GEOCRES
No:
30M3-64-3

ACRES CO.

WELLAND CANAL TUNNEL AT
DRILLING PROGRAM (AUG. 5-64)
THOROLD DIST. 4 (AUG 26-64)

W.P. 445-64

Mr. A. Stermac

Materials & Testing Division,
Downsview, Ontario,
August 12, 1964.

Mr. S. Tibshirani,
Executive Engineer,
H. G. Acres & Company Ltd.,
Consulting Engineers,
1259 Dorchester Road,
Niagara Falls, Ontario.

Dear Sir:

Re: Thorold Highway Tunnel,
Site Investigation,
W. P. 445-64

Thank you for your letter of August 5, 1964, and for the drawing showing your proposed drilling program, phase I, scheme 3, Alternate Alignment. Your program and the additions to it, appear satisfactory, and I have no comments to make at the present time.

Yours truly,

AR.

A. Rutka,
Materials & Testing Engineer.

AR/pa
c.c. Mr. J. Walter.

Mr. A. Stermac,
Mr. T. Kovich,
Mr. G. Wrong.
Files

CABLE ADDRESS ACRESCAN

H. G. ACRES & COMPANY LIMITED CONSULTING ENGINEERS

1259 DORCHESTER ROAD NIAGARA FALLS, CANADA

August 5, 1964
1161

Mr. Rutka,
Materials and Research Engineer,
Department of Highways of Ontario,
Downsview, Ontario.

W.P. 445-64

Dear Sir: Thorold Highway Tunnel
Site Investigations

We enclose four copies of drawing No. SK-1161-SA-14 entitled "Proposed Drilling Program Phase 1, Scheme 3 Alternative Alignment." This drawing shows the revised program of site investigations for the tunnel alignment given to us in the letter of July 31, 1964 from Mr. Draycott.

The general nature of the site investigations will be in accordance with our proposed program submitted to you on July 13, 1964. As before, we will select the holes required in Phase 2 of the drilling program as the results of the present investigations become available.

As a result of the studies to date, we consider that the following additions to the program are required:

1 - We propose to install standpipes in the bedrock in selected deep drill holes. The purpose of these will be to verify water levels in the bedrock during and after the draining of the canal next winter.

2 - We propose to drill several oblique NX holes to investigate vertical jointing patterns in the bedrock. The exact location of these holes will be determined on the basis of the results from the holes already drilled.

 August 5, 1964

The drilling is progressing well and we expect to be commencing Phase 2 of the program in about one week's time.

Yours very truly,

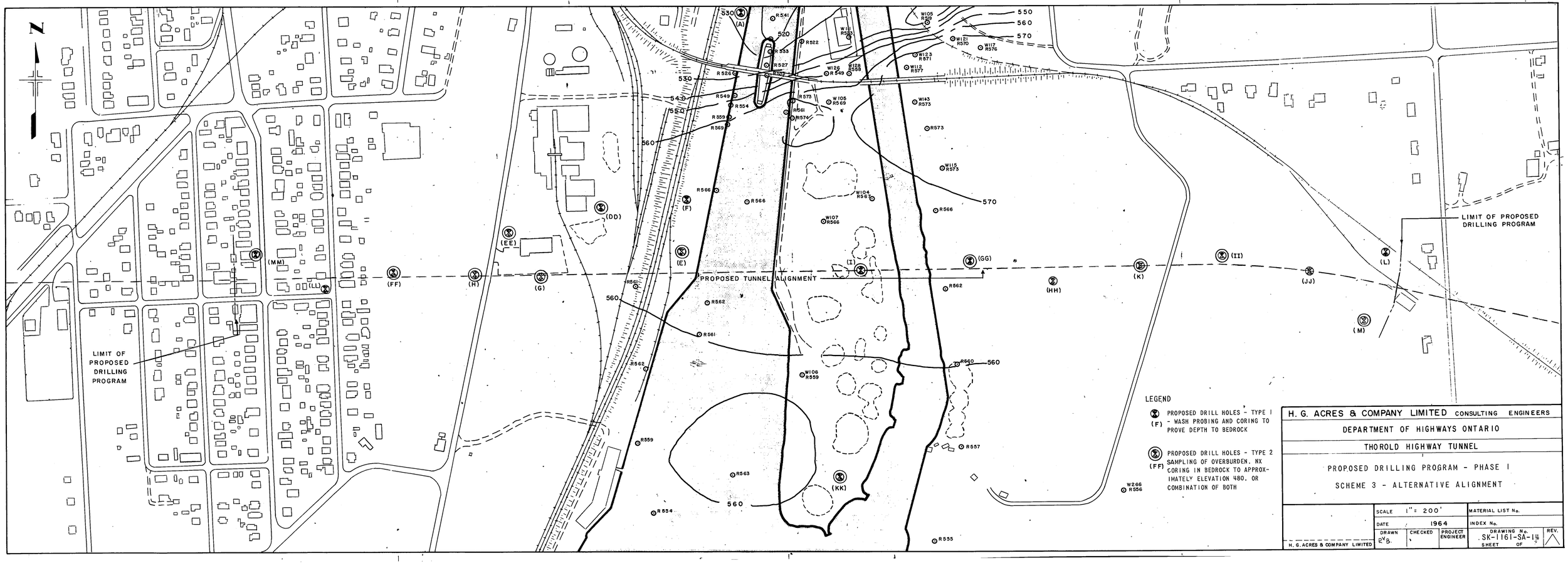
H. G. ACRES & COMPANY LIMITED

S. Tibshirani
Executive Engineer

RGT:hc

Enc.

cc: Mr. J. Walters, Director of Planning and Design



LEGEND

(F) PROPOSED DRILL HOLES - TYPE 1 - WASH PROBING AND CORING TO PROVE DEPTH TO BEDROCK

(FF) PROPOSED DRILL HOLES - TYPE 2 SAMPLING OF OVERBURDEN. NX CORING IN BEDROCK TO APPROXIMATELY ELEVATION 480. OR COMBINATION OF BOTH

H. G. ACRES & COMPANY LIMITED CONSULTING ENGINEERS

DEPARTMENT OF HIGHWAYS ONTARIO

THOROLD HIGHWAY TUNNEL

PROPOSED DRILLING PROGRAM - PHASE I

SCHEME 3 - ALTERNATIVE ALIGNMENT

H. G. ACRES & COMPANY LIMITED	SCALE 1" = 200'			MATERIAL LIST No.	
	DATE 1964			INDEX No.	
	DRAWN CHECKED PROJECT ENGINEER			DRAWING No. SK-1161-SA-14	REV.
	CRB			SHEET OF	

SK-1161-SA-14

A. Stermac

Materials & Testing Division,
Downsview, Ontario,
August 31, 1964.

Mr. S. Tibshirani,
Executive Engineer,
H. G. Acres & Co. Ltd.,
1259 Dorchester Road,
Niagara Falls, Ontario.

Re: Thorold Highway Tunnel,
W. P. 445-64,
Your File No. 1161

Dear Mr. Tibshirani:

This will acknowledge your letter of August 26, 1964, and drawing SK-1161-SA-17, showing your boring program.

Your investigation for bridges, retaining walls and pavement design purposes, should be carried out in sufficient detail to determine,

1. Foundation designs for structures and retaining walls.
2. Bedrock profile so that accurate quantities can be determined of earth and rock quantities.
3. Suitability of cut material for embankment purposes (type of soil and moisture content).
4. Stability of earth cuts (if this is a problem).

If the bedrock surface is not flat, it may be necessary to place additional bore holes to obtain accurate quantities. You can decide this as your boring program progresses.

Yours truly,

A. Rutka,
Materials & Testing Engineer.

AR/pa
c.c. Messrs. J. Walter,
G. Wrong, & T. Kovich.
A. Stermac.

Note to Gerry & Tom:
I have the functional report.
A.R.

CABLE ADDRESS ACRESCAN

H. G. ACRES & COMPANY LIMITED CONSULTING ENGINEERS

1259 DORCHESTER ROAD NIAGARA FALLS, CANADA

August 26, 1964
File No. 1161

Mr. A. Rutka,
Materials and Research Engineer,
Department of Highways of Ontario,
Downsview, Ontario.

Dear Sir; Thorold Highway Tunnel - W.P. 445-64

We enclose four copies of drawing SK-1161-SA-17, entitled "Scheme 3 Subsurface Investigations, Location of Drillholes".

This drawing has been revised to extend the program of site investigations to the limit of the western tunnel approach shown in the Functional Planning Report. The drill holes have been located to prove foundations for the road and rail bridge abutments, retaining walls and highway subgrade.

The drilling is progressing well and should be complete by the middle of September.

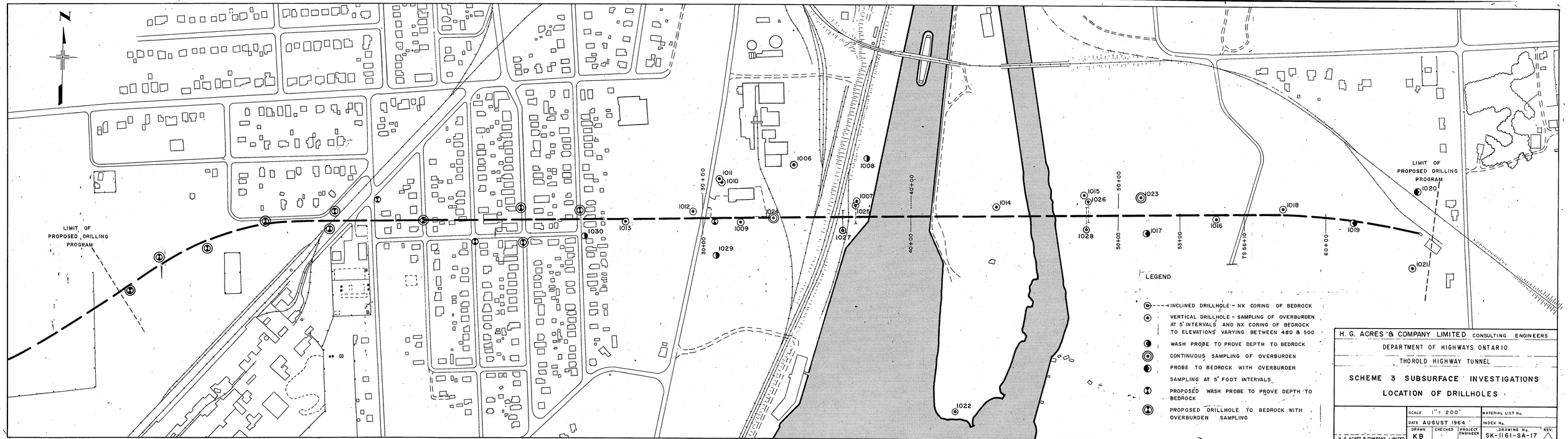
As a result of the additional drilling completed at the alternative sites for Schemes 1 and 4 and the extension of the limits of the program on the proposed tunnel alignment, the estimate of cost for the site investigations has been revised. The total cost of the program is now estimated to be $34,000.00, covering the cost of drilling, field supervision and laboratory testing to the end of the program. We trust that the increase in cost will be satisfactory.

Yours very truly,

H. G. ACRES & COMPANY LIMITED

S. Tibshirani
Executive Engineer

ST/isp
encl.
c.c. Mr. J. Walter



SK-1161-SA-17

H. G. ACRES & COMPANY LIMITED CONSULTING ENGINEERS

DEPARTMENT OF HIGHWAYS ONTARIO

THOROLD HIGHWAY TUNNEL

SCHEME 3 SUBSURFACE INVESTIGATIONS

LOCATION OF DRILLHOLES

	SCALE 1" = 200'		MATERIAL LIST No.
	DATE AUGUST 1964		INDEX No.
H. G. ACRES & COMPANY LIMITED	DRAWN KB	CHECKED	PROJECT ENGINEER
			DRAWING No. SK-1161-SA-17 SHEET OF REV.

cc: Foundations Office

Mr. A. Rutka,
Materials & Research Engr.,
Room 102, Lab. Bldg.

Mr. A. G. Stermac,
Principal Foundation Engr.,
Room 107, Lab. Bldg.

May 6, 1964

Welland Tunnel at Thorold W.P. 445-64

The proposed tunnel at Thorold will be in rock cut for its entire length according to the presently available subsoil information. The borehole logs supplied by The St. Lawrence Seaway Authority are confined to the central and eastern portion of the proposed tunnel. However, bedrock information seems to be available for the west part as well since bedrock is shown on the profile on the attached Plan No. 7698, and bedrock contours on the attached unnumbered plan.

The soil overlying bedrock is mostly silty clay to clayey silt with traces of sand and subangular gravel. In places, fine sand and silt was encountered. The undrained shear strength of the soil varies within quite a wide range - i.e., from 1,300 p.s.f. to 18,180 p.s.f. with most of the values well in excess of 2,000 p.s.f., indicating a stiff to hard consistency.

In view of the above information, it is our opinion that only very few minor problems would have to be solved and only minor difficulties from the foundation point of view could be expected.

If, at any time, more serious consideration is given to this site, it will undoubtedly be necessary to verify and augment the presently available soil and bedrock information.

AGS

AGS/MdeF
Encls.

A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

cc: Foundations Office
Gen. Files

A Stennes

H. G ACRES & COMPANY LIMITED CONSULTING ENGINEERS

RECEIVED

October 6, 1964
1161-02

Mr. R. G. Burnfield,
Regional Functional Planning Engineer,
Department of Highways,
Downsview, Ontario.

Dear Sir: Thorold Highway Tunnel
Study of Alternative Tunnel Location

We are in receipt of your letter of September 25, 1964 and the attached copies of our invoice dated August 31, 1964.

The engineering services covered by our invoice include only the work authorized by Mr. I. C. Campbell in his letter of July 8, 1964, to study alternative tunnel locations. All time spent on this study has been charged to contract 1161-02, while other phases of engineering pertaining to the Thorold Highway Tunnel were charged to separate accounts. For your information we list below, a breakdown of contract accounts used on this project:

1161-00	Thorold Highway Tunnel - Report
1161-01	Thorold Highway Tunnel - Site Investigations
1161-02	Thorold Highway Tunnel - Study of Alternative Tunnel Locations
1161-03	Thorold Highway Tunnel - Site Surveys
1161-04	Thorold Highway Tunnel - Soils Laboratory Testing

We are returning herewith, our invoice of August 31 with the hope that you will find the above information sufficient to approve the invoice for payment.

Yours very truly,

H. G. ACRES & COMPANY LIMITED

ST:hc
Enc.

S. Tibshirani
Executive Engineer

cc: Mr. J. Walter

A. Stermac

Mr. B. Glassford,
Senior Materials Engineer
(Aggregates)

Mr. A. Rutka

November 2, 1964.

Thorold Tunnel,
W. P. 445-64

H. G. Acres and Company had been retained by the Department to prepare a preliminary report regarding the feasibility of a tunnel. The Department will accept this report in the near future. A copy of it is attached.

You will note from page 34 that there will be a considerable amount of surplus excavation, and much of it will be rock. I refer you to plate 5 where the rock geology is given. It may be quite possible to utilize some of this rock for either granular base course or concrete aggregate, and I would be pleased if you would review the rock formations, and let me know if, in your opinion, it would be suitable for either G.B.C. or concrete.

I understand that this crossing is probably about two miles from the Walker Bros. Quarry in Thorold, and it might be possible to compare the stratigraphy without doing any further field work.

Would you please return this report to me.

ak

A. Rutka,
Materials & Testing Engineer.

AR/pa
c.c. A. Stermac,
T. Kovich.

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer.

From: Mr. A. Rutka,

Date: November 2, 1964.

Our File Ref.

In reply to

Subject: Thorold Tunnel - Soils Report, W. P. 445-64

I am sending you a copy of the soils report prepared by H. G. Acres. I have looked at it very quickly, and there does not appear to be any soils problems on this project.

As this is the only copy of the report we have, would you please review it and let me have any comments on it. Then pass it on to Mr. G. Wrong, and T. J. Kovich, who will then return it to you.

A. Rutka,
Materials & Testing Engineer.

AR/pa
c.c. G. Wrong,
T. Kovich,
Files.

A. Stermac

K. V. 10 ans

Mr. F. I. Hewson,
Consultant Liaison Engineer.

Mr. A. Rutka,
Materials & Testing
Engineer.

November 3, 1964.

Thorold Tunnel,
W. P. 445-64

Peter Smith has quickly reviewed H. G. Acres' feasibility report, and has made a few comments on the following items:

1. If guniting of the exposed shale is required, it is suggested that the Hydro procedures on the Chippawa Canal be studied. Apparently St. Lawrence low gypsum fast setting cement applied in one 3" layer works very well, as compared with the conventional 2 layer procedure.

2. Studies should be made on the sulphate content of the soil, and if there is a possibility of sulphate attack on the concrete, sulphate resisting cement should be used where interstices contain overburden.

3. Mention is made on page 35 about diverting flow of industrial wastes into a culvert. Possible attack of the industrial wastes on concrete should be studied.

4. It is proposed to use the membrane waterproofing system. This system is good. Special attention is needed during construction to protect against puncturing of the membrane by the backfill.

AR

A. Rutka,
Materials & Testing Engineer.

AR/pa

c.c. J. Walter,
P. Smith,
A. Stermac,
T. Kovich.

A. Stermac

Mr. D. Smith,

Mr. A. Rutka.

February 18, 1965.

Thorold Tunnel, W.P. 445-64,
H. G. Acres' Report, Appendix B

This report deals with the stability of the cut slopes and the foundations, for the structures and retaining walls outside of the canal area.

I am forwarding this report to you, and after you have reviewed the test results and correlated them with the invoice, would you please forward it on to Mr. Stermac. Mr. Kovich may need this report to complete his soils design report, and he can obtain it from Mr. Stermac whenever required.

ar

A. Rutka,
Materials & Testing Engineer.

AR/pa

Attach.

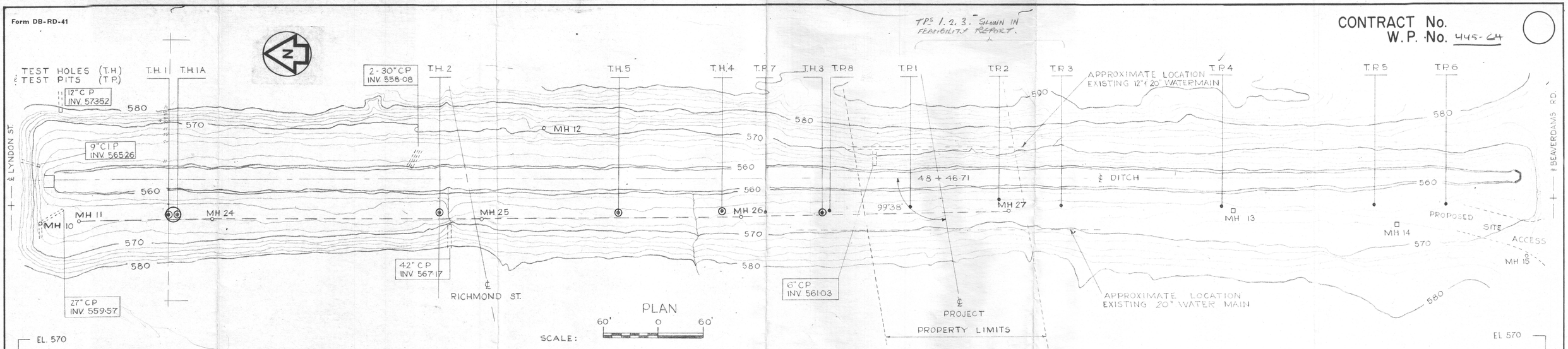
c.c. Messrs. A. Stermac,
G. Wrong,
T. Kovich.

Form DB-RD-41

CONTRACT No.
W.P. No. 445-04

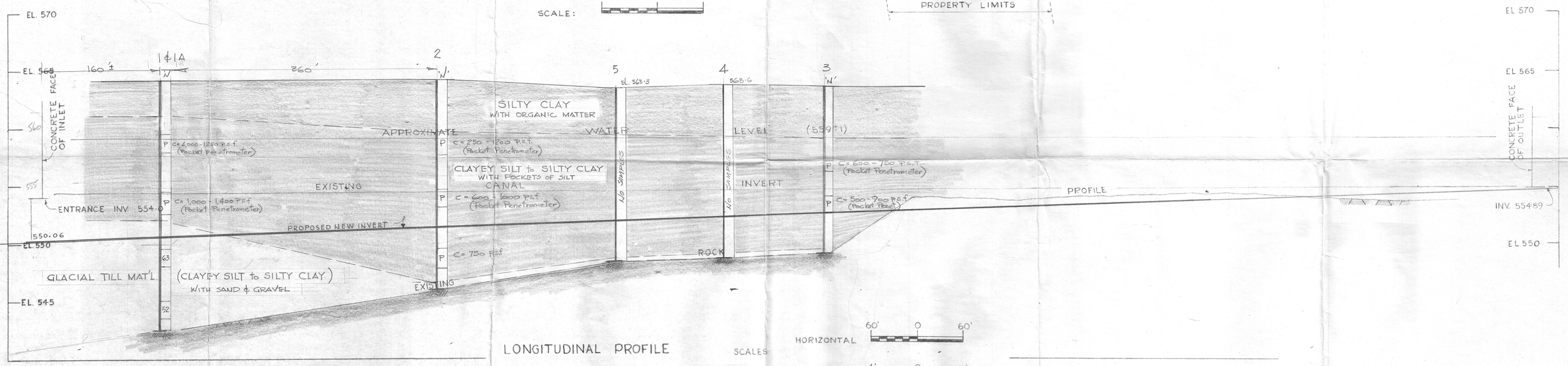
TPs 1, 2, 3, SHOWN IN FEASIBILITY REPORT.

TEST HOLES (T.H)
TEST PITS (T.P)



PLAN

SCALE: 60' 0 60'

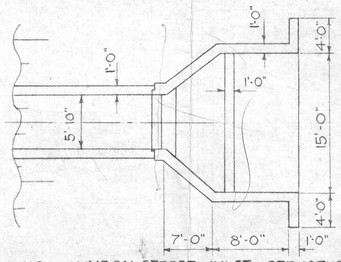


LONGITUDINAL PROFILE

SCALES

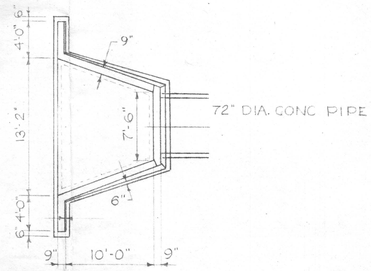
HORIZONTAL 60' 0 60'

VERTICAL 4' 0 4'



EXISTING LYNDON STREET INLET STRUCTURE SCALE

MANHOLE	24	25	26	27	10	11	12	13	14	15
GRATE ELEVATION	567.58	569.09	568.53	568.71	576.10	567.18	572.06	566.70	569.15	575.96
INVERT	557.88 N 557.93 S	559.29 N 559.39 S	560.38 N 560.43 S	561.76 N 561.81 S	564.70 W 560.50 S	556.23 N 556.68 S	565.96 E			564.76 E 564.86 W



EXISTING O'NEILL'S BRIDGE OUTLET STRUCTURE

ONTARIO

DEPARTMENT OF HIGHWAYS

Box 279, Burlington
March 31, 1965

W.P. 445.64

THOROLD TUNNEL

APRIL 2, 1965 2:00 P.M.

1. Minutes of Meeting of March 19, 1965
2. Matters Arising from Minutes
3. Cross-Sections and Utility Moves on West Approach
4. Disposal of Material - Marlatt's Pond
5. Other Business
6. Next Meeting

ONTARIO

DEPARTMENT OF HIGHWAYS

Box 279, Burlington
March 31, 1965

W.P. 445-64

THOROLD TUNNEL

MINUTES OF MEETING NO. 13

MEETING:

AT DEPARTMENT OF HIGHWAYS OFFICE, BURLINGTON, ON MARCH 19, 1965

PRESENT:

DEPARTMENT OF HIGHWAYS, ONTARIO

H. Greenland
F. I. Hewson
G. Celmins
R. Draycott
R. Britton

TOWN OF THOROLD

J. Cruickshank

TOWNSHIP OF THOROLD

C. Bauman

THE ST. LAWRENCE SEAWAY AUTHORITY

K. Aplin

H. G. ACRES & COMPANY LIMITED

S. Tibshirani
R. G. Tanner

SUMMARY OF DISCUSSIONS

ACTION REQUIRED

1. MINUTES

The minutes of the meeting held March 4, 1965 were read and approved.

2. ARISING FROM MINUTES

Item 17(11), General Arrangement Drawings - The comments of

ACTION REQUIRED

the Road Design Division have now been received and will be incorporated in the drawings.

Item 8(10), Fire Marshal's Requirements - The Fire Marshal's requirements are stated in a letter from Mr. Hewson, a copy of which is attached to these minutes.

Item 7(11), Disposal of Waste Materials - Mr. Bauman will arrange a meeting with the Township representatives by March 26, 1965 to discuss the proposed disposal arrangements for Marlatt's Pond. C.B.

As a result of Mr. Celmins' investigation into the use of disposal materials as fill in the new Highway No. 58 east of the Canal, it was agreed that this method of disposal should be incorporated in the tunnel contract. Presuming that the first 500,000 cubic yards or so of material to be excavated could be disposed of in local Seaway property, then the contractor would be instructed to start placing highway fill nine months after the start of the contract, that is in June, 1966. This will allow enough time for the highway alignment to be established, bridge structures erected, and property acquired. Highway fill requirements are estimated to be about 200,000 to 250,000 cubic yards.

Mr. Aplin will confirm this arrangement with the Seaway Authority. K.A.

Mr. Draycott will expedite the selection of the new highway alignment and will initiate procedures for the assumption of Davis Road at the commencement of tunnel construction.

DHO will provide Acres with rough quantities, typical cross-sections and a plan showing the road fill areas by April 30, 1965, to be incorporated in the tunnel contract. Acres will discuss specification requirements with Mr. Celmins. G.C.

Item 3(11, Access to Exolon Company - The Township of Thorold have requested that an official pedestrian walk be provided over the NS & T rail line adjacent to the proposed Queen Street Bridge. Mr. Draycott is taking this matter up with the CNR and Board of Transport Commissioners. R.D.

As requested by the Town of Thorold, DHO agreed to provide a fence alongside the playing field on Queen Street.

Item 3(12), Property Acquisition - Acres will establish working limits for the tunnel contractor and show them on the master plan for property for submission by March 26, 1965. Acres

Item 4(12), Domtar Property - Following Acres review of the effect of loading the tunnel with stockpiles of wood chips, DHO will decide whether or not to allow Domtar to build stockpiles over the tunnel. Once the policy is established, a meeting will be arranged with Mr. Cash of Domtar. Mr. Draycott will expedite this. R.D.

3. Seaway Construction Schedule

A master plan of the Lock 7 area showing the Seaway construction program for 1965-66 was provided. The results of the meeting held with the Seaway Authority on March 16, 1965 were discussed briefly.

The DHO do not intend to design the intersection at Davis Road and Leslie Street as no major traffic turning movements are predicted there.

4. Approval of Contract Drawings

Tunnel contract drawings will be signed by DHO representatives as follows:

(a)	Bridge Division Drawings	A. Toye
(b)	Special Road Design Standards	G. K. Hunter
(c)	Title Sheet	H. D. McMillan
		G. K. Hunter
		G. Celmins

Where space is provided in the title block for initials, under checked by, designed by, etc. it should be used by Acres' representatives.

It was agreed that the Regional Contract review for the tunnel contract be held in the District Office at Burlington, leaving only the Head Office review at Downsview.

Acres will endeavour to submit the contract drawings to DHO in appropriate blocks as they become available. The first block will consist of road design drawings, which should be available by about April 1, 1965.

The contract drawings will also be submitted to the Seaway Authority for comments.

5. Highway Bridges

The drawings for the highway bridges at Queen Street and Pine Street will be provided by DHO for incorporation in the contract documents by October, 1965.

6. Drainage Facilities in the Old Canal

Mr. Cruickshank will check existing pipes discharging into the Old Canal to determine if any of them are dead ends, in which case connections to the future culvert and manholes could be eliminated. J.C.

A meeting will be held on March 22, 1965 at Downsview to review Mr. Beaudro's comments on the contract documents for the drainage facilities.

7. West Approach

Critical dates for engineering design of the west approach are as follows:

June 1, 1965 - Alignment to Collier Street will be available.

July 1, 1965 - Soils Report prepared.

August 4, 1965 - Alignment to Collier Street finalized.

Mr. Hewson will check with Mr. Rutka as to who will perform the soils investigations. F.I.H.

The application to the Ontario Municipal Board to close roads in the Town of Thorold will be submitted within three months. Mr. Draycott is pursuing this. R.D.

8. Submission to Board of Transport Commissioners

Acres will complete the estimate for submission to the Board by April 1, 1965 provided that the CNR portions of the estimate will be available. Acres will check with Mr. Trapnell of CNR to determine when their estimates will be complete. Acres

Mr. Celmins will review the estimates with Acres before the end of March.

9. Chain Link Fencing

DHO will call a separate contract for installation of permanent chain link fencing after the tunnel construction is complete.

10. Bailey Bridges

In addition to the bailey bridge required for the Highway 58 diversion, it will be necessary to install a bridge to allow access over the Pondage Canal. Acres will notify DHO of the requirements for the bridge. Acres

11. Centreline of Richmond Street

Acres will determine the future centreline of Richmond Street after consultation with Mr. Celmins. Acres

12. Highway 58 Realignment

Acres will provide Mr. Draycott with a plan showing the right-of-way required for the realignment of Highway No.58. Acres

13. Field Organization

Mr. Greenland will discuss the field organization with Acres before March 26, 1965. H.G.

14. Next Meeting

The next meeting of the Technical Co-ordinating Committee will be held at Burlington, on April 2, 1965 at 2:00 P.M.

H. Greenland

H. Greenland
District Engineer

HG:ms

ONTARIO

DEPARTMENT OF HIGHWAYS

Box 279, Burlington
March 31, 1965

W.P. 445-64

THOROLD TUNNEL

MINUTES OF MEETING

MEETING: AT THE ST. LAWRENCE SEAWAY AUTHORITY OFFICE, ST. CATHARINES ON MARCH 16, 1965

PRESENT:

THE ST. LAWRENCE SEAWAY AUTHORITY

S. R. MacKay
A. W. Bridgewater
W. A. O'Neil
P. Murray
D. Ross
K. F. Aplin

DEPARTMENT OF HIGHWAYS, ONTARIO

H. Greenland
F. I. Hewson
G. Celmins

H. G. ACRES & COMPANY LIMITED

S. Tibshirani
B. Whelan
R. G. Tanner

PURPOSE: To discuss the construction program and review general arrangement drawings for the Tunnel.

SUMMARY OF DISCUSSIONS

1. Tunnel Construction Schedule

The Tunnel construction schedule is generally as described in the Feasibility Report, in that the work will proceed from each portal towards the Canal. However, due to the Canal widening proposed by the Seaway Authority, it will now be necessary to excavate in the Canal bed in the winter of 1965-66 and the schedule has been revised accordingly, as shown on Acres Drawing No. SK-1195-A-64.

The Seaway Authority stated that the unwatered period for the Canal

each winter will now be shortened to extend from midnight December 19 to midnight March 16. Since this will eliminate 12 days from the winter construction period, it will be necessary for Acres to review the tunnel construction schedule in detail.

2. Seaway Construction Schedule

The seaway construction program for the winter of 1965-66 in the vicinity of Lock 7 was reviewed briefly. A copy of the plan showing details of the program will be forwarded to the D.H.O. and Acres within a few days.

The Seaway Authority require an access road to Lock 7 to be maintained in the bottom of the Canal at the tunnel location during the winter of 1965-66.

3. Canal Widening Program

The Seaway Authority requested that the Canal widening program on the west bank of the Canal be included in the tunnel contract for completion in the winter of 1965-66. Acres will provide complete engineering services for this work, including design of the new Canal wall, and any special requirements set by the Seaway Authority.

The Seaway Authority will establish the limits of the Canal widening, following survey in the field to establish the line of the wall.

The Seaway Authority will supply bollards.

4. Pondage Canal Diversion

The Seaway Authority will be widening the existing pondage canal significantly in the summer of 1965, and this will also necessitate the widening of the pondage canal diversion required for tunnel construction. The Seaway Authority will provide the exact details of this, so that it can be incorporated into the contract drawings for the tunnel.

5. Tunnel Engineering Schedule

To meet the contract award date for the tunnel, the drawings must be finalized by May 31, so that it is imperative that changes or revisions be incorporated in the drawings as soon as possible.

6. Canal Unwatering Program

When the Canal is first drained at the start of the winter, there is a leakage through the Guard Gate structure of about 160 cfs. To reduce this leakage to the minimum, estimated to be less than 10 cfs, it will be necessary to seal the gates, an operation which will probably take several days. The Seaway Authority will be responsible for sealing the gates during the next three winters.

It will be necessary to isolate the tunnel excavation with cofferdams in the Canal bed. These cofferdams may be left in during the navigation season, provided they do not extend above elevation 541 feet. Since the Seaway Authority will have a number of contractors working in the area of Lock 7, they will evolve an overall policy regarding the unwatering of the Canal and the responsibility for pumping. The Department of Highways will be informed.

7. Tunnel General Arrangement Drawings

The general concepts shown in the tunnel General Arrangement drawings were approved by the Seaway Authority with the exception of the pondage canal diversion, which will require widening as mentioned earlier.

8. Disposal Areas

The Seaway Authority will review the situation regarding disposal of excavated materials on the east bank of the Canal, particularly from within the future channel limits. The DHO will be informed of the Seaway Authority policy within a few days.

The DHO felt that economic disposal can best be obtained by establishing one haul distance for each contract, so that the contractor will be organized for either a long haul or a short haul, but not both. DHO policy of purchasing local property for disposal rather than using Lake Ontario may be reconsidered in the light of possible local objections to unsightly piles.

9. Blasting Regulations

It was agreed that it will be impossible to restrict short wave radio transmission in the area of the tunnel and the contractor should merely be warned in the Specifications of the prevailing conditions and that he should be careful when ships are in the immediate vicinity.

It was suggested that there may be problems with Ontario Paper Company due to disruption of computerized machinery.

10. Concrete Batching

The concrete departments of the Seaway Authority and the DHO will be asked to assess jointly the ready-mix concrete and aggregate supplies available in the Canal area.

11. Intersection at Davis Road and Leslie Street

The Seaway Authority requested that the DHO review the design of the intersection at Davis Road and Leslie Street, particularly as the Seaway Authority will be moving the monument now located east of the pondage canal into the area of this intersection during the summer of 1965.

12. Seaway Haul Road

The Seaway Authority confirmed that the new haul road on the east bank of the Canal will be permanently available for use by DHO and the dock lessee. The haul road lies within the 50 foot width between the Seaway property line and the Canal bank. It will be necessary to provide a temporary access direct from Davis Road to the dock area when the haul road is cut during tunnel construction.

13. Seaway Property

The Seaway Authority will not grant an easement for the tunnel. Permission will be given to construct the tunnel and it was suggested that the DHO legal and property branch exchange letters with the Seaway Authority on this matter. Probably the Seaway Authority will grant a license for the future use of the land but this will contain a clause allowing it to be cancelled at any time.

H. Greenland
District Engineer

HG:ms

ONTARIO

DEPARTMENT OF HIGHWAYS

Box 279, Burlington
March 31, 1965

W. P. 445-64

THOROLD TUNNEL**

MINUTES OF MEETING

MEETING: AT ACRES OFFICE, NIAGARA FALLS, ON MARCH 16, 1965

PRESENT:

DEPARTMENT OF HIGHWAYS, ONTARIO.

G. Celmins

H. G. ACRES & COMPANY LTD.

G. Brown
R. Tanner

SUBJECT: Review of general arrangement drawings and property request.

SUMMARY OF DISCUSSIONS:

1. General Arrangement Drawings:

Comments of the Road Design Division regarding Acres' general arrangement drawings were noted for incorporation in the contract drawings.

2. Approval of Drawings:

Acres expect to complete pencil drafts of the road design contract drawings by April 1, 1965. These will be submitted to DHO at this time for approval before the drawings are inked.

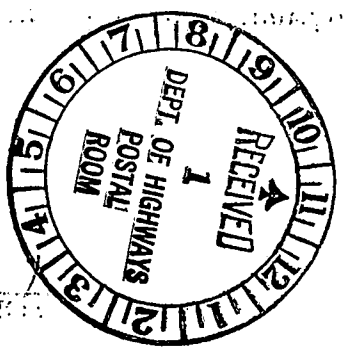
3. Property Request:

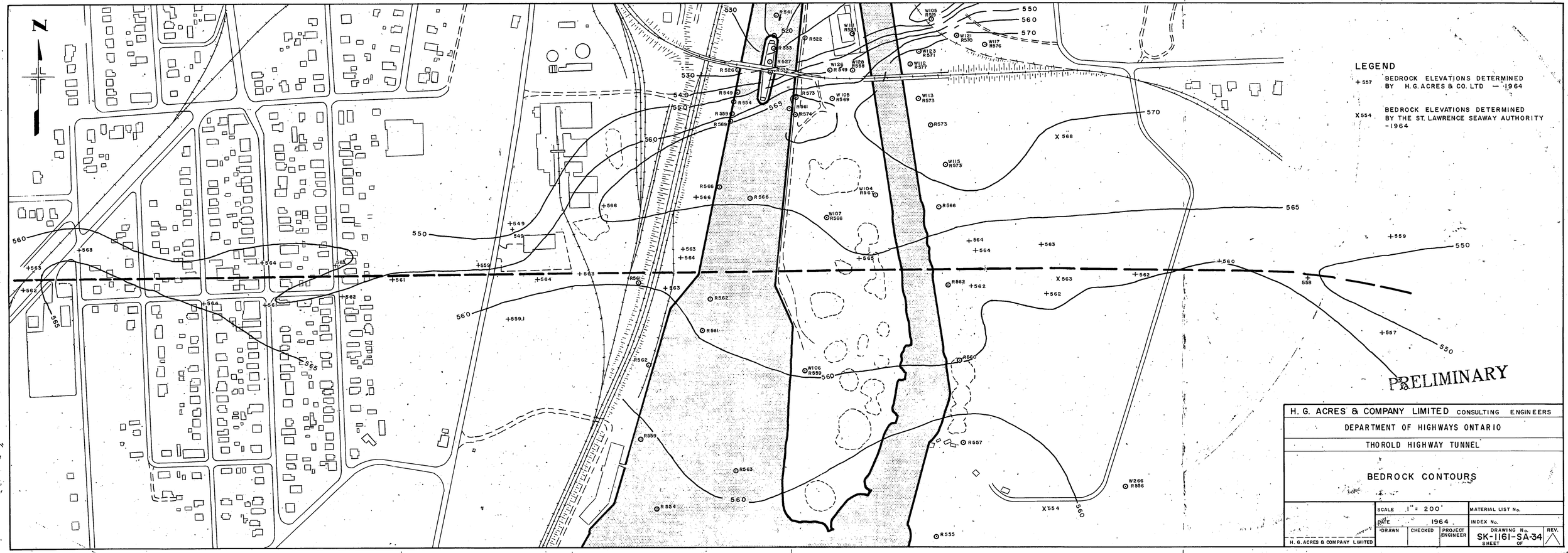
Acres will complete the property request drawing covering Seaway and CNR property in accordance with Mr. Celmins instructions. The drawing cannot be completed until dimensions for the pondage canal and Canal widening program are provided by the Seaway Authority.

H. Greenland
District Engineer

HG:ms


RECEIVED
APR 1 1965
SECTION 75


RECEIVED
1
DEPT. OF HIGHWAYS
POSTAL
ROOM


N
LEGEND
+557 BEDROCK ELEVATIONS DETERMINED BY H.G. ACRES & CO. LTD — 1964
X554 BEDROCK ELEVATIONS DETERMINED BY THE ST. LAWRENCE SEAWAY AUTHORITY -1964
PRELIMINARY
H. G. ACRES & COMPANY LIMITED CONSULTING ENGINEERS
DEPARTMENT OF HIGHWAYS ONTARIO
THOROLD HIGHWAY TUNNEL
BEDROCK CONTOURS
SCALE 1" = 200'
DATE 1964
DRAWN
CHECKED
PROJECT ENGINEER
MATERIAL LIST No.
INDEX No.
DRAWING No. SK-1161-SA-34
SHEET OF
REV.
H. G. ACRES & COMPANY LIMITED

W.P. 445-64 Le.
Thorold Hwy. Tunnel.

September 3, 1964
1161

THOROLD HIGHWAY TUNNEL

Laboratory and Field Investigations

Progress Report - September 3, 1964

W.P. 445-64

Progress

The field investigations to date in the vicinity of the site of the proposed tunnel consist of 24 drill holes within the tunnel portion and eastern approach as shown on SK-1161-SA-17 and 14 along the western approach. In 15 of the 24 holes extensive exploration of the bedrock was carried out, while the balance were drilled primarily to provide information on the depth to bedrock and the nature of the overburden.

It is estimated that the drilling program is about 95 per cent complete. The remainder of the program consists of the installation of 5 standpipes to determine the effect of draining the canal on the water level in the rock. In addition, it is proposed to dig several backhoe pits to investigate soil conditions in the at-grade portion of the proposed highway between the west approach and Collier Street.

The condition of the rock immediately beneath the main canal is not known at the present time. If a tunnelling operation is required beneath the canal, an additional program to investigate this rock will be needed when the canal is next dewatered.

The laboratory testing of the overburden samples from the tunnel area is almost complete, leaving only the testing of the samples from the approaches and the at-grade portion of the highway.

The investigations to date have disclosed the following information on the overburden and bedrock.

Overburden

The thickness of the overburden along the tunnel alignment varies from 10 to 35 feet with the average being approximately 25 feet.

The 10-foot depth is located in the vicinity of the main canal where the original ground surface has been excavated. The maximum depth is at Highway 58.

Below one to two feet of organic cover, the overburden consists of silty clay overlying a layer of clay till, which varies in thickness from several inches to five or six feet. The silty clay grades from a mottled material to a varved-like material containing layers of silty clay, clayey silt, silt and fine sand lenses with some small angular rock fragments. There is a decrease in plasticity with depth. The upper portion forms a stiff crust with undrained shear strengths as high as 10,000 psf. Minimum undrained shear strengths in the lower portion of the varved-like material are of the order of 1,000 to 1,500 pounds per square foot. The clay till is of medium density and consistency.

As a result of the studies to date, it is not expected that any major problems will arise in design or construction due to the nature and depths of the overburden materials.

Bedrock

The bedrock consists of unfaulted sedimentary rocks dipping uniformly in a southwesterly direction at approximately four degrees. Along the tunnel line, the rock surface is almost horizontal, although at the west end there is a slight depression in the rock.

A table of the rock formations intersected by the drill holes is as follows::

TABLE OF FORMATIONS

Age	Formation	Member	Thickness (ft)	Lithology and Structure
Youngest Middle Silurian	Lockport	Goat Island	17-25	Dolomite - dolomitic limestone Bedding ranges in thickness from 0.5 to 5.0 feet Vertical joints present.
	Lockport	Gasport	21-28	Limestone with calcareous shal Bedding ranges in thickness from 0.1 to 4.5 feet Vertical joints present. The thin layer of shale is thin bedded and tends to spall whe exposed.
	Decew	-	7-13	Dolomite - dolomitic limestone Bedding ranges in thickness from 0.5 to 2.0 feet Curved joints present
Oldest	Rochester		55+	Calcareous shale with thin limestone layers. Fissile and thin bedded The shale tends to spall when exposed.

Note - During the drilling, pockets of gas were encountered at various depths.

The rocks which will be encountered during construction can be divided into two groups, namely the dolomites and limestones, and the shales. Rocks of the first group, although jointed, are competent and they will not deteriorate when exposed.

The shales on the other hand are thin bedded and when exposed tend to spall. For this reason guniting may be necessary to prevent spalling. Provided spalling of the shale layers is prevented, there is no reason to suppose that vertical or nearly vertical cuts in the rock would not be stable.

However, it is possible that very thin clay seams might exist within the rock, the effect of which must be considered in stability studies for rock cuts.

If a tunnel is to be driven, both the dolomites and limestones, and the shales will be intersected. The former, being more competent, will provide better tunnelling conditions and will form a more stable opening. For this reason, tunnelling entirely in shale should be avoided if at all possible. During tunnelling, the possibility of encountering pockets of gas will need to be taken into account.

Although the studies of seepage conditions are not yet complete, the present indications are that no major design or construction problems are likely to be encountered due to seepage in the bedrock.