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MTADS Geophysical Survey of Potential Underground Storage Tank Sites at the Naval District Washington Anacostia Annex

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The Naval Research Laboratory performed a georeferenced, digital geophysical survey of eight sites at the Naval District Washington Anacostia Annex to determine the presence of underground storage tanks (USTs). The surveys were conducted using the Multi-sensor Towed Array Detection System (*MTADS*) using a pulsed-induction sensor array, a total-field magnetometer array, or both arrays on each site. Survey results were analyzed and are presented as anomaly image maps for each of the sites. On three sites we find evidence of UST-like objects near the locations identified by a search of historical records. On two sites we do not find anomalies with the characteristics of USTs. Two additional sites and part of a third are paved and have extensive utilities under the pavement. The underground utilities drive the sensors to near saturation, severely limiting detection sensitivity for deeply buried USTs. Our negative results do not necessarily rule out USTs on these sites. The final site is a mixture of grassy and paved areas. Four potential USTs are identified from historical records as possibly under the grassy area; we find no evidence for them.

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EXECUTIVE SUMMARY

Based on a search of the historical records by Jim Dolph of the Portsmouth Naval Shipyard, 15 potential Underground Storage Tanks (USTs) have been identified on the Naval District Washington Anacostia Annex. Many of the traditional methods used to conclusively determine the existence of a potential UST, such as drilling and excavation, can be time-consuming, expensive and environmentally hazardous. Non-intrusive geophysical surveys by contrast are rapid, relatively inexpensive and can contribute to the detection of USTs.

The Chemistry Division of the Naval Research Laboratory has developed the Multi-sensor Towed Array Detection System (*MTADS*) for the underground imaging of metallic objects with particular emphasis on Unexploded Ordnance (UXO). At the conclusion of a demonstration of the *MTADS* at the Portsmouth Naval Shipyard, Kittery, ME, NRL performed a geophysical survey of two areas suspected to contain USTs and was able to provide evidence that a 27-foot diameter steel-reinforced wooden tank was in one area and that the other area contained no USTs.

NRL has performed georeferenced, geophysical surveys of eight sites on the Naval District Washington Anacostia Annex containing potential USTs using the *MTADS* pulsed-induction and/or magnetometer arrays. On three of these sites, Sites 37, 95 and 99, there is evidence of four UST-like objects near the locations identified during a previous search of the historical records. The geographic coordinates of these possible USTs are tabulated below. On Sites 4 and 82A we do not find any anomalies with the characteristics of a UST; there are likely no USTs on these sites. Sites 32 and 64 are completely paved and have extensive utility service under the ground. The extensive underground metal results in our sensors being near saturation at all locations on these sites; consequently our sensitivity to an anomaly is low. Our negative results on these sites do not necessarily rule out the presence of a UST. The final site, Site 174, is a mixture of grassy and paved areas. While historical records indicate that four of the potential USTs on this site are under the grassy areas, we find no evidence for them. The final potential UST identified in historical records is under a paved portion of the site adjacent to two large dumpsters. As in the other paved sites, our sensitivity is low here and our negative results are inconclusive.

Site	Location of Suspected UST	
	Latitude	Longitude
37	38° 51' 22.45482" N	77° 00' 55.87235" W
37	38° 51' 22.36122" N	77° 00' 55.96238" W
99	38° 51' 11.59483" N	77° 00' 59.09455" W
95	38° 51' 11.27542" N	77° 01' 00.15107" W

MTADS GEOPHYSICAL SURVEY OF POTENTIAL UNDERGROUND STORAGE TANK SITES AT THE NAVAL DISTRICT WASHINGTON ANACOSTIA ANNEX

INTRODUCTION

The Environmental and Safety Department of the Naval District Washington has a program of remediation of unused Underground Storage Tanks (USTs) at sites under its control. One of these sites is the Anacostia Annex (ANA) on which they have identified 15 potential USTs from a search of historical records.[1] Some of these potential USTs were likely removed during building renovations or reconstructions but no definitive evidence of their removal or, for that matter their installation, exists. Several of the suspect locations were inspected in December 1998 and no evidence of USTs was found. Many of the traditional methods to conclusively determine the existence of a potential UST, such as drilling and excavation, can be time-consuming, expensive and environmentally hazardous. Non-intrusive geophysical surveys by contrast are rapid, relatively inexpensive and can contribute to the detection of USTs.

The Chemistry Division of the Naval Research Laboratory (NRL) has developed the Multi-sensor Towed Array Detection System (*MTADS*) for the underground imaging of metallic objects with particular emphasis on Unexploded Ordnance (UXO). The system has been demonstrated at a number of prepared and live ordnance ranges to assess its cost and performance relative to the existing, manual methods of UXO detection and location. In October 1998, the *MTADS* was demonstrated on the Jamaica Island and Topeka Pier Landfills at the Portsmouth Naval Shipyard in Kittery, Maine.[2] The purpose of the demonstration was to generate geophysical maps of the two landfills to identify ferrous or steel-reinforced concrete containers that had been used to dispose of materials in these landfills. At the completion of the survey, the Shipyard Environmental Office requested our assistance looking for two possible USTs. We performed a geophysical survey of the two suspect areas and were able to provide evidence that a 27-foot diameter steel-reinforced wooden tank was in one area and that the other area contained no buried steel tanks.

Based on these results, the Naval District Washington requested that NRL perform analogous surveys at the Anacostia Annex using the *MTADS*. The Environmental and Safety Office provided the approximate locations of 15 potential USTs located on eight sites. They requested that NRL survey a 50-ft radius around each location and provide its best judgment as to the existence of USTs at each site. This report conveys the results of these surveys.

Manuscript approved February 7, 2000

MTADS TECHNOLOGY DESCRIPTION

Field Hardware

The *MTADS* technology has been described in detail previously.[3-4] Briefly, the system hardware consists of a low-magnetic-signature vehicle that is used to tow linear arrays of magnetometer and pulsed-induction sensors to conduct surveys of large areas to detect buried UXO. The *MTADS* tow vehicle, manufactured by Chenowth Racing Vehicles, is a custom-built off-road vehicle, specifically modified to have an extremely low magnetic signature. Most ferrous components have been removed from the body, drive train and engine and replaced with non-ferrous alloys.

The pulsed-induction sensors (specially modified model EM-61s from Geonics) are deployed as an overlapping array of three sensors on a non-metallic trailer, Figure 1. These sensors transmit a short electromagnetic pulse into the Earth. Metallic objects interact with this transmitted field which induces secondary fields in the object. These secondary fields are detected by six detection coils that are

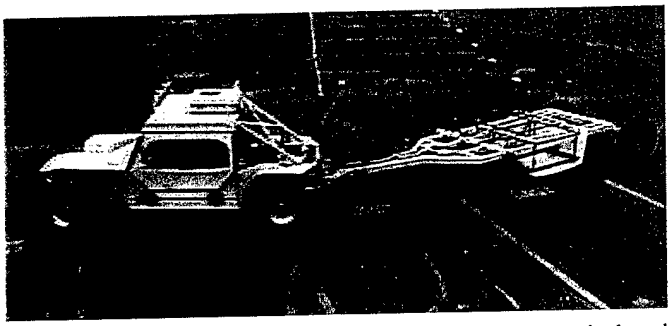

Fig. 1 — *MTADS* Tow Vehicle and pulsed-induction array deployed at the Naval District Washington Anacostia Annex

collocated with and above the transmit coils. The sensors employed by *MTADS* have been modified to make them more compatible with vehicular speeds; the transmit frequency is increased and the analog time constant is decreased, and to increase detection sensitivity to small objects; the transmit power and amplifier gain are increased and the sampling window is moved closer to the transmit pulse. The output of the pulsed-induction sensors is sampled at 10 Hz, which combined with our typical survey speed of 3 miles per hour, results in a sampling interval of ~15 cm along track with an across track spacing of 0.5 m.

In an environment such as the Anacostia Annex that is cluttered with military equipment, steel fences, parked cars, and buildings, the pulsed induction sensors are the survey instrument of choice for near-surface surveys. These sensors are much less susceptible to interference from nearby metal objects such as fences. They are active sensors that require two-way travel of the electromagnetic excitation however, so their sensitivity falls off relatively quickly with depth. For objects deeper than about two meters, the other *MTADS* sensor choice, passive magnetometers, is required.

The *MTADS* magnetometers are Cesium-vapor full-field magnetometers (Geometrics Model 822ROV) selected for low noise, a small dead zone, and inter-sensor reproducibility. An array of eight sensors is deployed as a magnetometer array on an Aluminum and composite platform, Figure 2. The

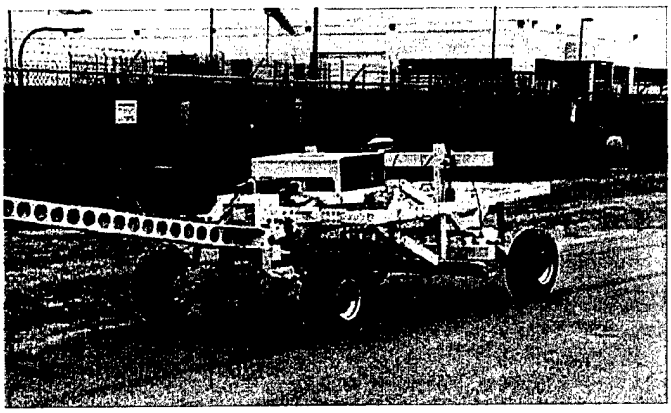

Fig. 2 — The *MTADS* magnetometer array deployed at the Naval District Washington Anacostia Annex

sensors are sampled at 50 Hz and typical surveys conducted at 6 mph; this results in a sampling density of ~6 cm along track with a sensor spacing of 25 cm. The time-variation of the Earth's field is measured by a ninth sensor deployed at a static site removed from the survey area. These data are used to correct the survey magnetic readings.

The sensor positions are measured in real-time (5 Hz) using the latest Real Time Kinematic (RTK) Global Positioning System (GPS) technology which results in position accuracies of ~5 cm. All navigation and sensor data are time-stamped with Universal Coordinated Time (UTC) derived from the satellite clocks and recorded by the data acquisition computer (DAQ) in the tow vehicle. The sensor, position, and timing files are downloaded periodically throughout a survey onto magnetic disks and transferred to the Data Analysis System (DAS) for analysis.

Data Analysis System

The *MTADS* Data Analysis System converts the sensor and position data files into an anomaly map by interpolating the individual sensor readings using the GPS-derived positions. The DAS software was developed specifically for the *MTADS* program as a stand-alone suite of programs in a UNIX environment. The data collected during this survey were analyzed using a workstation; PC-based code is also available and is being integrated into the field operations. The DAS is written for use by both sophisticated and novice users. Even the novice can perform a complete anomaly analysis using menu-driven tools and default settings. For the advanced user, there is an extensive range of options available including navigation data cleanup, sensor nulling and leveling, noise filtering, etc. The working screen of the DAS is shown in Figure 3.

In the case of ordnance targets in the far field (i.e. farther from the sensors than their characteristic dimension) the DAS employs resident physics-based models to determine target size, position, and depth. Extensive data sets have been acquired and processed to calibrate these models. These analysis capabilities are not applicable however to large, shallow targets such as the potential USTs located from historical documents that are the subject of this survey. In these cases, target anomaly maps are used to estimate the position and physical size of the anomaly and, in the case of the pulsed-induction sensors, the relative response of the upper and lower receive coils is used to estimate depth.

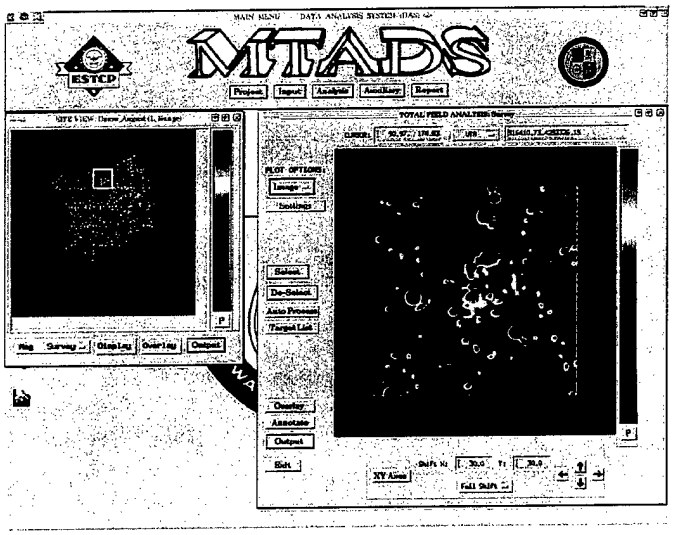

Fig. 3 — The *MTADS* Data Analysis System with the site view and target analysis windows visible

MTADS FIELD OPERATIONS

Survey Navigation Control

The *MTADS* sensor location system relies on differential corrections radioed from a GPS receiver at a known (first order, if possible) base station to the vehicular system for its accuracy. In many instances, particularly at remote field sites, these reference positions are established by a commercial surveyor prior to the *MTADS* survey. In this case, survey positions were available from a June 1996 survey conducted for the U.S. Army Engineer District, St. Louis (Contract DACW43-96-D-0512, Delivery Order No. 001). Three members of the *MTADS* team visited the Anacostia Annex on October 28th, 1999 to re-acquire these positions and ensure that line-of-site radio transmissions were possible between them and each of the survey sites. The two survey points that were used as control points for the *MTADS* geophysical survey are listed in Table 1.

Table 1 – Control Points Used For the *MTADS* Geophysical Surveys

Station	Latitude	Longitude	Elevation	Site Surveys Using
HV 58-75A	38° 51' 22.767988" N	77° 00' 21.196265" W	5.456 m	174
HV 58-75B	38° 51' 14.102637" N	77° 00' 37.907123" W	5.213 m	4, 32, 37 & 64, 82A, 95, 99

Individual Site Surveys

Historical documents identified several of the potential USTs to be investigated in this survey as possibly located under, or near, parking lots on the Anacostia Annex. To avoid interference from parked

and moving cars, the survey was planned for a government holiday, November 11th, 1999. The *MTADS* deployed to the Anacostia Annex from its home base at the Army Research Laboratory Field Site in Blossom Point MD on the afternoon of Wednesday, November 10th, 1999 and was stored for the evening in a parking garage on the base. Operations began at 7:00 AM on the morning of Thursday, November 11th, 1999. At that time, the *MTADS* field hardware was assembled and checked and the Data Analysis System was set up in an office in the Annex Administration building, Enterprise Hall, Bldg. 72. This allowed for rapid transfer of the data from the *MTADS* vehicle to the DAS and prompt evaluation of data quality.

Survey operations started at approximately 8:00 AM and continued until approximately 2:30 PM. Simultaneously with the geophysical survey, a member of the team used a portable GPS unit with hand-held data collector to record the locations of prominent utility connections and landmarks as shown in Figure 4. These landmark positions are used to give a point of reference on the survey maps. Just prior to starting landmarking on the final site we experienced a problem with the data collector that required a hard reset, resulting in the loss of all landmark data. Three members of the team returned to the Anacostia Annex on the morning of Friday, November 12th, 1999 to pack the equipment and to reacquire the landmark positions. The *MTADS* departed the Anacostia Annex at 11:00 AM, Friday, November 12th, 1999.

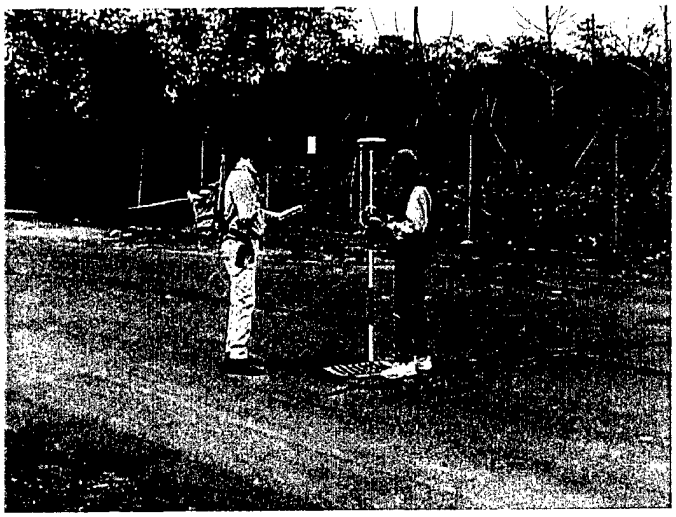

Fig. 4 — Members of the *MTADS* team landmarking a storm drain on Site 174

Although each individual area of concern was small, they were widely dispersed throughout the Anacostia Annex so seven individual sites were established to cover the 15 potential USTs. Methods and observations for each of these surveys are detailed below.

Site 174

Site 174 comprises the area along the South Capitol Street fence of the Anacostia Annex just North of Building 150. The approximate location of this site is shown overlaying a map of a portion of the Anacostia Annex in Figure 5. Historical records suggest that there are five potential USTs in this site,

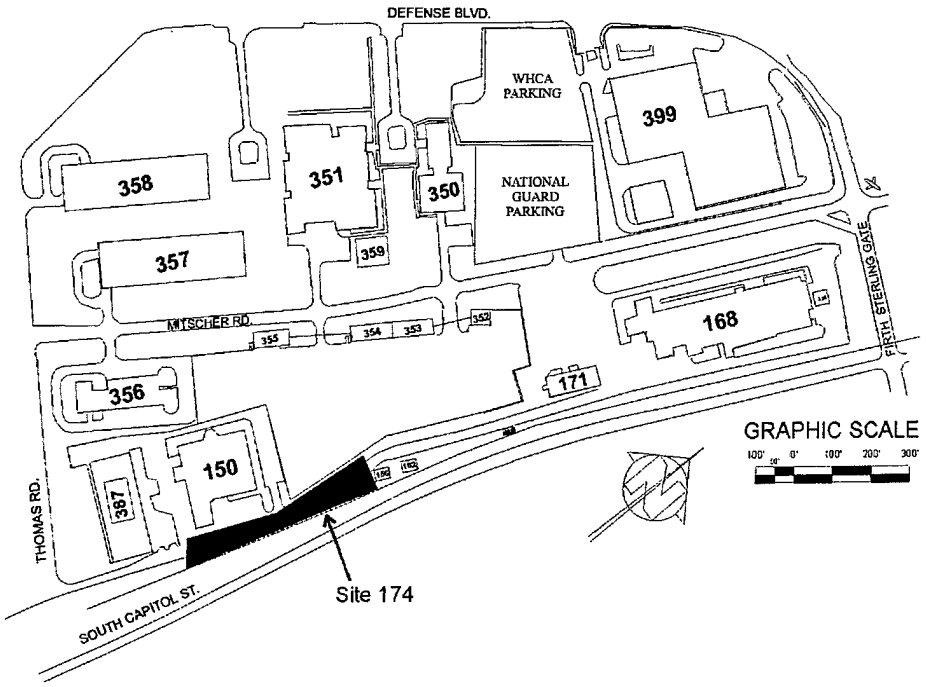

Fig. 5 — Map of a portion of the Naval District Washington Anacostia Annex with the approximate location of Site 174 marked

including one as large as 11,200 gallons. The pulsed-induction system was used to survey this site. The survey area covered the length of the site from the fence across the road and onto the grassy area West of the road. The survey was limited at the North end by the presence of two dumpsters that could not be moved. The positions of the dumpster corners were recorded with the landmarking system and are shown on the survey map.

Site 32

This site, in which there are three potential 5,000-gallon tanks, is located between Buildings 29 and 94. Its approximate location is marked on a map of the Anacostia Annex in Figure 6. Several elevated steam lines crossing the area and the buildings themselves, especially Building 94, restrict sky view. After consulting our GPS-planning software, we determined that there was a period of ~45 minutes in mid-morning during which sufficient satellites would be visible from this site. A pulsed-induction survey of this area was conducted during this time window. Even with this planning however, sky view was lost as the survey vehicle passed under the large steam line parallel to the road. To overcome this, all survey lines were collected driving NW to SE with a long run-in before the potential UST location to settle the GPS location system. To the extent possible, navigation corrections were made during data analysis.

Site 37 & 64

Sites 37, the grassy area just NE of the FAA antenna, and Site 64, the parking lot for Building 86, the Riverview Room, are contiguous and were thus covered in one survey. The pulsed-induction survey lines were collected parallel to the road, SW – NE, from the top of the grassy area to the NE boundary of the parking lot. The parking lot overlays many utility and storm water pipes, all surface exits were

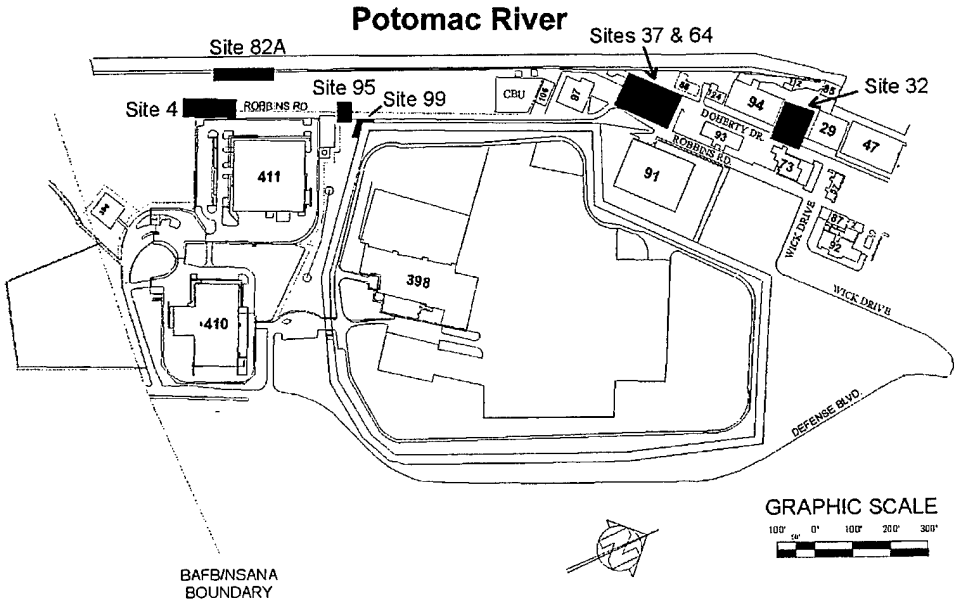

Fig. 6 — Map of a portion of the Naval District Washington Anacostia Annex with the approximate location of six of the survey sites marked

landmarked for correlation with the survey results. The grassy area near the FAA antenna contains two previously identified USTs that have been closed in-place.

Site 99

Site 99 wraps around the SW corner of Building 398. This area is too constricted for a vehicular survey so the *MTADS* man-portable adjunct was used for this site. It consists of a single pulsed-induction sensor, identical to the three in the *MTADS* array, with a GPS antenna mounted directly above the sensor. An operator, wearing sensor drive, data collection, and GPS electronics in a backpack, pulls the sensor unit. As with the *MTADS* vehicular system, GPS positions and time-stamped sensor readings are collected in a data recorder for later download into the DAS.

Site 4

Site 4 is an area SW of the corner of Building 411, on the river side of the extension of Robbins Road. This is the first of the three sites that are covered with Metro construction fill at depths of up to 12 feet. NRL had previously determined that this was too much fill to penetrate with the pulsed-induction sensors and therefore decided to use the passive magnetometers in the final three areas. The surveys were proceeding well at this point so Site 4 was surveyed using both the pulsed-induction and passive magnetometer sensor arrays.

Site 82A

Historical documents indicate that Site 82A may contain a 1000-gallon UST directly under the riverfront construction fill. The projected location of the tank is just off the hiking trail at the peak of the fill. This area was surveyed with the passive magnetometer array using 100-m long survey lines from the

river side of the hiking trail in for a distance of ~35 meters. Overall, the area was flat but there were several protruding tree stumps and large concrete rubble that caused several interruptions of the survey to free the *MTADS* vehicle and to replace wheels.

Site 95

The historical records indicate that Site 95 contains a potential 500-gallon UST on the river side of Robbins Road between Building 398 and Building 411. This site is on the edge of the riverfront fill; the bulk of the site is on a 10° or more slope. Although the potential UST location has sufficiently little fill to make a pulsed-induction survey possible, the site itself is too rough for the pulsed-induction trailer. The site was surveyed using the passive magnetometer array using a series of survey lines perpendicular to the road, down the slope. Several of the lines were in areas where the transition from the fill was so abrupt that the *MTADS* vehicle had to be pulled off the slope using our equipment truck.

SURVEY RESULTS

Magnetometer or pulsed-induction anomaly maps of the areas surveyed are shown in Figures 7 through 15. Each individual figure is plotted on a scale intended to maximize overall useful information. Data analysis is conducted at a variety of scales in order to accentuate objects from small to large. A careful analysis requires consideration of many different image presentations including scale changes, various false color options, use of pixel vs. interpolated image, difference between image from upper and lower coils, and comparisons of magnetometer and pulsed-induction images where available. For convenience, the locations in each figure are presented in *MTADS* local coordinates in meters. The original position data are recorded in absolute latitude and longitude, converted to UTM and then offset to the local units shown. Absolute positions for any point are available in the *MTADS* DAS.

The results for each of the individual surveys are discussed in detail in the following sections.

Site 174

The results of the pulsed-induction survey of Site 174 are shown in Figure 7. One can immediately see that the road areas are heavily obstructed with utility and storm water lines and other metal. The *MTADS* pulsed-induction sensors saturate at 10,000 mV; under much of the road area the sensors are near saturation and thus their sensitivity to anomalies such as buried steel tanks is low. Four of the potential USTs may have been located under the grassy area along the Anacostia Annex fence (the East side of the area from local y ~15 to ~-40). This area is relatively free from metallic interference. No evidence of USTs is seen in this area. Historical documents indicate that the fifth potential UST in site 174 is in the northern part of the site, just South of the location of the dumpsters. No evidence of this tank appears in the survey, although, as stated above, our sensitivity is low here because of the metallic interference under the pavement.

Site 32

The results of the pulsed-induction survey of site 32 are shown in Figure 8. Like the road portion of Site 174, the entire area of Site 32 is nearly saturated from sub-surface metallic interference. The presence of such extensive underground interference renders geophysical electromagnetic methods inconclusive at this site.

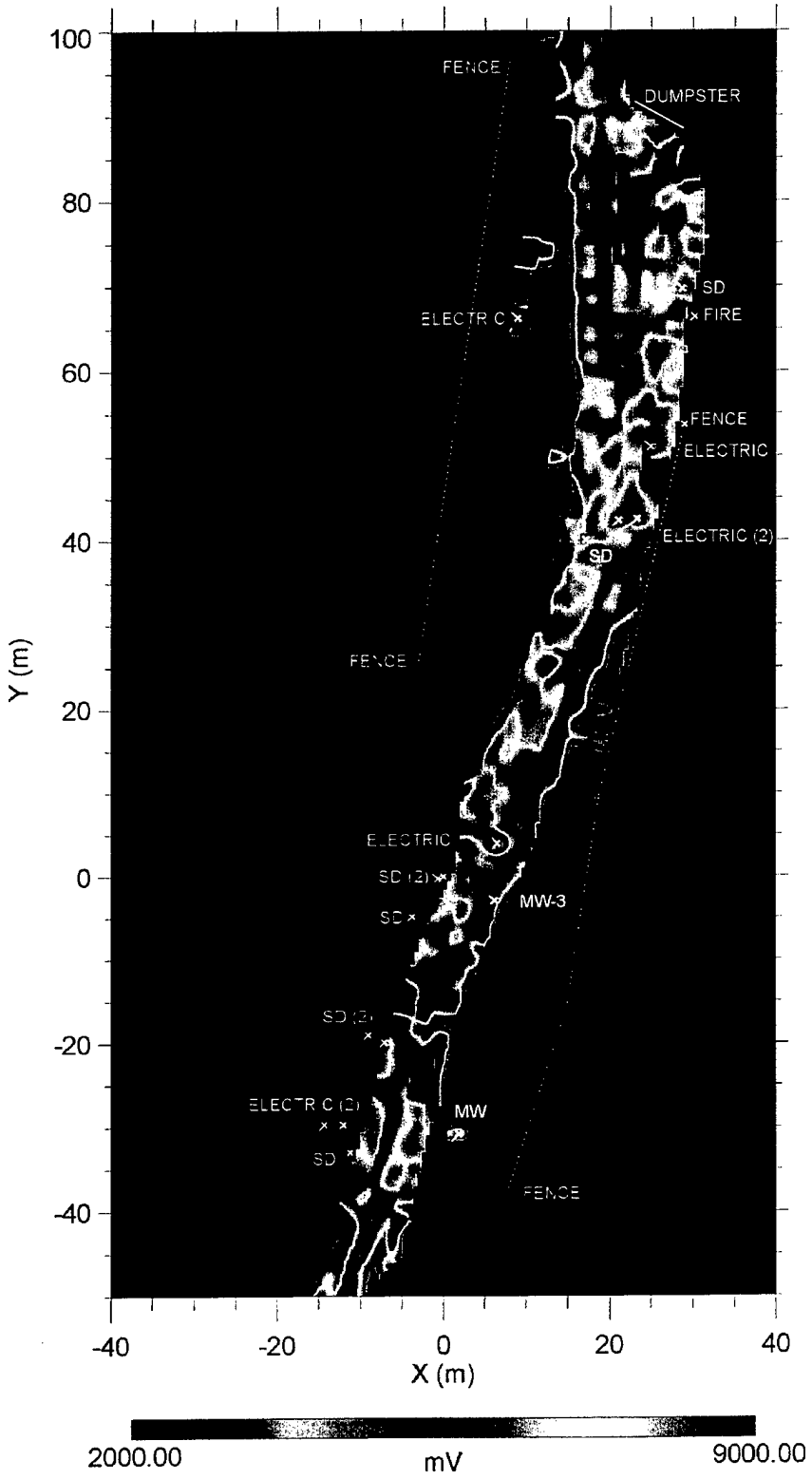

Fig. 7 — Pulsed-induction anaomaly image of Site 174. Fences and utility access ports are marked for reference.

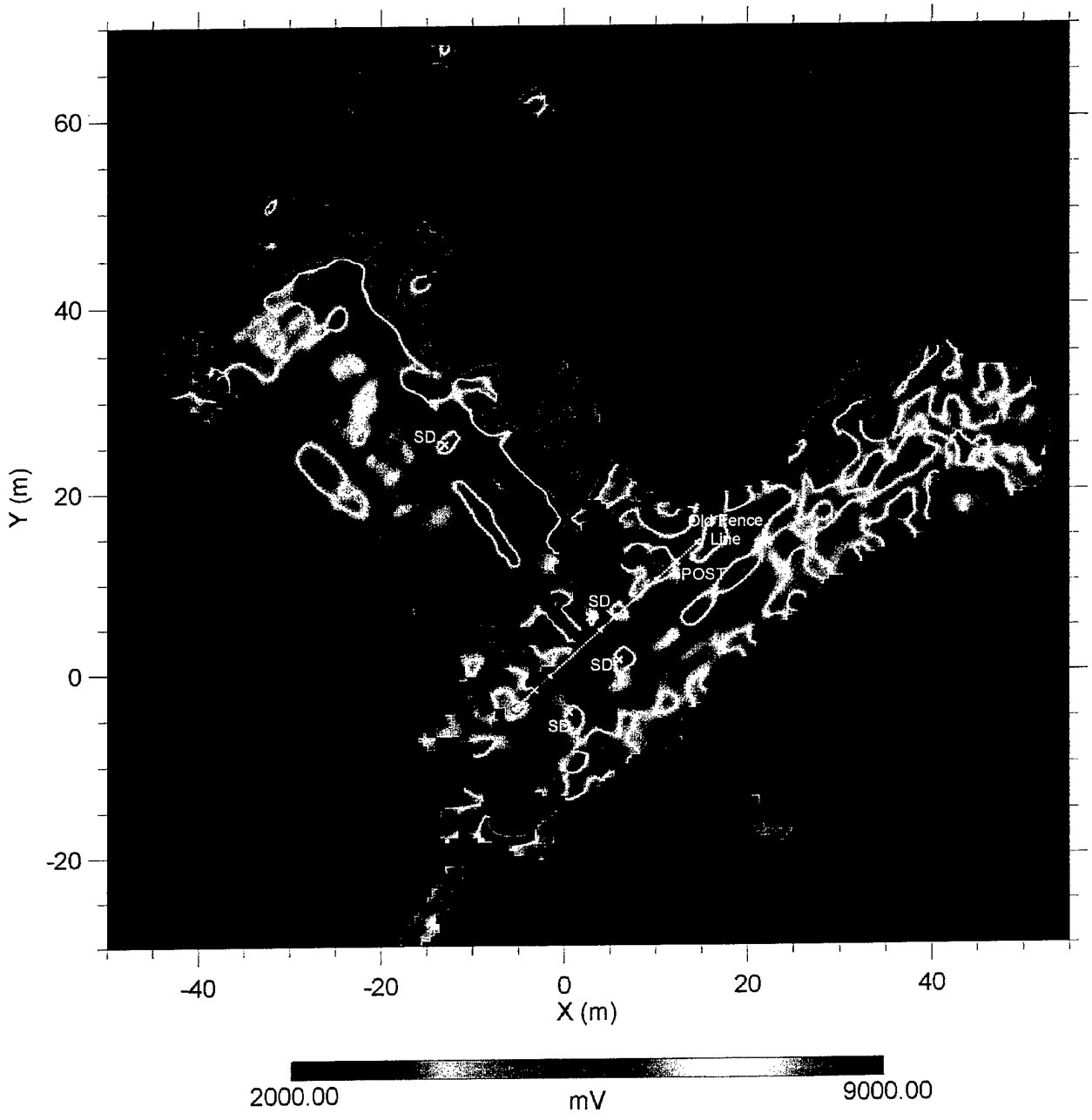

Fig. 8 — Pulsed-induction anomaly image of Site 32

Site 37 & 64

A pulsed-induction survey was also carried out on this site, the results are shown in Figure 9. As mentioned above, Site 37, the grassy area contains two previously identified and closed USTs (A37-9 and A37-10). One, or both, of these is identified on the SW edge of the survey. The two suspected 550-gallon tanks on Site 37 are in the northern corner of the site, near the roadway, 20 – 25 m from the closed tanks. In Figure 9, this is the area between the NW curb and the tree that caused the missed survey area (shown as black). This area is shown in more detail in Figure 10. There, analysis of the anomaly maps indicate 2 underground metal objects that are 4–6 feet deep and of appropriate size for a 550-gallon tank. These two objects may be USTs. Their positions are listed in Table 2. The potential tank in Site 64 is a 1000-gallon heating oil tank at approximately x = 35 and y = 10 in Figure 9. This area contains several utility connections and lines. Careful examination reveals no evidence of a UST in this site.

Table 2 — Approximate Location of Suspected USTs Identified In This Work

Site	Location of Suspected UST	
	Latitude	Longitude
37	38° 51' 22.45482" N	77° 00' 55.87235" W
37	38° 51' 22.36122" N	77° 00' 55.96238" W
99	38° 51' 11.59483" N	77° 00' 59.09455" W
95	38° 51' 11.27542" N	77° 01' 00.15107" W

Site 99

The results of the man-portable pulsed-induction survey of Site 99 are shown in Figure 11. Access to this site was restricted by several immovable objects. On the South edge of the site, there is a concrete barrier intended to block vehicular access to the area between this site and Building 411. On the Western edge of the site, there is a residual railroad-crossing control gate. Both of these obstructions are marked in the Figure. The residual signature of the fence surrounding Building 398 is also visible on the inside edges of the survey. Based on a search of historical records, the potential UST was suspected to be along the South fence, near its western edge. There is no signature in that location consistent with a UST. We do, however, identify an anomaly SSW of that location, near the brush line, that has the characteristics of a UST. This anomaly is identified on the figure and its location is listed in Table 2.

Site 4

This is a very challenging site for the *MTADS* sensor arrays. The depth of fill (approaching twelve feet in places) makes it unlikely that the pulsed-induction array would be able to detect a UST. The metal trash in the fill and the large fence bordering Building 411 are interferences to the magnetometer array. As mentioned above, both arrays were used to survey this site. The pulsed-induction results are shown in Figure 12. The landmarked utilities and near-surface clutter items are evident from this survey, but as expected, nothing was observed with the characteristics of a UST.

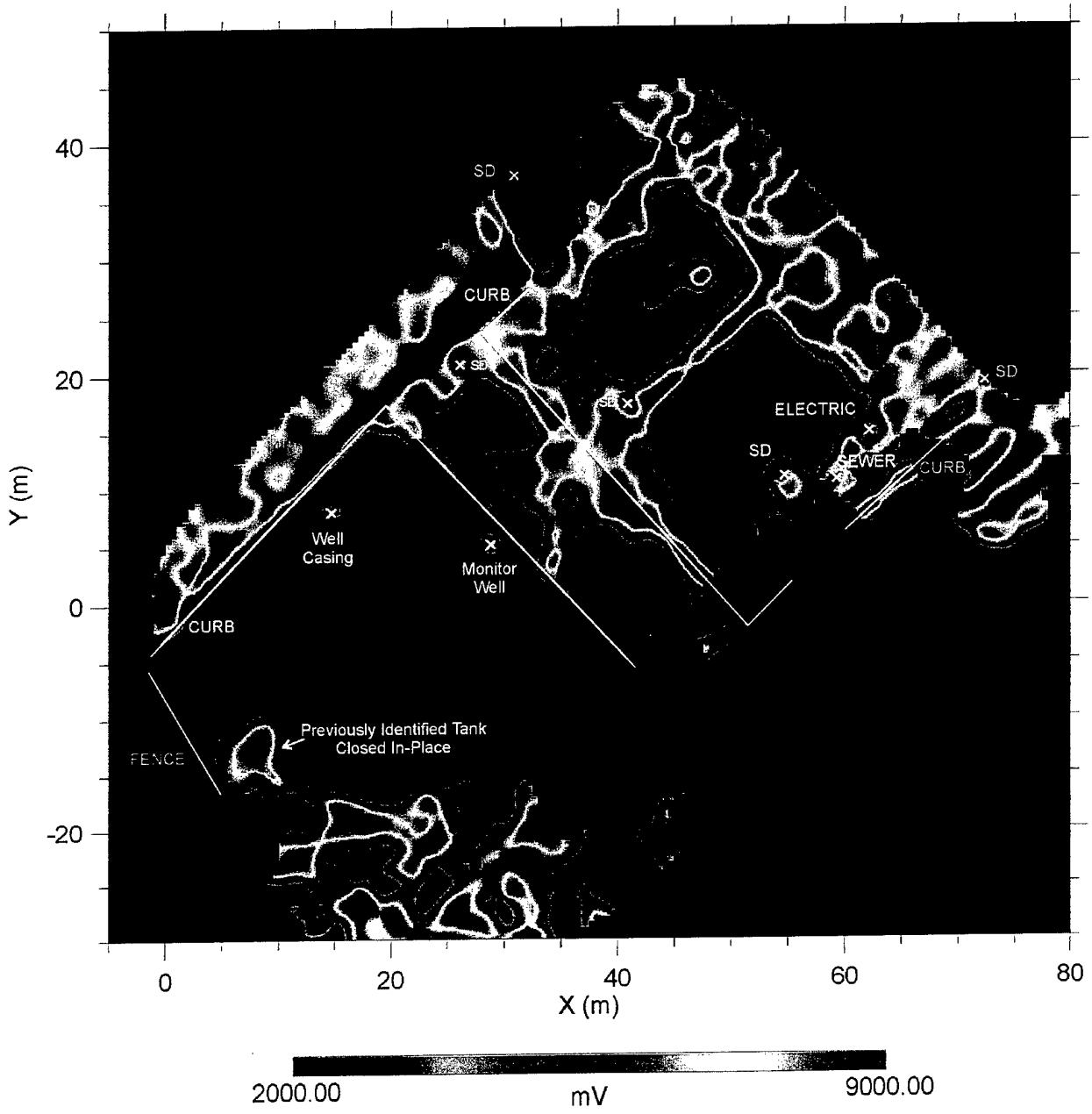

Fig. 9 — Pulsed anomaly image map of Sites 37 and 64

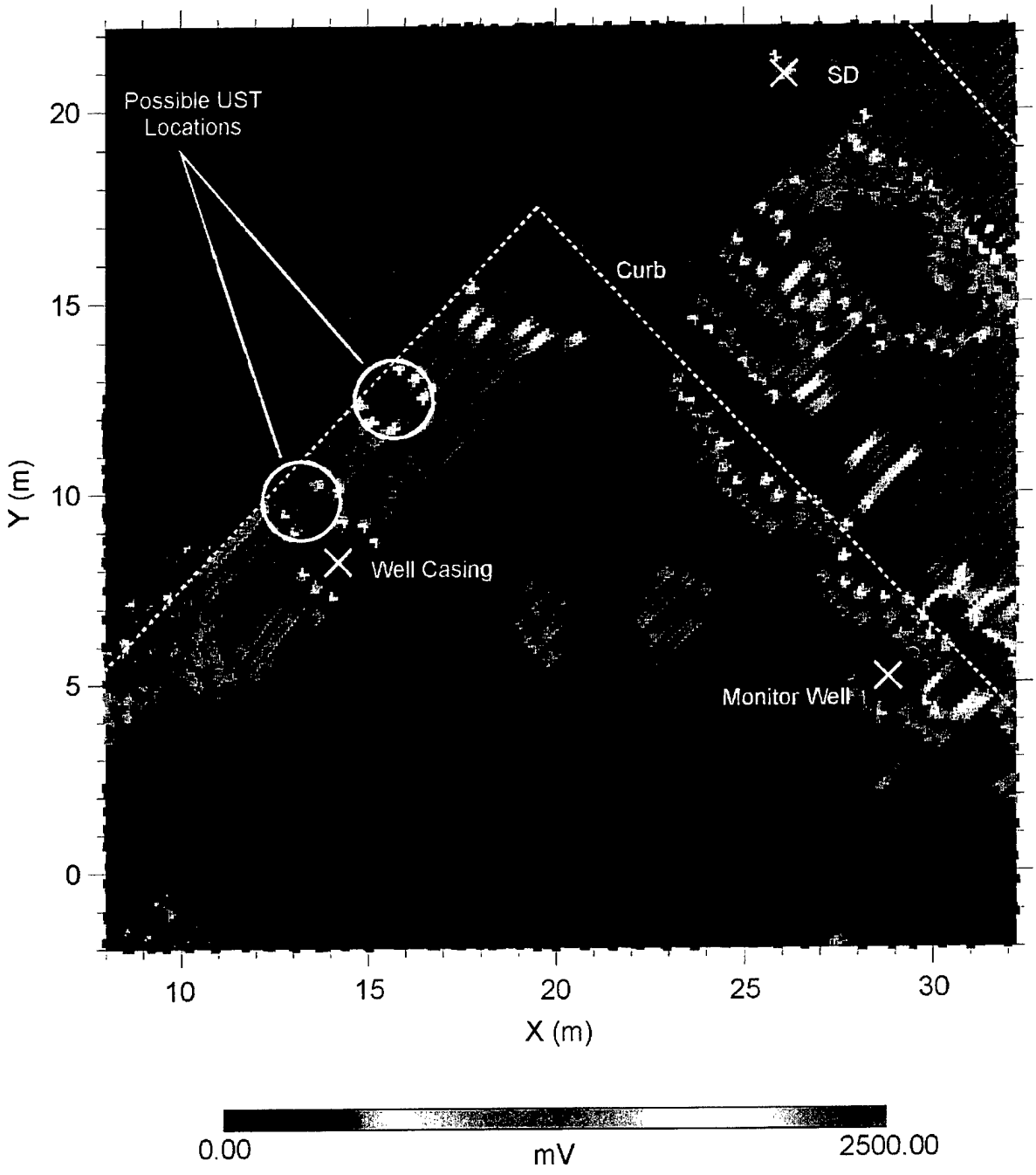

Fig. 10 — Detail of the pulsed-induction anomaly image of Site 37 from Figure 7. The positions of the two possible USTs are marked with circles.

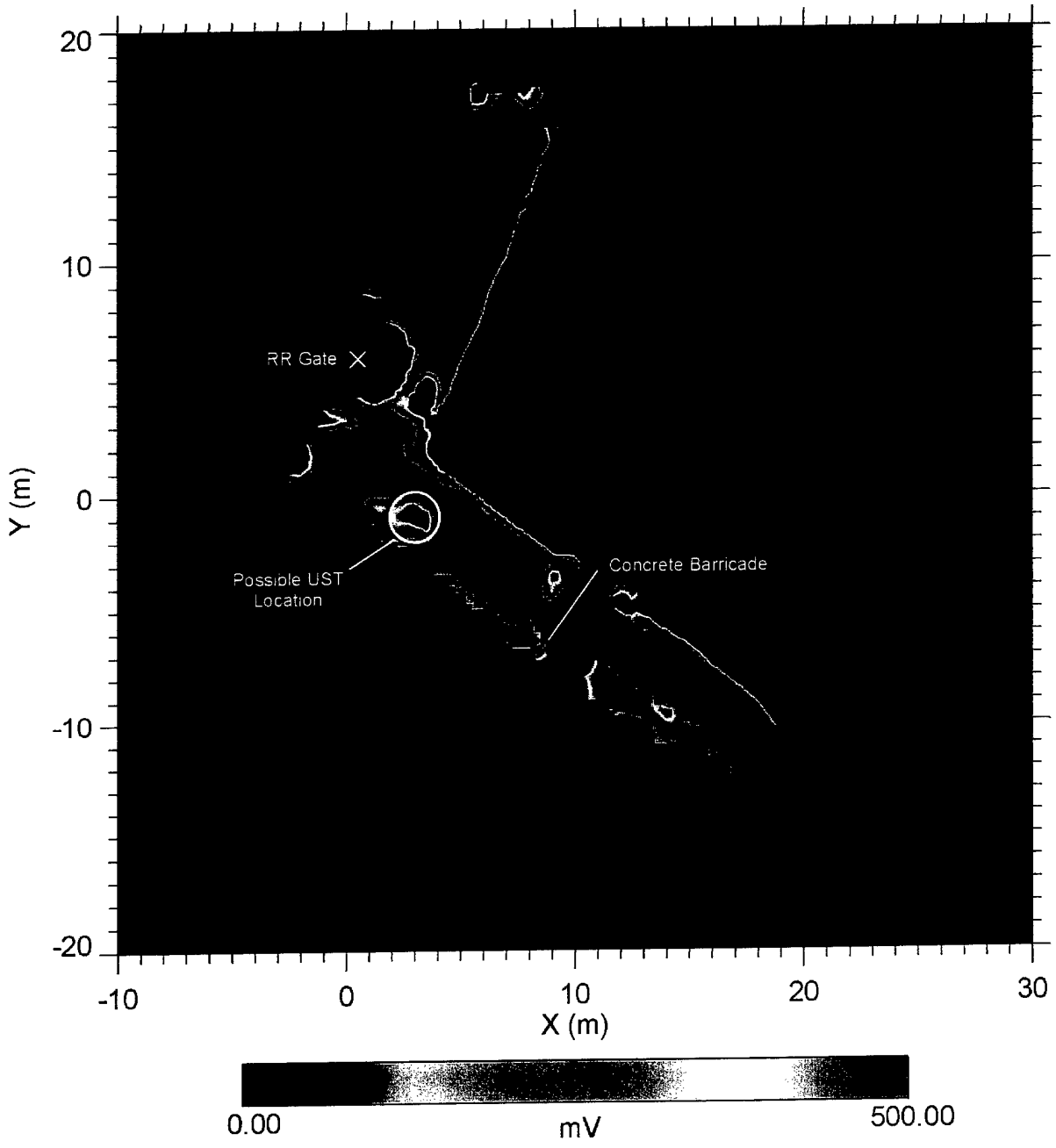

Fig. 11 — Pulsed-induction anomaly map resulting from the man-portable survey of Site 99. The obstructions encountered and the position of a possible UST are marked on the figure.

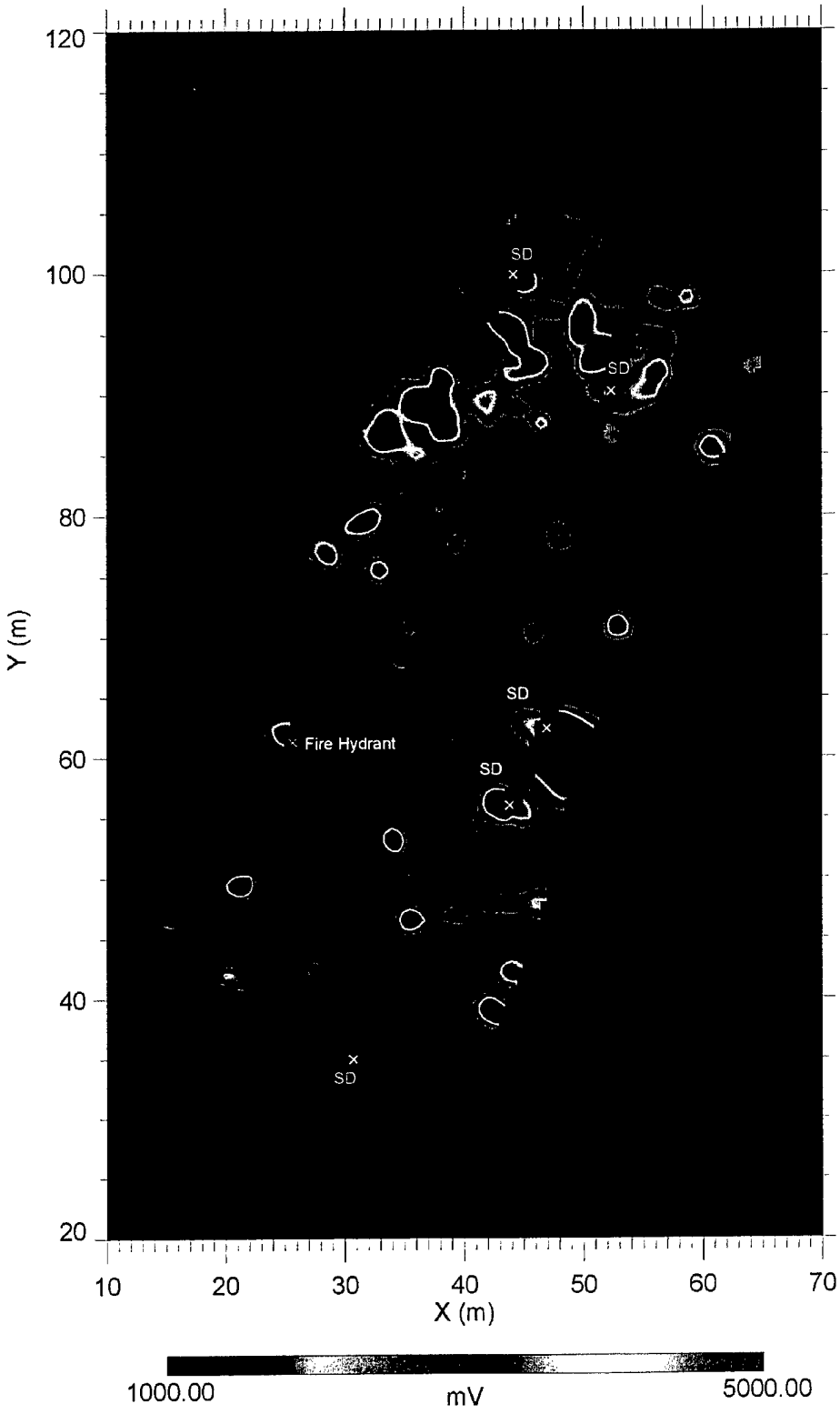

Fig. 12 — Pulsed-induction anomaly map of Site 4

The results of the total-field magnetometer survey are presented in Figure 13. The influence of the fence bordering Building 411 is clearly evident in these results. The potential UST indicated in the historical records is located in the Western quarter of this survey at approximately y = 70, just above the fire hydrant marked on the map. We find no anomalies with the characteristics of a UST in this site.

Site 82A

This site is also covered with construction fill but it does not have the bordering fence as did Site 4. The results of the total-field magnetometer survey from this site are shown in Figure 14. As can be seen from the Figure, the magnetic image is dominated by the contribution from a large underground pipe that connects to a sewer outfall on the edge of the river. The potential tank location identified from the historical records is on the South edge of this pipe anomaly. Careful examination of the survey data at a variety of scales does not reveal any anomaly with the characteristics of a UST on this site.

Site 95

This site is on the side of the hill created by the construction fill, across Robbins Rd. from Site 99. Due to the steep angle of the hillside, we also surveyed this site with the *MTADS* magnetometer array. The magnetic anomaly image map is shown in Figure 15. This map is dominated by a large oval anomaly very near the location of the potential UST as indicated in the historical records. We have marked the anomaly as a likely UST and have included its location in Table 2.

SUMMARY

The Chemistry Division of NRL has performed geophysical surveys of eight sites containing potential USTs using the *MTADS* pulsed-induction and/or magnetometer arrays. On three of these sites, Sites 37, 95 and 99, we have found evidence of four UST-like objects near the locations identified during a previous search of the historical records. The locations of these suspected USTs are listed in Table 2. On Sites 4 and 82A we do not find any anomalies with the characteristics of a UST; there are likely no USTs on these sites. Sites 32 and 64 are completely paved and have extensive underground utility service. The underground metal results in our sensors being near saturation at all locations on these sites; consequently our sensitivity to an anomaly is low. Our negative results on these sites do not necessarily rule out the presence of a UST. The final site, Site 174, is a mixture of grassy and paved areas. While historical records indicate that four of the potential USTs on this site are under the grassy areas, we find no evidence for them. The final potential UST identified in historical records is under a paved portion of the site adjacent to two large dumpsters. As in the other paved sites, our sensitivity is low here and our negative results are inconclusive.

ACKNOWLEDGEMENTS

We thank Russ Jeffries and Larry Koppe for their assistance with the measurements reported here, Jim Dolph of the Portsmouth Naval Shipyard for providing historical research and documentation and Lee Sessler of NDW for his support on site.

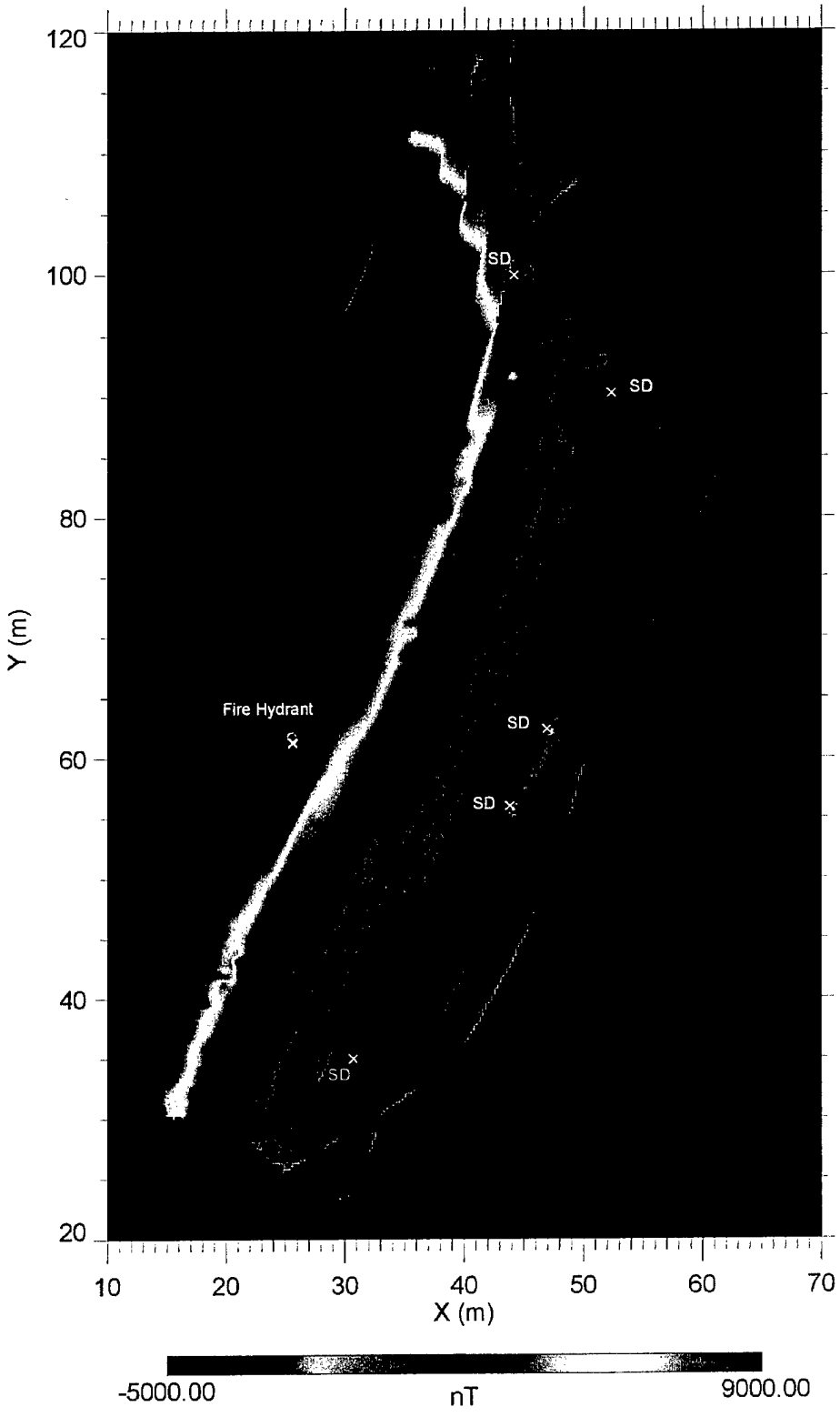

Fig. 13 — Magnetic anomaly image map of Site 4

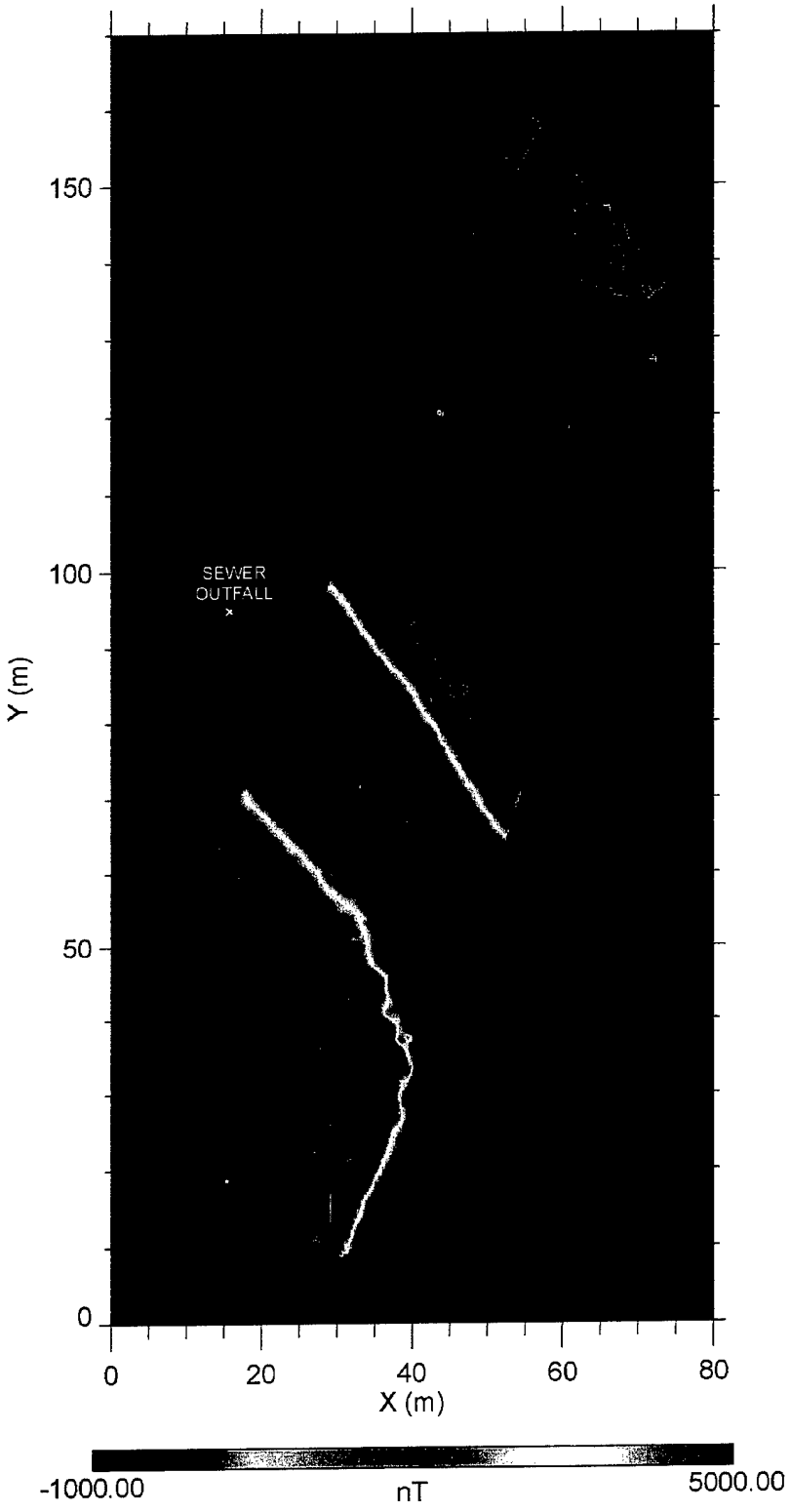

Fig. 14 — Magnetic anomaly image map of Site 82A

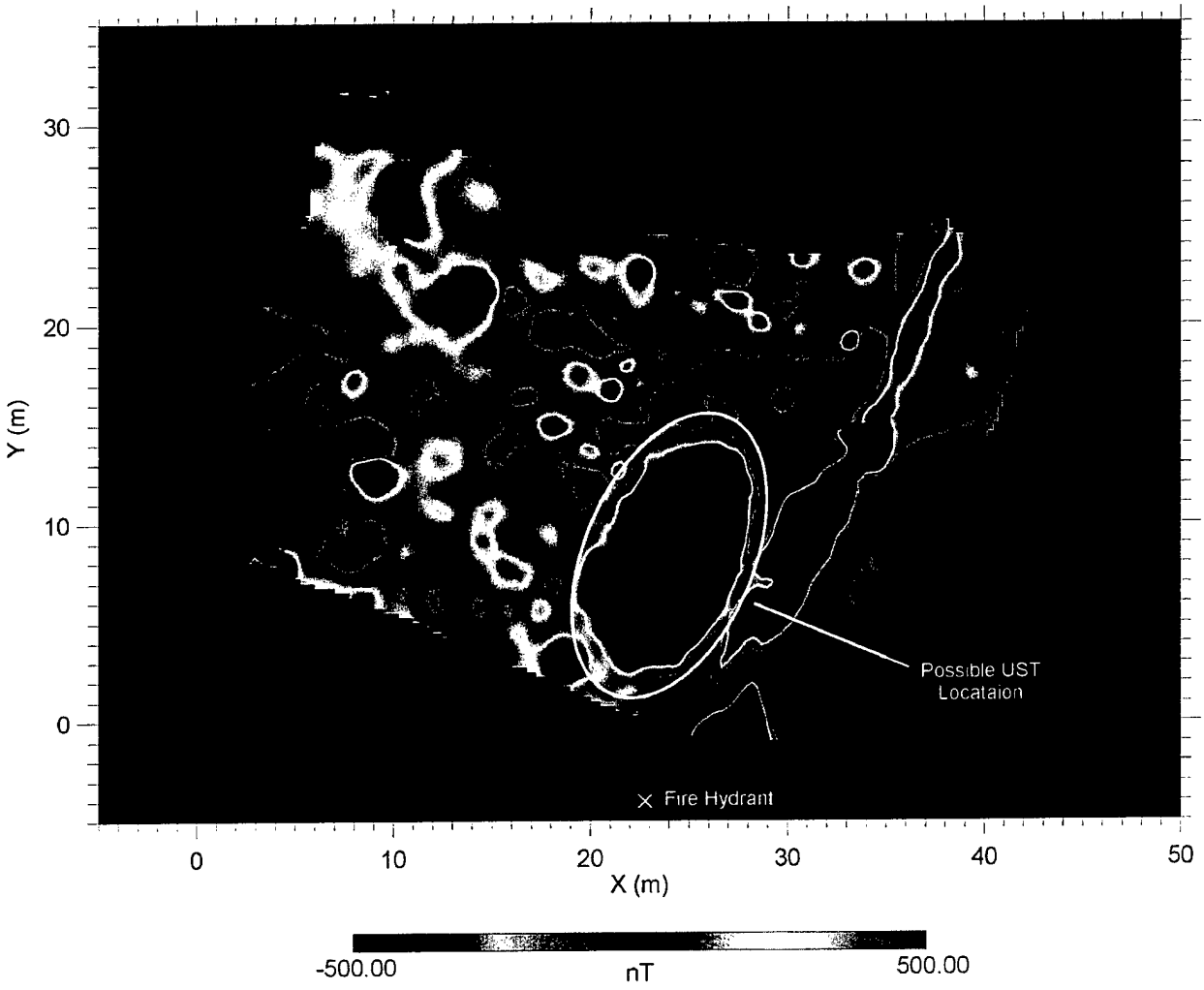

Fig. 15 — Magnetic anomaly image map of Site 95 with the position of the possible UST marked

REFERENCES

1. An in-depth literature search was conducted by Jim Dolph of the Portsmouth Naval Shipyard to identify all potential UST sites at Anacostia Annex. Records reviewed included: facility drawings (as-built and existing condition), spill records, property record cards, contracts (installation and removal), environmental reports, tank registration forms, annual command narratives, closure reports, base realignment and closure reports, spill prevention control and countermeasure plans, oil and hazardous material spills contingency plans, photographs, oil pollution surveys, and Shore Station master plans.

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