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Preliminary Geophysical Investigations at the Armored Vehicle Maintenance Area, OUE

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PROGRESS REPORT

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INTRODUCTION

The Armored Vehicle Maintenance Area (AVMA) is located on Fort Richardson north of the Davis Highway, bordered by railroad tracks to the west, First Street to the east, a wooded area to the north, and the old Davis Highway to the south (Fig. 1). Since the site has an overall shape similar to a pentagon, we also informally refer to it as the "pentagon site". The cleared area is approximately 88,300 m^2 (950,600 ft^2).

To the west of the AVMA, several wells surrounding and east of the former Building 45-590 contain measurable levels of solvents including PCE (AP-3468, AP-3534, AP-3789, AP-3773, AP-3774, AP-3775, AP-3776, AP-3439, AP-3440, AP-3387, AP-3871) (ENSR 1998) (Fig. 1). Chemical analysis of ground water samples collected from these wells in January 1998 indicate a westward decrease in the concentration of PCE (ENSR 1998). Manual ground water table measurements also indicate that local ground water is flowing westward with a very low gradient (Astley 2000).

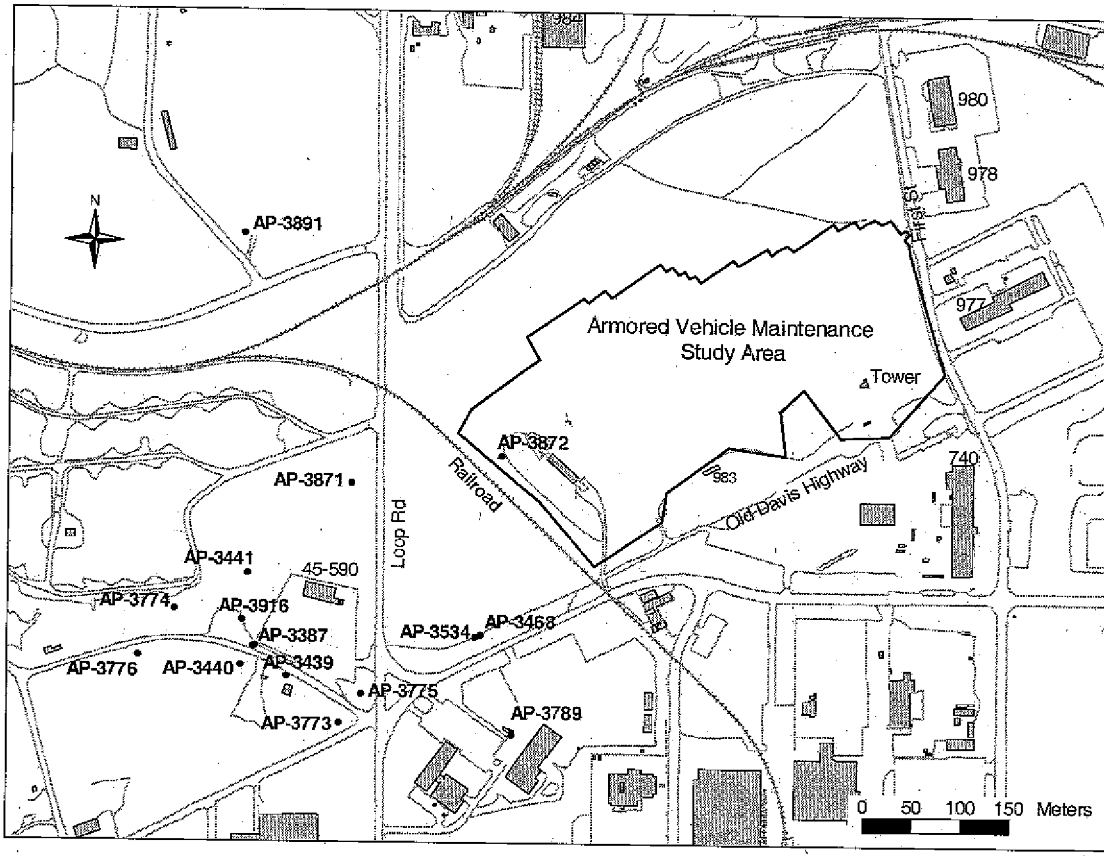

Figure 1. Location of Armored Vehicle Maintenance Study Area and monitoring wells discussed in the text.

SITE BACKGROUND

The AVMA was used as a gravel source during construction of the railroad in 1950. In the 1950's, it was used as a vehicle wash area during which solvents were used to clean armored vehicles. Since at least 1974, the area has been used as a physical training area and obstacle course. Although most of the obstacle course has been leveled or removed, two buildings and a parachute-jump landing simulator remain.

METHODS

We began our investigation with a search of historical aerial photos and obtained photos taken in 1950, 1962, 1974, and 1993 from various sources. The 1950 photo shows a large excavation in the south-central part of the site. The 1962 aerial photo shows apparent former trenches and possible scrap piles that may be current sources of contamination (Fig. 2). Other features including gravel berms, former buildings and structures, and pits are interpreted on multiple photos.

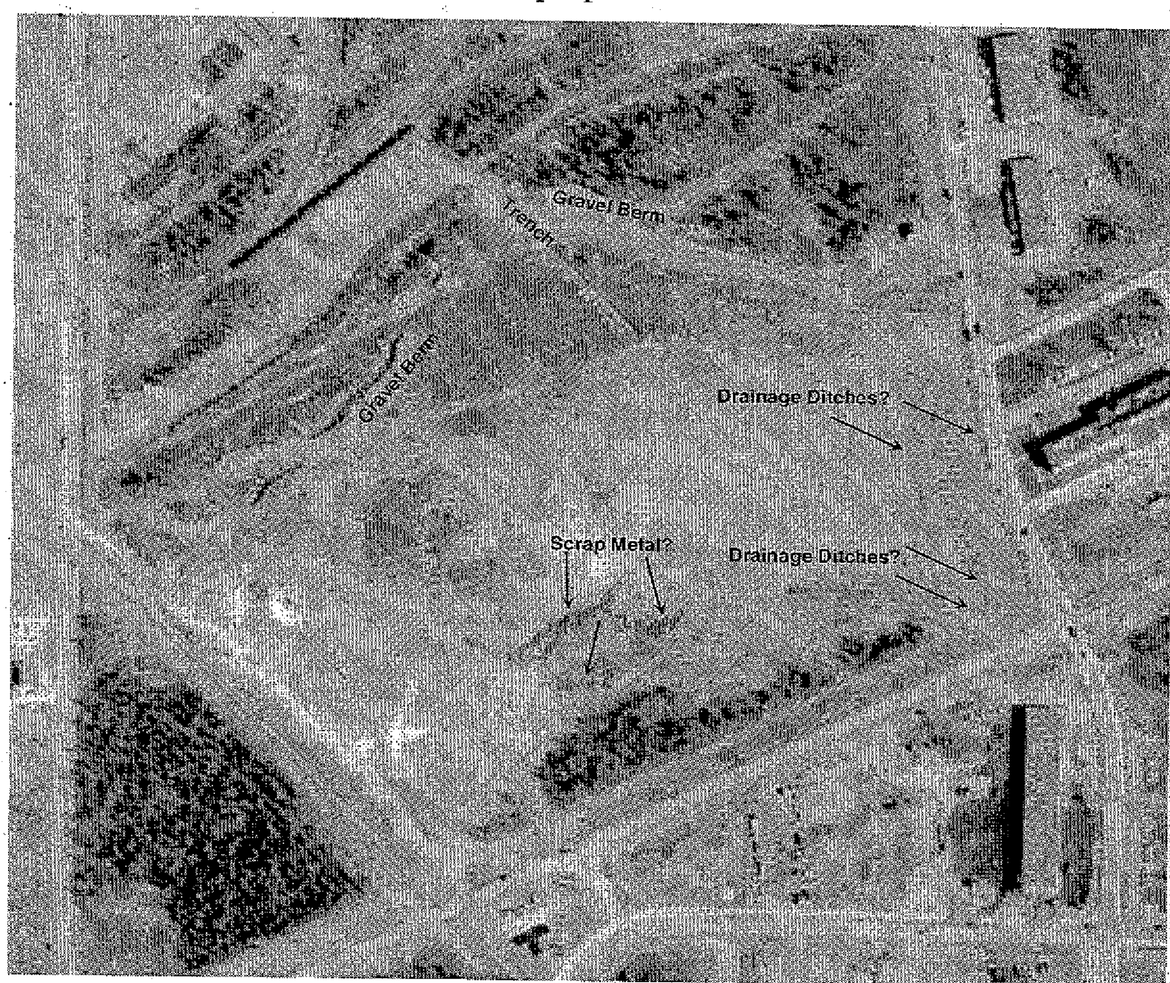

Figure 2. 1962 aerial photo with locations of interpreted features.

To investigate accessible portions of the cleared field within the AVMA, we established both a 10-m grid site-wide and a 2-m grid in the south central area (Fig. 3). Although the grid was not orientated exactly to true north, we refer to the transects as "north" or "east" for simplicity. The locations of the grid lines were mapped by GPS using a Trimble Pro-XR receiver and a TSC1 datalogger. The GPS data was real-time corrected from a National Geodetic Survey continuously operating reference station (CORS) station in Kenai, AK. Horizontal error of the GPS data varies according to the number of available satellites and their positions relative to one another, but is generally less than 1 meter.

CRREL collected GPR data using 200- and 100-MHz antennas to determine the locations of subsurface layers, objects, and former trenches penetrating to depths of 11 and 30 m, respectively. We collected GPR data with the 200 MHz antennas along all the 2-m and 10-m grid lines in both the "north" (y) and "east" (x) directions. Using the 100 MHz antennas, we collected data on the 2-m grid on odd transects in the N-S direction and on each 10-m grid line in the E-W direction only. Antennas were towed with a four-wheeler at a constant speed. Each GPR transect record will be examined and processed digitally on a computer. Particular attention will be paid to identifying possible former trenches and buried objects.

We collected electromagnetic data with a Geonics EM61. The EM61 can detect metal objects such as a single drum at a depth of 3 m. In May 2000, we ran preliminary transects over the study area to determine the areas with the greatest concentration of buried metal. The perimeters of these areas were flagged and surveyed with GPS. In June 2000, the 2-m grid was established with the flagged areas within its boundaries. Electromagnetic data was collected to further delineate buried metal objects within the 2-m grid. We collected electromagnetic data along the 10-m grid in June and July.

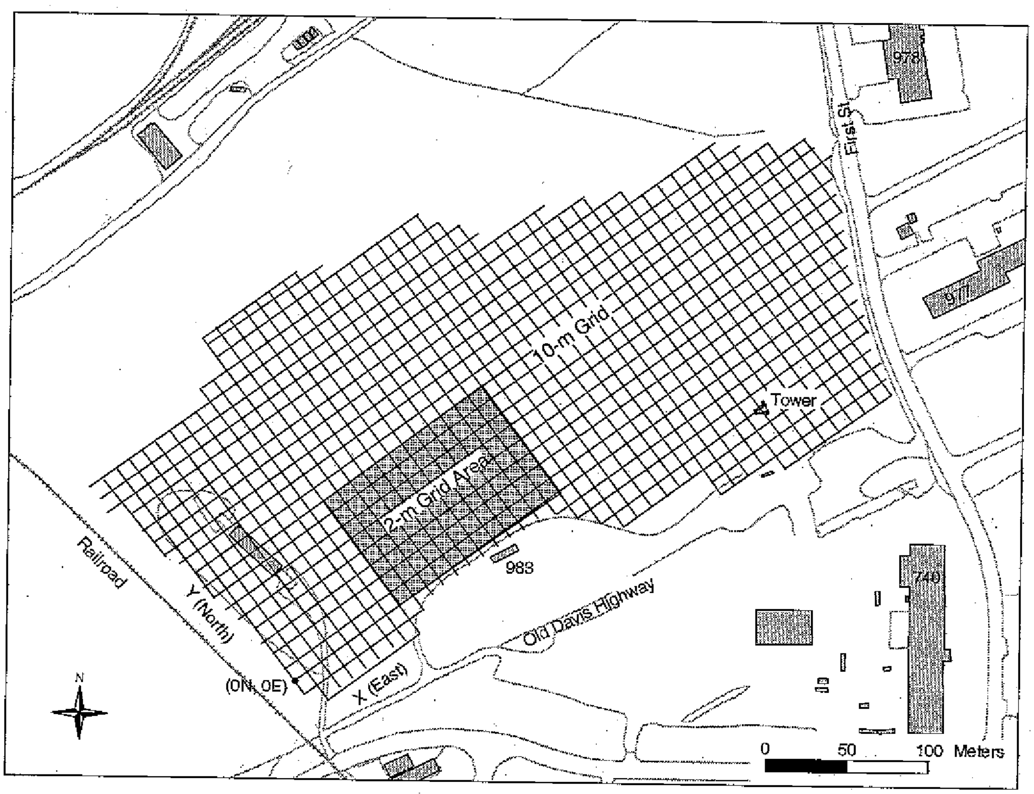

Figure 3. Data collection grid.

PRELIMINARY RESULTS

Ground-Penetrating Radar

Preliminary examination of the GPR records indicates that, in general, the central part of the pentagon site appears to be the most disturbed. This area contains small- and large-scale excavations that have been filled. Buried objects are interpreted in many of the records, with most of them located in the disturbed areas of the site.

Electromagnetic Survey

Subsurface metallic objects were detected with the EM61 instrument in almost every area of the AVMA. The highest concentration of electromagnetic responses over 100 mV appears to be within and to the west of the 2-m grid. This area also contains multiple excavation horizons in the GPR records. Figure 4 displays point values of the EM61 data collected along the grid lines superimposed on a registered 1993 aerial photo.

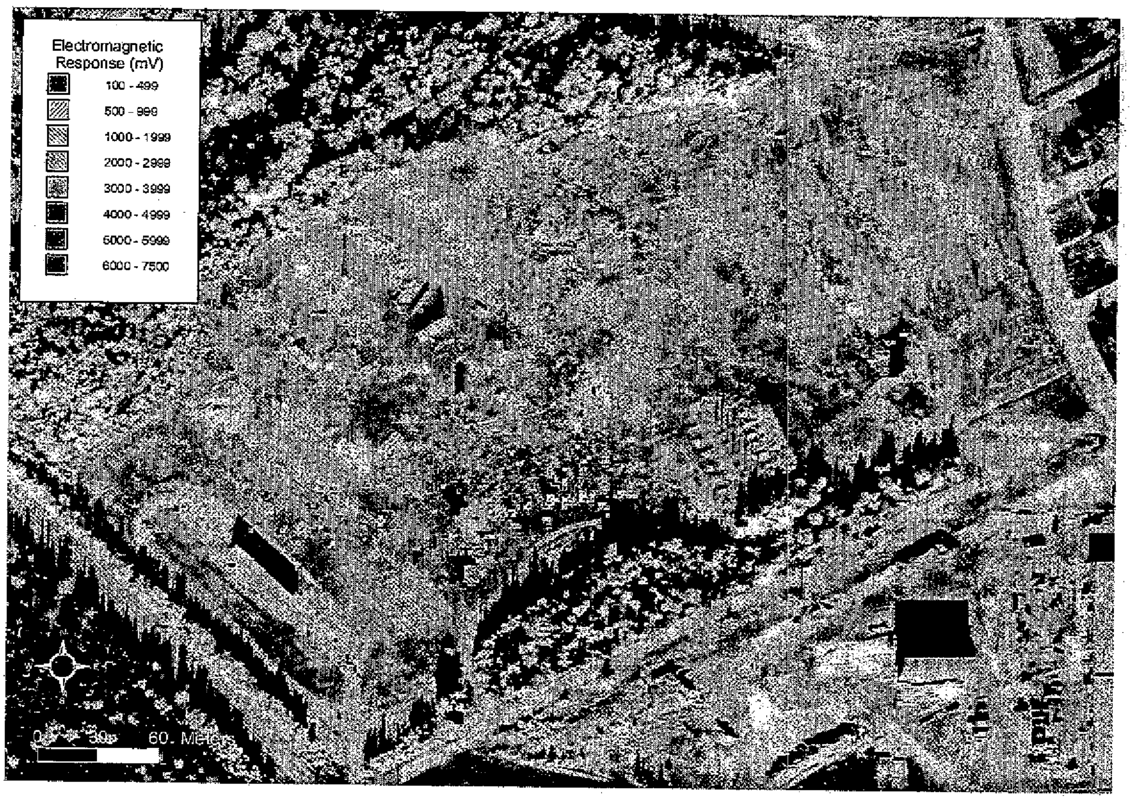

Figure 4. Electromagnetic survey data from the 2- and 10-m grids. Data are superimposed on a 1993 aerial photo base.

FUTURE WORK

We will continue our search for historical aerial photos that may provide clues about past site activities. The photos that we already have will be interpreted and used in conjunction with the geophysical data to create a history of site activities.

We will analyze the GPR data further to map the horizontal extent and depth of former excavations and compare hyperbolas with metal objects in the EM61 data. We will also collect additional GPR data with 30 MHz antennas to penetrate deeper below the surface to estimate the depth of deep excavations and to look for deeply buried objects.

The EM61 data will be analyzed to filter out near-surface, small objects to better delineate large buried metal objects. A map of the deep, larger buried metal objects will be produced and compared to the locations of former excavations interpreted from GPR data.

We will use DC resistivity to determine site geology and model the top of the confining unit. A hydrogeologic model will be constructed and used to interpret contaminant migration pathways away from buried objects identified with the GPR and EM61 data.

We will also test seismic surveying as a method to locate the confining unit and water table on Fort Richardson.

REFERENCES

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