HYDROGEOLOGY OF THE KELLEY RIVER HD BENCHMARK BASIN CUMBERLAND COUNTY NOVA SCOTIA

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ABSTRACT

The bedrock geology of the Kelley River area consists of a series of interbedded siltstones, sandstones and conglomerates. These rocks, of Pennsylvanian Age, form the Cumberland basin which is over 20,000 feet deep. The beds are gently dipping and interrupted by the Athol Syncline which is the major structure in the area. The surficial geology consists mainly of a thin mantle of sandy till which in places reaches a thickness of about 20 feet. Shallow deposits of glaciofluvial sands and gravels are found along the main channel of Kelley River.

Various types of hydrometric and meteorlogical instruments were installed in the watershed during late 1969. The precipitation records to date indicate a considerable variation in values among the sites, which suggests nonuniform precipitation patterns over the area. A mean annual discharge of 57,800 acre-feet was recorded at the hydrometric site. Using the precipitation values of the River Hebert station, this runoff represents about 85% of the mean annual inflow as precipitation to the watershed. The mean unit flow computed over a three year period was 6.5 acre-feet per day per square mile of watershed.

The fluid potential as recorded in the groundwater observation well varies by as much as 195 feet from the discharge to the recharge area of the groundwater flow system. Observation well No. 3 also shows distinct cyclic fluctuations in response to the tidal loading in the Chignecto Bay, about 5 miles away. The mean transmissibility of the rock units penetrated by the observation wells was calculated to be about 780 igpd/ft.

INTRODUCTION

Purpose and Scope of the Investigation

This report briefly describes the geology and hydrology of the Kelley River Basin, the first International Hydrologic Decade (IHD) Benchmark Basin to be instrumented in Nova Scotia. Some of the instrumentation available in the basin is listed and a few samples of data and records are briefly discussed.

General Description of the Area

The Kelley River Basin includes a drainage area of about 24.4 square miles in Cumberland County approximately midway between Parrsboro and Amherst (see Fig. 1). The principal access to the area is provided by the Boars Back Ridge road, south of River Hebert. Most of the watershed area lies within the Chignecto Management Unit which is administered by the Nova Scotia Department of Lands and Forests. A good system of fire and access roads is maintained within the area, allowing relatively easy vehicular travel to most parts of the watershed.

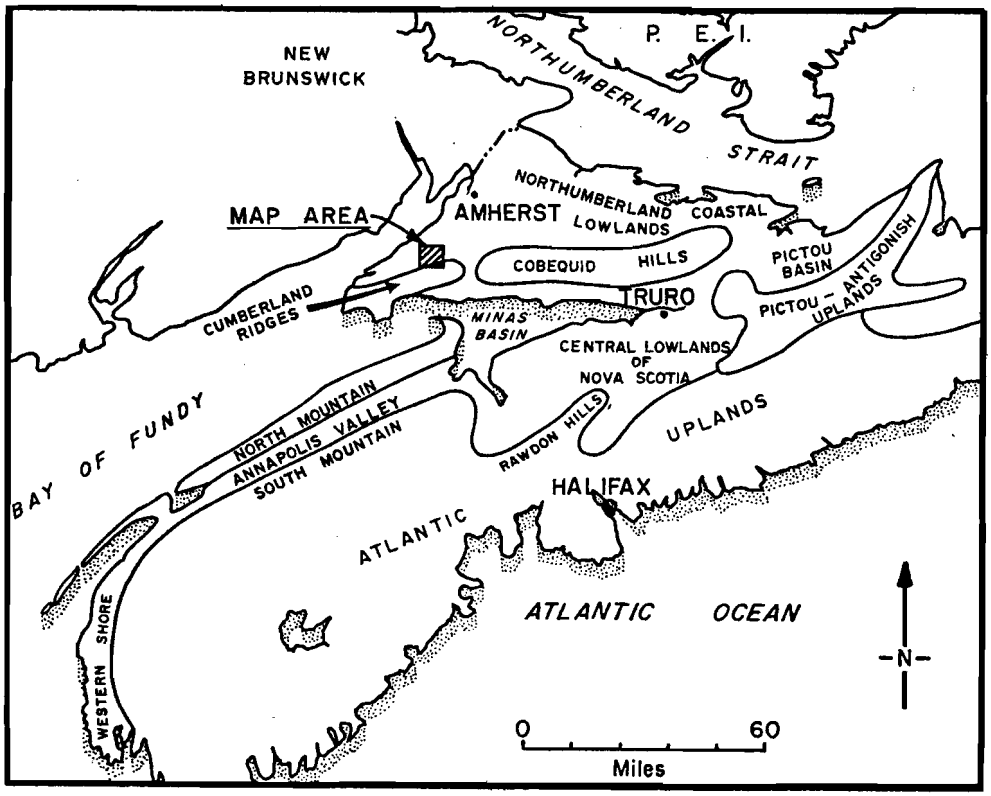


Figure 1. Location of Kelley River and Physiographic Units

Topographic relief in the watershed is nearly 350 feet with the elevation ranging from about 120 feet at the weir site to about 465 feet in the south part of the area. Most of the area is a gently undulating lowland with local relief less than 50 feet. Kelley River is incised in places more than 100 feet below the surface of the adjacent upland.

Soils in the watershed are strongly influenced by the underlying bedrock which consists of mainly sandstones and siltstones. About two-thirds of the area is covered by the Shulie Association of Soils as mapped and described by Whiteside and Smith (1945). These are fairly coarse textured soils developed in glacial till comprised of the weathered underlying Carboniferous sandstones and siltstones. The southern third portion of the watershed is covered with soils of the Southampton Association. These are coarser than the Shulie soils and reflect the underlying lithology of conglomerate and sandstone. The quantity of stone in both these soils limits their agricultural value. Both soils are best suited for supporting forest vegetation and are capable of producing good crops of timber (Whiteside and Smith, 1945).

At least two major fires are reported to have burned over the area. Both fires, one in 1917, the other in 1938, burned out of control with relatively little resistance, partly because of lack of forest fire fighting equipment and the state of fire fighting technology at that time. Consequently, it is considered by foresters that the forest floor and soils may have suffered considerable damage because of these burns. A forest inventory conducted in the Chignecto Management Unit by the Department of Lands and Forests in 1968 indicated that the land can be classified as 46 per cent softwood, 22 per cent hardwood, 21 per cent mixed wood, and 11 per cent nonforested. Plantations of softwood, mainly scotch and red pine, were started after the 1938 fire. Figure 2 is an areal view of the Boars Back Ridge road, center, River Hebert, left, and the Department of Lands and Forests' Headquarters, right.

Climate

Nova Scotia has a humid temperate continental climate, modified by the Atlantic Ocean which almost completely surrounds the province and by the Gulf Stream which runs northeasterly, parallel to the Atlantic Coast. The proximity of the ocean tends to prevent extreme temperatures in the summer and winter and minimizes the number of severe atmospheric storms (N. S. Department of Trade and Industry, 1965).

The nearest long-term climatic records are those for the Parrsboro and Nappan stations. The 30-year mean annual precipitation at Parrsboro, about 13

Figure 2. Areal View of Entrance to Chignecto Game Management Unit (View South).

miles southeast of the watershed, is 47.02 inches. Total snow fall for the winter months averages 67.7 inches. Precipitation is fairly well distributed during the year with slightly higher precipitation occurring during the fall and winter months than during the spring and summer months. The lowest mean monthly precipitation of 2.74 inches is for July. The highest value of 4.78 inches occur for December. At Nappan, about 18 miles northeast, the 30-year mean annual precipitation is only 40.87 inches. This indicates a difference in precipitation of over 15 per cent for an area with a radius of only about 30 miles.

The mean annual temperature at Parrsboro is 42.6°F; the mean temperature of the coldest month (January) is 21.0°F, and of the warmest month (July), 63.5°F. The average frost-free period in the Chignecto area is 120 days (Chapman and Brown, 1966).

The meteorological instruments in the Kelley River basin installed in November, 1969, include the rain gauge and Stevenson screen at River Hebert. This site is at the entrance to the sanctuary about 5 miles east of the hydrometric station. Table I summarizes the total annual precipitation and temperature data at the stations during the years 1970, 1971 and 1972.

TABLE I. SUMMARY OF ANNUAL PRECIPITATION AND TEMPERATURE AT SITES NEAR KELLEY RIVER

YEAR		PARRSBORO	NAPPAN	RIVER HEBERT
1970	°F	41.1	41.6	40.8
	Inches	47.82	45.53	47.67
1971	°F	41.3	42.4	
	Inches	47.22	40.20	48.68
1972	°F	40.0	40.2	
	Inches	57.72	56.29	59.92

It is interesting to note that there is a significant variation in the amounts of precipitation among the three sites, and that the values for Nappan are consistently low. Using the values obtained at the River Hebert site and applying them to the watershed area gives a mean annual inflow to the system of about 6.78×10^4 acre-feet.

TABLE II. SUMMARY OF ANNUAL PRECIPITATION AT SITES WITHIN THE KELLEY RIVER WATERSHED

SITE NO.	1970	1971	1972
2	44.8	45.1	46.6
3	42.8	43.6	42.2
4	45.5	48.7	60.0

Table II summarizes the annual precipitation data of the sites within the watershed where the spacing is much closer. A significant difference in the values is evident especially between site No. 4 and the other two.

Previous Investigations

The earliest recorded geological mapping of the Chignecto area is that of Fletcher (1905). This was published by the Geological Survey of Canada as Sheet No. 82, scale 1 inch to 1 mile. Later geological work by F. A. Kerr (1924), I. W. Jones (1928), W. A. Bell (1935), W. S. Shaw (1949 & 1950), and W. J. Copeland (1953) was published in map form by the G.S.C. in 1959. These maps show the areal extent of various bedrock types, describe the lithology, and show some structure and mineralized sites.

Some observations of the glacial features of Nova Scotia were made by Dawson (1893). Galdthwaits' (1924) description of the physiography of Nova Scotia includes discussions of geomorphic evolution and effects of glaciation in Nova Scotia.

The soils of the area were mapped, described and classified by Wickland and Smith (1945).

Field Work and Maps

Field work began in the watershed during 1969 when the various government agencies carried out reconnaissance surveys to determine location of the instrument sites. The program is under the chairmanship of the District Engineer of the Water Survey of Canada, which is also the co-ordinating agency.

Meteorological instrumentation consisting of two sacremento storage gauges, a standard rain gauge, a Stevenson screen, a hydrothermograph, an anemometer and a Fischer-Price recording precipitation gauge were installed in the basin during November, 1969. This instrumentation has been distributed among four separate sites which are located in the accompanying map.

Three exploratory test holes were drilled in the basin in December, 1971, to sample the bedrock units and aid in mapping the geology and determining the hydrologic characteristics of the water-bearing zones. Six-inch diameter casing was installed in each, and pumping tests were conducted on two of these wells. Stevens Type A-35 water level recorders were installed in July, 1972, in all three wells and the groundwater fluctuations are being continuously monitored.

Acknowledgements

The writer is indebted to all agencies participating in the program for co-operation and assistance in obtaining the necessary data. Special mention is given to Mr. John Peters who ably co-ordinated all these agencies and directed the program through its initial and development stages.

GEOLOGY

ROCK UNITS

Cumberland Group

The Cumberland Group underlies the entire watershed area, but is exposed mainly along Kelley River and its principal tributaries. These rocks are sediments of Pennsylvanian Age and form the Cumberland sedimentary basin in that part of the province. The rock types within the watershed are mainly conglomerates, sandstones and shales. About 10 miles north of the watershed the basin depth is estimated to be greater than 20,000 feet. Directly beneath the northern portion of the watershed, the depth of these sediments is in the order of about 10,000 feet. Table III shows a generalized section of the column of sediments under the northeast part of the watershed. The sediments are generally flat or gently dipping at this site. The upper surface of the pre-carboniferous slopes northward, resulting in a thickening sediment mass in that direction. Consequently, older sediments of the Canso, Windsor and Horton Groups occur under the central portion of the basin. In the south portion of the watershed, the underlying thickness of sediments is in the order of 3,000 feet.

"The map-area occupies part of the Cumberland basin of deposition which is believed to have persisted throughout Carboniferous time. Its main outlines were determined by the positions of the rising Caledonian land mass in southern New Brunswick and the Cobequid land mass of northern Nova Scotia. The axis of strongest subsidence trended roughly northeasterly through the present site of Amherst, a few miles north of the map area. The map-area, therefore, lies on the southern flank of the subsiding Carboniferous basin, with its northwest corner projecting into the axial region of the basin." (Shaw, 1950.)

"The Cumberland Group, containing important coal deposits, consist of a flat wedge of fine, dominantly grey, coal-bearing, clastic sedimentary beds, enclosed by coarser, barren strata that are partly contemporaneous with it. The wedge has its edge lying along the cobequid positive axis and thickens northward. Its regularity is broken on the eastern extremity in an area immediately north of Springhill that was structurally active during deposition." (Shaw, 1950.)

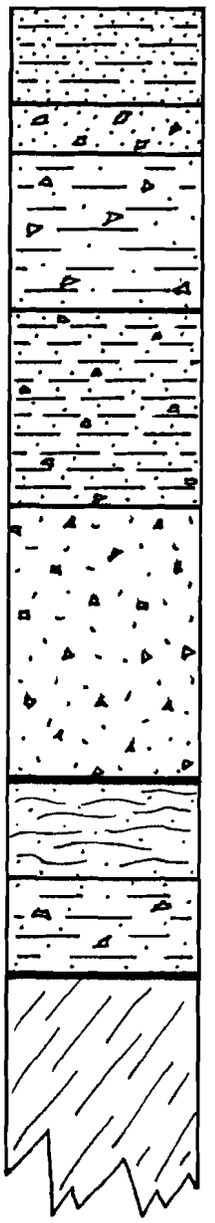
Two deep bore holes were drilled about 8 miles east of the watershed on strike with the bedding in the south portion of the area. These holes, located at Newville and Pettigrew Settlement, were drilled to depths of 2484 and 2518 respectively, in search of coal seams in 1906-1908. Neither hole penetrated the entire depth of sediments in the basin, both bottomed in conglomerates and sandstones belonging to the lower Cumberland Group.

TABLE III. GENERALIZED SECTION TAKEN NEAR NE CORNER OF WATERSHED AT ELM BROOK
(After W. S. Shaw, 1950)

Carboniferous

Pennsylvanian

Cumberland Group

DEPTH (ft.)		
1000		Sandstones and siltstones.
1500		Conglomerates and sandstones.
3150		Shales, sandstones and conglomerates.
5150		Shales and sandstones; coal.
8000		Conglomerate and sandstones.
		Riversdale Group
9000		Boss Point Formation. Sandstones and shales.
10000		Claremont Formation. Conglomerates, sandstones and shales.
		Precarboniferous
		Metamorphosed sedimentary and volcanic rocks; intrusive rocks.

SURFICIAL DEPOSITS

Glacial Till

The surficial deposits over most of the watershed is glacial till. Its thickness varies from 0 to 20 or more feet and its composition depends to a large degree on the nature of the underlying bedrock.

Till overlying the shales and siltstones reflect their composition and usually are cohesive and compact. In the field, these tills have been classed as clay till. Very little of the area is underlain by clay till, and that was on the east side. In the north half of the watershed, the tills were of a fine nature, reflecting the underlying siltstones and sandstones. The southern half of the watershed is covered with mainly sandy and gravelly tills, reflecting the underlying sandstones and conglomerates. In many areas the till is composed of a large fraction of bedrock particles, such as chips of sandstone. All of the gravelly and clay till areas were found to be small and isolated, therefore, the till cover shown on the map is all sandy till.

Glaciofluvial Deposits

Glaciofluvial deposits are found mainly along the Kelley River system. They consist of mostly kames (hills of stratified sand and gravel formed in contact with wasting ice) and terraces (also of sand and gravel). A few very small and isolated deposits of questionable stratified materials were found in the flanks of the Kelley River Valley. However, these were considered to be of insignificance for mapping purposes. The materials comprising the kames and terraces was found to be mainly fine to medium sands, with a small percentage of gravel. The gravel size materials that were found consisted of weathered pieces of sandstones and siltstones, and were not resistant enough to be of any commercial or industrial value.

Stream Alluvium

Most of the Kelley River channel is V-shaped and contains no flood plain. There are however, a few areas where small flood plains have formed in places where the valley widens.

Peat and Muck

Peat and muck have accumulated in several depressional areas throughout the watershed. The largest area of these deposits is in the north portion of the watershed.

STRUCTURE

The main structural feature in the Kelley River watershed is the Athol Syncline. The synclinal axis of this structure trends northeasterly and passes through the central portion of the watershed. Two sets of joints were noted in the sandstones. One set strikes perpendicular to the synclinal axis and dips between 70-90°, the other is parallel to the axis and varies in dip more in both directions. No large faults are recorded nor none found in the watershed. Minor faults, however, were observed off-setting beds, in the order of inches, at a few outcrops.

HYDROLOGY

Drainage

Surface drainage is good along the main channel of Kelley River and on the steeper slopes. On the relatively flat upland areas, however, surface drainage is poorly defined and shallow boggy areas are common. This is particularly so in the north portion of the watershed where numerous boggy areas are found along that tributary. Also, in the south portion at Tipping Meadows, several bogs have formed along that drainage system.

Stream Flow

Records of stream flow measurements have been collected by the Water Survey of Canada since December, 1969, at the hydrometric station established at 8-Mile Ford. These flows are being measured by recording the river stage and entering the recorded value in a stage-discharge rating curve. Stream flow in this area has two basic components: direct runoff and baseflow. Because this stream is below the water table, it continuously recieves groundwater flow, that is, it is effluent. It is also suggested that because of the thin till cover and relatively high permeability of the bedrock units that baseflow will be quite a significant part of flow for this stream.

Figure 3 shows a low altitude air photo of the hydrometric site, with Kelley River on the extreme right. The recorder building for the site and observation wells 1 and 2 can be seen in the photo.

Figure 3. Areal View of Hydrometric Site (View North).

The stream flow records for the years 1970, 1971 and 1972 indicate that flow conditions varied widely. A maximum mean dialy discharge during this period of 1650 cfs was recorded on May 4, 1972. While on January 27, 1970, a minimum mean daily discharge of 0.71 cfs was recorded. The mean daily rate of discharge over this three year period was also found to be about 80 cfs.

Table IV summarizes the monthly flow data for this station for the years 1970, 1971 and 1972. It is interesting to note the increase in stream flow with increasing precipitation. Also, both the runoff-rainfall ratio and the unit flow values increase with precipitation. The mean annual discharge of 57,800 acre-feet represents about 85% of the mean annual inflow into the watershed as precipitation.

TABLE IV. SUMMARY OF STREAM FLOW DATA AT KELLEY RIVER. DISCHARGE IN ACRE-FEET

MONTH	1970	1971	1972
January	761	1960	5970
February	2990	8980	2270
March	6360	4010	2950
April	10400	11000	12200
May	4350	6160	22700
June	2090	1340	3420
July	2720	319	2060
August	1640	3940	1630
September	2160	1090	579
October	4840	1560	6470
November	4200	3510	12000
December	3630	5350	5840
Total	46100	49200	78100
Mean flow	63.8 cfs	68.0 cfs	107 cfs
Precipitation	47.67"	48.68"	59.92"
Runoff/Rainfall ratio	39.8	41.4	53.4 Ac-ft/mi^2/in.
Unit flow Ac-ft/day/sq. mi.	5.2	5.5	8.8

Groundwater Fluctuations

Three observation wells were equipped with automatic water level recorders in July, 1972. Two of these wells (No. 1 and No. 2) were drilled in the discharge part of the groundwater flow system, while the third well (No. 3) was drilled in a recharge area. Table V summarizes the water level data recorded in

TABLE V. SUMMARY OF GROUNDWATER HYDROGRAPH DATA. MEAN DEPTH TO WATER IN FEET

MONTH '72	WELL #1	WELL #2	WELL #3
August	3.50	4.35	57.13
September	3.75	5.77	58.80
October	4.30	4.38	59.73
November	4.16	3.72	59.31
December	4.37	3.69	58.98
Min. Daily Water Level	2.10 Nov. 10	3.34 Nov. 10	56.67 Aug. 1
Max. Daily Water Level	4.92 Oct. 28	6.01 Sept. 26	59.98 Oct. 11
Mean Elevation in Feet above Mean Sea Level	129.45	143.54	325.46

these wells. It is interesting to note the difference in fluid potential between observation wells No. 1 and No. 3 which are about 3100 feet apart. The fluid potential in observation hole #1 is about 130 feet, while that of observation well #3 is over 325 feet, a difference of 195 feet. Figure 4 shows the well spacing, geology and framework of the groundwater flow system for the west side of the basin. This section views north and is taken more or less parallel to the strike of the beds in that area. Bearing in mind that the dip is relatively shallow southward at this site, and the character of the interbedded sandstones and shales, a fairly well confined groundwater flow system can be defined.

Figure 5 shows portions of hydrographs taken from each of the three wells during the first few days of August, 1973. Several interesting observations can be made from these data. All three graphs are at the same horizontal and vertical scale. The response of the three different wells to the precipitation shown varies considerably and also decreases from the discharge area towards the recharge area. In response to the 2.60 inches of precipitation during the first 3 days of August, observation well No. 1 peaked at 1.79 feet above the antecedent stage. Also, observation well No. 2 peaked at only 0.40 feet while well No. 3 showed an insignificant response.

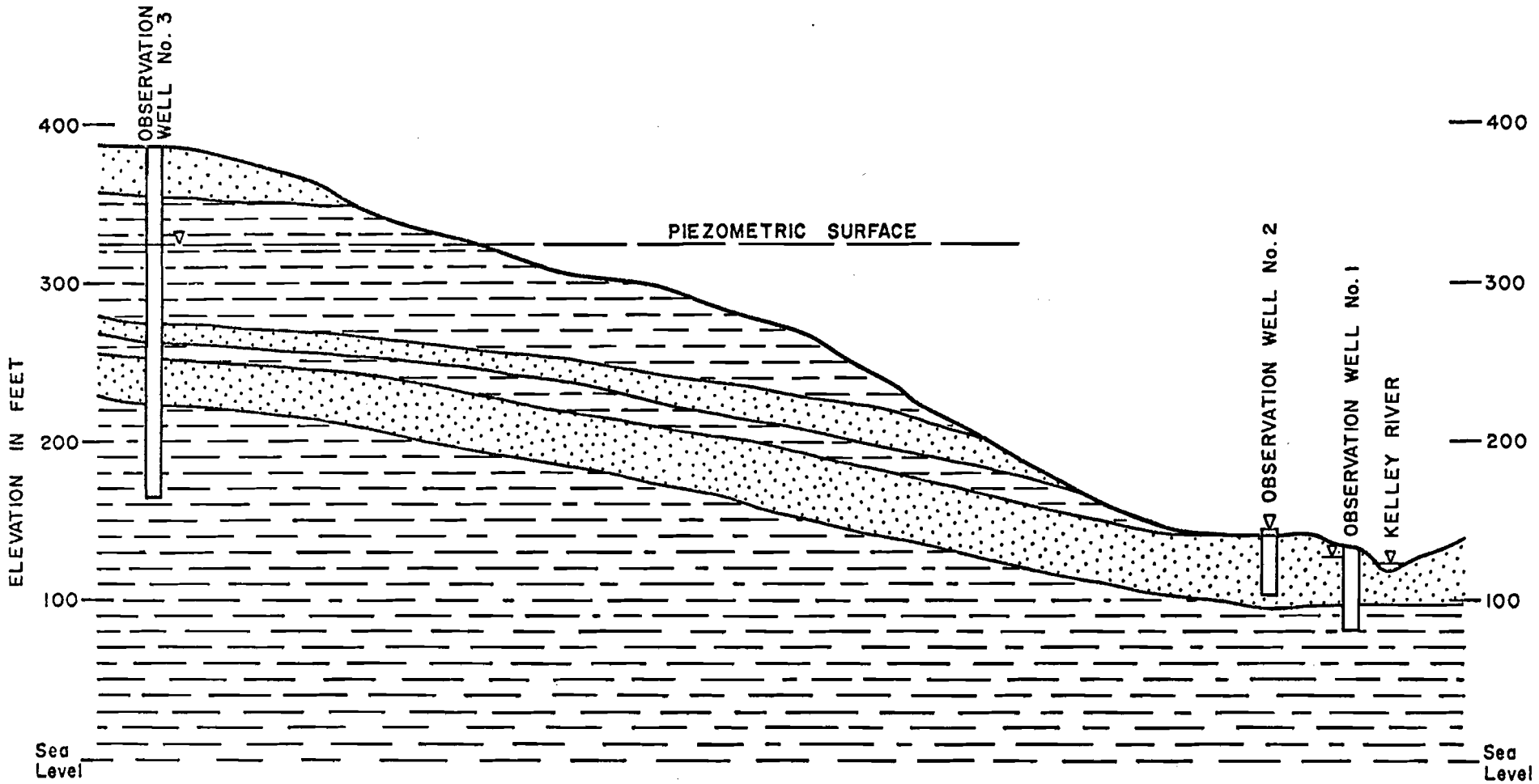


Fig. 4 - CROSS SECTION THROUGH OBSERVATION WELLS - VIEW NORTH

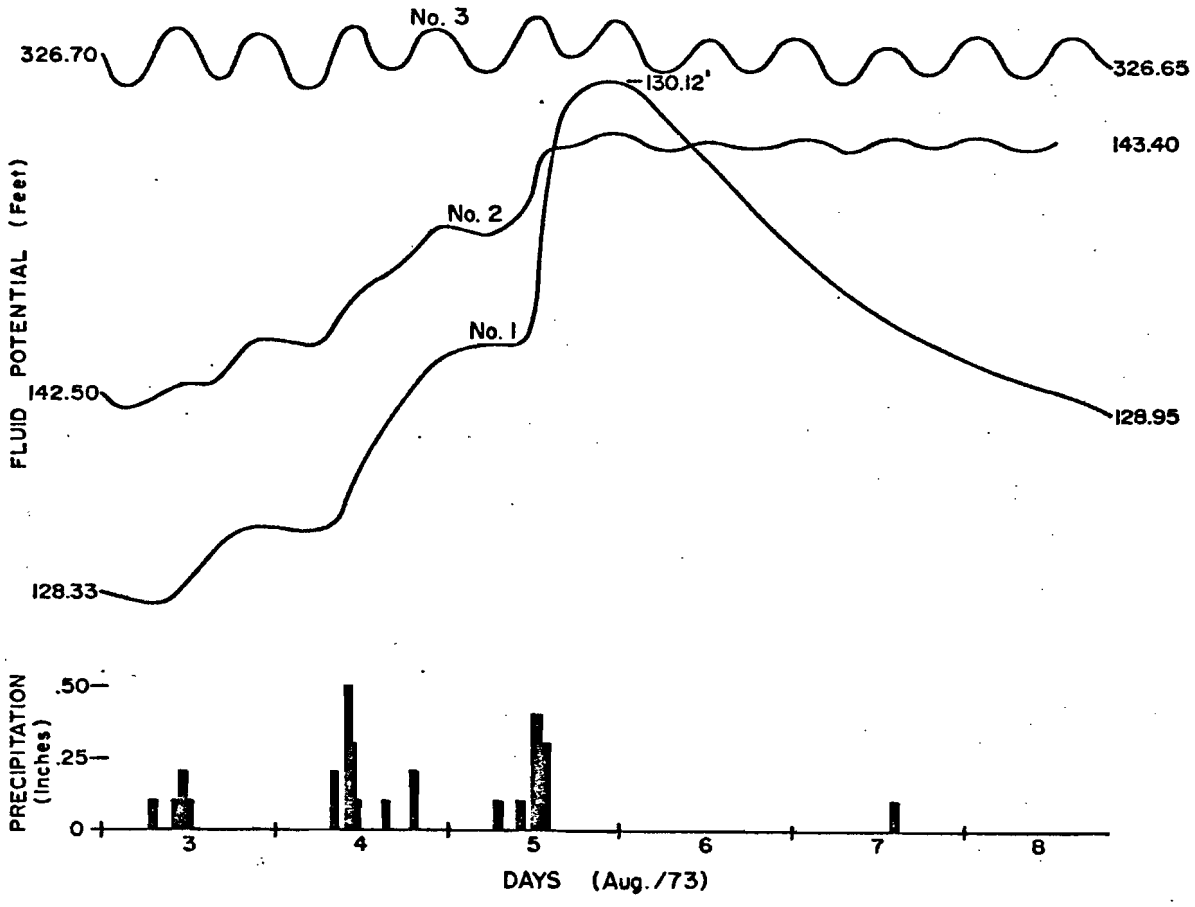


Figure 5. Hydrographs Showing Varying Responses to Recharge in the Three Observation Wells.

The hydrograph from well No. 3 shown in Fig. 5 shows regular and cyclic fluctuations which are the result of tidal loading effects in the Chignecto Bay. The fluctuations vary in both amplitude and cycle with the tides in that area. This well is located about 5 miles southeast of Chignecto Bay where the tidal range is over 40 feet.

Hydrologic Characteristics

A seventy-two hour pumping test was carried out on both observation well 1 and 3 at pumping rates of 15 and 30 igpm, respectively. These data are summarized in Table VI.

TABLE VI. SUMMARY OF PUMPING TEST DATA

Source	Pumping Rate	Amount of Drawdown After 72 Hours (ft.)	Average Transmissibility (igpd/ft)	Average Safe Yield for 20 Years (igpm)
Obs. Well #1	15	13	755	13.2
Obs. Well #3	30	40	805	66

During the pumping of Well #1, recharge boundary conditions influenced the data after about six hours of pumping. From the semi-log plot of the drawdown versus time curve, a mean T value of 755 igpd/ft was estimated for the water bearing zones penetrated by the well. Using a total available drawdown of 35 feet and the above T value, the safe 20-year yield of this well is about 13 igpm or 18,700 igpd.

Pumping Well No. 3 at 30 igpm resulted in a drawdown of 40 feet at the end of the test period. A well defined negative boundary influenced the drawdown in the well after about 20 hours. From the semi-log plots of both the drawdown and recovery data, a mean T value of 805 igpd/ft was estimated. Based on this T value and a total available drawdown of 150, a yield of about 66 igpm or 95,000 igpd could be expected from this well over a 20-year pumping period.

Water Quality

A water sampling station has been established at the weir site where samples are being collected for both chemical and suspended sediment analyses.

Table VII summarizes the chemical data for the samples which are collected on a monthly basis. All analyses are done in the Water Quality Branch Laboratory in Moncton where the results are stored on the NAQUADAT data storage and retrieval system. Provisions have been made in this program to complete up to 56 individual analyses on each sample.

TABLE VII. CHEMICAL ANALYSES OF SAMPLES COLLECTED AT KELLEY RIVER HYDROMETRIC SITE

NAQUADAT NO. 00NS01DK0001

Date	S. C.	TDS	pH	HCO_3	Ca	Cl	Na	Fe
12.5.70	480		4.0		1.0	2.9	2.5	0.37
15.6.70	27	15	5.7	5	1.0	3.4	3.1	0.32
9.11.70	22	12	5.3		0.9	3.6	2.2	0.44
18.1.71	27	13	5.8		1.1	2.5	2.9	0.29
18.3.71	20		4.2		0.6	2.3	1.7	0.22
13.4.71	17	8	4.9	0	0.8	1.7	1.1	0.14
10.5.71	17	9	5.8	3	0.7	2.1	1.9	0.23
3.6.71								
14.6.71	21	11	6.4	4	0.7	3.0	2.8	0.38
12.7.71	30	19	6.7	9	1.1	4.8	4.8	0.35
10.8.71	41	20	6.6	8	1.2	5.2	4.8	0.39
12.8.71	110		6.4					
15.9.71	25	13	5.7	4	1.1	3.7	3.0	0.56
15.11.71	29	15	5.5	2	1.1	4.6	3.0	0.30
15.12.71	30	13	4.9	1	1.4	3.7	2.2	0.29
18.1.72	24	10	5.1	1	0.7	2.7	2.0	0.24
21.2.72	36	17	6.7	3	1.1	4.9	3.6	0.17
20.3.72	19	10	5.3	1	0.8	2.3	1.6	0.12
18.4.72	21	11	5.5	2	0.9	2.9	2.0	0.20
23.5.72	17	10	5.3	3	0.6	2.0	1.6	0.24
19.6.72	20	10	6.0	4	0.7	2.4	2.4	0.27
19.7.72	27	15	6.3	6	0.9	3.4	3.7	0.24
21.8.72	29	13	6.1	6	0.8	3.4	3.3	0.04
18.9.72	30	16	6.3	6	1.2	4.0	3.7	0.29
23.10.72	22	11	5.4	1	0.9	3.5	2.4	0.49
21.11.72	22	16	5.1	2	0.7	8.0	1.8	0.09
18.12.72	23	11	6.6	0	0.8	3.5	2.4	0.15

TABLE VII CONTINUED

Date	S. C.	TDS	pH	HCO_3	Ca	Cl	Na	Fe
15.1.73	23	12	6.4	2	0.8	3.3	2.4	0.12
13.2.73	24	11	4.9	1	0.7	2.8	2.3	0.29
20.3.73	296	148	7.7	129	46.0	10.0	3.0	
10.4.73	22	9	4.8	0	0.7	2.1	1.6	0.14
7.5.73	21	10	5.0	5	0.6	2.0	2.0	0.24
11.6.73	23	13	5.8	4	0.7	1.7	2.8	0.44
9.7.73					0.8	3.0	2.0	0.52

Samples are collected at the same site daily for analysis of suspended sediment. These data are reported in mg/l and together with daily discharge in tons per day. Table VIII summarizes the suspended sediment data for 1971. It is interesting to note that the daily sediment load varied from 0.01 to 16.7 tons per day. Also, the total suspended sediment load carried past the weir site during 1971 totalled 276.8 tons.

TABLE VIII. SUMMARY OF SUSPENDED SEDIMENT LOADS, KELLEY RIVER 1971

	Discharge (cfs)	Sediment (tons/day)	Date
Max. Daily	413	16.7	April 15
Min. Daily	2.8	0.01	July 27
Max. Mean Monthly	184	2.3	April
Min. Mean Monthly	5.2	0.02	July

Two samples were collected from each of the three observation wells. A Kemeer sampling tube was used in each case to sample the wells at various depths.

Table IX summarizes the results of this sampling program. It is interesting to note the change in iron values with depth in all three wells. In Well No. 2, for example, the iron value increases over 60% from a depth of 26 to 37 feet.

TABLE IX. CHEMICAL ANALYSES OF SAMPLES COLLECTED FROM OBSERVATION WELLS

Source and Date	Depth (ft.)	S.C.	Total Dissolved Solids (ppm)	pH	Alkalinity (m.o.) (ppm)	Ca (ppm)	Cl (ppm)	Na (ppm)	Fe (ppm)
Well #1									
13/6/72	35	41	267	7.8	102	16.8	74	75	12
23/6/72	20	41	275	7.9	103	17.5	76	78	13.5
Well #2									
22/6/72	26	25	175	8.0	119	19.4	15	40	6.4
22/6/72	37	26.5	180	8.0	121	19.7	15	41	10.5
Well #3									
13/6/72	105	27	194	7.9	149	39.6	5.0	13	0.91
13/6/72	210	26	187	8.0	150	40	5.0	13	1.3

SUMMARY AND CONCLUSIONS

The Kelley River Basin with a drainage area of about 24.4 square miles is part of the Cumberland sedimentary basin. These interbedded series of sediments are reported to be over 20,000 feet thick.

The surficial deposits covering the watershed consist of mostly sandy till which varies in thickness up to about 20 feet. Some shallow deposits of glacio-fluvial sands and gravels are found immediately adjacent to the main channel of Kelley River.

Meteorological instrumentation was installed at four different sites in the area in late 1969. The records from these sites indicate that precipitation is not uniform over the area. In 1972, a variation of over 40% was recorded in precipitation values for these sites.

Streamflow varied greatly over the 3-year period. The maximum mean daily discharge recorded was 1650 cfs while the minimum mean daily flow was only 0.71 cfs. For the 3-year period 1970-72, the mean annual stream flow amounted to 57,800 acre-feet.

Three observation wells were drilled, pump tested and equipped with automatic water level recorders. Flowing artesian conditions were encountered in one well at a depth of only 38 feet. Fluctuations in fluid potential during a two-week period in autumn were in the order of 3.8 feet. The tidal response observed in well No. 3 is dampened from 40 feet, at Chignecto Bay 5 miles distant, to about 0.25 feet. This same well showed a negligible response to 2.6 inches of precipitation in early August while well No. 1 peaked at 1.79 feet.

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