

DATA SUMMARY REPORT

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**Hudson River Project
Sampling and Analysis Program**

**1991 Hydrographic Survey of the Upper
Hudson River**



**General Electric Company
Corporate Environmental Programs
Albany, New York**

May 1993



**O'BRIEN & GERE
ENGINEERS, INC.**

DATA SUMMARY REPORT

**HUDSON RIVER PROJECT
SAMPLING AND ANALYSIS PLAN**

1991 HYDROGRAPHIC SURVEY OF THE UPPER HUDSON RIVER

**GENERAL ELECTRIC COMPANY
CORPORATE ENVIRONMENTAL PROGRAMS
ALBANY, NEW YORK**

**O'BRIEN & GERE ENGINEERS, INC.
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SECTION 1 - INTRODUCTION

O'Brien & Gere Engineers, Inc. (O'Brien & Gere) conducted a hydrographic survey of the upper Hudson River. Field data collection and primary data reduction for the hydrographic survey was conducted by Hydro Data, Inc. of Chester, Connecticut, under subcontract to O'Brien & Gere. The field portion of the survey was conducted over the period of late July through early October 1991. This work was prompted by the PCB Reassessment Remedial Investigation and Feasibility Study (RRI/FS) being performed on the upper Hudson River by the U.S. Environmental Protection Agency (USEPA). The work being performed by USEPA in conjunction with the Hudson River RRI/FS is described in their Phase 1 Report (USEPA, 1991) and the Final Phase 2 Work Plan and Sampling Plan (USEPA, 1992). This report presents a brief background of the site, a brief overview of historical hydrographic surveys conducted on the site, as well as the objectives, scope of work, and results of the 1991 survey.

1.01 Site Background

The 1991 survey covered an area of the upper Hudson River extending from the Federal Lock in Troy upstream to the area of Baker Falls in Fort Edward, an approximately 45 mile stretch of the river as shown on Figure 1. The river above Troy is part of the New York State Champlain Canal System. A series of eight locks provide lift from the tidal influenced portion of the Hudson River below Troy, to an elevation of approximately 120 feet above mean sea level at Fort Edward (Figure 2). River flow is controlled by scheduled releases of the Great Sacandaga Lake by the

Hudson River/Black River Regulating District. Releases from the Great Sacandaga Lake via the Sacandaga River to the Hudson River near Hadley, New York represents approximately 40 percent of the flow in the Hudson River as measured at Fort Edward (Firda, 1989). The regulated releases of water serve several hydroelectric power plants along the Hudson River upstream of Troy.

From its construction in 1909, the Champlain Canal has been maintained by New York State Department of Transportation (NYSDOT). The initial construction and subsequent maintenance dredging, repair, river flow and flooding as well as other events such as the removal of the Fort Edward Dam in 1973 have the potential to change bed geometry through the years. Thus, an updated survey was considered necessary to support current investigations of the river.

1.02 Previous Hydrographic Surveys

Surveys of the Hudson River bottom have previously been performed. Early surveys provided information used to develop flood mapping and navigation charts. Of particular interest have been those surveys which were performed as part of the investigation of the PCB contamination problem. Table 1 shows a summary of the most recent hydrographic surveys which have been identified for the upper Hudson River.

Copies of the data developed from the Normandeau Associates, Inc. (Normandeau, 1976-1977), and the Raytheon Corp. (Raytheon Corp., 1982) surveys were available for review. Figure 3 shows a comparison of the relative distribution of the transects run by Normandeau in 1976-1977, Raytheon Corp. in 1982 as well as data obtained by Gahagan & Bryant in 1982 and the current survey performed by

Hydro Data in 1991 as presented in this report. The data obtained from the Normandeau and Raytheon surveys are briefly summarized below.

Normandeau Associates, Inc. - 1976-1977

Under contract to the NYSDEC, Normandeau surveyed and mapped the upper Hudson River from the Federal Lock at Troy to Bakers Falls. This work was conducted in 1977. As part of its work, aerial photographs were converted into a series of 120 planimetric maps at a scale of 1 inch = 200 feet. An example of this mapping is shown as Figure 4. The Normandeau maps show the canal centerline, location of sediment sampling points, the 1927 (New York) State Plane coordinate grid, and the locations of the transects run by Normandeau. Profiles were constructed from the data collected along each transect; an example of one of these transects is shown as Figure 5. In addition to the 1977 sounding depth profile, also shown are what are believed to be profiles of the river bottom from approximately the same location as measured in 1909 and 1914, before construction of the Champlain Canal. It is noted that the profiles on Figure 5 are referenced to USGS datum. The profiles for the 1982 and 1991 surveys, as discussed below, are referenced to the Barge Canal Datum. Approximately 1.17 feet should be added to the USGS datum values to make them comparable to the Champlain Canal datum (Carl Head, NYSDOT, Personal Communication).

The NYSDEC provided a copy of the planimetric maps and Normandeau provided copies of the profiles associated with the 1977 survey. Cross sections of the 1977 survey were run with a boat equipped with a Raytheon DE - 719B survey fathometer, and navigation was provided by means of a pulse radar Motorola Mini-

Ranger III. The accuracy of this survey was reported to be ± 1 inch of indicated depth. The Motorola Mini-Ranger III was reported to provide an accuracy of 3 meters.

Raytheon Corporation, 1982

Reach 8, also commonly referred to as the Thompson Island Pool (TIP), was surveyed in 1982 by the Raytheon Ocean Systems Company. Raytheon has since closed this division. This work was also commissioned by the NYSDEC. The survey consisted of the collection of approximately 50,000 individual depth soundings, scattered throughout the TIP. The soundings were taken at a spacing of approximately 25 feet. From the collected depth soundings, several hundred cross sections were created. An example of one of these cross sections is shown as Figure 6.

Specifics of the equipment used for this survey are not available from either the NYSDEC or from Raytheon. According to the NYSDEC's 1982 "Environmental Monitoring Program - Hudson River PCB Reclamation Demonstration Project Report" (NYSDEC, 1982), Raytheon used the same type of equipment as had previously been used by Normandeau in 1977. A data logger was added in order to accommodate the increased number of soundings. The bid specification required a horizontal and vertical accuracy of $\pm$ six feet and ± 0.5 feet respectively.

1.03 Objectives

The objective of the 1991 hydrographic survey was to collect updated river bottom profile data for that portion of the upper Hudson River, extending from the Federal Lock at Troy, New York, upstream to Bakers Falls at Hudson Falls, New

York. The remainder of this report describes the data collection activities and presents the results of the 1991 survey.

SECTION 2 - SCOPE OF WORK

2.01 Scope of Work

The scope of work for the 1991 hydrographic survey was developed with the objective of collecting data from areas that were previously mapped. The 1991 data could then be compared with the data from previous hydrographic surveys to evaluate changes which may have occurred to the river bottom over the intervening years. Through the use of improved horizontal and depth recording equipment, more precise positioning and depth data were obtained during the 1991 survey as compared to the previous surveys discussed in Section 1. Horizontal positioning with an accuracy of $\pm$ two feet and depth readings of $\pm$ 0.1 feet were obtained and recorded for subsequent use.

For convenience of data evaluation and presentation and for consistency with other studies of this portion of the upper Hudson River, ten reaches were defined (Reaches 1 - 10). Each reach was defined by the locks, or their associated dams, beginning with the Federal Dam at Troy on the downstream end (Reach 1) and extending upstream to the area of Bakers Falls at Hudson Falls (Reach 10). The reaches are listed on Table 2 and shown on Figure 1.

The 1991 survey included the retracing of the 1977 Normandeau transects from Troy to the TIP dam. In addition, ten transects were run in the 1,000 foot stretch upstream of each of the dams in this portion of the upper Hudson River. This scope of work obtained a coverage comparable to the Normandeau and Raytheon surveys. Above the TIP dam, transects were run at 100 foot intervals for the entire TIP and extended into Reach 9 and Reach 10 (old Fort Edward Dam site

to Bakers Falls). Transects collected in Reach 10 covered the same general areas as were previously collected in 1975 and 1976.

A summary of the number of transects collected in each reach of the upper Hudson River during the 1991 survey as well as the number of transects run in 1975 - 1976, 1977, and 1982 is presented on Table 3.

SECTION 3 - EQUIPMENT AND PROCEDURES

3.01 Hydrographic Survey

The hydrographic survey was performed by a two-person field crew from Hydro Data, Inc. The crew used a ten foot Zodiac boat with a 10 horse power outboard motor, an IMC "Hydro I" automated range-azimuth positioning system, and an Odom Echotrac depth sounder to collect the depth information (Photo 1).

Survey vessel positions and vessel control along each transect were obtained using the "Hydro I" positioning system and tracking the boat's position using an on board visual display (Photo 2). The system consists of a shore based laser linked to a Lietz DT5 digital theodolite (Photo 3), and a vessel based Hydrolink with an Omni directional prism mounted above the depth sounder transducer. Radio communication between the shore and vessel transfers coordinate positioning data to the boat at one second intervals.

Water depths were obtained using an Odom Echotrac digital depth sounder. Water depths were recorded continuously on strip chart and also stored digitally by the "Hydro I" used in conjunction with the Odom Echotrac, as described above (Photo 4).

The Echotrac depth sounder incorporated transducer draft corrections plus calibration adjustment for speed of sound through water. Calibration was accomplished by performing "bar checks" at the beginning and end of each day. This was done by lowering an acoustic target (lead disk) a known distance below the transducer and adjusting the speed of sound control until the instrument displays the correct depth to the target. The target was then raised to successively shallower

depths and the readings recorded for these depths. Variations shown at these indicated depths were incorporated into the post-processing procedures yielding accurate depth data.

Position data with an accuracy of ± 2 feet and depth readings with an accuracy of ± 0.1 feet were recorded digitally in the vessel-based Hydrolink.

3.02 Shore Control

To remain consistent with previous surveys, 1927 NAD horizontal ground control benchmarks were used to position the shore based Hydro 1 (Appendix A). O'Brien & Gere located the on-shore horizontal control. Where the line of site between shore station and vessel was obstructed by trees and bushes, the Hydro Data field crew set horizontal control points "offsets" using a Lietz DT5 digital theodolite, a surveyors tape, and standard land surveying methods. Offsets were generally less than 50 feet from the original control point.

The raw data, profiles, and contour maps presented in this report are referenced to the Barge Canal Datum. This datum is used by the NYSDOT to determining pool elevations within the Champlain Canal system above the Federal Lock in Troy. This datum is not the same as the National Geodetic Vertical Datum of 1927 (NGVD27). The USGS uses NGVD27 for reporting elevation along the river. The 1977 Normandeau cross sections were drawn referencing USGS Datum. Caution should be used when comparing surveys to insure that the same datum is used.

Based on information provided by the NYSDOT, there is a difference between the two datums of approximately 1.17 feet (5). The Barge Canal Datum is

1.17 feet above NGVD27 datum. To convert a USGS elevation to Barge Canal Datum add 1.17 to the USGS elevation. Field observations confirm this conversion.

Reach 7 and Reach 9 are not part of the canal system. A land-cut bypasses the Hudson River in Reach 7 and the Champlain Canal exits the Hudson River at the northern end of Reach 8. During field activities, data collected from these reaches were referenced to NGVD27. After collection, data from these reaches were converted to Barge Canal Datum by adding 1.17 feet to each sounding elevation. As a result, these reaches are reported in Barge Canal Datum.

It was observed that water levels fluctuated several tenths of a foot during barge lockages. Care was taken to record water levels that actually reflect normal conditions. During field activities, pool elevations were checked at the NYSDOT gages (Table 4). This information was later used in determining bed elevations.

SECTION 4 - DATA REDUCTION AND RESULTS

4.01 Data Reduction

During field operations, water depths were recorded both digitally and on analog strip charts. The analog strip chart recorded objects in the water column, including weeds, fish, bubbles, debris, as well as the actual bottom. These objects sometimes degraded the digital recordings. When this occurred the analog recording was used to identify the correct water depth. Depth values along the analog bottom trace were visually evaluated and manually entered into the digital data file using post-processing software. Therefore, interference from weeds and false bottom readings were eliminated from the raw data set. Each electronically collected transect was compared to the field generated strip chart to improve accuracy. Interference, noise, and false readings were all filtered out of the data and should have no significant effect on the results.

4.02 Results

As noted on Table 3, 333 Transects were run in Reach 8. Profile drawings were developed for approximately every 4th or 5th Transect. These are included in Appendix B and provide a representative depiction of the river bottom in this reach. Data collected for each transect were available for subsequent evaluation.

At the completion of the field work, the soundings were converted to elevations. A set of profile drawings, one for each of the transects run within reach 1-7 as part of the 1991 survey are included as Appendix B of this report. Contour drawings for each of the 1,000 foot section upstream of each lock or dam, as

described previously, were prepared and are included as Appendix C. Contour drawings for Reach 8, the TIP, are included as Appendix D. The results are presented in ASCII format on DOS formatted disks (Appendix E). Elevations and water levels are all referenced to Barge Canal Datum.

Contours are presented at two-foot intervals. Base maps were produced using shoreline data collected in the field as part of the hydrographic survey. Contour drawings are presented at a scale of 1 inch = 200 feet for Reach 8 and 1 inch = 100 feet for Reaches 1-7 and 9-10. Profile drawings were presented at a horizontal scale of 1 inch = 100 feet and a vertical scale of 1 inch = 10 feet.

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Tables



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TABLE 1
PREVIOUS HYDROGRAPHIC SURVEYS

<u>Agency/Consultant</u>	<u>Date</u>	<u>Coverage</u>
NYSDOT	1909	Champlain Canal System
USGS	1967	≈ 75 transects - Troy to Fort Edward
NYSDEC	1974-'76	≈ 45 transects - Rogers Island to Bakers Falls
USGS	1976-'77	≈ 25 transects - Troy to Lock #1
NYSDEC	Sept. 1976	≈ 24 transects - Troy to Fort Edward
Normandeau Assoc., Inc.	1976-'77	≈ 170 transects - Troy to Fort Edward
Gahagan & Bryant	1982	≈ 55 transects - Thompson Island Pool
Raytheon Corp.	1982	≈ 50,000 soundings in Thompson Island Pool

TABLE 2
1991 HYDROGRAPHIC SURVEY REACH LIMITS

<u>Reach</u>	<u>Downstream Limit (Approx. River Mile¹)</u>	<u>Upstream Limit (Approx. River Mile¹)</u>
1	Federal Dam at Troy, NY (153.9)	Lock 1 (159.5)
2	Lock 1 (159.5)	Lock 2 (163.5)
3	Lock 2 (163.5)	Lock 3 (166)
4	Lock 3 (166)	Lock 4 (168)
5	Lock 4 (168)	Lock 5
6	Northumberland Dam ² (183.5)	Lock 6 (186)
7	Lock 6 (186)	Thompson Island Dam (188)
8	Thompson Island Dam (188)	Lock 7 (193.5)
9	Lock 7 (193.5)	Old Fort Edward Dam Site ³ (194.5)
10	Old Fort Edward Dam Site (194.5)	Bakers Falls (197.5)

Notes:

1. Approximate "River Miles" as measured upstream of the Battery, New York City (River Mile 0.0).
2. The Northumberland Dam is located approximately 4,000 feet upstream of Lock 5.
3. The Old Fort Edward Dam Site is located approximately 1,300 feet upstream of the north end of Rogers Island.

TABLE 3
1991 HYDROGRAPHIC SURVEY & PREVIOUS SURVEY TRANSECTS

<u>Reach</u>	<u>1977</u>	<u>1982</u>	<u>1991</u>
Below Troy Dam	-	-	1
1	5	-	15 ¹
2	5	-	15 ¹
3	13	-	21 ¹
4	6	-	16 ¹
5	60	-	72 ¹
6	21	-	32 ¹
7	15	-	23 ¹
8	45	300	333 ¹
9	-	-	54
10	-	-	26

Notes:

1. Includes those transects run in the 1,000 foot stretch upstream of the dam at the downstream limit of each reach.

TABLE 4
VERTICAL CONTROL DURING 1991 FIELD WORK

<u>Date</u>	<u>Reach</u>	<u>Water Level¹</u>	<u>Time</u>
9 Oct	10	122.4	1600
14 Oct	10	122.4	1200
10 Oct	9	120.4	1600
11 Oct	9	120.4	1600
31 July	8	120.0	1200
		120.1	1450
1 Aug	8	120.2	1100
2 Aug	8	120.1	0830
		120.2	1200
		120.1	2000
3 Aug	8	120.2	0830
		120.15	2100
26 Aug	8	120.1	1105
		120.2	1200
27 Aug	8	120.2	1200
14 Oct	8	120.3	1400
13 Oct	7	115.8	0800
		116.0	1600
4 Sept	6	103.1	0940
6 Sept	6	103.1	0830
14 Oct	6	103.2	1500
15 Oct	6	103.2	1608
27 Aug	5	84.5	1030
6 Sept	5	84.5	1200
12 Oct	5	84.8	1200
28 Aug	4	71.4	1223
16 Oct ²	4	70.8-71.0	-
29 Aug	3	48.3	1600
17 Oct ³	3	49.1-49.8	-
18 Oct	3	49.6	1115
29 Aug	2	30.0	1200
18 Oct	2	31.9	1148
24 Oct ⁴	2	28.2	1000
23 Oct	1	16.7	1000
24 Oct	1	16.3	1600

Notes:

1. Champlain Canal Datum.
2. 16 Oct water level was lowered to allow passage of tug and barge under bridge.
3. 17 Oct hydro plant at Lock 3 releasing water.
4. 24 Oct water level low due to dam maintenance.

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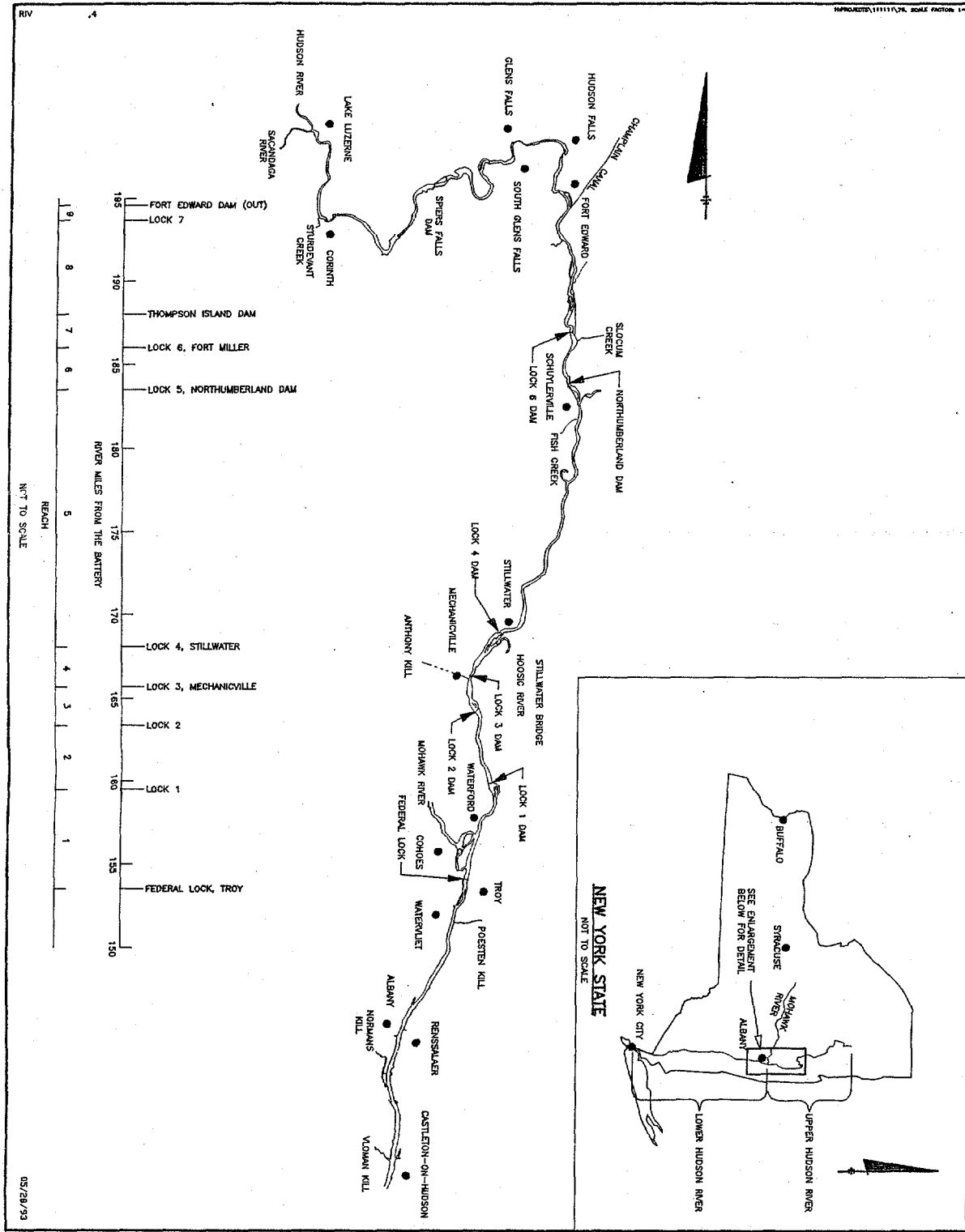
320505

Figures



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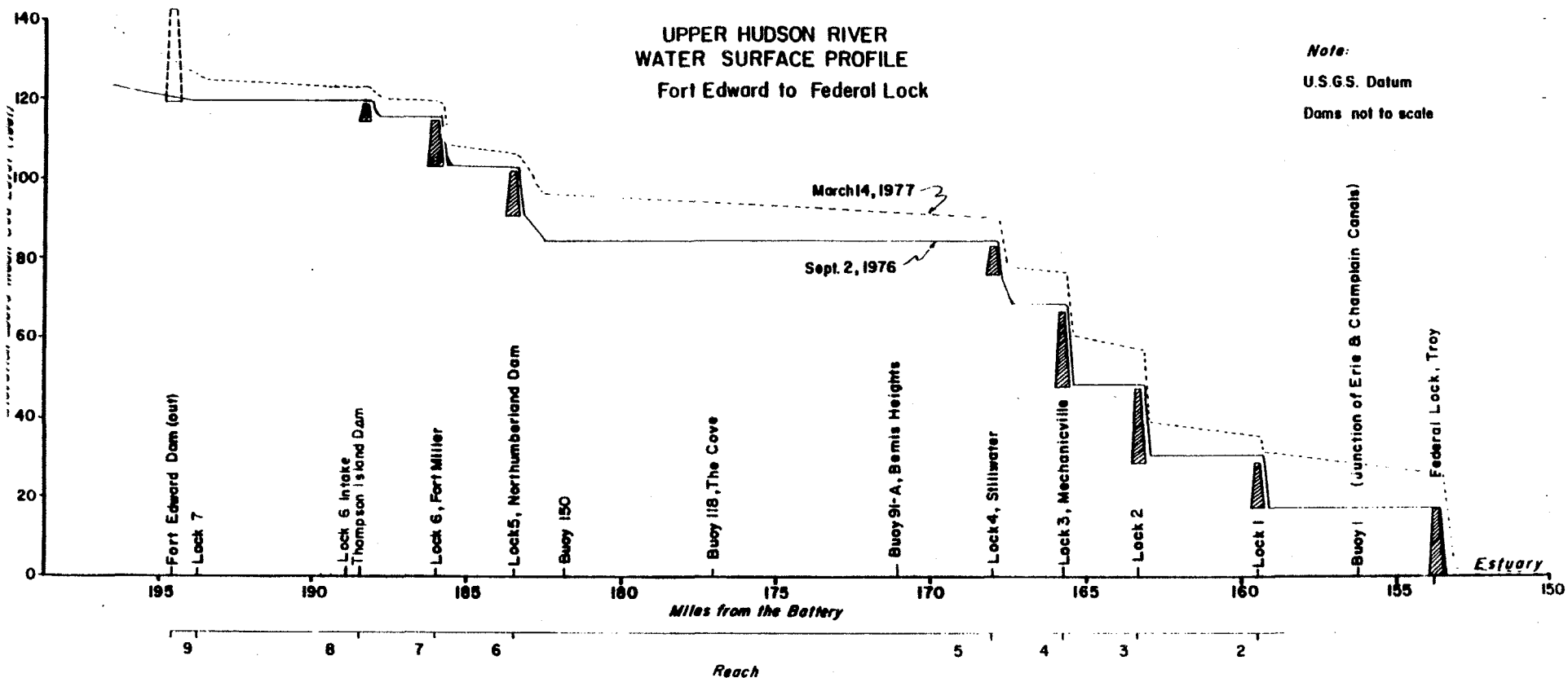
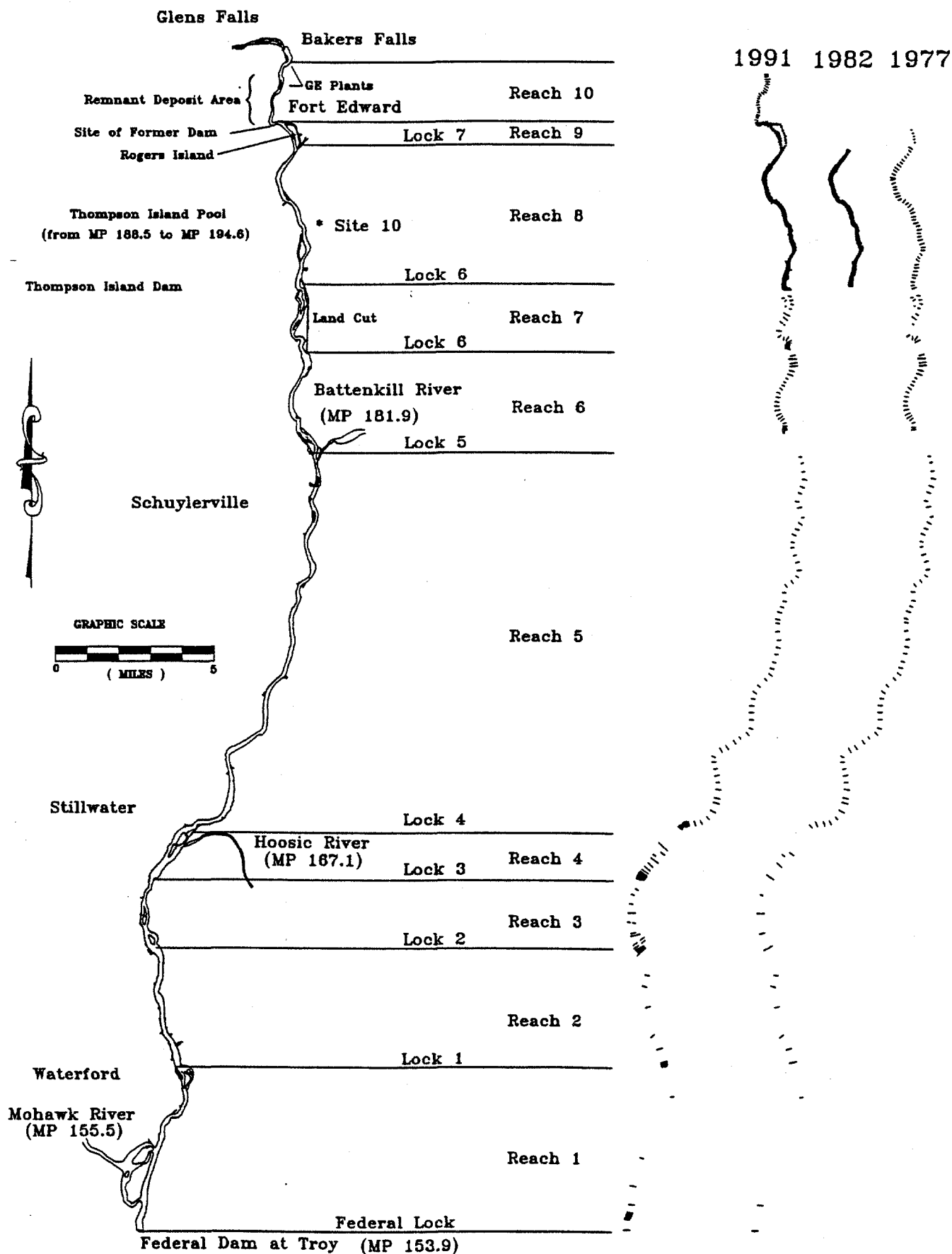


Figure 2

Source: Tofflemire, T. J., and Quinn, S. O., 1979, PCB in the Upper Hudson River: Mapping and Sediment Relationships, Technical Paper No. 56

Figure 3

UPPER HUDSON RIVER BATHYMETRIC SURVEYS



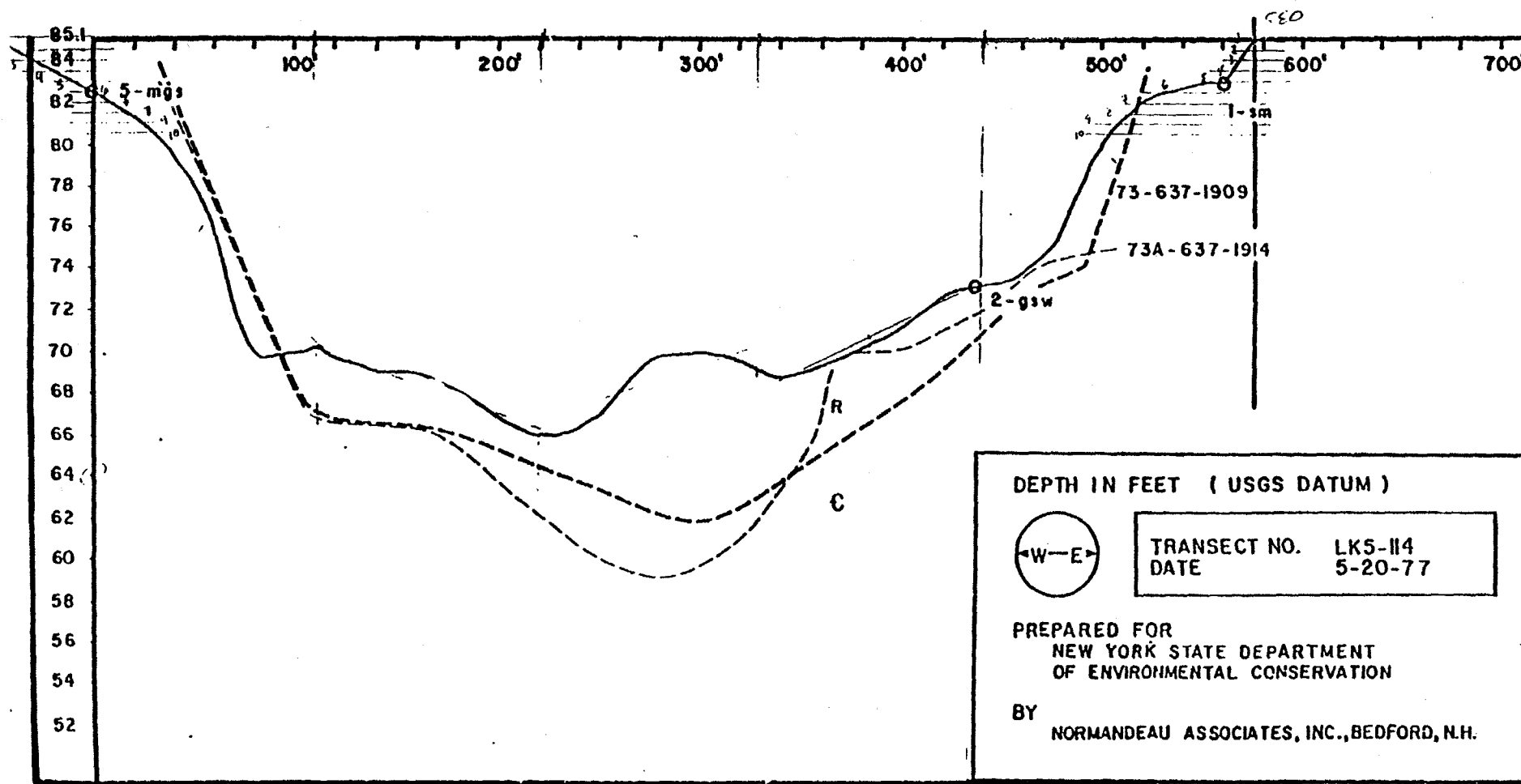
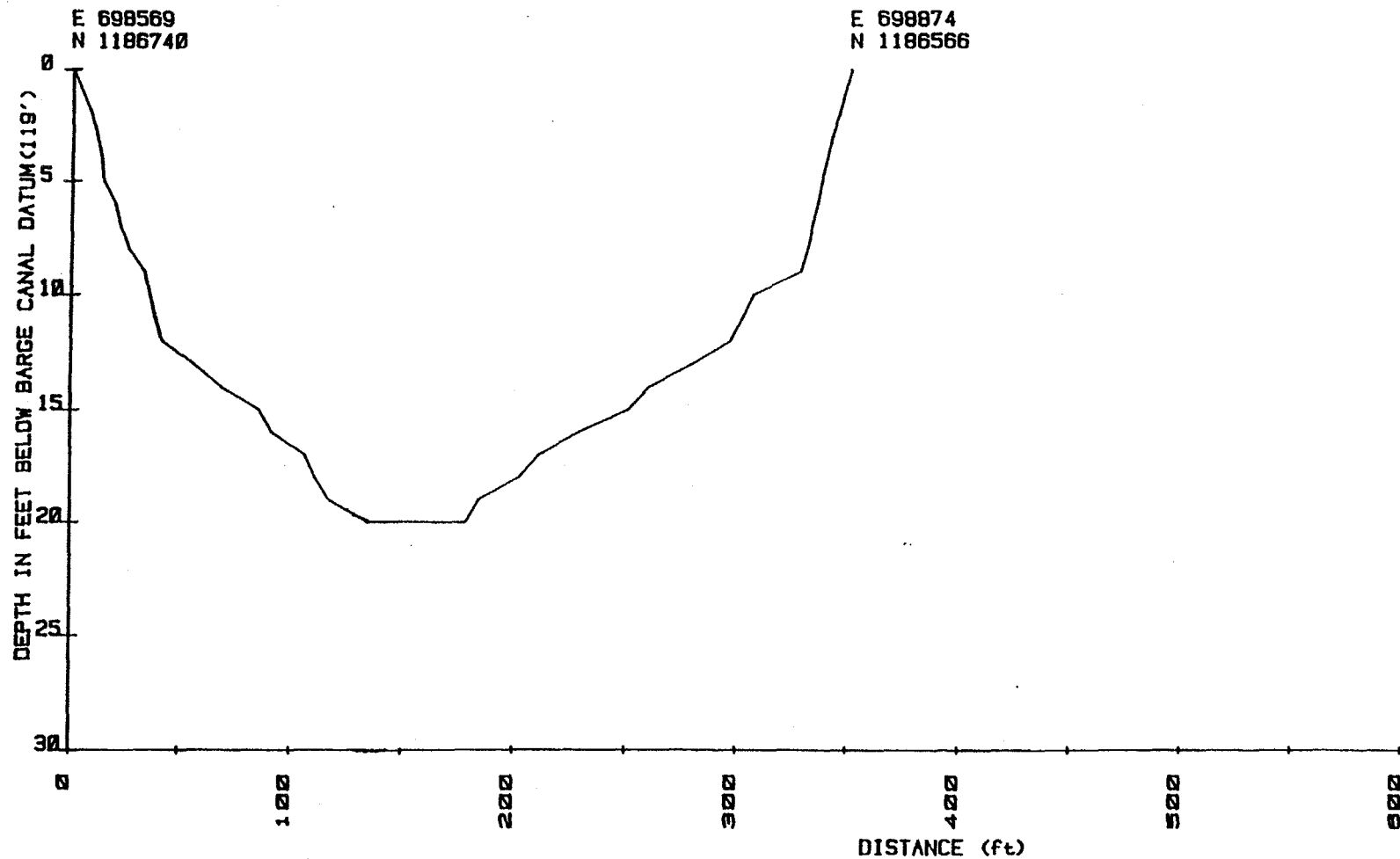


Figure 5



CROSS SECTION NO. HR1-025
HUDSON RIVER PCB RECLAMATION PROJECT
BATHYMETRIC SURVEY

Figure 6

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Photographs



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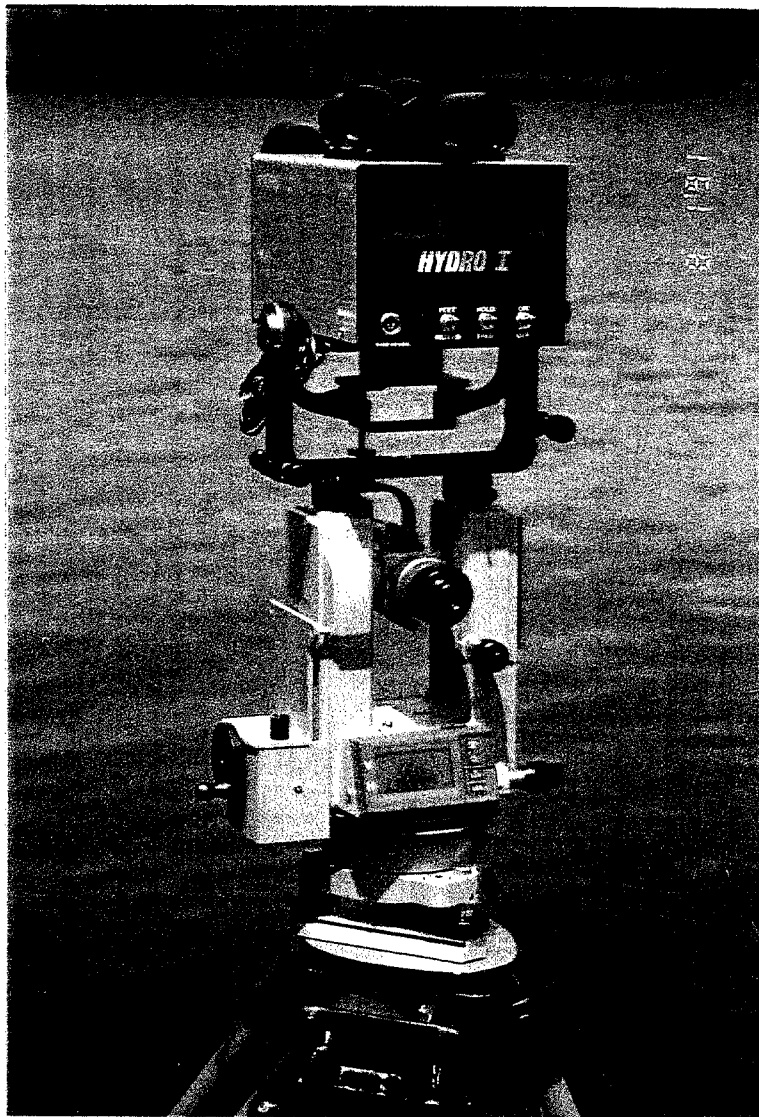


Photo 3
Lietz DT5
Digital Theodolite
(with "Hydro 1" Uni
Mounted on Top)

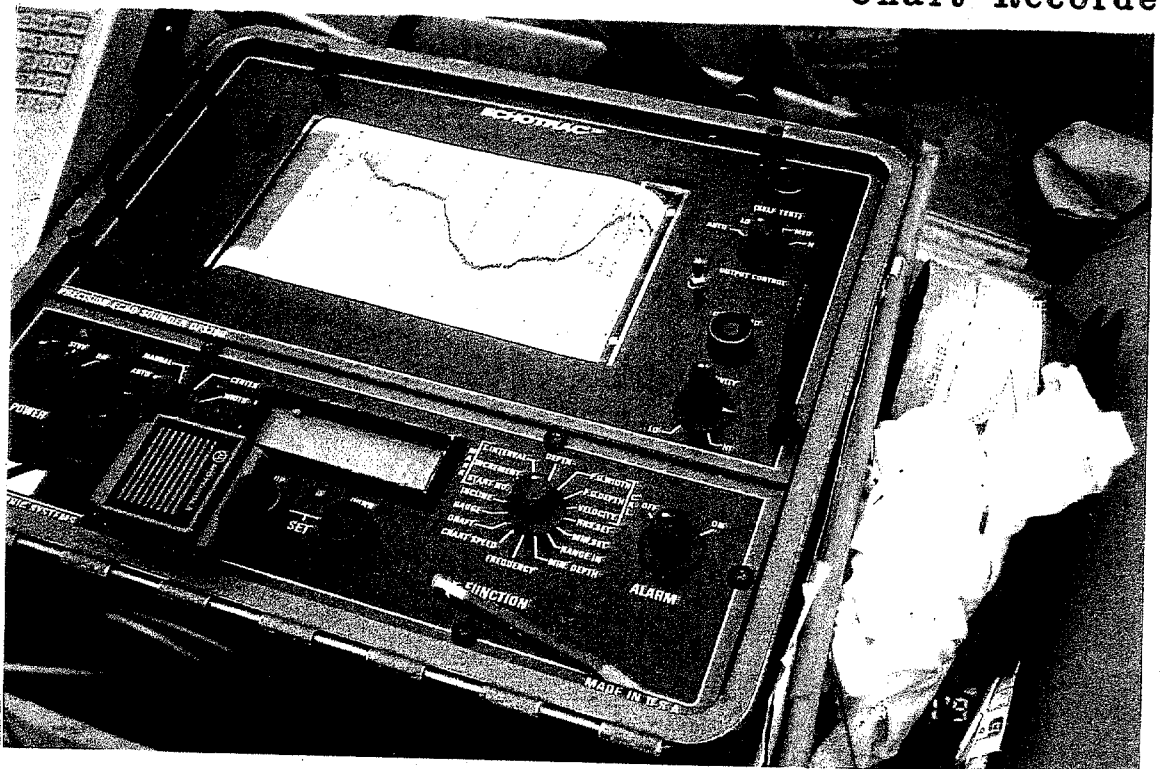


Photo 4
Odom Echotrac
Chart Recorder