



Englobe

Soils Materials Environment

Submitted To AECOM Canada Ltd.
189 Wyld Street Suite 103, North Bay, Ontario P1B 1Z2
On Behalf of the Ontario Ministry of Transportation

Bridge Rehabilitation – Hawk Creek Bridge
Highway 547
Stations 13+727 to 13+758 – Township of Esquega
Site No. 38C-016
GWP 5377-11-00

FINAL FOUNDATION INVESTIGATION REPORT

Date: August 12, 2015
Ref. N°: 15/04/15026-F1

Geocres No. 42C-35

Submitted To AECOM Canada Ltd.
189 Wyld Street Suite 103, North Bay, Ontario P1B 1Z2
On Behalf of the Ontario Ministry of Transportation

Bridge Rehabilitation – Hawk Creek Bridge
Highway 547
Stations 13+727 to 13+758 – Township of Esquega
Site No. 38C-016
GWP 5377-11-00

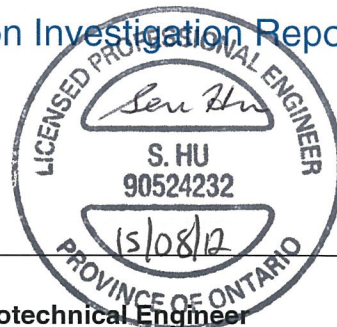
Final Foundation Investigation Report

Prepared by:

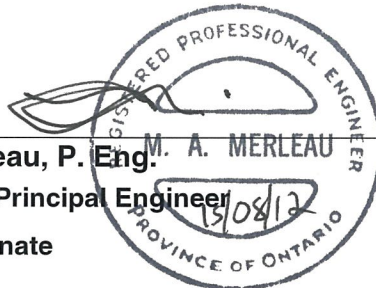


Sen Hu, P. Eng.

Englobe – Senior Geotechnical Engineer



Reviewed by:



M.A. Merleau, P. Eng.

Englobe – Principal Engineer

MTO Designate

TABLE OF CONTENTS

1 INTRODUCTION	1
2 SITE DESCRIPTION	1
2.1 Site Physiography and Surficial Geology.....	2
3 INVESTIGATION PROCEDURES	2
4 SUBSURFACE CONDITIONS	3
4.1 Hawk Creek Bridge, Township of Esquega	3
4.1.1 <i>Pavement Structure</i>	3
4.1.2 <i>Sand Fill</i>	4
4.1.3 <i>Sand with Silt to Sand</i>	4
4.1.4 <i>Previous Investigations</i>	4
4.2 Groundwater data	5

Appendices

Appendix 1 Drawings
Appendix 2 Subsurface Data
Appendix 3 Laboratory Data
Appendix 4 Photo Essay
Appendix 5 Historical Data

Property and Confidentiality

"This engineering document is the property of Englobe Corp. and, as such, is protected under Copyright Law. It can only be used for the purposes mentioned herein. Any reproduction or adaptation, whether partial or total, is strictly prohibited without having obtained Englobe's and its client's prior written authorization to do so.

Test results mentioned herein are only valid for the sample(s) stated in this report.

Englobe's subcontractors who may have accomplished work either on site or in laboratory are duly qualified as stated in our Quality Manual's procurement procedure. Should you require any further information, please contact your Project Manager.

Client:

AECOM Canada Ltd.
189 Wyld Street, Suite 103
North Bay, Ontario
P1B 1Z2

Attention: Mr. Al Rose

REVISION AND PUBLICATION REGISTER		
Revision N°	Date	Modification And/Or Publication Details
01	2015-08-12	FINAL FIR issued

DISTRIBUTION	
5 hard copies and 1 electronic copy	MTO Project Manager
1 hard copy and 1 electronic copy	MTO Pavement and Foundations Section, Foundation Group
1 hard copy	File

1 INTRODUCTION

LVM-Merlex, a Division of Englobe Corp. (now known as Englobe Corp.), has been retained by AECOM Canada Ltd., on behalf of the Ministry of Transportation of Ontario (MTO), to carry out a foundation investigation to supply subsurface data for the design of a protection system to be implemented at the existing Hawk Creek Bridge during the proposed rehabilitation and conversion to semi integral abutments. The bridge is located on Highway 547, some 3.7 km north of the intersection between Highway 101 and Highway 547 in the Township of Esquega (see Drawing No. 1 in Appendix 1).

The foundation investigation location was specified by the MTO in the Terms of Reference for work under Agreement No. PO 5013-E-0051: GWP 5377-11-00 for delivering a submission of Design-Build Contract package with an option of completing detailed design for a conventional Detailed Design Contract package. The terms of reference for the original scope of work are outlined in LVM-Merlex's Proposal P-14-175 dated November 7, 2014. After the kick-off meeting held on April 27, 2015, MTO decided that the scope of work be revised for a Detailed Design Contract package. Accordingly the revised terms of reference for the foundation investigation are outlined on LVM-Merlex's letter dated June 22, 2015 (LVM-Merlex Reference No.:15/04/15026-R2).

The purpose of this investigation was to determine the subsurface conditions in the area of the bridge approaches in order to provide factual subsurface information and design recommendations for a protection system to be implemented during rehabilitation activities. Englobe investigated the foundation area by the drilling of boreholes, carrying out in-situ tests, and performing laboratory testing on select samples.

2 SITE DESCRIPTION

The Hawk Creek Bridge is located on Highway 547, between approximately Stations 13+727 to 13+758, Township of Esquega (Site No. 38C-016). The bridge is a two-span structure, 31 m in length along the centerline and was constructed in 1964. The topography at this site is located in an area with generally level terrain. The existing approach embankments for the bridge currently support two undivided lanes of highway, running in a south-north direction. The Hawk Creek flows from the east to the west at the bridge location (right to left). A visual review of the highway pavement surface, to the north and south of the bridge, indicates that, in general, the approaches are in fair to good condition (see Photo Essay in Appendix 4).

At the bridge location, the existing highway centerline is at elevation 316.5 m at both ends of the bridge. The highway pavement structure is constructed on the sand fill of the approach embankments, which overlie the natural earth deposits. The existing approach embankments

extending out from the existing concrete wing walls, in the area of the bridge, have been built on slope angles of approximately 2H:1V to 2.5H:1V.

2.1 SITE PHYSIOGRAPHY AND SURFICAL GEOLOGY

This project is located in the Geomorphic Sub-province known as the Eastern Sandy Uplands. The topography on this section of Highway 547 is generally flat. Significant layers of earth overlay the bedrock. Within the project area native overburden primarily consists of sandy silt to silty sand.

Bedrock in the area consists of the granitic rocks of early Precambrian Age.

3 INVESTIGATION PROCEDURES

The fieldwork for this investigation was carried out between June 11th and June 12th, 2015 during which time two (2) sampled boreholes were advanced through the existing approach slab and the approach embankment at each end of the bridge.

The field investigation was carried out using a truck and/or bombardier mounted CME drilling rig equipped with hollow stem augers, standard augers, casing equipment, and routine geotechnical sampling equipment. Soil samples were obtained at the borehole locations at regular intervals of depth using the standard 50 mm O.D. split spoon sampler advanced in accordance with the Standard Penetration Test (SPT) procedures (ASTM D-1586). The SPT method involves advancing a 50 mm O.D. split spoon sampler with the force of a 63.5 kg hammer freely dropping 760 mm. The number of blows per 300 mm penetration was recorded as the “N” value. When cohesive deposits were encountered, the in-situ strength was measured using an “N” size field vane, vane collar, and calibrated torque meter. All samples taken during this investigation were stored in labeled airtight containers for transport to our North Bay laboratory for visual examination and select laboratory testing.

Groundwater conditions in the open boreholes were observed during the advancement of and immediately following, completion of the individual boreholes. A single 19 mm diameter standpipe was installed in one open borehole prior to backfilling to allow for further monitoring of the local groundwater level. All open boreholes were backfilled upon completion with compacted auger cuttings in the general order they were removed, and where necessary, bentonite pellet backfill was added to the boreholes to bring them up to grade in accordance with requirements of Ontario Regulation 903. At the borehole through the embankment, the upper portion of the hole, where necessary, was backfilled with an asphalt cold patch to seal the existing asphalt surface.

The fieldwork for this investigation was under the full time direction of a senior member of the Englobe engineering staff, who was responsible for locating the boreholes, clearing the borehole locations of underground services, in-situ sampling and testing operations, logging of the boreholes, labeling and preparation of samples for transport to our North Bay laboratory,

plus overall drill supervision. All samples received a visual confirmatory inspection in our laboratory. Laboratory testing of select samples included routine testing for natural moisture content determination and particle size analysis. The results of the laboratory testing are presented on the individual Record of Borehole Sheets (Appendix 2), with a summary of results presented on the laboratory sheets in Appendix 3 (Figures Nos. L-1 to L-2 and Table No. L-3).

The location of the individual boreholes was determined in the field using highway chainage (established by others) and offset relative to highway centerline. The MTO co-ordinates, northing and easting, were then established for the boring locations. Elevations contained in this report are referenced to a geodetic datum. The borehole elevations are based on a survey carried out by others.

4 SUBSURFACE CONDITIONS

Details of the subsurface conditions revealed by the investigation program are presented on the enclosed Records of Borehole Logs (Appendix 2) and on Drawing No. 2 (Appendix 3). Please note that stratigraphic delineations presented on the borehole logs and soil strata plot are the results of non-continuous sampling, response to drilling progress, the results of SPT, plus field observations. Typically such boundaries represent transitions from one zone to another and are not an exact demarcation of specific geological unit. Additional consideration should be given to the fact that subsurface conditions may vary markedly between adjacent boreholes and beyond any specific boring location, and are shown on the drawings for illustration purposes only.

4.1 HAWK CREEK BRIDGE, TOWNSHIP OF ESQUEGA

A plan and profile illustrating the borehole locations and stratigraphic sequences is shown on Drawing No. 2, Appendix 3. During the course of the exploration program, two (2) sampled boreholes were put down at this site, with Borehole No. 1 advanced behind the south abutment to the right of centerline (right side), and Borehole No. 2 advanced behind the north abutment to the right of centerline (right side).

At the time of the subsurface investigation, the ground surface elevations at Borehole Nos. 1 and 2 were recorded at elevations 316.5 m and 316.4 m, respectively.

4.1.1 Pavement Structure

At surface at Borehole No. 1, a pavement structure consisting of asphalt some 75 mm thick overlying a concrete slab 305 mm thick was penetrated. At Borehole No. 2, a pavement structure consisting of some 125 mm of asphalt overlying a concrete slab 305 mm thick was penetrated.

4.1.2 Sand Fill

Underlying the concrete approach slab at Borehole Nos. 1 and 2, a layer of brown sand and gravel, mixed with rock fill, trace to some silt to sand, trace gravel trace silt was penetrated. The natural moisture contents measured on samples of this deposit recovered from Borehole Nos. 1 and 2 were in the order of 4% to 27%, with the exception of a natural moisture content measured at 34% on a sample recovered at a depth of some 5.5 m below ground surface (i.e. about 1.5 m above the bottom of the fill deposit) from Borehole No. 1. Gradation analyses were carried out on six (6) samples of this deposit, recovered from Borehole Nos. 1 and 2, the results of which indicated 2% to 45% gravel size particles, 47% to 87% sand size particles, and 6% to 19 % silt and clay size particles (Figure No. L-1, Appendix 3). Results of grain size distribution testing carried out on six samples recovered from Borehole Nos. 1 and 2 indicate that half of fill samples meets requirements of Granular "B" Type I stated in OPS.PROV 1010 and the fine material contents of three (3) samples exceed requirements. Rock pieces of the cobble and boulder sizes were encountered at depths ranging from 0.8 m to 5.3 m below ground surface, at locations of Borehole Nos. 1 and 2, and resulted in sampler refusals during the 3rd and the 7th SPT tests at the location of Borehole No.2. Based on SPT 'N' values of 6 to 78 blows per 300 mm to 65 blows per 23 mm penetration, the compactness of this deposit was described as loose to very dense. This deposit was encountered to depths of 7.1 m and 8.6 m below grade at Borehole Nos. 1 and 2, respectively (elevations 309.4 m and 307.8 m, respectively).

4.1.3 Sand with Silt to Sand

Underlying the sand fill deposit at the locations of Borehole Nos.1 and 2, a layer of dark brownish grey to grey sand with silt trace clay to grey sand trace silt trace clay was penetrated. The natural moisture content measured on two samples of this deposit was in the order of 20% to 26% except the natural moisture content of one (1) sample was measured at 57 % due to trace organics and grass rootlets recovered from Borehole No. 1. Hydrometer analyses were carried out on two (2) samples of this deposit, the results of which indicated 0% to 9% gravel size particles, 64% to 93% sand size particles, 6% to 24% silt size particles, and 1% to 3% clay size particles (Figure No. L-2 in Appendix 3). Based on SPT 'N' values of 2 to 4 blows per 300 mm penetration, the compactness of this deposit was described as very loose. This deposit was encountered to depths of 9.8 m and 9.6 m below grade at locations of Boreholes Nos. 1 and 2, respectively (elevations 306.7 m and 306.8 m, respectively), where the boreholes were terminated.

4.1.4 Previous Investigations

A previous foundation investigation, W.P. 144-61, was carried out at this location in 1961 by the Ontario Ministry of Transportation. Results of the previous investigation shown on a Drawing No. 61-F-120A indicated the subsurface soils on the river banks consisted of very loose silty sand overlying the loose to very dense silty sand to sandy silt. Refusal of Dynamic Cone Penetration Testing (DCPT) was countered at approximate elevation 290 m (see Enclosure No.

5, Appendix 5). Based on a Drawing No. TWP 682-16-2-A of Contract No. 63-39, the existing bridge was founded on deep foundations (324 mm diameter steel pipe piles driven to refusal at approximate elevation 288 m) at both of the north and the south abutments and the central pier (Enclosure No. 6, Appendix 5).

4.2 GROUNDWATER DATA

The river water level was measured at elevation 312.0 m during the period of site investigation. Measurements of the groundwater table and cave-in levels were undertaken, where possible, in the open boreholes during the advance of the individual borings and upon completion. A standpipe was installed in Borehole No. 1 to obtain post borehole completion water level. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix 2) and shown on the Borehole Locations and Soil Strata Drawing No. 2 in Appendix 3.

At the time of this investigation, the water levels were measured at elevations 311.7 m (June 12th, 2015) and 313.1 m (June 12th, 2015) at Borehole Nos. 1 and 2, respectively. It's noted that the groundwater level encountered at the location of Borehole No.2 was measured immediately after completion of drilling and the water level probably had not yet become stable.

The groundwater and creek water levels will fluctuate seasonally/yearly.

Appendix 1 Drawings

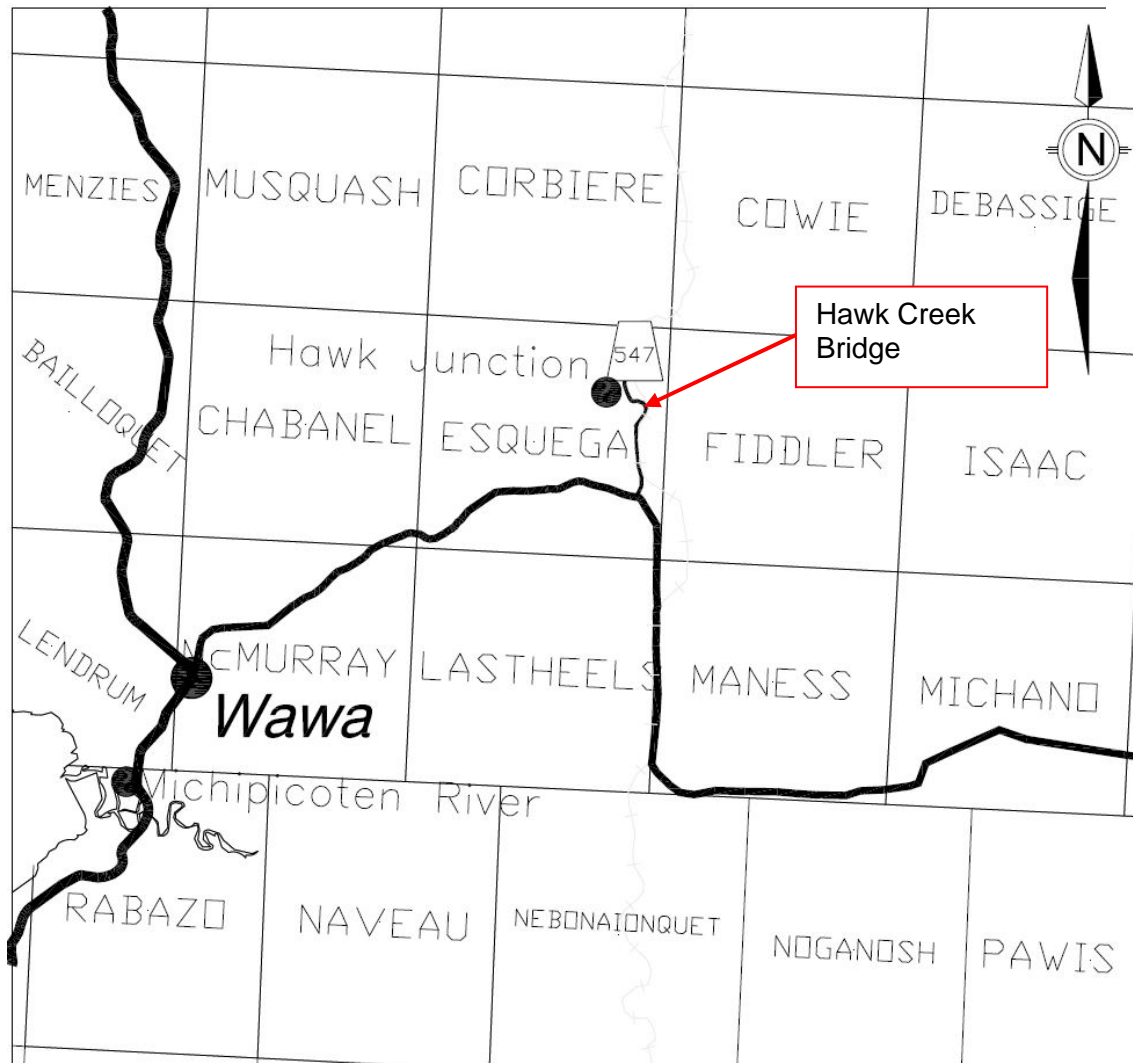
Drawing No. 1

Key Plan

MACRO KEY PLAN

Drawing No.1

NOT TO SCALE



FINAL FOUNDATION INVESTIGATION REPORT

GWP 5377-11-00

Highway 547

Hawk Creek Bridge

Site No. 38C-016

Township of Esquega



Reference No: 15/04/15026-F1

August 2015

Appendix 2 Subsurface Data

Enclosure No. 1	List of Abbreviations and Symbols
Enclosure Nos. 2 and 3	Record of Borehole Sheets

LIST OF ABBREVIATIONS & DESCRIPTION OF TERMS

The abbreviations and terms, used to describe retrieved samples and commonly employed on the borehole logs, on the figures and in the report are as follows:

1. ABBREVIATIONS

AS	Auger Sample
CS	Chunk Sample
DS	Denison type sample
FS	Foil Sample
NFP	No Further Progress
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure
RC	Rock core with size & percentage of recovery
SS	Split Spoon
ST	Slotted Tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash Sample
WH	Sampler advanced by static weight of hammer and/or rods
Rec	% recovery from individual run of rock core
RQD	Rock quality designation (%)

2. PENETRATION RESISTANCE/"N"

Dynamic Cone Penetration Test (DCPT):

A continuous profile showing the number of blows for each 300 mm of penetration of a 50 mm diameter 60° cone attached to AW rod driven by a 63 kg hammer falling 760 mm.

Plotted as —●—●—●—●—

Standard Penetration Test (SPT) or "N" Values

The number of blows of a 63 kg hammer falling 760 mm required to advance a 50 mm O.D. drive open sampler 300 mm.

3. SOIL DESCRIPTION

a) *Cohesionless Soils:*

"N" (blows/0.3 m)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

b) *Cohesive Soils:*

Undrained Shear Strength (kPa)	Consistency
Less than 12	very soft
12 to 25	soft
25 to 50	firm
50 to 100	stiff
100 to 200	very stiff
over 200	hard

3. SOIL DESCRIPTION (Cont'd)

c) *Cohesive Soils:*

RQD (%)	Classification
Less than 25	Very poor quality
25 to 50	Poor quality
50 to 75	Fair quality
75 to 90	Good quality
90 to 100	Excellent quality

d) *Method of Determination of Undrained Shear Strength of Cohesive Soils:*

- + 3.2 - Field Vane test in borehole.
The number denotes the sensitivity to remoulding.
- D - Laboratory Vane Test
- " - Compression test in laboratory

For a saturated cohesive soil the undrained shear strength is taken as one-half of the undrained compressive strength.

e) *Soil Moisture:*

Moisture	Described as
Dry	Below optimum moisture content
Moist	Near optimum moisture content
Wet	Above optimum moisture content

4. TERMINOLOGY

Terminology used for describing soil strata is based on the proportion of individual particle sizes present in the samples (please note that, with the exception of those samples subject to a grain-size analysis, all samples were classified visually and the accuracy of visual examination is not sufficient to determine exact grain sizing):

Trace, or occasional	Less than 10%
Some	10 to 20%
With	20 to 30%
Adjective (i.e. silty or sandy)	30 to 40%
And (i.e. sand and gravel)	40 to 60%

Terminology for cobbles and boulders is based on auger response and field observations:

Occasional	Obstructions encountered in borehole, however advance is not impeded
Numerous	Obstructions are essentially continuous over drilled length

SAMPLE DESCRIPTION NOTES:

1. **FILL:** The term fill is used to designate all man-made deposits of natural soil and/or waste materials. The reader is cautioned that fill materials can be very heterogeneous in nature and variable in depth, density and degree of compaction. Fill materials can be expected to contain organics, waste materials, construction materials, shot rock, rip-rap, and/or larger obstructions such as boulders, concrete foundations, slabs, abandoned tanks, etc.; none of which may have been encountered in the borehole. The description of the material penetrated in the borehole therefore may not be applicable as a general description of the fill material on the site as boreholes cannot accurately define the nature of fill material. During the boring and sampling process, retrieved samples may have certain characteristics that identify them as 'fill'. Fill materials (or possible fill materials) will be designated on the Borehole Logs. If fill material is identified on the site, it is highly recommended that testpits be put down to delineate the nature of the fill material. However, even through the use of testpits defining the true nature and composition of the fill material cannot be guaranteed. Fill deposits often contain pockets or seams of organics, organically contaminated soils or other deleterious material that can cause settlement or result in the production of methane gas. It should be noted that the origins and history of fill material is frequently very vague or non-existent. Often fill material may be contaminated beyond environmental guidelines and the material will have to be disposed of at a designated site (i.e. registered landfill). Unless requested or stated otherwise in this report, fill material on this site has not been tested for contaminants however, environmental testing of the fill material can be carried out at your request. Detection of underground storage tanks cannot be determined with conventional geotechnical procedures.
2. **TILL:** The term till indicates a material that is an unstratified, glacial deposit, heterogeneous in nature and, as such, may consist of mixtures and pockets of clay, silt, sand, gravel, cobbles and/or boulders. These heterogeneous deposits originate from a geological process associated with glaciation. It must be noted that due to the highly heterogeneous nature of till deposits, the description of the deposit on the borehole log may only be applicable to a very limited area and therefore, caution must be exercised when dealing with a till deposit. When excavating in till, contractors may encounter cobbles/boulders or possibly bedrock even if they are not indicated on the borehole logs. It must be appreciated that conventional geotechnical sampling equipment does not identify the nature or size of any obstruction.
3. **BEDROCK:** Auger refusal may be due to the presence of bedrock, but possibly could also be due to the presence of very dense underlying deposits, boulders or other large obstructions. Auger refusal is defined as the point at which an auger can no longer be practically advanced. It must be appreciated that conventional geotechnical sampling equipment does not differentiate between nature and size of obstructions that prevent further penetration of the boring below grade. Bedrock indicated on the borehole logs will be labeled 'possibly' or 'probable' etc. based on the response of the boring and sampling equipment, surrounding topography, etc. Bedrock can be proven at individual borehole locations, at your request, by diamond core drilling operations or, possibly, by testpits. It must also be appreciated that bedrock surfaces can be, and most times are, very erratic in nature (i.e. sheer drops, isolated rock knobs, etc.) and caution must be used when interpreting subsurface conditions between boreholes. A bedrock profile can be more accurately estimated, at the clients' request, through a series of closely positioned unsampled auger probes combined with core drilling.
4. **GROUNDWATER:** Although the groundwater table may have been encountered during this investigation and the elevation noted in the report and/or on the record of boreholes, it must be appreciated that the elevation of the groundwater table will fluctuate based upon seasonal conditions, localized changes, erratic changes in the underlying soil profile between boreholes, underlying soil layers with highly variable permeabilities, etc. These conditions may affect the design and type and nature of dewatering procedures. Cave-in levels recorded in borings give a general indication of the groundwater level in cohesionless soils however, it must be noted that cave-in levels may also be due to the relative density of the deposit, drilling operations etc.

REFERENCE	15/04/15026	DATUM	Geodetic	LOCATION	N 5326653.4 E 264111.1 - Esquega Twp., Station 13+725.5	ORIGINATED BY	JL
PROJECT	GWP 5377-11-00, Highway 547 - F1	BOREHOLE TYPE	Truck Mounted CME 45 - Hollow Stem Augers	COMPILED BY	SH		
CLIENT	AECOM	DATE (Started)	11 June 2015	TIME (Completed)	1:10:00 PM	CHECKED BY	MAM
		DATE (Completed)	11 June 2015				

MEL-GEO 15029 - BOREHOL LOGS - F1.GPJ MEL-GEO.GDT 10/8/15

METRIC**RECORD OF BOREHOLE NO. 2**

REFERENCE 15/04/15026 DATUM Geodetic LOCATION N 5326685.7 E 264098.5 - Esquega Twp., Station 13+760 ORIGINATED BY JL

PROJECT GWP 5377-11-00, Highway 547 - F1 BOREHOLE TYPE Truck Mounted CME 45 - Hollow Stem Augers COMPILED BY SH

CLIENT AECOM DATE (Started) 12 June 2015 TIME (Completed) 12:30:00 PM CHECKED BY MAM

DATE (Completed) 12 June 2015

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			20	40					
316.4	Ground Surface													
0.0	127 mm Asphalt													
316.0	305 mm Concrete													
0.4	FILL- sand with gravel trace silt, to sand trace gravel trace silt, rock pieces of the sizes of cobble and boulder encountered at depths from 1.7 m to 5.3 m below ground surface		1	SS	24									22 72 (6)
	brown, moist		2	SS	21									
	(compact/very dense)		3	SS	52/0.25 m									
			4	SS	32									31 50 (19)
	loose		5	SS	7									
			6	SS	53									
			7	SS	65/0.23 m									
			8	SS	16									27 64 (9)
	sand, trace gravel, trace silt greyish brown to grey		9	SS	5									
	loose		10	SS	6									
307.8	SAND - trace silt, trace clay trace grass rootlets													
8.6	grey, wet													
306.8	(very loose)		11	SS	2									0 93 6 1
9.6	End of Sampling End of Borehole													
COMMENTS							+ 3, × 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE		WATER LEVEL RECORDS Date (dd/mm/yy)/Time Water Depth (m) Cave In (m) 1) 12/6/15 12:30:00 PM 3.3 3.4 2) - - 3) - -					

The stratification lines represent approximate boundaries. The transition may be gradual.

EnGlobe Corp.

120 Progress Court, North Bay, On P1A 0C2 Phone: (705)476-2550 Fax: (705)476-8882 Email: northbay@vm.ca

MEL-GEO 15029 - BOREHOL LOGS - F1.GPJ MEL-GEO.GDT 10/8/15

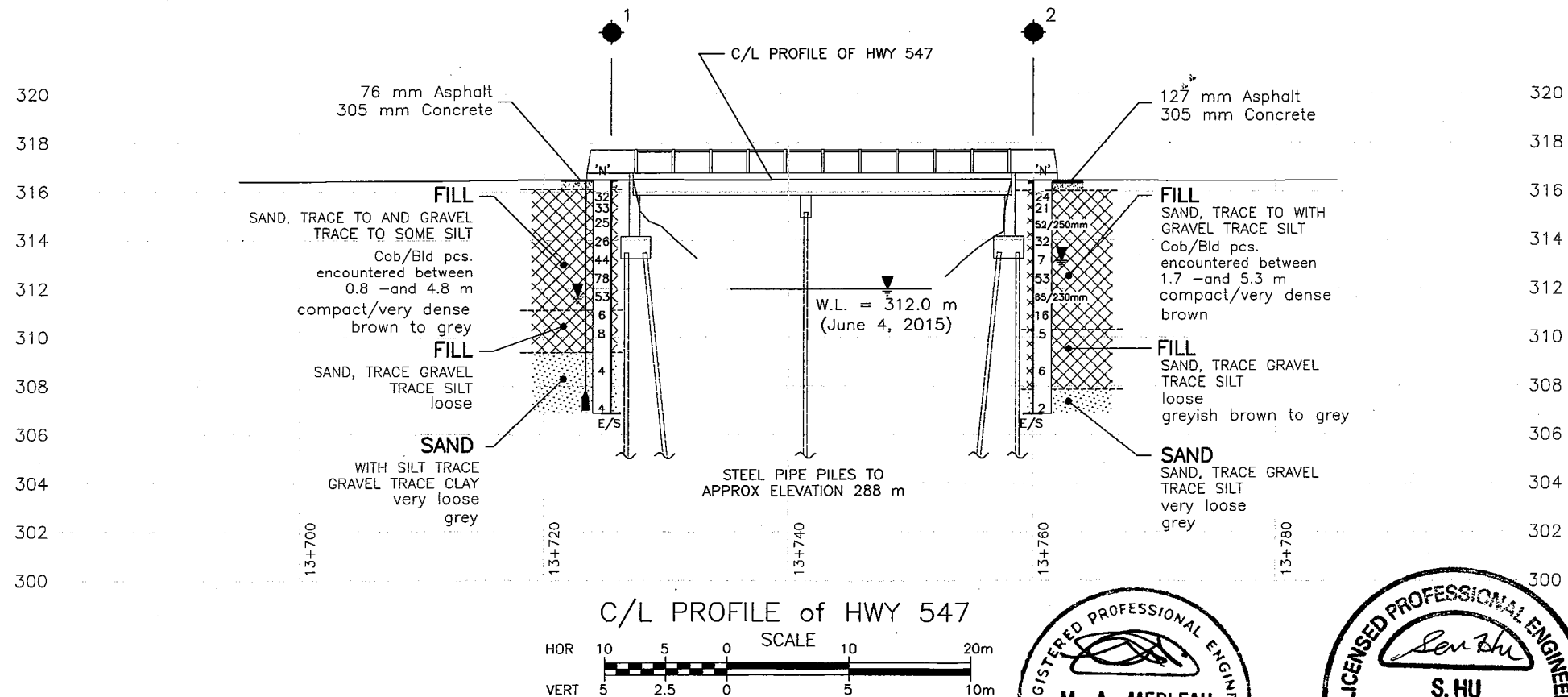
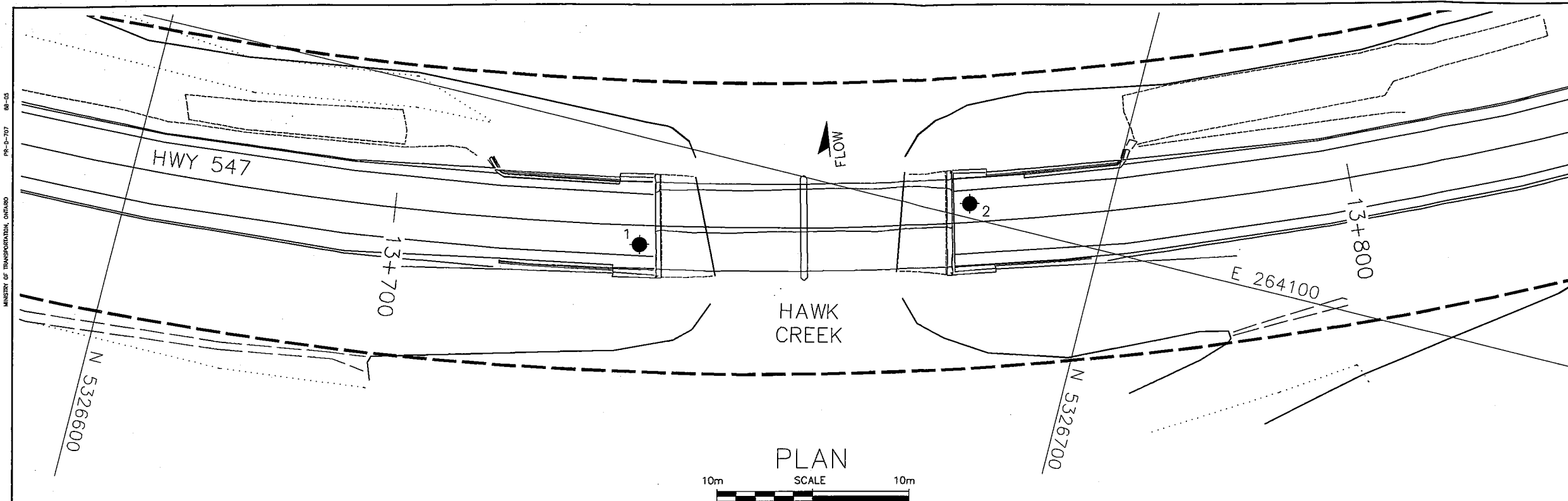
Appendix 3 Laboratory Data

Drawing No. 2: Borehole Location and Soil Strata

Figure Nos. L-1 and L-2: Grain Size Distribution Curves

Table No. L-3: Laboratory Test Summary Sheet

CAD FILE LOCATION AND NAME: G:\2015\15026 - EBN, Highway 547 GWP 5377-11-00 (AECOM)\Drawings\Hawk Creek Bridge\Working - Do Not Move or Delete Files\15026-F1 - Borehole Location Plan, Hawk Creek Bridge.dwg
MODIFIED: 8/10/2015 8:01:30 AM BY: GRASRY
DATE PLOTTED: 8/12/2015 11:08:24 AM BY: RYAN GRASSER



DISTRICT
CONT. No.
GWP No. 5377-11-00

HAWK CREEK BRIDGE
SITE NO. 38C-016
BOREHOLE LOCATIONS
AND SOIL STRATIGRAPHY

2

Englobe

KEY PLAN
N.T.S.

LEGEND

Borehole w/ DCPT

Borehole

Blows/0.3 m (Std Pen Test, 475 J/blow)

Blows/0.3 m (60° Cone, 475 J/blow)

Water Level at Time of Investigation

Auger Refusal at Elevation

End of Sampling

Piezometer

BOREHOLE No.	ELEVATION	O/S	NORTHING	EASTING
1	316.5	2.0m Rt	5326653.4	264111.1
2	316.4	2.0m Lt	5326685.7	264098.5

NOTES:
The boundaries between soil strata have been established at the borehole locations only. The boundaries illustrated and stratigraphy between boreholes on this drawing are assumed based on borehole data and may vary. They are intended for design only.

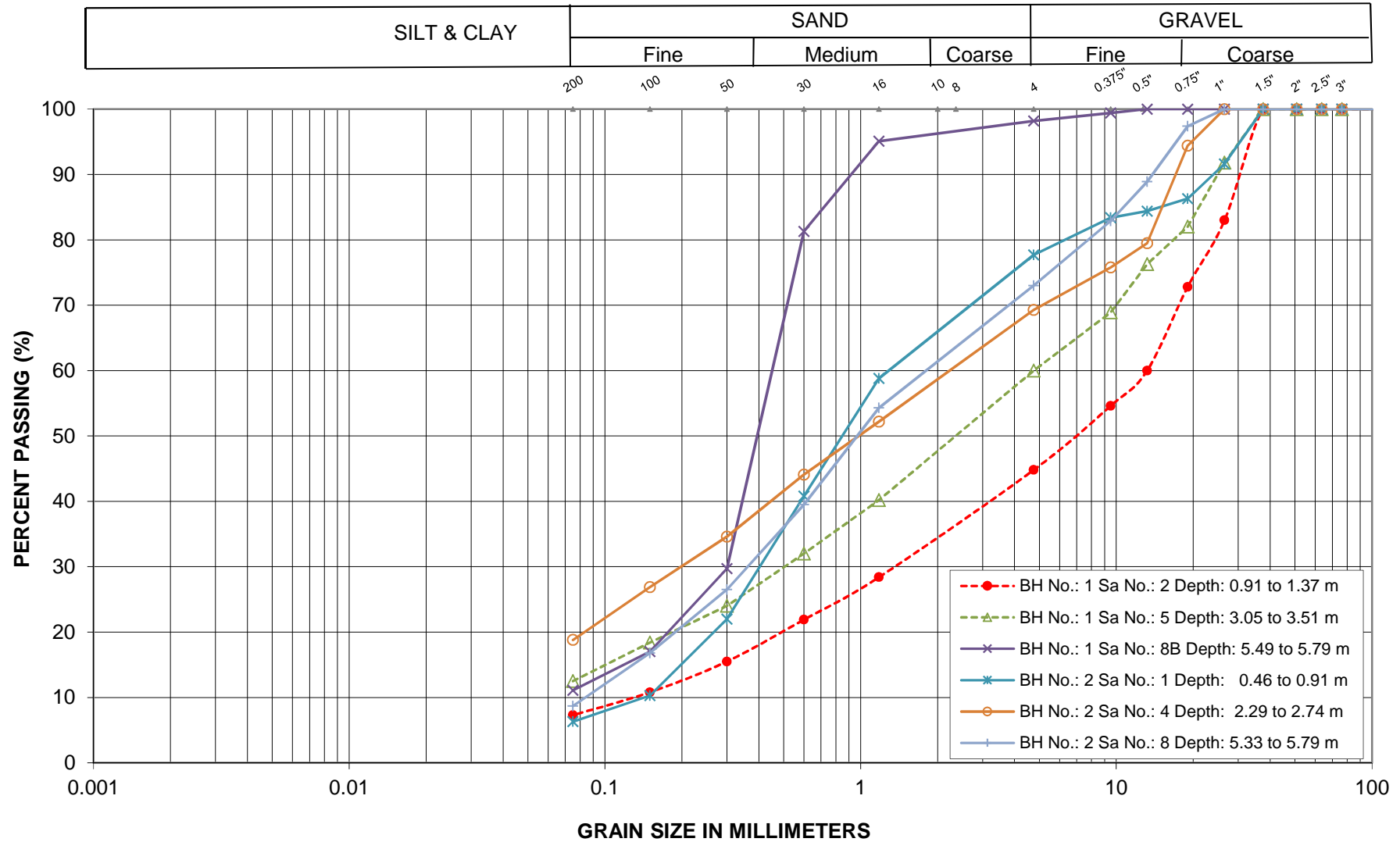
Base plan and alignment provided in digital format by Callon Dietz on June 16, 2015

GEOCRETS No. 42C-35

This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The proposed structure location is shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contract Documents.



REVISIONS		DESCRIPTION			
DESIGN	CHK	CODE	LOAD	DATE AUG/15	
DRAWN	RG	CHK	SH	SITE 38C-016	STRUCT
				SCHEME	TDWG 2

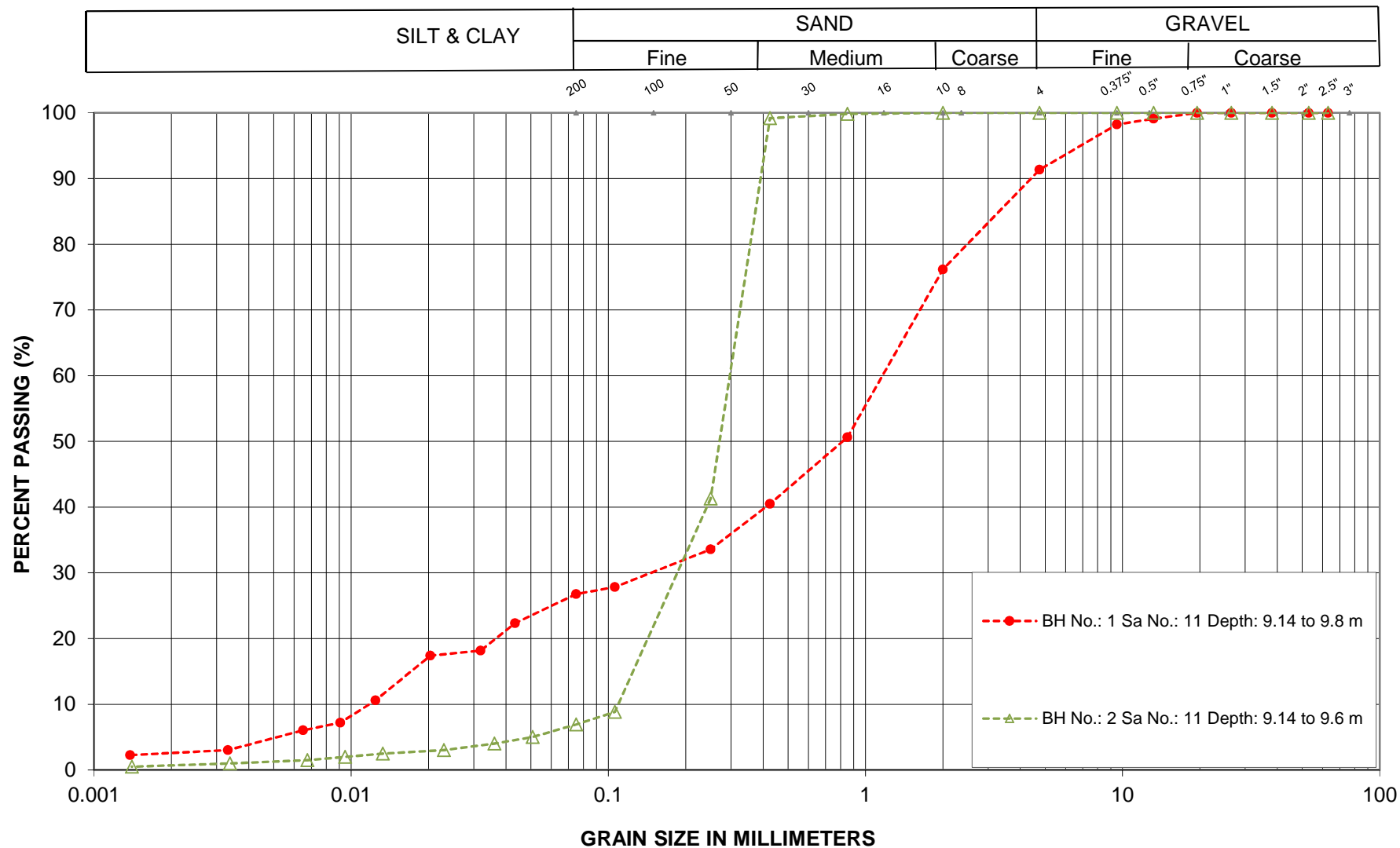
GRAIN SIZE ANALYSIS

LOCATION: Hwy 547, Hawk Creek Bridge

Sand Fill

Englobe Corp.

FIGURE L-1
GWP 5377-11-00

GRAIN SIZE ANALYSIS

LOCATION: Hwy 547, Hawk Creek Bridge

SAND to SAND with SILT

Englobe Corp.

FIGURE L-2
GWP 5377-11-00

Laboratory Tests - Summary Sheet



Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Unit Weight (kN/m3)	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
1	1	0.7					4.1				32			
	2	1.1	45	48	7		8.1				33			
	3	1.8					22.8				25			
	4	2.5					19.6				26			
	5	3.3	40	47	13		9.5				44			
	6	4.0					20.7				78			
	7	4.8					19.9				53			
	8A	5.4					26.2				6			
	8B	5.6	2	87	11		34.4							
	9	6.3					26.9				8			
	10	7.9					56.5				4			
	11	9.5	9	64	24	3	20.0				4			
2	1	0.7	22	72	6		3.9				24			
	2	1.1					4.1				21			
	3	1.7					5.3				52/0.25 m			
	4	2.5	31	50	19		6.0				32			
	5	3.3					7.9				7			
	6	4					5.8				53			
	7	4.7					10.6				65/0.23 m			
	8	5.6	27	64	9		15.5				16			
	9	6.3					19.3				5			
	10	7.85					20.2				6			
	11	9.4	0	93	6	1	26.4				2			

Appendix 4

Photo Essay

Enclosure No. 4:

Photo Essay

Bridge South side– Looking North

Photo: 1



Bridge North Approach Embankment – Looking Northwest

Photo: 2



Project: Hwy 547 – Hawk Creek Bridge, Township of Esquega

Photos Provided By:Englobe

Date: June 2015

Upstream of Creek– Looking Northeast

Photo: 3



Downstream of Creek to Hawk Lake – Looking Northwest

Photo: 4



Project: Hwy 547 – Hawk Creek Bridge, Township of Esquega

Photos Provided By:Englobe

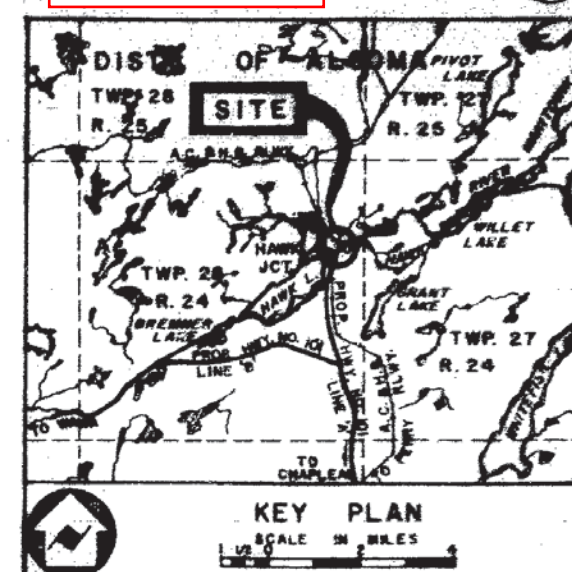
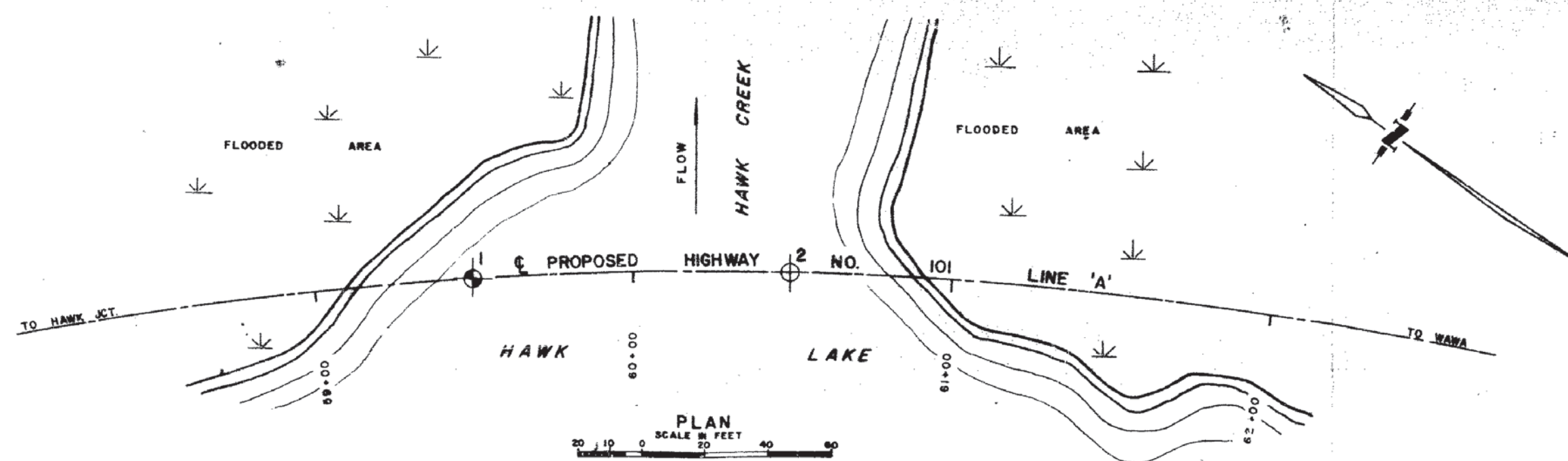
Date: June 2015

Appendix 5

Historical Data

Enclosure Nos. 5 and 6:

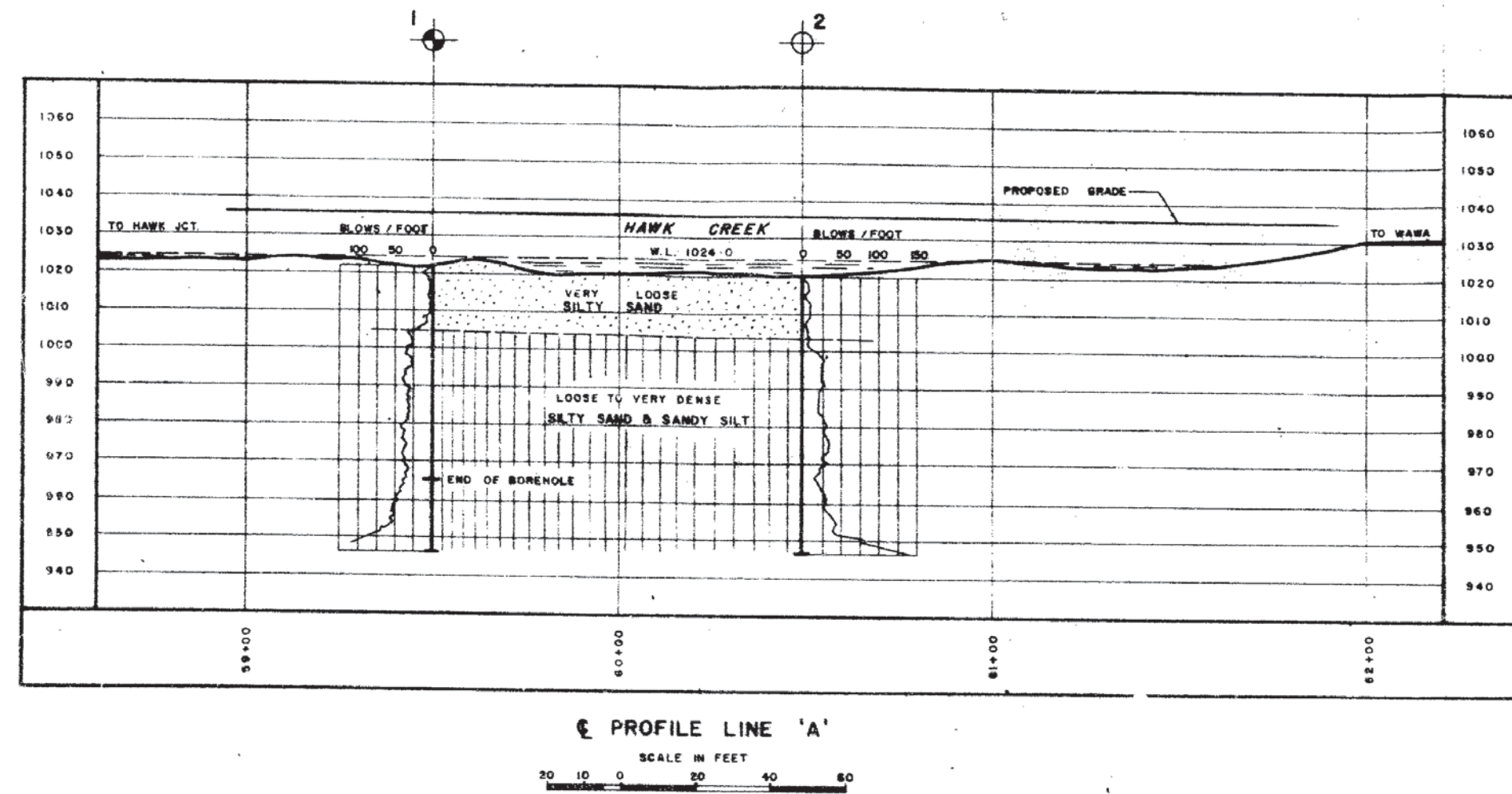
Historical Drawings



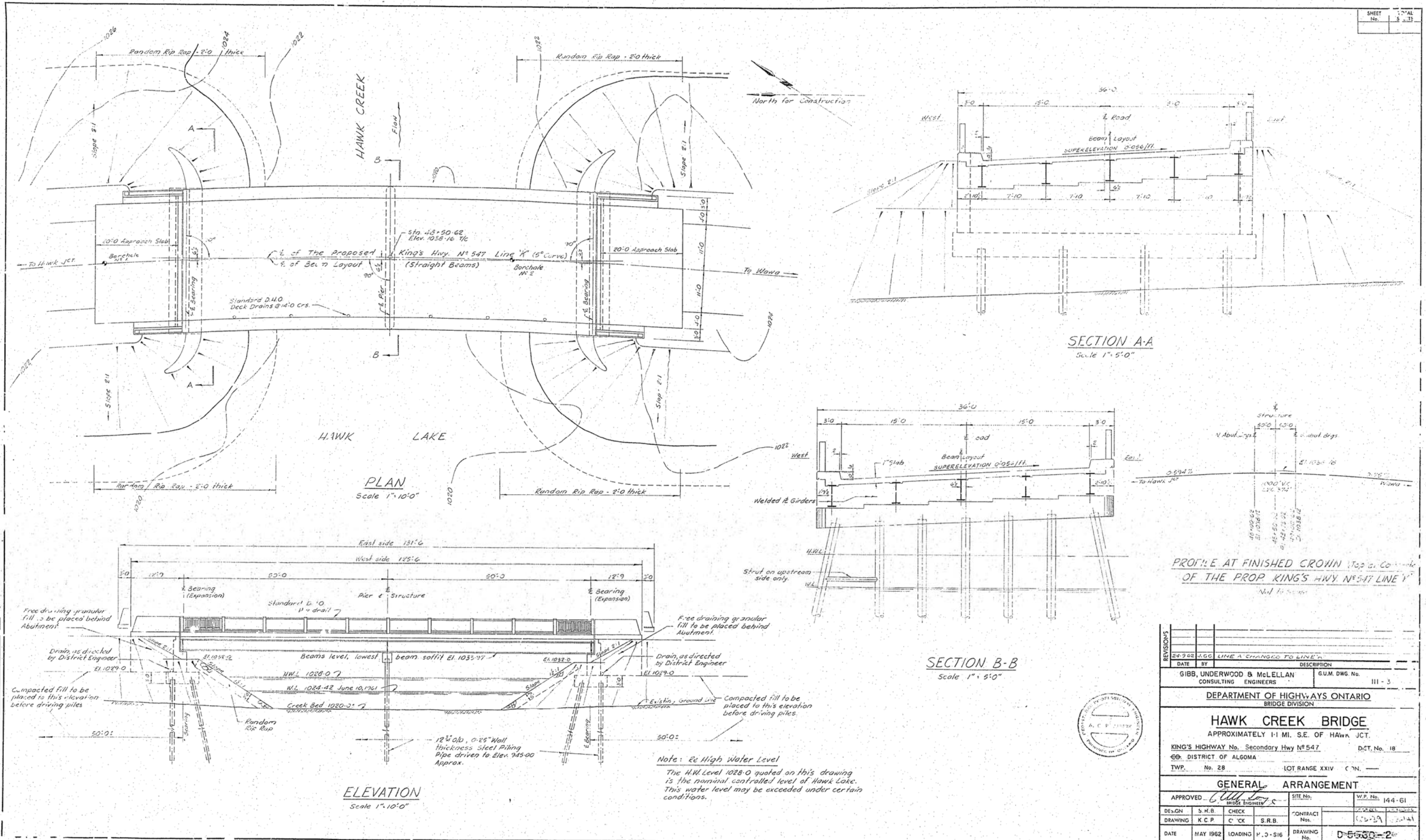
LEGEND			
	BORE & PENETRATION HOLE		
	PENETRATION HOLE (CORE)		
	BORE HOLE		
	WATER LEVELS - Established at Time of Field Investigation, DEC. 8, 1961		
NO.	ELEVATION	STATION	OFFSET
1	1022.0	59+50	E
2	1020.0	60+50	E

NOTE

The boundaries between soil strata have been established only at bore hole locations. Between bore holes the boundaries are assumed from geological evidence and may be subject to considerable error.



DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION			
HAWK CREEK AND PROPOSED HIGHWAY NO. 101 LINE 'A'			
ORIGINATED W. KULBATICZ	DISTRICT NO. 18	DATE FEB. 8, 1962	
DRAWN F. CLARK	W.P. NO. 144-81	JOB NO. 61-F-120	
CHECKED <i>[Signature]</i>	CONTRACT NO.	REVISION: 00	
APPROVED <i>[Signature]</i>		61-F-120A	



PROFILE AT FINISHED CROWN (Top of Center) OF THE PROPOSED KING'S HWY. NO. 547 LINE 1

REVISIONS		DATE		BY		DESCRIPTION			
1		24-9-62		J.G.C.		LINE A CHANGED TO LINE 1			
GIBB, UNDERWOOD & McLELLAN				CONSULTING ENGINEERS		G.U.M. DWG. No.		III - 3	
DEPARTMENT OF HIGHWAYS ONTARIO									
BRIDGE DIVISION									
HAWK CREEK BRIDGE									
APPROXIMATELY 1.1 MI. S.E. OF HAWK JCT.									
KING'S HIGHWAY No. Secondary Hwy No. 547						DIST. No. 18			
DISTRICT OF ALGOMA									
TWP. No. 28		LOT RANGE XXIV		C.N.					
GENERAL				ARRANGEMENT					
APPROVED <i>C.C.K.</i>				SITE No.		W.P. No.		144-61	
DESIGN S.H.B.		CHECK C.C.K.		CONTRACT No.		D-550-2		10-29	
DRAWING K.C.P.		LOADING J.C.S.				DRAWING No.		D-550-2	
DATE MAY 1962		LOADING J.C.S.		DRAWING No.		D-550-2			

Twp # 682-1-2-19



englobecorp.com