

61-F-214-C

W.P. # 928-61

NEPEAN BAY

OUTFALL SEWER

61-F-214-C

W.P. # 928-61

NEPEAN BAY

OUTFALL SEWER

RACEY, MACCALLUM AND ASSOCIATES LIMITED

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers
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MONTREAL



OTTAWA

TORONTO

DONALD C. MACCALLUM, B.ENG., M.E.I.C., P.ENG.

H. JOHN RACEY, B.SC., M.E.I.C., P.ENG.

GEORGE L. HOUGHTON, A.M.I.MECH.E., M.E.I.C., P.ENG.

TORONTO DIVISION

~~CONFIDENTIAL~~

Reference: B-632/7-3432

59 Carlaw Drive,
Don Mills, Ontario.

January 26, 1962.

De Leuw, Cathar & Co. of Canada Limited,
226 Sparks Street,
Ottawa 4, Ont.

Attention: Mr. H. Von Mirbach, P.Eng.

RE: SUBSURFACE INVESTIGATION
NEPEAN BAY OUTFALL SEWER

Dear Sirs:

Two well-point tests have been carried out on the north side of the east abutment of the Wellington Street Bridge, Ottawa. The well-point installation was pumped continuously for periods up to 21 hours and observations were made of water levels in piezometer holes at distances of 10 and 20 feet from the well-point.

From the results of the tests, the relationship between drawdown from the normal ground water table and distance from the well-point was obtained and this is plotted in Enclosure 1. As a result of the high permeability of the medium, the phreatic surface, within the range of practical interest, is relatively flat.

The most relevant result of the test was that the ground-water table could be lowered twelve inches at a radius of about twenty feet from a normal well-point. Since the ground water may require to be lowered by as much as fifteen feet at certain locations, it will be necessary to have a minimum of fifteen well-points within a radius of twenty feet of these locations.

With regard to the tunnelling beneath the C.N.R. Chaudiere Subdivision and the C.P.R. South Main Line, Enclosure No. 2 shows a suggested arrangement with well-points at intervals of three feet along the header pipes. A clearance of 7½ feet from the centre line of the tunnel and 8 feet from the track centres has been allowed. Once installed, the tops of the well-points will only protrude a few inches above the ground and there is thus not likely to be any conflict with the structural clearance requirements of the A.R.E.A. as depicted on page 28-2-1 (1960) of the A.R.E.A. manual.

Reference: S-612/T-3432

January 26, 1962.

In locations where there is limited clearance, one method of installing the well-points would be by the use of a skid-mounted diamond drilling rig which is only about three feet wide. The borehole is drilled at one end of the rig. This type of rig is standard equipment with most drilling contractors.

The proposition is, of course, subject to approval by the railway authorities.

If it is not possible to obtain permission for this proposal, the alternative scheme of driving a tunnel at right angles to the tracks instead of obliquely would be equally practicable. No well-point system has been shown for this alternative but the number of well-points required will be less.

We await your comments on this proposal.

Yours very truly,

RACEY, MACCALLUM AND ASSOCIATES LIMITED



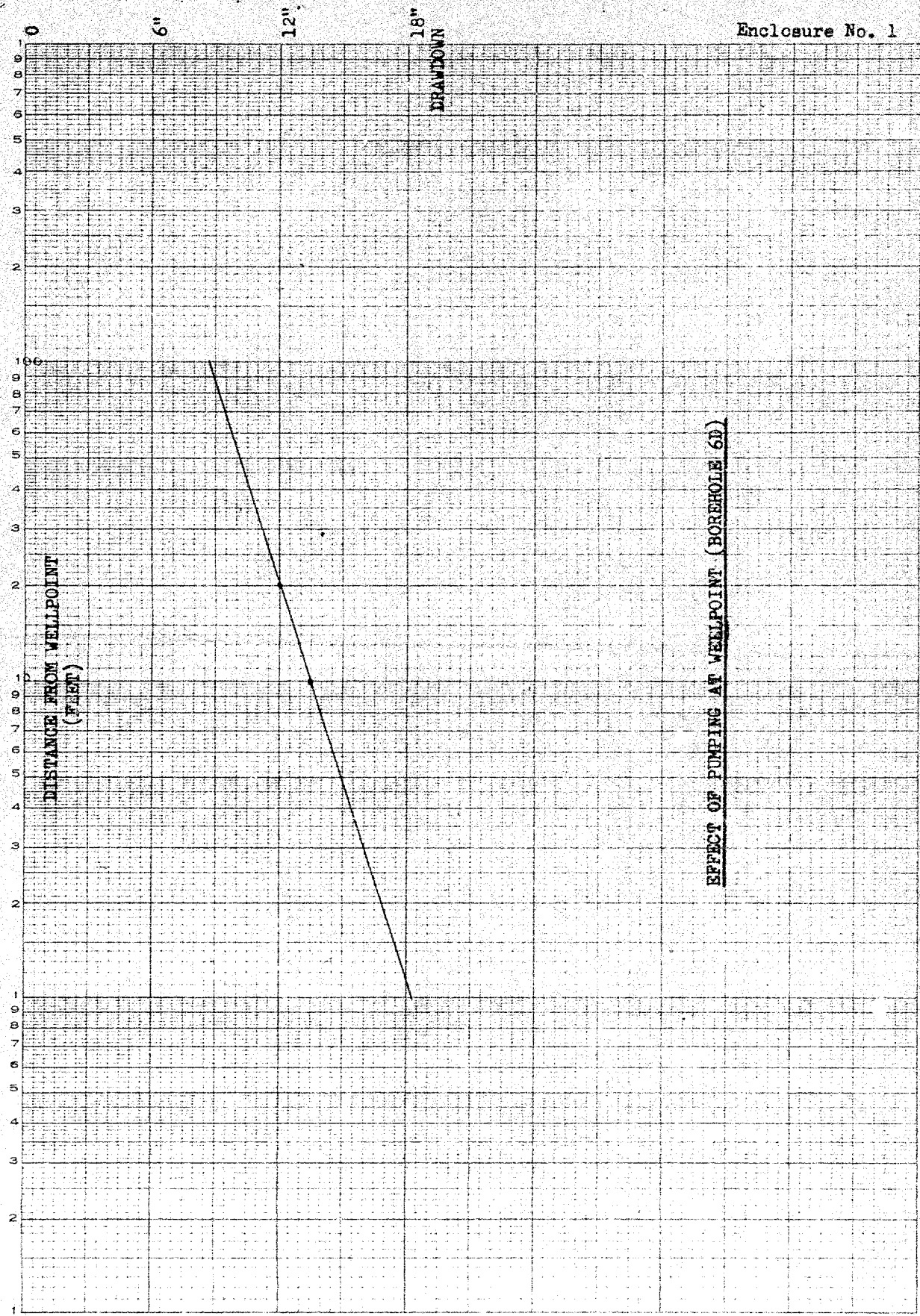
L. G. Bowie, P.Eng.,
Project Engineer.

IGB/KA

NO. 340R E-112 DIETZEN GRAPH PAPER
SEMI-LOGARITHMIC
4 CYCLES X 12 DIVISIONS PER INCH

EUGENE DIETZEN CO.
MADE IN U.S.A.

Enclosure No. 1



DISTANCE FROM WELLPOINT
(FEET)

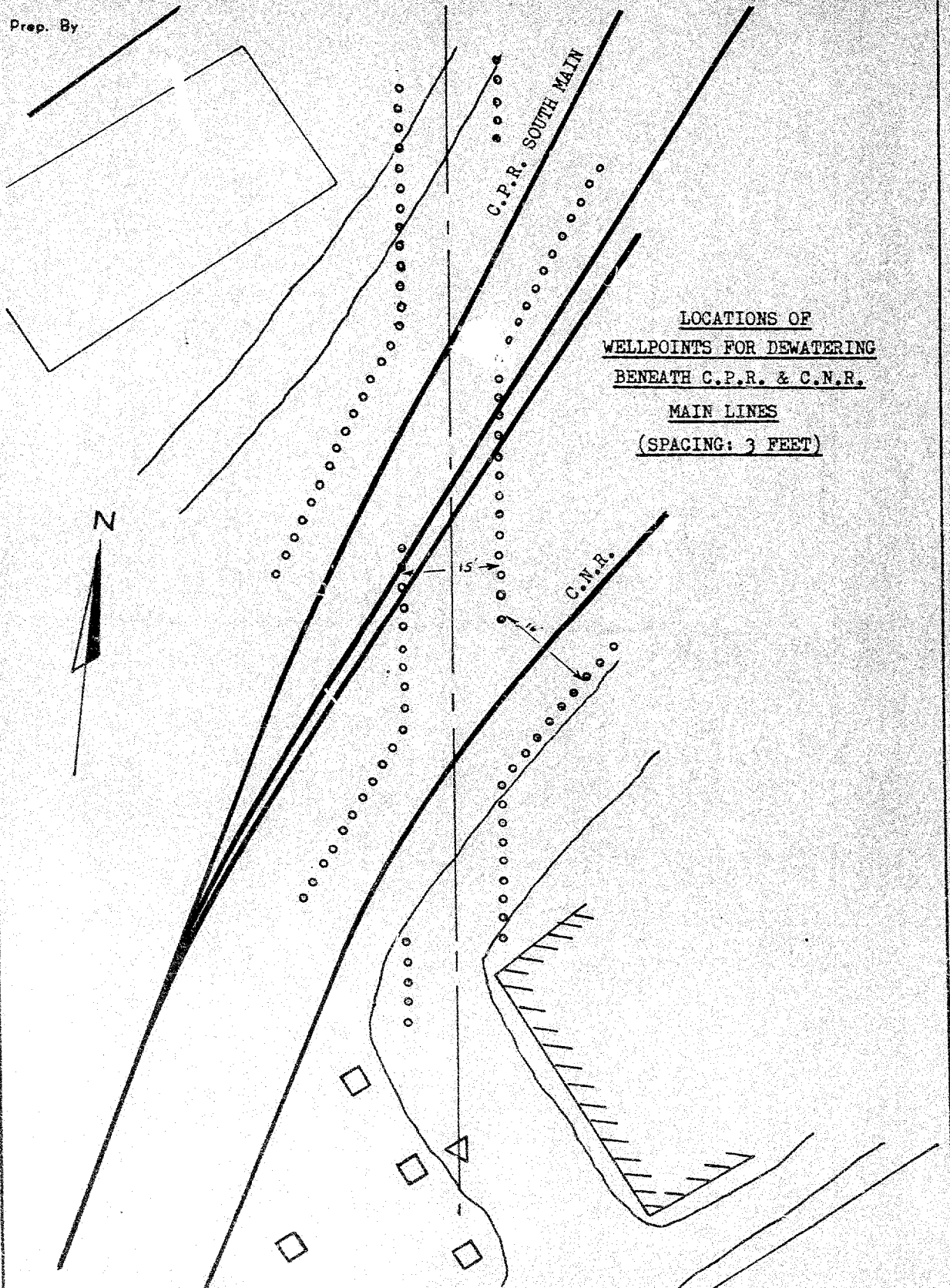
EFFECT OF PUMPING AT WELLPOINT (BOREHOLE 6D)

18"
BRANTOWN

Order No. S-632/T-3432

Enclosure No. 2

Prep. By



LOCATIONS OF
WELLPOINTS FOR DEWATERING
BENEATH C.P.R. & C.N.R.
MAIN LINES
(SPACING: 3 FEET)

Racey, MacCallum & Associates Ltd.

SCALE: ONE INCH = 20 FT.

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GEORGE L. HOUGHTON, A.M.I.MECH.E., M.E.I.C., P.ENG.

TORONTO DIVISION

~~RECEIVED~~

59 Carlew Drive,
Don Mills, Ontario.

January 8th, 1962.

OUR REFERENCE NO. S-632/T-7432

De Louw Cather & Co. of Canada Limited,
226 Sparks Street,
OTTAWA 4, Ontario.

Attention: Mr. H. Von Mirbach, P.Eng.

RE: SOIL INVESTIGATION NEPEAN BAY
OUTFALL SEWER.

Dear Sirs:

In connection with the above project, tests and observations have been carried out at certain boreholes in order to determine ground water conditions as they might affect tunnelling operations.

PRECEDING BOREHOLES

Boreholes 5 to 12 inclusive were primarily for the purpose of determining soil conditions and the water level observations in these holes were not any more comprehensive than in a normal site investigation. In actual fact, only Boreholes 5 and 6 were within the area in which tunnelling was likely and Borehole 6 was found to be entirely through fill on top of a City of Ottawa sewer running from east to west. The results of Borehole 6 were therefore considered to be not typical of the area as regards both soil and water conditions. (Seepage into and out of Borehole 6 was very slight, indicating that the large number of boulders in the fill had been mixed with a substantial quantity of impermeable, fine material.)

The series of borings undertaken after No. 12, was aimed at obtaining information about water conditions rather than details of the stratification. The results are summarized below:-

OUR REFERENCE NO. S-632/T-3432

January 8th, 1962.

BOREHOLE 5A

Location: 100 ft. north of Borehole 5.

Diameter - BX; Depth - 20.5 ft. (El. 156.2); Ground Surface Elev. 176.7.

Purpose: To determine seepage and permeability properties of the soil and to augment soil information from Borehole 5.

Seepage observations were carried out at depths of 5.0, 7.5, 10.0, 12.5, 15.0 and 16.5 feet. In first four of these, very little seepage into bailed hole. In last two: moderate seepage just above bedrock at 16.5 feet.

BOREHOLE 6A

Location: Just north of east abutment of Wellington Street Bridge.

Diameter - BX; Depth - 25.0 ft. (Elev. 156.6); Ground Surface Elev. 181.6. One AX diameter observation hole 25 ft. away to depth of 20 ft.

Purpose: To determine phreatic surface on pumping at one point and to provide intermediate soil information between Borehole 6 and Borehole 7.

A five-foot layer of gray silty clay was found to overlay bedrock with a mixture of silt, sand, gravel and boulders above. Size of pumping equipment was such that only 5 gal./min. could be pumped from depth of 20 feet and a maximum drop of six inches in water level was obtained in the observation hole.

BOREHOLE 6B

Location: Alongside loading platform and 25 ft. w.s.w. of Borehole 6.

One BX observation hole 10 ft. away and AX casing dropped down Borehole 6.

Purpose: To determine effects of pumping on somewhat larger scale on ground water table in yard area.

In contrast to Borehole 6A, seepage into hole was so slight that the proposed pumping with a submersible pump was not carried out. Difference between original ground water table and water level in BX observation hole was about two-thirds of the corresponding depth in the twelve-inch hole. No significant change in water level was observed in Borehole 6.

OUR REFERENCE NO. S-632/T-7432

January 8th, 1962.

BOREHOLE 6C

Location: Just north of east abutment of Wellington Street Bridge, adjacent to Borehole 6A.

Diameter - BX; Depth 18 ft. 3 ins.

Seepage tests were carried out at depths of 8.0, 10.0, 11.0, 16.0 and 18.3 feet. At 8.0 feet (and above), soil impermeable. At other depths, water flowed out of filled casing quite rapidly. At 16.0 and 18.3 feet a pump supplying 1200 gal./hr. could just maintain a head of 9 feet above ground water table.

GENERAL RESULTS

- (i) Across the yard area there is a deposit of fill consisting of sand, silt, boulders and gravel which extends from the present ground surface to a depth of approximately eight feet. Due to the presence of fines, this fill was found to be of low permeability.
- (ii) Close to the abutment of the Wellington Street Bridge is a permeable stratum of sand, gravel and boulders lying just beneath the fill referred to above. Material of such high permeability was not found elsewhere across the yard area except close to bedrock.
- (iii) A pumping rate of 2,500 - 3,000 gal/hr. would be required on a normal-size well point to lower the water table to a depth of 20 feet - as will probably be necessary for the construction of the sewer.

PROPOSAL FOR FUTURE WORK

Since the decision as to whether the sewer will be constructed along the proposed route will depend upon the cost of the tunnelling and consequently on the ease of combating the influx of ground water, it is suggested that the most direct method of determining the latter would be to install a well-point of the type likely to be used by the contractor and to carry out pumping test on it in conjunction with an observation hole a short distance away in order to determine the phreatic surface. These would, of course, be close to the east abutment of the Wellington Street Bridge. It is proposed to place the well-point in a six-inch hole and surround it by sand. The observation hole would be a BX diameter casing installed in a similar manner.

- 4 -

OUR REFERENCE NO. S-632/T-3432

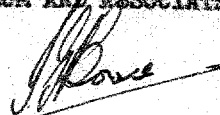
January 8th, 1962.

By imitating the probable procedure of the contractor it will thus be possible to assess the economic feasibility by the most direct means.

We hope to be able to discuss the matter with you in due course.

Yours very truly,

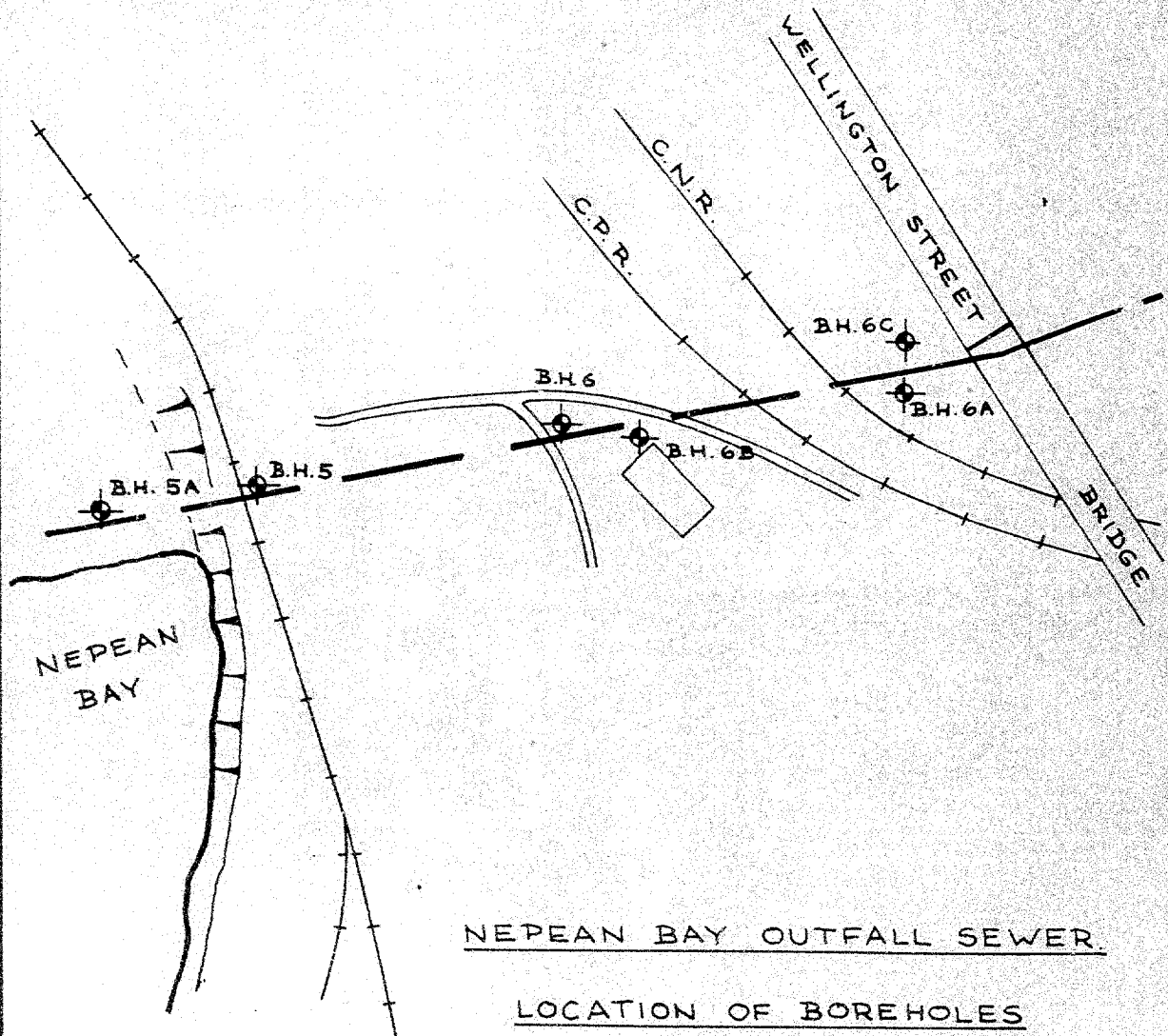
RACEY, MacCALLUM AND ASSOCIATES LIMITED



I. G. Bowie, P.Eng.,
Project Engineer.

IGB.

Prep. By H.K.



NEPEAN BAY OUTFALL SEWER.

LOCATION OF BOREHOLES
IN C.P.R. YARD AREA.

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H. JOHN RACEY, B.SC., M.E.I.C., P.ENG.

GEORGE L. HOUGHTON, A.M.I.MECH.E., M.E.I.C., P.ENG.

TORONTO DIVISION

~~27 CAVENDISH STREET~~

59 Curlew Drive,
Don Mills, Ontario.

December 29th, 1961.

Reference: S-632/T-3432

De Leuw, Cather & Company of Canada Limited,
226 Sparks Street,
Ottawa 4, Ontario.

Attention: Mr. H. Von Mirbach, P.Eng.

RE: SOIL INVESTIGATION,
NEPEAN BAY OUTFALL SEWER.

Dear Sirs:

Enclosed is a copy of your profile of the proposed sewer on which we have superimposed the results of our soil borings to date.

There would appear to be differences of a few feet between the elevations supplied for the ground surface at Boreholes 11 and 12 and the ground line on your profile. These boreholes are plotted at the elevations supplied by you.

Due to the large number of boreholes and observation holes put down in the area, a fairly comprehensive picture of the stratification to the north of Borehole 7 has been obtained and it is likely that further borings will not produce information contradictory, to any significant degree, of the arrangement shown. The surface of bedrock, in particular, seems to have been detected with reasonable certainty. The bedrock is almost a plane, although the distorted scale of the profile makes it appear as though there was a "hump" in the marine section.

At the southern end of the sewer, the simplicity of the stratification also makes it unlikely that the value of any additional information would justify the cost of additional borings.

However, your attention is particularly directed to the results of Boreholes 8, 9 and 10 where strata of totally different character, viz., peat, sand, gravel and boulders and clay respectively were encountered around the depth at which the proposed sewer is to be

Reference: S-632/T-3432

- 2 -

December 29th, 1961

laid. Since each of these strata occur at one borehole only, it is not possible to indicate strata boundaries with any confidence. Further intermediate borings would therefore seem to be indicated.

We would be interested to discuss this matter further with you after you have had the opportunity of studying the profile.

Yours very truly,

RACEY, MACCALLUM AND ASSOCIATES LIMITED


I. G. Bowie, P.Eng.,
Project Engineer.

ICB/KA

28-9, 0177024

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OTTAWA

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H. JOHN RACEY, B.SC., M.E.I.C., P.ENG.

GEORGE L. HOUGHTON, A.M.I.MECH.E., M.E.I.C., P.ENG.

TORONTO DIVISION
27 CARLTON STREET

Reference: S-632/T-3432
- Report -

November 16, 1961

De Leuw, Cather & Company of Canada Limited,
226 Sparks Street,
OTTAWA 4, Ontario.

Attention: Mr. H. Von Mirbach, P.Eng.

RE: PRELIMINARY SUBSURFACE INVESTIGATION,
NEPEAN BAY OUTFALL SEWER,
OTTAWA, ONTARIO.

Dear Sirs:

The enclosed report presents the results of our
soil investigation at the above location.

We hope the report is satisfactory to you; if you
have any questions about it please do not hesitate to get in
touch with us.

Thank you for this opportunity of being of service
to you.

Yours very truly,

RACEY, MacCALLUM AND ASSOCIATES LIMITED

J. J. Schoustra

J. J. Schoustra, P.Eng., *per KHK*
Divisional Soil Engineer.

JJS/KA

De Leuw, Cather & Company of Canada Limited
226 Sparks Street,
Ottawa, Ontario.

PRELIMINARY SUBSURFACE INVESTIGATION,
NEPEAN BAY OUTFALL SEWER,
OTTAWA, ONTARIO.

Reference: S-632/T-3432
- Report -

Racey, MacCallum and Associates
Limited

November 16, 1961.

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AND ASSOCIATED STAFF

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OTTAWA

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DONALD C. MACCALLUM, B.ENG., M.E.I.C., P.ENG.

H. JOHN RACEY, B.SC., M.E.I.C., P.ENG.

GEORGE L. HOUGHTON, A.M.I.MECH.E., M.E.I.C., P.ENG.

TORONTO DIVISION
27 CARLTON STREET

Reference: S-632/T-3432
- Report -

November 16, 1961

PRELIMINARY SUBSURFACE INVESTIGATION, NEPEAN BAY OUTFALL SEWER, OTTAWA, ONTARIO.

INTRODUCTION:

The purpose of the investigation was to determine the soil conditions beneath Nepean Bay, Ottawa, relevant to the location of the outlet of the proposed Nepean Bay Outfall Sewer.

Four short boreholes were put down along a line representing the probable route of the final section of the sewer.

This report gives the results of the boreholes and presents engineering recommendations based on these results.

FIELD WORK:

The locations of the boreholes are shown on the accompanying site plan, Enclosure No. 1.

The boreholes were carried out by means of a diamond drill rig mounted on a raft. A dynamic cone probe was attempted before each borehole, though, in every case, the cone only penetrated a short distance due to the early incidence of bedrock.

DISCUSSION OF RESULTS:

One of the features of the site to be investigated was the depth of old logs above the bottom of the Bay. The area had apparently once been used to collect logs for adjacent mills, some of the logs having become waterlogged and sunk. The ends of many logs could be seen protruding above the surface of the water and it was feared that there might be a considerable depth of submerged

Reference: S-632/T-3432

- 2 -

November 16, 1961

DISCUSSION OF RESULTS - Cont'd

logs above the natural soil in the Bay. In all four boreholes, however, there was no difficulty in commencing the sampling at the true bottom of the Bay. In Boreholes 1 and 3 the split spoon sampler appeared to alight on a log on first being put down but a slight movement to one side caused it to drop to soil or rock level.

An inspection of the area near the shore was carried out in a small boat to determine the depth of the logs. It was found that they were generally deposited only to one log in depth or two logs at the most. Some of them were waterlogged at one end whereas the other end was either above or just below the surface. Although this type is a navigational hazard to a small boat, its occurrence is less frequent than may be imagined from the large number of log ends protruding above the surface of the water which give the impression that the logs are deposited almost to the water surface.

In Borehole No. 1, beneath seven feet of water there was ten inches of grey silty clay overlying dark grey shale. The split spoon penetrated eight inches into the shale which changed from soft to hard in this distance.

Borehole No. 2 produced similar results. On reaching the shale, it was decided to core into it to prove and determine the nature of the bedrock. A total of 6'-4" was drilled with a recovery of 80%. The upper part of the core was found to be shale and limestone conglomerate and the lower part limestone.

Borehole No. 3 was similar to Nos. 1 and 2, but, in borehole No. 4, there was no soft soil above bedrock. Furthermore, the bedrock surface seemed to be somewhat jagged and uneven. A dynamic cone was attempted in one location with complete refusal from the very first blow at a depth of 10'-9". The raft then moved about four feet away from the shore and the same result was obtained at a depth of 12'-8". The bedrock was drilled for a depth of four feet with complete recovery. The rock was found to be limestone with shale partings.

RECOMMENDATIONS:

Enclosure No. 6 shows a cross-section of the surface of the bedrock in relation to the proposed grade of the sewer. It will be seen that the invert of the sewer is at a depth of about four feet below the surface of the bedrock for most of the length of this section of the sewer.

Reference: S-632/T-3432

- 3 -

November 16, 1961

RECOMMENDATIONS - Cont'd

Thus the main problem is no longer to determine whether the material beneath the invert of the proposed sewer is sufficiently stable to support the sewer but rather to investigate the construction difficulties involved in excavating into the bedrock.

Examination of the "AX" diameter rock cores revealed that approximately the uppermost two feet consisted of limestone and shale which could be fragmented without much difficulty. It is considered that this top two feet of material could be dislodged by the impact of the bucket of normal excavating machinery.

Below a depth of two feet, however, the proportion of limestone increased and the pieces recovered in the cores showed a definite increase in hardness to about the maximum possible with limestone. Consequently, it is most unlikely that the lower two feet of the four feet of rock above invert level could be removed by machinery. It will therefore be necessary to drill and blast to the required excavation depth.

It is possible that the blasting will result in a rough rock surface and in order to correct this and provide a suitable bedding for the sewer it is suggested that the rock be excavated to a little below the bottom of the pipe and then backfilled with pit-run gravel to grade.

Since only just over two feet of the sewer will protrude above the plane of the rock surface, it would therefore be possible and convenient to cover the sewer with rock fill. The harder rock removed by blasting would be suitable for this purpose.

With regard to the method of construction, it is probable that it will be more economical to carry out the excavation without the construction of a dam around the sewer location and dewatering, though the construction procedure may well be left to the option of the contractor provided the design specifications are finally adhered to.

There is an average of about one foot of clayey overburden above the bedrock surface with some waterlogged timber above the overburden as mentioned earlier. Neither of these items is likely to cause any serious hindrance to construction.

CONCLUSIONS:

The main results of the report may be summarized as follows:

Reference: S-632/T-3432

- 4 -

November 16, 1961

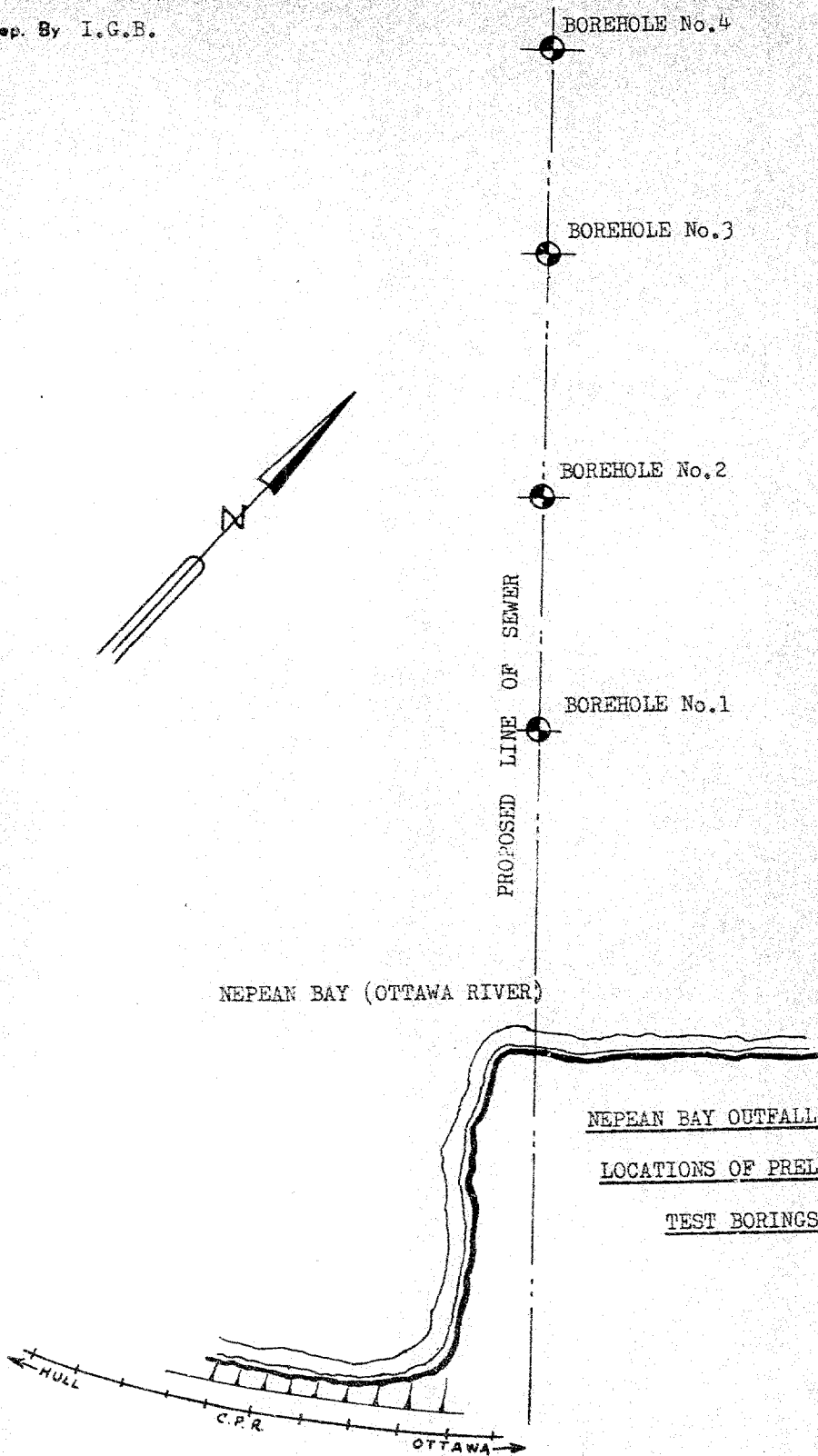
CONCLUSIONS - Cont'd

1. Limestone and shale bedrock occurs at depths below the water surface ranging from $6\frac{1}{2}$ feet to $12\frac{1}{2}$ feet and overlain by an average of one foot of clayey overburden.
2. Some old logs rest on top of the overburden but they are not likely to cause construction difficulties.
3. The uppermost two feet of the bedrock fragment easily enough to be removed by normal excavation methods but, below this depth, resort will have to be made to blasting methods.
4. It is suggested that the rock should be removed to a little below the level of the bottom of the sewer and pit-run gravel be used as bedding.

*I. G. Bowie*I. G. Bowie, P.Eng.,
Project Engineer.*per J.P.C.*

IGB/KA

Prep. By I.G.B.



RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: 1

Project: NEPEAN DAY OUTFALL SEWER,

Location: OTTAWA, ONTARIO,

Hole Location: See Enclosure No. 1

Hole Elevation and Datum: 173.5

Field Supervisor: I.G.B. Prep.: I.G.B.

Driller: F.E.J. Checked: J.J.S. Date: 3-11-'61.

LEGEND

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

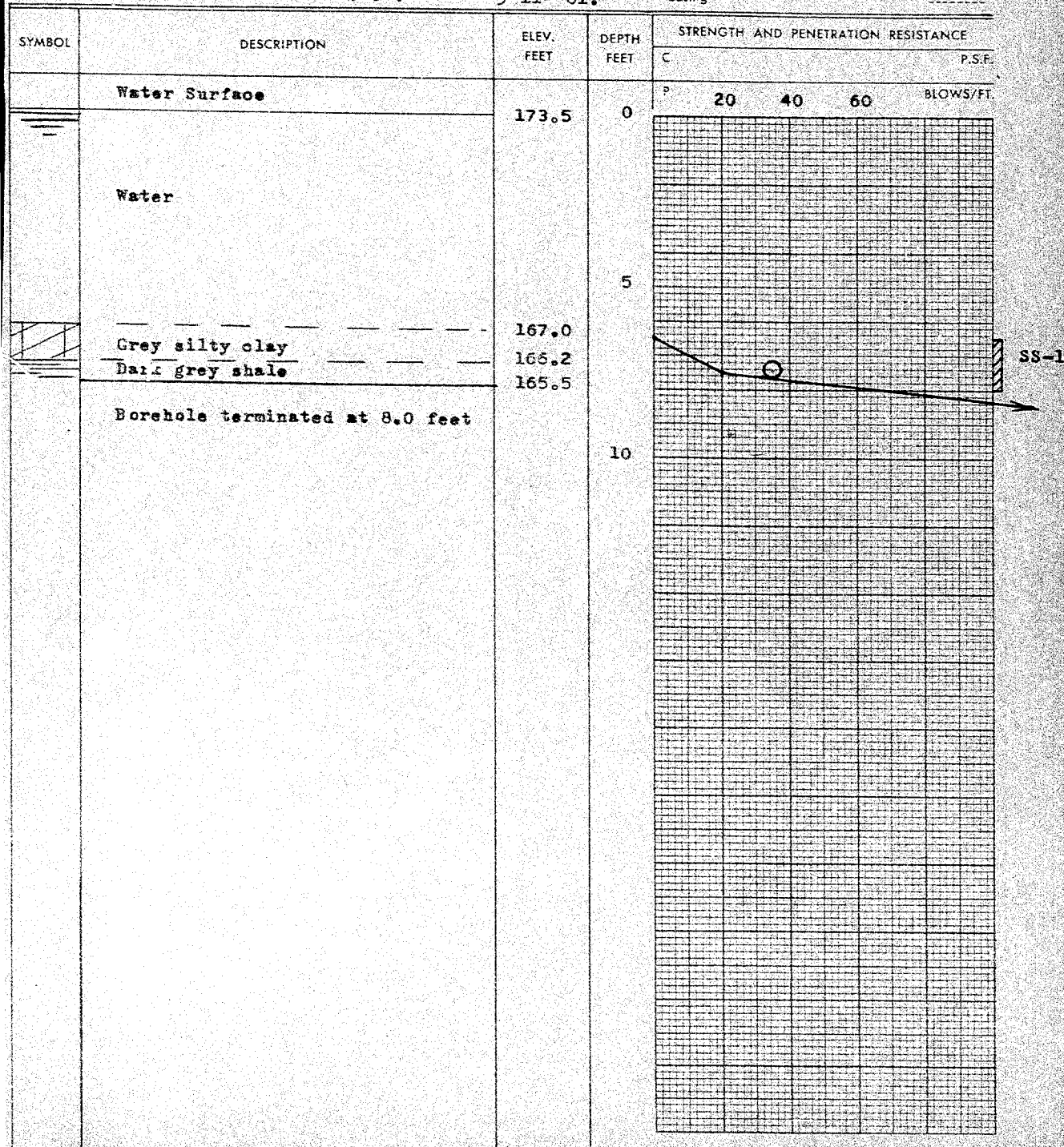
2" Split tube

2" Dia. Core

Casing

⊕
+s

⊕ ⊕



RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: 2

Project: NEPEAN BAY OUTFALL SEWER,
 Location: OTTAWA, ONTARIO,
 Hole location: See Enclosure No. 1,
 Hole Elevation and Datum: 173.5
 Field Supervisor: R.B. Prep.: I.G.B.
 Driller: F.E.J. Checked: J.J.S. Date: 3-11-'61.

LEGEND

Shear Strength (C)

Unconfined compression
 Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing

⊕
4'

⊕ ⊕

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				C	P.S.F.		
				P	20	40	60 BLOWS/FT.
	Water Surface	173.5	0				
	Water		5				
	Grey clay	166.8					
	Black sand	166.2					
		165.8					
	Bedrock: Shale and limestone conglomerate at top, turning to limestone.		10				
		159.0	15				

SS-1

AX-
core

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: 3

Project: NEPEAN BAY OUTFALL SEWER,
Location: OTTAWA, ONTARIO,
Hole Location: See Enclosure No. 1,
Hole Elevation and Datum: 173.5
Field Supervisor: R.B. Prep.: I.G.B.
Driller: F.E.J. Checked: J.J.S. Date: 4-11-'61.

LEGEND

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

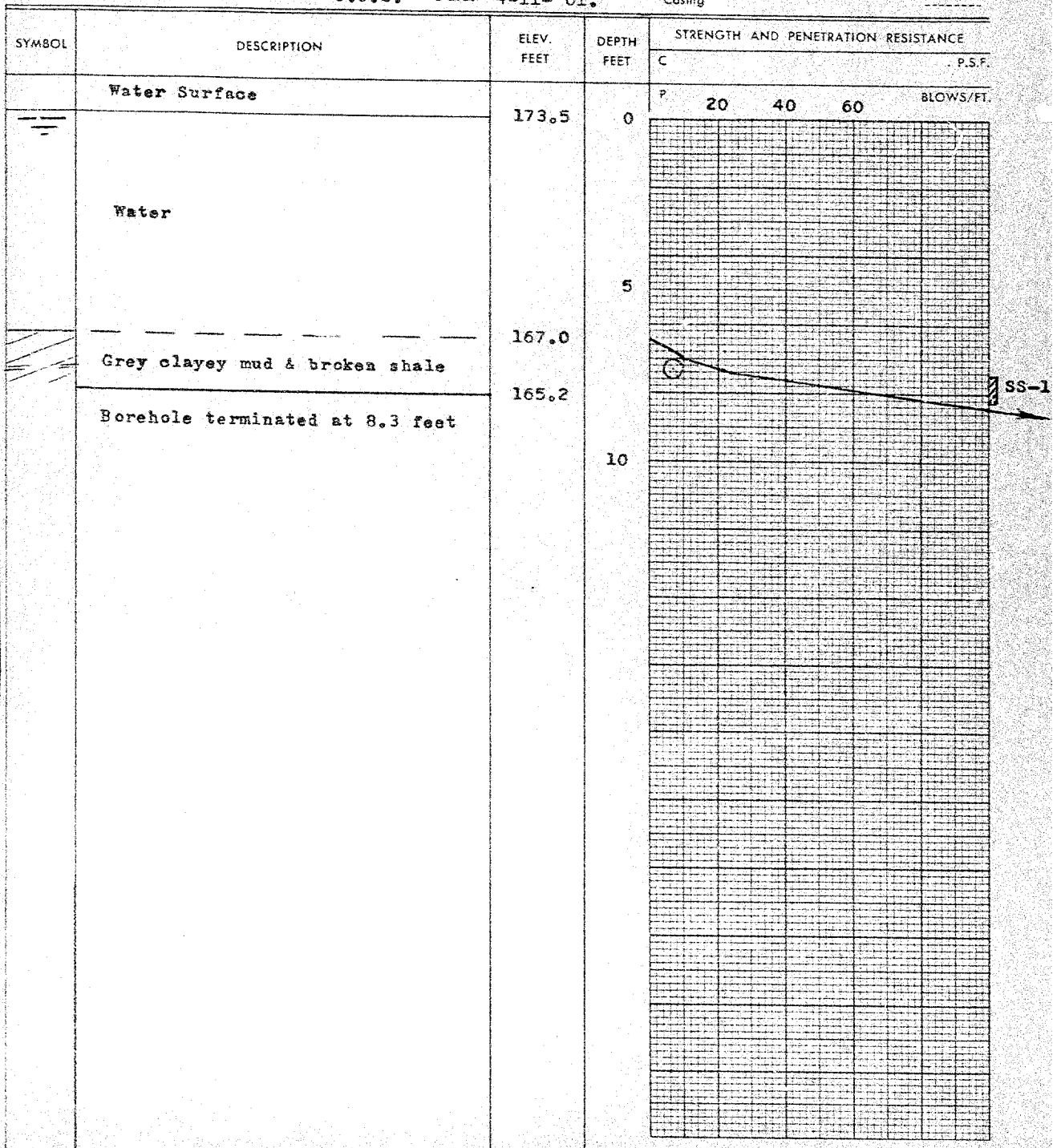
2" Split tube

2" Dia. Cone

Casing

⊕
+3

⊕ ⊕



Foundation Engineering Division

Engineering Data Sheet for Borehole: 4

LEGEND

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

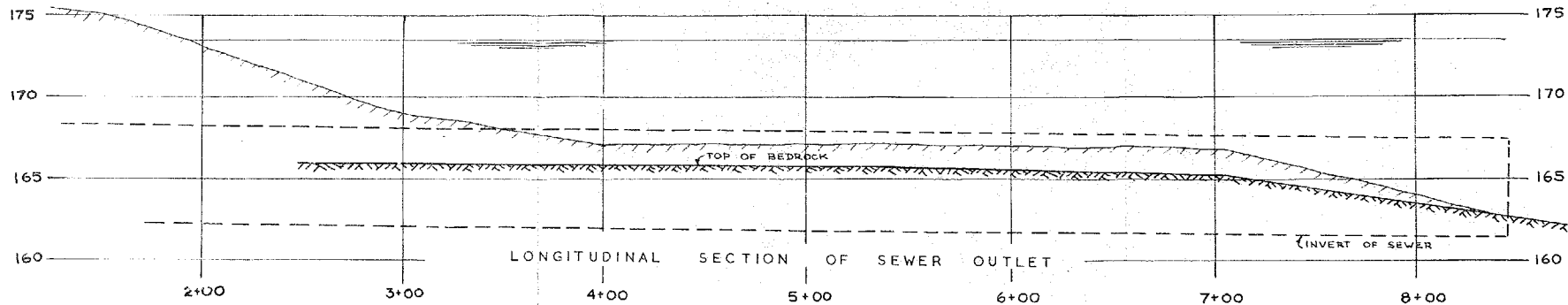
2" Split tube

2" Dia. Cone

Casing

 \oplus

AX-
COTC



REVISIONS			REFERENCE		RACEY, MACCALLUM AND ASSOCIATES LTD. A COMPANY OWNED, OPERATED & DIRECTED BY CONSULTING ENGINEERS TORONTO MONTREAL OTTAWA
NO.	DESCRIPTION	BY APP. DATE	DRAWING TITLE	DRWS. NO.	
					NEPEAN BAY OUTFALL SEWER
					LOCATION OF BEDROCK
					RELATIVE TO SEWER OUTLET
					DRAWN BY H.K. ORDER 5-632/T-3432 DRAWING NO.
					CHECKED BY T.G.R. DATE Nov. 14 1961 ENCLOSURE

Materials and Research Division

March 1, 1962

Mr. C. G. Stewart,
Project Manager,
De Leuw, Cather & Co.
of Canada, Ltd.,
Consulting Engineers,
226 Sparks Street,
Ottawa 4, Ontario.

Dear Mr. Stewart:-

Re: Soils Investigation - Nepean Bay Outfall
Ottawa Queensway

Herewith, we acknowledge the receipt of your letter of February 15th, 1962, your Ref. 2-59-Q-17, with the four copies of Racey MacCallum's report and three subsequent letters.

We have reviewed the above-mentioned enclosures and found most of the information well presented. However, for a better and more complete understanding of the problems that are now evident from the established ground and water conditions, we would appreciate it if you could obtain from Racey MacCallum, the following additional information:-

1. A detailed description of operations, as well as a numerical presentation of all results obtained from the investigation reported in their letter of January 8th, 1962.
2. A detailed description, possibly with a drawing, of the well point installation and the results of the pumping test - i.e., time-discharge relationship.

We realize that all the presented data and information are in a preliminary form, and that most probably, the above will appear in the final report, but we find it very difficult to properly interpret the results without familiarizing ourselves with all the pertinent details.

AGS/MdeF

Yours very truly,

cc: Messrs. F. I. Hewson
D. Farren
Foundations Office
Gen. Files.

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

DE LEUW, CATHER & COMPANY
OF CANADA LIMITED
CONSULTING ENGINEERS
TORONTO OTTAWA

226 SPARKS STREET
OTTAWA 4, ONTARIO
CENTRAL 3-4075

Our Ref. 2359-Q-17
February 15th, 1962

Mr. A. G. Stermac,
Principal Foundations Engineer,
Materials & Research Division,
Department of Highways of Ontario,
Parliament Buildings,
Toronto, Ontario.

Dear Mr. Stermac:

Re: Soils Investigation - Nepean Bay Outfall
Ottawa Queensway

Most of the investigation mentioned above is completed, but due to some uncertainties about the final alignment, a small number of additional holes will still be required. We are enclosing four prints of a drawing showing the proposed alignment, and four copies of the following:

- a) Racey, MacCallum's report of November 16th about the marine section.
- b) Racey, MacCallum's letter of December 29th, giving a general review of the work done up to that time, with a soils profile.
- c) Racey, MacCallum's letter of January 8th, with an analysis of groundwater tests and a proposal of the arrangement for wellpoint pumping test.
- d) Racey, MacCallum's letter of January 26th, summarizing the results of this pumping test.

The enclosures contain the vital results of the investigation. We have asked Racey, MacCallum to hold up the formal report, since we would rather wait until the final alignment is settled; it may take a few months before this can be done.

In the meantime, Racey, MacCallum have sent in an intermediate bill for the work done so far. We are submitting this bill with our billing to the Department of Highways in the usual manner.

Yours very truly,

DE LEUW, CATHER & CO. OF CANADA LIMITED

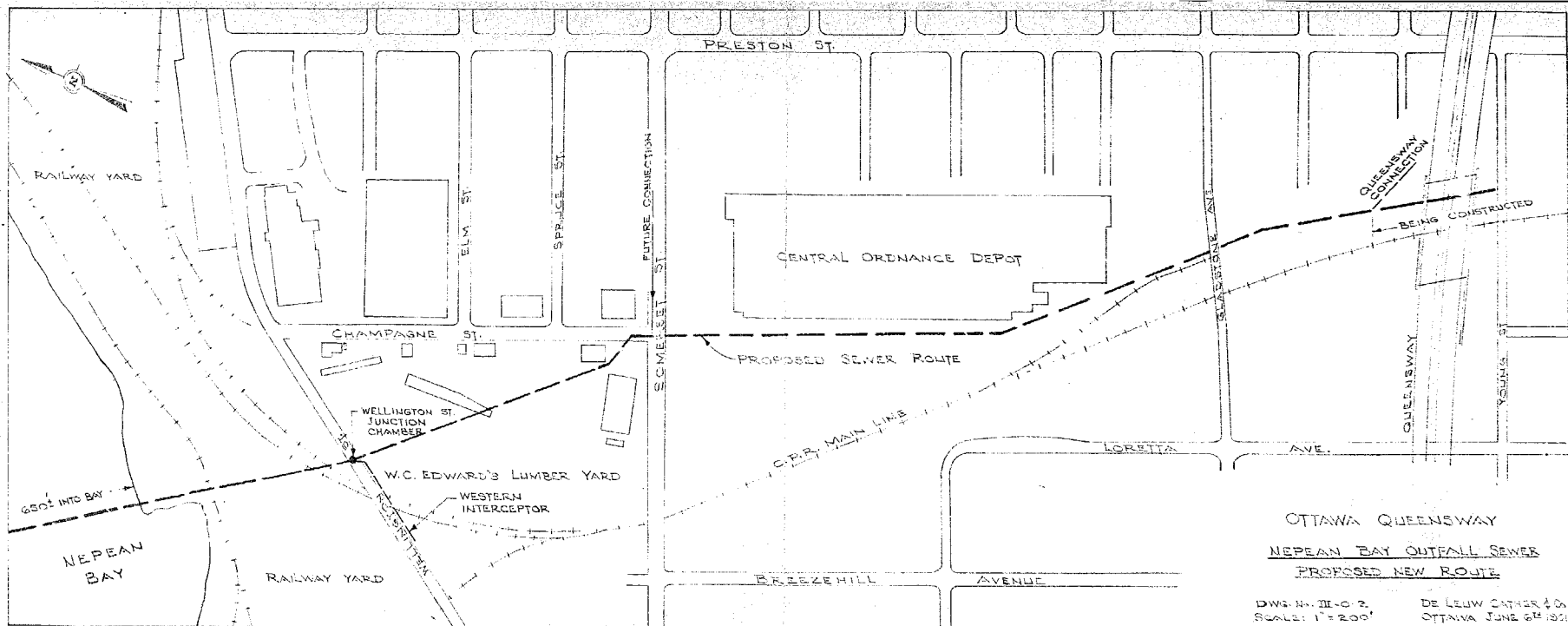
A handwritten signature in dark ink, appearing to read 'G. G. Stewart', with a stylized, flowing script.

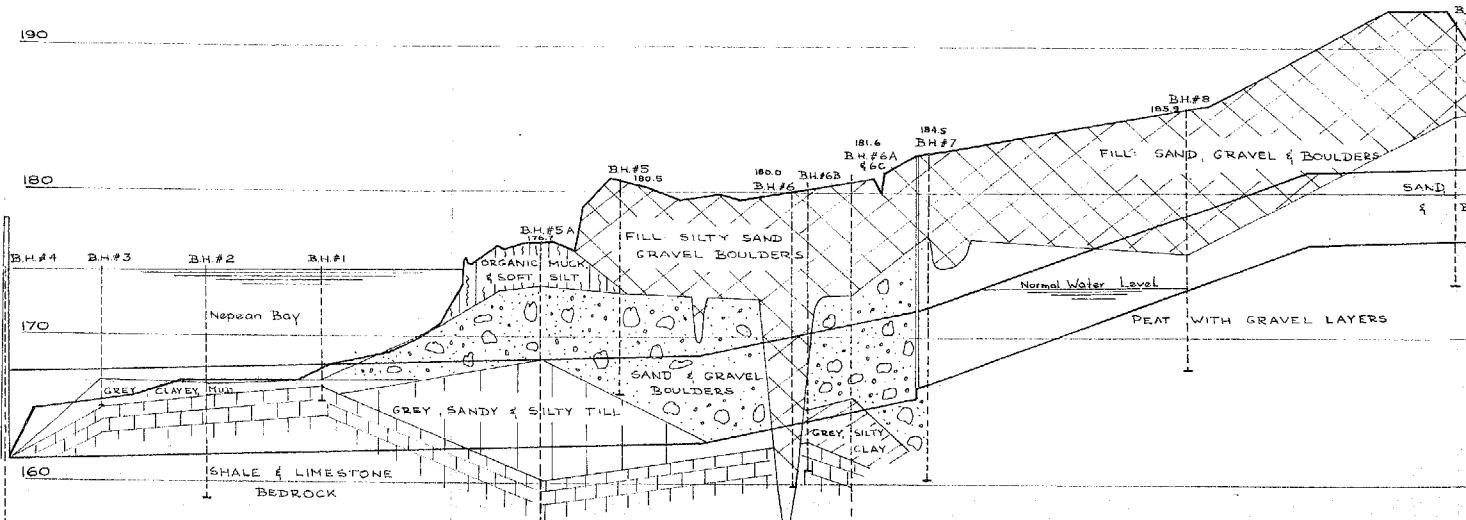
G. G. Stewart
Project Manager

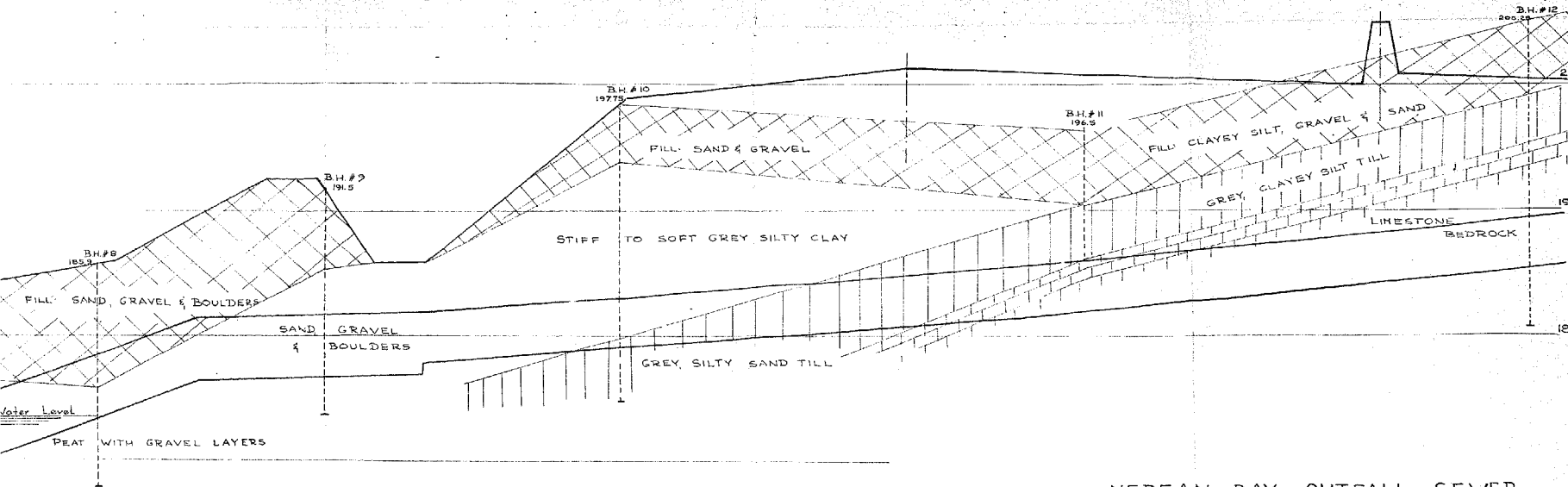
HVM:rm

Encls.

cc: Mr. J. Gruspier
(1 set of enclosures)







NEPEAN BAY OUTFALL SEWER
PROPOSED PROFILE AND
STRATIFICATION.

Scale: horiz. : 1" = 100'

vert. : 1" = 5'