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DEPARTMENT OF ENVIRONMENT  
INLAND WATERS BRANCH  
WATER SURVEY OF CANADA

DATA GATHERING PROGRAMME  
AT BLACK BROOK AND HOLMES BROOK  
RESEARCH BASINS

APRIL, 1972

DATA GATHERING PROGRAMME AT BLACK BROOK  
AND HOLMES BROOK RESEARCH BASINS

Introduction

Since April, 1971, streamflow and suspended sediment data have been collected by the Water Survey of Canada in support of a soil erosion and water quality study at Black Brook and Holmes Brook, fig. 1 and 2. Meteorological data collection, including rainfall, temperatures and snow accumulations, was begun in September of the same year. The study is being conducted by the Canada Department of Agriculture Research Station in Fredericton.

At the outset of the study programme, it was decided to gather hydrometric and sediment data at three sites and to evaluate these at the end of the first year, namely 1971. This would make it possible to assess the effectiveness of the data collection programme and to recommend changes in sampling for the subsequent years of the study.

In this report prime consideration is given to runoff and sediment data. A brief appraisal of the meteorological data programme is made but little evaluation is possible at this time.

Data Programme 1971

(a) Hydrometrics

Three stream gauging sites were selected - one at the Black Brook Basin and two at the Holmes Brook Basin, fig. 2 and 3. These were officially registered as:

1. Black Brook near St. Andre de Madawaska  
Station No. 1AF-6
2. Upper Holmes Brook near Moose Mountain  
Station No. 1AJ-6
3. Lower Holmes Brook near Holmesville  
Station No. 1AJ-7

The station site descriptions are given in figures 4, 5, and 6.

Daily discharge data were obtained beginning in April based on daily staff gauge readings by Water Survey of Canada, Canada Department of Agriculture and local hired observers. The data in the Holmes Brook Basin is adequate for most periods of the year except for those times when there are sudden changes in water level as for example, runoff peaks. For these portions of the record considerable estimating was required to reconstruct the peak flow hydrographs.

The streamflow data at Black Brook is of inadequate quality throughout most of the 1971 record. This difficulty arose because of inconsistent performance by the local observer. In addition, uncertainty with respect to financial support of the project delayed the construction of planned continuous stream gauging facilities. The difficulty has since been overcome through support by the Water Survey of Canada. This support will make it possible to install continuous recording gauges at Black Brook, Station No. 1AF-6, and Lower Holmes Brook, Station No. 1AJ-7. Unfortunately, budget constraints will make it necessary to continue the staff gauge at Upper Holmes Brook, Station No. 1AJ-6.

The number of staff gauge readings taken during 1971 are given in Table I.

TABLE I  
NUMBER OF STAFF GAUGE READINGS

	<u>JAN.-MARCH</u>	<u>APR.-JUNE</u>	<u>JULY-SEPT.</u>	<u>OCT.-DEC.</u>
Black Brook	-	18	83	0
Upper Holmes Brook	-	59	156	182
Lower Holmes Brook	-	60	157	182

(b) Sediment

(1) Primary Sampling

Primary samples are those which are collected on the main stream at the hydrometric site. Suspended sediment samples were obtained at all three stream gauging stations. The sampling coverage in the Holmes Brook Basin was adequate, but more consistency is required during peak runoff sampling. At such times, the greatest amount of sediment is discharged from the basins and it is most important to sample all peaks on the rising and falling stage. This, it is realized, is not always possible because peaks sometime occur during the night or are of very short duration and thus often are missed even in the daytime. Sampling coverage at Black Brook was very poor for the same reasons given for inadequate hydrometric staff gauge readings. This problem will be overcome in 1972 and subsequent years by installing an automatic sediment sampler at this site.

(2) Secondary Sampling

Secondary sampling is often required because of artificial or natural conditions which create a non-homogeneous sediment yield from a basin. Such samples are referred to as grab samples. There are three sites where grab samples were taken in 1971, one in the Black Brook Basin and two in the Holmes Brook Basin.

(i) Black Brook

The Black Brook stream has one major tributary which diagonally traverses cultivated land. Consequently, its contribution to the sediment yield is very important. The natural regime of this small stream has been distributed by the construction of a small storage pond which is used as water supply for a cottage, fig. 7. To reconstruct the natural sediment yield of this tributary, grab samples were taken at the inflow of the pond as well as the outflow of the pond. It is intended with the aid of these samples to compute the sediment which is trapped, thereby adjusting the total sediment yield from the basin by this amount to obtain a representative value.

(ii) Upper Holmes Brook

The Upper Holmes Brook hydrometric station is at the upstream end of a small pond created by an old breached dam, fig. 6. Suspended sediment samples at this site have been taken to obtain an indication of the sediment yield from the highlands of the Upper Holmes Brook Basin. Grab samples have been taken in the breach of the dam to get an estimate of the amount of sediment that passes the dam which must be included in the sediment yield of the portion of the watershed below the Upper Holmes Brook sub-basin.

(iii) Lower Holmes Brook

A small tributary enters Holmes Brook on the left bank approximately 30 feet above the bridge where the primary sediment samples are taken, fig. 5. Grab samples were taken on this tributary just above the high-water confluence with Holmes Brook. Visual observations have indicated that this tributary has sediment concentrations during peak flows which are greater than those of the main stream at this site.

The close proximity of the confluence of the tributary to the primary sampling site creates some problem with regard to uniformity of concentrations in the mainstream cross-section. Therefore the grab samples from the tributary provide an important means for making adjustments for the total sediment yield computed at the primary site on the bridge. In addition, these grab samples were thought to be useful since this tributary drains about 1.2 square miles which consists of cultivated fields.

Sediment computations from this small drainage area will provide a useful comparison with the sediment yield of the whole Holmes Brook Basin.

The total number of sediment samples taken by local observers are shown in Table II.

TOTAL NUMBER OF SUSPENDED SEDIMENT SAMPLES

STATION	JAN-MAR	APR-JUNE	JULY-SEPT	OCT-DEC
Black Brook	0	17	7	13
Upper Holmes Brook	0	63	58	36
Lower Holmes Brook	0	63	58	44

In addition to the above sampling, a comprehensive bed material survey was made to determine particle size distribution of stream bed material throughout the basins. This will provide valuable information in describing the geomorphology of the two research basins.

(c) Meteorology

Primary and secondary stations were installed in both basins. These two types of stations gather the following type of information.

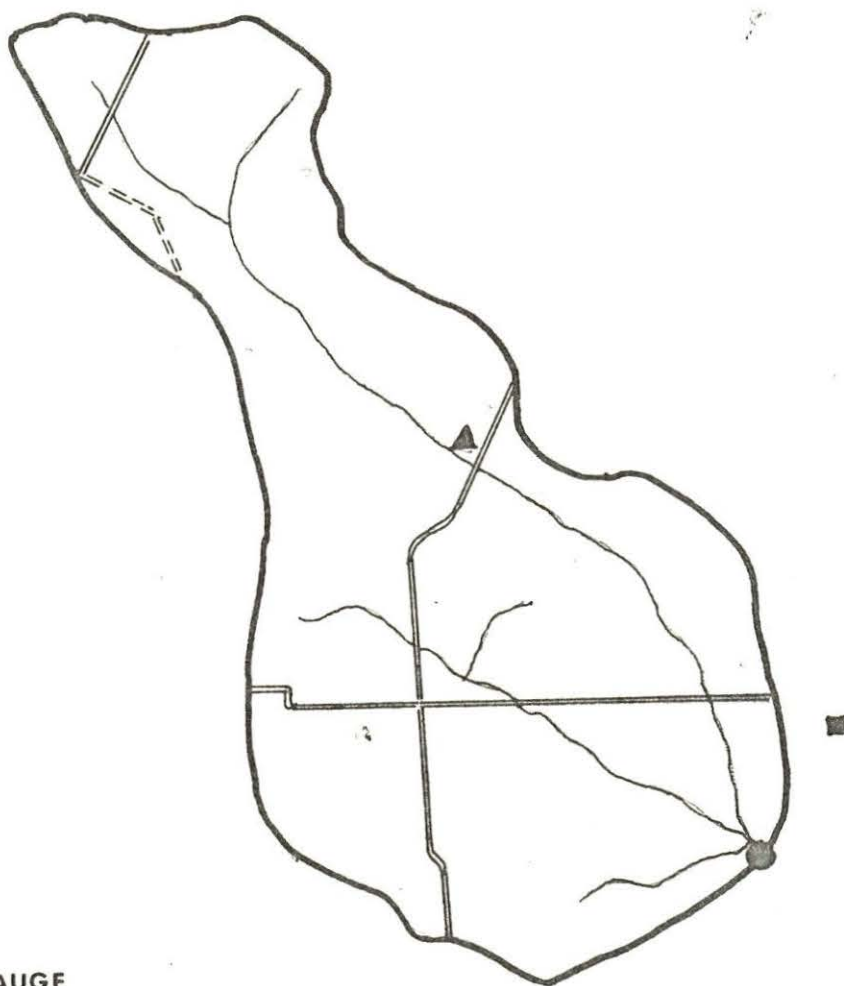
(1) Primary Station

- (i) Hour rainfall (six months)
- (ii) Maximum, minimum, current temperature
- (iii) Cumulative snow storage
- (iv) Daily depth of snow
- (v) Daily rainfall (8" standard gauge, six months)

(2) Secondary Station

- (i) Daily rainfall (8" standard gauge, six months)
- (ii) Daily depth of snow.

The secondary stations are used to adjust data at primary stations for topographic effects. These two types of stations are deployed in the basins as shown in Table III.



- STREAM GAUGE
- ▲ PRIMARY MET. STATION
- SECONDARY MET. STATION

**BLACK BROOK**

**FIG. 2**

TABLE III  
NUMBER AND TYPE OF METEOROLOGICAL STATIONS

	<u>PRIMARY</u>	<u>SECONDARY</u>
Black Brook	1	1
Holmes Brook	1	2

Data Programme 1972

Hydrometrics

The streamflow data will be much improved with the installation of continuous recording facilities at Black Brook, Station 1AF-6, and Lower Holmes Brook, Station 1AJ-7. The recording gauge at Lower Holmes Brook will also serve to improve the streamflow estimates during critical periods at the Upper Holmes Brook staff gauge, Station 1AJ-6.

During this year a temporary water level recorder has been installed just above the inflow to the storage pond on the Black Brook tributary, fig. 7. The gauge is located on the entrance of a 30 inch concrete pipe passing through a farmer's equipment road. Using formulae, the discharge through this pipe can be readily computed to provide the rate of flow into the storage pond.

A staff gauge has also been placed on the upstream face of the storage pond to record the water levels from daily readings. Inflow from a spring on the right edge of the pond makes it necessary to compute the discharge through the two dam overflow spill boxes, fig. 7.

It would be of great help to record the water level of the tributary at Lower Holmes Brook at the timber culvert. As stated earlier, this tributary drains an area of 1.2 square miles being composed almost entirely of cultivated land. It is recommended to have a temporary recorder, such as installed at the pond in the Black Brook Basin, or at least a staff gauge which could be read by a resident living at the site. The discharges from this tributary are required to compute the sediment discharges of the stream into Holmes Brook.

### Sediment

#### (1) Primary Sampling

The major change will be made at Black Brook, where an automatic sediment sampler will be installed in time for the spring freshet. This will reduce the cost of manual sampling and will provide much better coverage throughout the year and particularly for peak flows.

At Lower Holmes Brook it is hoped to obtain a full "depth integrated" sediment sample each time the technician visits the gauge. These measurements will provide a good indication of the distribution of sediment in the cross-section at different levels of flow, thus aiding in the computation of the sediment discharge at this gauge.

There are no changes planned for primary sediment sampling at Upper Holmes Brook. Manual samples by the local observer and Water Survey of Canada will be done with the frequency depending on the time of year and flow of the stream.

(2) Secondary Sampling

Grab sampling will be continued at the same locations as during 1971. However, more attention will be paid to time and frequency. An effort must be made to collect grab samples whenever primary samples are taken. It is important that both types of samples are taken at the same time in order to relate one to the other.

Meteorology

There are no changes planned for the collection of meteorologic data.

Estimated Costs for Data Programme 1972

Hydrometrics

- Gauges

(a) Black Brook Basin:	
Permanent gauge house	1,000.00
Temporary gauge at pond	nil
(b) Holmes Brook Basin:	
Permanent gauge house	750.00
Temporary gauge at tributary	
90 feet above permanent gauge	<u>nil</u>
Gauges	1,950.00

- Observers

(a) Black Brook Basin:	
Permanent stream gauge at \$10 per month	120.00
Temporary stream gauge at \$10 per month for 9 months	90.00
Staff gauge at pond at \$1 per day for 275 days	275.00
(b) Lower Holmes Brook:	
Permanent stream gauge at \$10 per month for 8 months	80.00
Staff readings for January - April	70.00
Temporary stream gauge at tributary at \$10 per month for 8 months	80.00
(c) Upper Holmes Brook:	
Staff gauge at \$1.50 per day	<u>547.00</u>
Observers	1,262.50

Hydrometric Total 3,212.50

Sediment

(1) Primary Samples

Black Brook 50 at \$2.50	125.00
Lower Holmes Brook 200 at \$2.50	500.00
Upper Holmes Brook 200 at \$2.50	<u>500.00</u>

Primary Samples 1,125.00

(2) Secondary Samples

Black Brook:

Inflow to pond 200 at \$2.50	500.00
Outflow of pond 200 at \$2.50	500.00

Lower Holmes Brook:

Tributary 30 feet above gauge 200 at \$2.50	500.00
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Upper Holmes Brook:

Outflow through breach in dam 200 at \$2.50	<u>500.00</u>
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Secondary Samples 2,000.00

Sediment Total 3,125.00

Meteorology

Black Brook Basin

Primary Station

Temperature at \$17 per month	204.00
Standard rain gauge at \$17 per month	204.00
Automatic rain gauge at \$21 per month for six months	126.00
Sacramento gauge at \$17 per month for six months	<u>102.00</u>
	636.00

Secondary Gauge

Standard rain gauge at \$17 per month	204.00
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Holmes Brook Basin

Primary station: same as above	636.00
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Secondary station: two as above at \$204.00	<u>408.00</u>
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Total meteorological cost 1,884.00

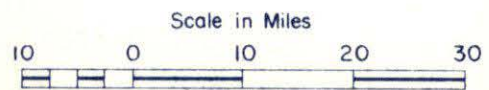
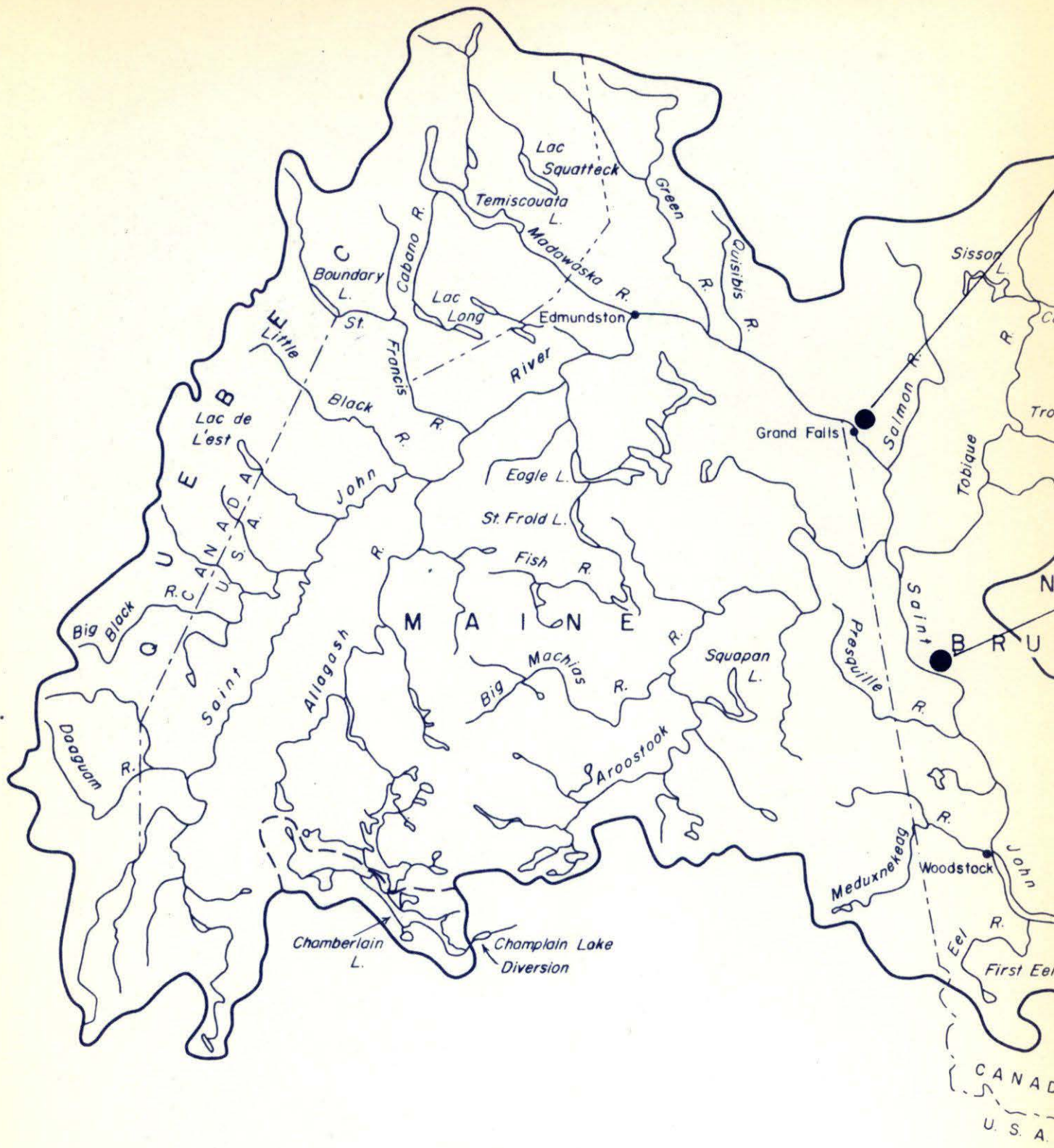
Project Cost for 1972

- Hydrometrics	\$ 3,212.50	
- Sediment	3,125.00	
- Meteorology	<u>1,884.50</u>	
TOTAL		\$ <u>8,221.50</u>

The above costs do not include instrumentation of the gauges. These items are on loan to the project and are returned to Water Survey of Canada's and Department of Atmospheric Environment's stock inventory.

FIGURES

1 TO 7



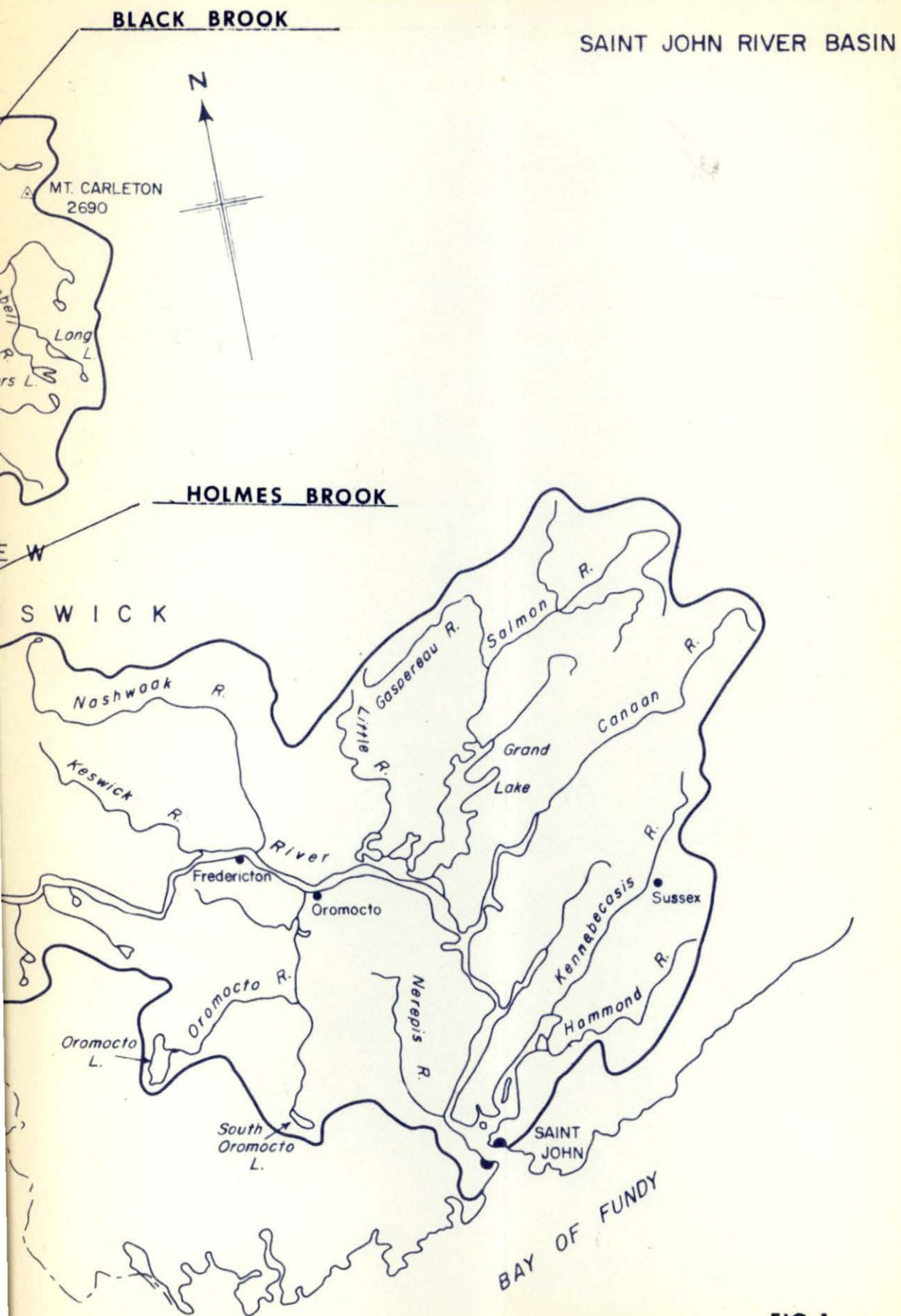
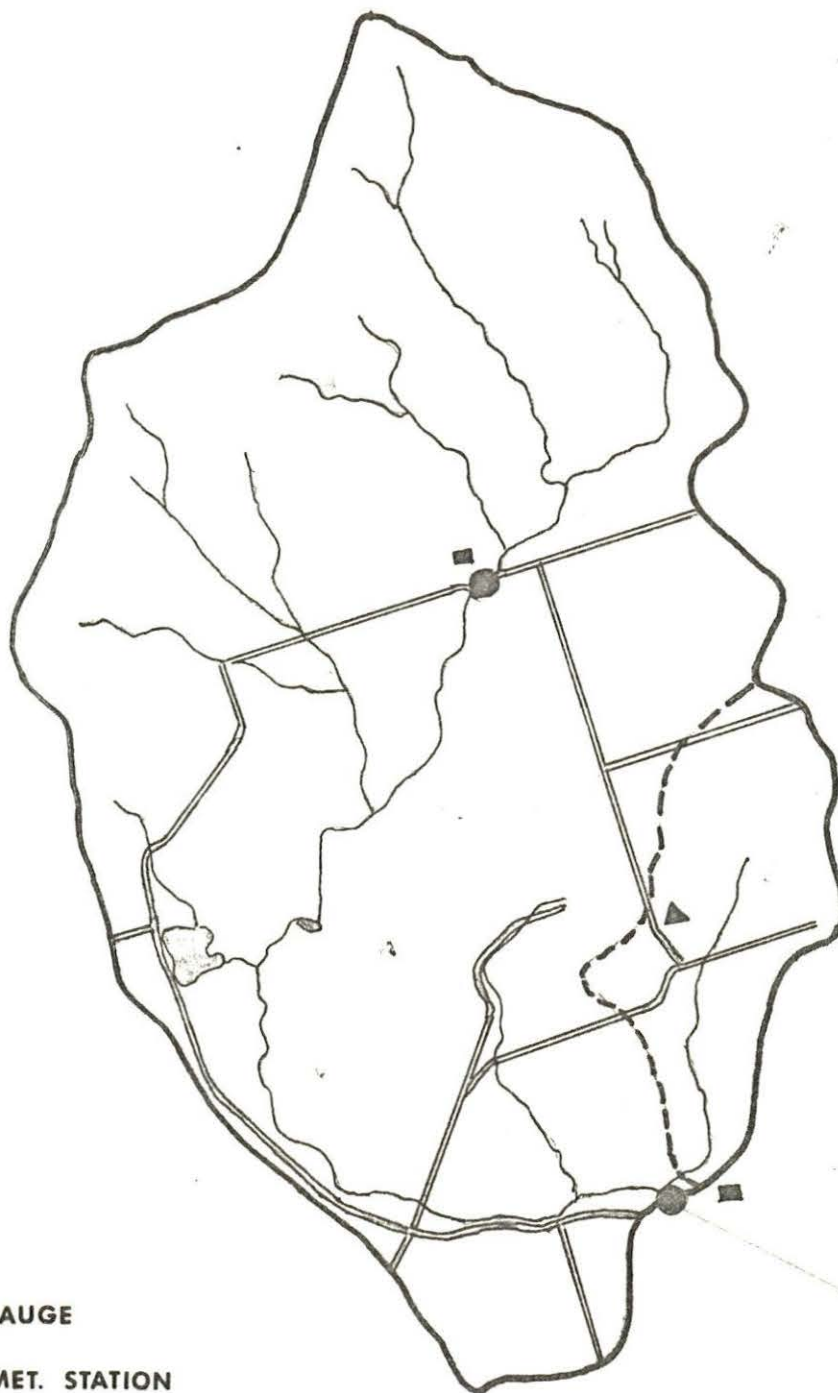


FIG. 1



- STREAM GAUGE
- ▲ PRIMARY MET. STATION
- SECONDARY MET. STATION

## HOLMES BROOK

FIG. 3

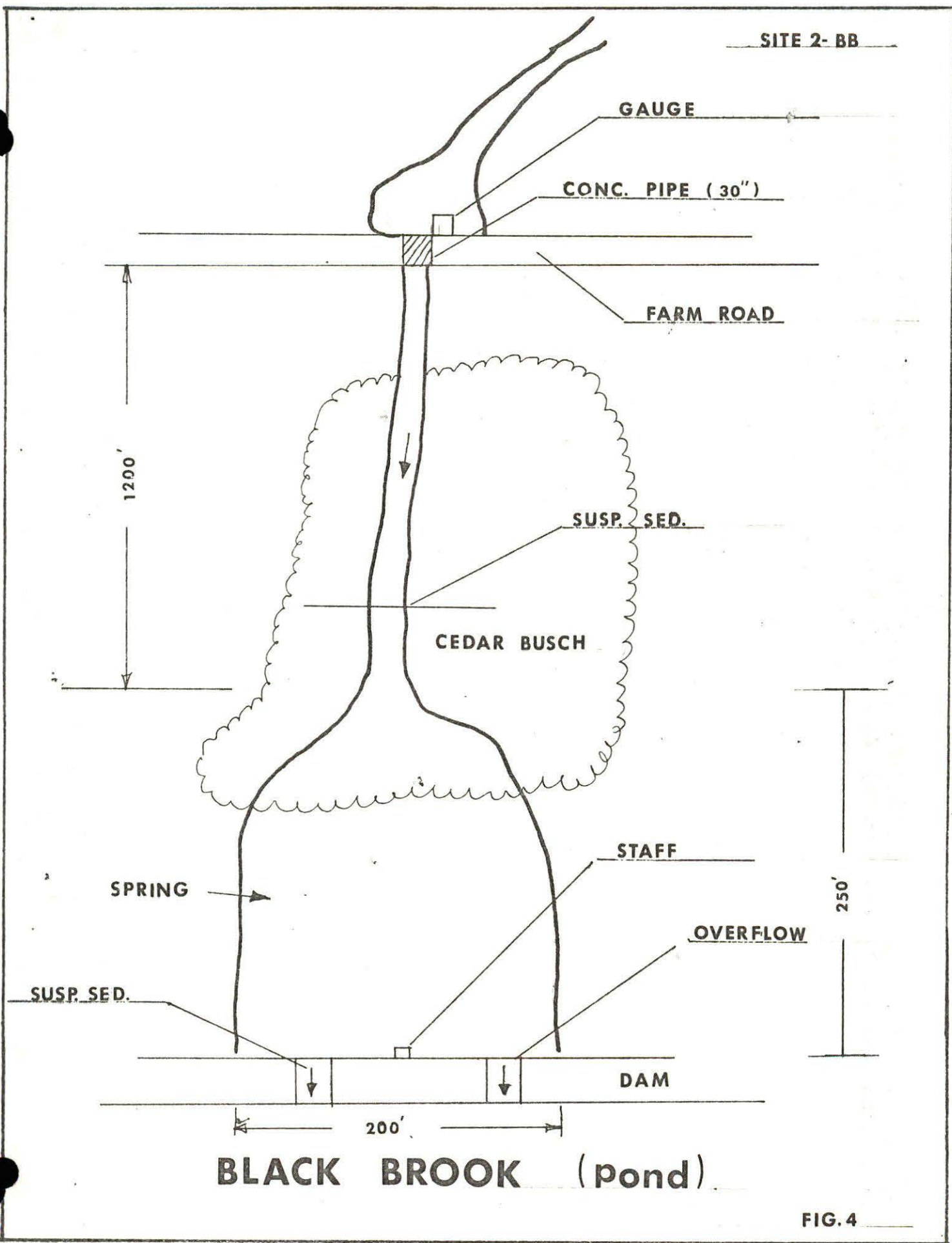
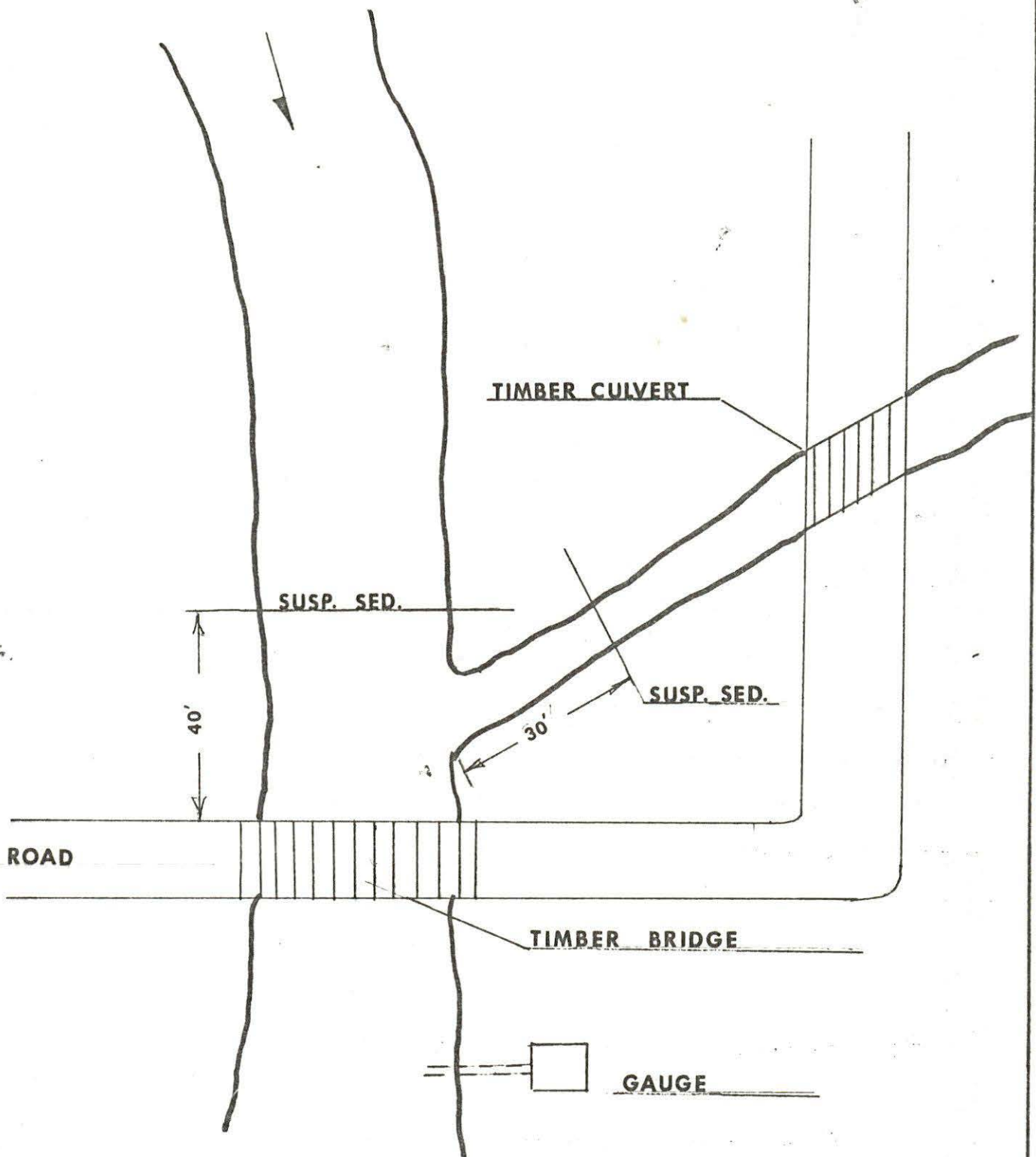
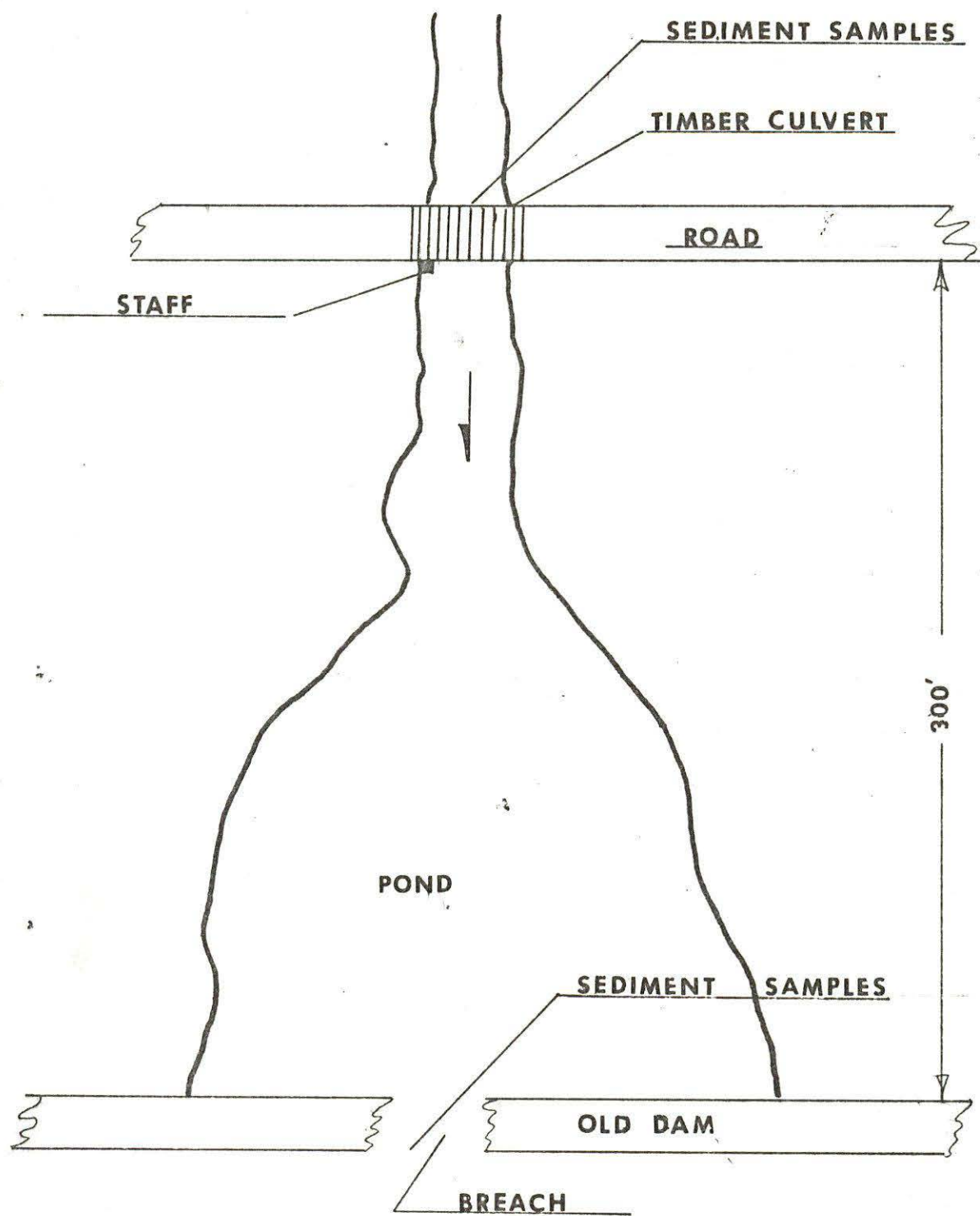


FIG. 4



LOWER HOLMES BROOK 1AJ-7

FIG. 5



UPPER HOLMES BROOK - 1AJ-6

FIG. 6

SITE 1-BB

TIMBER CULVERT

SUSP. SED.

8'x10' GAUGE

EQUIPMENT TRAIL

BLACK BROOK 1AF-6

FIG. 7

