major overhaul, rebuilding fleet aircraft, engine overhaul, and accessories overhaul. The base supported an average load of 1,223 planes, supplying aviation parts and materials for the 13th and 17th Naval Districts.
 - NAVSTA PS was the receiving point for vast stockpiles of war materials from the 13th District.
 - Naval Air Reserve Training Unit (NARTU) was reestablished at NAVSTA PS.
- **August 1945:** Japan surrendered, ending World War II.

A list of aircraft that were part of operations or maintenance at NAVSTA PS based on information in reviewed documents is presented as Table 5-1. The aircraft listed are prop planes; no records of jets were found. Additionally, the runways at NAVSTA PS were too short for jets to land (Friends of Sand Point Magnuson Park Historic District 2015). Therefore, it appears that no jets were part of maintenance or operations at the former NAVSTA PS.

5.3 NAVAL OPERATIONS AFTER WORLD WAR II (1946–1970)

After World War II, NAVSTA PS was designated a Naval Reserve Air Station. Active O&R activities were concluded in 1953 but continued to a far lesser degree under the reserve mission until 1959–1960. In 1955, Navy approval was granted for use of the base as a Coast Guard Air Station, with the closure of the Coast Guard Air Station at Port Angeles. From 1945 to 1970, the station maintained Naval Reserve squadrons for supplementing active duty forces, both in the continental United States and abroad. Aviation activities at NAVSTA PS officially ceased on June 30, 1970. Records indicate that from 1966 to 1970, the AEC Nevada Operations Office (NVOO) provided funding to the University of Washington, Laboratory of Radiation Ecology, to assess the bioenvironmental consequences of a series of nuclear detonations originating from Johnston Island in the Central Pacific. These studies used Building 15 at NAVSTA PS. The primary objectives of these studies were as follows:

- Obtain information for the prediction and evaluation of the biological impact from the explosion of a nuclear-tipped rocket at Johnston Atoll
- Assemble a cadre for the bioenvironmental assessment of a nuclear test series (UW 1966)

Highlights in the operations of NAVSTA PS during this period included the following events, as chronicled in the base histories (Stuhaug 1992; NAS Seattle 1949, 1951a, 1951b):

- **1946:** Disestablishment of Class “A” A&R Department.
 - A&R Departments repaired PBY, JRF, J2F, and J4F aircraft in 156 shops and 4 hangars.
 - Supply greatly scaled back. Returned war materials were sent to other stations.
- **1947:** NARTU mission with NF4U-10 aircraft operating at station.
- **1948:** Construction of second-story addition in Hangar 32 including space for supply shop stores, small stores, electronic shop stores, shop spaces, and a parachute loft (NARTU 1948).
 - Reactivation of O&R Department as Class “A,” increasing overall ceilings for station civilian personnel. First PBY-5A inducted into department.
- **1949:** O&R Department, Class “A,” had the following activities: overhaul, repair, modification, salvage, and testing of aircraft, engines, accessories, and other related naval aeronautical equipment; limited manufacture of aircraft parts and assemblies; and maintenance and limited manufacture of tools and equipment.
 - Primary role of NAVSTA PS became Naval Air Reserve Training and secondary role became support of O&R Department.
 - Increase in personnel from 601 to 1,499.
- **1950:** Although threatened with closure by the Navy at the beginning of the year, the mission of NAVSTA PS was revived when North Korea attacked South Korea on June 25. Because of the conflict in Korea and increasing tensions around the world, NAVSTA PS was forced to a 6-day work week to keep pace with the backlog of planes that required modernization.
- **1951:** O&R Department left Building 33 and moved to permanently assigned buildings.
 - Erection of welding shop for use of O&R Department.

- *Seattle Post Intelligencer* (1951) ran story on NAVSTA PS, including a photo of personnel washing radium off aircraft instrument dials with acid (Figure 5-4).
- **1952:** Mission supporting fleet reconnaissance, antisubmarine activities, transport, navy and marine reserve aircraft, operational and training flights, O&R operations, primary aviation supply point, and 13th Naval District.
- **1953:** The Korean Conflict ended on July 27, 1953. Active base O&R shops were shut down for good; civilian employment decreased from 1,800 to 200.
 - NAVSTA PS converted to a Naval Air Reserve Training base.
- **1958:** Major facilities remaining on NAVSTA PS included six hangars, one O&R shop with hangar space, a supply warehouse at the north end, and a transportation hangar with storage at the south end.
- **1961:** Sand Point naval air reservists were called up to complement active duty forces during the Berlin Air Lift.
- **1966:** The nation's first Naval Reserve construction battalion was dedicated at NAVSTA PS.
- **1966–1970:** University of Washington, Laboratory of Radiation Ecology, leases Building 15 at NAVSTA PS for the Johnston Atoll Bioenvironmental Program.
- **1970:** On July 1 the station was reclassified from a naval air station to a naval supply activity; all air operations ceased at that time.

5.4 PONTIAC BAY SHORELINE MODIFICATIONS

During the scoping process, it was decided that the scope of the PA would include a historical account of the shoreline at the north end of the study area, documenting changes in the shoreline to assess potential areas of radiological contamination from storm drain outfalls and sediment deposition. The identification of significant changes to the shoreline was essential to the planning of relevant sediment sampling in the future and to the identification of appropriate locations for dredge spoil deposition.

Changes to the northern shoreline in the study area were identified by evaluating base maps and aerial photos showing this portion of NAVSTA PS throughout its history. The compiled maps and aerial photos span 82 years of Site operation. The changing locations of the Pontiac Bay

shoreline (Figure 3-2) show that portions of Pontiac Bay were filled between 1932 and 1936 to accommodate the construction of Building 27.

In 2005, the City of Seattle conducted a beach restoration project at the north end of the Site in the vicinity of Building 11 and Building 27 (Anchor 2005). The new configuration of this section of shoreline is shown on Figure 5-5. These modifications altered the nature of the shoreline from a former bulkhead to a beach-type environment. This project included the installation of new boat launch and dock facilities, the placement of beach material adjacent to the existing bulkheads, and retrofitting of two storm drain outfalls by extending the outfall piping offshore into Pontiac Bay using high-density polyethylene (HDPE) piping strapped to precast-concrete planks. A geotextile covered with cobble and fish mix was placed near the boat launches, docks, and outfalls. The beach restoration extends 30 to 35 feet from the bulkhead along the Lake Washington shoreline. The maximum thickness of the gravel fill is approximately 5 to 6 feet adjacent to the bulkhead and varies depending on the depth of the lake bottom that was adjacent to the bulkhead prior to the beach restoration. The thickness of the gravel fill decreases away from the shoreline (Anchor 2005, KPFF 2009).

5.5 NAVY TRANSFER OF PORTIONS OF NAVSTA PS TO NOAA AND CITY OF SEATTLE

After the runway closure in 1970, the Navy rented much of its facilities until the property was subsequently transferred. On November 4, 1973, the General Services Administration divided the station into three parts, conveying via the General Services Administration (GSA) considerable portions of the property that had supported air operations (runways and adjacent structures) to the NOAA (approximately 100 acres) and the City of Seattle (approximately 165 acres). Environmental obligations as a result of former military activity at property transferred prior to BRAC are administered under the “Formerly Used Defense Sites” (FUDS). The United States Army Corps of Engineers is the federal agency which manages the FUDS program. The remainder of the property (approximately 150 acres) was retained by the Navy and subsequently transferred via BRAC to NOAA, the City, and other entities between 1998 and 2000. The FUDS program encompasses those properties that left DoD control prior to October 1986. The BRAC program encompasses military installations identified for closure or realignment in a series of special legislation since 1988.

From November 1993 to October 1997, the Navy prepared and distributed an EIS under the National Environmental Policy Act to analyze the environmental impacts of the proposed disposal and reuse of the facilities and land at the former NAVSTA PS. The final EIS was distributed in October 1997 and identified the actions that would be necessary to mitigate impacts associated with reuse and redevelopment. The final EIS stated that the acquiring entity, under direction of federal, state, and local agencies with regulatory authority over protected resources, would be responsible for implementing necessary measures. The final EIS also stated

that the Navy would include appropriate restrictive covenants in the deeds for parcels where hazardous substances remained, and for the historic properties in accordance with applicable federal and state laws. The Navy issued a Record of Decision in December 1997.

From 1988 to 1995, the Navy conducted several environmental investigations and cleanup actions on portions of former NAVSTA PS. A master lease between the Navy and the City of Seattle was executed in July 1996, which allowed the city to constructively use buildings south of NE NOAA Drive before full conveyance. Although this master lease did not encompass Buildings 2 or 27, the master lease contained an “Environmental Finding” section, which included a FOSL document. The FOSL noted, that “historical records indicate Sand Point (NAS Seattle, NAVSTA Puget Sound) never handled radioactive or mixed waste.”

This Environmental Finding applied to the entirety of NAVSTA PS and was relied upon by the Navy in all subsequent transfers of property associated with NAVSTA PS. No further radiological surveys were conducted by the Navy until after the notification by the City of Seattle in 2009. An environmental baseline survey (EBS) was performed to determine the suitability of transfer of portions of the former NAVSTA PS and a report was issued. The EBS report identified Buildings 2 and 27 as “areas where only storage of hazardous substances or petroleum products has occurred (but no release, disposal, or migration from adjacent areas has occurred).” The EBS did not contain any information regarding the potential for radiological contamination. The EBS report was submitted to the Washington State Department of Ecology, who issued a No Further Action letter dated May 16, 1996, for Parcel 2, which included Building 27. A FOST was signed on April 15, 1998 (amended August 11, 1998 and March 9, 2000), that contained use restrictions for the subject property. Nine parcels were transferred from the Navy to the City of Seattle and other entities from 1998 to 2003 (Table 5-2 and Figure 5-6).

The Navy’s assignment of the Magnuson Park property to the U.S. Department of Interior (DoI) for subsequent conveyance to the City of Seattle required the DoI to include the following in the conveyance deeds:

- A covenant warranting that all remedial action necessary has been taken to protect human health and the environment with respect to any hazardous substance remaining on the property.
- A covenant warranting that any remedial action found to be necessary after the date of such transfer be conducted by the United States.
- A clause granting the United States access to the property in any case in which remedial action or corrective action is found to be necessary after the date of such transfer.

5.6 USE OF RADIOACTIVE MATERIALS

The information reviewed for this PA indicated the presence of five PROCs at NAVSTA PS: radium-226 (Ra-226), cesium-137 (Cs-137), strontium-90 (Sr-90), thorium-232 (Th-232), and plutonium-239 (Pu-239). Of the PROCs used or stored at NAVSTA PS, the use of radium in radioluminescent paint was confirmed in Buildings 2 and 27 at the Site, as shown on Figure 5-7 (Navy 1943b), and plutonium-contaminated coral grit from Johnston Island was reportedly used by the University of Washington, Laboratory of Radiation Ecology, in Building 15 (UW 1968; Olson 2014).

The removal and re-application of radioluminescent paint to aircraft instrumentation at NAVSTA PS may have been occurring as early as 1941, as evidenced by a request to the commanding officer of NAVSTA PS to provide the Bureau of Aeronautics with the number of employees engaged in application of radium luminous compound (Bureau of Aeronautics 1941). The use of radium paint on all navigation instruments was reduced to just bank and turn indicators in 1949–1950 (*The Carrier* 1949; Bureau of Aeronautics 1950).

The handling of radium and associated waste products was described in detail by Navy safety regulations (Navy 1942), and possible changes to operations in the 1950s were highlighted by the U.S. Naval Radiological Defense Laboratory (Skow 1952) as further detailed below.

Cs-137 and Sr-90 were not detected at concentrations greater than the project release criteria in soil and sewer sludge samples collected during the radiological RI (Shaw E&I 2011). Cs-137 and Sr-90 are associated with global fallout from atmospheric testing of nuclear weapons or cleaning and maintenance of contaminated planes exposed during monitoring activities associated with nuclear testing. Sr-90 was also present in personnel markers, which may have been present at NAVSTA PS.

Because patents introducing the use of thorium oxide as a component of tungsten electrodes for welding rods date from 1949, use of thoriated welding rods during welding activities at NAVSTA PS was investigated. Because welding activities occurred in Buildings 2, 11, 27, 30, and 308 after 1949, thoriated welding rods could have been used at NAVSTA PS. Th-232 is considered a potential contaminant associated with welding shops and machine shops. No records were discovered during this PA confirming the use of thoriated welding rods during the operational history of NAVSTA PS. Scoping surveys were conducted in the welding shops of Buildings 2, 11, and 27 by the TCRA contractor and will be presented in a TCRA After Action Report that is expected to be completed in the summer of 2016.

Originally, the project team was concerned that operations in Building 17 (former Engine Test Building, now demolished) may have included the use of engine exciters, which have been known to contain the radiological contaminants such as Cs-137 and Sr-90. However, engine exciters were used in jet engines, and the known aircraft to be stationed and maintained at the

site were all prop planes (see list of aircraft discussed in Section 5.2). Therefore, engine exciters would not have been involved in engine maintenance that occurred in this building.

The project team was initially concerned that some aircraft stationed at former NAVSTA PS may have contained depleted uranium counterweights. However, there is no evidence to suggest that depleted uranium counterweights were used on the aircraft in operation at NAVSTA PS. The first use of depleted uranium other than in munitions was armor plating in the 1973 Arab-Israeli war (Rokke 2001). Although the exact date of the first use of depleted uranium as aircraft counterweights was not identified in reviewed documents, it appears that depleted uranium counterweights were used only after 1970 when aviation activities ceased at the facility (see Section 5.3). Therefore, it is very unlikely that depleted uranium counterweights were used in any aircraft at the Site.

5.6.1 Instructions for Radium Painting Operations

General Safety Rules, Section No. 9, Safe Handling of Radioactive Luminous Compound (Navy 1942) covered the facility requirements and operating procedures to be used during the application of radioactive paint to aircraft instruments at naval shore facilities. These rules were based largely on the National Bureau of Standards Handbook H27, *Safe Handling of Radioactive Luminous Paint*, and were divided into several sections, including Section IV, Work Rooms and Equipment, which spelled out the following facility construction requirements for radium painting, as well as proper disposal of waste products from the operation:

- **Floors:** The floors shall have smooth, continuous surfaces and shall have a surface of water repellent material, such as painted concrete or linoleum.
- **Ventilation:** Forced ventilation shall be provided for all workrooms and dark rooms, so that the radon content of the air does not exceed 10^{-10} curie per liter at any place at any time.
- **Hoods:** Each work table shall be provided with individual mechanical exhaust ventilation. This removes radon and dust from radioactive luminous compounds at the source and also serves to increase the general ventilation of the workroom. Dry scraping must be done under a hood of the same design as the painting hood, but provided with an independent exhaust ventilating system capable of producing an air movement of not less than 200 linear feet per minute at the face of the hood opening. The discharge point of the exhaust duct for the scraping hood shall be at least 6 feet above the roof line of the building.
- **Disposal of Wipes and Cleaning Materials:** If accidental spilling does occur, all traces of spilled compound shall be cleaned up immediately with wiping papers which shall be disposed of in covered containers provided with paper bag liners. The containers for discarded wipes shall be removed at least once each

day. The contents shall be permanently disposed of outside the workrooms, by burning or returning to the manufacturer of radioactive luminous compound for reclaiming the radium.

- **Disposal of Liquid Materials:** The liquid of the scraping bath should be emptied directly into the sewage system or deposited in a hole in the earth.

These aspects of radium painting facilities and methods of waste disposal helped to identify facilities used in radium painting and predict potential areas of radioactive waste disposal on the Site. The application of these practices would account for the extent of contamination found outside the immediate radium painting areas and in soil and storm drains found to have contamination in the vicinity of instrument shops (i.e., disposal of contaminated water from instrument repair and general cleaning).

5.6.2 Aircraft Instrumentation Shop Radium Hazard Study and New Control Measures

The U.S. Naval Radiological Defense Laboratory conducted a survey of the aircraft instrumentation shop at Alameda Naval Air Station (NAS) where radium dials for aircraft were painted (Skow 1952). The study recommended and may have been the driving force for the institution of the following control measures in radium painting facilities throughout the Navy around 1952:

- A special paper with a moderately adhesive wax surface is used to cover the floor, the inside of dial painting hoods, and all other surfaces in the dial painting room, to better trap radium dust.
- All surfaces in the painting area are vacuumed with a commercial cleaner equipped with a water trap and paper filter that prevent dispersal of collected dust.
- The ventilation systems have been modified to eliminate stray air currents.
- Cloth booties are worn over shoes in dial painting rooms.

These measures reportedly were implemented at Alameda NAS to prevent the spread of contamination. Similar measures may have been implemented at NAVSTA PS after 1952.

5.6.3 University of Washington Johnston Atoll Bioenvironmental Program

In 1967–1968, the University of Washington, Laboratory of Radiation Ecology, reportedly had 200 to 300 pounds of plutonium-contaminated coral sand from Johnston Atoll shipped to the University of Washington. It was registered with the local radiological safety officer as radioactive materials commonly would have been (Olson 2014). This material was moved into

the greenhouse (Building 15) at former NAVSTA PS. The researchers set up an area in one wing of the greenhouse that measured approximately 20 square feet and maybe 1 foot deep and created an environment suitable for the invertebrates they were working with and cultured them in that system for 1 to 2 years (Olson 2014). The annual report for the Johnston Atoll Bioenvironmental Program for fiscal year 1969 (Held 1969) states that the mobile field laboratory was moved from Seattle to Astoria, Oregon on June 19, 1968. In about 1970, the study was terminated. It was reported that according to standard practice, the radioactive coral grit would have been packaged and sent to Hanford Nuclear Reservation (Hanford) as radioactive waste for disposal (Olson 2014). The research performed during this PA, did not turn up any documents confirming the packaging, transport, and disposal of this material at Hanford. A U.S. Department of Agriculture 1969 permit (Andrews 1969) obtained by the Laboratory of Radiation Ecology for shipping coral soils from Bikini Island to the United States indicates that the soil would be disposed of by incineration offsite. Based on this permit for a different experiment by the same researchers, there is a possibility that the soil may have been incinerated offsite, but the location is unknown.

Historical documents about the radiological experiments conducted by the Laboratory of Radiation Ecology indicate that strontium (Sr-90), tritium (H-3), and plutonium (Pu-239) were radionuclides being evaluated in experiments (UW 1966 and 1968) during the radiological experiments performed in former Building 15.

University of Washington budget documents indicated that tritium may have been planned for use as part of research in the greenhouse and the mobile field laboratory. The thorough archival research conducted and personnel interviewed (Olsen 2014) as part of this preliminary assessment did not provide any positive indication that these experiments were actually conducted at this site. Due to this lack of evidence, the removal of the building structure in 2003, and the exposure of any potential outdoor tritium contamination to the local rainfall, tritium is not being considered a PROC leaving only Pu-239 and Sr-90 as PROCs in this area of the site.

5.7 HISTORICAL RADIUM CLEANUP

Navy personnel were aware of an incident in 1970 during which barrels containing radioluminescent aircraft instruments were discovered in an area north of a storage pad that was located east of the Site on what is now NOAA property. The Navy had temporarily stored drums containing these instruments on a storage pad and shipped the drums to Hanford for disposal on August 21, 1970 (Seattle Times 1976b). This incident is evidence of the use of radiological materials at the former NAVSTA PS.

The Navy determined that radiological materials leaked from the drums contaminating a small volume of soil. This area of soil was reportedly decontaminated, and approximately 30 cubic feet of soil were removed and sent to a radioactive waste disposal site. Navy records show that the drums, containing discarded instrument dials, and soil from the area were shipped to a burial ground at Hanford (RASO 1976). Information provided by NOAA (2016) indicates that both the Navy and the Washington State Department of Social and Health Services, Radiation Control Program collected soil samples for analysis in four different laboratories. The results of all four analyses confirm that the contamination was minimal -- the amount of radium involved in the spill was equivalent to the amount it would take to paint half a dozen luminous dials on wristwatches (Seattle Times 1976b).

RASO provided photographic slides with labels that indicate that they were from a RASO removal action at NAVSTA PS, dated November 1973. These photos further document the removal of contaminated soil associated with the drums containing aircraft instruments. A note card with the slides states that a technical assistance visit report was written for the removal action and those health physicists Fred Combs and Neil Jordan performed the 1973 visit (RASO 1973). However, a 1973 technical assistance visit report for NAVSTA PS was not found while reviewing historical records at RASO in Yorktown, Virginia.

In February 1976, a former NAVSTA PS employee notified a Seattle television station of radioactive contamination at Sand Point. Specifically, the former employee indicated that they observed an area near a storage pad that had been roped and posted with radiation warning signs. It is not clear when the former employee made this observation, but it appears that it would have been in 1970 during the drum removal or in 1973 during the soil removal near the storage pad. As a result of the television and newspaper news reports (Seattle Times 1976a and Seattle Post Intelligencer 1976), health physics personnel from the Puget Sound Naval Shipyard surveyed the area around the storage pad and discovered an additional plot of radiologically contaminated soil on the southeast side of the pad. Soil samples were collected, and laboratory analysis identified the contaminant as Ra-226.

In response to this 1976 discovery of additional radiologically contaminated soil, RASO made a second technical assistance visit to NAVSTA PS from February 20 to February 24, 1976 (RASO 1976). RASO personnel conducted an additional survey of the area confirming results of the Puget Sound Naval Shipyard survey. Radiation greater than background levels was found. The contaminated area was approximately 30 feet long, with a maximum width of 10 feet and 1.5 feet deep. Approximately 8.5 cubic yards of soil and grass were removed and disposed of at a radioactive waste burial site. The excavation was backfilled with clean soil and gravel. After filling the area was resurveyed, and no radiation levels in excess of background were observed (RASO 1976).

RASO personnel surveyed other areas and facilities across the station and reported that no readings greater than natural background levels or indications of buried radioactive wastes were noted during these additional surveys. The surveyed areas included the following:

- Buildings 1, 2, 15, 27, 30, and 5B
- Three NOAA hangars (1, 32, and 33)
- Engine test building (17)
- Radar building
- Control tower
- Lake Washington shoreline
- Known former dumping areas

The survey included the former instrument repair areas in which the results were also negative.

During the surveys in Building 5B, fourteen radioluminescent deck clocks and one radioluminescent depth gauge were found. All of the devices were intact and posed no internal hazard to personnel. Disposition instruction for the deck clocks and depth gauge were provided to the Navy and Naval Historical Center personnel.

A 2010 records search conducted by the Washington Office of Radiation Protection discovered a letter from the Washington State Department of Social and Health Services, Radiation Control Program to the Mayor of Seattle dated April 28, 1976, summarizing results of the February 1976 removal activities (NOAA 2016).

5.8 BASE REALIGNMENT AND CLOSURE

NAVFAC NW oversaw the environmental restoration of NAVSTA PS through the creation and evolution of the BRAC Cleanup Plan (BCP), a dynamic document updated regularly to reflect the status and strategies of remedial actions (URS 1994a).

The schedule and strategies presented in the BCP streamlined the necessary response actions associated with remediation in order to facilitate the earliest disposal and reuse of NAVSTA PS. As part of the BCP, the Navy involved the Sand Point community in the cleanup program by making information available, providing opportunities for public comment, and establishing and seeking public participation through an advisory committee (URS 1994b).

The BRAC PMO became involved at NAVSTA PS in 2009, when the City of Seattle sent documents providing results of radiation screening surveys at the Site that identified radiological contamination (Ostrowski 2009). The documents described screening-level radiation surveys

that were conducted in Building 2, Building 27, sewage pump house 116, and the surrounding exterior.

In accordance with CERCLA 120(h), the Navy conducted a radiological RI and a TCRA to remove radiological contamination in these areas. Ecology is the lead regulatory agency for the radiological cleanup at NAVSTA PS. The TCRA is following the substantive requirements of CERCLA and the NCP.

5.9 RECENT INVESTIGATIONS AND REMOVALS

During 2009 planning for proposed renovations of Building 27, the City of Seattle reviewed historical drawings that identified rooms labeled “radium room” and “instrument shop” in the south shed of Building 27. After this discovery, the City of Seattle also reviewed drawings for Building 2 that identified a space labeled “instrument shop.” The City completed a radiation survey of Building 27 in spring 2009 (Argus 2009), after which the Navy took immediate action to conduct a formal investigation of the extent of radiological contamination in and outside Buildings 2 and 27.

In 2010, the Navy initiated radiological characterization surveys, sampling, limited contamination removal actions, and waste management activities as part of a radiological RI conducted in and around Buildings 2 and 27. Because of the potential for radiological contamination in the sewers, radiological surveys were conducted in the sanitary sewer, storm drains, and sewage pump houses 98, 116, and 117 located in the vicinity of Building 27. The results of these activities are described in a radiological RI report (Shaw E&I 2011) and are summarized in Section 5.9.1.

Currently, the Navy has completed the field portion of a TCRA in and around Buildings 2, 12, and 27. The areas of focus for the TCRA are summarized in Section 5.9.2. The results of these activities will be presented in a TCRA After Action Report that is expected to be completed in summer of 2016.

5.9.1 Results of Radiological Remedial Investigation

Radiological characterization surveys were conducted within Buildings 2 and 27. Pipe location surveys, tracer surveys, and mapping were conducted at sewage pump houses 98, 116, and 117; and within the sanitary sewer and storm drain system in the vicinity of Buildings 2 and 27. Sludge samples were collected from within manholes and catch basins surrounding Building 27 (Shaw E&I 2011).

During an investigation to establish a background reference area for soil, a survey of the area west of Building 27 detected elevated radiological activity. As a result, gamma walkover surveys were conducted over areas surrounding Buildings 2, 12, and 27 that were unpaved during the 1940s.

Project cleanup criteria for the RI were calculated as follows:

- Ra-226 in sludge: 3.85 picocuries per gram (pCi/g)
- Ra-226 in soil: 1.40 pCi/g
- Sr-90 in soil: 3.76 pCi/g
- Ra-226 on equipment and building surfaces: 100 disintegrations per minute (dpm)/100 square centimeters (cm²)
- Beta-gamma emitters on equipment and building surfaces: 5,000 dpm /100 cm²

The results of the radiological surveys conducted by the Navy identified radiological contamination that exceeded the project cleanup criteria in the south shed area of Building 27, within and adjacent to the former instrument shops in Building 2, in storm drain catch basins CB-1 and CB-3 south of Building 27, and in soil from historically unpaved areas south and west of Building 27, north and east of Building 12, and south of Building 2 (Shaw E&I 2011).

5.9.2 Results of Time Critical Removal Actions

The Navy has completed a TCRA to remediate the radiologically contaminated areas in and around Buildings 2 and 27 identified in the radiological RI (Shaw E&I 2011). The field portion of the TCRA started in July 2013 and ended in May 2015. The areas of focus for this TCRA were the central portion of Building 2 including a second floor sink and drain line that traverses east to the NOAA property line; the south shed of Building 27; the catch basins south of Building 27 and the storm drain lines connected to these catch basins that flow into Lake Washington; and soil areas containing hot spots adjacent to Buildings 2, 12, and 27, as described in the radiological RI. The project release criteria planned to be used for the TCRA are included in Table 5-3.

The removal actions completed as part of the TCRA included the removal of radiologically contaminated building materials in Buildings 2 and 27; removal of radiologically contaminated soil surrounding Buildings 2, 12, and 27; removal of the radiologically contaminated sediments within the storm drain system components; and partial replacement of storm drain lines associated with Buildings 2 and 27 (Navy 2013). The associated TCRA After Action Report is expected to be completed in the summer of 2016.

5.10 PROBABLE SOURCE TYPES AND SIZES

As stated in Section 5.6, only radium sources, such as aircraft instrumentation and deck clocks painted with radioluminescent paint, and plutonium-contaminated coral grit were confirmed at the Site.

Radium contamination was also found in the soil surrounding Buildings 2, 12, and 27 and in catch basins of the storm drain system surrounding these buildings. The probable source for this contamination around Buildings 2 and 27 appears to be discarded wash water generated during daily mopping of floors within these buildings. The radiological contamination near the exterior of Building 12 was identified during the radiological RI when the surveys were expanded to include these unpaved areas because of their proximity to Buildings 2 and 27 (Shaw E&I 2001). It is believed that some of the contaminated soil that was present on the south side of Building 27 was transported and deposited near Building 12 during the construction of NE NOAA Drive in the late 1970s (see Figure 6-20). Much of the extent of soil contamination and the locations of radium contamination within Buildings 2 and 27 is detailed in the radiological RI report (Shaw E&I 2011). The TCRA further refined the extent during the removal actions which will be described in detail in the TCRA After Action Report that is expected to be completed in the summer of 2016.

Cs-137 and Sr-90 were detected, but not at concentrations greater than the project release criteria. No activity was identified at former NAVSTA PS that would prove the sources of these radionuclides. However, Cs-137 and Sr-90 are associated with global fallout from atmospheric testing of nuclear weapons or cleaning and maintenance of contaminated planes or ships exposed during monitoring activities associated with nuclear testing. Cs-137 and Sr-90 have been found to concentrate in areas where water collects.

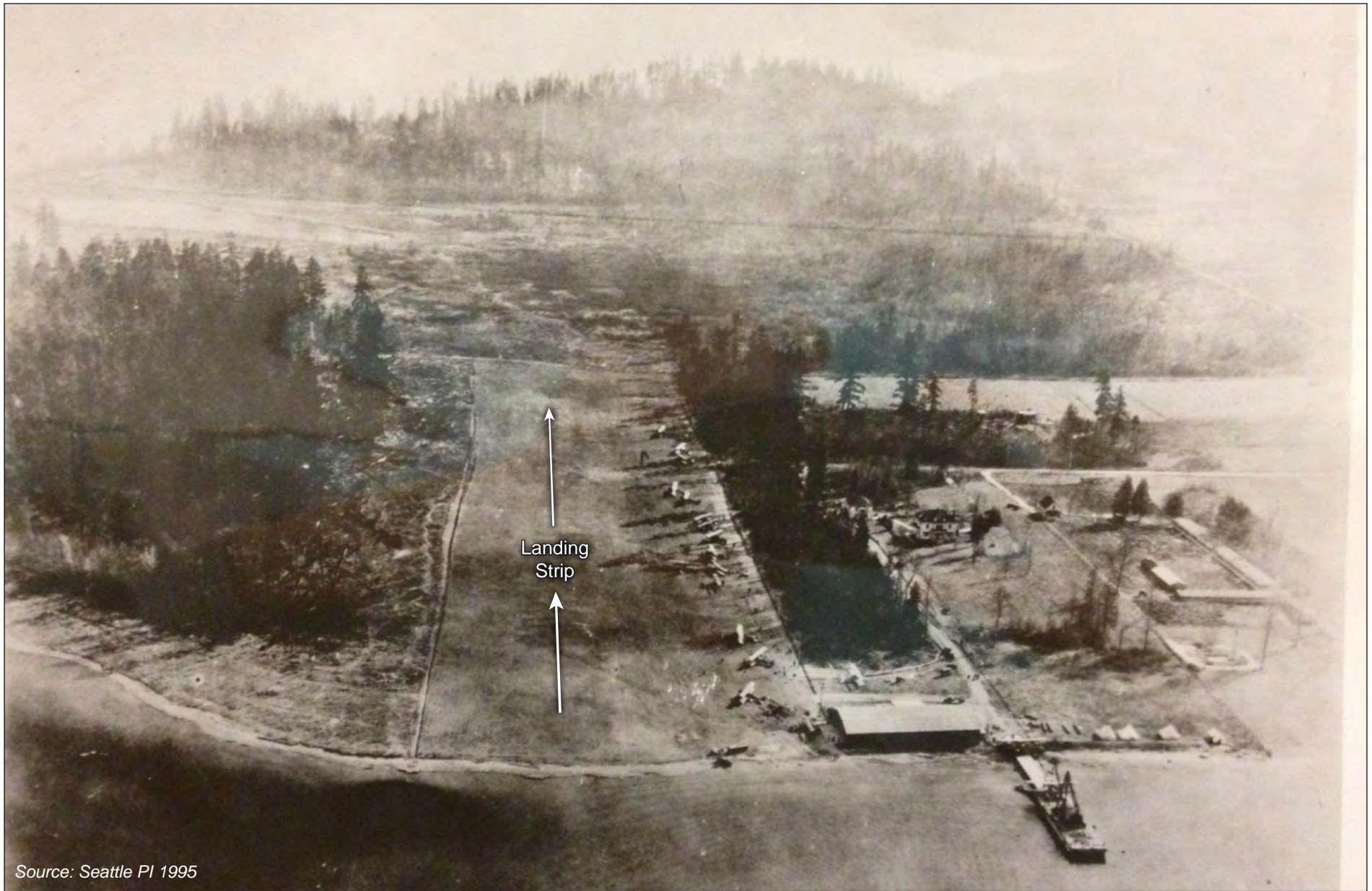
The other confirmed activity that involved the use of radioactive materials at the site was the use of plutonium-contaminated coral grit for research purposes by the University of Washington, Laboratory of Radiation Ecology. At the end of the research project, the 200 to 300 pounds of radioactive coral grit used in Building 15 would have been packaged and sent to Hanford for disposal, according to standard practice (Olson 2014). This PA was not able to definitively locate documents confirming the packaging and transport of this material to Hanford. However, it may have been incinerated offsite as suggested by a U.S. Department of Agriculture permit for transporting coral soil from Bikini Atoll into the U.S. which was obtained by the same group (University of Washington Laboratory of Radiation Ecology) as explained in Section 5.6.3.

Potential sources of radiological contamination at NAVSTA PS include the following:

- Buildings with historical activities in which PROCs were used

- Contaminated soil in grassy areas near buildings with historical activities in which PROCs were used
- Some contaminated soil south of Building 27 may have been mechanically transported to other areas (i.e., near Building 12) during the construction of NE NOAA Drive
- Storm drain system infrastructure near buildings with historical activities in which PROCs were used
- Sediments along the Pontiac Bay shoreline of Lake Washington where storm drain outfalls discharge

Buildings or areas that may have had historical activities of potential concern as it relates to activities using radiological materials within the Site boundaries at former NAVSTA PS are indicated in yellow highlighting on Plate 1. These areas provided the focus of the archival research conducted for this PA.



Source: Seattle PI 1995

U.S. NAVY

Figure 5-1
Landing Strip at Sand Point in 1925

Delivery Order 0076
NAVSTA PS
Seattle, Washington
PA Report



The transformation from a quiet grass field into a major air base was in full swing in 1939 with construction of what was called the finest hangars in the Navy well under way.

Source: *Stuhaug 1992*

U.S. NAVY

Figure 5-2
Construction at NAVSTA PS in 1939

Delivery Order 0076
NAVSTA PS
Seattle, Washington
PA Report

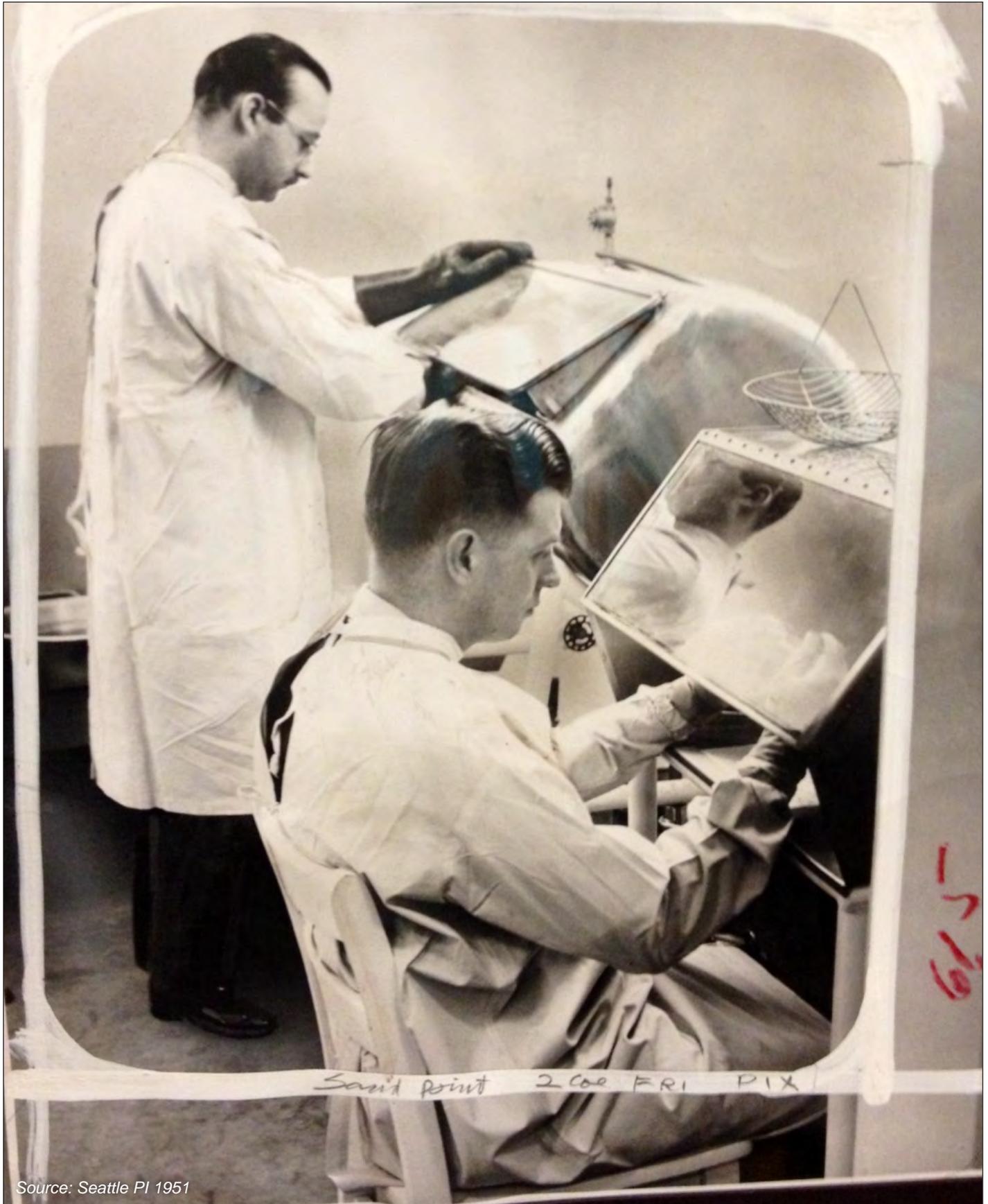


Source: U.S. Department of the Navy 1941

U.S. NAVY

**Figure 5-3
NAVSTA PS as of 1941**

Delivery Order 0076
NAVSTA PS
Seattle, Washington
PA Report

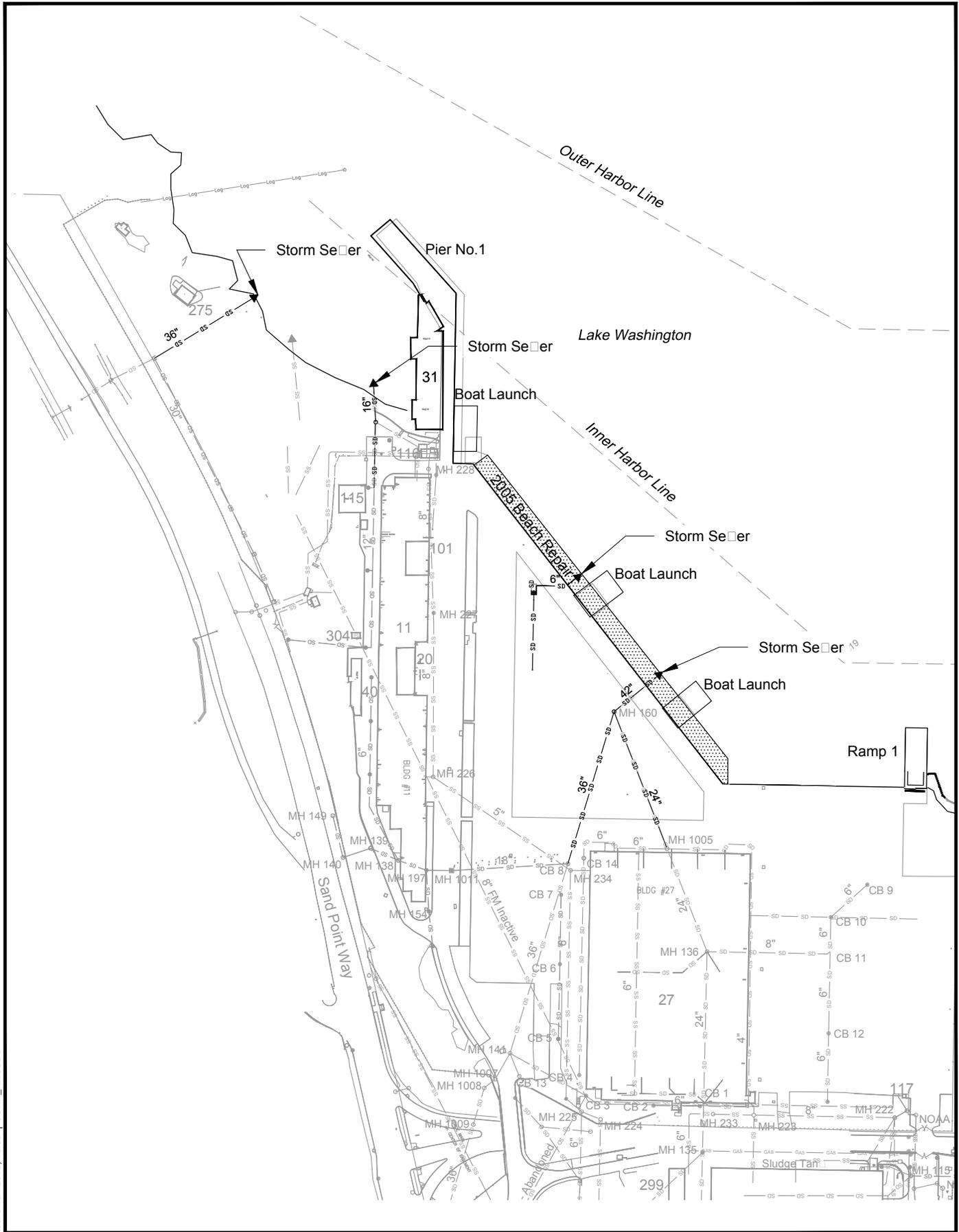


Source: Seattle PI 1951

U.S. NAVY

Figure 5-4
Harold Greenwood and John Swinney Wash
Radium off of Aircraft Instrument Dials at
NAVSTA PS on February 14, 1951

Delivery Order 0076
NAVSTA PS
Seattle, Washington
PA Report



J:\GIS\Projects\NAVY\MAGNUSON\ID076\Work\Plan\Fig 5-5 Lake Shoreline.dwg
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U.S. NAVY



Figure 5-5
Configuration of Lake Washington
Shoreline Resulting From Major
Modifications Performed by the City of Seattle

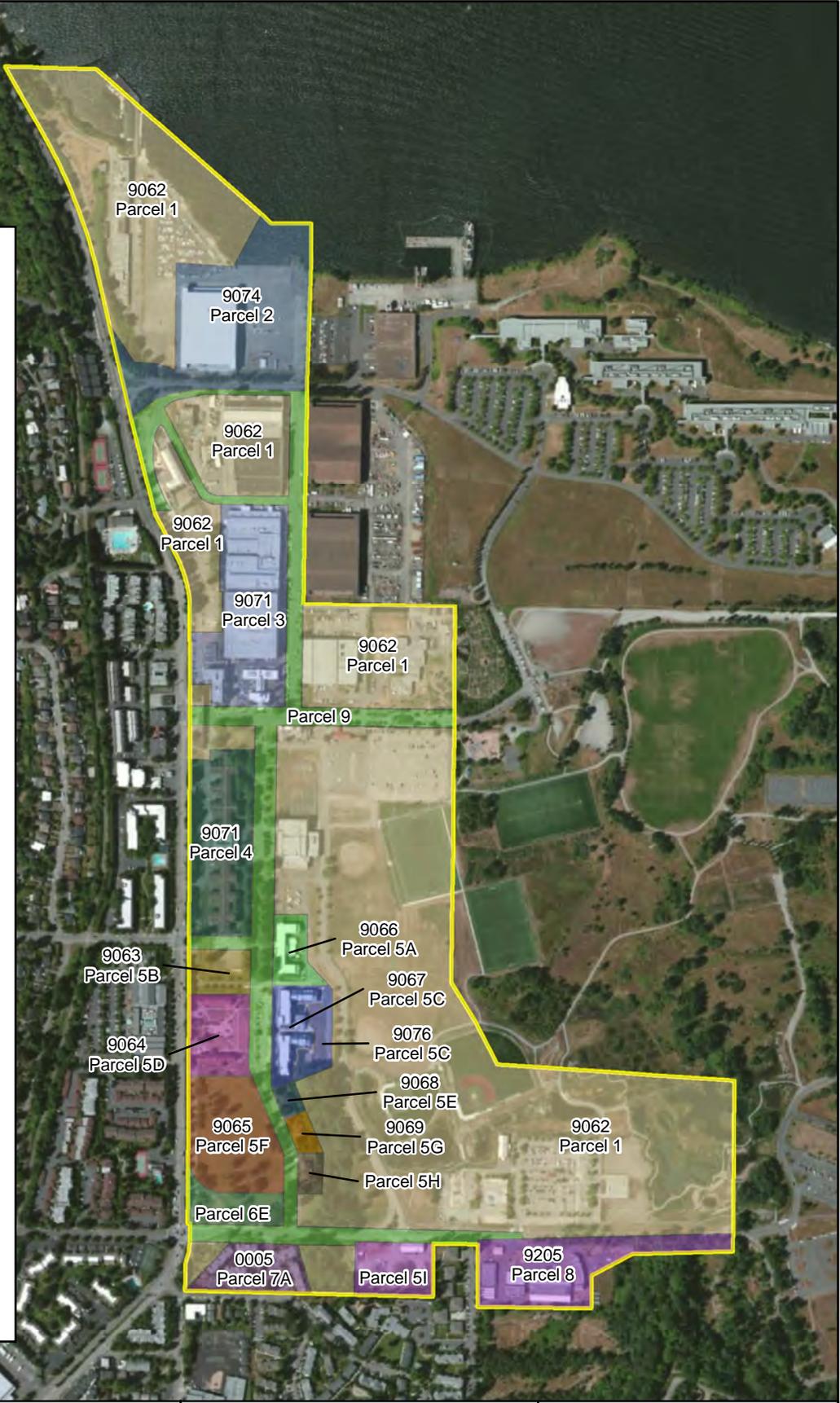
Delivery Order 0076
 NAVSTA PS
 Seattle, WA
 PA REPORT

Legend

 Site Boundary

Parcels from KC Assessor

-  Parcel 1
-  Parcel 2
-  Parcel 3
-  Parcel 4
-  Parcel 5A
-  Parcel 5B
-  Parcel 5C
-  Parcel 5D
-  Parcel 5E
-  Parcel 5F
-  Parcel 5G
-  Parcel 5H
-  Parcel 5I
-  Parcel 6E
-  Parcel 7A
-  Parcel 8
-  Parcel 9



U.S. NAVY

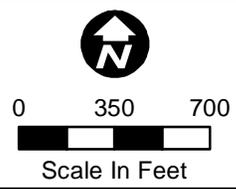
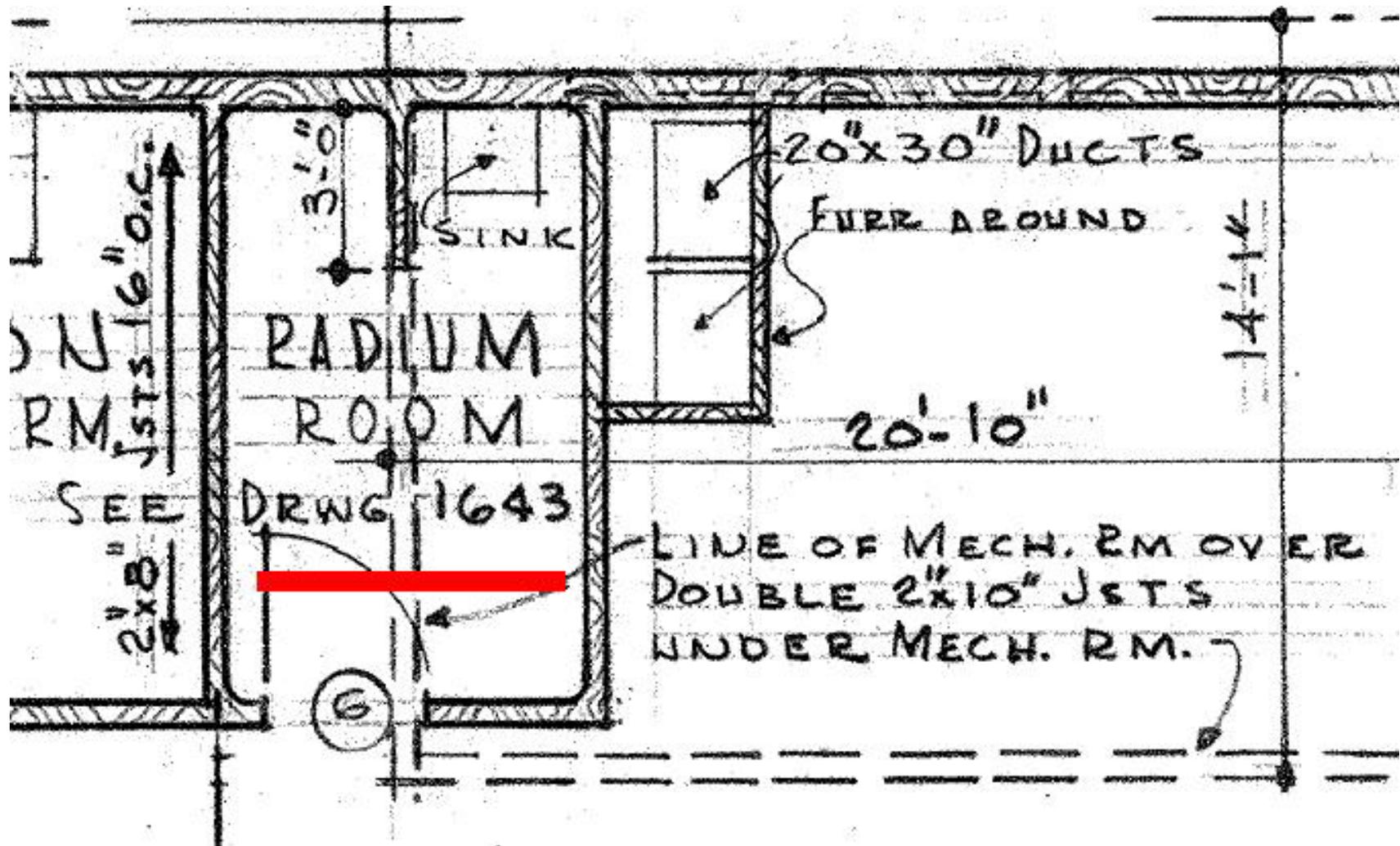


Figure 5-6
Study Area Showing
Parcels as Recorded
by King County Assessors

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Source: Navy 1943b

U.S. NAVY

Figure 5-7
Drawing Showing Confirmed Presence of
Radium Room in Building 27 in 1943

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**Table 5-1
 Types of Aircraft at Former Naval Station Puget Sound**

Year	Squadron	Type
1935	VP-12	PBY
1936	--	2-engine Biplane (Flying Boat)
	VMS-9R	O2C Curtis Helldivers
1938	VS-16R	single engine biplane
1939	--	4-engine patrol plane (PBY-like)
	VB-2, VB-4, VF-2, VT-3	Carrier Group from USS Saratoga
	--	SBC4s single-engine biplanes
1942	Patrol Wing 4 / Air Wing 4	PBY and PBY3
1943	Naval Air Transport VR-5	--
	Air Group 10	Torpedo Bombers
1944	Air Groups 1, 12, 13, 15, 25, 50, 60	--
	VPB-61 and -62	PBY
	VPB-135 and -139	PV-1 Ventura
1946	--	PBY, JRF, J2F, J4F
1947	NARTU	NF4U-10
1957	--	P4Y-2
--	--	F6Fs
--	--	JF-3 amphibian
--	--	OJ-10
--	--	OJ-2
--	--	SBC-4
--	--	SBDs
--	--	SF-1
--	--	TBFs
--	--	F6Fs

-- - not identified in reviewed references

Table 5-2
Transfer of NAVSTA PS to City of Seattle and Other Entities under BRAC

Parcel (Lots)	Acres	Transferee	Date
1, 3 (E), 6	93	City of Seattle	Mar-99
2 (Building 27)	8	City of Seattle	Jan-03
2 (NE NOAA Drive)	3	NOAA	Aug-07
3 (A-D)	7	University of Washington	Sep-99
4 (A, Building 9)	5	University of Washington	Oct-99
5 (A-I)	15.5	City of Seattle (Homeless Assistance)	Apr-98
7 (A)	2.2	University of Washington	Jan-99
8	4.9	U.S. Geological Survey	Nov-98
9 (road structures)	14	City of Seattle	Dec-99
9A	13.5	City of Seattle	Aug-98

**Table 5-3
 Time-Critical Removal Action Project Release Criteria**

Radionuclide of Concern	Surfaces		Soil/Sediment		
	Building Surfaces (dpm/100 cm ²) ^a	Dose (mrem/y)	Radiological Remedial Investigation Mean Background (pCi/g)	Dose-Based Guideline (pCi/g) ^b	Release Criteria (pCi/g) ^{c,d}
Cesium-137	5,000	1.64	Not determined	25.63	25.63
Radium-226	100	1.71	0.467	1.07	1.54
Strontium-90	1,000	0.685	0.055	9.45	9.51

Source:

Final Action Memorandum, Time-Critical Removal Action, Former Naval Station Puget Sound, Seattle, Washington (Navy 2013)^e

Note(s):

^aThese limits are based on U.S. Atomic Energy Commission Regulatory Guide 1.86 (1974). Limits for removable surface activity are 20 percent of these values.

^bThe resulting dose is based on 15 mrem/year using RESRAD-Build Version 3.3 or RESRAD Version 6.5.

^cThe off-site laboratory will ensure that the MDA meets the listed project release criteria by increasing the number of samples or counting time as necessary. The MDA is defined as the lowest net response level, in counts, that can be seen with a fixed level of certainty, customarily 95 percent. The MDA is calculated per sample by considering background counts, amount of sample used, and counting time.

^dRelease criteria for soil/sediment is the summation of the dose-based concentration guideline (15 mrem/year) and the Radiological Remedial Investigation mean background concentration (0.467 pCi/g for Radium-226 and 0.055 pCi/g for Strontium-90). Mean background has not been established for Cesium-137. A background investigation and establishment of site background levels was conducted prior to implementation of the time-critical removal action.

^eNew release criteria established during the TRCA will be published in the TCRA After Action Report that is expected to be completed in the summer of 2016.

dpm/100 cm² - denotes disintegrations per minute per 100 square centimeters

MDA denotes minimum detectable activity.

mrem/y denotes - millirems per year.

pCi/g denotes picocuries per gram

6.0 FINDINGS AND RECOMMENDATIONS

This section describes the findings of the PA for 11 sites (buildings/structures) at NAVSTA PS that have been designated as AOPCs with respect to radiological contamination:

- Building 2 – O&R shop
- Building 11 – public works repair shops
- Building 15 – greenhouse (previously existing)
- Building 27 – seaplane hangar O&R shop
- Building 30 – Naval Reserve hangar
- Structure 120 – sludge pit at the southeast corner of Building 2
- Building 283 – oil/water separator at former plane washing shed
- Building 308 – welding shop
- Sanitary sewer system
- Storm drain system (including downgradient Lake Washington sediment)
- NE NOAA Drive

Each of these locations is identified in yellow on the site map (Plate 1).

The Navy assessed historical operations at NAVSTA PS to identify AOPCs within the BRAC-transferred property with the potential for radiological contamination; however, during the research, information pertaining to adjacent non-BRAC transferred property was also found as noted in Section 6.12. Areas without known or potential radioactive contamination are not considered for radiological investigation. The various media at an AOPC that could exhibit potential radioactive contamination include:

- Surface soil: The top layer (0 to 6 inches) of soil, fill, gravel, waste piles, concrete, or asphalt that is available for direct exposure.
- Subsurface soil: Solid materials and media found below the surface soils.
- Sediment: Solid material at the bottom of a water body
- Sludge: Solid material in the bottom of a manhole, catch basin, or oil/water separator
- Surface water: Waters found in streams, rivers, lakes, ponds, wetlands, and oceans as well as coastal tidal waters

- Groundwater: Waters contained in subsurface soils and rocks
- Air: Atmosphere that becomes a migration pathway for resuspension and dispersals of radioactive contamination and contaminated media.
- Structures: Man-made structures constructed either above or below ground.
- Drainage systems: Sanitary sewers, storm drains, septic systems and leach fields, and the sludge contained therein.

For each AOPC, each type of medium was rated in terms of its potential for contamination. For this PA the rating system as defined in MARSSIM was used. These ratings may change if additional historical information becomes available or further information is developed during future surveys. The assessment ratings of media at an AOPC include the following:

- High: Evidence of contamination in the medium or migration pathway has been identified.
- Moderate: The potential for contamination in the medium or migration pathway exists, but the extent has not been fully assessed.
- Low: The potential for contamination in the medium or migration pathway is remote.
- None: Evidence of contamination in the specific medium or migration pathway has not been found, or known contamination has been removed, and surveys indicate that the medium or migration pathways meet the current release criteria.

The assessment of each AOPC included an evaluation of the migration pathways. The migration pathways discussed in each of the following subsections are based on current conditions which accounts for recent radiological cleanup activities. The above rating criteria were also used to evaluate the potential migration pathways.

6.1 BUILDING 2 – OVERHAUL AND REPAIR SHOP

Site Description: Building 2 was constructed in 1929 and enlarged to its current size of 144,232 square feet in 1941. It housed administrative offices and aircraft repair facilities that included a machine shop, a sand blast shop, a paint shop, two welding shops, a wash platform, a parts cleaning area, a parachute loft, a parachute shop, a bomb sight and automatic pilot maintenance room, and three instrument shops. Historical floor plans for this building were reviewed to determine the locations of operational activities within the building. A preliminary sketch (Navy

1940c) of the large southern expansion of the building shows three potential locations of instrument rooms on the second floor. However, subsequent drawings show no evidence of instrument rooms in those locations. The layout of the historical activities of concern is shown on Figure 6-1. A current photograph of Building 2 is provided as Figure 6-2. Building 2 has also been used for Marine Corps training activities, heavy equipment storage and maintenance, Coast Guard Reserve activities, and a film studio. Active aircraft maintenance ceased when NAVSTA PS was decommissioned as a naval air station in 1970.

Former Radiological Use: As the O&R shop, an area on the second floor mezzanine of this building contained three instrument shops that repaired aircraft instruments. In some or all of these shops, the activities included the application of radium paint on instrument dials as confirmed by analyses and subsequent remediation. Cs-137 was detected at concentrations below project cleanup levels in a sediment trap located adjacent to the west side of Building 2 at very low concentrations. No point source was identified for this Cs-137.

Although no evidence of their uses was established during this PA, thoriated welding rods could have been used in the welding shops identified in this building after 1949. Because a survey was conducted by the TCRA contractor and no radiological contamination was detected in the welding shops, the welding shops are not considered an AOPC.

The parachute loft and parachute shop may have contained personnel markers which may have contained radioactive material. These rooms were included as part of a scoping survey during the radiological RI (Shaw E&I 2011). There was no report of finding personnel markers. Additionally, activity levels within the square meter test areas (referred to as “cells” in the radiological RI) within these two rooms did not exceed the cleanup criteria of 100 disintegrations per minute per 100 cm² (Figure 17 of Shaw E&I 2011). Therefore, the former parachute loft and parachute shop are not considered AOPCs.

The wash platform that was shown in a 1939 drawing and was located at the northeast exterior corner of Building 2 appears to have been removed. The drain from the wash platform drained into the storm drain system at the northeast corner of Building 2 that was remediated as part of the recent TCRA.

Current Site Use: The building is currently vacant except for one area in the northwest corner of the ground floor that houses the offices of the Seattle Conservation Corps. The use of Building 2 is restricted to uses which do not penetrate the building’s concrete slab. Soil sampling under the slab reveal metals above MTCA levels (DoI 1999).

Potential Radionuclides of Concern: Ra-226, Cs-137, Sr-90, and Th-232

Previous Radiological Investigations: Three radiological investigations have been conducted in Building 2 by the Navy. A radiological materials survey was conducted as part of a RASO technical assistance visit in 1976 (RASO 1976). In 2010, the Navy initiated radiological characterization surveys, sampling, limited contamination removal actions, and waste management activities as part of a Radiological RI that included the former instrument shops in Building 2 (Shaw E&I 2011). Between 2013 and 2015, the Navy conducted a TCRA to remediate the radiologically contaminated areas in and around Buildings 2 that were identified in the radiological RI and conducted additional scoping surveys of grassy areas in the immediate vicinity of Building 2. The areas of focus for this TCRA were the central portion of Building 2 including a sink drain line that traverses east to the NOAA property line, radiologically contaminated soil, and radiologically contaminated components of the storm drain system. The results of the TCRA will be presented in the TCRA After Action Report that is expected to be completed in the summer of 2016.

Radiological contamination (Ra-226) was limited to structure surfaces in and around the two instrument shops that were located on the second floor mezzanine. This includes the wood flooring beneath the floor tile, wall board, a brick wall behind the removed wall board, the ventilation system ducts, and a drain pipe associated with a former sink in the instrument shop. This contamination was concentrated around the second floor instrument shops. Radiological contamination (Ra-226) was also identified in limited areas of shallow soil located along the south and east side of Building 2. The vertical extent of the affected soil was reported to be less than 2 feet bgs. These locations are shown on Figure 6-1.

Additional remedial activities have been completed as part of the TCRA. Contaminated building material and soil adjacent to the building were removed and disposed of offsite. The Navy received a letter from the Washington DoH, dated January 27, 2015, stating that they reviewed the site-specific information relating to Building 2 and is allowing unrestricted use of the structure (WDoH 2015).

Site Contamination Potential: Low

Contaminated Media:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - Low
- Drainage systems - Low

Current Potential Migration Pathways:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - None
- Drainage systems - Low

Recommended Actions: Because the Navy conducted radiological surveys and removals inside Building 2, performed soil removal actions south and northeast of Building 2, removed contaminated drain lines within the building, and cleaned or replaced contaminated components of the storm drain system in the vicinity of Building 2, no further interior surveys or soil investigation immediately adjacent to the building is recommended. Washington DoH has approved unrestricted use of the Building 2 structure (WDoH 2015).

6.2 BUILDING 11 – PUBLIC WORKS REPAIR SHOPS

Site Description: The southern portion of the single-floor public works repair shops (Building 11) was initially constructed in 1940. The building was enlarged to its reported size of 59,206 square feet during the latter half of the 1940s by the construction of a two-story addition north of the existing structure. A 1943 construction diagram (Navy 1943a) identifies a planned blacksmith and welding shop in the northeast corner of the ground floor of the addition. The layout of the activities within this building is shown on Figure 6-3. This structure is still present at former NAVSTA PS and has been converted to non-industrial use since the property was transferred to the City of Seattle. A current photograph of Building 11 is provided as Figure 6-4.

Former Radiological Use: This building had the public works repair shops, an area on the first floor was the location of a blacksmith and welding shop. Although no evidence of their uses was established during this PA, thoriated welding rods could have been used in the welding shops identified in this building after 1949.

Current Site Use: Building 11 is currently occupied by the Waldorf School, the Cascade Bicycle Club, and the Sail Wand Point Boating Program operated by the Seattle Department of Parks and Recreation. The use of the paved tarmac east of Building 11 by Sail Wand Point Boating is restricted to uses which do not penetrate the tarmac. Soil sampling under the slab reveal petroleum concentrations above MTCA levels (DoI 1999).

Potential Radionuclides of Concern: Th-232

Previous Radiological Investigations: A radiological materials survey of Building 11 was conducted on November 9-10, 2013 for the Seattle Department of Parks and Recreation to verify the absence of any residual radioactive material resulting from work conducted within the building (SoundEarth 2013). This survey identified no areas with measured radiation greater than the background level. The Navy conducted a confirmatory survey of the blacksmith shop in 2014, and no radiological contamination was found. The results of the Navy survey will be presented in a report in 2016.

Site Contamination Potential: None

Contaminated Media:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - None
- Drainage systems - Low

Current Potential Migration Pathways:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - None
- Drainage systems - Low

Recommended Action: Because previous radiological surveys conducted in Building 11 identified no areas where measured levels of radiation were greater than the background level, no further action is recommended.

6.3 BUILDING 15 – GREENHOUSE

Site Description: A single-wing greenhouse (Building 15) was constructed in 1938. In early 1940, a second greenhouse wing was added to the structure. The resulting structure consisting of two independent greenhouse areas attached to an indoor work area with rest rooms reportedly covered an area of 3,269 square feet. The period of time that Building 15 was actively used as a

greenhouse is uncertain. From 1966 to approximately 1970, the structure was leased to the University of Washington, Laboratory of Radiation Ecology. In 1975, the structure was remodeled by joining the two greenhouse areas under a single gable roof and enclosing the greenhouse walls with wood sheathing. The resulting structure was used as a hobby shop. The layout of this building is shown on Figure 6-5. A current photograph of the former Building 15 site is provided as Figure 6-6.

Former Radiological Use: During its lease, the University of Washington, Laboratory of Radiation Ecology, used the building as laboratory space according to an interview conducted with a former University of Washington employee (Olson 2014) and supporting historical documents. During this period, approximately 300 pounds of radioactive coral grit was reportedly transported to this building from Johnston Island in the central Pacific after the explosion of a nuclear-tipped rocket on its Johnston Island launch pad. According to the interview with the former University of Washington research associate, the plutonium-contaminated grit was placed in a terrarium in Building 15, for biological research. The Laboratory of Radiation Ecology parked a mobile field laboratory containing analytical equipment next to the greenhouse for testing samples during the experimentation there. The mobile field laboratory was moved from Seattle to Astoria, Oregon on June 19, 1968 (Held 1969). In about 1969 or 1970, the study was terminated.

It was reported that according to standard practice, the radioactive coral grit would have been packaged and sent to Hanford Nuclear Reservation (Hanford) as radioactive waste for disposal (Olson 2014). The research performed during this PA, did not find any documents confirming the packaging, transport, and disposal of this material at Hanford. However, there is a possibility that the soil may have been incinerated offsite. A U.S. Department of Agriculture 1969 permit (Andrews 1969) obtained by the Laboratory of Radiation Ecology for shipping coral soils from Bikini Island to the United States indicates that the soil would be disposed of by incineration offsite.

Historical documents about the radiological experiments conducted by the Laboratory of Radiation Ecology indicate that strontium (Sr-90), tritium (H-3), and plutonium were radionuclides being evaluated in experiments (UW 1966 and 1968) during the radiological experiments performed in former Building 15.

University of Washington budget documents indicated that tritium may have been planned for use as part of research in the greenhouse and the mobile field laboratory. The thorough archival research conducted and personnel interviewed (Olsen 2014) as part of this preliminary assessment did not provide any positive indication that these experiments were actually conducted at this site. Due to this lack of evidence, the removal of the building structure in 2003, and the exposure of any potential outdoor tritium contamination to the local rainfall, tritium is not being considered a PROC leaving Pu-239 and Sr-90 as PROCs for this area.

Current Site Use: The structure was demolished in the 2003 as part of a controlled burn conducted by the Seattle Fire Department. The site currently consists of bare ground; nothing of the former structure remains.

Potential Radionuclides of Concern: Sr-90, and Pu-239

Previous Radiological Investigations: None

Site Contamination Potential: Unlikely

Contaminated Media:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - None
- Drainage systems - None

Current Potential Migration Pathways:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - None
- Drainage systems - None

Recommended Action: Because no records of a radiological survey of Building 15 or documentation of the off-site disposal of the radiologically contaminated coral grit were found during this PA, it is recommended that the Navy conduct a scoping survey of surface and subsurface soil at the site.

6.4 BUILDING 27 – SEAPLANE HANGAR O&R SHOP

Site Description: The seaplane hangar portion of Building 27 was planned in 1937 (Navy 1927) and constructed in 1938 (Navy 1938). The two-story south shed that housed offices, store rooms, and O&R shops was added to the building in 1945, bringing the total area of the structure to 101,787 square feet (Navy 1953). A shared wall separated the main hangar and the shops in

the south shed. Four stairways provided access to the second floor of the south shed: one at the west end of the south shed, one at the east end of the south shed, and two in the middle of the south shed. One of the middle stairways led outside through the south wall via the quarterdeck and the other led through the north wall into the main hangar. Historical floor plans for this building were reviewed to determine the locations of operational activities within the building. The layout of the activities within the south shed portion of Building 27, as shown on a 1943 floor plan, is indicated on Figure 6-7. A current photograph of the Building 27 is provided as Figure 6-8.

Former Radiological Use: The second floor of the south shed contained a shop in which aircraft instruments were repaired (“instrument shop” on Figure 6-7) (Navy 1943b). Facility personnel refurbished aircraft instrument dials using radium paint, most likely during the 1940s. A room on the second floor (“radium room” on Figure 6-7) (Navy 1943b) was likely used for radium paint removal and application on aircraft instruments. According to the Radiological RI (Shaw E&I 2011), Sr-90 was detected in a drainpipe at very low concentrations.

Potential Radionuclides of Concern: Ra-226 and Sr-90

Previous Radiological Investigations: Three radiological investigations have been conducted in Building 27 by the Navy. A radiological materials survey was conducted as part of a RASO technical assistance visit in 1976 (RASO 1976). In 2010, the Navy initiated radiological characterization surveys, sampling, limited contamination removal actions, and waste management activities as part of a Radiological RI that included the south shed portion of Building 27 (Shaw E&I 2011). Between 2013 and 2015, the Navy conducted a TCRA to remediate the radiologically contaminated areas in and around Buildings 27 that were identified in the radiological RI. This included the complete demolition of the south shed portion of the building, excavation and off-site disposal of radiologically contaminated soil, and the restoration or removal and replacement of radiologically contaminated components of the storm drain system. The results of the TCRA will be documented in the TCRA After Action Report that is expected to be completed in the summer of 2016.

Radiological contamination (Ra-226) was limited to structural surfaces in the south shed and the two existing stairways located at the southeast and southwest corners of Building 27 (the east and west ends of the south shed). The contaminated surfaces include the second floor wood flooring beneath the floor tile, the floor joists, the wall board, and to a limited extent the ducts of the ventilation system. Radiological contamination was also found on the concrete floor of the first floor welding shop where a drainpipe from the second floor penetrated the concrete. It has been reported that the radiological contamination in the south shed probably originated in the instrument shop and was spread throughout the building by floor mopping.

Radiological contamination (Ra-226) was also identified in two storm drain catch basins south of Building 27 and in shallow soil in unpaved areas along the south side and west side of the building. The vertical extent of this affected soil was reported to be less than 2 feet bgs. These catch basins and the area of planned soil removal associated with the TCRA are shown on Figure 6-7. The source of the radiological contamination in soil appears to be the historical release of Ra-226-contaminated floor mopping water resulting from past cleaning activities.

Additional remedial activities have been completed as part of the TCRA. Contaminated building material and soil adjacent to the building were removed and disposed of offsite. The Navy received a letter from the Washington DoH, dated January 27, 2015, stating that they reviewed the site-specific information relating to Building 27 and is allowing unrestricted use of the structure (WDoH 2015).

Site Contamination Potential: None (after completion of the TCRA)

Contaminated Media:

- Surface soil - None
- Subsurface soil - None
- Surface water - Low
- Groundwater - Low
- Air - None
- Structures - None
- Drainage systems - None

Current Potential Migration Pathways:

- Surface soil - None
 - Subsurface soil - Low
 - Surface Water - Low
 - Groundwater - Low
 - Air - None
 - Structures - None
 - Drainage systems - Low
- This migration pathway is identified as low because of the documented cleanup of portions of the storm drain system during TCRA.

Recommended Action: Because the Navy conducted radiological surveys and removals inside Building 27 that included demolition of the entire south shed structure, performed extensive soil removal actions along the south and southwestern portions of Building 27, and cleaned or replaced contaminated components of the storm drain system in the vicinity of Building 27, no

further interior surveys or soil investigation immediately adjacent to the building is recommended. Washington DoH has approved unrestricted use of the Building 27 structure (WDoH 2015).

6.5 BUILDING 30 – NAVAL RESERVE HANGAR

Site Description: The Naval Reserve hangar was constructed in 1938 and was enlarged to its current size of 80,066 square feet in 1940. This structure originally housed the Naval Reserve offices, barracks, club, aircraft hangar and associated maintenance shops. It also housed the Navy band, photographic studio, and tennis courts. A small instrument shop measuring approximately 20 feet by 20 feet was situated in the extreme southeast corner of the building in the 1940s. There is no evidence of sinks or drains on the construction drawings that depict the instrument shop (Navy 1940b). The absence of sinks and drains in the instrument shop suggests that it is unlikely that radium was used in significant quantities if at all. Additionally, the existence of active radioluminescent painting operations in Building 2 greatly reduces the chance of having a second radium painting shop on a base the size of former NAVSTA PS.

A welding shop was located near the same general area of the building near where the City of Seattle currently stores their files of construction drawings. The layout of the known activities (welding shop and instrument shop) within this building based on a 1940 site plan (Navy 1940a) is shown on Figure 6-9. A paint room was located in the northwest portion of the building, but there is no reason to believe that radioluminescent paint was used to paint dials and gauges in that room because it was not located near the instrument room, the radium paint operations were already established in another location on the facility, and the paint shop was adjacent to other typical aircraft maintenance shops. Active aircraft maintenance ceased when NAVSTA PS was decommissioned as a naval air station in 1970.

The southeast corner of the building that includes the areas of the former instrument shop and welding shop has been renovated significantly since the 1940s, and all original floor and wall surfaces are covered with carpeting and drywall. The most recent renovations have occurred within the past few years. A current photograph of Building 30 is provided as Figure 6-10.

Former Radiological Use: As the Naval Reserve hangar, an area in the southeast corner of the ground floor contained an instrument repair shop and a welding shop. During the research associated with this PA, no information was found indicating that radium paint was used in the instrument shop or that thoriated welding rods were used in the welding shop. Although no evidence of their uses was established, the handling and repair of radium-painted instrumentation within the shop could have resulted in the spread of radiological contamination to building surfaces. Also, thoriated welding rods could have been used in the welding shops identified in this building after 1949 when thoriated welding rods became available for use.

Current Site Use: The building is currently occupied by the Seattle Department of Parks and Recreations offices, artist studios, and a multiuse area in the former hangar.

Potential Radionuclides of Concern: Ra-226 and Th-232

Previous Radiological Investigations: A radiological material search survey of Building 30 was conducted as part of a RASO Technical Assistance Visit in 1976. No readings were greater than natural background levels during this survey.

Site Contamination Potential: Low

Contaminated Media:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - Low
- Drainage systems - Low

Current Potential Migration Pathways:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - Low
- Drainage systems - Low

Recommended Action: Although a 1976 radiological materials survey of Building 30 produced negative results, the purpose of this survey was limited to location of radioactive objects that may have been stored within the facility. There is no indication that the facility was assessed for radioactive contamination. Although the potential for radiological contamination for all media is low, additional limited inspection is recommended for the former instrument shop. This precautionary direction is based on the potential that radioluminescent instrumentation may have been serviced in the instrument shop. Because the research associated with this PA turned up no documentation that thoriated welding rods were used at Building 30 no further surveys of the former welding shop are recommended. Because the potential for radiological contamination exists, it is recommended that the Navy conduct a scoping survey of surface and subsurface soil

in the unpaved areas surrounding Building 30. Further, additional inspection may be necessary for drain systems associated with Building 30.

6.6 STRUCTURE 120 – SLUDGE PIT

Site Description: Structure 120 is a 1,000-gallon sludge pit installed in a grass area along the south wall of Building 2 near the southeast corner of the building. The majority of this structure is below grade. This pit may have formerly contained waste liquids from floor drains in maintenance shops located in the southeastern portion of Building 2. These shops include a parts cleaning shop and a welding shop. A sand blasting shop was located in an adjacent room that is not served by these floor drains. Initially this sludge pit discharged into the storm drain system, but the discharge was diverted to the sanitary sewer on an undated drawing showing planned modifications for the vehicle maintenance shop in the Marine Corps Reserve Center. The location of Structure 120 and the associated floor drains that fed the pit are shown on Figure 6-11. A current photograph of the sludge pit is provided as Figure 6-12.

Former Radiological Use: This structure could have received wash-down water from the welding shop.

Current Site Use: This structure is currently not in use.

Potential Radionuclides of Concern: Th-232

Previous Radiological Investigations: The sludge pit structure was investigated during the TCRA conducted by the Navy between 2013 and 2015. Very little material was present in the sludge pit. However, one sample was collected and analyzed. The results reported Sr-90, Ra-226, and Th-232 concentrations below the TCRA release criteria.

Site Contamination Potential: Unlikely

Contaminated Media:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - Low
- Drainage systems - Low

Current Potential Migration Pathways:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - Low
- Drainage systems -Low

Recommended Action: No further interior action is recommended. During the recent TCRA, a sample was collected from the minimal amount of material that was present in the sludge pit. Analytical results of that sample showed that Sr-90, Ra-226, and Th-232 concentrations were below the TCRA release criteria.

6.7 BUILDING 283 – OIL/WATER SEPARATOR AT FORMER PLANE WASHING SHED

Site Description: According to available records, the plane washing shed was constructed in 1946. Wastewater from this 9,550-square-foot structure drained to a trench drain east of the building and into an oil/water separator. Water from the oil/water separator flowed through a storm drain and discharged into Lake Washington. A review of aerial photos indicates that this building was demolished in 1984. The trench drain and associated oil/water separator remain in place at this site. The locations of Building 283, the trench drain, the associated oil/water separator and piping are shown on Figure 6-13. A current photograph of the oil/water separator is provided as Figure 6-14.

The use of the paved tarmac in the vicinity of the oil/water separator is restricted to uses which do not penetrate the tarmac. Soil sampling under the slab reveal petroleum concentrations above MTCA levels (DoI 1999).

Former Radiological Use: This building had no known radiological use. However, because the plane washing shed was in use during the period of time that the United States conducted atmospheric nuclear testing, planes returning from such tests could have been decontaminated at this wash facility. Cs-137 and Sr-90 may have been present on planes that may have been washed at this facility.

Current Site Use: The former plane washing shed has been demolished. The site is currently an asphalt paved area used by the Seattle Department of Parks and Recreation for boat storage. Nothing of former Building 283 remains; however, the associated trench drain, oil/water separator, and storm drain outfall remain in place.

Radionuclides of Concern: Cs-137 and Sr-90

Previous Radiological Investigations: None

Site Contamination Potential: Low

Contaminated Media:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - Low
- Drainage systems - Moderate

Current Potential Migration Pathways:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - Low
- Drainage systems – Moderate to low
 - In the past, radionuclides within wastewater discharged from the plane washing shed may have migrated to the oil/water separator associated with the trench drain.

Recommended Action: Because radiological materials may have been discharged from the plane washing shed into the oil/water separator structure, it is recommended that the Navy conduct sludge sampling from the oil/water separator.

6.8 BUILDING 308 – WELDING SHOP

Site Description: Available records indicate that Building 308 was constructed in 1951 at its original location along Sand Point Way near Building 27. This single floor, 3,000-square-foot structure was used as a welding shop by the Navy. Building 308 was moved in 1978, as shown in the inset photograph on Figure 6-15; it was transported to a new location in the southeastern portion of former NAVSTA PS near NE 65th Street, and repurposed. Both the former and

current locations of Building 308 are shown on Figure 6-15. The area in which the building was formerly located was heavily reworked in 1978 when NE NOAA Drive was constructed. The original walls and floors were removed from the building when it was moved and are no longer part of the current structure. A new concrete floor was poured at the new location. There is no interior sheeting or sheetrock. A current photograph of Building 308 is provided as Figure 6-16.

Former Radiological Use: Since this building was used as an active welding shop after 1949, thoriated welding rods containing Th-232 could have been used in the structure.

Current Site Use: The structure is currently used as a storage building for Seattle Department of Park and Recreation ground maintenance crews. The Department of Parks and Recreation has developed schematic plans for renovating the building into crew quarters, but the plan has stalled because of issues related to its final uses and project funding. There is no public access to the building.

Potential Radionuclides of Concern: Th-232

Previous Radiological Investigations: None

Site Contamination Potential: Unlikely

Contaminated Media:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - Low
- Drainage systems - Low

Current Potential Migration Pathways: None

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - Low
- Drainage systems - Low

Recommended Action: Because the research associated with this PA turned up no documentation that thoriated welding rods were used at the site, and the walls and floors that were present during welding operations no longer exist, no further action is recommended.

6.9 SANITARY SEWER SYSTEM

Site Description: The sanitary sewer system at former NAVSTA PS consisted of a combined gravity and forced main sewer system. Before 1938, all of the gravity sanitary sewers at the facility drained to pump station 117 located approximately 100 feet north of the northeast corner of Building 2. As development of the station continued, a second pump station was needed. In 1938, sewage pump station 116 was constructed north of Building 11. These pump stations moved sewage upslope to the on-site sewage treatment system west of Building 11 until the station was connected to the City of Seattle system in the 1940s. The on-site treatment system was removed in the 1970s. The former structures that have been removed include the following:

- Imhoff Sewage Tank (Building 3)
- Clarigester tank (Building 110)
- Primary filter tank (Building 111)
- Primary filter tank (Building 112)
- Secondary clarifier (Building 113)
- Second stage digester (Building 208)
- Secondary clarifier (Building 209)
- Final filter (Building 210)
- Final clarifier (Building 211)
- Sludge drying shed (Building 207)

The locations of the former and existing sanitary sewer structures are shown on Plate 1. The existing sanitary sewer structures are shown on Figure 6-17.

Former Radiological Use: These structures could have received radium paint waste or other radionuclides that may have entered the sanitary sewer system.

Current Site Use: The discharge sewer from pump station 116 currently connects to the city sewer under Sand Point Way. Sewage pump station 117 and the forced main that formerly moved waste to the on-site sewage treatment system are now inactive. The sanitary sewers formerly served by these structures are now connected to the NOAA sewer system. Sewage in this system is pumped to the city sewer by the NOAA pump station at the northeast corner of Building 2 (Shaw E&I 2011).

Potential Radionuclides of Concern: Ra-226

Previous Radiological Investigations: In 2010, the Navy initiated radiological characterization surveys, sampling, limited contamination removal actions, and waste management activities as part of a Radiological RI that included portions of the sanitary sewer system including pump stations 116 and 117 (Shaw E&I 2011). Sludge samples were collected from the sanitary sewer system at 11 locations within the sanitary sewer system: 9 manholes in the gravity sewer system, and pump stations 116 and 117 at the ends of the forced main. No radiological contamination greater than the established cleanup criteria were detected in these samples. The sampling locations are shown on Plate 1.

Site Contamination Potential: None

Contaminated Media:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - None
- Drainage systems - None

Current Potential Migration Pathways:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - None
- Drainage systems – None

Recommended Action: Because no radiological contamination greater than the established cleanup criteria was detected by either direct reading instruments or analyses of sludge samples from accessible locations within the sanitary sewer system, no further action is recommended for the sanitary sewer system. Please refer to Section 6.11 for a discussion of recommended sediment sampling in Lake Washington to assess potential sediment contamination downgradient of the sanitary sewer system.

6.10 STORM DRAIN SYSTEM

Site Description: The existing storm drain system at former NAVSTA PS collects surface water runoff from all exterior paved surfaces at the Site, including roads, parking areas, uncovered exterior storage areas, and building roofs. This system consists of numerous catch basins, manholes, oil/water separators (sludge pits), and miles of various-diameter sewer piping. The information obtained during this PA indicates that shop floor drains and sinks were historically connected to the storm drain system, including the sinks in the known former instrument shops and floor drains in welding areas. Water that enters the storm drain system discharges into Lake Washington at four outfall locations (see Plate 1) on Site:

- A 16-inch-diameter pipe located approximately 60 feet west of Building 31
- A 6-inch-diameter pipe located approximately 100 feet northeast of former Building 283
- A 42-inch-diameter pipe located north of Building 27
- A 30-inch-diameter pipe located approximately 380 feet east of the Site boundary

Restrictions are in place for Pontiac Bay sediments adjacent to the quay wall for the full extent of Parcel 2 to limit, to the extent practicable, activities that disturb these sediments. Activities that cause the continued disruption of these sediments are prohibited. In addition, new land uses are prohibited that involve continual resuspension or disturbance of sediments, such as public swimming, or windsurfing (DoI 2003).

Former Radiological Use: The storm drain system is known to have received radium paint waste via sinks located in Buildings 2 and 27. Cs-137 and Sr-90 were detected in upgradient storm-drain components at levels below the project release criteria. Th-232 may have entered the storm drain system from the mop water or drainage water from welding shops that may have used thoriated welding rods.

Current Site Use: The storm drain system no longer receives wastewater from the former industrial areas at the Site. However, it still receives storm water from all exterior paved surfaces at the Site.

Potential Radionuclides of Concern: Ra-226, Cs-137, Sr-90, and Th-232

Previous Radiological Investigations: In 2010, the Navy initiated radiological characterization surveys, sampling, limited contamination removal actions, and waste management activities as part of a Radiological RI that included 12 catch basins, 3 manholes, and hundreds of feet of sanitary sewer piping in the vicinity of Buildings 2 and 27 (Shaw E&I 2011). Between 2013 and

2015, the Navy conducted a TCRA to remediate the radiologically contaminated areas within the storm drain system that were identified in the radiological RI. The results of the TCRA will be presented in a TCRA After Action Report that is expected to be completed in the summer of 2016.

Sludge samples from three catch basins (CB-1, CB-3, and CB-5) collected during the Radiological RI contained elevated levels of Ra-226. These catch basins are located south and west of Building 27. Water within these structures drains to manhole MH-160 before discharging into Lake Washington.

Sediment (sludge) was removed from these catch basins as part of the radiological RI, and quick-drying cement was troweled over the sides and bottoms to seal in place any residual sludge (Shaw E&I 2011). No radiological contamination greater than the project radiological RI release criteria was detected in sludge from any of the other sampled catch basins and manholes within the investigated portion of the storm drain system. However, the sludge samples collected from MH-160 exceeded the updated release criteria for radium. Figure 6-18 shows all storm drain lines in the industrialized area according to the City of Seattle GIS records. The sections of the storm drain system from Buildings 2, 27, and possibly Building 30 (not confirmed) may have received radium paint waste or other radionuclides during Navy-based operations at the Site.

Additional remedial activities have been completed as part of the TCRA that began in 2013. Contaminated catch basins and drain lines were removed and replaced during this TCRA. All contaminated materials were disposed of offsite.

Site Contamination Potential: Low

Contaminated Media:

- Surface soil - Low
- Subsurface soil - Low
- Surface water - Low
- Groundwater - Low
- Air - Low
- Structures - Low
- Drainage systems - Moderate to low

Current Potential Migration Pathways:

- Surface soil - Low
- Subsurface Soil - Low
- Surface water - Low

- Groundwater - Low
 - Air - Low
 - Structures - Low
 - Drainage systems - Moderate to Low
- Much of the storm drain system was evaluated, and identified radiological contamination was remediated. These portions of the storm drain system would have a low current potential migration pathway. Some of the storm drain system that was not evaluated south of Building 2 and near Building 30 would have a moderate or low current potential migration pathway.
 - A storm drain line that originates near the northeast corner of Building 2 drains to the east onto adjacent property and ultimately discharges to Lake Washington. Section 6.12.2 discusses this storm drain pipe in more detail.
 - During active aircraft operations and maintenance radionuclides within wastewater discharged into the storm drain system would have been ultimately discharged into Lake Washington where radionuclides may have been deposited in sediment near storm drain discharges.

Recommended Action: Because the Navy remediated, restored or replaced the contaminated components of the storm drain system in the vicinity of Buildings 2 and 27, during the 2013-2015 TCRA, no further action is recommended for the storm drain system in these areas. It is recommended that sludge sampling be conducted from accessible, non-sampled locations within the storm drain system near areas where potential radiological contamination was identified during this PA. This includes the portion of the storm drain system located on NOAA property that is downstream from Building 2. In addition, it is recommended that sediment samples be collected in Lake Washington near each of the five outfalls that have discharged water originating on the Site and are located between the western Site boundary and the NOAA Pier.

6.11 NE NOAA DRIVE

Site Description: NE NOAA Drive (also known as NE 80th Street) was constructed in 1978 (Figure 6-19). This road provides direct access from Sand Point Way to the NOAA Western Regional Center located on the north side of the Sand Point peninsula and east of the Site (Plate 1). The road lies between Buildings 27 and 2. According to several historical site maps, there was a previously existing road (First Street) in the same general area before the construction of NE NOAA Drive (Figure 6-20). There was also a small area for parking between Building 27 and First Street. During the road construction in 1978, much of the surface soil was regraded, and additional soil was imported to elevate the road to allow vehicles to drive under the new road to access the northern portion of the Site (e.g., Buildings 11 and 27) from south of

NE NOAA Drive (Figure 6-21). Many photos of the road construction (NOAA 1979) are included in the document database (Appendix B). The construction limits for the new road based on 1977 construction drawings (Naramore Bain Brady and Johanson 1977) are shown on Figure 6-19.

In 2000, the Department of the Navy assigned the property that included NE NOAA Drive to the Department of the Interior/National Parks Service (DOI/NPS) for subsequent transfer to the City of Seattle (City) for park related uses. However, the City relinquished its interest in NE NOAA Drive in favor of NOAA and the property was transferred to the United States Department of Commerce (Commerce) – NOAA on August 2, 2007 via the General Services Administration (GSA).

Former Radiological Use: There was no former radiological use associated with NE NOAA Drive. However, the adjacent south shed of Building 27 contained an instrument shop on the second floor. In the instrument shop, facility personnel refurbished instrument dials using radium paint. It appears that low-level radiation from this activity migrated (possibly by foot traffic, disposal of water from cleaning buckets on the ground, or other mechanisms) to soil outside the south shed.

Current Site Use: NE NOAA Drive is used to provide direct vehicle access the NOAA Western Regional Center.

Potential Radionuclides of Concern: Ra-226

Previous Radiological Investigations: Based on investigation activities conducted during the Radiological RI (Shaw E&I 2011) and the 2013-2015 TCRA, low-level radiation was detected in soil south of Building 27, within the construction limits for NE NOAA Drive. As shown on Figures 6-20 and 6-21, surface soil was disturbed extensively during the road construction. This activity could have potentially redistributed radiologically contaminated soil across the construction site resulting in soil with radiation levels greater than background levels within the construction limits of the road.

The Navy has completed the field portion of a TCRA to remediate the radiologically contaminated soil on both sides of and immediately adjacent to NE NOAA Drive that was identified in the Radiological RI. This included the removal and off-site disposal of radiologically contaminated soil from the margins of NE NOAA Drive area ultimately achieving clean soil samples at approximately 20 feet from each side of the road. The extent of known impacts on both sides of the road was removed based on the results of confirmation soil samples. There are no known impacts under the road based on the TCRA sampling. Yet, it is possible that impacted soil could exist under the road because during road construction in the 1970s, large quantities of heterogeneous soil were mixed and spread to form the roadbed.

The results of the TCRA are to be presented in the TCRA After Action Report that is expected to be completed in the summer of 2016.

Site Contamination Potential: Unknown

Contaminated Media:

- Surface soil – Low
- Subsurface soil – Moderate
- Surface water – Low
- Groundwater – Low
- Air – None
- Structures – None
- Drainage systems – Low

Current Potential Migration Pathways:

- Surface soil – Low
- Subsurface soil – Low
- Surface water – Low
- Groundwater – Low
- Air – None
- Structures – None
- Drainage systems – Low

Recommended Action: It is recommended the property owner ensure that any future subsurface soil disturbing activities are conducted with appropriate controls in place for worker health and safety and proper disposal of material.

6.12 OFFSITE AREAS ADJACENT TO THE PROPERTY

This section addresses the possibility of low-level radiological contamination to areas beyond the Site boundary.

- A storm drain pipe that exited Building 2 associated with the instrument shop known to have contained radium crosses the Site boundary to the east, ultimately to an outfall into Lake Washington.
- Areas on NOAA and City of Seattle property where dredged sediment from the vicinity of the existing NOAA pier may have been placed.

- Former trash burn and disposal areas located to the east of the site where low-level radioactive materials from radium painting operations or personnel markers could have been burned with other miscellaneous trash.
- Historical Radium Cleanup Site

6.12.1 Storm Drain Pipe

As shown in Figure 6-22, there is a functioning storm drain pipe that is connected to manhole MH-115 near the northeast corner of Building 2 and drains to the east past the Site boundary onto adjacent property. This 30-inch-diameter pipe ultimately discharges into Lake Washington near the NOAA pier. During the TCRA, the Navy remediated impacted sludge from the storm drain which exits Building 2 within former BRAC property. MH-115 is the last manhole before the storm drain pipe exits former BRAC property and continues onto adjacent property. Two samples were collected from MH-115, and the results did not exceed the project release criteria.

Recommended Action: It is recommended that sludge samples be collected in the manholes associated with this storm drain line and possibly lake sediment sample(s) at the storm drain outfall in Lake Washington near the NOAA pier.

6.12.2 Potential Sediment Dredge Material Areas Near NOAA Pier

The information obtained during the research for the PA indicates that near-shore sediments adjacent to the NOAA property and outfall may have been dredged and placed on adjacent land during construction which spans from 1980 to 1983. Specific dredge events are noted below. On December 23, 1976, NOAA submitted to the U.S. Army Corps of Engineers an application to dredge sediment from Lake Washington for the planned construction of four ship piers to provide vessel moorage (NOAA 1976). This application called for the removal of approximately 360,000 cubic yards of offshore material and 50,000 cubic yards of terrestrial material (sand, silt, and clay) and was assigned Permit No. 071-OYB-003858 (USACE 1977). Because local homeowners objected to NOAA docking its ships at the Lake Washington facility, the revised pier construction plans showing the completed dredging area were approved on May 18, 1982, to allow a single pier (NOAA 1982).

Lake sediments may have been removed to a depth of 22 feet below the maximum lake level within the area shown on Figure 6-23 (Associated Engineers and Contractors 1979). This material was placed in a bermed area (drying impoundment) for dewatering. A 1980 aerial photograph (Figure 6-24) shows the upland placement of dredged sediment in the drying impoundment primarily on the NOAA property. The southernmost portion of the drying impoundment was located on what is now the City of Seattle property where the dog park is located. In 2015, Thomas Gray and Associates, Inc. performed a radiological survey of the City's property for the City of Seattle including the dog park area. The report concluded that

radionuclides of interest were identified as either not present or present, but at levels that were not radiologically significant (Thomas Gray and Associates 2015).

The City of Seattle requested to use some of the dredge materials at Magnuson Park (Seattle Department of Parks and Recreation 1977). An undetermined quantity of this dredged material appears to have been transported to the Magnuson Park property to form what is now known as Kite Hill on the City of Seattle's property. A 1982 aerial photograph (Figure 6-25) shows sediment placed at this location and a haul road used to transport the sediments from the drying impoundment. The remainder of the sediments may have remained in the area of the drying impoundment which is now beneath the paved parking area at the NOAA facility, the grassy area to the south of the parking area on NOAA property, and an area east of the Brig on City of Seattle property. A more recent aerial view of this area is shown in Figure 3-1. The NOAA pier was completed in 1983 (USACE 1983).

Recommended Action: Inform property owner of findings of the PA.

6.12.3 Trash Burn and Disposal Areas

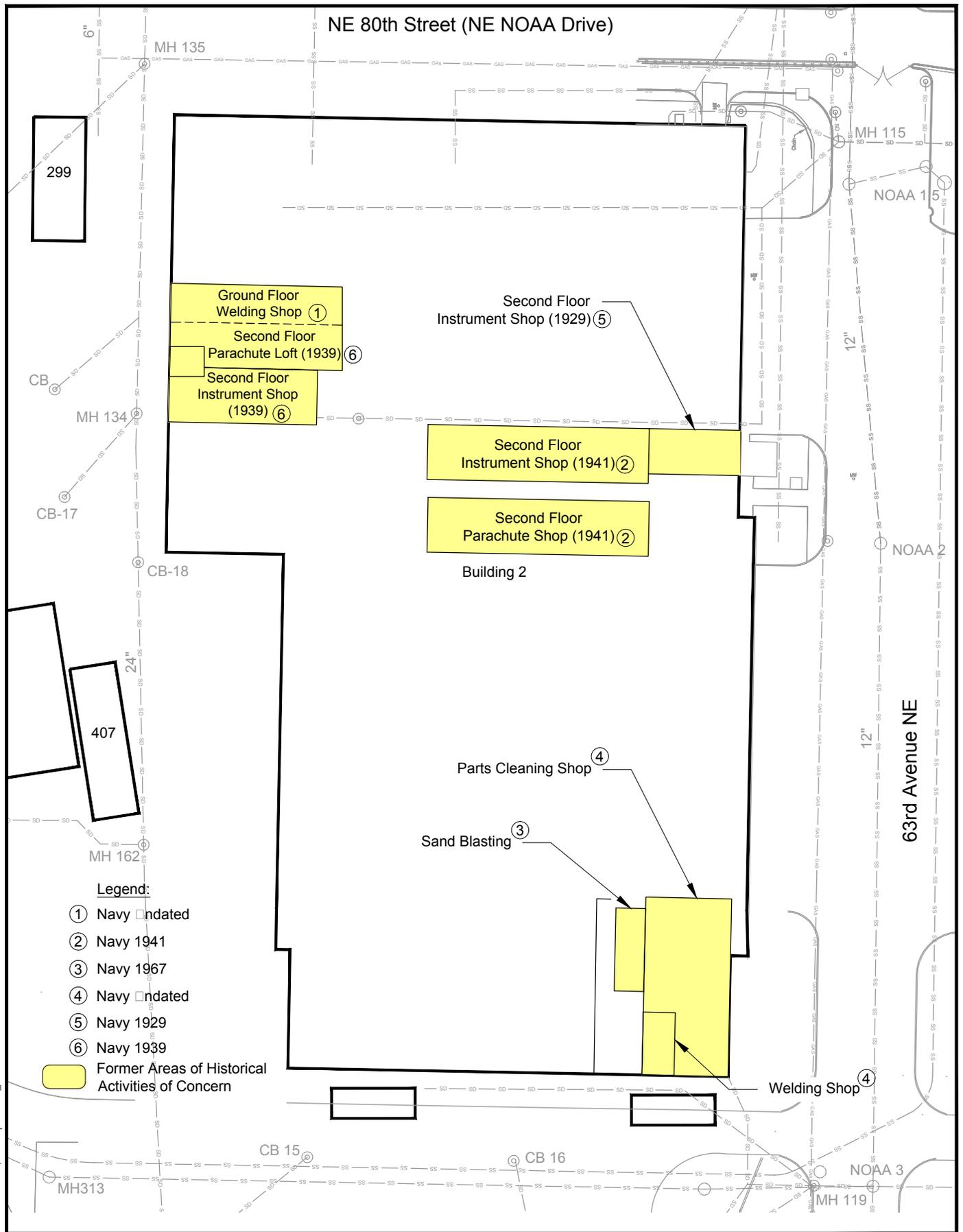
During the PA research efforts, two small trash burn and disposal areas for former NAVSTA PS were identified at the far eastern edge of what is now Magnuson Park. The approximate locations are shown in Figure 6-26. Plumes of smoke and pits are evident in the aerial photographs from 1953, 1954, 1958, and 1959. Potentially, radioactive materials from radium painting operations or personnel markers could have been burned as trash by the Navy during Site operations. By the mid-1970s, it appears that the areas were no longer used, and the areas were covered with vegetation.

Recommended Action: Inform property owner of findings of the PA.

6.12.4 Historical Radium Cleanup Site

As discussed in Section 5.7, in 1970 temporarily stored drums containing radioluminescent aircraft instruments east of the Site leaked and contaminated nearby soil. The location of the incident is shown in Figure 6-27 according to technical assistance visit report (RASO 1976). This area has been developed, and appears to be within the NOAA complex as shown in Figure 6-28. Soil was removed on two occasions in the 1970s from this area. Although no radiation levels in excess of background were observed, no analytical confirmation was provided in available documentation.

Recommended Action: Inform property owner of findings of the PA.



Legend:

- ① Navy Undated
- ② Navy 1941
- ③ Navy 1967
- ④ Navy Undated
- ⑤ Navy 1929
- ⑥ Navy 1939

Former Areas of Historical Activities of Concern

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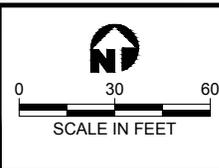


Figure 6-1
Site Plan for Building 2 and the Surrounding
Area Showing Areas of Historical Activities
of Concern in the Building

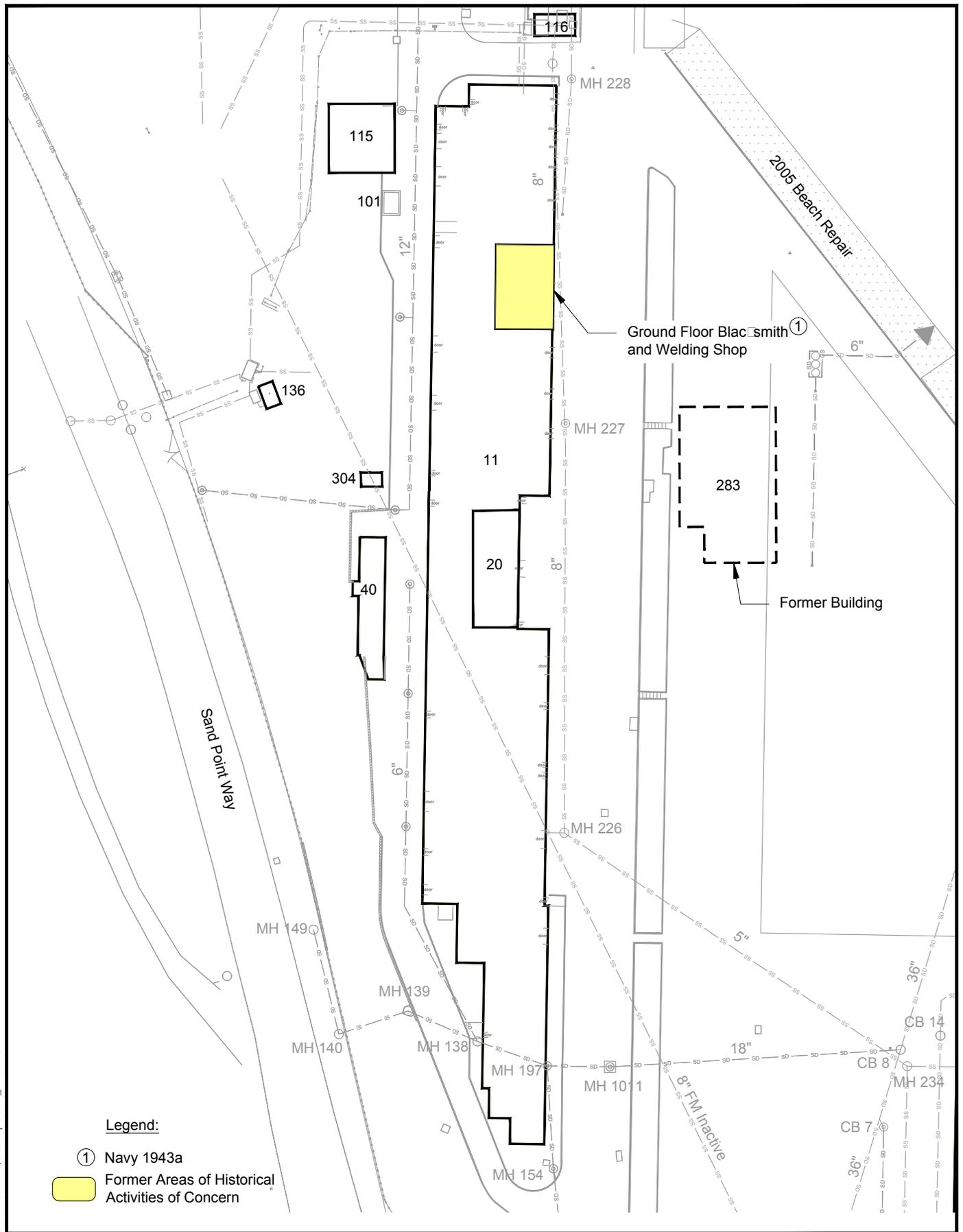
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Figure 6-2
Building 2 as Viewed from the
East, South, and Southeast

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Legend:

- ① Navy 1943a
- Former Areas of Historical Activities of Concern

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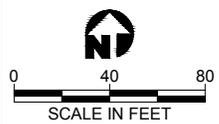


Figure 6-3
Site Plan for Building 11 Area Showing an Area of Historical Activities of Concern in the Building

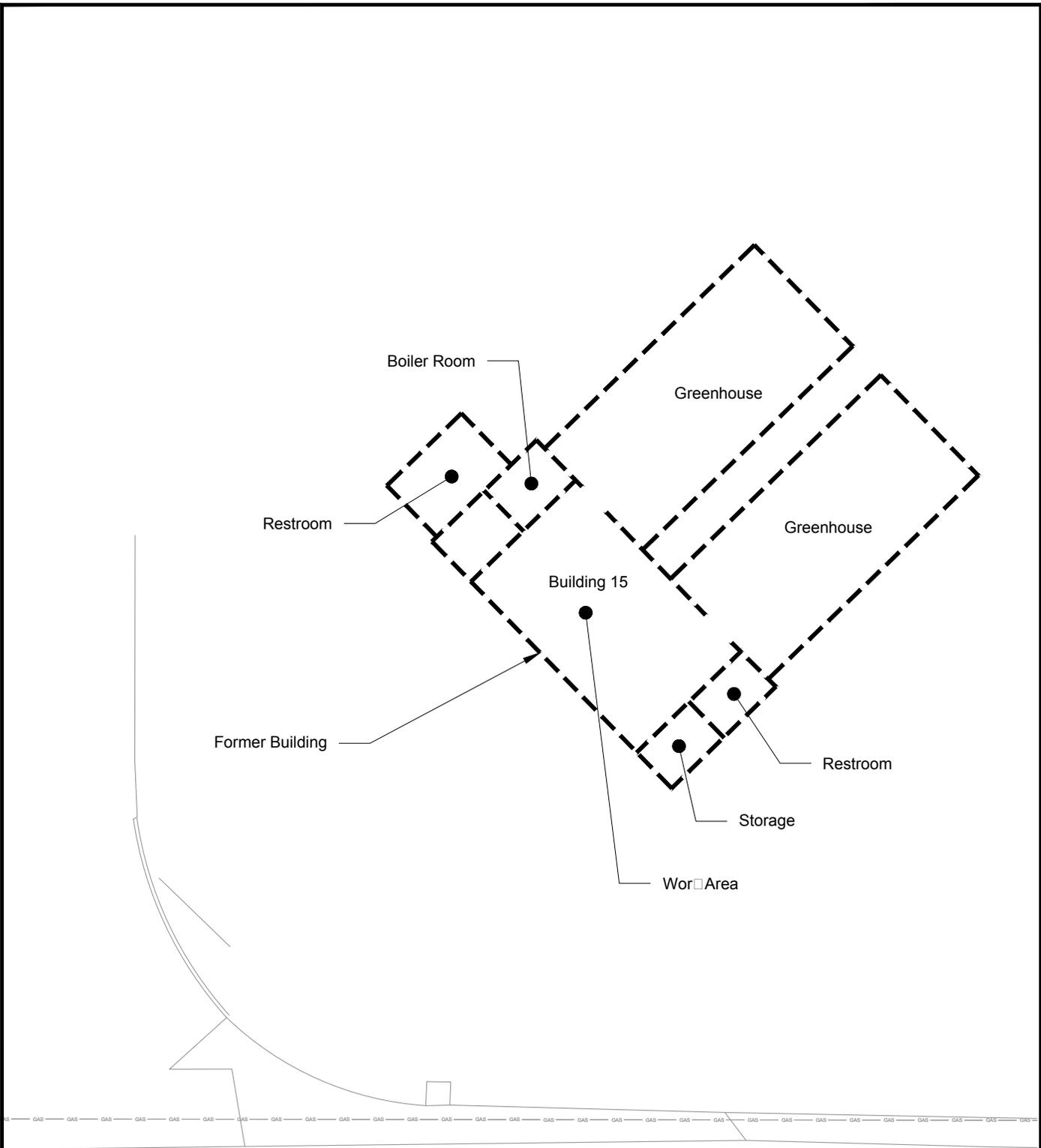
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Figure 6-4
East Side Building 11 as Viewed from
the South and North

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Note:
 Location of University of Washington
 experimentation within building 15 is unknown.

NE 65th Street

Source: Navy 1975

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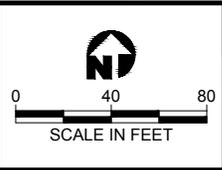


Figure 6-5
Site Plan for Building 15 While Leased to the
University of Washington Laboratory
of Radiation Ecology

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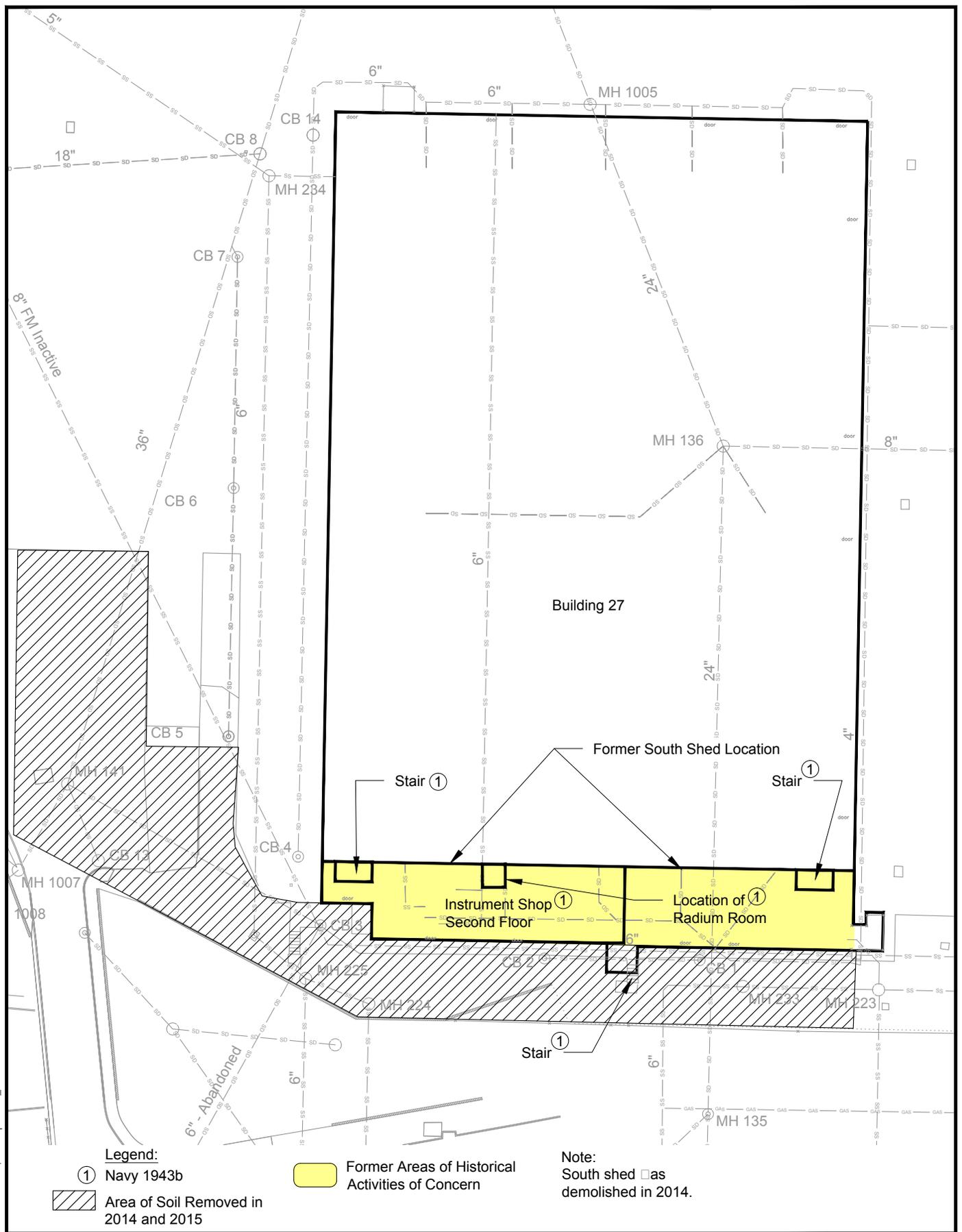


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**Figure 6-6
Former Building 15 Site as viewed
from the South**

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Legend:
 ① Navy 1943b
 [Hatched Area] Area of Soil Removed in 2014 and 2015

[Yellow Area] Former Areas of Historical Activities of Concern

Note:
 South shed [Square] as demolished in 2014.

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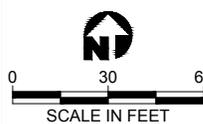


Figure 6-7
Site Plan for Building 27 Showing Areas of Historical Activities of Concern

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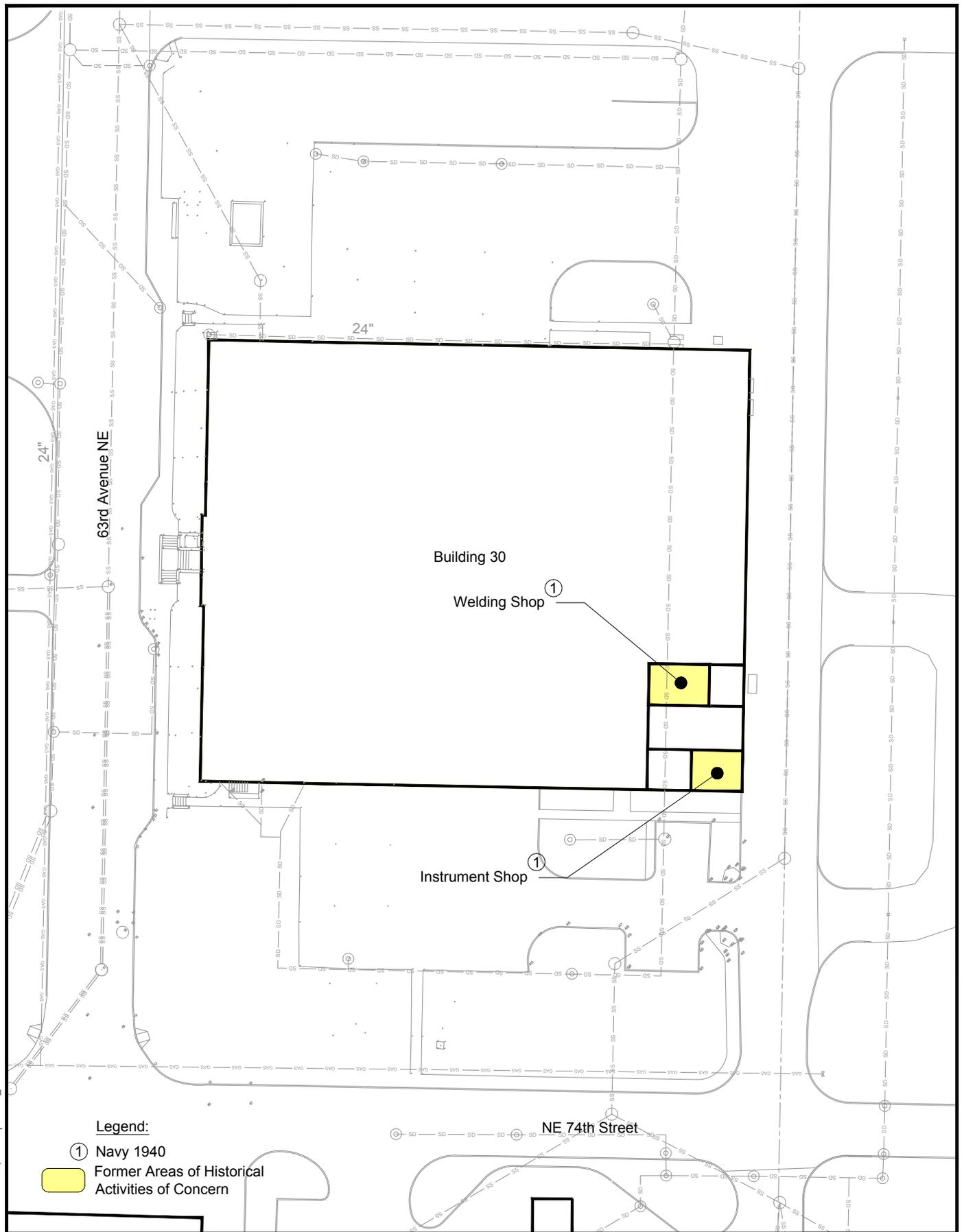


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Figure 6-8
Building 27 as Viewed from
the Northwest and Southwest

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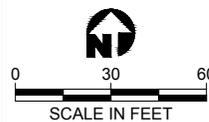


Figure 6-9
Site Plan for Building 30 Showing Areas of
Historical Activities of Concern

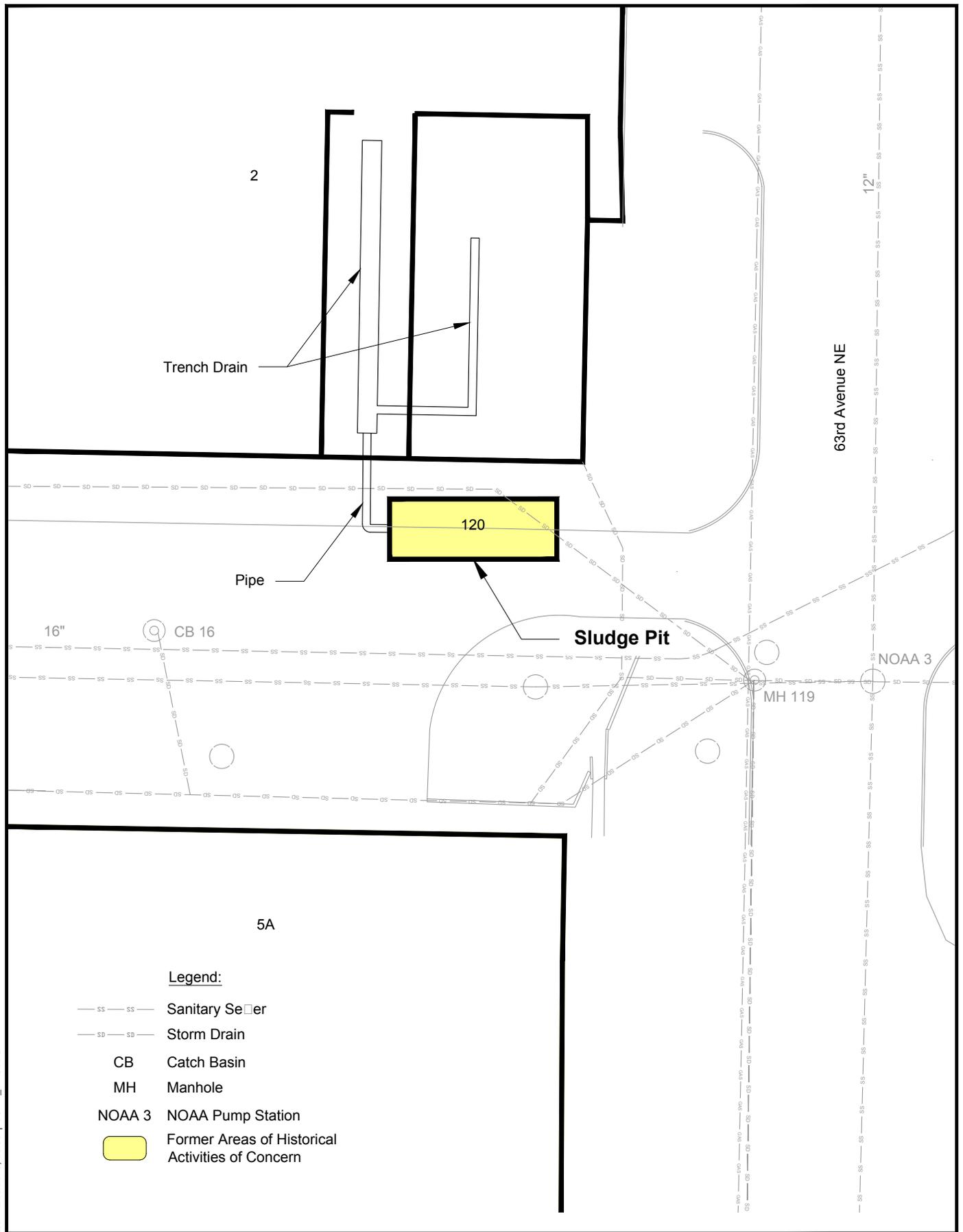
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Figure 6-10
Building 30 as Viewed from
the Southeast and West

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Legend:

- SS — SS — Sanitary Sewer
- SD — SD — Storm Drain
- CB Catch Basin
- MH Manhole
- NOAA 3 NOAA Pump Station
- Former Areas of Historical Activities of Concern

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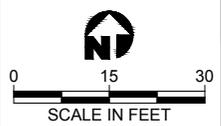


Figure 6-11
Location of Structure 120 Sludge Pit at
Southeast Corner of Building 2 and Storm
and Sanitary Sewers in Surrounding Area

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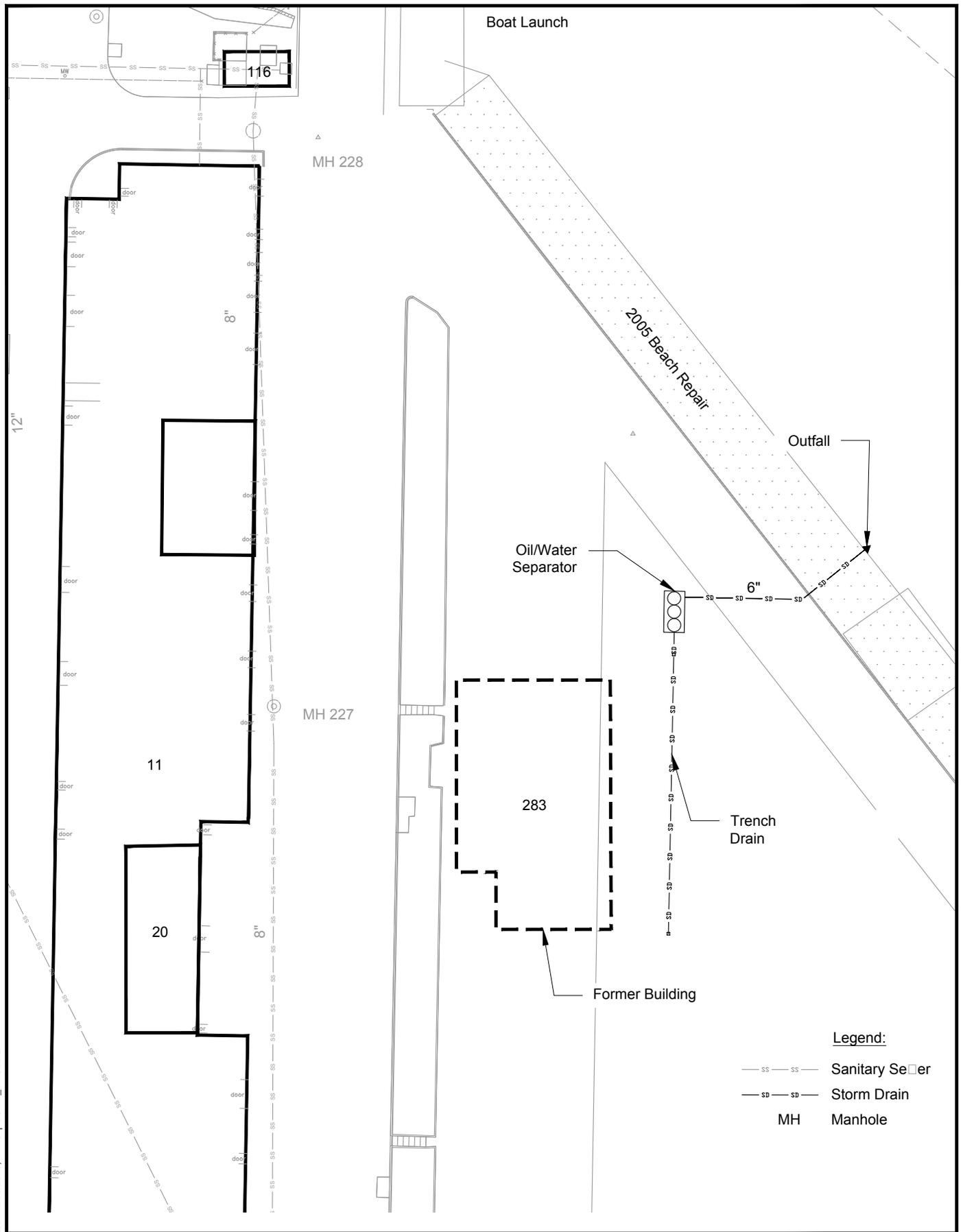


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Figure 6-12
Structure 120 Sludge Pit

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- Legend:**
- SS — SS — Sanitary Sewer
 - SD — SD — Storm Drain
 - MH Manhole

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Figure 6-13
Site Plan for Building 283 and the Surrounding
Area Showing the Associated
Oil/Water Separator

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Figure 6-14
Trench Drain (center of top photograph) and
Oil/Water Separator at Former Building 283 Area

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PA Report

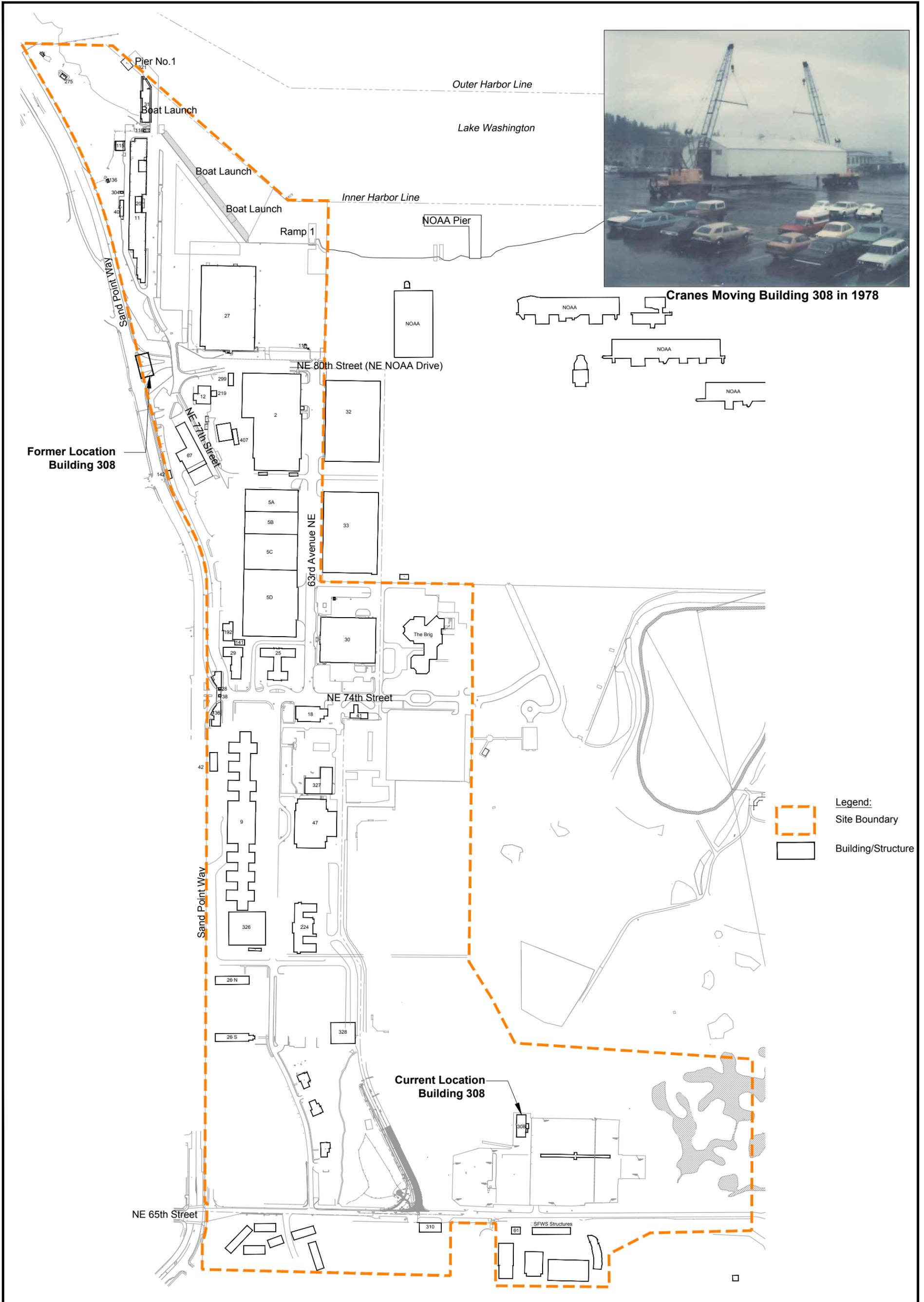


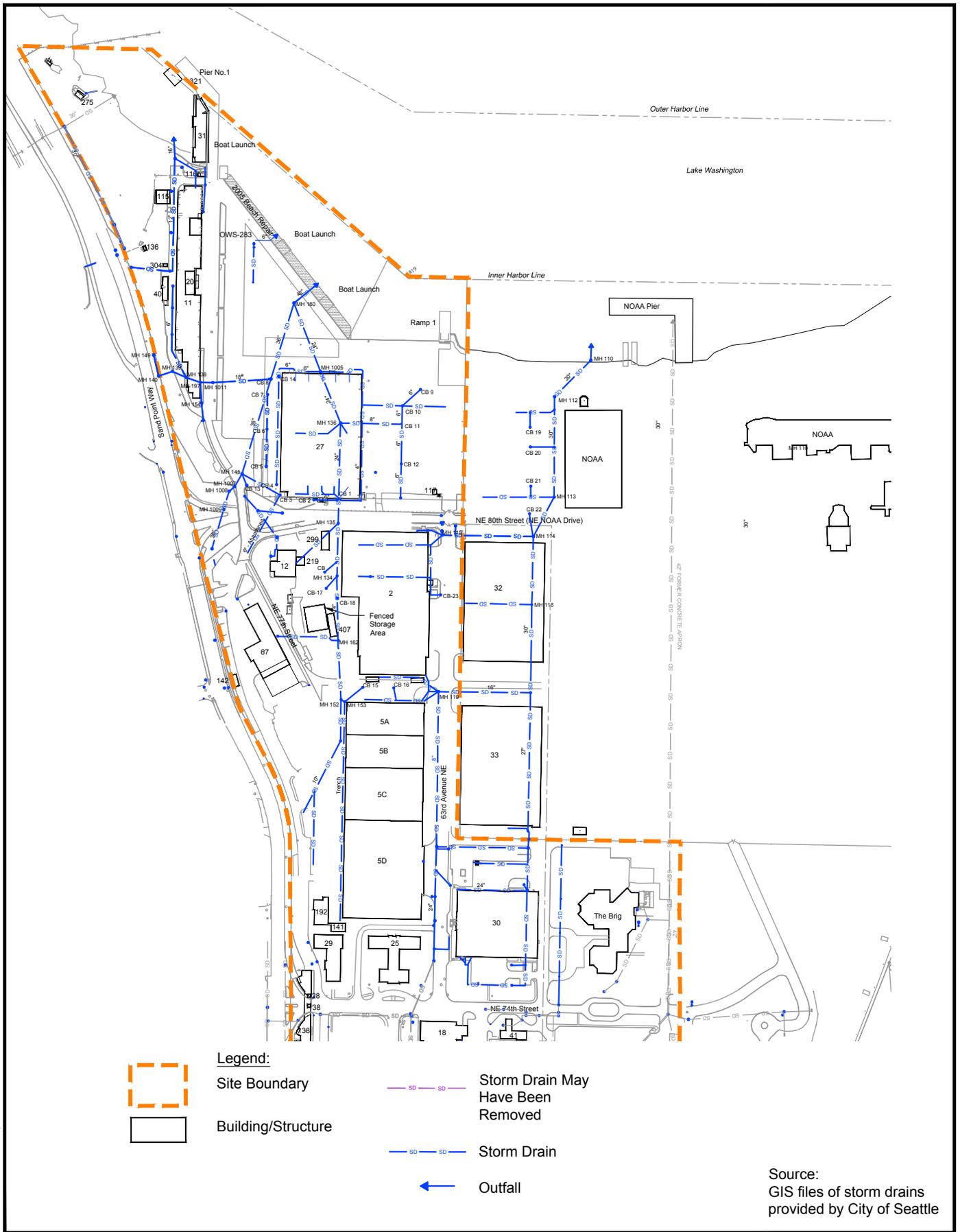
Figure 6-15
Former and Current Locations of Building 308



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Figure 6-16
Building 308 as Viewed from
the Southeast

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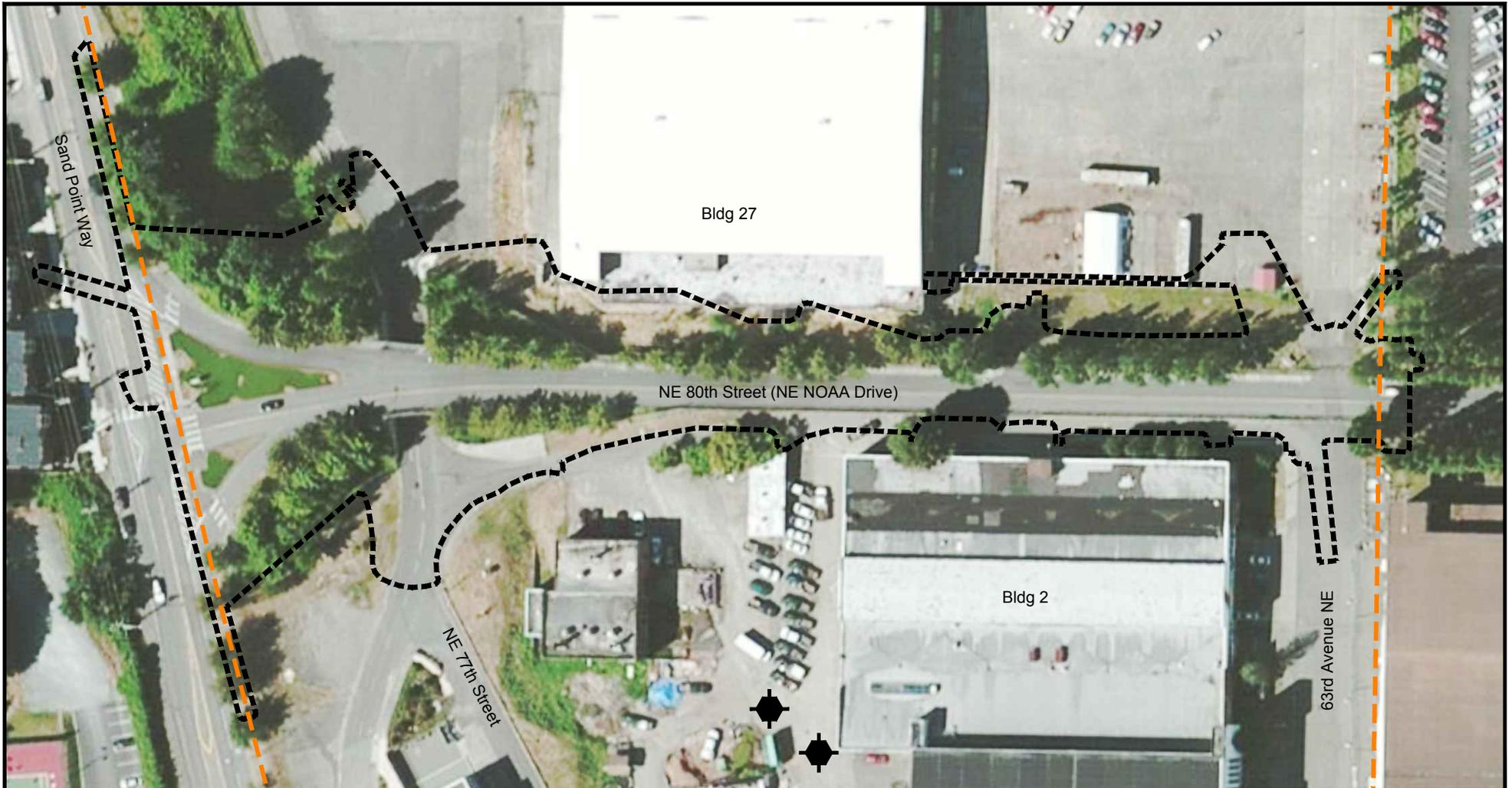
J:\DCS\Projects\GIS\NAV\MAGNUSON\DO 76\Work Plan\Fig 6-18 Storm Drain_Radium.dwg
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Figure 6-18
Storm Drain System
in the Industrialized Area

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Legend:

- - - - - Site Boundary
- - - - - Approximate Limits of Road Construction
(Naramore Bain Brady and Bohanson 1997)

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Figure 6-19
Northeast NOAA Drive Showing Approximate
Limits of Road Construction

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Source: NOAA 1979.

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Figure 6-20
Previously Existing Road in 1977 (top) and
Initial Construction of New Road,
Looking East Between Buildings 27 and 2

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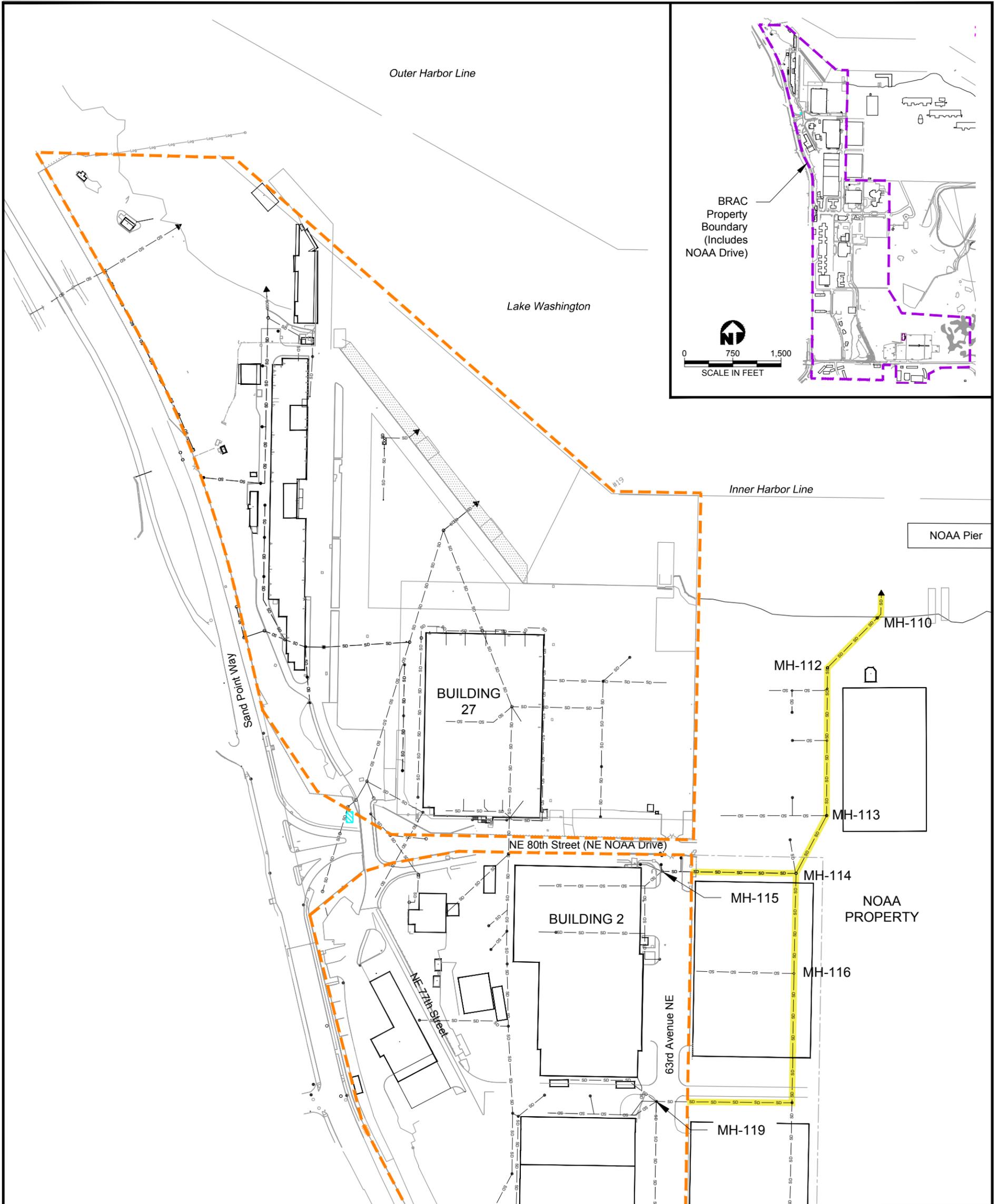


Source: NOAA 1979.

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Figure 6-21
Initial Fill Material Placed to Elevate Road,
Looking East Between Buildings 27 and 2

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- Legend:**
- PA Boundary
 - BRAC Property Boundary
 - Building/Structure
 - Storm Drain
 - MH Manhole on NOAA Property
Not Field Verified
 - NOAA Storm Drain

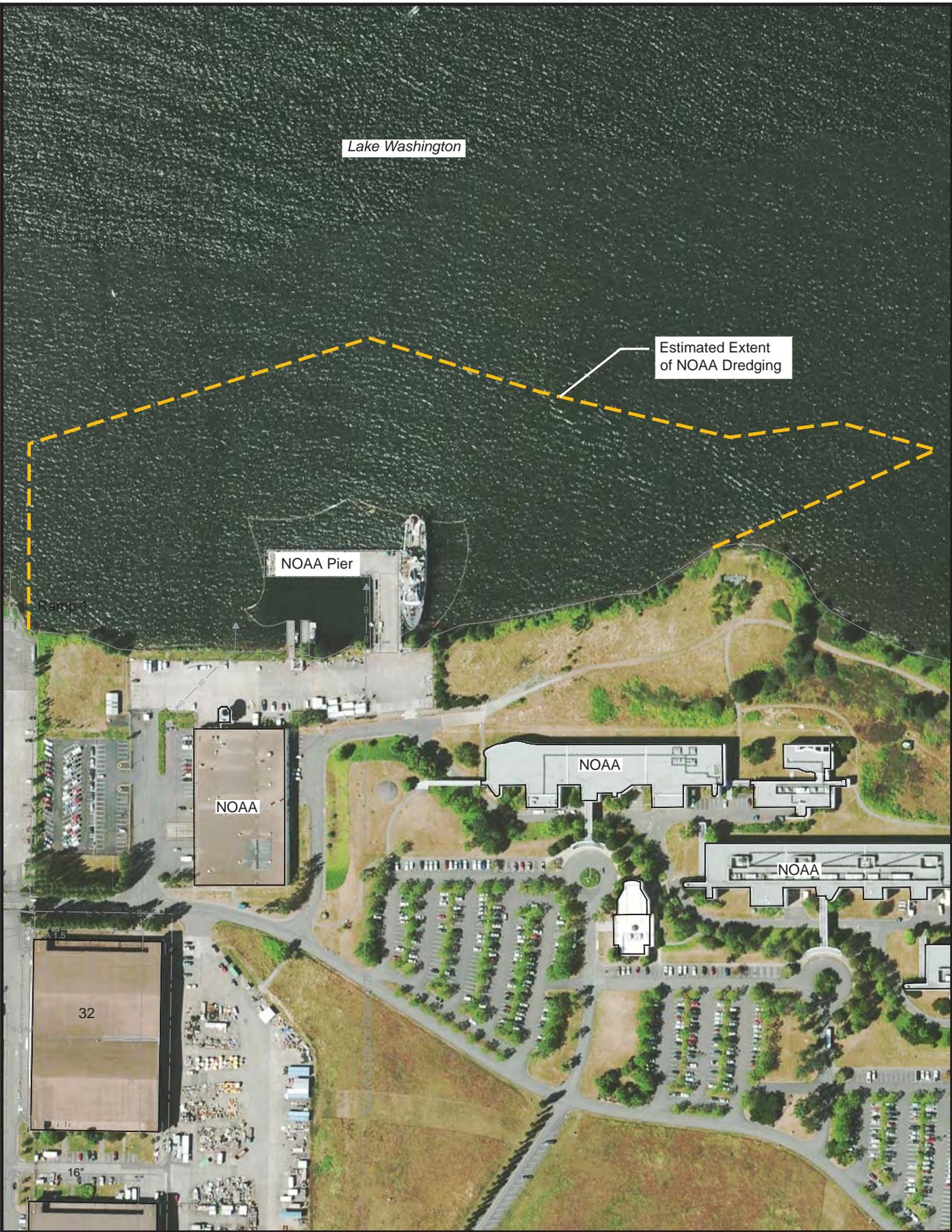
Sources: Available CAD data provided by City of Seattle, available historical maps, and aerial photographs included in electronic database.

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SCALE IN FEET

Figure 6-22
Location of Storm Drain That
Drains Offsite on NOAA Property

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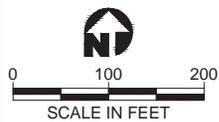


Figure 6-23
Estimated Extent of 1980
Dredged Sediment Removal by NOAA Pier

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 Seattle, WA
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Figure 6-24
1980 Aerial Photo Showing Upland Placement of Dredged Sediment on NOAA Property for Dewatering

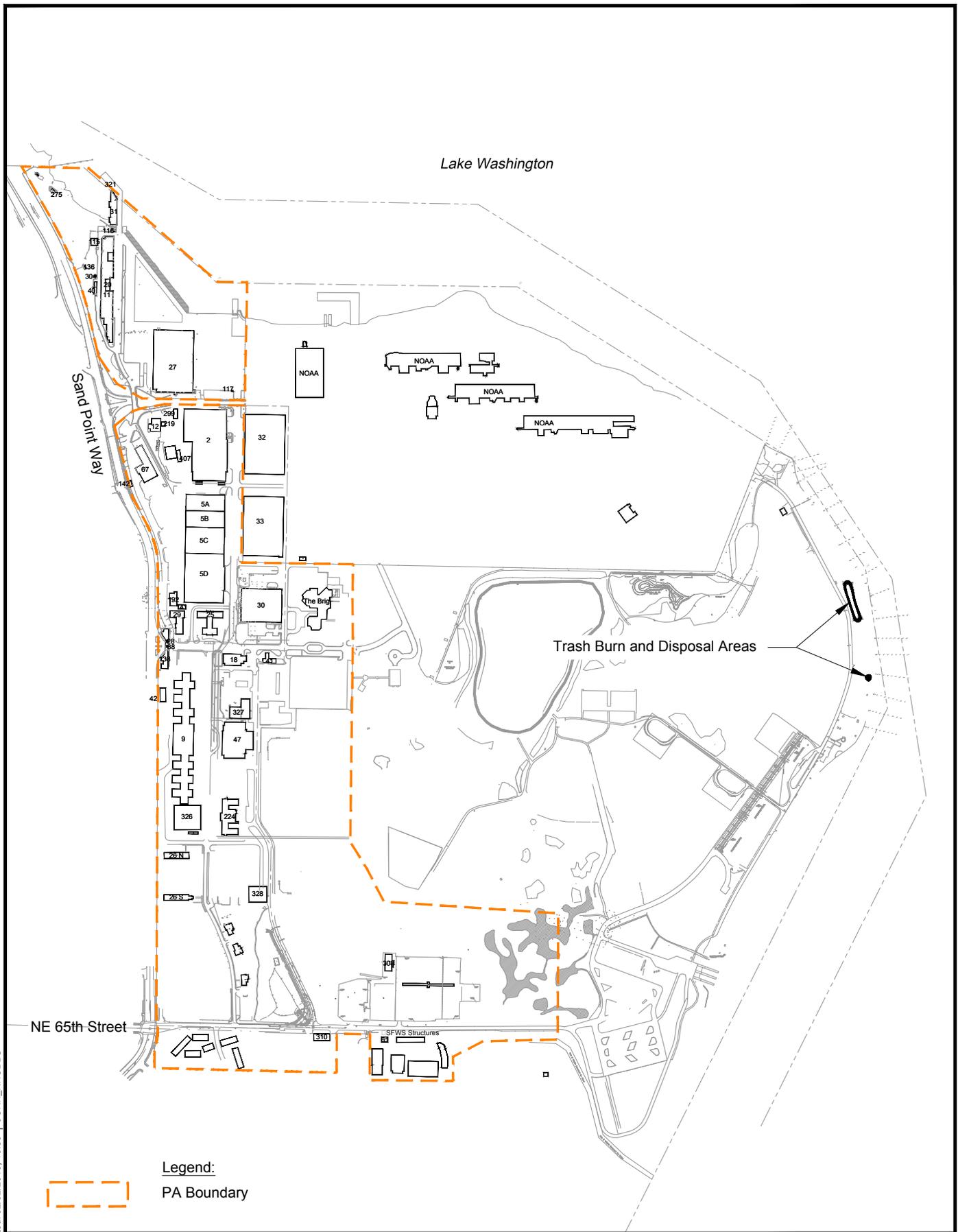
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Figure 6-25
1982 Aerial Photo Showing Upland Placement of
Dried Dredged Sediment at Kite Hill on Magnuson Park Property

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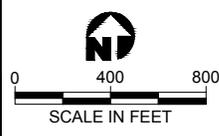
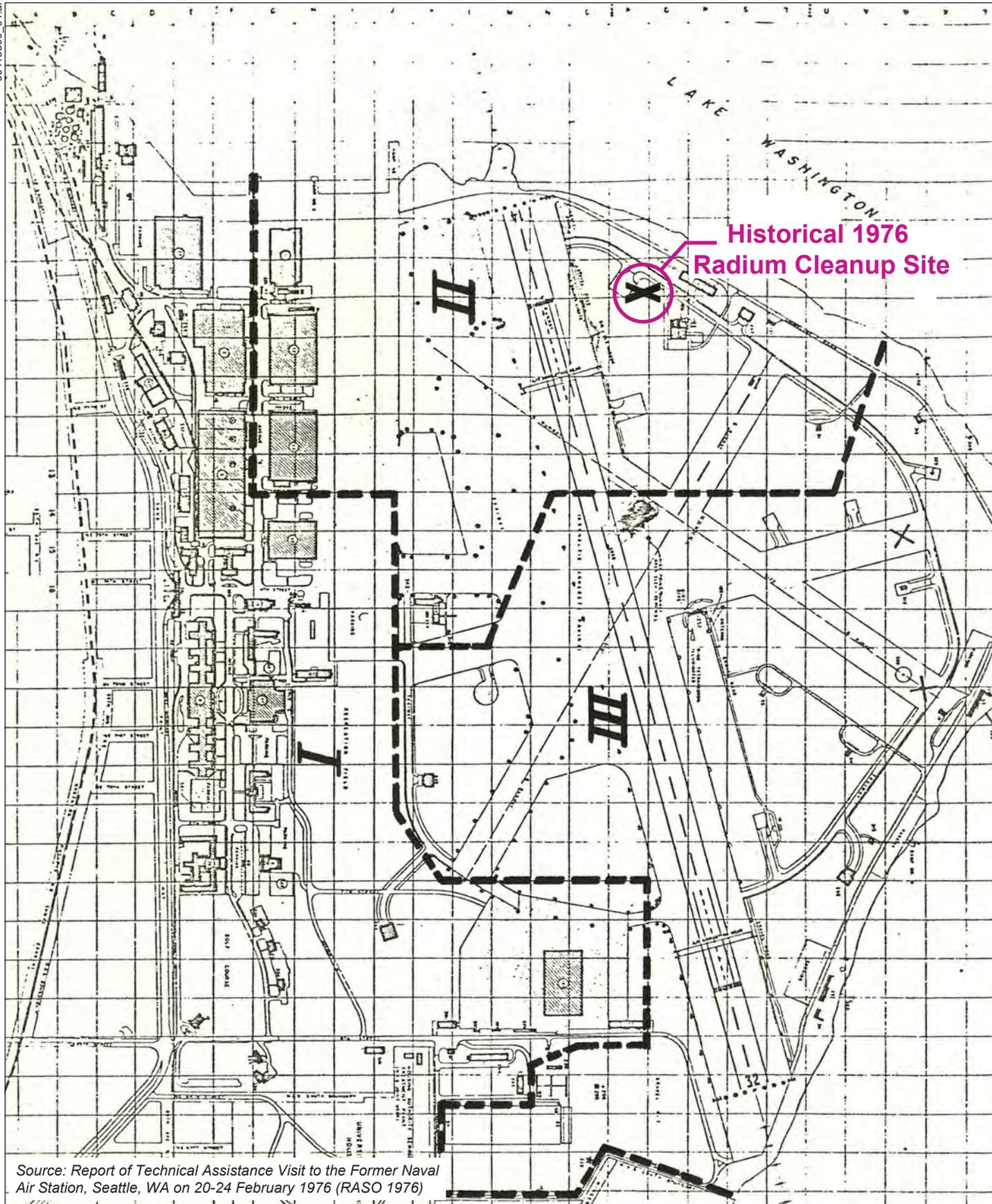


Figure 6-26
Approximate Locations of Former
Trash Burn and Disposal Areas

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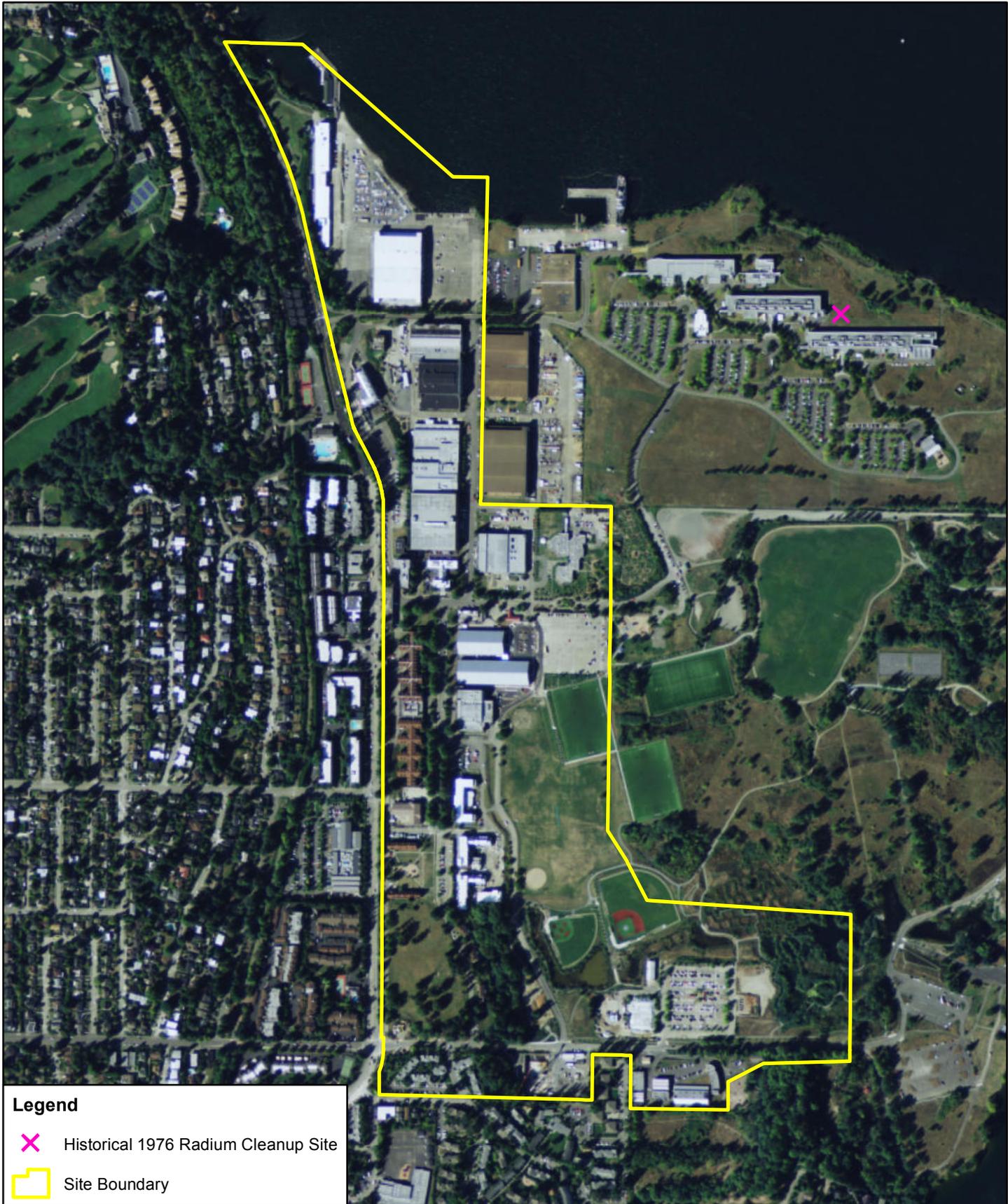


Source: Report of Technical Assistance Visit to the Former Naval Air Station, Seattle, WA on 20-24 February 1976 (RASO 1976)

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Figure 6-27
Location of Historical 1976
Radium Cleanup Site

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Legend

-  Historical 1976 Radium Cleanup Site
-  Site Boundary

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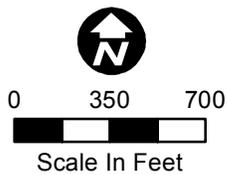


Figure 6-28
Location of Historical 1976
Radium Cleanup Site
Showing Current Development

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7.0 CONCLUSIONS

7.1 POTENTIAL RADIONUCLIDES OF CONCERN

The information reviewed as part of this PA indicates the presence of five PROCs at NAVSTA PS: Ra-226, Cs-137, Sr-90, Th-232, and Pu-239. Of the PROCs used or stored at NAVSTA PS, the use of Ra-226 in radioluminescent paint at the Site was confirmed in instrument repair shops in Buildings 2 and 27, and Pu-239-contaminated coral grit from Johnston Atoll was reported to have been used by the University of Washington, Laboratory of Radiation Ecology, in Building 15.

During the radiological RI in 2011, Cs-137 and Sr-90 were not detected at levels greater than the project release criteria in soil and sewer sludge samples. These PROCs are contaminants associated with global fallout from the atmospheric testing of nuclear weapons, cleaning and maintenance of contaminated planes or ships used in monitoring activities associated with nuclear testing. No records were found that documents the cleaning of contaminated ships or planes. Sr-90 was also used in personnel markers, which may have been present at NAVSTA PS. Lastly, Th-232 is considered a potential contaminant associated with welding shops and machine shops because there is potential that thoriated welding rods were used at NAVSTA PS.

University of Washington budget documents indicated that tritium (H-3) may have been planned for use as part of research in the greenhouse and the mobile field laboratory. The thorough archival research conducted and personnel interviewed (Olsen 2014) as part of this preliminary assessment did not provide any positive indication that these experiments were actually conducted at this site. Due to this lack of evidence, the removal of the building structure in 2003, and the exposure of any potential outdoor tritium contamination to the local rainfall, tritium is not being considered a PROC.

7.2 AREAS OF POTENTIAL CONCERN

A review of historical documents assembled during this PA and findings of recent investigations and removal activities conducted by the Navy resulted in the identification of 11 buildings or structures at NAVSTA PA as AOPCs for PROCs:

- Building 2 - O&R shop
- Building 11 - public works repair shops
- Building 15 - greenhouse (previously existing)
- Building 27 - seaplane hangar O&R shop
- Building 30 - Naval Reserve hangar

- Structure 120 - sludge pit at southeast corner of Building 2
- Building 283 - plane washing shed (previously existing)
- Building 308 - welding shop
- Sanitary sewer system
- Storm drain system (including downgradient Lake Washington sediment)
- NE NOAA Drive

Past known contamination in identified areas within Buildings 2 and 27 has been remediated and disposed of at proper facilities. Cleanup of external contaminated areas around Buildings 2 and 27 was completed during 2015. The report of these activities is documented in the TCRA After Action Report that is expected to be completed in the summer of 2016.

Four outfalls have discharged water originating on the Site into Lake Washington and are located within the Site boundary. Because potentially contaminated water may have been disposed of in the storm drain system or former sanitary sewer, the near-shore sediment of Lake Washington is considered to be an AOPC.

Additionally, four offsite areas on adjacent property were identified:

- Storm drain pipe on adjacent property
- Areas on NOAA and City of Seattle property where dredged sediment from the vicinity of the existing NOAA pier may have been placed
- Two trash burn areas
- Historical Radium Site

7.3 RECOMMENDATIONS

Based on the information assembled and reviewed during this PA, no further action is recommended for Buildings 2, 3, 11, 27, 308, and the sanitary sewer system. However, it is recommended that the Navy conduct the following additional activities as part of the follow-on SI:

- Radiological inspections of surface and subsurface soil in the vicinity of former Building 15
- Radiological investigations of surface and subsurface soil in the unpaved areas surrounding Building 30
- Limited radiological inspection of former instrument repair shop area located inside Building 30

- Collection of additional sludge samples from certain accessible storm drain locations that have not been previously sampled; locations in the roads east and south of Building 2, offsite locations east and northeast of Building 2, locations east and north of Building 30, and the oil-water separator northeast of former Building 283
- Collection of sediment samples from Lake Washington in the vicinity of five storm drain outfalls that discharge water originating on the Site; four located within boundaries of the Site and one outfall near the western end of the NOAA pier
- Notification to property owners to ensure that any future subsurface soil disturbing activities are conducted with appropriate controls in place for worker health and safety, and the proper disposal of materials.

If a CERCLA release is verified at an AOPC based on the SI sampling results and evaluations, the AOPC would become an area of concern (AOC).

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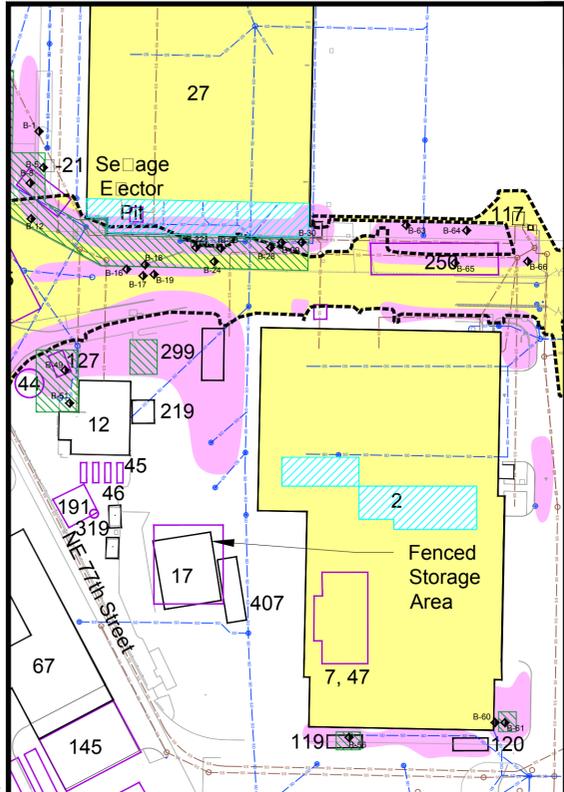
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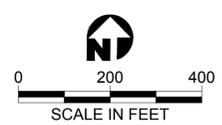
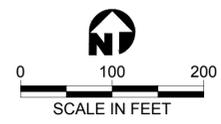
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Plate 1

Site Map of Former NAVSTA PS



Existing Soil Boring Approximate Locations at Buildings 27 and 2



- Legend:**
- Site Boundary
 - Building/Structure
 - Building/Structure Removed (Note: Site and location are based on historical maps and aerial photograph and are approximate)
 - Construction Limit Boundary for NE NOAA Drive
 - TCRA Building Removal Action
 - TCRA Soil Removal Action
 - Completed Gamma Wall over Survey Area
 - Structures Having Historical Activities of Potential Concern
 - Sanitary Sewer/Storm Drain May Have Been Removed
 - Sanitary Sewer
 - Storm Drain
 - Existing Sanitary Sewer Sample Location
 - Existing Storm Drain Sample Location
 - ◆ Existing Soil Boring Location

Plate 1
Site Map of Former
NAVSTA PS

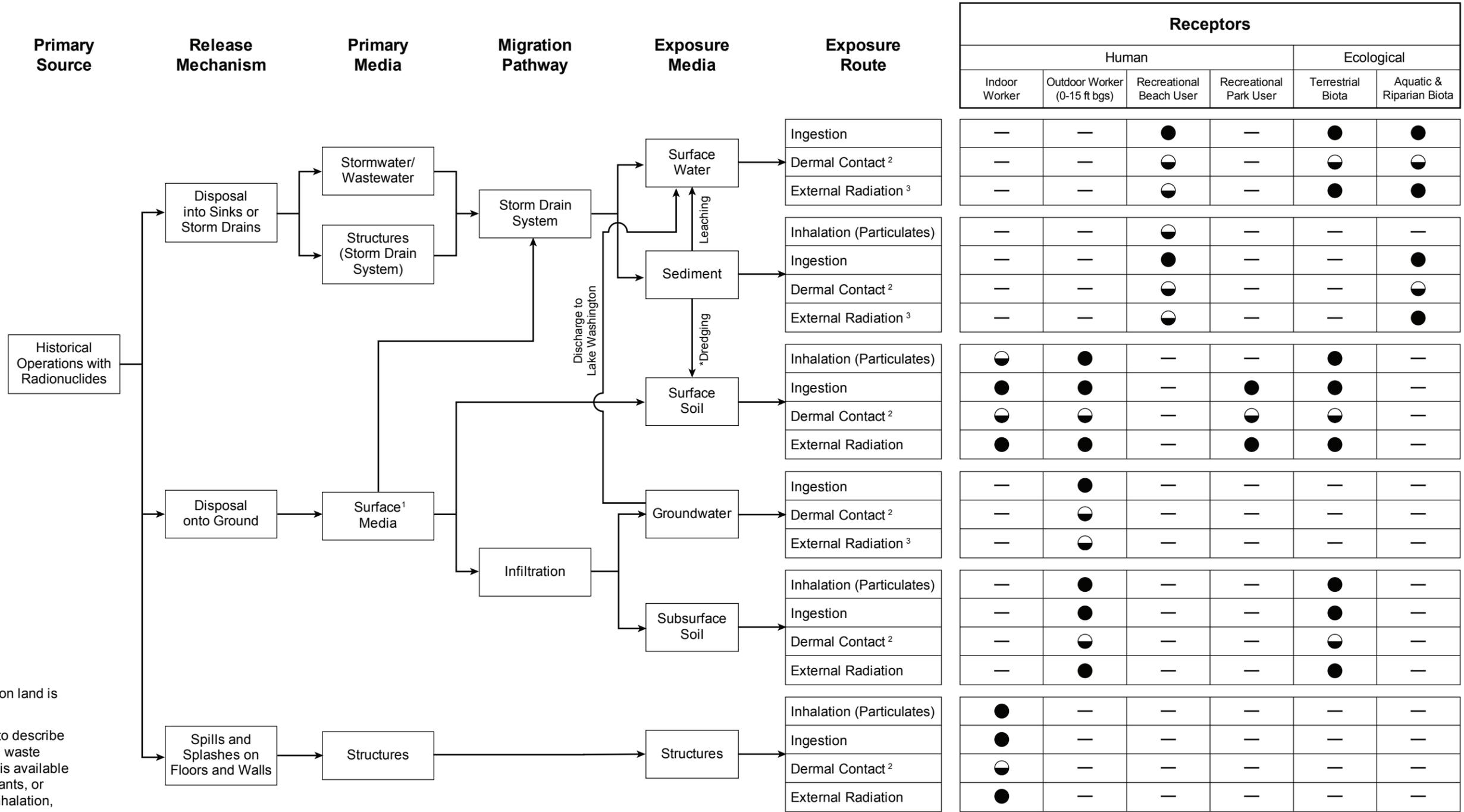
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Sources: Available CAD data provided by City of Seattle and available historical maps and aerial photographs included in electronic data base.

Appendix A
Conceptual Site Models
Preliminary and Updated



Legend:
 ● Complete pathway
 ◐ Complete yet insignificant
 — Incomplete pathway

Notes:
 * Dredged material placed back on land is evaluated as surface soil.
 1 **Surface Media** – A term used to describe the top layer of soil, fill, gravel, waste piles, concrete, or asphalt that is available for direct exposure, growing plants, or resuspension of particles for inhalation, and mixing from human disturbances.
 2 Dermal pathway is insignificant compared to ingestion (EPA 540/R/99/05).
 3 External radiation is only significant for photon emitters in soil (EPA 540/1-89/002).

Table A-1
Considerations for Preliminary Conceptual Site Model and Items of Interest During Document Reviews

Potential Source at Site	Radionuclide	Confirmed?	Industrial Process	Release Mechanism	Migration Pathway	Items of Interest During Document Reviews
Radioluminescent paint	Radium-226	Yes	Painting or cleaning of radioluminescent dials, gauges, personnel markers, and possible incineration	Spills on floor, disposal into drains, disposal onto ground, and possible incineration	<ul style="list-style-type: none"> • Floor cleaning • Foot traffic • Related ventilation system • Storm and sanitary sewer system • Discharge into Lake Washington • Surface runoff into Lake Washington • Surface water • Dredging of contaminated sediment • Disturbance of surface soils in industrial areas • Wind-blown surface soil • Groundwater • Airborne particulates from incineration • Ashes in incinerator 	<ul style="list-style-type: none"> • Instrument shop • Welding area/forging area • Sludge pit • Radium room • Machine shop • Cleaning room • Parachute facilities • Electronics/electrical shops • Optical shops • Gauge shops • Gyrocompass shops • Laboratories • Related plumbing drains (storm and sanitary) • Related ventilation systems • Vehicle maintenance facilities • Incinerator • Burn pits • Wastewater/sewage treatment plant • Storm and sanitary sewer lines • Catch basins and lift stations • Dredging records • Structure/building use history • Any documents related to shipments, storage, use, or disposal involving radionuclides • Disturbed soil of any kind on aerial photographs • Debris disposal areas on aerial photographs • Changes in shoreline on aerial photographs • Counterweights • Materials purchased for operations • Standard operating procedures
Thorium-magnesium alloys in aircraft parts	Thorium-232	No	Machining of parts	Particulates in shops		
Monazite sand	Thorium-232	No	Sandblasting	Particulates in shops		
Welding rods	Thorium-232	No	Welding and grinding welds	Particulates in shops		
Atmospheric testing of nuclear weapons (global contamination)	Cesium-137	Radionuclide present	<ul style="list-style-type: none"> • No industrial process • Contaminated planes or ships exposed during nuclear testing 	<ul style="list-style-type: none"> • Global fallout from atmospheric testing of nuclear weapons • Cleaning of planes or ships or machining of contaminated parts 		
Atmospheric testing of nuclear weapons (global contamination)	Strontium-90	Radionuclide present	<ul style="list-style-type: none"> • No industrial process • Contaminated planes or ships exposed during nuclear testing 	<ul style="list-style-type: none"> • Global fallout from atmospheric testing of nuclear weapons • Cleaning of planes or ships, machining contaminated parts 		
Depleted uranium	Uranium isotopes	No	Maybe used as counterweights	Unknown		

Appendix B

**Document Database
(Electronic Format Only; on DVD Inside Back Cover)**

Appendix C

Former and Existing Structures within the Study Area

Table C-1
Former and Existing Structures within the Study Area
Former Naval Station Puget Sound

Building/ Structure No.	Year Built (Including Second Year for Major Addition)	Radiological Surveys	Historical Names/Historical Use (Quoted From Historical Maps)	Potential Radiological Concerns Related to Building/Structure	Current Use	Grid Location	Floor Space (square feet)
A	1939	None identified	Married Officers' Quarters, Commissioned Officers Quarters	None identified	Structure Removed	G-26	6,152
B	1939	None identified	Married Officers' Quarters, Commissioned Officers Quarters	None identified	Structure Removed	G-26	6,047
C	1939	None identified	Married Officers' Quarters, Commissioned Officers Quarters	None identified	Structure Removed	G-25	6,152
D	1939	None identified	Married Officer's Quarters	None identified	Structure Removed	G-28	1,892
E	1939	None identified	Married Officer's Quarters	None identified	Structure Removed	G-29	1,971
2	1929-1941	Conducted as part of the 1976 RASO Technical Assistance Visit Conducted as part of the 2011 Radiological Remedial Investigation Remediated as part of the TCRA	Overhaul Shop, Assembly and Repair Shop, O and R Hangar and Shop; hangar aircraft repair, offices, Marine Corps training, heavy equipment storage, Coast Guard Reserve, film studio	<ul style="list-style-type: none"> instrument room in second floor south wing maintenance shop and paint shop north side first floor washing platform NE corner liquid cleaning area parachute room SE area oil and sludge separation tank, north side cleaning pit ground floor bomb sites automatic pilots room parachute loft machine shop welding shop Adjacent storm drains and nearby unpaved surfaces that were not previously investigated may be of concern.	North Wing – Seattle Conservation Corps, Central Offices – Vacant, South Wing – Vacant	F-10	144,232
3	Unknown	None identified	Imhoff Tank	This structure received sewage waste prior to the installation of the treatment plant system in 1941. This structure could have received radium paint waste through the sanitary sewer system. However, it appears that sewage waste was confined in this structure prior to further treatment. This structure was removed when the sewage treatment system was constructed in 1941.	Structure Removed	B-4	--
4	1938 ^a		Filter and Sludge Bed	Sludge from the sanitary sewer system may have been treated in this structure prior to 1944. Sludge could have contained radioactive residue. However, it appears that treated material was confined in this structure prior to disposal. This structure was eventually demolished and replaced with larger sludge beds (Structure 207).	Structure Removed	B-3	--

Table C-1 (continued)
Former and Existing Structures within the Study Area
Former Naval Station Puget Sound

Building/ Structure No.	Year Built (Including Second Year for Major Addition)	Radiological Surveys	Historical Names/Historical Use (Quoted From Historical Maps)	Potential Radiological Concerns Related to Building/Structure	Current Use	Grid Location	Floor Space (square feet)
5	1929		Storehouse (divided into 5A – 5D in 2001 site map)	None identified	see 5A through 5D	F-12 to F-14	see 5A through 5D
5A	1929	None identified	Storehouse, supply, and office spaces	None identified	Harborview Medical Center Storage	F-12	29,140
5B	1938	Conducted as part of the 1976 RASO Technical Assistance Visit	Office, classroom, supply warehouse	None identified	University of Washington Medical Center Materials Management, Pacific Northwest Center for Construction Research & Education	F-12	43,800
5C	1940	None identified	Office, classroom, supply warehouse	None identified	School of Art Graduate Artist Studios, Harborview Medical Center Materials Management Warehouse	F-13	95,800
5D	1940	None identified	Supply warehouse, office, band rehearsal	None identified	UW Records Storage	F-14	248,770
6	1939	None identified	Badminton and squash court	None identified	Structure Removed (Brettler Family Place Townhomes)	G-23	7,895
7	1935-1938	None identified	Public Works Office, Inflammable Storage (Appears to have been labeled as building 20 on 1940 site map)	None identified	Structure Removed	E-11	Unknown
8	1938 ^a	None identified	Gasoline Storage Tanks	None identified	Structure Removed	D-11	--
9	1929-1938	None identified	Barracks: Housing, dining, catering, night club, offices, courtroom, chapel, conference, classrooms, storage	None identified	Vacant	E-19	74,639
10	1909-1941	None identified	Flattie Boat House	None identified	Structure Removed	A-3	654
11	1940-1944	Conducted in 2013 by SoundEarth Strategies, Inc. for the City of Seattle (PA-0388) (blacksmith shop tested by Navy in 2014 – clean – report not yet available)	Shop Building, Shop and Office Building – Public Works,	<ul style="list-style-type: none"> • industrial shops • paint shop • blacksmith and welding shop NE corner 	Sail Sand Point Boating Programs; Waldorf School, Cascade Bicycle Club	C-5	59,206
12	1930-1942	None identified	Boiler Plant, Heating Plant	None identified	Vacant, uninhabitable due to asbestos contamination	D-9	5,433
13	1938 ^a	None identified	Garage, storage shed	None identified	Structure Removed	C-5	Unknown
14	1938 ^a	None identified	Chief Petty Officer's Quarters (Building number appears at a new location in 1942.)	None identified	Structure Removed	D-14, G-28	Unknown

Table C-1 (continued)
Former and Existing Structures within the Study Area
Former Naval Station Puget Sound

Building/ Structure No.	Year Built (Including Second Year for Major Addition)	Radiological Surveys	Historical Names/Historical Use (Quoted From Historical Maps)	Potential Radiological Concerns Related to Building/Structure	Current Use	Grid Location	Floor Space (square feet)
15	1938	None identified	Greenhouse, U of W Research Lab	University of Washington, Laboratory of Radiation Ecology conducted a study on the uptake by hermit crabs of strontium and other elements from sediment ("coral grit") from Johnston Island in a terrarium installed in this building during approximately 1965 through 1967.	Structure Removed	E-27	3,268
17	1936-1951	None identified	Engine Test Building, O. and R. Shop Building, Fish and Wildlife Laboratory	Operations in this building may have included use of engine exciters. After this facility was removed in 1983 or 1984 based on aerial photographs, a storage area with concrete slab was constructed between 1993 and 1994. Adjacent storm drains may be a concern.	Structure Removed	E-10	4,943
18	1936-1952	None identified	Firehouse & Garage, Fire Station, barracks	None identified	Vacant	G-16	14,137
20	1936	None identified	Inflammable Storage, Torpedo Shop, Public Works Paint Storage Building, P.W. Storage Building	None identified	Vacant	C-5	2,055
22	1936 ^a	None identified	Gasoline Pump House	None identified	Structure Removed	D-11	--
23	1935-1938	None identified	50,000 Gallon Gasoline Tank (Structure number appears at new location in 1940.)	None identified	Structure Removed	A-2, D-11	--
24	1935-1938	None identified	50,000 Gallon Gasoline Tank (Structure number appears at new location in 1940.)	None identified	Structure Removed	A-2, D-12	--
25	1937	None identified	Administration Building, COM13 Admin, offices, computer center, telecommunications	None identified	Washington Dental Services Building for Early Childhood Oral Health	F-15	27,892
26N	1940	None identified	Bachelor Officer Quarters, BOQ	None identified	Family Housing	E-22	16,082
26S	1937	None identified	Bachelor Officer Quarters, BOQ	None identified	Family Housing	E-24	17,282
27	1937-1945	Conducted as part of the 1976 RASO Technical Assistance Visit Conducted as part of 2011 Radiological Remedial Investigation Remediated as part of the TCRA	Seaplane Hangar, Hangar, O. and R. Shop Building, C.B. Training – ACFT Maintenance	<ul style="list-style-type: none"> sewage ejector pit (1937 south edge of bldg. under addition) instrument shop washing area for instrument shop welding shop machine shop radium room 	Indoor Sports (Arena Sports), Health Club (Magnuson Athletic Club)	E-7	105,000

Table C-1 (continued)
Former and Existing Structures within the Study Area
Former Naval Station Puget Sound

Building/ Structure No.	Year Built (Including Second Year for Major Addition)	Radiological Surveys	Historical Names/Historical Use (Quoted From Historical Maps)	Potential Radiological Concerns Related to Building/Structure	Current Use	Grid Location	Floor Space (square feet)
28	1938 ^a	None identified	Guard House	None identified	Structure Removed	E-16	Unknown
29	1937		Dispensary; Infirmary; Dispensary, Medical Hdqtrs. 18th	None identified	UW School of Public Health	E-15	33,744
30	1938-1940	Conducted as part of the 1976 RASO Technical Assistance Visit	Naval Reserve Building; Hangar and Office Building; Hangar, Administrative Offices, EM Club; Admin, Training; Office, aircraft hangar, barracks, club, band rehearsal, photography studio, machine shops, storage, tennis courts, assembly	<ul style="list-style-type: none"> instrument shop in SE corner turned into lounge floor plan, welding, machinery, industrial, SE corner where instrument shop was pit room and trenches paint room First Floor Plan East has a note that says "exist'g radiation." It is believed that the drawing should have said "exist'g radiator" based on other similar symbols on the drawing and a 2014 site visit to this area of Building 30. 	West Wing – Artist Studios; Hangar - Multiuse; East Wing - Offices	G-15	80,066
31	1938	None identified	Boat House, repairs, office	None identified	Boat House	C-3	4,443
34	1940 ^a	None identified	C.P.O. Quarters, Chief Petty Officer's Quarters (Building number appears at a new location in 1942.)	None identified	Structure Removed	D-14, G-29	Unknown
35	1940 ^a	None identified	Imhoff Tank	This structure received sewage waste for approximately 1 year prior to the installation of the treatment plant system in 1941. This structure could have received radium paint waste through the sanitary sewer system. However, it appears that sewage waste was confined in this structure prior to further treatment. This structure was removed when the sewage treatment system was constructed in 1941.	Structure Removed		--
36	1940 ^a	None identified	Filter Bed	Sludge from the sanitary sewer system may have been treated in this structure prior to 1944. Sludge could have contained radioactive residue. However, it appears that treated material was confined in this structure prior to disposal. This structure was eventually demolished and replaced with larger sludge beds (Structure 207).	Structure Removed	B-3	Unknown
37	1942	None identified	Gate House, Gate House (North Sentry)	None identified	Structure Removed	C-10	12
38	1942	None identified	Gate House, Gate House (Main Sentry), Main Entrance Sentry House	None identified	Vacant	E-16	70
39	1942	None identified	Gate House, Gate House (South Sentry), G.C.A. Head Building	None identified	Structure Removed	E-28	Unknown

Table C-1 (continued)
Former and Existing Structures within the Study Area
Former Naval Station Puget Sound

Building/ Structure No.	Year Built (Including Second Year for Major Addition)	Radiological Surveys	Historical Names/Historical Use (Quoted From Historical Maps)	Potential Radiological Concerns Related to Building/Structure	Current Use	Grid Location	Floor Space (square feet)
40	1943	None identified	Welding Shop - Public Works (on 1942 map), Paint Storage/Public Works (on 1944 through 1959 maps), P.W. Shop	Welding activities prior to 1949 were determined to not to be a potential concern because thoriated welding rods were patented in 1949.	Cascade Bicycle Club	B-5	924
41	1939	None identified	Ships' Service, Gasoline Station; Navy Exchange, Gasoline Station, administrative	None identified	Tennis Center Sand Point leased area, Parks Grounds Crew Quarters	H-16	2,030
42	1939-1943	None identified	Main Electric Substation, Main Substation	None identified	Main Electric Substation (4kV Parks facilities)	D-17	564
44	1941	None identified	Fuel Oil Reservoir	None identified	Structure Removed	D-9	--
45	1939	None identified	Fuel Oil Tank	None identified	Structure Removed	D-10	--
46	1939	None identified	Fuel Oil Tank	None identified	Structure Removed	D-10	--
47	1941	None identified	650 seat theater, library, gymnasium, weight rooms, swimming pool, offices, lounge (Appears to have been identified as building 7 on 1940 site map)	None identified	Magnuson Community Center, Seattle Musical Theatre	G-19	50,060
60	1940	None identified	Fuze and Detonator Magazine	None identified	Structure Removed	N-28	130
61	1940	None identified	Small Arms and Pyrotechnic	None identified	Storage	L-28	870
64	1941	None identified	Machine Gun Range Firing Shed, Rifle Range Firing Shed	None identified	Structure Removed	K-29	1,879
65	1941	None identified	Machine Gun Range Head, Rifle Range Firing Shed Head	None identified	Structure Removed	K-29	83
67	1941-1950	None identified	Motor Pool, Garage, barracks, offices, vehicle repair	None identified	Mountaineer's Headquarters	D-11	20,872
68	1941	None identified	Inflammable Stores Building	None identified	Structure Removed	D-12	34,876
69	1942 ^a	None identified	Carport - B.O.Q (parking lot)	None identified	Parking Lot	G-23	--
70 - 85	1940	None identified	Gasoline Tanks	None identified	Structure Removed	A-3	--
86 - 93	1940	None identified	Gasoline Control Valve Pits	None identified	Structure Removed	A-3	--
94-95	1940	None identified	Gasoline Pressure Control Pits	None identified	Structure Removed	A-3	--
96	1940	None identified	Gasoline Manifold and Meter Pit	None identified	Structure Removed	A-4	--
97	1940	None identified	Gasoline Meter Pit	None identified	Structure Removed	A-4	--
98	1940	2011 Radiological Remedial Investigation	Gasoline Pump House, Gas Pump	None identified	Vacant/Inactive	B-5	98
99	1941	None identified	Gasoline Tank, Vehicle Fuel Tank	None identified	Structure Removed	B-5	--
100	1941	None identified	Gasoline Tank, Vehicle Fuel Tank	None identified	Structure Removed	B-5	--
101	1941	None identified	Tank Truck Loading Rack, Tank Truck Fuel Stand	None identified	Unused	C-4	--
109	1940	None identified	Main Water Meter Pit (South Gate)	None identified	Structure Removed	E-27	--

Table C-1 (continued)
Former and Existing Structures within the Study Area
Former Naval Station Puget Sound

Building/ Structure No.	Year Built (Including Second Year for Major Addition)	Radiological Surveys	Historical Names/Historical Use (Quoted From Historical Maps)	Potential Radiological Concerns Related to Building/Structure	Current Use	Grid Location	Floor Space (square feet)
110	1941	None identified	Sewage Clarigester Tank	Part of the former sanitary sewer. This structure may have received residual radium paint waste through the sanitary sewer system. However, it appears that waste may have been generally confined in the treatment system. This structure was eventually removed from the site.	Structure Removed	B-4	--
111	1941	None identified	Sewage Secondary Tank, Sewage Primary Filter Tank	Part of the former sanitary sewer. This structure may have received residual radium paint waste through the sanitary sewer system. However, it appears that waste may have been generally confined in the treatment system. This structure was eventually removed from the site..	Structure Removed	B-4	--
112	1941	None identified	Sewage Primary Tank, Sewage Primary Filter Tank	Part of the former sanitary sewer. This structure may have received residual radium paint waste through the sanitary sewer system. However, it appears that waste may have been generally confined in the treatment system. This structure was eventually removed from the site.	Structure Removed	B-4	--
113	1941	None identified	Sewage Secondary Clarifier Tank, Sewage Secondary Clarifier	Part of the former sanitary sewer. This structure may have received residual radium paint waste through the sanitary sewer system. However, it appears that waste may have been generally confined in the treatment system. This structure was eventually removed from the site.	Structure Removed	B-4	--
114	1941	None identified	Laboratory and Pump House, P.W. Maintenance Shop	Part of the former sanitary sewer. This structure may have received residual radium paint waste through the sanitary sewer system. However, it appears that waste may have been generally confined in the treatment system. This structure was eventually removed from the site.	Structure Removed	B-4	240
115	1941	None identified	Sewage Sludge Bed Building, Tank Farm Repair Storage, P.W. Maintenance Shop	Part of the former sanitary sewer. Unlikely that sludge was managed in this building.	Vacant	B-4	1,363
116	1938	2011 Radiological Remedial Investigation	Sewage Pump House, Sewage Pumping Station	Part of the former sanitary sewer that was addressed under the 2011 Radiological Remedial Investigation	Sewer Pump Station	C-3	99
117	1928	2011 Radiological Remedial Investigation	Sewage Pump Pit	Part of the former sanitary sewer that was addressed under the 2011 Radiological Remedial Investigation	Inactive	F-8	--
118	1928	None identified	Sewage Pump Pit	None	Unknown	F-15	--

Table C-1 (continued)
Former and Existing Structures within the Study Area
Former Naval Station Puget Sound

Building/ Structure No.	Year Built (Including Second Year for Major Addition)	Radiological Surveys	Historical Names/Historical Use (Quoted From Historical Maps)	Potential Radiological Concerns Related to Building/Structure	Current Use	Grid Location	Floor Space (square feet)
119	1941	None identified	Dope Storage Building, Flammable Storage	area addressed under the TCRA	Vacant	F-11	99
120	1941	current TCRA	Sludge Pits (A. and R.), Sludge Pit (O. and R.)	area addressed under the TCRA	Existing, possibly inactive	F-11	--
124	1942	None identified	Aqua System Pump Pit, Aqua System Pump Pit	None identified	Structure Removed	C-3	--
127	1941	None identified	Gasoline Tank – Power Plant	None identified	Structure Removed	D-9	--
133	1942 ^a	None identified	Office Building - Austin Co., Post Office Building	None identified	Structure Removed	C-9	Unknown
134	1942 ^a	None identified	Store House - Austin Co.	None identified	Structure Removed	C-9	Unknown
135	1942 ^a	None identified	Pass Office - Austin Co.	None identified	Structure Removed	C-8	Unknown
136	1940	None identified	Gasoline Meter Pit	None identified	Structure Removed	B-5	--
137	1942-1944	None identified	Laundry Building, Navy Exchange Laundry and Store	None identified	Structure Removed	D-14	11,447
138	1942	None identified	Main Gate House, Gatehouse (Main Entrance), Sand Point Magnuson Park administrative offices	None identified	South Wing – Offices; North Wing – Offices, DoIT telecom room	E-16	12,806
141	1942-1944	None identified	Medical Storage Building, Respiratory Training Building, U. of W. Physics Lab Building, Fish and Wildlife Laboratory	None identified	Vacant (planned demolition)	E-15	1,342
142	1942	None identified	Gasoline Pump, Filling Station	None identified	Structure Removed	C-11	126
143	1942	None identified	Gasoline Tank, Vehicle Fuel Tank	None identified	Structure Removed	D-11	--
144	1942	None identified	Gasoline Tank, Vehicle Fuel Tank	None identified	Structure Removed	D-11	--
145	1942	None identified	Gasoline Tank, Vehicle Fuel Tank	None identified	Structure Removed	D-11	--
166	1939	None identified	Gasoline Tank	None identified	Structure Removed	H-16	--
167	1939	None identified	Gasoline Tank	None identified	Structure Removed	H-16	--
168	1942	None identified	Gasoline Tank	None identified	Structure Removed	H-16	--
169	1942	None identified	Gasoline Tank	None identified	Structure Removed	H-16	--
170	1943 ^a	None identified	Ordnance Vehicle Shed	None identified	Structure Removed	D-17	Unknown
189	1943 ^a	None identified	Synthetic Training Building	None identified	Structure Removed	H-17	Unknown
190	1943	None identified	Synthetic Training Building, NARTU Paint and Storage Building, A/C Maint Paint Shop and Storage	None identified	Structure Removed	H-17	2,580
191	1943	None identified	Gas Training Building, Storage Building (Temporary)	None identified	Structure Removed	D-10	191
192	1944	None identified	Low Pressure Training Building; Medical Storage Building; U. of W. Physics Lab Building; Ceramics Hobby Shop, Fish and Wildlife Office; education support	None identified	Vacant (planned demolition)	E-15	3,282
193	1943	None identified	Transport Hangar	None identified	Structure Removed	N-26	84,050

Table C-1 (continued)
Former and Existing Structures within the Study Area
Former Naval Station Puget Sound

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194	1943 ^a	None identified	Storage Building (Temporary)	None identified	Structure Removed	L-28	Unknown
195	1943 ^a	None identified	Storage Building (Temporary)	None identified	Structure Removed	L-28	Unknown
196	1943 ^a	None identified	Storage Building (Temporary)	None identified	Structure Removed	L-29	Unknown
199	1943	None identified	Firing Shed, Firing Charge	None identified	Structure Removed	N-28	984
200	1943	None identified	Office and Armory Building	None identified	Structure Removed	N-28	667
201	1943 ^a	None identified	Indoor Shooting Range Building	None identified	Structure Removed	N-28	Unknown
204	1944	None identified	Overseas Air Cargo Terminal, Storage and Office Building, Fish and Wildlife Laboratory	None identified	Structure Removed	L-28	8,019
205	1944 ^a	None identified	Public Works Storage Building	None identified	Structure Removed	L-28	Unknown
206	1944	None identified	Pump House, Sewage Pumping Station	None identified	Structure Removed	B-3	304
207	1944	TCRA 2014	Sludge Beds	Part of the former sanitary sewer. This structure could have received radium paint waste; however, waste was contained and this structure was removed from the site. No radioactivity in excess of background was detected at this location when the Navy tested this area when underground utilities were installed in 2014.	Structure Removed	B-3	6,786
208	1944	None identified	Second Stage Digester	Part of the former sanitary sewer. This structure may have received residual radium paint waste through the sanitary sewer system. However, it appears that waste may have been generally confined in the treatment system. This structure was eventually removed from the site.	Structure Removed	A-4	--
209	1944	None identified	Secondary Clarifier	Part of the former sanitary sewer. This structure may have received residual radium paint waste through the sanitary sewer system. However, it appears that waste may have been generally confined in the treatment system. This structure was eventually removed from the site.	Structure Removed	B-4	--
210	1944	None identified	Final Filter	Part of the former sanitary sewer. This structure may have received residual radium paint waste through the sanitary sewer system. However, it appears that waste may have been generally confined in the treatment system. This structure was eventually removed from the site.	Structure Removed	B-4	--

Table C-1 (continued)
Former and Existing Structures within the Study Area
Former Naval Station Puget Sound

Building/ Structure No.	Year Built (Including Second Year for Major Addition)	Radiological Surveys	Historical Names/Historical Use (Quoted From Historical Maps)	Potential Radiological Concerns Related to Building/Structure	Current Use	Grid Location	Floor Space (square feet)
211	1944	None identified	Final Clarifier	Part of the former sanitary sewer. This structure may have received residual radium paint waste through the sanitary sewer system. However, it appears that waste may have been generally confined in the treatment system. This structure was eventually removed from the site.	Structure Removed	B-4	--
213	1944	None identified	N.A.T.S. Temporary Storage Building, Overseas Air Cargo Building, Fish and Wildlife Storage	None identified	Structure Removed	P-27	7,798
215	1944	None identified	VR-5 Radio Shop	None identified	Structure Removed	Q-27	383
216	1943	None identified	Hose Reel House, Hose and Foam Storage	None identified	Structure Removed	A-4	63
217	1943	None identified	Foam Generator Building	None identified	Structure Removed	B-5	48
219	1944	None identified	Hot Well (Secondary Containment for former AST)	None identified	Inactive	D-9	--
220	1944 ^a	None identified	Auxiliary Fire House	None identified	Structure Removed	O-27	Unknown
222	1944	None identified	Enlisted Waves Barracks, USAF Reserve Center, Avtech Training	None identified	Structure Removed, Tennis Center Sand Point	G-17	28,245
223	1944	None identified	Aerial Free Gunnery Training School, Aviation Technical Training, Navy Finance Office	None identified	Structure Removed	I-18	8,245
224	1944	None identified	Junior Officers Quarters; JOQ, CPO Club, Waves Quarters; CPO and Waves Barracks; Barracks	None identified	Santos Place (SRO Housing)	G-21	38,264
228	1944	None identified	VR-5 Carpenter Shop, Fish and Wildlife Storage	None identified	Structure Removed	M-27	2,307
229	1944	None identified	VR-5 Paint Shop, Hobby Shop	None identified	Structure Removed	M-27	684
230	1944	None identified	Storage Building, Steam Heating Plant	None identified	Structure Removed	L-27	215
236	1944	None identified	Trainer Building (Temporary)	None identified	Structure Removed	I-18	671
238	1944	None identified	Storage Shed, Indoor Shooting Range Building (Building number appears at new location in 1952.)	None identified	Structure Removed	C-10, N-28	1517
244	1944-1945	None identified	Storage Shed, Public Works Storage	None identified	Structure Removed	J-25	4,834
248	1941	None identified	Car Shelter (Temporary); Vehicle Storage Shelter	None identified	Structure Removed	C-10	1,909
250	1945 ^a	None identified	O. and R. Shop (Temporary)	None identified	Structure Removed	F-8	Unknown
251	1945 ^a	None identified	Sewage Ejector Pit	None identified	Structure Removed	P-27	--
253	1945	None identified	Gunnery Training Building (Temporary). Av. Tech. Training Building (Temporary)	None identified	Structure Removed	I-18	583
254	1945	None identified	Gunnery Training Building (Temporary). Av. Tech. Training Building (Temporary)	None identified	Structure Removed	I-18	583

Table C-1 (continued)
Former and Existing Structures within the Study Area
Former Naval Station Puget Sound

Building/ Structure No.	Year Built (Including Second Year for Major Addition)	Radiological Surveys	Historical Names/Historical Use (Quoted From Historical Maps)	Potential Radiological Concerns Related to Building/Structure	Current Use	Grid Location	Floor Space (square feet)
255	1945	None identified	Gunnery Training Building (Temporary). Av. Tech. Training Building (Temporary)	None identified	Structure Removed	I-18	583
257	1945	None identified	Gunnery Training Building (Temporary). Av. Tech. Training Building (Temporary)	None identified	Structure Removed	I-18	1,652
263	1945 ^a	None identified	Storage Building (Temporary)	None identified	Structure Removed	C-9	Unknown
265	1946	None identified	Civilian Cafeteria and Storage Building (Temporary), Petty Officers' Club	None identified	Structure Removed	C-9	4,260
268	1943 ^a	None identified	Sewage Pump Pit	None identified	Unknown	D-13	--
275	1945	None identified	Storage and Shelter Building and Flattie Dock, Boat Dock Shelter and Dock	None identified	Sailing storage (Sail Sand Point)	A-2	258
281	1941	None identified	Water Meter Pit	None identified	Structure Removed	C-10	--
282	1943	None identified	Sewage Pump Pit	None identified	Unknown	N-25	--
283	1946-1952	None identified	Plane Washing Shed, Plane Washing Shed (Tank Truck Repair), Construction Equipment Maintenance Shop	Plane washing activities could have released fallout from planes.	Structure Removed	C-5	9,550
285	1947	None identified	Gasoline Truck Loading Rack, Aircraft Truck Fuel Stand	None identified	Structure Removed	D-5	--
299	1949	None identified	Inflammable Stores Bldg. O. and R., Inflammable Stores Bldg.	None identified	Seattle Conservation Corps Storage	E-9	1,120
301	1951	None identified	Ordnance Shop (per PA-0108), Carpenter Hobby Shop, Hobby Shop	None identified	Structure Removed	K-27	4,140
303	1950	None identified	Crash Crew (per PA-0108), Gate House (North Sentry)	None identified	Structure Removed	C-10	41
304	1950	None identified	Lube Oil Storage Tank, Lube Oil Tank	None identified	Structure Removed	B-5	--
307	1951	None identified	Storage Building, COM13 Storage	None identified	Structure Removed	M-28	4020
308	1951-1953	None identified	Welding Shop (in its original location per PA-0108), Automotive Hobby Shop, Hobby Shop	Welding activities could have involved the use of thoriated welding rods. Building has been removed. This area was heavily reworked when the NOAA entrance road was constructed in 1978. This building was moved in approximately 1977 to a location on NE 65 th Street (L-26 on Site Map). It was used for an automotive hobby shop and currently for Seattle Park's storage. The original walls and floors have been removed since the time that structure was moved.	Ground Parks Storage	C-9, then L-26	3,000
310	1952	None identified	Storage Building, Fish and Wildlife Storage	None identified	Parks Grounds Storage	J-28	4,020
319	1959 ^a	None identified	Fuel Oil Storage Tank, Sludge Oil Storage Tank	None identified	Structure Removed	D-10	--
320	1941 ^a	None identified	Flag Pole	None identified	Flag Pole	F-16	--

Table C-1 (continued)
Former and Existing Structures within the Study Area
Former Naval Station Puget Sound

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321	1938 ^a	None identified	Small Craft Berthing Pier No. 1, Small Craft Pier	None identified	Pier	C-2	Unknown
324	1959 ^a	None identified	Recreational Pier No. 7, Recreational Boat Dock	None identified	Structure Removed	B-2	Unknown
326	1953 ^a	None identified	Enlisted Mens Tennis and Volleyball Courts	None identified	Parking Lot	E-21	Unknown
327	1942 ^a	None identified	Waves Tennis and Volleyball Courts, Playing Court	None identified	Playing Court	G-18	Unknown
328	1943 ^a	None identified	Officers Tennis Court, Playing Court	None identified	Parking Lot	G-24	Unknown
330	1939	None identified	Married Officer Quarters "A", Quarters "A"	None identified	Harmony House – Teen Housing	G-26	6,390
331	1939	None identified	Married Officer Quarters "B", Quarters "B"	None identified	Pathway House – Teen Housing	G-25	6,233
332	1939	None identified	Married Officer Quarters "C", Quarters "C"	None identified	Passages House – Teen Housing	G-25	6,233
333	1939	None identified	Married Officers Quarters "D", Quarters "D"	None identified	Structure Removed	G-28	1,990
334	1939	None identified	Married Officers Quarters "E", Quarters "E"	None identified	Structure Removed	G-29	2,113
340	1974	None identified	Service station, storage	None identified	Structure Removed	J-26	Unknown
341	1974	None identified	Service station, storage	None identified	Structure Removed	J-26	Unknown
344	1974	None identified	Country store, storage	None identified	Structure Removed	L-27	11,000
345	1976	None identified	Auto repair shop, storage	None identified	Structure Removed	K-27	9,217
385	Unknown	None identified	Regulator Vault	None identified	Structure Removed	Q-27	Unknown
391	Unknown	None identified	Truck Scale	None identified	Structure Removed	L-28	Unknown
406	1988	None identified	Brig, community center	None identified	The Brig at Magnuson Park (recreation annex)	I-15	29,270
407	1989	None identified	Hazardous Waste Storage	None identified	Seattle Conservation Corps Storage	E-10	900
502	1998 ^a	None identified	Picnic Shelter #4	None identified	Picnic shelter	J-18	--
503	1998 ^a	None identified	Picnic Shelter #5	None identified	Picnic shelter	A-3	--
--	1928	Conducted as part of the 2011 Radiological Remedial Investigation Remediated as part of the TCRA	Storm Drain System	transport pathway from storm drain system from industrial area. Much of the storm drain system was sampled and remediated where radiological contamination was present. Some catch basins and manholes may not have been sampled.			
--	Unknown	None identified	Outfall into Lake Washington, 36" dia. from gasoline field, northwest corner of study area	None identified	outfall	A-2	--
--	Unknown	None identified	Storm Drain Outfall and Lake Washington - Outfall into Lake Washington, 16" dia. from former sewage treatment plant and Bldg. 11, north of Bldg. 11	Former transport pathway from former sanitary sewer system to Lake Washington	outfall	B-3	--

Table C-1 (continued)
Former and Existing Structures within the Study Area
Former Naval Station Puget Sound

Building/ Structure No.	Year Built (Including Second Year for Major Addition)	Radiological Surveys	Historical Names/Historical Use (Quoted From Historical Maps)	Potential Radiological Concerns Related to Building/Structure	Current Use	Grid Location	Floor Space (square feet)
--	Unknown	None identified	Storm Drain Outfall and Lake Washington - Outfall into Lake Washington, 6" dia. outfall from Plane Washing Shed, Bldg. 283, discharges northwest of Bldg. 27	transport pathway from the former Plane Wash Shed to Lake Washington	outfall	D-4	--
--	Unknown	None identified	Storm Drain Outfall and Lake Washington - Outfall into Lake Washington, 42" dia. from the industrialized area, discharges north of Bldg. 27	transport pathway from storm drain system from industrial area to Lake Washington	outfall	D-5	--

^aDate estimated based on first appearance on available site maps and known dates of listed structures.

Notes:

Green-highlighted historical name/use indicates that there is potential of radiological history based on historical use, and sampling is recommended.

Yellow-highlighted historical name/use indicates that there is potential of radiological history; however, the contamination potential is none based on previous investigations, TCRA, or building removal and disposal.

Sources:

- City of Seattle. 1998. *Sand Point Peninsula*. March 26, 1998.
- City of Seattle. 2001. *Sand Point/Magnuson Park Parcels*. June 8, 2001.
- City of Seattle. 2002. *Sand Point/Magnuson Key Map*. January 30, 2002.
- City of Seattle. 2014. *Building List 1944-2009*. Provided by Kevin Bergsrud of Seattle Parks and Recreation. March 25, 2014.
- U.S. Navy, 1953. *Master Shore Station Development*. November 20, 1953.
- U.S. Navy, Public Works. 1949. *Map of Naval Air Station, Seattle, Wash, Showing Conditions on June 30, 1949*.
- Seattle Parks and Recreation. 2012. *Buildings/Structures Warren G. Magnuson Park & Sand Point Historic District*. PA-0389

**Table C-2
Building/Structure Use Chronology**

Building/ Structure No.	1938 (PA-0021)	1940 (PA-0020)	1942 (PA-0019)	1944 (PA-0396)	1949 (PA-0026)	1950 (PA-0025)	1951 (PA-0171)	1952 (PA-0177)	1959 (PA-0397)	1965 (PA-0428)	1998 (PA-0093)	2001 (PA-0100)
A	Not Listed	Married Officers' Quarters	Quarters "A"	Married Officer's Quarters	Commissioned Officers Quarters	Commissioned Officers Quarters	Commissioned Officers Quarters	Commissioned Officers Quarters	See 330	See 330	See 330	See 330
B	Not Listed	Married Officers' Quarters	Quarters "B"	Married Officer's Quarters	Commissioned Officers Quarters	Commissioned Officers Quarters	Commissioned Officers Quarters	Commissioned Officers Quarters	See 331	See 331	See 331	See 331
C	Not Listed	Married Officers' Quarters	Quarters "C"	Married Officer's Quarters	Commissioned Officers Quarters	Commissioned Officers Quarters	Commissioned Officers Quarters	Commissioned Officers Quarters	See 332	See 332	See 332	See 332
D	Not Listed	Not Listed	Not Listed	Not Listed	Married Officers Quarters	Married Officers Quarters	Married Officers Quarters	Married Officers Quarters	See 333	See 333	See 333	Not Listed
E	Not Listed	Not Listed	Not Listed	Not Listed	Married Officers Quarters	Married Officers Quarters	Married Officers Quarters	Married Officers Quarters	See 334	See 334	See 334	Not Listed
2	Overhaul Shop	Overhaul Shop	Assembly and Repair Shop	Assembly and Repair Shop	Assembly and Repair Shop	Assembly and Repair Shop	Assembly and Repair Shop	Overhaul and Repair Shop	O and R Hangar and Shop (USARTC Wash. Mil. Dist.)	Hangar (Vacant); Misc. Storage	complex of two hangars	recreation complex, special events center
3	Imhoff Tank	Imhoff Tank	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
4	Filter and Sludge Bed	Filter and Sludge Bed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
5	Storehouse	Storehouse	Storehouse	Storehouse	Storehouse	Storehouse	Storehouse	Storehouse	Storehouse, Supply and Office Space; GSA	Warehouse	Not Listed	Not Listed
5A	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	high bay warehouse	art education , pottery school, studio
5B	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	two-story office building and high bay warehouse	graduate studio spaces, storage
5C	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	two-story high bay warehouse with offices	graduate studio spaces, storage
5D	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	four-story warehouse	active storage
6	Not Listed	Badminton and Squash Courts	Badminton and Squash Courts	Badminton and Squash Courts	Badminton and Squash Courts	Badminton and Squash Courts	Badminton and Squash Courts	Badminton and Squash Courts	Badminton and Squash Courts	Badminton and Squash Courts	Badminton Bldg.	Not Listed
7	Public Works Office	Recreation Building	Office Building (W.P.A.)	Office Building	Not Listed	Not Listed	Not Listed	Not Listed				
8	Gasoline Storage Tanks	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
9	Barracks	Barracks	Barracks	Barracks	Barracks	Barracks	Barracks	Barracks	Barracks, 13th ND Headquarters and Offices	EM Barracks; COM13 Admin	three-story barracks, dining, and office complex	vacant
10	Not Listed	Not Listed	Flattie Boat House	Flattie Boat House	Flattie Boat House	Flattie Boat House	Flattie Boat House	Flattie Boat House	Not Listed	Not Listed	Not Listed	Not Listed
11	Shop Building	Shops and Office Building (P.W.)	Shop and Office Building - Public Works	Shop and Office Building, Public Works	Public Works	single and two-story office and shops	special event venue, non-motorized boating office					

Table C-2 (Continued)
Building/Structure Use Chronology

Building/ Structure No.	1938 (PA-0021)	1940 (PA-0020)	1942 (PA-0019)	1944 (PA-0396)	1949 (PA-0026)	1950 (PA-0025)	1951 (PA-0171)	1952 (PA-0177)	1959 (PA-0397)	1965 (PA-0428)	1998 (PA-0093)	2001 (PA-0100)
12	Boiler Plant	Boiler Plant	Boiler Plant	Boiler Plant	Boiler Plant	Boiler Plant	Boiler Plant	Boiler Plant	Boiler Plant	Heating Plant	utility structure	arts/cultural
13	Garage	Not Listed	Storage Sheds - Public Works	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
14	Chief Petty Officers Quarters	C.P.O. Quarters (North)	C.P.O. Quarters	Chief Petty Officer's Quarters	Not Listed	Not Listed	Not Listed	Not Listed				
15	Green House	Greenhouse	Greenhouse	Greenhouse	Greenhouse	Greenhouse	Greenhouse	Greenhouse	Greenhouse	U of W Research Lab	Not Listed	future demolition
17	Engine Test Building	Engine Test Building	Engine Test Building	Engine Test Building	O. and R. Shop Building	(Shop and Laboratory) Storage	Fish and Wildlife Laboratory	Not Listed	Not Listed			
18	Fire House and Garage	Firehouse	Fire House	Fire House and Garage	Fire House and Garage	Fire House and Garage	Fire House and Garage	Fire House and Garage	Fire House and Garage	Fire Station	Firestation	arts studio
20	Inflammable Storage	Inflammable Storage	Inflammable Storage	Torpedo Shop	Public Works Paint Storage Building	P.W. Storage	Not Listed	Not Listed				
22	Gasoline Pump House	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
23	Gasoline Tank	50,000 Gal. Gasoline Tank (North) (Location changed)	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
24	Gasoline Tank	50,000 Gal. Gasoline Tank (South) (Location changed)	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
25	Administration Building	Administration Building	Administration Building	Administration Building	Administration Building	Administration Building	Administration Building	Administration Building	Administration Building 13th ND, Tel. SWDS	COM13 Admin	office building	Future school
26	Bachelor Officers' Quarters	Bachelor Officers' Quarters	Bachelor Officers' Quarters	Bachelor Officer's Quarters	Bachelor Officers Quarters	BOQ	Not Listed					
26N	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Officers barracks	community housing
26S	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Officers barracks	community housing
27	Seaplane Hangar	Seaplane Hangar	Hangar	Seaplane Hangar	O. and R. Shop Building	Hangar (Fish and Wildlife Service Storage)	C.B. Training; ACFT Maintenance	Not Listed	indoor participant sports			
28	Guard House	Guard House	Guard House	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed

Table C-2 (Continued)
Building/Structure Use Chronology

Building/ Structure No.	1938 (PA-0021)	1940 (PA-0020)	1942 (PA-0019)	1944 (PA-0396)	1949 (PA-0026)	1950 (PA-0025)	1951 (PA-0171)	1952 (PA-0177)	1959 (PA-0397)	1965 (PA-0428)	1998 (PA-0093)	2001 (PA-0100)
29	Dispensary	Dispensary	Dispensary	Dispensary	Dispensary	Dispensary	Dispensary	Infirmary	Dispensary, Medical Hdqtrs. 18th	Dispensary	medical/dental clinic	education support
30	Naval Reserve Building	Naval Reserve Building	Naval Reserve Building	Hangar and Office Building	Hangar, Administration Offices, EM Club	Admin; Training	office buildings surrounding open hangar bay	arts/cultural/public library, offices				
31	Not Listed	Boat House	Boat House	Boat House	Boat House	Boat House	Boat House	Boat House	Boat House	Boat House	boat house	boat house
31A	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	boat house
34	Not Listed	C.P.O. Quarters (North)	C.P.O. Quarters (location changed)	Chief Petty Officer's Quarters	Not Listed	Not Listed	Not Listed	Not Listed				
35	Not Listed	Imhoff Tank	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
36	Not Listed	Filter Bed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
37	Not Listed	Not Listed	Gate House	Gate House (North)- (Sentry)	Not Listed	Not Listed	Not Listed	Not Listed				
38	Not Listed	Not Listed	Gate House	Gate House (Main)- (Sentry)	Main Entrance Sentry House	Not Listed	Not Listed					
39	Not Listed	Not Listed	Gate House	Gate House (South)- (Sentry)	G.C.A. Head Building	Not Listed	Not Listed	Not Listed				
40	Not Listed	Not Listed	Welding Shop - Public Works	Paint, Storage, Public Works	P.W. Shop	Not Listed	former paint, storage, Public Works					
41	Not Listed	Not Listed	Ship's Service, Gasoline Station	Ships' Service, Gasoline Station	Ships' Service, Gasoline Station	Ships' Service, Gasoline Station	Ships' Service, Gasoline Station	Ships' Service, Gasoline Station	Navy Exchange, Gasoline Station	Navy Exchange Gas Station	Gas station	grounds maintenance
42	Not Listed	Not Listed	Main Electric Sub- Station	Main Electric Substation	Main Substation	Not Listed	Not Listed					
44	Not Listed	Not Listed	Fuel Oil Reservoir	Fuel Oil Reservoir	Fuel Oil Reservoir	Fuel Oil Reservoir	Fuel Oil Reservoir	Fuel Oil Reservoir	Fuel Oil Reservoir	Not Listed	Not Listed	Not Listed
45	Not Listed	Not Listed	Fuel Oil Tank	Fuel Oil Tank	Fuel Oil Tank	Fuel Oil Tank	Fuel Oil Tank	Fuel Oil Tank	Fuel Oil Tank	Not Listed	Not Listed	Not Listed
46	Not Listed	Not Listed	Fuel Oil Tank	Fuel Oil Tank	Fuel Oil Tank	Fuel Oil Tank	Fuel Oil Tank	Fuel Oil Tank	Fuel Oil Tank	Not Listed	Not Listed	Not Listed
47	Not Listed	Not Listed	Recreation Building	Recreation Building	Recreation Building	Recreation Building	Recreation Building	Recreation Building	Recreation Building	Recreation Building	recreation center	community recreation center
60	Not Listed	Not Listed	Fuze and Detonator Magazine	Fuze and Detonator Magazine	Fuze and Detonator Magazine	Fuze and Detonator Magazine	Fuze and Detonator Magazine	Fuze and Detonator Magazine	Fuze and Detonator Magazine	Magazine	Not Listed	Not Listed
61	Not Listed	Not Listed	Small Arms and Pyrotechnic Magazine	Small Arms and Pyrotechnic Magazine	Small Arms and Pyrotechnic	Small Arms and Pyrotechnic	Small Arms and Pyrotechnic	Small Arms and Pyrotechnic	Inflammable Stores	Disaster Control Storage	Not Listed	Not Listed
64	Not Listed	Not Listed	Machine Gun Range Firing Shed	Machine Gun Range Firing Shed	Machine Gun Range Firing Shed	Machine Gun Range Firing Shed	Machine Gun Range Firing Shed	Machine Gun Range Firing Shed	Rifle Range Firing Shed	Firing Shed	Not Listed	Not Listed
65	Not Listed	Not Listed	Machine Gun Range Head	Machine Gun Range Head - Firing Shed	Rifle Range Firing Shed Head	Toilet	Not Listed	Not Listed				
67	Not Listed	Not Listed	Garage	Garage	Garage	Garage	Garage	Garage	Garage	Transportation	repair garage	arts/cultural

Table C-2 (Continued)
Building/Structure Use Chronology

Building/ Structure No.	1938 (PA-0021)	1940 (PA-0020)	1942 (PA-0019)	1944 (PA-0396)	1949 (PA-0026)	1950 (PA-0025)	1951 (PA-0171)	1952 (PA-0177)	1959 (PA-0397)	1965 (PA-0428)	1998 (PA-0093)	2001 (PA-0100)
68	Not Listed	Not Listed	Inflammable Stores Building	Inflammable Stores Building	Inflammable Stores Building	Inflammable Stores Building	Inflammable Stores Building	Inflammable Stores Building	Storage	Flammable Warehouse	Not Listed	Not Listed
69	Not Listed	Not Listed	Carport - B.O.Q	Carport - B.O.Q	Carport - B.O.Q	Carport - B.O.Q	Carport - B.O.Q	Carport - B.O.Q	Carport - B.O.Q	BOQ Carport	Not Listed	Not Listed
70 - 85	Not Listed	Not Listed	Gasoline Tanks	Gasoline Tanks	Gasoline Tanks	Gasoline Tanks	Gasoline Tanks	Gasoline Tanks	Gasoline Tanks	ACFT Fuel Tanks	Not Listed	Not Listed
86 - 93	Not Listed	Not Listed	Gasoline Control Valve Pits	Gasoline Control Valve Pits	Gasoline Control Valve Pits	Gasoline Control Valve Pits	Gasoline Control Valve Pits	Gasoline Control Valve Pits	Not Listed	Not Listed	Not Listed	Not Listed
94-95	Not Listed	Not Listed	Pressure Control Pits	Gasoline Pressure Control Pits	Gasoline Pressure Control Pits	Gasoline Pressure Control Pits	Gasoline Pressure Control Pits	Gasoline Pressure Control Pits	Not Listed	Not Listed	Not Listed	Not Listed
96	Not Listed	Not Listed	Gasoline Manifold and Meter Pit	Gasoline Manifold and Meter Pit	Gasoline Manifold and Meter Pit	Gasoline Manifold and Meter Pit	Gasoline Manifold and Meter Pit	Gasoline Manifold and Meter Pit	Not Listed	Not Listed	Not Listed	Not Listed
97	Not Listed	Not Listed	Gasoline Meter Pit	Gasoline Meter Pit	Gasoline Meter Pit	Gasoline Meter Pit	Gasoline Meter Pit	Gasoline Meter Pit	Not Listed	Not Listed	Not Listed	Not Listed
98	Not Listed	Not Listed	Gasoline Pump House	Gasoline Pump House	Gasoline Pump House	Gasoline Pump House	Gasoline Pump House	Gasoline Pump House	Gasoline Pump House	Gas Pump	Not Listed	former gasoline pump house
99	Not Listed	Not Listed	Gasoline Tank	Gasoline Tank	Gasoline Tank	Gasoline Tank	Gasoline Tank	Gasoline Tank	Gasoline Tank	Vehicle Fuel Tank	Not Listed	Not Listed
100	Not Listed	Not Listed	Gasoline Tank	Gasoline Tank	Gasoline Tank	Gasoline Tank	Gasoline Tank	Gasoline Tank	Gasoline Tank	Vehicle Fuel Tank	Not Listed	Not Listed
101	Not Listed	Not Listed	Tank Truck Loading Rack	Tank Truck Loading Rack	Tank Truck Loading Rack	Tank Truck Loading Rack	Tank Truck Loading Rack	Tank Truck Loading Rack	Tank Truck Loading Rack	Tank Truck Fill Stand	Not Listed	Not Listed
109	Not Listed	Not Listed	Main Water Meter Pit	Main Water Meter Pit (South Gate)	Not Listed	Not Listed	Not Listed					
110	Not Listed	Not Listed	Sewage Clarigester Tank	Sewage Clarigester Tank	Sewage Clarigester Tank	Sewage Clarigester Tank	Sewage Clarigester Tank	Sewage Clarigester Tank	Sewage Clarigester Tank	Not Listed	Not Listed	Not Listed
111	Not Listed	Not Listed	Sewage Primary Tank	Sewage Primary Filter Tank	Sewage Primary Filter Tank	Sewage Primary Filter Tank	Sewage Primary Filter Tank	Sewage Primary Filter Tank	Sewage Primary Filter Tank	Not Listed	Not Listed	Not Listed
112	Not Listed	Not Listed	Sewage Secondary Tank	Sewage Primary Filter Tank	Sewage Primary Filter Tank	Sewage Primary Filter Tank	Sewage Primary Filter Tank	Sewage Primary Filter Tank	Sewage Primary Filter Tank	Not Listed	Not Listed	Not Listed
113	Not Listed	Not Listed	Sewage Secondary Clarifier Tank	Sewage Secondary Clarifier	Not Listed	Not Listed	Not Listed					
114	Not Listed	Not Listed	Laboratory and Pump House	Laboratory and Pump House	Laboratory and Pump House	Laboratory and Pump House	Laboratory and Pump House	Laboratory and Pump House	Laboratory and Pump House	P.W. Maintenance Shop	Not Listed	Not Listed
115	Not Listed	Not Listed	Sewage Sludge Bed Building	Sewage Sludge Bed Building	Sewage Sludge Bed Building	Sewage Sludge Bed Building	Sewage Sludge Bed Building	Sewage Sludge Bed Building	Tank Farm Repair Storage	P.W. Maintenance Shop	Not Listed	former tank farm repair and storage
116	Not Listed	Not Listed	Sewage Pump House	Sewage Pump House	Sewage Pump House	Sewage Pump House	Sewage Pump House	Sewage Pump House	Sewage Pump House	Sewage Pumping Station	Not Listed	Not Listed
117	Not Listed	Not Listed	Sewage Pump Pit	Sewage Pump Pit	Sewage Pump Pit	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
118	Not Listed	Not Listed	Sewage Pump Pit	Sewage Pump Pit	Sewage Pump Pit	Sewage Pump Pit	Sewage Pump Pit	Sewage Pump Pit	Sewage Pump Pit	Not Listed	Not Listed	Not Listed

Table C-2 (Continued)
Building/Structure Use Chronology

Building/ Structure No.	1938 (PA-0021)	1940 (PA-0020)	1942 (PA-0019)	1944 (PA-0396)	1949 (PA-0026)	1950 (PA-0025)	1951 (PA-0171)	1952 (PA-0177)	1959 (PA-0397)	1965 (PA-0428)	1998 (PA-0093)	2001 (PA-0100)
119	Not Listed	Not Listed	Dope Storage Building (A. and R.)	Dope Storage Building (A. and R.)	Dope Storage Building (O. and R.)	Dope Storage Building (USARTC Wash Military District)	Flammable Storage (Vacant)	Not Listed	Not Listed			
120	Not Listed	Not Listed	Sludge Pits (A. and R.)	Sludge Pits (A. and R.)	Sludge Pit (O. and R.)	Sludge Pit (O. and R.)	Sludge Pit (O. and R.)	Sludge Pit (O. and R.)	Not Listed	Not Listed	Not Listed	Not Listed
124	Not Listed	Not Listed	Not Listed	Aqua System Pump Pit	Aqua Pumping Station	Not Listed	Not Listed					
127	Not Listed	Not Listed	Gasoline Tank - Power Plant	Not Listed	Not Listed	Not Listed	Not Listed					
133	Not Listed	Not Listed	Office Building - Austin Co.	Post Office Building	Not Listed	Not Listed	Not Listed	Not Listed				
134	Not Listed	Not Listed	Store House - Austin Co.	Not Listed	Not Listed	Not Listed	Not Listed					
135	Not Listed	Not Listed	Pass Office - Austin Co.	Not Listed	Not Listed	Not Listed	Not Listed					
136	Not Listed	Not Listed	Gasoline Meter Pit	Not Listed	Not Listed	Not Listed	Not Listed					
137	Not Listed	Not Listed	Laundry Building	Navy Exchange Laundry and Store	Not Listed	Not Listed						
138	Not Listed	Not Listed	Main Gate House	Gate House (Main Entrance)	Gatehouse	Gatehouse	Sand Point Magnuson Park administrative offices					
141	Not Listed	Not Listed	Not Listed	Respiratory Training Building	Medical Storage Building	Medical Storage Building	Medical Storage Building	U. of W. Physics Lab Building	Fish and Wildlife, Dept. of Interior	Fish and Wildlife Laboratory	Not Listed	education support
142	Not Listed	Not Listed	Not Listed	Gasoline Pump	Filling Station	Not Listed	Not Listed					
143	Not Listed	Not Listed	Not Listed	Gasoline Tank	Vehicle Fuel Tank	Not Listed	Not Listed					
144	Not Listed	Not Listed	Not Listed	Gasoline Tank	Vehicle Fuel Tank	Not Listed	Not Listed					
145	Not Listed	Not Listed	Not Listed	Diesel Oil Tank	Gasoline Tank	Gasoline Tank	Gasoline Tank	Gasoline Tank	Gasoline Tank	Vehicle Fuel Tank	Not Listed	Not Listed
166	Not Listed	Not Listed	Not Listed	Gasoline Tank	Not Listed	Not Listed	Not Listed					
167	Not Listed	Not Listed	Not Listed	Gasoline Tank	Not Listed	Not Listed	Not Listed					
168	Not Listed	Not Listed	Not Listed	Gasoline Tank	Not Listed	Not Listed	Not Listed					
169	Not Listed	Not Listed	Not Listed	Gasoline Tank	Not Listed	Not Listed	Not Listed					
170	Not Listed	Not Listed	Not Listed	Ordnance Vehicle Shed	Not Listed	Not Listed	Not Listed	Not Listed				
189	Not Listed	Not Listed	Not Listed	Synthetic Training Building	Not Listed	Not Listed	Not Listed	Not Listed				
190	Not Listed	Not Listed	Not Listed	Synthetic Training Building	NARTU Paint and Storage Building	NARTU Paint and Storage Building	NARTU Paint and Storage Building	NARTU Paint and Storage Building	A/C Maint Paint Shop and Storage	Storage; Paint Shop	Not Listed	Not Listed
191	Not Listed	Not Listed	Not Listed	Gas Training Building	Storage Building (Temporary)	Storage Building (Temporary)	Storage Building (Temporary)	Storage Building (Temporary)	Not Listed	Not Listed	Not Listed	Not Listed

Table C-2 (Continued)
Building/Structure Use Chronology

Building/ Structure No.	1938 (PA-0021)	1940 (PA-0020)	1942 (PA-0019)	1944 (PA-0396)	1949 (PA-0026)	1950 (PA-0025)	1951 (PA-0171)	1952 (PA-0177)	1959 (PA-0397)	1965 (PA-0428)	1998 (PA-0093)	2001 (PA-0100)
192	Not Listed	Not Listed	Not Listed	Low Pressure Training Building	Medical Storage Building	Medical Storage Building	Medical Storage Building	U. of W. Physics Lab Building	Ceramics Hobby Shop, Fish and Wildlife Office	Fish and Wildlife Admin; Hobby Shop	offices	education support
193	Not Listed	Not Listed	Not Listed	Transport Hangar	Transport Hangar	Transport Hangar	Transport Hangar	Transport Hangar	Transport Hangar	Hangar (Vacant); Misc. Storage	Not Listed	slated demolition
194	Not Listed	Not Listed	Not Listed	Storage Building (Temporary)	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
195	Not Listed	Not Listed	Not Listed	Storage Building (Temporary)	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
196	Not Listed	Not Listed	Not Listed	Storage Building (Temporary)	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
199	Not Listed	Not Listed	Not Listed	Firing Shed	Firing Shed	Firing Shed	Firing Shed	Firing Shed	Firing Shed, Pistol Range	Firing Charge	Not Listed	Not Listed
200	Not Listed	Not Listed	Not Listed	Office and Armory Building	Office and Armory Building	Office and Armory Building	Office and Armory Building	Office and Armory Building	Not Listed	Not Listed	Not Listed	Not Listed
201	Not Listed	Not Listed	Not Listed	Indoor Shooting Range Building	Indoor Shooting Range Building	Indoor Shooting Range Building	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
204	Not Listed	Not Listed	Not Listed	Overseas Air Cargo Terminal	Storage and Office Building	Storage and Office Building	Storage and Office Building	Storage and Office Building	Storage, Laboratory and Office (Wildlife)	Fish and Wildlife Laboratory	Not Listed	Not Listed
205	Not Listed	Not Listed	Not Listed	Public Works Storage Building	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
206	Not Listed	Not Listed	Not Listed	Pump House	Pump House	Pump House	Pump House	Pump House	Pump House	Sewage Pumping Station	Not Listed	Not Listed
207	Not Listed	Not Listed	Not Listed	Sludge Beds	Sludge Beds	Sludge Beds	Sludge Beds	Sludge Beds	Sludge Beds	Not Listed	Not Listed	Not Listed
208	Not Listed	Not Listed	Not Listed	Second Stage Digester	Second Stage Digester	Second Stage Digester	Second Stage Digester	Second Stage Digester	Second Stage Digester	Not Listed	Not Listed	Not Listed
209	Not Listed	Not Listed	Not Listed	Secondary Clarifier	Secondary Clarifier	Secondary Clarifier	Secondary Clarifier	Secondary Clarifier	Secondary Clarifier	Not Listed	Not Listed	Not Listed
210	Not Listed	Not Listed	Not Listed	Final Filter	Final Filter	Final Filter	Final Filter	Final Filter	Final Filter	Not Listed	Not Listed	Not Listed
211	Not Listed	Not Listed	Not Listed	Final Clarifier	Final Clarifier	Final Clarifier	Final Clarifier	Final Clarifier	Final Clarifier	Not Listed	Not Listed	Not Listed
213	Not Listed	Not Listed	Not Listed	N.A.T.S. Temporary Storage Building	Overseas Air Cargo Building	Overseas Air Cargo Building	Overseas Air Cargo Building	Overseas Air Cargo Building	Storage Building	Fish and Wildlife Storage	Not Listed	Not Listed
215	Not Listed	Not Listed	Not Listed	V.R.5. Radio Shop	VR-5 Radio Shop	VR-5 Radio Shop	VR-5 Radio Shop	VR-5 Radio Shop	Not Listed	Not Listed	Not Listed	Not Listed
216	Not Listed	Not Listed	Not Listed	Hose Reel House	Hose Reel House	Hose Reel House	Hose Reel House	Hose Reel House	Hose Reel House	Hose and Foam Storage	Not Listed	Not Listed
217	Not Listed	Not Listed	Not Listed	Foam Generator Building	Foam Generator Building	Foam Generator Building	Foam Generator Building	Foam Generator Building	Not Listed	Not Listed	Not Listed	Not Listed
219	Not Listed	Not Listed	Not Listed	Hot Well	Hot Well	Hot Well	Hot Well	Hot Well	Not Listed	Not Listed	Not Listed	Not Listed

Table C-2 (Continued)
Building/Structure Use Chronology

Building/ Structure No.	1938 (PA-0021)	1940 (PA-0020)	1942 (PA-0019)	1944 (PA-0396)	1949 (PA-0026)	1950 (PA-0025)	1951 (PA-0171)	1952 (PA-0177)	1959 (PA-0397)	1965 (PA-0428)	1998 (PA-0093)	2001 (PA-0100)
220	Not Listed	Not Listed	Not Listed	Auxiliary Fire House	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
221	Not Listed	Not Listed	Not Listed	Target Shed	Target Shed	Target Shed	Target Shed	Target Shed	Not Listed	Not Listed	Not Listed	Not Listed
222	Not Listed	Not Listed	Not Listed	Enlisted Waves Barracks	Enlisted Waves Barracks	Enlisted Waves Barracks	Enlisted Waves Barracks	Enlisted Waves Barracks	USAF Reserve Center	Avtech Training	Not Listed	Not Listed
223	Not Listed	Not Listed	Not Listed	Aerial Free Gunnery Training School	Aerial Free Gunnery Training School	Aerial Free Gunnery Training School	Aerial Free Gunnery Training School	Aerial Free Gunnery Training School	Aviation Technical Training	Navy Finance Office	Not Listed	Not Listed
224	Not Listed	Not Listed	Not Listed	Junior Officer's Quarters	Junior Officers Quarters	Junior Officers Quarters	Junior Officers Quarters	Junior Officers Quarters	JOQ, CPO Club, Waves Quarters	CPO and Waves Barracks	Barracks	Sand Point Community Housing Association - transitional housing
228	Not Listed	Not Listed	Not Listed	Not Listed	VR-5 Carpenter Shop	VR-5 Carpenter Shop	VR-5 Carpenter Shop	VR-5 Carpenter Shop	Carpenter Shop (Inactive)	Fish and Wildlife Storage	Not Listed	Not Listed
229	Not Listed	Not Listed	Not Listed	Not Listed	VR-5 Paint Shop	VR-5 Paint Shop	VR-5 Paint Shop	VR-5 Paint Shop	Paint Shop (Inactive)	Hobby Shop	Not Listed	Not Listed
230	Not Listed	Not Listed	Not Listed	Not Listed	Storage Building	Storage Building	Storage Building	Storage Building	Storage Building (Inactive)	Fish and Wildlife Shop	Not Listed	Not Listed
236	Not Listed	Not Listed	Not Listed	Not Listed	Trainer Building (Temporary)	Trainer Building (Temporary)	Trainer Building (Temporary)	Trainer Building (Temporary)	Not Listed	Not Listed	Not Listed	Not Listed
238	Not Listed	Not Listed	Not Listed	Not Listed	Storage Shed (Temporary)	Storage Shed (Temporary)	Storage Shed (Temporary)	Indoor Shooting Range Building (location changed)	Indoor Shooting Range Building	Small Arms Range	Not Listed	Not Listed
244	Not Listed	Not Listed	Not Listed	Not Listed	Storage Shed	Storage Shed	Storage Shed	Storage Shed	Storage Shed	Public Works Storage	Not Listed	Not Listed
248	Not Listed	Not Listed	Not Listed	Not Listed	Car Shelter (Temporary)	Car Shelter (Temporary)	Car Shelter (Temporary)	Car Shelter (Temporary)	Car Shelter	Vehicle Storage Shelter	Not Listed	Not Listed
250	Not Listed	Not Listed	Not Listed	Not Listed	O. and R. Shop (Temporary)	Not Listed	Not Listed	Not Listed	Not Listed			
251	Not Listed	Not Listed	Not Listed	Not Listed	Sewage Ejector Pit	Sewage Ejector Pit	Sewage Ejector Pit	Sewage Ejector Pit	Not Listed	Not Listed	Not Listed	Not Listed
253	Not Listed	Not Listed	Not Listed	Not Listed	Gunnery Training Building (Temporary)	Av. Tech. Training Building (Temporary)	Not Listed	Not Listed	Not Listed			
254	Not Listed	Not Listed	Not Listed	Not Listed	Gunnery Training Building (Temporary)	Av. Tech. Training Building (Temporary)	Not Listed	Not Listed	Not Listed			

Table C-2 (Continued)
Building/Structure Use Chronology

Building/ Structure No.	1938 (PA-0021)	1940 (PA-0020)	1942 (PA-0019)	1944 (PA-0396)	1949 (PA-0026)	1950 (PA-0025)	1951 (PA-0171)	1952 (PA-0177)	1959 (PA-0397)	1965 (PA-0428)	1998 (PA-0093)	2001 (PA-0100)
255	Not Listed	Not Listed	Not Listed	Not Listed	Gunnery Training Building (Temporary)	Gunnery Training Building (Temporary)	Gunnery Training Building (Temporary)	Gunnery Training Building (Temporary)	Av. Tech. Training Building (Temporary)	Not Listed	Not Listed	Not Listed
257	Not Listed	Not Listed	Not Listed	Not Listed	Gunnery Training Building (Temporary)	Gunnery Training Building (Temporary)	Gunnery Training Building (Temporary)	Gunnery Training Building (Temporary)	Av. Tech. Training Building (Temporary)	GCA Quarters and Shop	Not Listed	Not Listed
263	Not Listed	Not Listed	Not Listed	Not Listed	Storage Building (Temporary)	Storage Building (Temporary)	Storage Building (Temporary)	Storage Building (Temporary)	Not Listed	Not Listed	Not Listed	Not Listed
265	Not Listed	Not Listed	Not Listed	Not Listed	Civilian Cafeteria and Storage Bldg. (Temporary)	Civilian Cafeteria and Storage Bldg. (Temporary)	Civilian Cafeteria and Storage Bldg. (Temporary)	Civilian Cafeteria (Temporary)	Petty Officers' Club	Not Listed	Not Listed	Not Listed
268	Not Listed	Not Listed	Not Listed	Not Listed	Sewage Pump Pit	Sewage Pump Pit	Sewage Pump Pit	Sewage Pump Pit	Not Listed	Not Listed	Not Listed	Not Listed
275	Not Listed	Not Listed	Not Listed	Not Listed	Storage and Shelter Bldg. and Flattie Dock	Storage and Shelter Bldg. and Flattie Dock	Storage and Shelter Bldg. and Flattie Dock	Storage and Shelter Bldg. and Flattie Dock	Storage and Shelter Bldg. and Flattie Dock	Boat Dock Shelter and Dock	Not Listed	Not Listed
281	Not Listed	Not Listed	Not Listed	Not Listed	Water Meter Pit	Water Meter Pit	Water Meter Pit	Water Meter Pit	Water Meter Pit	Not Listed	Not Listed	Not Listed
282	Not Listed	Not Listed	Not Listed	Not Listed	Sewage Pump Pit	Sewage Pump Pit	Sewage Pump Pit	Sewage Pump Pit	Not Listed	Not Listed	Not Listed	Not Listed
283	Not Listed	Not Listed	Not Listed	Not Listed	Plane Washing Shed	Plane Washing Shed	Plane Washing Shed	Plane Washing Shed	Plane Washing Shed (Tank Truck Repair)	Const. Equip Maint. Shop	Not Listed	Not Listed
285	Not Listed	Not Listed	Not Listed	Not Listed	Gasoline Truck Loading Rack	Gasoline Truck Loading Rack	Gasoline Truck Loading Rack	Gasoline Truck Loading Rack	Gasoline Truck Loading Rack	Aircraft Truck Fuel Stand	Not Listed	Not Listed
299	Not Listed	Inflammable Stores Bldg. O. and R.	Inflammable Stores Bldg. O. and R.	Inflammable Stores Bldg. O. and R.	Inflammable Stores Bldg.	Not Listed	Not Listed	storage				
301	Not Listed	Not Listed	Not Listed	Not Listed	Carpenter Hobby Shop	Hobby Shop	Not Listed	storage				
303	Not Listed	Not Listed	Not Listed	Not Listed	Gate House (North Sentry)	Gatehouse	Not Listed	Not Listed				
304	Not Listed	Not Listed	Not Listed	Not Listed	Lube Oil Storage Tank	Lube Oil Tank	Not Listed	Not Listed				
307	Not Listed	Not Listed	Not Listed	Not Listed	Storage Building	COM13 Storage	Not Listed	Not Listed				
308	Not Listed	Not Listed	Not Listed	Not Listed	Automotive Hobby Shop	Hobby Shop	Not Listed	storage				
310	Not Listed	Not Listed	Not Listed	Not Listed	Storage Building	Fish and Wildlife Storage	Not Listed	storage				
319	Not Listed	Not Listed	Not Listed	Not Listed	Fuel Oil Storage Tank	Sludge Oil Storage Tank	Not Listed	Not Listed				
320	Not Listed	Not Listed	Not Listed	Not Listed	Flag Pole	Flag Pole	Not Listed	Not Listed				
321	Not Listed	Not Listed	Not Listed	Not Listed	Small Craft Berthing Pier No. 1	Small Craft Pier	Not Listed	Not Listed				

Table C-2 (Continued)
Building/Structure Use Chronology

Building/ Structure No.	1938 (PA-0021)	1940 (PA-0020)	1942 (PA-0019)	1944 (PA-0396)	1949 (PA-0026)	1950 (PA-0025)	1951 (PA-0171)	1952 (PA-0177)	1959 (PA-0397)	1965 (PA-0428)	1998 (PA-0093)	2001 (PA-0100)
324	Not Listed	Recreational Pier No. 7	Recreational Boat Dock	Not Listed	Not Listed							
326	Not Listed	Enlisted Mens Tennis and Volleyball Courts	Not Listed	Not Listed	Not Listed							
327	Not Listed	Waves Tennis and Volleyball Courts	Playing Court	Not Listed	Not Listed							
328	Not Listed	Officers Tennis Court	Playing Court	Not Listed	Not Listed							
330	Not Listed	Married Officers Quarters "A"	Quarters "A"	single-family home	Sand Point Community Housing Association - group home							
331	Not Listed	Married Officers Quarters "B"	Quarters "B"	single-family home	Sand Point Community Housing Association - group home							
332	Not Listed	Married Officers Quarters "C"	Quarters "C"	single-family home	Sand Point Community Housing Association - group home							
333	Not Listed	Married Officers Quarters "D"	Quarters "D"	single-family home	Not Listed							
334	Not Listed	Married Officers Quarters "E"	Quarters "E"	single-family home	Not Listed							
340	Not Listed	Not Listed	Not Listed	storage								
341	Not Listed	Not Listed	Not Listed	storage								
344	Not Listed	Not Listed	Not Listed	storage								
345	Not Listed	Not Listed	metal pre-engineered building, shop, storage	storage								
385	Not Listed	Regulator Vault	Not Listed	Not Listed								
391	Not Listed	Truck Scale	Not Listed	Not Listed								
406	Not Listed	Not Listed	Brig, community center	community activity center								
407	Not Listed	Not Listed	Not Listed	Not Listed								
502	Not Listed	Not Listed	Not Listed	picnic shelter #4								
503	Not Listed	Not Listed	Not Listed	picnic shelter #5								

Note:
Names shown on site maps are capitalized in this table, whereas building uses on site maps are not.

Appendix D

Published Public Notices for Personal Interviews

< U.S. Open

FROM A1

CHAMBERS BAY READY FOR 2015 SPOTLIGHT

No World Cup then, and Tiger may be back

U.S. Open, has been busy the past two weeks helping out at Pinehurst in virtual anonymity. The spotlight now moves to him.

"Sunday was a big day for Pinehurst, but it's also a huge day for Chambers Bay," Sink said. "There are a lot of milestones in the buildup, but I think this one-year-out one is the biggest."

Matt Allen, the general manager at Chambers Bay, said the reality of hosting in 2015 sank in for him last year while he attended the U.S. Open at Merion Golf Club outside Philadelphia.

"This just takes it to a whole different level, and you can tell by the amount of media interest I am getting this week," said Allen, one of 29 members of the advance site delegation who made the trip to Pinehurst.

Buildup for the 2015 U.S. Open could be the biggest in the history of the event for many reasons.

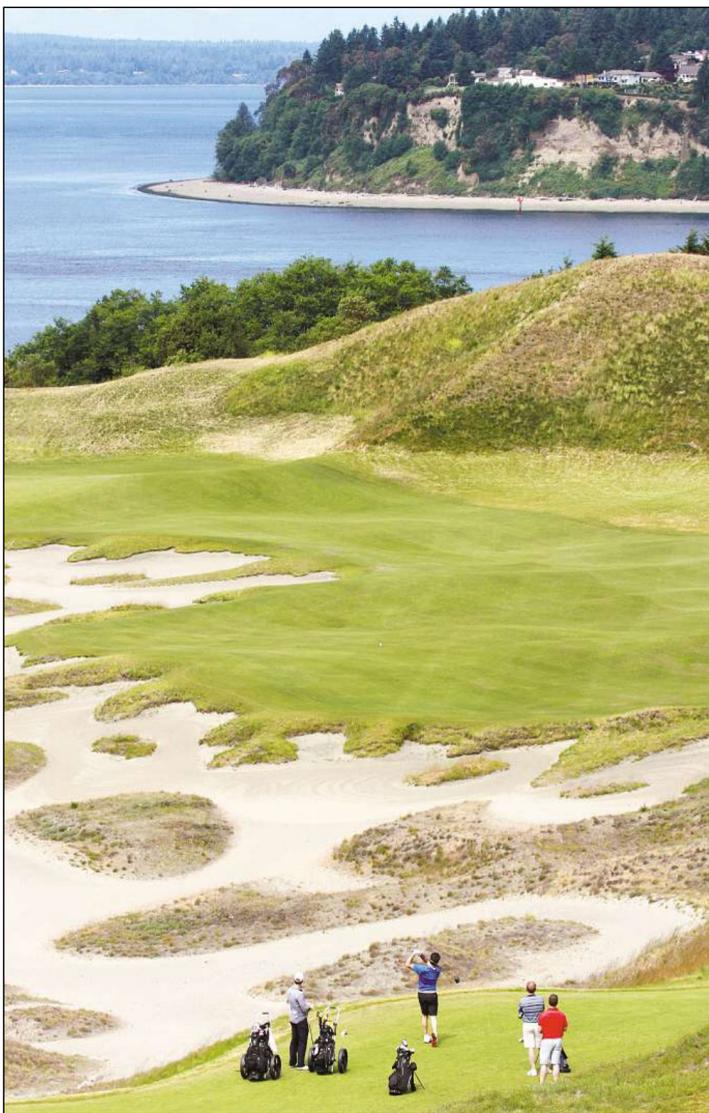
Fox will be televising its first-ever golf tournament and undoubtedly will promote the event to the hilt. That promotion began with a spot from Chambers Bay during January's NFC Championship Game between the Seahawks and the San Francisco 49ers.

The U.S. Open also won't have to share the sports stage with soccer's World Cup next year, as it did this year.

Several pieces of history will be made at Chambers Bay. It will be the first U.S. Open played on a true links course, the first played on fine fescue grass and the first to be played in the Northwest. The USGA surprised the golf world by selecting the course in 2008 after it had been open only for about eight months.

"People from the East Coast still think the Northwest is Southern Alaska," said Sink, who has been working at Chambers Bay since the fall of 2012 preparing for the tournament. "They are going to want to see it."

And never discount the Tiger Woods effect. After a back injury forced him to miss this U.S. Open, Woods figures to be back for the Open at Chambers Bay as he continues his pursuit of Jack Nicklaus' record of 18 wins in major championships. Woods has been stuck at 14



Puget Sound and Fox Island are in the background in this view of golfers teeing off at hole 14, known as "Cape Fear," at Chambers Bay Golf Course in University Place, where the 2015 U.S. Open will be held. It will be the first Northwest setting for the event.

KEN LAMBERT / THE SEATTLE TIMES

since winning the U.S. Open in 2008.

Maybe then it should be no surprise that when the call for volunteers was made in February for the 2015 U.S. Open, more than 6,000 people signed up in the first 36 hours for the 4,500 slots. At most venues, it takes months to fill the slots.

The USGA is similarly happy with the pace of ticket sales. Corporate ticket sales have been well ahead of the normal pace, as were presale promotions. The remaining 22,500 tickets went on sale to the general public last Monday and about half reportedly have been sold.

About 235,000 people (including volunteers, media and nonpaying children) are expected to attend the U.S. Open at Chambers Bay, in-

cluding three days of practice rounds.

The transportation plan, which likely will include mass transit, is close to being set but won't be announced until next spring. Plans also have been made for the other major logistics, from security to first aid to fan viewing, with just tweaking needed to be made.

"It's 365 days until the start of the practice rounds, so the clock is ticking but we've been preparing for this for six years," McCarthy said.

Bruce Kendall, CEO and president of the Economic Development Board for Tacoma-Pierce County, said the U.S. Open will be a "seven-day commercial that money can't buy."

University Place Mayor Denise McCluskey was taking

it all in at Pinehurst this week, learning what she could. She said she can hardly wait for her city to be on the world stage.

"They are going to be blown away," she said.

Scott Hanson: 206-464-2943 or shanson@seattletimes.com

MARTIN KAYMER wins this year's Open by 8 strokes > C1

< Tuition

FROM A1

NEW PROGRAM FOR STARBUCKS WORKERS

Company to pay part of cost of degree

At the same time, in March Schultz said the proposal to raise Seattle's minimum wage to \$15 an hour could lead to job losses due to the stress it will impose on small businesses. The City Council approved the plan this month.

Starbucks says the tuition-reimbursement program aims to help mitigate the woes faced by nearly half of U.S. college students, who drop out because of rising debt and conflicts with work responsibilities.

"In the last few years, we have seen the fracturing of the American Dream," Schultz said in a statement. "There's no doubt, the inequality within the country has created a situation where many Americans are being left behind. The question for all of us is, should we accept that, or should we try and do something about it."

Starbucks staffers participating in the program will have access to dedicated coaching, including a financial-aid counselor and an academic adviser.

"Starbucks is going where no other major corporation has gone," said Jamie Meristis, president and CEO of the Lumina Foundation, a group focused on education. "For many of these Starbucks employees, an online university education is the only reasonable way they're going to get a bachelor's degree." Many employers offer

tuition reimbursement. But those programs usually come with limitations, like the full cost not being covered, new employees being excluded, a requirement that workers stay for years afterward, or that the courses be work-related.

An official announcement to staffers is expected Monday in New York City, at the company's first Partner Family Forum in the U.S. The event will include employees as

well as family members, following similar events organized for Starbucks employees in China, where families play a key role in young people's career choices.

The gathering will include Schultz, ASU President Michael Crow and U.S. Secretary of Education Arne Duncan.

Material from The New York Times is included in this report. Angel González: 206-464-2250 or agonzalez@seattletimes.com. On Twitter: @gonzalezseattle

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Do you have any information about the historical use or disposal of radiological material at former Naval Station Puget Sound (Magnuson Park)?

The U.S. Navy is conducting an assessment regarding the historical use and disposal of radiation sources at the former Naval Station Puget Sound. One known source of radiation was the use and refurbishment of radium dials and gauges during aircraft maintenance activities in the 1940s. Examples of other activities associated with radiation sources include the use of personnel markers, thoriated welding rods, certain types of engine exciters, and depleted uranium counterweights. If you have information about the historical use of radiation sources at this site, the Navy would appreciate your insight and recollections. Please contact Tom Abbott (project manager for the preliminary assessment) by phone at (206) 438-2004, or by email at tom.abbott@urs.com.

In trial, artificial pancreas shows lots of promise

REGULATES BLOOD SUGAR FOR DIABETICS

More tests needed; costs not known

By NICHOLAS BAKALAR
The New York Times

A portable artificial pancreas built with a modified iPhone successfully regulated blood-sugar levels in a trial with people who have Type 1 diabetes, researchers reported Sunday.

Type 1 diabetes, which usually starts in childhood or young adulthood, is a chronic condition in which the pancreas produces little or no insulin, the hormone that lowers blood-sugar levels. Insulin works in conjunction with glucagon, a hormone that raises blood sugar. Together, they keep blood sugar in a healthy range.

Currently about one-third of people with Type 1 diabetes rely on insulin pumps to regulate blood sugar. They eliminate the need for injections and can be programmed to mimic the natural release of insulin by dispensing small doses regularly.

But these pumps do not automatically adjust to the patient's variable insulin needs, and they do not dispense glucagon. The new device, described in a report in The New England Journal of Medicine, dispenses both hormones, and it does so with little intervention from the patient.

Dr. Fredric E. Wondisford, director of the diabetes institute at Johns Hopkins, found the results encouraging. But he cautioned that effectiveness and practicality had not been tested in large numbers of patients over time. He also raised the issue of cost and insurance coverage.

Type 1 diabetes patients not using pumps need two or more insulin injections a

day, and all have to monitor blood sugar several times a day by pricking their skin and testing their blood.

Maintaining safe blood-sugar levels requires precise adjustments, especially to prevent hypoglycemia, or extremely low blood sugar. Hypoglycemia can occur quickly, without the patient's awareness, and can be a life-threatening emergency.

For patients with adequate treatment, elevated blood sugar is usually not an emergency but can cause vascular damage over time that can lead to eye problems and amputations.

The artificial pancreas is the latest version of a device that researchers have been refining for several years. The system consists of an iPhone 4S with an attached glucose-monitoring device, two pumps, and reservoirs for insulin and glucagon.

A sensor implanted under the skin on one side of the patient's abdomen measures the glucose in the fluid between the cells, which corresponds closely to blood glucose levels. The sensor delivers the reading to the smartphone, and the phone's software calculates a dose of insulin and glucagon every five minutes.

The medicine is then pumped through thin tubes to two tiny infusion points embedded just under the skin on the other side of the patient's abdomen.

The phone also has an app so a patient can enter information immediately before eating, indicating whether the meal is breakfast, lunch or dinner, and whether the carbohydrate content will be small, large or typical. The device then calculates and dispenses the proper dosages.

The device still requires a finger stick twice a day to get an accurate blood reading, which the patient enters into the phone.

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WORLD CUP TIME

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Dean Rutz / The Seattle Times

SEATTLETIMES.COM

How missile program got off the ground

By DAVID WILLMAN
Los Angeles Times

For decades, America's defense against the nuclear threat was based on the Cold War doctrine of "mutually assured destruction," which held that the prospect of massive retaliation would deter both the U.S. and the Soviet Union from striking first.

The 1972 Anti-Ballistic Missile Treaty entrenched this doctrine by prohibiting either side from fielding systems to intercept intercontinental missiles. The idea was that the prospect of mutual annihilation had proved effective and missile defense would undermine it; if either side thought it could block a retaliatory response, the temptation to attack would be greater.

After taking office in 2001, President George W. Bush withdrew from the treaty,



Sen. Richard Shelby backs missile program. Fellow Alabama Sen. Jeff Sessions does, too.

which he said was outmoded and prevented the U.S. from protecting itself against new threats from the world's "least responsible states," notably North Korea.

Bush was not the first president to see promise in missile-defense technology. In 1983, President Reagan launched the Strategic Defense Initiative, which envisioned ground- and space-based systems that would render nuclear weapons "impotent and obsolete." An estimated \$30 billion was

spent on the effort, but no system was ever deployed.

The nation's defense against a massive attack by Russia or China continues to be based on mutually assured destruction. The Ground-based Midcourse Defense system was conceived as a safeguard against a "limited nuclear attack" by a less imposing adversary.

In 1995, Congress attached to the Defense Department budget a provision requiring deployment of such a system by 2003.

President Clinton vetoed the bill, saying it "would waste billions of dollars" on a negligible threat. But the administration said it would test elements of a missile-defense system for three years to see if the technology was reliable enough to deploy.

Missile-defense proponents in Congress responded by appointing an advisory

commission chaired by Donald Rumsfeld, who became Bush's secretary of defense. In a 1998 report, the commission said U.S. intelligence agencies had failed to recognize the threat posed by North Korea, which it said had the "capability to deploy chemical or biological warheads on missiles."

The panel suggested that Iran, Iraq and North Korea were developing nuclear weapons.

In July 1999, Clinton signed the National Missile Defense Act, which called for a system to defend against limited ballistic missile attack. The law said an "effective" system should be deployed "as soon as is technologically possible."

Two of the first three flight tests of rocket interceptors, conducted in 1999 and 2000, failed. The Clinton administration supported continued research but declined to

deploy a system.

That policy changed when Bush took office in 2001 and Rumsfeld became secretary of defense. On Dec. 16, 2002, Bush signed a presidential directive requiring "deployment of a set of missile defense capabilities in 2004."

The week before, two flight tests of the fledgling system had failed. At that point, its performance record stood at five successful intercepts in nine attempts. Bush's directive called the results "impressive."

Instead of delaying deployment until the system had been rigorously tested, the Missile Defense Agency, beginning in 2004, placed interceptors in silos at Vandenberg and Fort Greely and declared the system operational.

Rumsfeld and his aides said it made more sense to improve the system over time rather than to try to field a

finished version at the start.

Launches planned for Dec. 15, 2004, and Feb. 14, 2005, were scrubbed when the interceptors remained stuck in their silos.

By then, a dozen interceptors had been placed in silos. The system's proponents maintained that this skeletal shield provided unprecedented protection.

"If we didn't have this ... we would be absolutely naked, given an unexpected attack," said Sen. John Cornyn, R-Texas, at an April 7, 2005, Armed Services Committee hearing.

A new Missile Defense Agency director, Lt. Gen. Henry A. Obering III, told the senators that day: "We maintain our confidence in the system's basic design, its hit-to-kill effectiveness and its inherent operational capability."

Obering conceded, however,

Continued on next page >

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Missile

FROM A1

COSTLY SYSTEM PROVES UNRELIABLE

Critics blame political push to deploy quickly

fallen away, and the kill vehicle was hurtling through space at 4 miles per second. It was supposed to crash into the mock enemy warhead and obliterate it.

It missed. At a cost of about \$200 million, the mission had failed.

Eleven months later, when the U.S. Missile Defense Agency staged a repeat of the test, it failed, too.

The next attempted intercept, launched from Vandenberg on July 5, 2013, also ended in failure.

The Ground-based Midcourse Defense system, or GMD, was supposed to protect Americans against a chilling new threat from "rogue states" such as North Korea and Iran. But a decade after it was declared operational, and after \$40 billion in spending, the missile shield cannot be relied on, even in carefully scripted tests that are much less challenging than an actual attack would be, a Los Angeles Times investigation has found.

The Missile Defense Agency has conducted 16 tests of the system's ability to intercept a mock enemy warhead. It has failed in eight of them, government records show.

Despite GMD's problems, influential members of Congress have protected its funding and are pushing to add silos and interceptors in the Eastern U.S. at a potential cost of billions of dollars.

Boeing manages the system for the Pentagon. Raytheon manufactures the kill vehicles. Thousands of jobs in five states, mostly in Alabama and Arizona, depend directly or indirectly on the program.

Despite years of tinkering and vows to fix technical shortcomings, the system's performance has gotten worse, not better, since testing began in 1999. Of the eight tests held since GMD became operational in 2004, five have been failures. The last successful intercept was on Dec. 5, 2008. Another test is planned at Vandenberg, on the Santa Barbara County coast, later this month.

The GMD system was rushed into the field after President George W. Bush, in 2002, ordered a crash effort to deploy "an initial set of missile defense capabilities." The hurried deployment has compromised its effectiveness in myriad ways.

"The system is not reliable," said a recently retired senior military official who served under Presidents Obama and Bush. "We took a system that was still in development — it was a prototype — and it was declared to be 'operational' for political reasons.

"At that point, you couldn't argue anymore that you still needed to develop and change things. You just needed to build them."

Dean Wilkening, a physicist at Lawrence Livermore National Laboratory in California, offered a similar assessment. Wilkening served on a National Academy of Sciences panel that

issued a 2011 report on missile defense.

GMD remains a "prototype system" that "has performed less well than people had hoped," he said at a May 28 policy conference in Washington, D.C.

At a separate conference this month, Wilkening called the system's test record "abysmal."

After interviewing missile-defense scientists and current and former Defense Department officials, and reviewing thousands of pages of congressional testimony and reports by the Government Accountability Office, the Pentagon's independent testing office, the National Academy of Sciences and the Defense Science Board, the Los Angeles Times has found that official pronouncements about the GMD system have overstated its reliability.

In 2003, the Pentagon's chief weapons buyer, Defense Undersecretary Edward C. "Pete" Aldridge Jr., told the House Armed Services Committee that he had high confidence an attack could be foiled by firing one to three missiles at each enemy warhead. "The effectiveness would be in the 90 percent range," he said.

But given GMD's record in flight tests, four or five interceptors probably would have to be launched to take out a single enemy warhead, according to current and former government officials familiar with the Missile Defense Agency's projections.

The system's 30 interceptors — four at Vandenberg and 26 at Fort Greely — could be overwhelmed by an attack with multiple missiles.

The threat would be even greater if enemy missiles were outfitted with decoys or shed metal debris, which could confuse GMD's radar and sensors.

The Obama administration, after signaling that it would keep the number of interceptors at the current 30, now supports expanding the system. Defense Secretary Chuck Hagel has called for deploying 14 new interceptors at Fort Greely by late 2017.

Missile Defense Agency Director Vice Adm. James Syring told a Senate subcommittee Wednesday that officials had identified the causes of the two most recent flight-test failures, and that the underlying problems had been fixed or would be by the end of this year.

Raytheon referred questions about GMD to Boeing, the prime contractor for the system.

A Boeing spokesman, Dexter Q. Henson, said the company "remains confident in the system's ability to defeat potential adversaries."

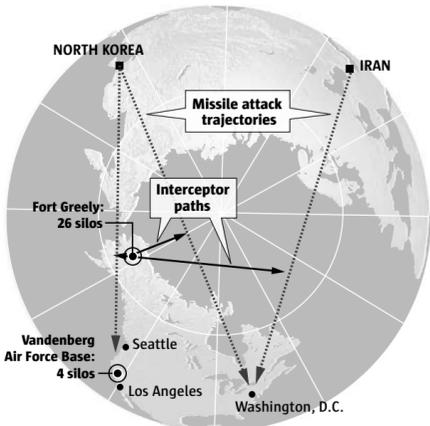
Missiles launched from North Korea or Iran probably would fly over the Arctic Circle on their way to the U.S., the most direct route. The GMD system is designed to destroy incoming warheads at roughly the midpoint of their arcing journey, as they begin their descent toward Earth — hence the term "midcourse."

Intercepting a ballistic missile is a supreme technical challenge. Scientists liken it to hitting one speeding bullet with another.

The GMD system's bullet is the 5-foot-long, 150-pound kill vehicle. During flight, it

Missile-attack scenarios

Shown below are what Pentagon officials consider likely paths of missiles launched against the U.S. in hypothetical attacks by North Korea and Iran. The target cities are Los Angeles and Washington, D.C. In the scenario shown, the incoming warheads are destroyed by interceptors of the Ground-based Midcourse Defense system launched from Fort Greely, Alaska. This is one of hundreds of scenarios developed by missile-defense planners.



Source: Los Angeles Times reporting

McCLATCHY-TRIBUNE

is subjected to extreme stresses: blazing heat and violent vibrations, followed by frigid temperatures outside Earth's atmosphere. Each kill vehicle has more than 1,000 components. The slightest glitch can foil an attempted intercept.

"Fly, then buy" is a maxim in the defense and aerospace fields, meaning that customers should wait until a complicated new system has been rigorously tested before purchasing.

With GMD, the government's approach was the opposite: "Buy, then fly."

Then-Secretary of Defense Donald Rumsfeld exempted the Missile Defense Agency from standard procurement rules and testing standards, freeing it to use research and development money to buy and deploy a system quickly.

The rocket interceptors were essentially prototypes rather than finished products when put in the field. The first model of kill vehicle was not flight-tested against a mock warhead until September 2006 — two years after the vehicles had been placed in the silos.

Because each of the kill vehicles is handmade, no two are identical. A fix that works with one interceptor might not solve problems with others. The piecemeal approach has left the system short of spare parts for critical components.

Pressure to produce and deploy the interceptors at a

breakneck pace made it difficult to revise engineering drawings to correct shortcomings exposed in flight tests or keep up with technological advances.

One senior official involved in the system described his frustration at learning that some computers aboard the kill vehicles lacked the processing power of common cellphones.

About a third of the kill vehicles now in use — the exact number is classified — are the same model that failed in the 2010 tests, according to people familiar with the system who spoke on condition of anonymity. That model has yet to intercept a target.

Because interceptors used in test flights burn up when they re-enter the atmosphere or are lost in the ocean, scientists have been hard-pressed to pinpoint the causes of the failures.

But some of the system's problems can be traced to the kill vehicles' internal guidance center — the electronic brain that dictates final speed and trajectory.

This crucial component, called the "inertial measurement unit," malfunctioned in preliminary factory testing and during seven subsequent flight tests, according to interviews with missile-defense scientists and federal auditors and reports by the GAO and the Pentagon's testing and evaluation office. Scientists suspect that

intense vibration during the interceptors' ascent is the cause of some of the test failures. A GAO report in April described vibration as a "systemic problem."

It could take years of additional engineering work to solve this and other technical problems in the kill vehicles, scientists said.

Lehner, the Missile Defense Agency spokesman, said vibrations were successfully dampened in a January 2013 flight test. The test did not involve an attempt to intercept a target.

Philip E. Coyle III, who oversaw several early test flights as the Pentagon's director of operational testing and evaluation from 1994 to 2001, said that even the system's eight successful interceptions should be viewed skeptically because of the staged conditions.

"The tests are scripted for success," said Coyle, who has also served as a science adviser in the Obama White House. "What's amazing to me is that they still fail."

Boeing and Raytheon are among the top four defense contractors worldwide in revenue. From 1999 through March of this year, Boeing spent \$261.6 million on general lobbying of the federal government and Raytheon spent \$144.4 million, public records show.

One of the staunchest advocates for speedily expanding the system has been Sen. Jeff Sessions, a Republican from Alabama, where missile-defense jobs are heavily concentrated.

Sessions, the senior Republican on the Senate subcommittee responsible for missile defense, has fought moves to slow the production of the rockets and has warned repeatedly about what North Korea or Iran might do.

Alabama's other senator, Richard Shelby — the ranking Republican on the Ap-

propriations Committee — has also sought to deflect concerns about the test failures and the program's cost.

"We're interested in cost," Shelby said at an appropriations subcommittee hearing on July 17, 2013. "We're also interested in defending this country."

Though both North Korea and Iran have launched crude unarmed missiles, U.S. intelligence assessments provided to Congress indicate that neither country has the capability to deliver a long-range, nuclear-tipped missile to the United States.

Appearing before a House Armed Services subcommittee on May 8, 2013, Syring said the next flight test would "demonstrate the improvements made" to the fleet of interceptors.

The test was held July 5, 2013 — 31 months after the last attempted intercept, which failed.

After burning its boosters to reach space, the interceptor failed to separate from the rocket, preventing it from striking the target.

Syring is asking Congress for \$99.5 million to begin what he described Wednesday as a "redesign improvement" of the kill vehicle. The work would stop short of a complete redesign, according to people familiar with the matter.

Frank Kendall III, Defense undersecretary for acquisition, technology and logistics, broke ranks recently with those who have given upbeat assessments of GMD.

"We recognize the problems we have had with all the currently fielded interceptors," Kendall told a defense-industry conference in Washington in February. "The root cause was a desire to field these things very quickly and very cheaply. ... We are seeing a lot of bad engineering, frankly, and it was because there was a rush."

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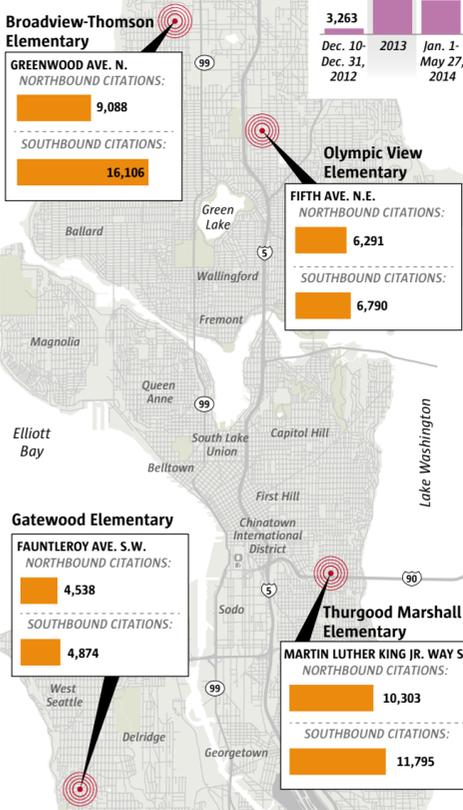
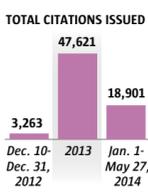
PUBLIC NOTICE

Do you have any information about the historical use or disposal of radiological material at former Naval Station Puget Sound (Magnuson Park)?

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Where to get fined \$189

Nearly 70,000 motorists were mailed citations for speeding past school-zone traffic cameras between Dec. 10, 2012, and May 27, 2014.



Sources: American Traffic Solutions, Seattle Police Department
GARLAND POTTS / THE SEATTLE TIMES

Pay or fight?

Most drivers ticketed through school-zone cameras pay some or all the \$189 fine, but at least 15 percent try to get it reduced or dismissed. Seattle Municipal Court records processed in 2013 show:

Total cases:	50,560
Paid in full, uncontested:	31,466
Defaulted (went unpaid):	7,941
Full or partial payment after a challenge or mitigation:	6,795
Pending:	2,040
Canceled:	1,463
Dismissed as "not committed":	855

Source: Seattle Municipal Court

School, Dearborn Park Elementary, Eckstein Middle School and Bailey Gatzert Elementary.

Fixed school-zone cameras resulted in 47,621 speeding citations last year at the four schools, and close to 3,000 more were generated by van-mounted cameras.

Tabulations by camera vendor American Traffic Solutions (ATS) say the fixed cameras triggered an average 43 tickets per school per school day in January 2013, but that declined to 27 tickets a day in January 2014 — indicating a trend toward safer behavior, the company says.

Experience in other states suggests the cameras reduce collisions by one-fifth to one-fourth, said Jim Curtin, city traffic-safety coordinator. "They're well worth the effort," he said.

The \$189 school-zone penalty is the same amount as if someone were stopped by a police officer, except that camera-generated tickets don't go on one's driving record for insurance purposes. (Most traffic offenses cost \$124, while speeding ranges from \$113 to \$411 based on severity. The costliest ticket in Seattle is \$1,062 for obstructing an ambulance.)

School-zone speed cameras brought the city \$6.9 million last year — far more than expected. Seattle's 2014 budget anticipates \$8.6 million.

About \$1.5 million covers court, police and camera costs, including \$38,000 a month to Arizona-based ATS.

That leaves \$7.1 million earmarked for sidewalks, bicycling, and education.

One of a kind

Hunt, who had lost his case in Municipal Court, is the only motorist to challenge the sign wording in Superior Court, said Kimberly Mills, spokeswoman for the City Attorney's office.

Nationally, the Federal Highway Administration (FHWA) hasn't heard of any similar wording disputes, said spokesman Neil Gaff-

ney.

Chang said the signs met federal standards when installed, several years ago. Many of the flashing lights and school-zone signs were installed before the cameras were added. Signs installed since 2012, in both camera and noncamera school zones, say "WHEN FLASHING."

"Shorter language is easier to comprehend," said Gaffney. However, the FHWA doesn't require school-zone signs to be replaced immediately, unless there's a known safety hazard, he said.

Seattle Department of Transportation spokesman Rick Sheridan commented:

"The bottom line remains this — drivers who speed in school zones put children at risk. Whether or not this citation was upheld, nothing makes endangering children by speeding in a school zone right."

The National Motorists Association, a Wisconsin-based group that opposes camera enforcement, hasn't heard of similar cases.

More commonly, drivers challenge tickets by arguing children weren't present, said John Bowman, communications director. In some states, motorists have been cited long after the students went home, he said.

Less than 5 percent of drivers contest camera tickets, he said, because fines in most states are too low to bother fighting them.

In Seattle, at least 15 percent of those cited through school-zone cameras have tried to get their fine reduced or dismissed.

Seattle Municipal Court finally dismissed Hunt's ticket Friday, as a result of the higher-court ruling.

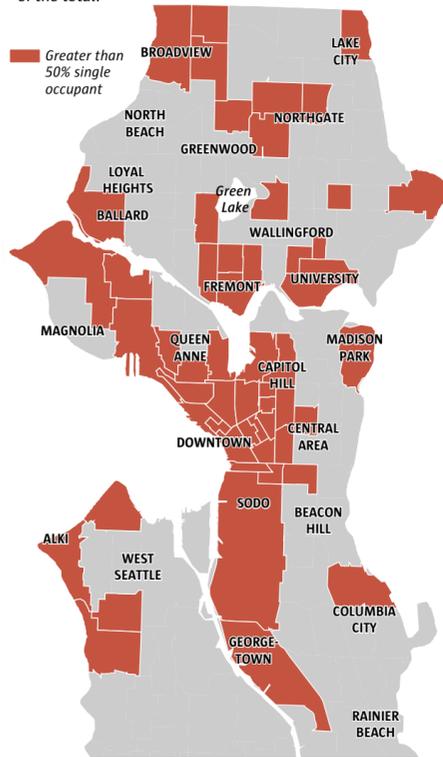
But taking the case to Superior Court required extra time and money.

Hunt calculated that his court-filing fees, transcription costs and paperwork to beat the \$189 ticket cost him \$536.

Mike Lindblom: 206-515-5631 or mlindblom@seattletimes.com. On Twitter: @mikelinblom

Seattle renters go it alone

More than half of Seattle apartments are occupied by a person living alone. This census tract map highlights areas where rental units with a single occupant exceed 50 percent of the total.



Source: U.S. Census Bureau, 2012
GARLAND POTTS / THE SEATTLE TIMES

< FYI Guy

FROM A1

SEATTLEITES TREAT SELVES TO SOLO LIVING

51% of apartment dwellers live alone

sink or practicing guitar when you're trying to watch TV. No partner forcing you to share precious closet space. You can indulge the quirks of solo living — from cooking in the middle of the night to traipsing around naked.

But that freedom comes at a cost — literally. With no one to split the rent and utilities, living alone is something of a luxury. Average rent in Seattle is now \$1,480, having increased 21 percent in the past five years, according to real-estate research firm Apartment Insights.

So it is not surprising that among the cities with the highest percentage of solo renters, nearly all are significantly cheaper than Seattle: Atlanta, Cincinnati, St. Louis and Pittsburgh. The exception is Washington, D.C., another high-rent city like Seattle.

Will Seattle's skyrocketing rents bring down the number of apartment dwellers who can afford to go it alone? The data already show a downtick from 2009, when 56 percent of rental units here had a single resident. But perhaps the recent proliferation of affordable micro-apartments will stem the tide and allow more Seattleites to experience solo living, even if it is in a teeny space.

We'll be sure to keep an eye on new data as it comes out, so stay tuned.

Gene Balk: gbalk@seattletimes.com. On Twitter: @genebalk

< Signs

FROM A1

TWO WORDS TOO MANY LEADS TO UNIQUE CASE

School-zone driving infraction dismissed

Hunt said he's glad his challenge prodded the city to respond.

Still, there are other problems, he said — in his opinion, the school zone's yellow lights are obscured by utility poles and by support poles for traffic lights.

"If the goal is to enhance safety, every effort should be made to make the signs as visible as possible," he said.

Advance warning signs are required before such cameras, and the Broadview-Thomson school zone has them.

But the northbound advance sign, three blocks before 130th, can be hard to notice because it stands 19 feet to the right of the four-lane, 35 mph Greenwood corridor.

It also doesn't list the upcoming 20 mph speed, which the manual says a sign should do wherever the school-zone speed drops more than 10 mph below the standard speed.

Hunt was ticketed while traveling 32 mph at 8:11 a.m. Feb. 21, 2013, according to the citation. He was on a trip north to visit his father in Edmonds.

His Municipal Court record in Seattle since 2000 shows one dismissed charge of running a stop sign.

"Worth the effort"

School-zone crackdowns are part of a broader pedestrian-safety campaign spanning the Nickels, McGinn and Murray mayoral administrations.

A person hit by a vehicle traveling 30 mph has a 55 percent chance of survival, but at 20 mph the odds improve to 95 percent, according to the Harborview Injury Prevention & Research Center in Seattle.

Seattle ranked No. 2 in pedestrian and bike safety in a recent national survey. There were 220 injury crashes and eight deaths involving pedestrians in 2012, a city report says.

Speed cameras went up at Broadview-Thomson in November 2012 (and warnings were issued the first few weeks) along with Olympic View, Gatewood and Thurgood Marshall elementaries.

This fall, five more school zones will get them, at Roxhill Elementary, Holy Family

Missing-jet search shifts southwest

The New York Times

CANBERRA, Australia — Australia plans to resume searching for Malaysia Airlines' missing Flight 370 to the southwest of the area in the Indian Ocean where the seafloor was scanned in detail last month, Australian officials said.

The shift reflects analyses of a series of electronic "handshakes" between the missing Boeing 777-200 and a satellite operated by London-based Inmarsat and a satellite in the hours after the plane vanished March 8 during a flight from Kuala Lumpur, Malaysia, to Beijing with 239 people aboard.

The satellite data, suggesting the jetliner had turned south across the Indian Ocean after skirting the northern tip of the Indonesian island of Sumatra, remains the best lead that investigators have, said Angus Houston, the retired chief of the Australian military leading the search.

An Australian vessel, the Ocean Shield, did an exhaustive search last month of a small section of seafloor in the northeast half of the arc of possible locations for the plane.

The search was conducted after the ship detected sounds initially interpreted as locator pings from the

aircraft's so-called black boxes, sounds that were later found not to be pings.

On Tuesday, the BBC quoted officials at Inmarsat who said that while Australia had understandably paid considerable attention to the detected sounds, Inmarsat's modeling of the satellite handshakes had long showed the highest-probability zone for the aircraft's final location as lying farther to the southwest.

PUBLIC NOTICE

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FROM A1

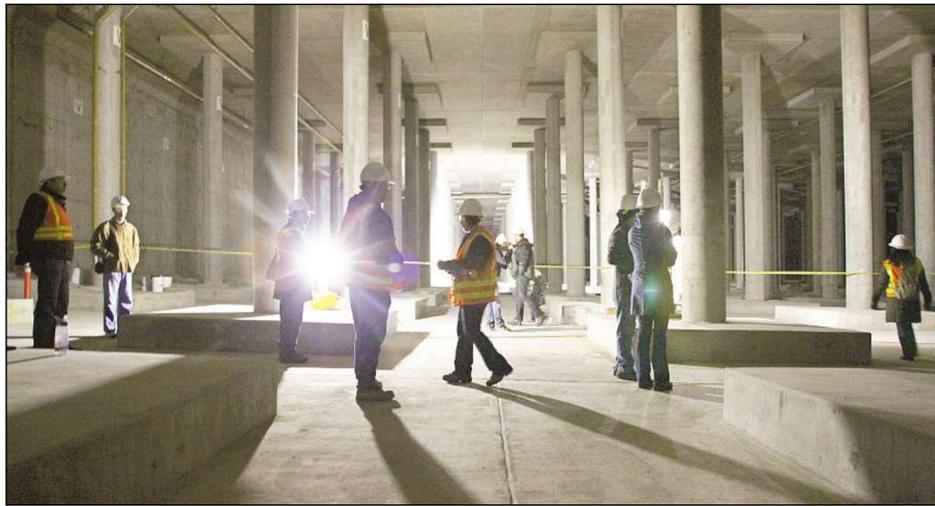
RETROFIT WORK NEEDED

Seismic deficiencies discovered

lion-gallon underground water vaults would hold up to a giant earthquake was no easy task.

After learning of the potential structural deficiencies, the city hired a panel of three experts in geology and engineering, which recommended the utility conduct a 3D analysis on the reservoirs. The city then hired CH2M Hill, which worked with new software and a specially designed supercomputer setup that could handle the enormous amount of data required to conduct the tests.

Engineers for CH2M Hill ran simulations on measures of different sizes and weighed how the West Seattle Reservoir would hold up. In a lower-level earthquake — the kind that occurs every 50 to



ALAN BERNER / THE SEATTLE TIMES, 2011

The then-new underground Maple Leaf Reservoir in Seattle was open for guided tours on this day in 2011. It is one of four underground reservoirs in the city that may need retrofit work to prepare them for a catastrophic earthquake.

100 years — the damage would be relatively minor, with some cracking and leaks, but no serious safety risks. In simulating a “maximum credible earthquake,” the pulse was great enough

to move the reservoir about three-quarters of an inch within 10 seconds, causing substantial damage.

“It would primarily be a large amount of cracking in the corners of the reservoir,”

said Wally Bennett, senior structural engineer for CH2M Hill. “The cracking would be significant enough that we’d start to lose the contents of the reservoir. It wouldn’t be a catastrophic

immediate rush of water, but you’d start to lose water. You wouldn’t have any water left after a short period of time.”

Research showed they’d be able to minimize the sustained damage by reinforcing

ing a joint on the floor of the reservoir with a concrete slab secured by rebar. They could also minimize cracking and potential leakage by adding a polyurea liner to part of the reservoir wall.

“Under a seismic event like this you would expect any structure — these buildings, bridges, anything else — you’d expect there to be some damage,” said Bennett. “The idea is that you have predictable damage that is not threatening to life safety and that in some cases can be prepared.”

The city will begin accepting bids for the West Seattle project July 2. Construction will likely go from September to early next year.

The city is still analyzing the other underground reservoirs, but it’s expected that all four will need retrofitting. Workers will have to drain the reservoirs for the construction. They plan to start work on the Maple Leaf Reservoir sometime in 2015, followed by Myrtle that same year and Beacon Hill beginning in 2016.

Andy Mannix:
amannix@seattletimes.com

< Bezos Q&A

FROM A1

2 WINNING IDEAS

Amazon CEO says that was the seed for building device

television programs and songs, and lets customers shop for the item or search to learn more about it.

The other, Dynamic Perspective, is a sensor system that lets users tilt the phone to navigate websites, fly through items on Amazon’s shopping site and dig out information from a map application.

In the interview, Bezos talked about how the new features differentiated the Fire Phone from rivals and how the company would be patient as it worked to build customer enthusiasm for the device.

Here’s an edited version of that conversation:

Q: Why does Amazon need to have its own phone?

Bezos: We don’t. Our product-development process works very differently from that. If you go back four-plus years, we didn’t ask: “We need a phone. What are we going to do?” We asked in-

stead: “If we are going to build a phone, how are we going to be different?”

Our development process always starts with an idea. It has to be differentiated. What’s going to be unique? And it has to be differentiation constrained by something that customers will find useful.

What later got named “Dynamic Perspective” and what later got named “Firefly,” those were the two winning ideas. We said if we can make that work, that would be something that would be really useful.

Q: Does your research show that customers are willing to switch from iPhones and Android devices for features such as Firefly and Dynamic Perspective?

Bezos: Here, you have to put yourself in the right mental model of one customer at a time. A lot of businesses make this mistake. A lot of people would say, “You’re late to the smartphone game. It’s too late.”

If you take that line of reasoning to its logical conclusion, then basically what you’re saying is that there can never be new entrants in any arena, which we know isn’t true. These things do change. We’re incredibly early in

wireless devices. The players come and go. They switch. They change.

We want to build a phone that for many customers — it doesn’t have to be all, but for many customers — they’ll see value in it. Our job is to take that as a beginning and put one foot in front of the other. We have a long track record of being patient, working to improve those things, being customer-centric about it the whole time.

Q: That said, plenty of people have mobile devices today.

Bezos: And people do switch. They switch at certain events. They switch when their contract expires or when they break their phone.

Q: Will Firefly and Dynamic Perspective drive people to switch?

Bezos: Those two are very unique and very important, and they will drive people to like the phone. But I think it’s too simplistic to say, “Is this the feature that’s going to get people to switch?” I would resist that. I think you have to look at the totality of it. We put a huge amount of effort into making this a great phone.

What doesn’t work is going up against an established

competitor with a me-too product. Our job is to build great products, and then customers get to choose.

Q: How much do you worry about rivals such as Apple and Google dominating the mobile phone platform business when media consumption and mobile e-commerce are taking off?

Bezos: I have a different opinion about that. We don’t need to do this. In business, sometimes people get crossways if they start thinking defensively. We think we had a great idea to build a better phone. My view is that’s the right thing to do. You want to be motivated by opportunity.

Q: Do you have no concerns about Apple and Google, which are increasingly becoming competitors of Amazon’s, dominating the mobile phone platform business?

Bezos: Do you think they would not let their customers shop on Amazon?

Q: They could make it more difficult.

Bezos: It’s pretty speculative. To me, it doesn’t seem like a credible future scenario.

Q: With other devices, Amazon has said it tries to break

even when it sells the devices and make money when customers use them. Is that the model here?

Bezos: Yeah. It’s a little different because you subscribe to phones and we’re partnering with AT&T. They are going to make this a hero product in their stores. We’re using their business model. The phone has so much premium hardware in it that it is a very aggressive price point.

We don’t want to lose money on hardware because then I also think that gets you misaligned with customers. The advantage of this is that we never have to get customers on an upgrade treadmill. We don’t care.

Q: Do you expect mobile phone shopping to be higher for users of the Fire Phone than the general population?

Bezos: I don’t know. Phones have a lot of surface area. If you look at how phones are used, they are primarily about email and messaging, and occasionally a phone call.

Even though shopping is a very important piece, and we know internally that people are using their phones more and more for mobile shopping, but it’s not the biggest piece. It’s an important activity. It’s certainly in the top

10; it might be in the top five. But it’s not the top one.

Q: One thing you didn’t discuss this morning was the data that Amazon will be able to collect from the way customers use the phone. Amazon uses customer data to optimize its website. Do you anticipate doing the same thing with the data you collect on phone usage?

Bezos: I don’t think there are many features that do that. If there is something there where we can create real value for customers, and if we can do it a really transparent way, [then we’ll do that]. I don’t think [the phone] does very much in that regard.

Q: What are the metrics that you will use to measure the success of the Fire Phone?

Bezos: Just like with Prime, I always want to see people using our services. If the early people who buy this phone are satisfied, if they’re engaged, if they are using it, if they love the features; that’s a very important set of metrics to watch.

It’s one customer at a time. Our job is to build a great product and then be patient.

Jay Greene: 206-464-2231 or jgreene@seattletimes.com
Twitter: @greene

< Amazon

FROM A1

JUMPS INTO SMARTPHONE MARKET

Novel tools aim to make shopping easy

July 25, will be offered exclusively on AT&T’s network and will start at \$199 for the version with 32 gigabytes and a two-year contract on AT&T. That includes 12 months of Prime membership, which otherwise costs \$99 a year.

The phone is Amazon’s latest bid to more deeply control the devices that run the content it sells. The company first jumped into the device business in 2007, when it debuted its Kindle e-reader. Since then, it has launched the Kindle Fire tablet line and, in April, the Fire TV set-top box.

The Fire Phone, which sports a 4.7-inch screen, will have 2 gigabytes of RAM, a 2.2 gigahertz quad core processor and a 13 megapixel camera.

Amazon is diving into a market that’s dominated by Apple and Samsung. It’s also trying to succeed where others, such as Microsoft and Facebook, have either made only modest headway or failed.

In an interview with The Seattle Times after the launch event, Bezos said it would be a mistake for Amazon to write off the market because rivals are already there.

“If you take that line of reasoning to its logical conclusion, then basically what you’re saying is that there can never be new entrants in any arena, which we know isn’t true,” Bezos said. “These things do change. We’re incredibly early in wireless devices. They players come

Amazon Fire Phone
Network: AT&T
Connectivity: LTE, GSM, Wi-Fi, Bluetooth, NFC
Processor: Quad-core Qualcomm Snapdragon 2.2 GHz
RAM: 2 GB
Display: 4.7-in. HD
Sound: Dual speakers with Dolby Digital Plus
Firefly: Feature that combines Amazon’s physical and digital content with website content, QR and bar codes, various media content and products.
Dynamic perspective: Technology in phone that uses cameras to track user movement for easier navigation on display.
Mayday: Video-chat customer support.
Price: Starts at \$199 (32 GB model), plus service plan. For a limited time, price includes one year’s Amazon Prime membership.
Availability: July 25; pre-orders available now.

and go. They switch. They change.”

The key, Bezos said, was to come up with a device that’s differentiated from the ones already in the market.

“What doesn’t work is going up against an established competitor with a me-too product,” Bezos said. “Our job is to build great products, and then customers get to choose.”

Bezos highlighted two breakthroughs at the launch event, held at Fremont Studios in Seattle’s Fremont neighborhood.

The technology that makes it easier to shop, an important scenario for a phone



KEN LAMBERT / THE SEATTLE TIMES

Jeff Bezos shows off some of the Fire Phone’s features Wednesday in Seattle. With the smartphone, Amazon enters a market already dominated by Apple and Samsung.

from the online retail giant, is called Firefly. Customers can use the phone’s camera to scan bar codes, book covers and even phone numbers or Web addresses to tap into servers to find data about those items.

Firefly can also use the phone’s microphone to determine the name of a song playing nearby or a television program on a TV.

With that information, Amazon can offer consumers the ability to buy those items or just learn more about them from the Web.

Bezos is so keen on Firefly that Amazon has included a dedicated Firefly button to make it easy to use.

“Firefly is so easy to access. Customers are going to love this,” Bezos said.

The device also comes with a clever bit of tech called “Dynamic Perspective,” which lets users tilt the phone to navigate websites, fly through items on Amazon’s shopping site and dig out new information from a map application.

With a news story from a website, users can gently tilt the phone up and the story will slowly scroll on its own.

On Amazon’s site, users can tilt up and down to get a close-up of a particular product.

When listening to a song, users can tilt the phone to the side to see the lyrics and tilt back to see the album art.

“It’s completely a very natural easy, one-handed gesture,” Bezos said.

To make Dynamic Perspec-

tive work, Amazon has placed four cameras at each corner on the front of the phone. That way, the phone can track users’ faces to know where they are as they look at the phone, so the imagery can move with them.

Bezos talked about the significant challenge of making the technology work, taking into account the different type of faces that users have, the different lighting scenarios in which people would use the phone, and the problems of users wearing hats or having beards.

“All of this variety is an extremely difficult machine-learning problem,” Bezos said.

Amazon collected millions of images in the lab and in the real world to solve the challenge.

“We got really good at tracking faces and finding heads — and doing that in real time,” Bezos said.

As clever as the new features are, the Fire Phone will likely take time to build a

following, said Rebecca Lieb, an analyst with The Altimeter Group, a research firm.

“Do I think this is going to be the must-have device at Christmas? No,” Lieb said.

But she said Amazon is nothing if not patient. And the mobile phone market is too important for the company to ignore.

Increasingly, consumers are shopping with mobile devices. And a mobile phone will also give Amazon the ability to track consumer habits, something that could have tremendous value as it works to optimize its mobile applications to generate more sales.

“They are not just selling something here,” Lieb said. “They are getting something, too.”

Amazon’s stock, which has slid nearly 20 percent this year, rose 2.7 percent Wednesday, closing at \$334.38.

Jay Greene: 206-464-2231 or jgreene@seattletimes.com
Twitter: @greene

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GREG GILBERT / THE SEATTLE TIMES

The new Brooks headquarters is at Stone Way North and North 35th Street in Seattle's Fremont neighborhood, across from the Burke-Gilman Trail.

< Brooks

FROM A10

100 YEARS, AND PICKING UP THE PACE

Running-shoe focus formula for success

ment. Running shoes made the cut sort of like a \$3 cup of coffee or a smartphone made the cut."

Past struggles

With only 13 percent U.S. market share of the \$3.5 billion performance-running category of athletic footwear, Brooks has a lot of room for growth, Weber said.

But the goal is not to be like Nike, which has captured 46 percent of sales, he said, acknowledging that Brooks has run into trouble in the past.

In the mid-1970s, Brooks was selling all types of athletic footwear, including ice skates and baseball cleats. Brooks was among the nation's top-selling brands with rave reviews from Runner's World magazine — right there with Adidas and Nike.

Jerry Turner and his brother-in-law were running the company, and the two helped come up with many technologies still used in running shoes today, Turner said.

The running boom hit in the 1970s, but by the early '80s Brooks couldn't keep up with production, forcing the company to file for bankruptcy protection in 1981.

"Ultimately we grew so fast that we outgrew our ability to manage the business," Turner said. "We went from the boom to bankrupt, and I lost it all."

Michigan-based Wolverine Worldwide — maker of Hush Puppies — acquired Brooks

out of bankruptcy, then sold it to the Seattle-based Rokke Group in 1993. The Rokke Group moved Brooks from Michigan to Bothell.

The company managed to stay afloat selling \$30 to \$40 shoes to retail chains, such as Big 5 Sporting Goods and Just for Feet, but the high operating costs on the mediocre shoes ultimately led Brooks into debt, Weber said.

When Weber took over in 2001, Brooks had more than \$30 million in debt.

Since arriving in Washington, Brooks has changed hands three more times and cycled through five CEOs. The company has been a subsidiary of Warren Buffett's Berkshire Hathaway since 2006.

Focus on the run

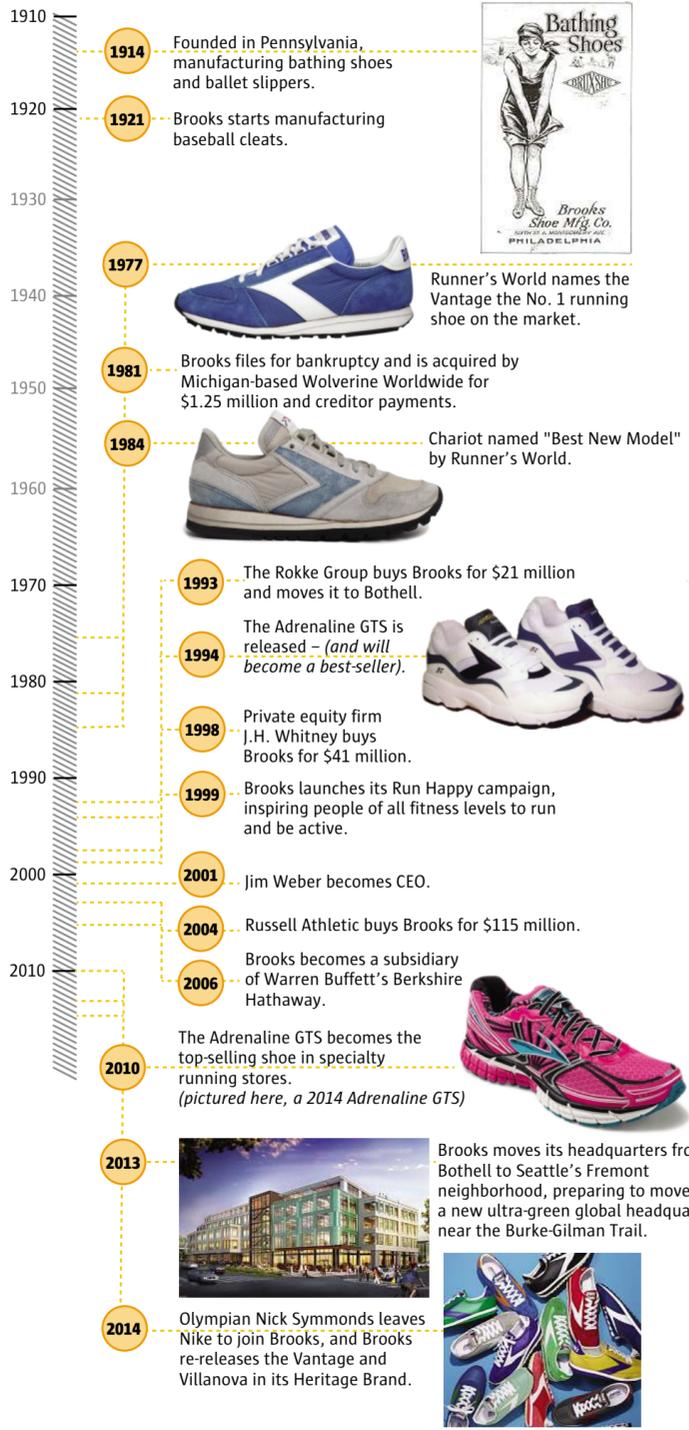
The plan when Brooks originally moved to the area was to get rid of everything that wasn't strictly running. When Weber joined the company he knew that was the right tactic, but his focus was on higher quality, more expensive shoes to be sold at specialty running stores, such as Pacers Running Stores in Washington, D.C., and Super Jock 'N Jill in Seattle.

That coupled with bringing on athlete endorsements, sponsoring races, such as the Rock 'n' Roll Marathon, and turning Brooks' 1999 Run Happy ad campaign into the company motto and way of life. Weber said he knew his plan to turn around the company would work — even as people told him it wouldn't.

His plan did work. "Brooks is No. 1 in specialty-retail stores right now. They have so brilliantly combined the product part with the soul part," said David Willey, editor-in-chief of Runner's World magazine.

"Runners can trust them and

Running through 100 years of Brooks Sports



Source: Brooks Sports

MARGARET NG / THE SEATTLE TIMES

"Running is the cheapest, most convenient form of exercise. You don't need a health-club membership; you don't need any equipment."

BROOKS SPORTS CEO JIM WEBER

Chris Farley, owner of Pacers Running Stores in Washington, D.C., said he attended for two reasons: Brooks is his No. 1 seller — followed by Saucony and Asics — and because Brooks' Run Happy motto and everything about the company resonate with runners.

"They really focus on running and running only," he said while lacing up to run his leg of the relay race at Olympic Sculpture Park. "That really does make a difference for runners."

Next 100

As Brooks continues to grow and expand its company, Chet James, owner of Seattle's Super Jock 'N Jill — a longtime retail partner with Brooks — says he hopes the company won't grow so much that it loses its specialty-retail focus.

"We always do better when a shoe company has gone down to the bottom and is trying to make it in the market," said James, who helped Brooks with some shoe designs in the 1990s when the company moved to Bothell. "I'm hoping they will be able to maintain that connection with the specialty running stores while still growing."

In August, the company will move into its new ultra-green office building at Stone Way North and North 35th Street in Seattle's Fremont neighborhood, across the street from the Burke-Gilman Trail, where it will also open a retail store.

"This is a chance for Seattle to become part of Brooks and Brooks to become part of Seattle," Weber said. "Between the innovation and retail that we have here in Seattle — Starbucks, Microsoft, Amazon, Boeing — and the active lifestyle, we are going to be associated with the city like those companies are."

Coral Garnick: 206-464-2422 or cgarnick@seattletimes.com. On Twitter @coralgarnick

to do that on top of where they were — all the ups and downs that they've had — it is a testament to their product."

Many specialty-retail partners attended Brooks' anniversary celebration in May

and ran in the relay to support their top-selling brand.

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< Harley

FROM A10

ELECTRIC-MOTORCYCLE PROTOTYPE

Includes silent engine, rapid acceleration

tion and better handling. LiveWire's design places the engine at the bottom of the bike.

"When you ride a motorcycle, it's the movement of the top of the bike side to side that gives you agility in regard to making turns. So, if I put weight low in a motorcycle, I can turn faster. I can drop the bike down and make quicker moves," said Gary Gauthier of NextEnergy, a Detroit-based nonprofit with expertise in electric vehicles.

One hurdle Harley and others have yet to address is the limited range offered by electric motorcycles. Batteries typically must be recharged after about 130 miles, and that can take 30 minutes to an hour.

San Jose State University police Capt. Alan Cavallo helped his department buy two Zero motorcycles and said officers have been "super happy" with the quiet, environmentally friendly bikes made nearby in Scotts Valley, Calif. But he said American riders who like to hit the highway would likely lose patience with the technology.

"That's the deal with the cars; you can't jump in a Tesla and drive to L.A.; it won't make it," Cavallo said, adding later, "People want the convenience of 'I pull into a gas station, I pour some gas in my tank and I go.'"

Harley President Matt Levatich said he expects

"Nobody can predict right now how big that industry will be or how significant it will be."

MATT LEVATICH
President of Harley-Davidson

technology to improve and the company is less interested in immediate demand than long-term potential. True growth in electric vehicles also will require common standards for rapid charging and other features, as well as more places for people to plug in. Harley

expects to play a role in that, he said, noting that its dealership network could provide charging stations.

"We think that the trends in both EV technology and customer openness to EV products, both automotive and motorcycles, is only going to increase, and when you think about sustainability and environmental trends, we just see that being an increasing part of the lifestyle and the requirements of riders," Levatich said. "So, nobody can predict right now how big that industry will be or how significant it will be."

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100 years of PASSION IN GLASS.

The Seattle Times congratulates

Kusak Cut Glass Works

on its sparkling centennial.

On June 14, 1914, a Moravian/Czech master crystal engraver named Anton C. Kusak founded a small company in the bustling frontier town of Seattle. Over the decades, Kusak realized his dream of owning the finest crystal house in the United States. Three generations later, Kusak Cut Glass Works continues to be the country's leading freehand stone wheel engraver, offering an extensive selection of hand cut crystal stemware, chandeliers and art glass.

As another local family-owned business, The Seattle Times salutes Kusak Cut Glass Works for its ten decades of outstanding craftsmanship, success in business, and reaching this notable milestone. From one centenarian to another, here's to another beautiful 100 years.



Three generations of crystal craftsmen: Anton Kusak with son, Tony, and grandson, Chuck.

The Seattle Times

< IRS

FROM A1

HEARING ON EMAILS IS SHOUTING MATCH

Agency chief stands up to GOP grilling

ago, told Koskinen bluntly that “nobody believes you.” “I have a long career. That’s the first time anybody has said they do not believe me,” said Koskinen, who came out of retirement in December to take over the IRS. Previously, he served in other positions under Presidents Clinton and George W. Bush.

The hearing showed that emotions are running hotter than ever in the dispute over the IRS and political fundraising.

Rep. Dave Camp, of Michigan, chairman of the Ways and Means Committee, asked Koskinen to testify a



John Koskinen, commissioner of IRS

week after the IRS disclosed it had lost an untold number of emails to and from Lois Lerner. Lerner headed the division that processes applications for tax-exempt status during a time, the IRS has acknowledged, agents improperly scrutinized applications from tea party and other conservative groups.

Camp was clearly expecting Koskinen to be more contrite.

“What I didn’t hear in that was an apology to this committee,” Camp said after Koskinen’s opening statement.

“I don’t think an apology is owed,” Koskinen replied.

Treasury’s inquiry

The IRS commissioner also dismissed Camp’s call for a special prosecutor to investigate, saying there are six government investigations under way and a special prosecutor would be a “monumental waste of taxpayer money.”

Later, White House spokesman Josh Earnest was equally dismissive. “I’m not sure that there’s a whole lot more to be discovered here,”

Key dates in missing IRS emails mystery

Key dates regarding the missing emails sought in the investigation into the IRS’ targeting of tea-party groups:

June 13, 2011: Lois Lerner, the IRS official at the center of the investigation, reports her computer’s hard drive has crashed, according to an email from another member of the Exempt Organizations Division, which Lerner led.

June 29: Lerner first learns that groups with “tea party,” “Patriot” or “9/12 Project” are being targeted for extra scrutiny by members of her staff, according to a report from Treasury inspector general for tax administration.

Aug. 5: Lerner is told that the data on her hard drive is unrecoverable, according to an email provided to Congress.

December 2011: The computer of Lerner’s boss’ chief of staff, Nikole Flax, crashes.

June 2012: Treasury inspector general selects cases of applications for tax-exempt status for review after concerns had been raised months earlier in the media.

May 3: Rep. Dave Camp, R-Mich., chairman of House Ways and Means Committee, sends letter to IRS commissioner requesting all applications seeking tax-exempt status in 2010 and 2011, including all files, correspondence and internal IRS records related to the applications.

May 10: Lerner apologizes on behalf of IRS for “inappropriate” targeting of conservatives. White House says the matter is being investigated by an inspector general.

May 14: Treasury inspector general releases report finding that IRS supervisors had known since 2011 that conservative groups applying for tax-exempt status were being unfairly targeted. The Justice Department says it will conduct a criminal investigation.

Late May/early June 2013: IRS asks certain employees to retain records.

February 2014: IRS realizes emails are missing.

May 8: IRS promises to turn over Lerner’s emails to the House Ways and Means Committee.

June 13: IRS tells Congress some of Lerner’s emails are missing because her computer crashed in 2011.

The Associated Press

Earnest said.

Koskinen, in his testimony, pointed to a report by an inspector general of the Treasury Department, the parent agency of the IRS, which concluded that while agency employees had acted improperly, there was no evidence of political motivation or outside influence.

He also said a delay in the disclosure of the lost emails was not indicative of a cover-up.

The IRS says it lost Lerner’s emails when her computer crashed in June 2011. At the time, technicians went to extraordinary means to recover them, even sending Lerner’s hard drive to the agency’s forensic lab, Koskinen said. But to no avail. He

pointed out that the effort to retrieve the lost messages had occurred before the agency was notified Congress was receiving complaints from conservative political groups that they were being unfairly scrutinized.

In 2011, the IRS had a policy of backing up emails on computer tapes, but the tapes were recycled every six months, Koskinen said. He said Lerner’s hard drive was recycled and presumably destroyed.

“I am sitting here listening to this testimony. I just, I don’t believe it,” said Ryan. “That’s your problem. Nobody believes you.”

When Koskinen objected, Ryan cut him off: “I don’t

believe you.”

Democrats on the committee were much more accommodating. “I want to apologize to you for the way you’re being treated this morning,” said Rep. John Lewis, D-Ga. “I thought this was a hearing and not a trial.”

Several Democrats also called the inquiry a “witch hunt” meant to create the appearance of a conspiracy during an election year.

Some Democrats also said the committee’s inquiry was missing a larger point: that political groups of all kinds were effectively getting subsidies from taxpayers as “social-welfare groups,” even though they actually conducted political activities.

67,000 emails

The IRS was able to generate 24,000 Lerner emails from the 2009 to 2011 period because she had copied in other IRS employees. Overall, the IRS said it is producing a total of 67,000 emails to and from Lerner, covering 2009 to 2013

On Monday, IRS technicians told the congressional panel’s staff that the hard drives of six other workers involved in the probe had also crashed. Among them was Nikole Flax, who was chief of staff to Lerner’s boss, then-Deputy Commissioner Steven Miller.

On Friday, Koskinen increased the total to eight — including Lerner’s — saying the agency had discovered another crashed hard drive.

Committee Republicans likened the revelations to the drip, drip, drip of a scandal.

Koskinen rejected statements made by Camp earlier in the week that the crashes had destroyed records kept by Flax. Koskinen said Flax’s emails were retrieved from a second computer. He said it is still not known whether emails have been lost because of the other crashes.

Koskinen suggested he would no longer provide incremental reports on the crashed hard drives to Camp, for fear it would be distorted in the media.

“So those news releases with regard to Nikole Flax were inaccurate and misleading, and it demonstrates why we will provide this committee a full report about the (hard drives)

when it is completed,” Koskinen said. “We’re not going to dribble out the information and have it played out in the press.”

After the hearing, Camp said he still has questions about Flax’s computer.

“We don’t know where her hard drive is, we don’t know that the hard drive to the laptop has been saved,” Camp said. “He said he hasn’t secured it. I think he has a lot of questions to answer about Nikole Flax before he throws any accusations in my direction.”

Improper scrutiny

A little more than a year ago, Lerner disclosed that IRS agents had improperly scrutinized applications by tea party and other conservative groups from 2010 to 2012.

At the time, she apologized on behalf of the agency. Since then, she has refused to answer questions at two congressional hearings and has been forced to retire

under threat of being fired. The House voted this year to hold her in contempt of Congress.

The Justice Department and three congressional committees, including Ways and Means, are investigating the IRS.

Congressional investigators have shown that IRS officials in Washington, D.C., were closely involved in handling tea-party applications, many of which languished for more than a year without action. But they have not publicly produced evidence that anyone outside the agency directed the targeting or knew about it.

If anyone outside the agency was involved, investigators were hoping for clues in Lerner’s emails. A White House official said Wednesday it has found no emails between anyone in the executive office of the president and Lerner.

Material from The New York Times and McClatchy Washington Bureau is included in this report.

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Prolific feral hogs snarfing down cropland

\$800M IN DAMAGE

Finding a method for meeting their demise an obstacle

By JANET MCCONNAUGHEY
The Associated Press

NEW ORLEANS — A preservative used to cure bacon is being tested as poison for the nation's estimated 5 million feral hogs.

The swine, descendants of escaped domestic pigs and imported Eurasian boars, cost the U.S. about \$1.5 billion a year, including \$800 million in damage to farms nationwide.

Hunting and trapping haven't done the trick for these big, wildly prolific animals. So, the U.S. Department of Agriculture kicked off a \$20 million program this year to control feral swine, which have spread from 17 states in 1982 to 39 now.

Sodium nitrite is far more toxic to pigs than people and is used in Australia and New Zealand to kill feral swine. USDA scientists say it may be the best solution in the U.S., but they're not yet ready to ask for federal approval as pig poison.

Vance Taylor, of Brooks-ville, Miss., has seen up to 50 hogs in a field at once. He

estimates the animals cost him 40 to 60 acres of corn and soybeans a year. They once rooted up about 170 acres of sprouting corn; they trample ripe corn, taking a few bites from each ear.

"It looks like a bulldozer has been through your field," he said. To minimize damage, he hires a hunter and sometimes heaps corn away from his fields so the hogs will eat there.

Males average 130 to 150 pounds but can range up to 250, and hogs snarf down just about anything: peanuts, potatoes, piles of just-harvested almonds. Rooting for grubs and worms leaves lawns, levees, wetlands and prairies looking like they've been attacked by packs of rototillers gone wild. Swine compete with turkey and deer for acorns, and eat eggs and fawns.

Damage is not limited to their eating habits. Feral pigs' feces were among likely sources of E. coli that tainted fresh California spinach in 2006, killing three people and sickening 200.

To stay even, at least 70 percent of an area's feral pigs must be killed each year, said Fred Cunningham, a biologist at the USDA's National Wildlife Research Center field station in Starkville, Miss. Texas alone has an



JOHN SCHMIDT, 2008

Feral hogs caught by trapper John Schmidt are caged in St. Charles Parish, La. The swine are descendants of escaped domestic pigs and wild Eurasian boars.

estimated 2 million feral swine.

"The problem will never, ever end until they find a way to poison them," said Cy Brown, of Carencro, La., a weekend hunter who added that he has shot 300 to 400 a year for farmers.

The USDA program that began in April includes \$1.5 million for the research center headquartered in Fort Collins, Colo. Its scientists have made sodium nitrite studies a top priority.

Sodium nitrite, used as a salt to preserve meat, can keep red blood cells from grabbing oxygen in live animals. Unlike people and tested domestic animals, pigs make very low levels of an enzyme that counteracts the chemical. Swine that eat enough sodium nitrite at once show symptoms akin to carbon-dioxide poisoning: They become uncoordinated, lose consciousness and die.

But baits so far haven't hit the 90 percent kill rate on

penned pigs (feral or domestic), they're all the same species) needed for Environmental Protection Agency consideration. Once the bait does, approval could take up to five years, Cunningham said.

One problem is creating baits in which pigs will eat a lethal dose. Sodium nitrite tastes nasty and breaks down quickly in the presence of air or water, making it easier for pigs to smell and avoid, said Fred Vercauteren, project

leader in Fort Collins.

Microencapsulating the powder masks its odor and keeps it stable longer.

"We'll work on that throughout the summer," Vercauteren said.

There's another big hurdle: making a bait dispenser other animals can't break into.

Raccoons have pilfered one being tested. "And we'll probably have a hard time keeping a motivated bear out," Vercauteren said.

A solar-powered machine designed to open only when pigs grunt and snuffle is being tested at the Kerr Wildlife Management Area in Hunt, Texas. The HAM (Hog Annihilation Machine) delivers a 15,000-volt shock to animals that touch it when its hoppers are closed — not enough to faze a pig or injure other wildlife but enough to send a bear or raccoon running, said inventor Harold Monk, of Denham Springs, La.

He said it can also be programmed to ignore sounds. When a wildlife camera showed it opening to an alligator's bellow, he took the camera's recording and fed it to HAM's sound card.

"I said, 'That sound is not a hog.' Thereafter, it never opened again on that sound," Monk said.

Mass immigrant graves found in Texas cemetery

BURIALS SHOCK RESEARCHERS

Multiple bodies found stuffed into bags

By MAYA SRIKRISHNAN
AND MOLLY HENNESSY-FISKE
Los Angeles Times

Researchers have discovered a series of mass graves filled with the remains of unidentified migrants in a South Texas cemetery.

The researchers exhumed bodies that had been buried by the Funeraria del Angel Howard-Williams funeral home from 52 plots in the Brooks County-owned Sacred Heart Burial Park Falfurrias. One plot contained

three bodies stuffed inside a single body bag, another had at least five bodies in body bags and small plastic garbage bags. Other plots contained skulls and skeletal remains in biohazard bags.

The total number of people buried was unclear because the remains had been intermingled.

"I was pretty upset at the end, because this isn't the way to be interred," Baylor University anthropologist Lori Baker said. "The idea that all along the border there are these people buried anonymously is horrible. This isn't even the worst we've seen, and it has to stop."

Brooks County Sheriff's

Chief Deputy Benny Martinez said he will meet with the Brooks County judge and commissioners Tuesday in Austin to investigate what happened with the graves. "I'm trying to get a grasp as to why that occurred," he said.

He added that the funeral home charges \$450 to handle each body that deputies recover.

But he doesn't foresee any criminal charges for the funeral home, he said.

"We have always been under budget constraints," he said. "Maybe there was no money to facilitate burying the bodies."

Brooks County Judge Raul Ramirez told The Corpus Christi Caller Times that for

16 years the county had been paying the funeral home to take care of bodies of immigrants who died crossing into the U.S. illegally.

A spokeswoman for Service Corporation International, owner of the funeral home, said in an email: "No matter if this is one of our client families we serve on a traditional basis or a migrant family's loved one we're serving, and we don't have any identification of the loved one, I do want to let you know it is our policy to treat the decedent with care, to treat them just like we would treat anyone else."

The anthropology researchers who exhumed the bodies this month include professors and students from Baylor and the University of Indianapolis who are working on the Reuniting Families project. That multiyear effort is attempting to identify the bodies of hun-

"... I do want to let you know it is our policy to treat the decedent with care, to treat them just like we would treat anyone else."

SPOKESWOMAN FOR FUNERAL HOME

dreds of immigrants who have died while illegally crossing the Texas-Mexico border in the past few years.

Brooks County has a high number of immigrant deaths each year. The county has recorded 33 deaths this year, 87 last year and 129 the year before that, Martinez said. The county has a Border Patrol checkpoint on the main highway north, which many immigrants and the smugglers helping them try to avoid by crossing nearby ranch land. Their bodies often are found in the unforaging terrain.

The bodies were buried

between 2005 and 2009, Baker estimated.

Baker said that when the researchers discussed the matter with the funeral home before the excavation, they were told that Sacred Heart didn't have maps or lists showing where bodies were buried or who they belonged to. When they asked about materials used for the burials, they were shown fiberboard coffins, Baker said.

"But we are yet to find any burials using those," she said.

Because the county is 70 miles from the border, it doesn't receive federal funding to help with immigration issues.

"They're so overworked," Baker said. "Trying to keep people alive who are in distress is the county's No. 1 priority, so they haven't been able to make the remains one."

Material from The Associated Press is included in this report.

Monitor

FROM A1

WORKPLACE DATA BOOSTS PRODUCTIVITY

Privacy concerns follow advancements

a pharmaceutical company replaced coffee makers used by a few marketing workers with a larger cafe area. The result? Increased sales and less turnover.

Yet the prospect of fine-grained, digital monitoring of workers' behavior worries some privacy advocates. Companies, they say, have few legal obligations other than informing employees. "Whether this kind of monitoring is effective or not, it's a concern," said Lee Tien, a senior staff lawyer at the Electronic Frontier Foundation in San Francisco.

When Jim Sullivan began working as a waiter at a Dallas restaurant a few years ago, he was being watched — not by a human boss, but by intelligent software.

The digital sentinel, he was told, tracked every waiter, every ticket, and every dish and drink, looking for patterns that might suggest employee theft. But that torrent of detailed information, parsed another way, cast a computer-generated spotlight on the most productive workers.

Sullivan's data shone brightly. And when his employer opened a fourth restaurant in the Dallas area in 2012, Sullivan was named the manager — a winner in the increasingly quantified world of work.

Industry needs privacy

Even people involved in the workplace-analytics business say rules governing privacy are needed if the emerging industry is to flourish.

Ben Waber is chief executive of Sociometric Solutions, a startup that grew out of his

doctoral research at MIT's Human Dynamics Laboratory, which conducts research in the new technologies. Sociometric Solutions advises companies using sensor-rich ID badges worn by employees. These sociometric badges, equipped with two microphones, a location sensor and an accelerometer, monitor the communications behavior of individuals: tone of voice, posture and body language, as well as who speaks to whom for how long.

Sociometric Solutions is working with 20 companies in the banking, technology, pharmaceutical and healthcare industries, involving thousands of employees. The workers must opt in to have their data collected. Waber's company signs a contract with each employee guaranteeing that no individual data is given to the employer (only aggregate statistics), and that no conversations are recorded.

"Privacy policy is going to have to deal with the workplace and not just the consumer issues," Waber said.

The payoff for well-designed workplace monitoring, Waber said, can be significant. The underlying theme of human-dynamics research is that people are social learners, so arranging work to increase productive face-to-face communication yields measurable benefits.

For example, the company studied workers in Bank of America call centers and observed that those in tight-knit communications groups were more productive and less likely to quit. To increase social communication, the shared 15-minute coffee break was introduced. Afterward, call-handling productivity increased more than 10 percent, and turnover declined nearly 70 percent, Waber said.

Waber's company also provided the data-guided insight to help the pharmaceutical company increase sales with its new cafe area.



DYLAN HOLLINGSWORTH / THE NEW YORK TIMES

Jim Sullivan, center, was a waiter named manager after intelligent software attested to his superior productivity.

At a tech company, his company found, workers who sat at larger tables in the cafeteria, thus communicating more, were more productive than workers who sat at smaller tables.

Bryan Koop, a commercial-office developer who has worked with Sociometric Solutions, points to the potential for more scientifically designed work environments. There are current fashions in office design, he said, that are assumed to increase worker productivity, like stationing workers at communal bench-style tables and constructing work cubicles with lower dividers.

"We don't know if those tactics work," Koop said. "What we're starting to see is the ability to quantitatively measure things instead of just going by intuition."

Skeptics warn of a digital-age rerun of Frederick Winslow Taylor's "scientific management" from a century ago, whose excesses were satirized in Charlie Chaplin's "Modern Times." Taylor's instrument of measurement was the stopwatch, used to time and monitor a worker's every movement. His time-and-motion studies determined the best way to do work.

Initially, Taylorism was hailed as a progressive force that would free workers from the whim of autocratic boss-

es and benefit all. "This is the way workplace analytics is being presented now," said Peter Cappelli, director of the Center for Human Resources at the Wharton School of the University of Pennsylvania.

But the ideas of Taylorism, he said, were simplified and hardened into a speedup dogma used by bosses, and workers hated it.

Level and context

Digital tools for workplace surveillance, according to Lamar Pierce, an associate professor at Olin Business School at Washington University in St. Louis, can be simplistically viewed as either good or bad. "The real challenge for all of us," he said, "is what is the right level and in what context it is being done."

Pierce was a co-author of a research paper published last year that examined the effect of the monitoring software used in restaurants, like the one in Dallas where Sullivan works, on employee behavior.

The researchers studied the data on all transactions and patterns suggesting theft, before and after the software was installed, at 392 restaurants, in 39 states. The savings from the theft alerts were modest, at \$108 a week per restaurant. More startling, revenue increased

an average of \$2,982 a week at each restaurant, about 7 percent, a sizable gain in the low-margin restaurant industry.

Servers, knowing they were being monitored, pushed customers to have that dessert or a second beer, which resulted in the increased revenue for the restaurant and tips for themselves.

The monitoring software is a product from NCR called Restaurant Guard. The product, introduced in 2009, exploits the rapid progress in so-called big data technology, for collecting, storing and analyzing vast amounts of data.

"That's the big change that

makes this possible," said Jeff Hughes, general manager for digital insight at NCR. The software is used in several thousand restaurants.

Today, Sullivan is the one using the software to monitor workers. For example, he said, the data might show that someone who is efficient at serving several tables is not very good at sales, if that person's average ticket is less than the restaurant's.

That server, Sullivan said, would benefit from advice on how to talk to customers and suggest featured dishes and drinks. "The data allows me to go back and coach and train them," Sullivan said, "so we can make more money and so can they."

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The U.S. Navy is conducting an assessment regarding the historical use and disposal of radiation sources at the former Naval Station Puget Sound. One known source of radiation was the use and refurbishment of radium dials and gauges during aircraft maintenance activities in the 1940s. Examples of other activities associated with radiation sources include the use of personnel markers, thoriated welding rods, certain types of engine exciters, and depleted uranium counterweights. If you have information about the historical use of radiation sources at this site, the Navy would appreciate your insight and recollections. Please contact Tom Abbott (project manager for the preliminary assessment) by phone at (206) 438-2004, or by email at tom.abbott@urs.com.

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The many nuances of 'aiding and abetting'

By Matthew B. Tully

Q. Can a service member get in trouble for returning to base in a car with a friend who has pot with him in the car or on his person?

A. Wrongfully introducing a controlled substance onto a military installation violates Article 112a of the Uniform Code of Military Justice.

However, the concept of "guilt by association" does not apply under the UCMJ. So if a service member is in a vehicle with someone who possesses a controlled substance and that vehicle enters a military installation, the important question for the nonpossessor becomes this: Did he or she do anything to aid or abet the wrongful introduction?

Anyone who "aids, counsels, commands, or encourages the commission of an offense" is known as an "aider and abettor" and violates Article 77 of the UCMJ. An aider and abettor usually can be punished as though he or she was the actual offender, according to the Manual for Courts-Martial.

But military courts have long held that merely being present at the scene of a crime is "not sufficient" to establish liability for aiding and abetting, as the U.S. Court of Appeals for the Armed Forces noted in *U.S. v. Stephen P. Gosselin II* (2006). Furthermore, "failure to take affirmative measures to prevent the commission of the larceny does not in any way

establish guilt as a principal."

For the nonpossessor service member to become an aider and abettor to wrongful introduction in the kind of scenario we're talking about here, guilt or innocence hinges on multiple factors.

According to the court in *Gosselin*, a service member must have a specific intent to facilitate the commission of a crime by another. He or she also must know someone else was committing the offense and assist or participate in that offense.

Gosselin involved an airman first class who had pleaded guilty to, among other things, wrongfully introducing psilocybin mushrooms onto an air base under the theory of aiding and abetting. The appellant traveled with another airman to a head shop in the Netherlands. While the appellant went to the head shop with the stated intention of buying a dragon statue, the other airman went there with the intent of purchasing hallucinogenic mushrooms.

The appellant knew how to get to the town where the head shop was, and had told the other airman so. But because there was no evidence that the appellant gave the other airman navigational assistance or that the two discussed any shared plans for the mushrooms, the U.S. Court of Appeals for the Armed Forces found the appellant did not properly plead guilty to wrongfully introducing a controlled substance onto a military installation. The charge and its sentence were set aside on appeal.

Service members accused of aiding and abetting a crime should immediately contact a military law attorney. □

Matthew B. Tully is a veteran of the wars in Iraq and Afghanistan and founding partner of Tully Rinckey PLLC (www.fedattorney.com). Email questions to askthelawyer@militarytimes.com.

[ASKTHELAWYER]

[TRICAREHELP]

as this, when the parents are not together and the child lives with the nonsponsor parent, ID cards may be authorized for children under 10.

The military sponsor — the girl's father — can start that process through the ID Card/DEERS office at his military installation. You can also get general information from the main DEERS support office in California. The toll-free number is 800-538-9552.

Q. I am deployed. My fiancée and I are getting married when I return from deployment. She has a pre-existing condition for which she has been seen by a doctor on a somewhat regular basis. She needs to go in soon for another appointment. When she becomes eligible for Tricare, will we be able to get refunds for these uncovered expenses? Will she be covered for issues related to this condition in the future?

A. Tricare will not reimburse or otherwise cover your fiancée for any medical costs incurred before you marry her and properly register her in DEERS as your dependent spouse.

On a more positive note, Tricare places no restrictions on coverage of pre-existing conditions. Once you are married and your fiancée is registered in DEERS, Tricare will cover her as an active-duty family member for any and all of her medical needs, even those relating to a condition that predates your marriage. □

Write to Tricare Help, Times News Service, 6883 Commercial Drive, Springfield, VA 22159; or tricarehelp@militarytimes.com. In email, include the word "Tricare" in the subject line and do not attach files. Get Tricare advice any time at www.militarytimes.com/tricarehelp.

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Announcements

Looking for shipmates from the USS Northampton 1957-1961 regarding asbestos-related cancer of Robert Lee Witherow, radarman. If you have any info that could help, please call Brandy Dietz at 800-226-9880.

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Robert L. Witherow

Former Naval Air Station Seattle at Sand Point (former Naval Station Puget Sound) Do you have any information about the historical use or disposal of radiological material at former Naval Air Station Seattle (former Naval Station Puget Sound)?

The U.S. Navy is conducting an assessment regarding the historical use and disposal of radiation sources at the former Naval Station Puget Sound. One known source of radiation was the use and refurbishment of radium dials and gauges during aircraft maintenance activities in the 1940s. Examples of other activities associated with radiation sources include the use of personnel markers, thoriated welding rods, certain types of engine exciters, and depleted uranium counterweights. If you have information about the historical use of radiation sources at this site, the Navy would appreciate your insight and recollections. Please contact Tom Abbott (project manager for the preliminary assessment) by phone at (206) 438-2004, or by email at tom.abbott@urs.com.

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Appendix E
Personal Interview Transcripts

**Transcript of Interview with Paul Olson
Preliminary Assessment, Former Naval Station Puget Sound**

Date: 7/02/14

Time: 11:00 AM

Location: Seattle Parks and Recreation office at Magnuson Park

Transcribed by: Kerry Rustad

Attendees: Paul Olson, Tom Abbott (URS), Tobey Clarkin (URS), Joe Sevcik (Navy, Radiological Affairs Support Office)

Tom: Is it okay, Paul, that we record our conversation for preparing a transcript?

Paul: Certainly, no problem.

Tom: Thank you. We have Paul Olson with us [middle name Richard], and Tobey Clarkin and Tom Abbott here [and Joe Sevcik on the telephone] today to discuss briefly what Paul's history was within the study area of the former Naval Station Puget Sound. Paul, can you give us a little background regarding your involvement with the site and any radiological information that you may have about the area?

Paul: Our laboratory at the UW (University of Washington) was initially named Applied Fisheries Lab, and in about 1951 was renamed Laboratory of Radiation Biology. Contacted during WW II, our director, Prof Lauren R Donaldson was asked about salmon in the Columbia River, which he knew well, and the effect of radiation on the fish, of which little was known. Turns out the lab conducted radiation studies with X-rays and in 1945 discovered they were part of the Manhattan Project which had established a large plant at Hanford, Washington. As weapons testing began with the nuclear age the Lab was involved at Bikini in 1946. As testing continued, we were involved also at Eniwetok atoll (Marshall Islands). I graduated from the UW in 1950 with a BS in Fisheries and added a MS in 1964. I became a full time researcher with the Laboratory in 1950. I monitored 8 tests in 1951 at Mercury, Nevada, processed samples in from the Pacific, and participated in testing at Bikini and Eniwetok in 1954 and after. I estimate I witnessed about 60 nuclear detonations between 1954 and 1968, and collected specimens in the field in both water and on land. We did a lot of basic ecological monitoring, dissected specimens, analyzed the organs for isotope identification and amount and submitted reports to the AEC (Atomic Energy Commission).

In 1954, March 1 detonation at Bikini, a wind change contaminated the atoll of Rongelap, and the US Navy evacuated the natives. We were called in and continued monitoring that site until 1957. The natives were temporarily returned, and we joined Brookhaven National Lab in follow up studies. We determined some of the natives preferred foods that had surprising levels of the isotope strontium, which behaves like calcium. It is a bone seeker and is often deposited near hemopoietic tissue. As a result, the AEC again moved the natives from the atoll. Although typically the muscle tissue might be low in count, if the invertebrate was molting, the hepatopancreas tissue became a temporary storage area and was of health consequence.

In 1962 we were not on hand during the series of space shots conducted at Johnston Island about 700 miles west of Hawaii. Four apparently failed to properly launch, one still on the ground when it was blown apart by high explosive, contaminating the local area with plutonium. Cleanup by bulldozer resulted, much of the material being moved into the surrounding ocean. Due to the health concerns

surrounding Pu and difficulty in monitoring it, we were called in for a series of surveys between 1962 and 1968. Still detectable, levels of Pu were a concern to AEC, and additional studies were discussed. Professor Ed Held of our laboratory suggested additional studies with invertebrate uptake of Pu, as a consequence of the Rongelap experience. The study was approved and about 200 or 300 pounds of coral grit from Johnston Island was shipped to the laboratory. This material was registered with the UW Rad Safe Officer as radioactive materials commonly would. Ralph Baltzo was the Rad Safe Officer at that time and I expect he would have it logged into his record.

Professor Ed Held heard of available greenhouse space at the Sand Point Naval Air Station and obtained access to it. He set up an area in one wing of the greenhouse, as I recall about 20 square feet, a depth of about one foot. I assisted in the lay out, and he created an environment suitable for the invertebrates he was working with and cultured them for one to two years. I was busy with my own projects and didn't get back to check with Ed, but he reported success with the culture. In about 1970 Ed took sick so he terminated the study. As the routine was, we would involve the Rad Safe Officer which I believe was still Ralph Baltzo. We would pack up that material and send it to Hanford to the radioactive waste disposal area. As Magnuson Park was developed at Sand Point, the greenhouses were removed and the site established with grass and landscaping. Typically when radioactive material like the soil was to be shipped off to waste disposal, extreme care was exercised with follow up monitoring. Records might be found at Rad Safe or in the laboratory archives stored in the library.

Tom: You said you were on full-time staff for University of Washington, do you recall what years those were?

Paul: I had my master's degree and was employed as a researcher from 1950 and left UW in 1971 when they stopped the contract. DOE [Department of Energy] took over for AEC.

Tom: Do you have questions, Tobey or Joe?

Tobey: Regarding the 300 lbs of coral soil that was brought back, plutonium was the major contaminant?

Paul: Yes, there was not a neutron flux because it hadn't been detonated; they hit it with high explosives. That's my understanding. In our analysis of it, that was reflected, too. There might be some of those reports buried in the old classified literature by Professor Ed Held out of the laboratory of Radiation Biology, UW Seattle.

Tom: You did your own analyses?

Paul: Yes, we had very extensive radio[-isotope] analyses; typically, we had the latest in sensitive instruments and quite an assortment. We had some very competent chemists.

Joe: Just for clarification, this is Joe Sevcik, a health physicist from the Navy Radiological Affairs Support Office, you said his name is Ed Hill?

Paul: No, H-E-L-D. He passed away probably late 70s or early 80s.

Joe: Can you repeat and spell the name of the RSO?

Paul: Ralph Baltzo B-A-L-T-Z-O. He was the radiological safety officer on campus at the UW for at least 20 years or maybe 30 years. I suspect there is a radiological safety officer on campus now because

there are doctors working with radioisotopes still that probably have logbooks going back to those early days. He would have been responsible for shipping the material to Hanford.

Tom: We can confirm that the material was shipped off properly, and it should be in the log book.

Joe: The 300 lbs of sand, which particular location did this come from?

Paul: That came from Johnston Island; my understanding is that that island had been scraped pretty clean before we got invited there. They had made a mess. If you look it up on the web "Johnston Island Nuclear Activities" it is descriptive of what went on and the mess that was made.

Joe: Was that in the 1960s when this happened?

Paul: Your question is about the detonation at Johnston Island?

Joe: When the sand was shipped back.

Tom: That was 1968, correct?

Paul: Yes. The accident was in 1962, and it was a hot enough potato for the AEC that they wanted help with it. Because of our work at Rongelap, they felt that this was a good group to work this over and we did an ecological review of the biota at Johnston Island. I think that was 1968.

Joe: At the greenhouse, where the soil was used to do testing, are you aware of any other radioactive materials that were brought into that area?

Paul: No, I don't believe so. We were working jointly with the College of Forestry at that time, and they may have tuned us in to the availability of the greenhouse, and we had introduced the College of Forestry in some other programs to the use of some of the isotopes in the field. I'm not aware that any were introduced by them into that greenhouse at all or into the Sand Point area at all.

Joe: You mentioned additional studies so I just wanted to be sure that there no other radioactive studies there.

Paul: Our work in the field with Forestry was measuring moisture changes in some of the salal leaves under summer deprivation of water by having an isotope source on one side of the leaf and a GM tube on the opposite side and seeing the change of record of material passing through the leaf as the moisture in the leaf changed.

Joe: Those studies were done there or elsewhere?

Paul: Those studies were done in southwest Washington at Fern Lake in Kitsap County where we had a 90-acre game-department-owned lake and a watershed that fed down into it. It gave us an opportunity to crank out a lot of grad students and introduce them to some new techniques.

Tom: I think we can wrap this up. So Paul, we will put together a transcript that you can approve and make adjustments to it. If you have an address we can send it to, we will make sure it gets to you.

Paul: My e-mail address is ... [not provided for confidential reasons]

Tom: We will send an electronic copy to your email address.

End of transcript

Approval of Paul Olson (Interviewee)

I believe that the statements in this transcript reflect the statements made in the interview on July 2, 2014, and I agree to allow this information to be used in the Navy's investigation and reporting of historical operations at the former Naval Station Puget Sound in Seattle, Washington.

Paul R Olson

Paul Olson

July 17, 2014

Date

**DRAFT Transcript of Interview with Robert Feyko
Preliminary Assessment, Former Naval Station Puget Sound**

Date: 7/02/14

Time: 9:15 AM

Location: Seattle Parks and Recreation office at Magnuson Park

Transcribed by: Kerry Rustad

Attendees: Robert Feyko, Tom Abbott (URS), Tobey Clarkin (URS), Joe Sevcik (Navy, Radiological Affairs Support Office)

Tom: We have Tobey Clarkin and Tom Abbott from URS, and we are going to interview Robert Nick Feyko. Is it okay if we record this conversation so that we can prepare a transcript for you to approve?

Robert: Sure, go ahead.

Tom: We are now recording. Joe Sevcik is also on the line from the Radiological Support Office for the Navy. Robert, we've spent the last hour going around to different locations at former Naval Station Puget Sound, and Robert has been a wealth of information. I am thankful that he has taken the time to meet with us. He has pointed out several interesting things; one being that he worked in building 11 and told us that he was the main welder there. What years were you the welder there?

Robert: from 1961 to 1967.

Tom: That was the welding shop we looked at, Joe, with the wood end-grain flooring. Did you use any thoriated welding rods?

Robert: No.

Tom: What kind of welding did you do?

Robert: [additional information from an e-mail from Robert Feyko dated July 6, 2014] In about 1965, an old secondhand TIG (aka "heliarc") welding machine was acquired and installed in this welding shop. It was seldom used over the next 30 years (1965-1995). I was the only operator of this machine the first two years, and I guesstimate my usage at one hour/month that a steady arc was maintained. This required me to sharpen the tip of the tungsten electrode 2 or 3 times during a one-hour period. I used a stationary grinding wheel in this shop, which had no dust collector on it. For the other 28 years (1967-1995), I don't know how often this TIG welding machine was used, but some type of "thoriated" tungsten electrode was probably used during its operation.

Most of the welding done in this shop was "stick welding", type 6011 (mild steel), type 7018 (low high), and type 18/8 (stainless steel), using an old Hobart DC welding machine. There was some oxy-acetylene welding/brazing, and silver soldering. Average "hands on" welding time in this shop: maybe 6 hours/week, over many years.

The entire floor of this welding shop area has a wood block floor.

Tom: You showed us the sanitary sewer system. Can you explain what you told us on site?

Robert: The Navy treated all of its sewage from the late 30s to 1968 in a treatment plant at the north end of the base. When the City put a new sewer main along Sand Point Way in 1968, we abandoned the plant and pumped it into the new city sewage pipe. It sat there until the early 80s, when it was demolished. I showed Tom where the final discharge pipe was from the sewage treatment plant. The terminal point was roughly 25 feet from the edge of the shoreline (underwater).

Tom: Was that offshore pump station building 116?

Robert: Yes.

Tom: What years did you start working at the base, and when did you retire?

Robert: I arrived from Adak Naval Air Station in 1961 as a civilian and worked here at Sand Point until 1989 – 28 years; the first 6 years as a welder and the next 22 years as a planner/estimator/facilities inspector.

Tom: We looked at building 40, which is the former welding shop that became a paint storage shop later. Can you tell us what you know about that building?

Robert: That was used by the public works painters as a storage and paint mixing site. Our crew only painted interior/exterior of buildings and did striping on the roads. I don't know if O&R operations stored paint there in the 40s or 50s and can't recall hearsay that they did store radioactive paint there.

Tom: After we looked around building 11, we went to the corner of Sand Point Way and NE 65th Street where Robert told us some interesting information about building 15, which was the former greenhouse that was in that area.

Robert: During the 60s I heard from several people that plants had been brought to the greenhouse that were taken from the South Pacific islands where the U.S. conducted nuclear bomb tests during the late 40s and 50s. Supposedly, these plants were stored there in one portion of the building for the purpose of the UW studying these plants. I presume that would be the botany department but that was just hearsay. I never actually saw plants.

Tom: After that we looked at the trash and burn disposal areas on the east side of Magnuson Park. These areas are outside of our study, but we walked that area using a 1970 aerial photograph and a GIS site map. Robert, can you tell us about those trash/burn areas?

Robert: Up until 1963, the Navy had their own dumpster cans and two dumpster trucks. These cans were located throughout the base. The trucks would come and pick up the cans, take them to the burn pit, dump them, and return them. One guy, Remus (Dore Remus), would burn all this debris and then wheelbarrow it out and dump it in the lake periodically. They would bring in gravel from the gravel pit and dump it on top of the new debris and cover it. I heard that back in the 40s and 50s that all kinds of stuff were dumped in the lake at that site. The Navy dumped there until about 1963 and then started taking the cans to the public landfill by the UW (north of Husky Stadium) that extended to University Village. In 1967 the Navy got rid of their dumpster cans/trucks and contracted out the garbage business. You might be able to pinpoint the actual dumpsite by comparing the shoreline of the 1970 aerial photo with earlier ones and look for a change in the shoreline.

Tom: Thank you for that information. Are there any other people you would recommend that we contact? Also, you mentioned that we should run an ad in another publication such as the Navy Times?

Robert: Yes, the Navy Times; it's a monthly publication, and a lot of retired Navy people subscribe to it. Use the old official title "Naval Air Station Seattle" in bold letters at the top, and underneath it you can put "also known as NAS Sand Point". I would use the period from 1930 to 1970 and when anything hot may have been dumped/spilled/used. If an old-timer catches that ad, he will relay it on to his old buddies scattered around the U.S., and you might get some input.

Tom: Do you recall anyone talking about the use of radium paint or glow-in-the-dark dials?

Robert: No. Just 4 years ago a lady died that I knew that worked in aircraft maintenance in the instrument department, so we just missed her. I know one person that was stationed here in the 50s and worked there in the 60s and 70s (Dave Nelson) probably in his early 90s now and lives near Snohomish. My former supervisor who may still be living was Dale Williams, and he retired in the early 80s and moved to Camano Island. Another was Bill Perry who lived up near Orcas Island, likely deceased. I don't know of any others still living.

Tom: I don't have any other questions. This is great information to use in our reporting. Tobey, do you have any questions?

Tobey: No, you picked up on them.

Robert: I think Whidbey Island has a lot of former Navy aviators in that area and have a publication worth putting an ad in.

Joe: Were there any other welding facilities you worked in?

Robert: Aircraft maintenance had a welder over in hangar 32 or 33 who did welding work for the airplanes. My shop was just related to the buildings and facility/utility systems, strictly public works and no aircraft.

Joe: Do you remember when the roadway to the NOAA facility was put in behind building 27?

Robert: The early 70s when that portion of the air station was transferred to NOAA they built their new buildings and put in the roadway during the early to mid 70s.

Joe: Do you recollect any of that process?

Robert: No, our public works department wasn't involved in any of that. NOAA hired its own engineering contractors.

Tom: Do you have anything else to add, Robert?

Robert: You're looking at radiological, and I guess the Navy is still on the hook for other hazardous sites. I know of other things that should be corrected. There is a lot of buried steel piping related to the aviation gas and automotive gas distribution systems with a lot of lead in it. The Navy used to bring in a fuel barge to the bulk pier and pumped oil up to building 12 oil storage tanks, and there are underground storage tanks still there. There was a pipe that went from the bulk pier up to the storage tanks, and I don't think that line was ever flushed out and drained, and could start leaking someday. If it ever does, it'll drip right into the lake water which is about 12" below. There are other hazardous sites that I know of, so if you ever want to come back and ask about them I'm available.

Joe: I appreciate your willingness to do so. It's nice to talk somebody who was out there and knew the operations of the base.

Robert: Mr. Dave Nelson near Snohomish is a good source. I'll get you his address.

Tom: We will put together a transcript with our conversations and send it to you for review. We will send a hard copy to your post office address.

Robert: Send it to my PO Box, which is ... [not provided for confidential reasons]

End of transcript

Approval of Robert Feyko (Interviewee)

I believe that the statements in this transcript reflect the statements made in the interview on July 2, 2014, and I agree to allow this information to be used in the Navy's investigation and reporting of historical operations at the former Naval Station Puget Sound in Seattle, Washington.

Robert N. Feyko

Robert Feyko

July 17, 2014

Date