

United States
Department of
Agriculture

Soil
Conservation
Service

Northeast NTC
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Subject: Ground-penetrating radar (GPR)
survey of Black Lake, St. Lawrence
County, New York; February 5-10, 1989

Date: March 7, 1989

To: Donald W. Lake, Jr.
State Conservation Engineer
USDA-Soil Conservation Service
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100 S. Clinton Street, Room 771
Syracuse, New York 13260

File code:210-6

Purpose:

To assist St. Lawrence County Soil Conservation District and Clarkson University conduct a GPR sediment survey of Black Lake.

Principal Participants:

Nick Carbone, District Manager, St. Lawrence CO. SCD, Canton, NY
Anthony Collins, Assoc. Prof., Clarkson Univ., Potsdam, NY
James Doolittle, Soil Specialist (GPR), NSC, SCS, Chester, PA
Robert Sinsabaugh, Ass't. Prof., Clarkson Univ., Potsdam, NY
David Sullivan, Geologist, SCS, Syracuse, NY

Activities:

The GPR unit arrived in Ogdensburg, New York, during the afternoon of 5 February. Black Lake was not completely frozen at the time of this survey and numerous, time-consuming corings were made to insure safe ice thicknesses. Falling and blowing snow obliterated many of the observation sites established along transects lines. Ice measurements were made and transect lines established on February 6 to 8. Initial GPR calibrations were conducted on February 7. GPR surveys were conducted on 8 and 9 February, under adverse weather conditions. The GPR unit returned to Chester, PA, on 10 February.

Equipment:

The equipment used was the SIR-System-8 radar. This unit consist of the model 4800 control unit, ADTEK SR-8004H graphic recorder, and the ADTEK DT-6000 tape recorder. In addition, the 120 MHz antenna with the 705DA transceiver was used. The unit was powered by two 12-volt marine batteries and mounted on a John Deere lawn tractor. The scanning time of the control unit was set at 450 nanoseconds, which assuming a dielectric constant of 81 for water, provided a scanning depth of 24.6 feet.

The tape recorder was sensitive to the cold air temperatures and operated intermittently. Use of the tape recorder was discontinued after initial field tests.

Discussion:

Four transects (# 3, 4, 13, & 19) were completed with observation marks at 100 foot intervals. However, falling and blowing snow quickly obliterated observation marks and flags placed on the ice. All other transects were completed without the use of observation marks. The extent of each transect was measured on topographic maps. Uniform speeds of advance were maintained between the end points of each transect. Figure 1 shows the location and direction of advance along each transect line. The length of each transect is listed in Table 1.

TABLE 1

LENGTHS OF TRANSECTS COMPLETED WITH THE GPR
AT BLACK LAKE, NEW YORK
(All lengths in feet)

#	Length	#	Length
1	4200	11	3600
2	3800	12	2800
3	10600	13	4800
4	800	14	9100
5	600	15	4000
6	4700	16	1500
7	600	17	3700
8	1100	18	3000
9	1500	19	8000
10	3700		

Figure 2 is a representative GPR profile from Black Lake. The transect (transect #15) was conducted from Wood Island to the western shore of Black Lake (see Figure 1). The horizontal scale is dependent upon the speed of antenna advance across the ice surface. The horizontal distance is approximately 4000 feet. The vertical scale is dependent upon the velocity of electromagnetic propagation through the various mediums. The velocity is 0.50 ft/ns for ice, 0.11 ft/ns for water, and 0.32 ft/ns for saturated silts. 1.

A rock pinnacle (a) and a bedrock mount (b) can be seen in Figure 2. Features within the mount are clearly evident in this figure. These features represent the contact between bottom sediments and bedrock or firm sediments, and fracture planes or veins of dissimilar materials within the bedrock. The bedrock mount

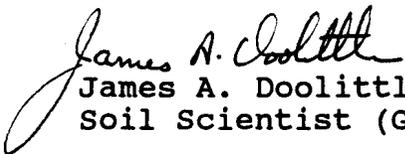
1. Morey, R. M. 1974. Continuous profiling by impulse radar. p. 213-232. In Proc. Engineering Foundation Conference on Subsurface Exploration for Underground Excavations and Heavy Construction, Henniker, NH. 11-16 Aug. 1974. Am. Soc. Civil Eng., New York.

separates two troughs which are being filled with sediments. In Figure 2, the trough on the right has filled more rapidly than the trough on the left. In the center of these troughs, the thickness of these sediments cannot be determined because of excessive background noise and signal attenuation.

Graphic Profiles:

The graphic profiles are being returned to David Sullivan prior to their delivery to Dr. Anthony Collins, Clarkson University. Each transect is identified by a number and a description of the location of their end points. To determine the depth of water at any point on these profiles the following steps should be used: (i) measure the distance between the uppermost black line (see line labeled "00" in Figure 2) and the uppermost line of the bottom sediments using the 20 scale on an engineering ruler; (ii) divide this measurement by 4.890; (iii) the resulting value is the depth in feet. Though slightly more inaccurate (due to variations in the thickness and the speed of the signal through saturated silts), the same procedure could be used to determine the thickness of the bottom sediments.

With kind regards.


James A. Doolittle
Soil Scientist (GPR)

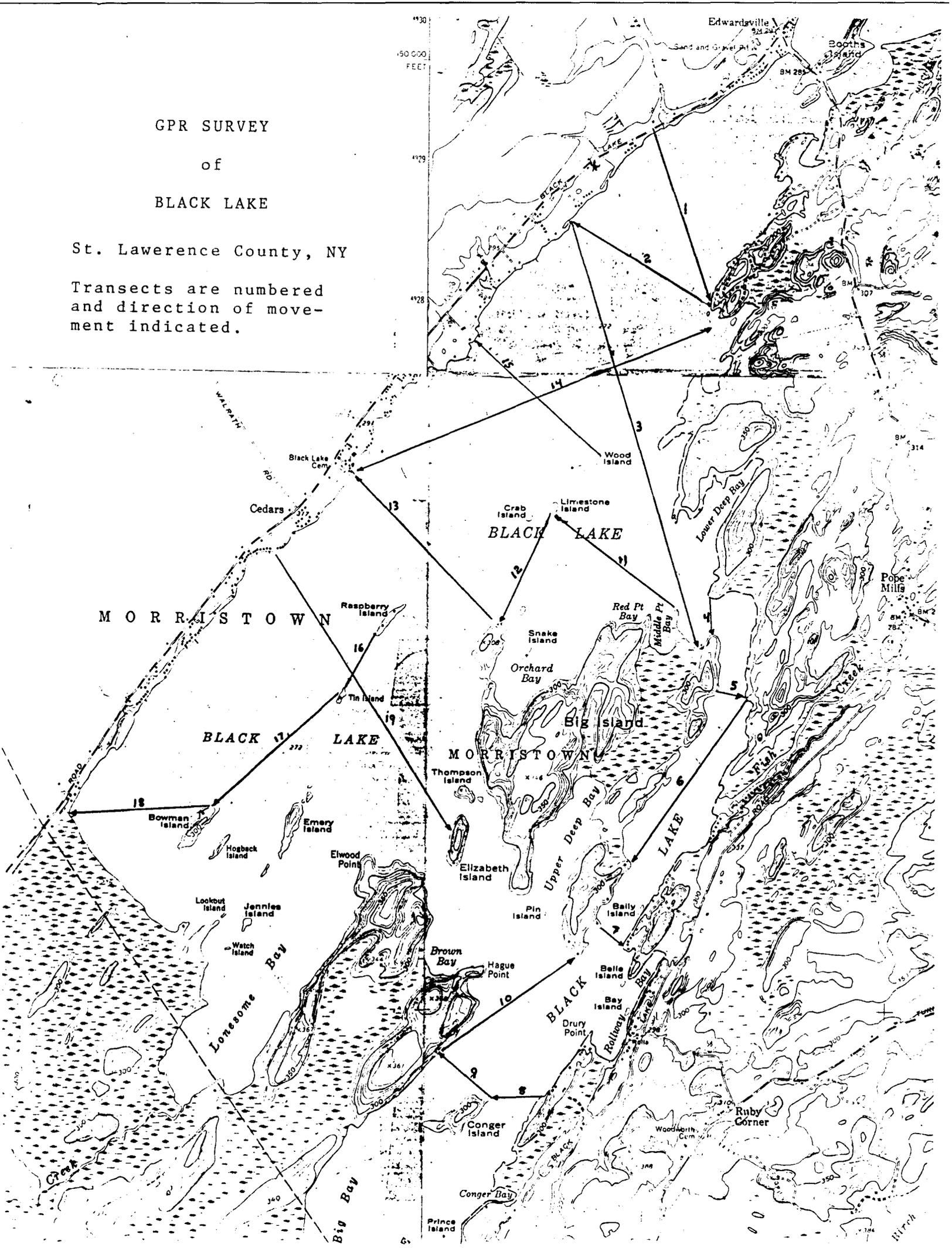
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GPR SURVEY
of
BLACK LAKE

St. Lawrence County, NY

Transects are numbered
and direction of move-
ment indicated.



00 100 200

WATER

b

c

SEDIMENT

200

100

