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(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Impact Level	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-EN-TI-281		0	Geophysical Investigation of the 216-B-3-1 Ditch Operable Unit 200-BP-11, 200 East Area	N/A	1/2	1	

16. KEY

Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
1, 2, 3, or 4 (see MRP 5.43)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Impact Level for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1/2	1	Cog.Eng. K. A. Bergstrom	JWF for	6/30/94	H6-06	EPIC (2)			H6-08	3	
1/2	1	Cog. Mgr. J. W. Fassett	JWF	6/30/94	H6-06	Geophysics Files (2)			H6-06	3	
		QA				~~IRA (2)~~			~~H4-17~~	~~2~~	
		Safety				OSTI (2)			L8-07	2	
		Env.									
3		R. K. Transbarger (2)			H6-03						
3		Central Files (2)			L8-04						

18.	19.	20.	21. DOE APPROVAL (if required)
for K. A. Bergstrom J.W. Fassett 6/30/94 Signature of EDT Originator Date	Authorized Representative for Receiving Organization Date	J. W. Fassett J.W. Fassett 6/30/94 Cognizant/Project Engineer's Manager Date	Ltr. No. [] Approved [] Approved w/comments [] Disapproved w/comments

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RELEASE AUTHORIZATION

Document Number:	WHC-SD-EN-TI-281, REV. 0
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This document was reviewed following the procedures described in WHC-CM-3-4 and is:

APPROVED FOR PUBLIC RELEASE

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WHC Information Release Administration Specialist:

N.L. Solis N.L. SOLIS — 9/9/94

(Signature) **(Date)**

SUPPORTING DOCUMENT

1. Total Pages 47

2. Title	3. Number	4. Rev No.
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7. Abstract

Bergstrom, K. A. and J. P. Kiesler, 1994, "Geophysical Investigation of the 216-B-3-1 Ditch Operable Unit 200-BP-11, 200 East Area." WHC-SD-EN-TI-281, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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CONTENTS

FIGURES:

1.0 INTRODUCTION

Ditch 216-B-3-1 is located within the 200-BP-11 Operable Unit, located immediately northeast of the 200 East Area (Figure 1). At one time, it drained into B Pond. The ditch has been filled with soil and the surrounding area reclaimed. There is no remaining physical evidence showing the original location of the ditch. Survey stakes were recently emplaced that show the documented location of the ditch from survey coordinates. The objective of this investigation was to verify the staked location of the ditch with non-intrusive geophysical methods. Ground-penetrating radar (GPR) and electromagnetic induction (EMI) were the methods selected for the investigation. GPR has been used successfully to locate similar ditches in other parts of the Hanford Reservation. EMI was used because it is much quicker to collect and interpret, and if successful, could be used to rapidly map the entire length of the ditch.

2.0 GROUND-PENETRATING RADAR METHODOLOGY

The GPR system used for this work utilized a 300-megahertz transducer. The transducer transmits electromagnetic energy into the ground. Buried objects such as pipes, barrels, foundations, and buried wires can cause all, or a portion, of the transmitted energy to be reflected back to a receiving antenna. Geologic features such as crossbedding, caliche horizons, paleosols, and clays can also cause reflections of the transmitted energy. The reflected energy provides the means for mapping the subsurface features of interest, whether man-made or geologic.

The maximum depth of investigation varies from site to site and is a function of the transmit power, receiver sensitivity, frequency of the antenna, and attenuation of the transmitted energy. The attenuation of the energy is primarily a function of the local soil conditions. Depth of investigation is also affected by highly conductive material, such as metal drums and pipes which essentially reflect all the energy. Since all the energy is reflected, the method cannot "see" below such objects. Maximum depths of penetration for these surveys ranged from 8 to 10 ft.

Display and interpretation of GPR data are similar to that of seismic reflection data (i.e. data displayed as horizontal distance vs. time, depicting pseudo cross-sections of the earth). The approach to an interpretation is quite variable and influenced by the objectives of the survey and the experience of the interpreter. There are also numerous data processing techniques available that may or may not aid in the interpretation process. In some areas, interpretations can be straight forward, but often a highly variable subsurface yields complex data that are difficult to interpret. A common end-product is a plan view map showing the locations and depths of the features that were detected within the survey area.

GPR data in these surveys were collected with a Geophysical Survey Systems Inc. (GSSI) Subsurface Interface Radar (SIR)™[1] System 8, model 4800, and digitally stored on a GSSI DT6000A tape drive. A recording window of 80 nanoseconds, two-way travel time, was used.

3.0 ELECTROMAGNETIC INDUCTION

The EMI techniques are used to determine the electrical conductivity of the subsurface soil, rock, and groundwater. They are generally used for shallow investigations. The method is based on a transmitting coil radiating an electromagnetic field which induces eddy currents in the earth. A resulting secondary electromagnetic field is measured at a receiving coil as a voltage which is linearly related to the subsurface conductivity.

Terrain or ground conductivity is a function of the natural soil matrix and pore fluid electrical conductivity. The depth of investigation is dependent upon the electrical conductivity of the subsurface, the distance between the transmitting and receiving coils, the sensitivity of equipment, and the power of the source. The conductivity value resulting from a measurement is a composite, representing the combined effects of the thickness of the stratigraphic layers, their depths, their specific conductivity, and any man-made conductive objects that may be present, such as metal objects. Metallic objects generally overwhelm the natural conductivity of the ground.

A Geonic's EM-31D™[2] ground conductivity meter was used for the survey. It has a maximum depth of penetration of approximately 18 ft.

EMI is a very effective reconnaissance method used to locate buried metallic objects. The interpretation of EMI data does not yield reliable quantitative information such as depths and the shapes and size of objects. However, in areas where the effectiveness of GPR is limited by the surrounding terrain, EMI yields valuable information. The most reliable interpretations are a result of the integration of GPR and EMI.

4.0 SURVEY LOCATION

Initially, data were collected within two grids near the western end of the ditch. The western-most grid is referred to as Grid I and the second grid, located approximately 190 ft to the east, is referred to as Grid II.

Grid I is 80 ft by 80 ft and Grid II is 80 ft by 100 ft (Figure 2). Painted stakes mark the corners of each grid. All distances were measured and posted in feet. The southwestern corner of each grid is designated E100/N100 and serves as the "origin" for the survey locations. The letters "N" or "E" refer to a direction that trends generally north or east, respectively. The

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[1]A trademark of Geophysical Survey Systems, Inc. (GSSI).

[2]A trademark of Geonics Limited.

number refers to a distance in feet. For example, grid point E135/N120 lies 35 ft "east" and 20 ft "north" of grid point E100/N100.

GPR data were collected along two sets of profiles perpendicular to each other. There was a 10-ft spacing between profiles that ran north-south (i.e., perpendicular to the ditch) and a 20-ft spacing between profiles running east-west.

5.0 QUALITY CONTROL

These data were collected using procedures in WHC-CM-7-7 EII 11.2, Rev. 3, *Environmental Investigations and Site Characterization Manual*, (WHC). The data and records are stored in the Geophysics files.

6.0 RESULTS

The ditch was not identified in either the GPR or EMI data. Along several GPR profiles, there were anomalous areas that may be attributed to the ditch; however, the lack of continuity of such anomalous zones between profiles leaves too much uncertainty in the interpretation. There are two possible explanations considered. The first is that the grids were not located over the ditch. The second, preferred, interpretation is that there were insufficient physical contrasts between the soil within the ditch and the surrounding ditch for either method. To identify any subsurface feature with the selected methods requires a contrast in the physical properties between the feature of interest and the surrounding soil. An open ditch, located immediately to the south of the 216-B-3-1 ditch, shows the soil to be a very homogeneous loess. It is highly likely that the soil surrounding 216-B-3-1 and the material used to fill the ditch are essentially the same material with the same physical properties, which explains the lack of signature. Numerous reconnaissance profiles (interpreted in the field - no hard copy) were extended beyond the established grids in an attempt to locate the ditch, but they were unsuccessful.

7.0 REFERENCES

WHC, *Environmental Investigations and Site Characterization Manual*, WHC-CM-7-7 EII 11.2, Rev. 3, Westinghouse Hanford Company, Richland, Washington.

Figure 1. Location Map.

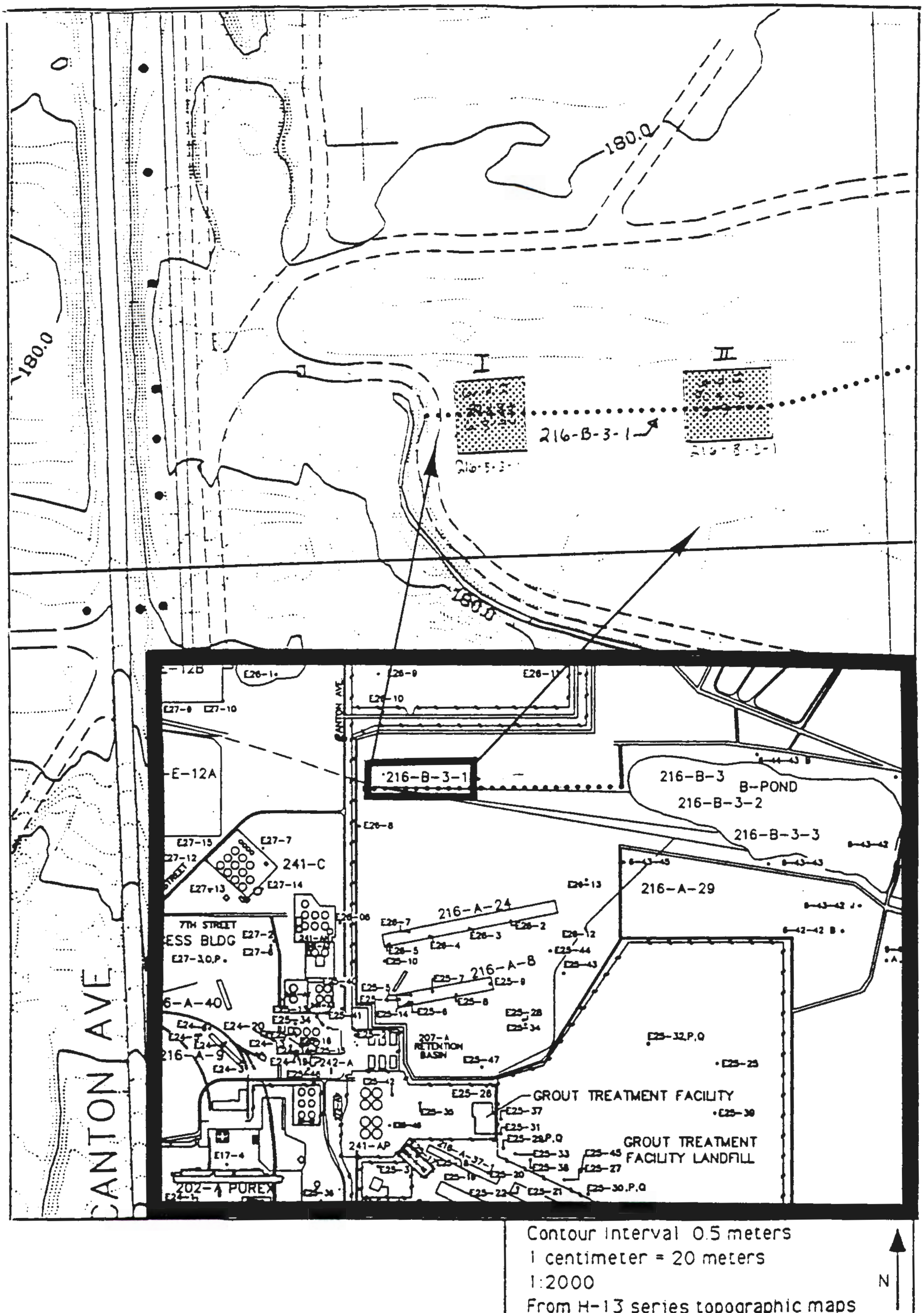
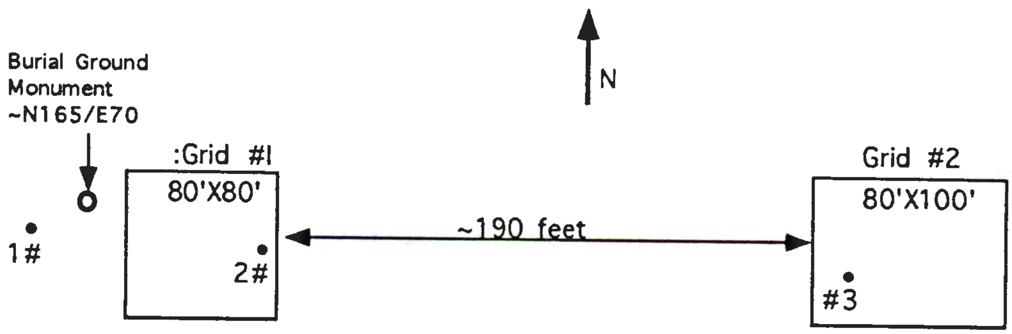


Figure 2. Survey Area Layout for Ditch 216-B-3-1.



•- Survey Stakes from Documented Ditch coordinates
#1 ~N148/E155 (N43671.1 /W46928.9)
#2 N135/E154 (No survey coordinates)
#3 N124/E109 (N43620/W46600)