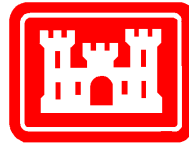


STRATEGIC OPTIMIZATION TECHNICAL MEMORANDUM

For

**Buxton Naval Facility
Buxton, North Carolina
FUDS Numbers I04NC000101 and I04NC000103**

Prepared by:



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May 2024

Environmental and Munitions Center of Expertise (EM CX)
Strategic Optimization Technical Memorandum for:
Buxton Naval Facility, Buxton, North Carolina
FUDS Numbers I04NC000101 and I04NC000103

EM CX Tiger Team: Michelle Lordemann, EM CX Director; Carrie Ables-Hamre, Risk Assessor; Jennifer Grimm, Geologist; Erin Stewart, Geologist; Carl Harms, Engineer; TR Shepherd, Chemist; Dr. Melinda McClellan, Chemist; Mike Felix, Geologist

Documents Reviewed

- *Memorandum Of Understanding between US Department of Interior, National Park Service and US Department of Transportation, US Coast Guard, 13 March 1984*
- *Inventory Project Report, Site No I04NC000100, Buxton Naval Facility, 26 April 1991*
- *Analytical Data, North Carolina TPH Samples, 2 May 1991*
- *Correspondence, North Carolina to USCG, Notice of Violation, 6 August 1991*
- *Final Site Characterization of Soil and Groundwater at Three Sites at the USCG Station, Group Cape Hatteras Station, 23 July 1992*
- *Findings and Determination of Eligibility, 20 October 1992*
- *Correspondence, from John Keiser to Zainul Kidwai, Scope Issues, 21 December 1998*
- *Correspondence, from John Keiser to Zainul Kidwai, Buxton Sampling & Testing Scope Issues, 10 January 1999*
- *Management Plan For Excavation and Removal of one UST, Waste Oil Piping, and Closure in Place of Underground Fuel Lines at the Buxton Coast Guard Facility, 1 March 2000*
- *Correspondence, from Julie Hiscox to John Keiser, Discussion, 20 March 2000*
- *Correspondence, from Julie Hiscox to John Keiser, Tank Removal Issues, 30 March 2000*
- *Comprehensive Site Assessment Report, Former Buxton Naval Facility Building 9 and AST Pad Sites, February 2001*
- *Revised Final Corrective Action Plan Report (CAP), Former Buxton Naval Facility, December 2001*
- *Final Soil Cleanup Report, Former Buxton Naval Facility, Multiple Sites, January 2005*
- *Phase I Environmental Site Assessment, U.S. Coast Guard Facility Old Lighthouse Road Cape Hatteras Buxton, North Carolina, February 2008*
- *Technical Review of Phase I ESA, Cape Hatteras National Seashore Buxton United States Coast Guard Site, April 2009*
- *Final Preliminary Assessment, Buxton Naval Facility, July 2013*
- *Revised Inventory Project Report and Finding of Determination of Eligibility, July 2013*
- *Final Fourth Long Term Monitoring (June 2015) and Final Summary Report, Former Buxton Naval Facility, January 2016*
- *Final Long Term Monitoring Report, April 2017 Sampling Event, for FUDS Project I04NC000103, December 2017*
- *Long Term Monitoring Report, April 2018 Sampling Event, October 2018*
- *Work Plan for Buxton Naval Facility, (Update to the Corrective Action Plan), February 2019*
- *Final Groundwater Assessment Report, June/September 2019, For Buxton Naval Facility, April 2020*

- *Corrective Action Analytical Update Report for Three FUDS, July 2021*
- *Precautionary Public Health Advisory, Dare County News, September 2023*
- *Report of Findings September 2023 to February 2024, Buxton Naval Facility, March 2024*
- *Correspondence, Mr. Foust Letter to Ms. Beasley, 29 March 2024*
- *Correspondence, North Carolina Coastal Federation Letter to Col Sturgeon, 5 April 2024*
- *Town Of Nags Head, Remediation of Petroleum Contamination and Removal of Derelict Infrastructure on Buxton Beach, (2024 News Release), 8 April 2024*
- *Correspondence, Ms. Beasley Letter to Mr. Foust, 10 April 2024*
- *Notice of Regulatory Requirements for Contaminant Assessment and Cleanup, 17 April 2024*
- *Draft ISE Determination for FUDS POL-Only Projects, FUDS Project Number: 104NC000101, 18 April 2024*
- *Presentation, FUDS – Buxton Overview, 22 April 2024*
- *Seashore Comments on the Army Corps of Engineers' Draft Final Report of Findings, September 2023 to February 2024 at Buxton Navy Facility Formerly Used Defense Site 104NC0001, March 2024, 26 April 2024*
- *Correspondence, Ms. Keisler Letter to Mr. Scott, 29 April 2024*
- *Contract 47QMCH24G0005, PWS Former Buxton Naval Facility, April 2024*
- *Draft Site Investigation Report, CERCLA Investigation (prepared for USCG), May 2024*
- *Draft ISE Determination for FUDS POL-Only Projects, FUDS Project Number: 104NC000103, 06 May 2024*
- *Correspondence, Mr. Hallac Letter to Mr. Evans and Col Sturgeon, 09 May 2024*

Summary of Review Observations

The following presents the Tiger Team's key observations regarding site conditions, site characterization efforts, and remaining data gaps at the Buxton Naval Facility Formerly Used Defense Site (FUDS).

The United States Army Corps of Engineers (USACE) Conceptual Site Model (CSM) has been most informed by investigation activities conducted during the late-1990s/early 2000s. USACE has focused most of the investigation and remediation work into an area near former fuel tanks and an associated pipeline [Areas 4, 5, 7 from Figures 4 and 5 in the USACE Preliminary Assessment (PA)]. Work conducted since then [excavations in 2004, groundwater Long-Term Monitoring (LTM), 2020-2021 in-situ injections] focused on that CSM.

Petroleum, Oil and Lubricants (POL) and hazardous substances continued to be used/stored by the United States Coast Guard (USCG) after USACE's most significant investigation efforts in the 1990s/early-2000s. A 2001 USACE report identified a 5,000 gallon diesel tank and an unknown sized diesel tank still in use by USCG. The 2001 USACE report also identified the septic drain field (Figure 1 from 2005 Soil Cleanup Report) as a possible, unknown source. The Phase I Environmental Site Assessment (ESA) completed in 2009 for General Services Administration and USCG noted the presence of hazardous chemical storage and identified the septic drain field as a possible Hazardous, Toxic and Radioactive Waste (HTRW) source. USCG also operated a gasoline filling station approximately 400 feet west of USACE's assumed sources of POL contamination.

Review of the 2005 USACE Final Soil Cleanup Report indicates data gaps remained after POL contaminated soils were excavated (some data gaps were identified in the report, others have been identified by USACE while preparing this memo): 1) Not all areas designated for excavation were completed due to the presence of existing infrastructure. 2) Confirmation sampling was limited to only United States Environmental Protection Agency (EPA) Method 8270. Current North Carolina Department of Environmental Quality Underground Storage Tank (NCDEQ UST) program guidance would have required EPA Methods 8260 and 8270, and Massachusetts Department of Environmental Protection

Volatile Petroleum Hydrocarbons and Extractable Petroleum Hydrocarbons since low boiling point fuels and medium/high boiling point fuels were stored on-site. 3) Confirmation samples were apparently not collected at the bottom depth of excavations. 4) Excavations appear to have only been completed to the water table even though the highest Flame Ionization Detector screening results were detected from soil samples identified as “wet” and sheens were noted on the water in the excavations. 5) The method for delineating the extent of excavations was not given (surveyed or estimated). 6) Lastly, the location of the excavation backfill source was not identified and no sampling data characterizing the backfill was included.

Some portion of the fuel distribution pipeline likely remains at the site; removal activities were limited in Areas G, H, and I (see Figure 1 excerpted from 2005 Soil Cleanup Report) due to subsurface concrete pads, utility corridors, and direct-buried utilities; and removal activities were limited vertically in Area E due to concerns related to destabilizing the adjacent road, utility damage, and impacting the Building 7 foundation. Residual petroleum contamination could remain in any of these areas. Because these areas are located near a shoreline with high rates of erosion, the areas are susceptible to surface exposure if erosion continues to progress.

Following the completion of the excavation activities there likely was not a remaining risk from the direct contact exposure pathway to contaminated media that may have remained in-place. The potential for the soil-leaching to groundwater pathway remained and has continued to be monitored as part of LTM. The change in site conditions through major erosion has now potentially changed that risk because there are now potentially complete direct contact exposure pathways to groundwater and soils by tourists primarily during erosional events and through tidal influence. The shore is continuing to recede, and therefore, may present a future risk for direct contact exposure to groundwater and soils. Shoreline recession and erosion may also expose remnant buried infrastructure.

Buxton Beach erosion rates average 10 feet per year horizontally; the Buxton shoreline is now much further inland than when the Navy facilities were built, as shown in arial photos excerpted in the attachments below. The area of exposed infrastructure was buried under beach sand and sand dunes until September 2023 when a storm caused a major erosional event. Since then, the area has been exposed and reburied several times. During an erosional event, the vertical loss of sand can be 10 feet, and this may only last several days before additional sand is deposited. The buried infrastructure appears to be remnants of Building 19 (terminal building), which formerly housed the terminus of listening cables that were used to detect enemy warships off the coast. Building 19 was demolished in 1986. The building was originally located on the west side of the dunes, but remnants are now underneath the dunes and beach.

EM CX staff conducted a site visit on 9 May 2024. Buxton Access closure signs placed by the National Park Service (NPS) and Dare County were observed along with a recently installed sign for USACE’s soil testing and pipe removal project. Much of the beach-side remnant infrastructure that had been exposed by storm events in the past year was buried by sand, although some infrastructure was still visible. No obvious signs of petroleum contamination (odors, staining, or sheen on water) were noted during the site visit. Representatives from NPS, USACE South Atlantic Savannah (SAS) District, and SAS’s soil testing and pipe removal contractor were present throughout the day, and EM CX staff had discussions with those various representatives. Additional site visit details are included in an attachment to this document.

A contract was awarded by SAS to locate and remove the full extent of a small diameter iron pipe near the southwest area of Building 19 that was exposed during recent storm events and collect soil samples to confirm the presence or absence of petroleum contamination. Ground Penetrating Radar had been completed in the vicinity of the iron pipe prior to the EM CX site visit and excavation activities were scheduled to begin on 13 May 2024.

Initial Findings

HTRW features on the Buxton FUDS that could be sources of petroleum contamination included seven (7) above-ground storage tanks (ASTs), 27 underground storage tanks (USTs), a grease/oil change ramp (OCR), and associated underground pipeline. (2013 PA, PDF p.15)

The Containerized/Hazardous, Toxic, and Radioactive (CON/HTRW) project (Project 01) was approved in 1989. "The project consisted of sampling and testing the contents of 7 aboveground fuel storage tanks (six 1000-gallon tanks, and one 57.6' x 14' tank), removal and disposal of the tanks and their contents, testing and removal of the soil under the tanks, and backfilling disturbed areas. In 1991, three additional aboveground storage tanks (one 3,000-gallon, one 4,000-gallon, and one 7,000-gallon tank) were removed from the property. The project was NDAI'd [No Department of Defense Action Indicated] on 30 September 1993 and closed out on 29 September 2009 with regulator concurrence." (2013 Revised Inventory Project Report and Finding of Determination of Eligibility, July 2013)

The HTRW project (Project 03) was approved in 1998 "in response to soil contamination discovered following the removal of 27 underground storage tanks (UST) from the U.S. Coast Guard Group, Cape Hatteras Station during February 1991. Contamination was also discovered in the oil change ramp/grease ramp area, the area around Building 9 and the former petroleum products area. In 2004, the former grease ramp/oil change ramp was demolished and removed from the property, and more than 2,700 cubic yards of petroleum contaminated soil was excavated and shipped to a licensed land farm." (2013 Revised Inventory Project Report and Finding of Determination of Eligibility, July 2013)

Petroleum contamination tests were conducted in 1992, after the 27 heating oil UST removals and at the location of the oil change ramp (OCR). The results of the investigation concluded that two of the former heating oil UST sites (Buildings 66B and 69B) and the OCR had Total Petroleum Hydrocarbon (TPH) levels that exceed NCDEQ action levels for petroleum contamination in soils. (2013 PA, PDF p.18) Fuel-related hydrocarbons were detected in shallow soils (up to approximately 3 feet below ground surface [bgs]) at the OCR. The hydrocarbons were identified as having a distillation range similar to #2 fuel oil. While not present in soil, several compounds commonly associated with heavier fuel fractions such as diesel and motor oils (naphthalene and others) were identified in groundwater samples collected near the OCR and at Buildings 66B and 69B. (1992 Site Characterization Report, PDF p.20) The report indicates, "Although groundwater in the immediate vicinity of the OCR had detectable dissolved hydrocarbons, the absence of these compounds in groundwater collected from nearby monitoring wells suggests that most of the hydrocarbon content in the soil [at the OCR] is evidently immobile, probably because only the less mobile constituents have remained through weathering." (1992 Site Characterization Report, PDF p.21)

During fieldwork conducted in 1999, a fuel oil pipeline was found that connected the above ground storage tank and Building 9, which previously housed a boiler. The pipeline was reportedly removed in March 2000, and the closure sampling revealed oil and grease contamination in the soil. (2013 PA, PDF p.19)

Contrary to reports indicating the fuel oil pipeline was removed in March 2000 (see above), it appears some of the pipeline may remain. From 30 March 2000 correspondence: "They dug up the pipeline at the oil change ramp, then tried to follow it out to the end." They "stopped digging at the edge of [a] utility trench and [were] unable to locate the pipe on the other side of the trench." "They cut the pipe at the OCR and grouted both sides of the pipe to seal it. Since there was no sign of contamination, they did not take any samples." "They also followed 200 ft. of pipe from the vault out to the vicinity of the septic field." "Since they already dug up the pipe following it, ... they simply [removed] the pipe." (30 March 2000, Correspondence, Project 03, OCR Building 9, AST Pads)

As part of corrective action activities (CAP dated December 2001), petroleum contamination areas investigated and surrounding the OCR were divided into four "sites"; a former AST Pad south of (behind) Building 7, the former Building 9 (boiler house) area, the OCR (located between Buildings 6 and 7), and

the area around former Building 19 in the vicinity of the facility septic drain field. (2013 PA, PDF p.19) Petroleum contamination identified at the OCR is likely related to its past use as a grease rack, while petroleum contamination in other parts of the facility are presumably related to a former fuel oil distribution pipeline, which once fed a boiler at former Building 9 and connected to former Building 41. (2001 CAP, PDF p.9)

In 2004, a total of approximately 4,006 tons of soil were removed from the four sites. The excavations typically extended to 7 feet below ground surface. Subsequent soil sampling (30 confirmation samples) “revealed all contaminated soil had been removed” except associated with one sample in Area I (I-03), which could not be completed because of an asphalt road and the presence of critical utilities. Sample I-03 results indicated benzo(a)anthracene at a concentration (0.382 parts per million (ppm)) exceeding the NCDEQ standard of 0.34 ppm. (2013 PA, PDF p.20, and Soil Cleanup Report PDF p.5)

Approximate soil volumes for the excavation areas: Area A/H (east side of road), 617 cubic yards; Area B, 375 cubic yards; Area C, 550 cubic yards; Area D, 490 cubic yards; Area F, 648 cubic yards; and Areas G, H, and I, 27 cubic yards. (2005 Soil Cleanup Report, PDF p.9).

The water table during removals varied between approximately 4.5 and 6 feet bgs. Visible petroleum contamination was typically limited to a depth between 3 feet bgs and the water table. Petroleum sheen or a rainbow was present in most excavations and a petroleum odor was noticeable. (2005 Soil Cleanup Report, PDF p.9) From the documents reviewed, free product has not been measured in monitoring wells.

Between September 2023 and March 2024, NPS staff have noticed petroleum odors, observed discolored soils, and/or observed sheen in and around former Building 19 at the Buxton FUDS more than two dozen times (NPS letter dated 29 March 2024). Additionally, the header wall, parts of the foundation, the cable vaults, piping, septic components, metal, concrete blocks, and other remnant infrastructure from Building 19 and other Navy structures have been observed. During that time, the public has reported observations of sheen, strong petroleum odors, and apparent petroleum product on wetsuits, skin, and hair following surfing in the ocean near the site. The public and agency staff have reported health effects including eyes burning, nausea, and headache associated with apparent petroleum odors emanating from the site.

Between October 2023 and February 2024, USACE used a Photo Ionization Detector (PID) to measure ambient air and air at exposed pipes, collected surface samples, and dug three test pits to 3 feet bgs. Ambient air at one test pit measured 49 ppm at 3 feet bgs. No peat, organic material or petroleum were observed in test pits. An NPS letter indicates USACE soil samples collected from test pit just south of Bldg. 19 contained measurable levels of C9-C18 aliphatic compounds and C9-C22 aromatics characteristic of petroleum contamination.

In December 2023, USACE advanced nine boreholes to 15-20 feet bgs to identify a potential peat/organic layer below water table, which was thought to be a potential secondary source of petroleum contamination. Between 2010 and 2023, the beach eroded 25 feet vertically; these boreholes were deeper than previous investigations, including existing monitoring wells. Existing monitoring wells, initially installed to 30 feet bgs, became exposed due to erosion. The exposed portions of the well casings were cut off and the wells now extend only 8 feet bgs. Peat was noted at 3.5-4.5 feet bgs in boring adjacent to ZMW-11. That sample contained 5,200 milligram per kilogram (mg/kg) coal tar. No peat, organic material or petroleum were observed in the other borings, and no other lab samples were collected. Groundwater monitoring was conducted at eight wells with Ground Water Quality Standard (GWQS) exceedances within past two years. 1-methylnaphthalene was detected in one well at 6.95 microgram per liter (ug/L), above the GWQS of 1 ug/L.

In February 2024, USACE visited the site after the NPS reported petroleum odors that were so strong that people could only stand to be in the area for a few minutes. USACE did not smell any odors or see any sheens or stained soils but did observe five baseball sized peat mats on the beach. A concrete structure, manhole and a 2-inch pipe were exposed on the beach. These areas were inspected and probed with a

shovel and probe rod. No evidence of a tank or other structure were identified. On February 1, 2024 NPS took two samples of sand from the end of what NPS believed to be a steel fuel pipe that was exposed just south of Building 19 and within the Corps' 1985 DERP restoration footprint area. The samples contained 160 mg/kg and 260 mg/kg Total Petroleum Hydrocarbons-Diesel Range Organics (TPH-DRO). On February 14, 2024 NPS also collected a sand sample from the end of a steel pipe around Bldg. 19. Analytical results indicated 6,300 mg/kg TPH-DRO. Other analyses of the sample resulted in measurable amounts of 1,2,4 and 1,2,5 trimethylbenzene, 2- and 4-chlorotoluene, hexanone, naphthalene, n-butylbenzene, n-propyl benzene, ortho-xylene, p isopropyl toluene, sec-butylbenzene, and toluene.

SAS has noted that "A significant beach nourishment project was undertaken in June and July 2022. The possibility that this may have exposed offshore contamination has not been adequately investigated." The Tiger Team conducted a limited search for publicly-available data from this beach nourishment project; some grain size analysis of the imported material has been found. NPS claimed that USACE and North Carolina regulators had access to detailed sediment analysis each week, but the Tiger Team has not seen that data. The beach nourishment project does not seem to be a likely source for recent POL observations.

USCG conducted a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Site Inspection (SI) for the former Coast Guard facility and prepared a Draft Site Inspection Report in May 2024. Soil and groundwater analytes included metals, TPH-DRO, Total Petroleum Hydrocarbons-Gasoline Range Organics (TPH-GRO), Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), Polychlorinated Biphenyls, perchlorate, pesticides, and Per- and Polyfluorinated Substances. The following samples were collected that assist with the understanding of petroleum contamination at the site:

- 21 soil samples were analyzed for TPH-DRO and TPH-GRO
- 44 soil samples were analyzed for VOCs
- 43 soil samples were analyzed for SVOCs
- 15 temporary monitoring wells were analyzed for VOCs
- 14 temporary monitoring wells were analyzed for SVOCs

TPH-DRO and 1-Methylnaphthalene were detected at concentrations above the NCDEQ UST Section Action Levels and NCDEQ Protection of Groundwater (PoG) Preliminary Soil Remediation Goal (PSRG), respectively, in one boring located about 200 feet west of former Building 19. Benzo(a)pyrene was detected at concentrations above the Residential PSRG in three soil samples. Two of these concentrations also exceeded the PoG PSRG. These sample locations are about 150 feet west, 250 feet southwest, and 300 feet southwest of former Building 19. 1-Methylnaphthalene was detected above the NC 2L Groundwater Standard in a groundwater sample collected approximately 200 feet west of former Building 19. No other indications of petroleum impacts were evident in the USCG SI data.

The Formerly Used Defense Sites Chemistry Database (FUDSChem) was used as a tool for review of historical and current data as well as current project status and active data collection activities. First impressions of the project status in FUDSChem are that events are being appropriately created in FUDSChem as they occur in the field and that the project should be well positioned to quickly plan events, load and review data, and have data available for reporting. Location information, one of the required data uploads, appears to be in good shape with both wells and soil locations loaded without obvious data quality concerns. Location data is readily available for mapping. The database includes chemistry data for Project 03 from 21 events dating back to 2016 with quarterly groundwater monitoring going back to November 2021. These data can be readily exported to maps with color-coded icons showing detects and exceedances of the assigned project screening or action levels. There are several more recent events which do not yet have the data fully uploaded into the database. These include the more recent groundwater monitoring and soil sampling results. Following onsite training provided by EM CX earlier this FY, SAS has been actively working with the EM CX FUDSChem project delivery team (PDT) to complete these data uploads.

POL Imminent and Substantial Endangerment (ISE) Determinations:

POL ISE determinations have been drafted by SAS in accordance with the FUDS Handbook (02 DEC 2022) and the FUDS Program Interim Guidance Document 2023-01 for POL Decision Documents. The draft ISE determinations for Projects 01 and 03 are summarized below.

Project 01 (I04NC000101)

- CON/HTRW project. Impacts to soil and groundwater were confirmed in 1991.
- Recent feedback from NPS employees suggests there may be additional contamination near the southern corner of former Building 19 that has not been adequately characterized. Possibly complete exposure pathways exist for outdoor workers and current and future recreational users through direct contact, ingestion, and inhalation of soil from the pipe at the southern corner of former Building 19 as the pipe is degrading and not capped. The pipe near former building 19 is in close proximity to a rapidly eroding portion of the beach and could serve as a possible point of release to the environment if further erosion were to occur. Weather and tides at Cape Hatteras are extreme and further beach erosion in this area is expected.
- ISE is indeterminate at this site. Further sampling of soil and groundwater due to potential releases in all areas where there is CON/HTRW is recommended followed by a reevaluation of ISE.

Project 03 (I04NC000103)

- Impacts to soil and groundwater were confirmed, and ISE was present at the time of project initiation.
- Groundwater is not used for drinking water within 500 feet of the site, as required by the 2001 CAP, and all nearby residences (farther than 500 feet from the site) are on a municipal water supply. Additionally, the groundwater is not suitable for drinking water in the area due to high salinity. The drinking water pathway is incomplete at the site. The proposed remedy is continuation of groundwater monitoring as agreed to in the 2001 CAP and no further action after completion of four sequential groundwater monitoring events with groundwater meeting 15A NCAC 2L.0200 Standards. Target project closure by fiscal year 2025.

Questions

The Tiger Team has the following questions based on review of listed documents.

- EM CX does not have access to data referenced by other federal agencies (letter from David Hallac dated 26 April). NPS references this data on multiple occasions as a key source of information.
- It is not clear if the soil contamination associated with heating oil USTs 66B and 69B was addressed; however, this area has been redeveloped and is currently a residential neighborhood.
- The April 2024 SAS Contract for soil testing and pipe removal did not indicate expected extent of pipe and soil removal, what potential other underground expenditures may be encountered during this action, or the estimated number of analytical samples.

Summary of Recommendations

The following recommendations are based on focused review of listed documents in the USACE repository, a site visit, and limited interviews. Re-consideration/adaptation by the executing District is anticipated as additional information is gathered from USACE or other agencies.

- Institute a comprehensive soil and groundwater sampling plan, focusing on areas that have historically had less investigation work and where access (during 2004 removal activities) was limited by buildings, roads, or subsurface infrastructure (Areas E, G, H, and I, see attached figure). The southern portion of former Building 19 extending westward toward the pond is the area where the least amount of investigation has been completed historically (see attached maps, pg. 13&14). Sampling by USCG in 2024 also identified TPH-DRO contamination (OG-B80-4-6) in this area.
- Based on the likely progression of shoreline erosion, recommend attempting to re-acquire (potentially using geophysical methods) any fuel distribution pipeline that may have been abandoned in place during the 2000 AST/pipeline removal (see attached map, pg. 13).
- The district PDT should continue to engage with the EM CX FUDSChem PDT to finalize data uploads in the FUDSChem database and should continue to load data during future sampling events. Any sampling events scheduled into the future, should be proactively managed in FUDSChem. The PDT should utilize the available FUDChem reports and data visualization tools in preparation of plans and reports to show the historical findings, locations, and trends for all the data currently in the system and upcoming activities. It is highly encouraged for the district PDT to reach out to EM CX FUDSChem personnel for any needed assistance in ensuring timely completion of data loading, approval, and utilization of reports and visualization tools.

Recommendations for Any Future Investigation:

These recommendations are intended to help the PDT identify opportunities for improvement of future investigation work. Further analysis of the recommendations may be needed prior to implementation, based on the PDT's goals for the site and strategy for achieving those goals.

- High-Resolution Site Characterization (HRSC) should be implemented given the relatively small size of the areas needing investigation. HRSC could be accomplished either via high-density soil and groundwater sampling for laboratory analysis, or a combination of Laser-Induced Fluorescence (LIF) and confirmatory soil/groundwater sampling. A primary concern with using LIF at this site would be that high concentrations of contaminants have not been detected to-date in significant portions of the site; LIF does not generally detect contaminants at the levels that laboratory analysis can achieve. However, recent TPH-DRO detections during the USCG CERCLA investigation were within the range of detection for LIF, which is approximately 100 ppm or greater. Advantages of using LIF for HRSC would include the ability to measure for contamination continuously through the vadose and saturated zones and development of a much more comprehensive data set than discrete soil and groundwater sampling alone can provide. Confirmation soil/groundwater sampling for laboratory analysis would also be needed with LIF, which would also provide some safety if concentrations are too low at the site for LIF to detect.
- Soil samples from above and below the water table should be collected, given that the highest field screening results were observed in saturated soils during the previous excavation activity.
- Future investigation work should avoid over reliance on PID readings based on lack of significant quantities of measurable VOCs, limited detections via PID in previous investigations, and presence of heavier-range compounds as evidenced by TPH-DRO and Oil & Grease Detections (see 2001 Comprehensive Site Assessment and 2024 USCG SI).
- Geophysical investigation methods are recommended within the same areas that would be subject to additional investigation. The geophysical investigation would search for unknown buried structures such as pipes, vaults, or tanks. Ground penetrating radar, possibly with confirmation using an electromagnetic sensor, is considered a viable geophysical method for this purpose.

Attachments - Extracted Figures and Photos

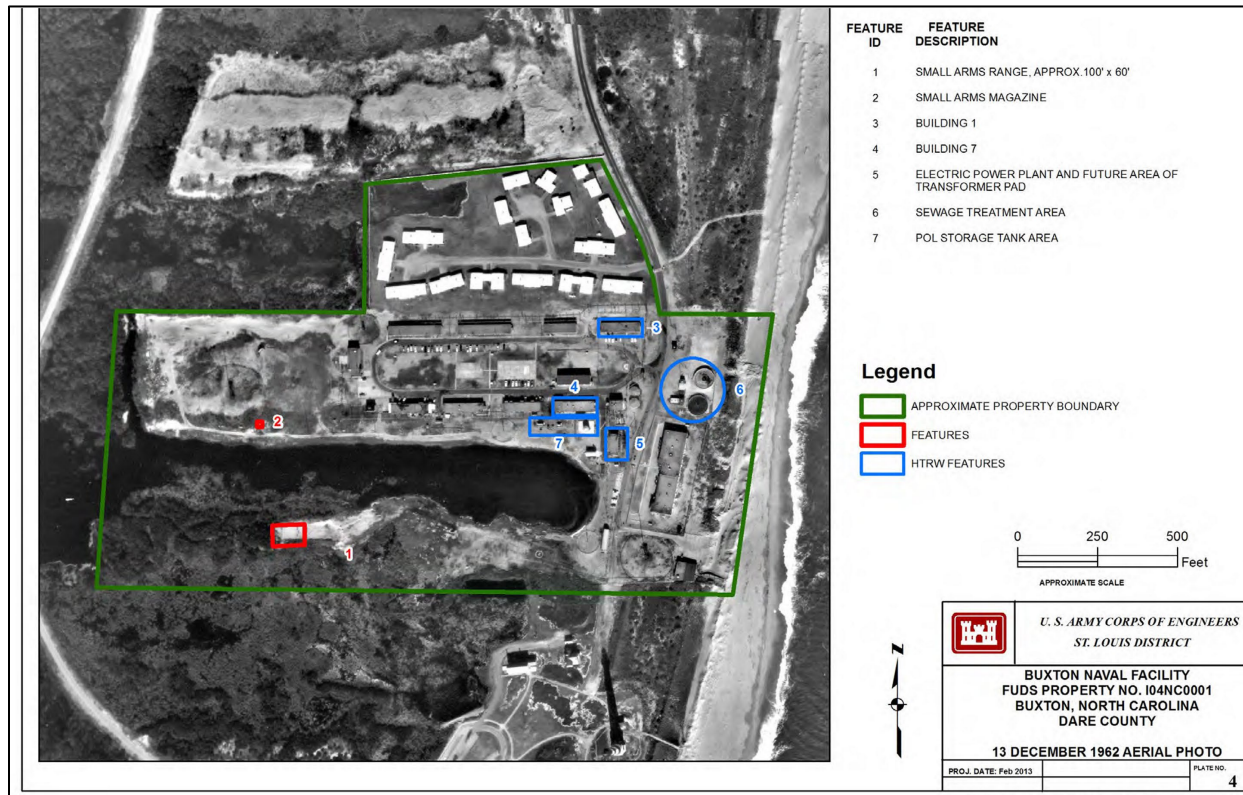


Figure 4 from the 2013 Preliminary Assessment – 1962 Aerial photo indicating Areas 4, 5, and 7.

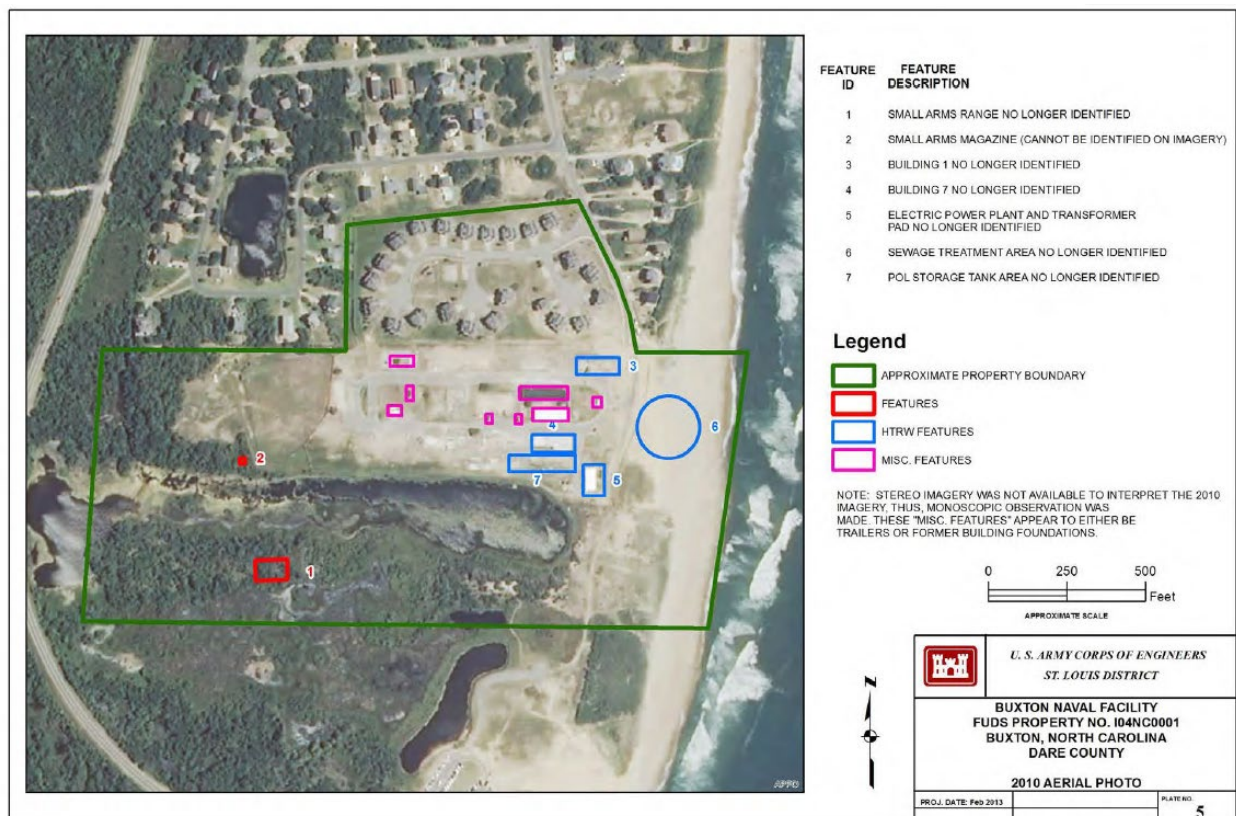


Figure 5 from the 2013 Preliminary Assessment – 2010 Aerial photo indicating Areas 4, 5, and 7.

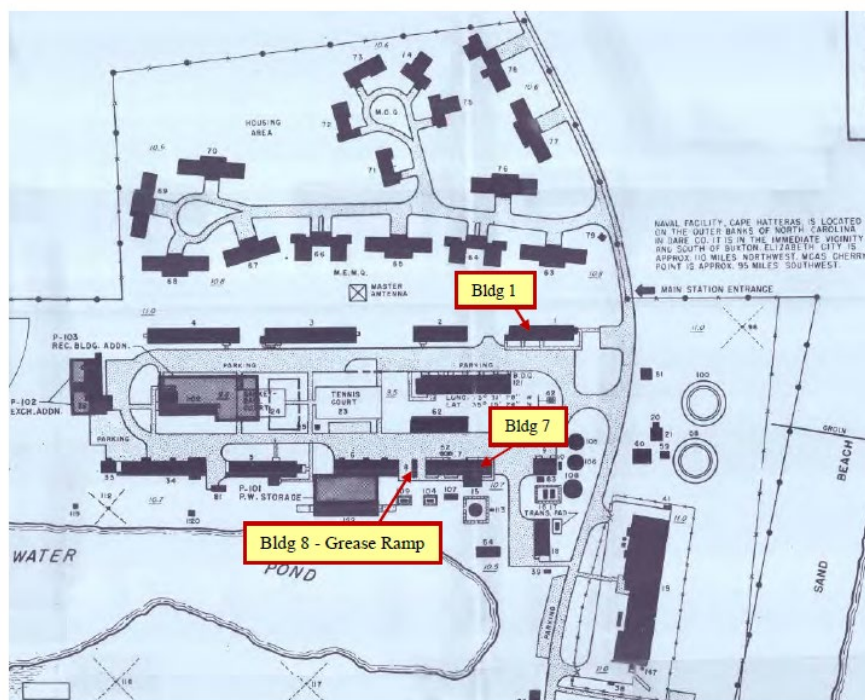


Figure from 2013 Preliminary Assessment (Section 4.2.2.1)



Figure from 2013 Preliminary Assessment (Section 4.2.2.2):

The petroleum, oil, and lubricants (POL) storage tanks and distribution operations at Buxton Naval Facility included a 540 BBL Diesel Oil Tank (#15), two 5,000 gallon fuel oil tanks (#16 and #17), a 1,000 gallon diesel oil tank (#38), two 2,000 gallon diesel oil tanks (#39 and #41), two motor gasoline (MOGAS) pumps (#52) at the service station, a 3,000 gallon MOGAS tank (#104), and a 1,500 gallon MOGAS tank (#109)

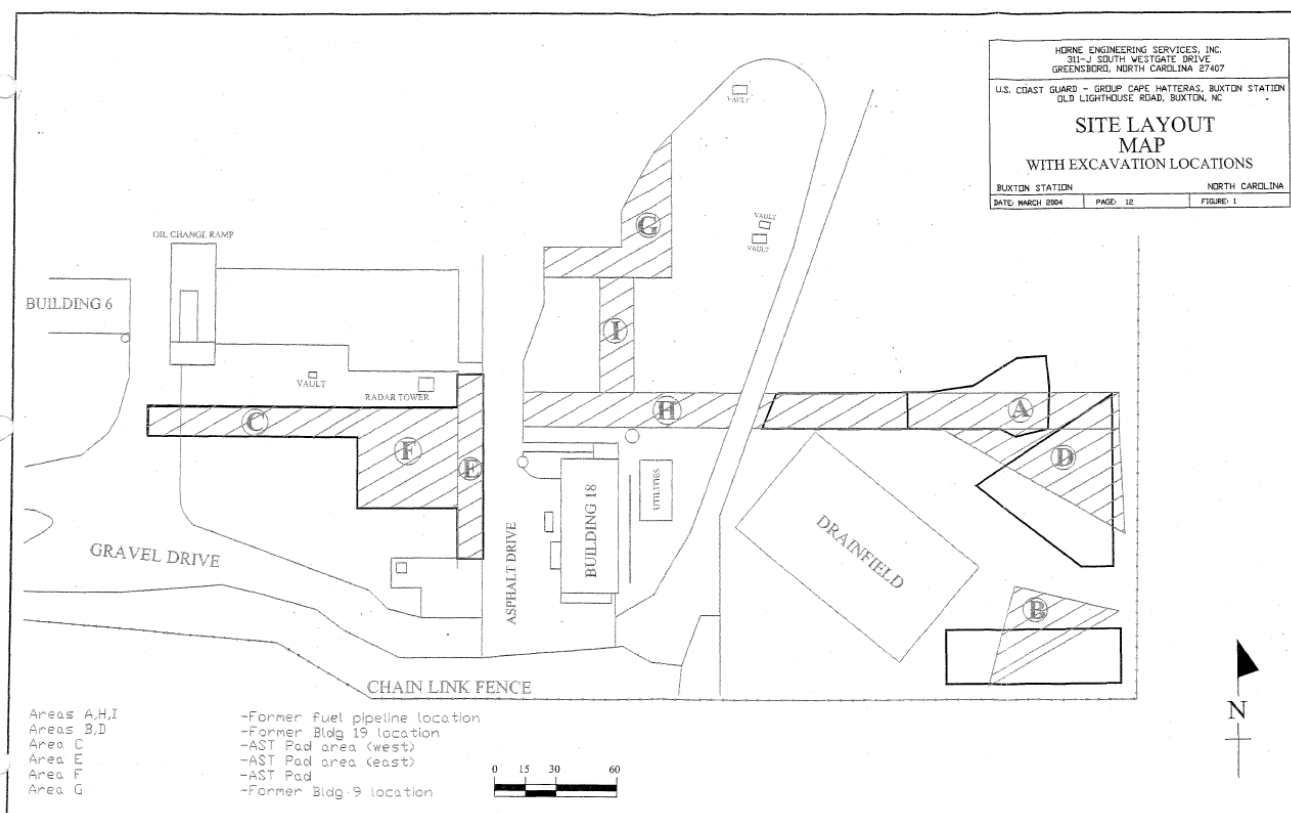
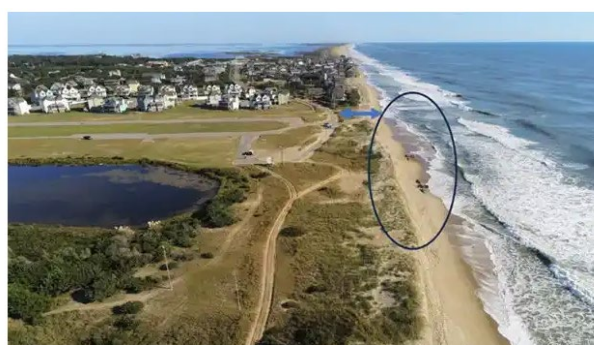


Figure 1 from 2005 Soil Cleanup Report



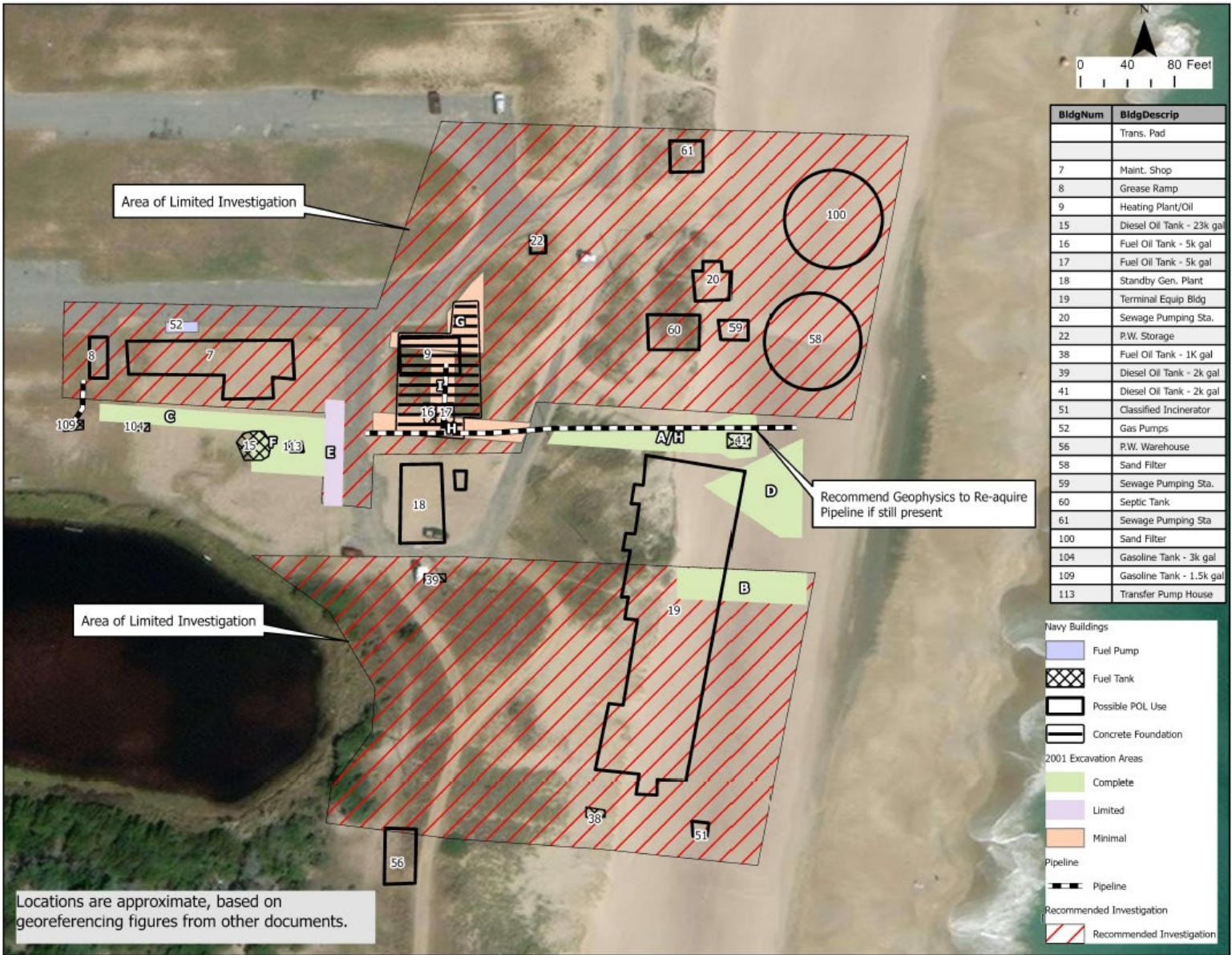
Photos from presentation by the National Park Service on March 27, 2024 show dramatic erosion. The location of buildings in the Navy Base and the current position of the tide line. Courtesy NPS

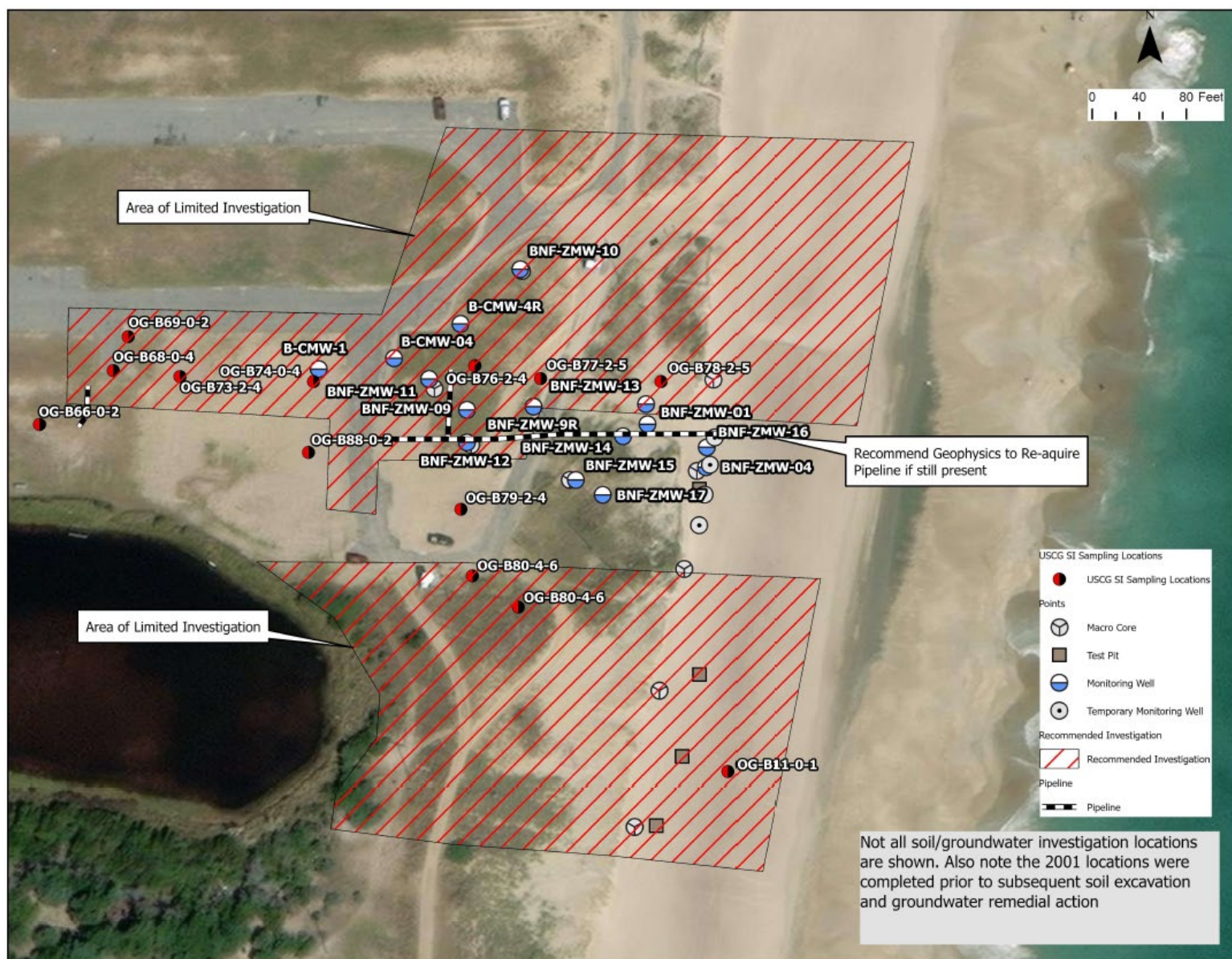


Photos from presentation by the National Park Service on March 27, 2024 show dramatic erosion. The location of buildings in the Navy Base and the current position of the tide line. Courtesy NPS

NPS Photos Showing Erosion at Buxton Beach

Maps of recommended areas for additional investigation.





Buxton Beach FUDS Site Visit – 09 May 2024

Participants (note this is not a complete list of all persons on-site. The site was active throughout the day with persons from USACE Savannah District (SAS), USACE contractors SLSCO/Forgen, and National Parks Service. Not all persons on-site at the same time, and not all persons engaged in same activities):

- USACE EMCX: Michelle Lordemann, Erin Stewart, Carl Harms
- USACE Savannah District: Erik Blechinger (SAS DPM), Steve Blanchard, Terry Brooks
- National Parks Service: David Hallac (Park Superintendent), Meaghan Johnson, Michael Flynn,

Itinerary/Activities:

- 0915: EMCX on-site. Meet Steve Blanchard and Terry Brooks from SAS. Meet Michael Flynn from NPS. Begin site visit, walking along beach from southern groin to southern part of FUDS.
- 1105: EMCX and Steve Blanchard/Terry Brooks (SAS) off-site for lunch.
- 1200: EMCX and Steve Blanchard/Terry Brooks (SAS) return to site. Resume site visit. Others from USACE SAS, NPS, USACE contractor begin to arrive on-site for meeting at 1300. EMCX team attended on-site meeting, completed inspection of beach, and completed visual inspection of remainder of FUDS. Did not inspect woody area along freshwater pond to south and north.
- 1500: EMCX off-site.

Observations

- No sheens were noted on any water either at the beach or in two manholes opened on the dune side of the FUDS. No noticeable petroleum odors were observed (see next bullet discussion regarding peat materials).
- Several varieties of materials that could be considered peat were observed. Peat materials were noted both on the FUDS-portion of the beach and on adjoining portions of beach to the north and south. A summary of the different types of peat or peat-like materials observed: 1) relatively clean fine sands with dark black coloration. Some cohesion. No noticeable odor 2) Hard, dense, cohesive chunks that either could be asphalt fragments or have similar characteristics to asphalt (tacky, bitumen-like material, fine sand, fragments of coarser sand/small gravel). No noticeable odor. 3) Light, somewhat friable chunks. Black with some gray discoloration. Some organic materials (e.g. leaves, root material). Some chunks earthy odor, others faintly petroleum-like odor. These peat-like fragments were only found in the vicinity of the southern leach field/former Building 19.
- Much of the beach-side remnant infrastructure that has been exposed recently (i.e. past year) was covered by sand. Visible infrastructure included 1) concrete manhole located near southern end of former Building 19. This is the manhole with two metal pipes exiting from the north and west sides (pipes ~2" and 4" diameter, metal). The manhole also had two very small metal pipes exiting from the southeast side that had been cut flush with the manhole, 2) one PVC drainpipe located approximately in the mapped location of the southern leach field. The PVC pipe consisted of an outer pipe ~12" diameter and inner pipe ~2" diameter. The outer pipe had weep holes drilled along its length, 3) A metal pipe stub ~2" protruding horizontally from the beach near the former wastewater treatment building, 4) two small metal pipes/conduits protruding from the dune face north of the former wastewater treatment building, 5) the two rebar-reinforced concrete

cable anchors located within the footprint of the former Building 19. 6) A square concrete pad with four timber post (~1 foot tall) and various small metal bars protruding from the concrete pad.

- The dune-side portion of the FUDS included very little remnant infrastructure, limited mainly to manholes for utilities. Two manholes believed to be communications-related were located and opened. Both manholes were partially filled with water (no sheen or odor). The manholes had cable conduits/chases running in two directions from the manholes. Several sanitary sewer manholes were present. Two were opened and inspected. No odors were noted. A small amount of baseflow was noted in one manhole.
- Monitoring wells were noted on the dunes and further inland. Wells were both flush-mount and stickup type. The monitoring wells were all closed, locked, and in good condition.
- The location of the buried pipe to be excavated and sampled underneath was marked with yellow pin flags. The location of this pipe had been determined by the contractor earlier in the week using ground penetrating radar (GPR). Two “anomalies” had also been located with GPR south of and close to the buried pipe. The buried pipe is located about 10-20 feet south of the two pipes that run west from the concrete manhole structure visible on the beach. No terminuses could be seen for any of these pipes.

Discussions

- Michael Flynn (NPS) stated: The first significant petroleum exposure/presence on the beach was in September 2023. The beach is a dynamic environment – erosion events and subsequent re-covering events can occur rapidly. The most significant erosion event was in March 23-26 of this year. North Carolina DOT has good historical aerial photography available online.
- Terry Brooks/Steve Blanchard (SAS Resident Engineers): NPS has indicated that they will perform morning surveys of the beach for turtles/crabs. Otherwise sounds like no concerns/impediments to working in the dune area. Resident Engineer office noted FUDSCHEM requirement. Asked if Dawson (sub-contractor supporting sampling) aware of FUDSCHEM. EMCX indicated that SAS chemist should be aware, EMCX can provide support if needed.

Meeting @ 1300

- Meeting occurred on beach. Several NPS, SAS, EM CX, and contractor personnel were present. Mr. Hallac provided an overview of site history based on historical documents. He discussed Navy and Coast Guard operations, agreements between NPS and the Navy regarding property restoration, dynamic shoreline conditions, recreational and habitat uses of the beach area, and previous environmental investigations. Most of the discussion focused on NPS observations of the beach and remnant infrastructure exposed during erosional events between September 2023 and present. Mr. Blechinger discussed USACE organizational structure and project funding structure and noted the misconception that USACE is unwilling to remediate the site. Mr. Blechinger further noted funding must be properly appropriated on a project-specific basis in accordance with fiscal law.



Photo 1 - NPS entrance sign to Buxton Beach north vehicle entrance. Recently installed USACE sign.



Photo 2 - County Public Health Advisory Sign at southern entrance to Buxton Beach



Photo 3 - Access restriction signs at southern entrance to Buxton Beach. Note Old Lighthouse location marker on left.



Photo 4 - Southern "groin" structure installed south of FUDS site by Navy



Photo 5 - Small capped metal pipe located south of FUDS site along beach



Photo 6 - Manhole structure located near southern part of former Building 19. Note two metal pipes going west from manhole.



Photo 7 - Additional view of manhole structure. Two smaller pipes/conduits protruding to southeast. Smaller conduit appears to have metal cable inside.



Photo 8 - Concrete pad with timber piers located south of former Building 19 and manhole structure.



Photo 9 - One of two reinforced concrete structures located in footprint of former Building 19. Believed to be access point for submarine listening equipment to exit building toward beach/water



Photo 10 - Assumed sanitary leach field drain pipe located north of former Building 19.



Photo 11 - Small metal pipe located on beach, north of former Building 19



Photo 12 - Two small metal cables/conduits protruding from dune face, near north end of FUDS



Photo 13 - Exposed dune face showing different soil layers



Photo 14 - Boulders and likely asphalt chunks placed on beach near southern "groin" south of FUDS



Photo 15 - Example of soil that could be considered "peat-like". This fragment found on dunes, moderately cohesive, no odor, no evidence of organics



Photo 16 - Example of larger chunk of "peat-like" material found on beach near southern leach field. Material was light, friable, had visible organic material and organic odor.



Photo 17 - Additional example of "peat-like" material on beach. Light, friable, visible organic material (wood, leaves), organic odor and possibly fuel-related odor. Some gray discoloration noted.



Photo 18 - Additional exposed septic leach field pipe and evidence of backfill (gravel in dune face)



Photo 19 - One of two manholes located west of dunes, eastern/southern part of FUDS. Both contained water, no odor/sheen. Cable conduits going north-south and east-west. Assumed communication cables observed, cut-off metal pipes observed.



Photo 20 - One of several sanitary sewer manholes noted. Two manholes opened. No odors or sheen. One manhole had small amount of assumed groundwater baseflow



Photo 21 - Former location of Building 9 (identified as Heating Plant/Water Pumping Station)



Photo 22 - Representative photo of monitoring well