Table A1: Evaluation of Settlement Mitigation Options
Highway 17 WBL – STA 12+220 to 12+570 (High Fill Area H1)

Stability/Settlement Mitigation Option	Option No.	Rank	Advantages	Disadvantages	Relative Costs	Risks/Consequences
Consolidation and Maintenance ■ 3 year preload period	A	1	■ Standard embankment construction operation – no need for specialized material or equipment.	■ **Does not meet MTO's Settlement Criteria** ■ Contractor will have to remobilize to site for maintenance. ■ Significant wait period is required before settlement is mitigated. ■ Instrumentation and monitoring program required to assess end of preload period.	■ Remobilization costs required for maintenance.	■ There will be no impact on the construction schedule ■ Very low risk of not achieving stability of preload embankments on weak/soft foundation soils. ■ Low risk of experiencing unexpected post-construction settlements (i.e. creep). ■ Low risk that unexpected post-construction settlements create an unsafe travelled laneway.
Partial Embankment Sub-Excavation and Lightweight Fill (EPS) ■ A 2.5 m zone of EPS	B	2	■ Meets MTO's Settlement Criteria ■ Creates a negligible load on subsoils thereby inducing negligible settlement of foundations soils. ■ Re-grading is not required	■ Expensive material compared to conventional embankment fill. ■ Will need to sub-excavate some of the existing embankment material.	■ Relative cost of EPS fill is about an order of magnitude higher than fill required for the other options. ■ 5,000 m^3 x \$200/m^3 = \$1,000,000.	■ There will be a minimal impact on the construction schedule ■ Very low risk of not achieving stability of preload embankments and final EPS embankments on weak/soft foundation soils. ■ Low risk of experiencing unexpected post-construction settlements (i.e. creep).
Full Sub-Excavation of Cohesive Deposit (up to approximately 13.4 m below existing highway grade) ■ 6 to 12 month preload period required to reduce post-construction settlement of rock fill.	C	NP	■ Reduces total settlement of foundations soils as most of the soft compressible material has been removed.	■ Extensive roadway protection system required at huge additional cost ■ Generation of large volume of excess excavation spoil – may not have suitable disposal area depending on environmental and property concerns. ■ Large quantity of rock fill backfill required. ■ Longer construction period required to install shoring, sub-excavate and replace with rock fill. ■ Additional post-construction settlement of rock fill itself and 6 to 12 month preload period required (or allow traffic and conduct future maintenance). ■ Conventional/long-stick backhoe equipment not capable of removing material to its full depth - specialized equipment (i.e., dragline) and additional effort required for deep sub-excavation and replacement below the groundwater level.	■ Shoring, sub-excavation, disposal and replacement of weak/soft, compressible deposits. ■ Cost of shoring (250 m long, average 15 m deep) @ 500/m^2(salvage material)= \$1,875,000. ■ 82,100 m^3 x \$14/m^3 (sub-excavation and replacement with rock fill) = \$1,149,400. ■ Cost for disposal not quantified.	■ Higher risk of not achieving/maintaining stability of excavation slopes unless shoring utilized. ■ Very low risk of not achieving/maintaining stability of proposed embankments if using shoring. ■ High risk of experiencing unexpected post-construction settlements (i.e. long term rock fill settlement). ■ High risk that not all compressible soils are removed during the sub-aqueous operations which could lead to additional settlement.

NP: Not Practical

Prepared By: SEMC **Reviewed By:** JMAC

Table A2: Evaluation of Settlement Mitigation Options
Highway 17 EBL – STA 12+220 to 12+570 (High Fill Area H1)

Stability/Settlement Mitigation Option[1]	Option No.	Rank	Advantages	Disadvantages	Relative Costs	Risks/Consequences
Staged Construction and 1.3 m Surcharge with Wick Drains and Toe Berms ■ 1st stage 5.7 m high for 10 months ■ 2nd stage 1.8 m fill for 10 months ■ 1.7 years total surcharge period ■ 1.5 m high by 14 m wide toe berm on south side of embankment	A	1	■ Improves engineering parameters of soft cohesive soils thereby improving stability and reducing post-construction settlement. ■ Reduced time for primary consolidation when compared to not using wick drains	■ Toe berms are required to maintain embankment stability but are smaller than for non-staged construction options. ■ Delay in construction for each stage to allow for strength gain in soft soils for stability of subsequent stage. ■ More expensive Granular B required to backfill peat sub-excavation to facilitate wick drain installation. ■ Detail wick drain investigation and design will be required. ■ Additional time required for installation of wick drains. ■ Wick drains increase magnitude of secondary consolidation (creep) settlement as a result of the accelerated completion of primary consolidation settlement. ■ Instrumentation and monitoring program required to assess end of each stage. ■ Increased handling of surcharge fills upon completion of surcharge period.	■ Rock fill toe berm material and associated sub-excavation and replacement of organic deposits below toe berm ($137,000) ■ Granular backfill for peat sub-excavation required to facilitate wick drain installation. ($23,000 more than rock fill) ■ Surcharge material (Granular B). ($90,000) ■ Detail wick drain investigation and design. ($50,000) ■ Installation of wick drains including pre-drilling, instrumentation and associated monitoring program. ($342,500)	■ Surcharging time for each stage will be determined by assessment of the monitoring data. ■ There will be a high impact on the schedule. ■ There is a risk that unexpected post-construction settlements (i.e. creep) will be experienced depending on the efficiency of improving/strengthening the soft/weak soil deposit.
2 m Surcharge with Wick Drains and Toe Berms ■ 10 month surcharge period ■ 2 m high by 25 m wide toe berms on south side of embankment	B	2	■ Reduced time for primary consolidation when compared to not using wick drains ■ One stage construction.	■ Very large toe berms (twice as large as Option A) required for embankment stability including additional peat sub-excavation and backfilling. ■ Delay in construction to reduce magnitude of post-construction settlement. ■ More expensive Granular B required to backfill peat sub-excavation to facilitate wick drain installation. ■ Detail wick drain investigation and design will be required. ■ Additional time required for installation of wick drains. ■ Wick drains increase magnitude of secondary consolidation (creep) settlement as a result of the accelerated completion of primary consolidation settlement. ■ Instrumentation and monitoring program required to assess end of surcharge period. ■ Increased handling of surcharge fills upon completion of surcharge period.	■ Rock fill toe berm material and associated sub-excavation and replacement of organic deposits below toe berm ($247,500) ■ Granular backfill for peat sub-excavation required to facilitate wick drain installation. ($23,000 more than if rock fill is used) ■ Surcharge material (Granular B). ($117,000) ■ Detail wick drain investigation and design. ($50,000) ■ Installation of wick drains including pre-drilling, instrumentation and associated monitoring program. ($382,900)	■ Surcharging time will be determined by assessment of the monitoring data. ■ There will be a moderate impact on the construction schedule. ■ Property issues may arise due to the size of the toe berms. ■ There is a risk that unexpected post-construction settlements (i.e. creep) will occur.

Table A2: Evaluation of Settlement Mitigation Options
Highway 17 EBL – STA 12+220 to 12+570 (High Fill Area H1)

Stability/Settlement Mitigation Option[1]	Option No.	Rank	Advantages	Disadvantages	Relative Costs	Risks/Consequences
Full Sub-Excavation (up to approximately 10 m below ground surface) ■ 6 to 12 month preload period required to reduce post-construction settlement of rock fill.	C	3	■ Reduces total settlement of foundations soils as soft compressible material has been removed.	■ Generation of very large volume of excess excavation spoil – may not have suitable disposal area depending on environmental and property concerns. ■ Very large quantity of rock fill backfill required. ■ Longer construction period required to sub-excavate and replace with rock fill. ■ Additional post-construction settlement of rock fill itself and 6 to 12 month preload period required. ■ Specialized equipment (i.e. dragline) and additional effort required for deep sub-excavation and replacement below the groundwater level. ■ May require additional right-of-way to accommodate deep sub-excavation.	■ Sub-excavation, disposal and replacement of weak/soft, compressible deposits. ■ 210,000 – 50,000 m^3 x \$14/m^3 (sub-excavation and replacement with rock "supply" fill) = \$2,240,000. ■ Cost for disposal not quantified.	■ Higher risk of not achieving/maintaining stability of excavation slopes. ■ Very low risk of not achieving/maintaining stability of proposed embankments. ■ High risk of experiencing unexpected post-construction settlements (i.e. long term rock fill settlement). ■ High risk that not all compressible soils are removed during the sub-aqueous operations which could lead to unexpected settlement.
Partial Preload with Lightweight Fill (EPS) ■ 3.2 year preload period ■ 2.5 m of EPS	D	4	■ Reduces total load on subsoils thereby reducing total settlement of foundations soils. ■ Rock fill can be used to backfill peat sub-excavation. ■ Toe berms are not required.	■ Expensive material compared to conventional embankment fill. ■ Significant wait period is required (since wick drains not being utilized). ■ Instrumentation and monitoring program required to assess end of preload period. ■ Removal of preload material required prior to EPS installation.	■ Relative cost of EPS fill is about an order of magnitude higher than fill required for the other options. ■ 10,125 m^3 x \$200/m^3 = \$2,025,000. (which assumes 40.5 m^2 for a 250 m length)	■ There will be a very high impact on the construction schedule, longer than all other options. ■ Very low risk of not achieving stability of preload embankments and final EPS embankments on weak/soft foundation soils. ■ Low risk of experiencing unexpected post-construction settlements (i.e. creep).
Partial Preload with Lightweight Fill (EPS) and Wick Drains ■ 3.2 year preload period ■ 2.5 m of EPS	E	5	■ Reduces total load on subsoils thereby reducing total settlement of foundations soils. ■ Toe berms are not required. ■ Reduced time for primary consolidation when compared to not using wick drains.	■ Expensive material compared to conventional embankment fill. ■ More expensive Granular B required to backfill peat sub-excavation to facilitate wick drain installation. Rock fill cannot be used to backfill peat sub-excavation unless pre-drilling through rock fill is carried out to allow for installation of wick drains. ■ ■ Detail wick drain investigation and design will be required. ■ Additional time required for installation of wick drains. ■ Wick drains increase magnitude of secondary consolidation (creep) settlement as a result of the accelerated completion of primary consolidation settlement. ■ Instrumentation and monitoring program required to assess end of each stage ■ Removal of preload material required prior to EPS installation.	■ Relative cost of EPS fill is about an order of magnitude higher than fill required for the other options. ■ Granular backfill for peat sub-excavation required to facilitate wick drain installation. (\$23,000 more than rock fill) ■ Cost of EPS 10,125 m^3 x \$200/m^3 = \$2,025,000. (which assumes 40.5 m^2 for a 250 m length). ■ Detail wick drain investigation and design. (\$50,000) ■ Installation of wick drains including pre-drilling, instrumentation and associated monitoring program. (\$342,500)	■ Low impact on the construction schedule. ■ Very low risk of not achieving stability of preload embankments and final EPS embankments on weak/soft foundation soils. ■ Low risk of experiencing unexpected post-construction settlements (i.e. creep).

Table A2: Evaluation of Settlement Mitigation Options
Highway 17 EBL – STA 12+220 to 12+570 (High Fill Area H1)

Stability/Settlement Mitigation Option[1]	Option No.	Rank	Advantages	Disadvantages	Relative Costs	Risks/Consequences
2 m Surcharge with Toe Berms (no Wick Drains) ■ 2.1 year surcharge period ■ 2 m high by 23 m wide toe berms on south side of embankment	F	6	■ Standard construction operation. ■ Rock fill can be used to backfill peat sub-excavation.	■ Very large toe berms (twice as large as Option A) required for embankment stability including additional peat sub-excavation and backfilling. ■ Significant wait period is required (since wick drains not being utilized). ■ Instrumentation and monitoring program required to assess end of surcharge period. ■ Increased handling of surcharge fills upon completion of surcharge period.	■ Rock fill toe berm material and associated sub-excavation and replacement of organic deposits below toe berm. ($205,000) ■ Use of rock fill as backfill instead of granular fill as in Options A and B creates a savings of $23,000 ■ Surcharge material (Granular B). ($117,000)	■ Surcharging time will be determined by assessment of the monitoring data ■ There will be a very high impact on the construction schedule (only option C is longer). ■ Property issues may arise due to the size of the toe berms.
Partial Sub-Excavation and Preloading	G	NF	■ Reduces total settlement of foundations soils as some of the soft compressible material has been removed. ■ Specialized equipment (i.e. dragline) may not be required compared to sub-excavation to the full depth. ■ Reduced construction schedule compared to full sub-excavation and possibly wick drain installation ■ Less volume of material to be diposed.	■ Generation of large volume of excess excavation spoil – may not have suitable disposal area depending on environmental and property concerns. ■ Large quantity of rock fill backfill required. ■ Longer construction period required to sub-excavate and replace with rock fill although not as long as full sub-excavation. ■ Additional post-construction settlement of rock fill itself and preloading of clay deposit for extended period of time (as wick drains not utilized). ■ Toe berms may still be required depending on depth of sub-excavation.	■ Sub-excavation, disposal and replacement of weak/soft, compressible deposits. ■ Cost for disposal not quantified.	■ High risk of not achieving/maintaining stability of excavation slopes. ■ High risk of not achieving/maintaining stability of proposed embankments. ■ High risk of experiencing additional post-construction settlements (i.e. long term rock fill settlement) as well as settlement of the cohesive deposit.
Ground Improvement ■ Dry/wet soil mixing ■ Geopiers (rammed aggregate)	H	NF	■ Reduces future creep settlement of clay (and potentially peat) by improving strength and stiffness of the material. ■ No spoil material for off-site disposal	■ Need bulk samples of clay for mix design to allow for design of soil mixing columns or piers. ■ Specialized design and equipment required. ■ High cost of specialized equipment and mobilization to the site. ■ Geogrid reinforced embankment required to distribute the load over the columns/piers and to mitigate potential differential settlement. ■ Bench scale tests and field program may be required. ■ No readily available information on mixes of peat/clay and additives and potential strength gain – may require large amount of cement or aggregate to realize improvement.	■ Cost of DSM columns or rammed aggregate piers and geogrid. ■ Cost would be higher than other options including potentially full sub-excavation with preloading and EPS options	■ Future creep settlement may still occur in the subsoils between the columns/piers. ■ May not mix properly with organic and fine grained clayey soil – likely no guarantee from contractor. ■ Potential increase in cost for additional cement or aggregate if required to enhance soil/peat or soil/clay cement mix.

NF: Not Feasible
Note: 1. All of these mtitgation options assume that the peat/organics is sub-excavated and replaced with backfill.

Prepared By: SEMC **Reviewed By:** JMAC

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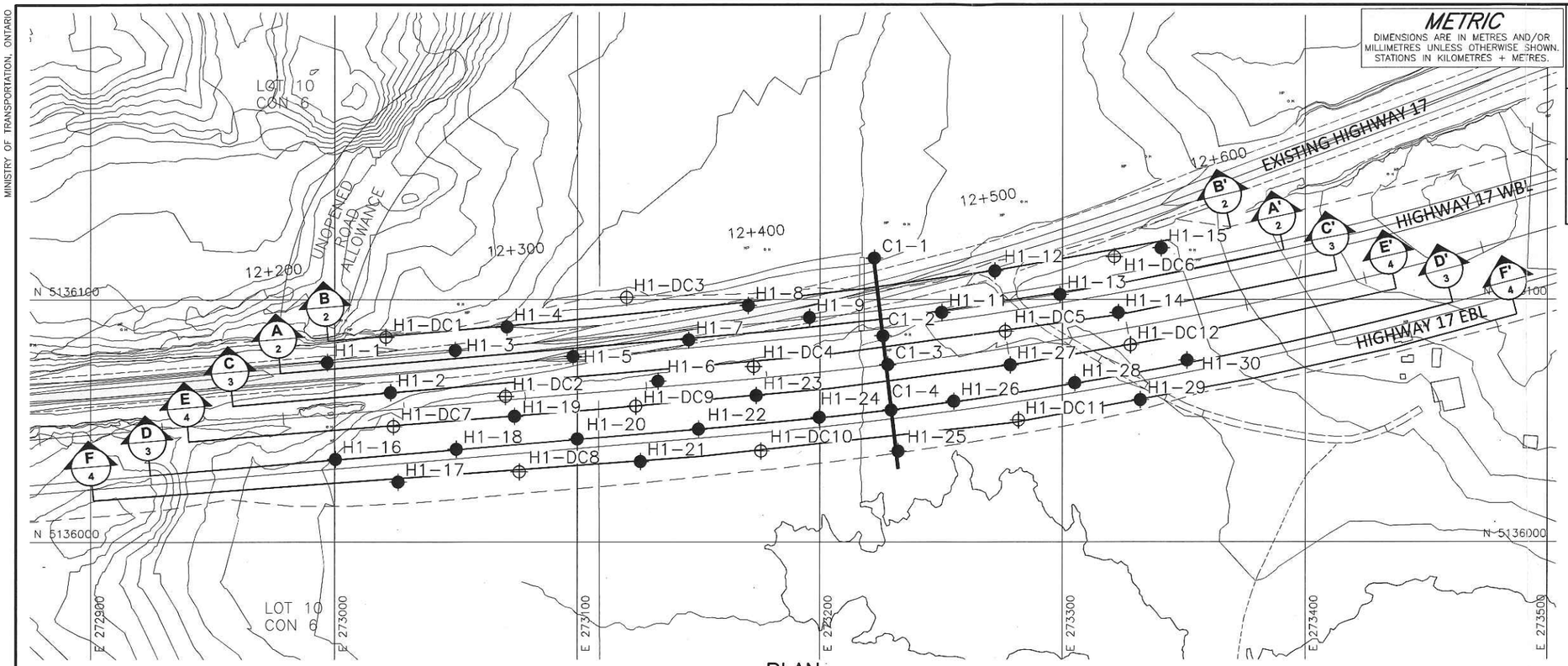

PLAN

SCALE

20 0 20 40 m

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
H1-1	246.6	5136074.1	272996.9
H1-2	242.2	5136061.6	273023.1
H1-3	246.6	5136079.0	273049.7
H1-4	241.6	5136088.7	273071.0
H1-5	246.3	5136076.5	273098.2
H1-6	241.3	5136066.4	273133.1
H1-7	246.0	5136083.3	273145.8
H1-8	245.8	5136097.6	273170.5
H1-9	245.8	5136092.6	273195.7
H1-11	243.2	5136094.7	273250.1
H1-12	246.3	5136111.9	273271.9
H1-13	243.0	5136102.1	273299.0
H1-14	244.5	5136094.6	273323.0
H1-15	244.6	5136121.3	273340.6
H1-16	241.3	5136034.1	273000.3
H1-17	241.3	5136024.7	273026.2
H1-18	241.3	5136038.3	273050.1
H1-19	241.3	5136051.9	273074.1
H1-20	241.2	5136042.5	273099.9
H1-21	241.0	5136033.1	273125.8
H1-22	241.0	5136046.5	273149.8
H1-23	241.3	5136060.4	273173.8
H1-24	241.2	5136051.4	273199.8
H1-25	241.2	5136037.4	273232.1

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
C1-1	241.7	5136117.1	273222.2
C1-2	241.4	5136085.0	273225.8
C1-3	241.5	5136073.1	273227.8
C1-4	241.2	5136054.4	273229.2
H1-26	241.3	5136058.0	273255.1
H1-27	241.6	5136073.0	273278.4
H1-28	241.3	5136065.6	273305.1
H1-29	241.3	5136058.6	273332.0
H1-30	241.2	5136075.0	273351.3
H1-DC1	245.1	5136084.5	273021.1
H1-DC2	241.3	5136060.1	273070.4
H1-DC3	242.0	5136100.9	273120.1
H1-DC4	241.3	5136072.3	273172.7
H1-DC5	242.6	5136086.8	273276.3
H1-DC6	243.2	5136117.6	273321.3
H1-DC7	241.2	5136047.6	273024.2
H1-DC8	241.2	5136028.9	273076.0
H1-DC9	241.3	5136056.1	273123.9
H1-DC10	241.2	5136037.5	273175.7
H1-DC11	241.0	5136050.2	273281.8
H1-DC12	241.2	5136081.2	273327.9

CONT No.
GWP No. 156-98-00

SHEET

HIGHWAY 17 4 LANING
HWY 17 EBL – STA 12+220 TO 12+570
HWY 17 WBL – STA 12+220 TO 12+570
BOREHOLE LOCATIONS

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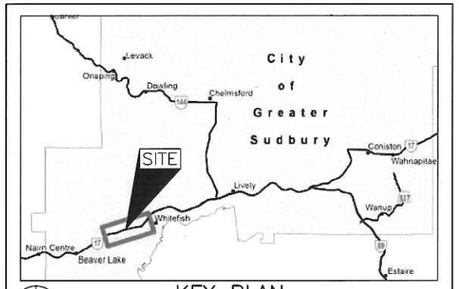
SUDBURY, ONTARIO, CANADA



LEGEND

- Borehole – Current Investigation
- Dynamic Cone Penetration Test

NOTES

This drawing is for subsurface information only. The proposed details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

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REFERENCE

Base plans provided in digital format by DM Wills, drawing files 581_base.dwg, GWP156-98-00_B & C Plans.dwg and 581_contours.dwg received Jan 17, 2012.

NO.	DATE	BY	REVISION

Geocres No. 41I-323

HWY: 17		PROJECT NO. 11-1191-0007	DIST.
SUBM'D. EC	CHKD.	DATE: APR 2015	SITE:
DRAWN: TB	CHKD. SEMP	APPD. JMAC	DWG. A1

PLOT DATE: April 15, 2015
FILENAME: \\golder.gds\gal\sudbury\CAD-GIS\CAD\Projects\2011\11-1191-0007 HWY 17 4 Laneg\11191100070A001_H1.dwg

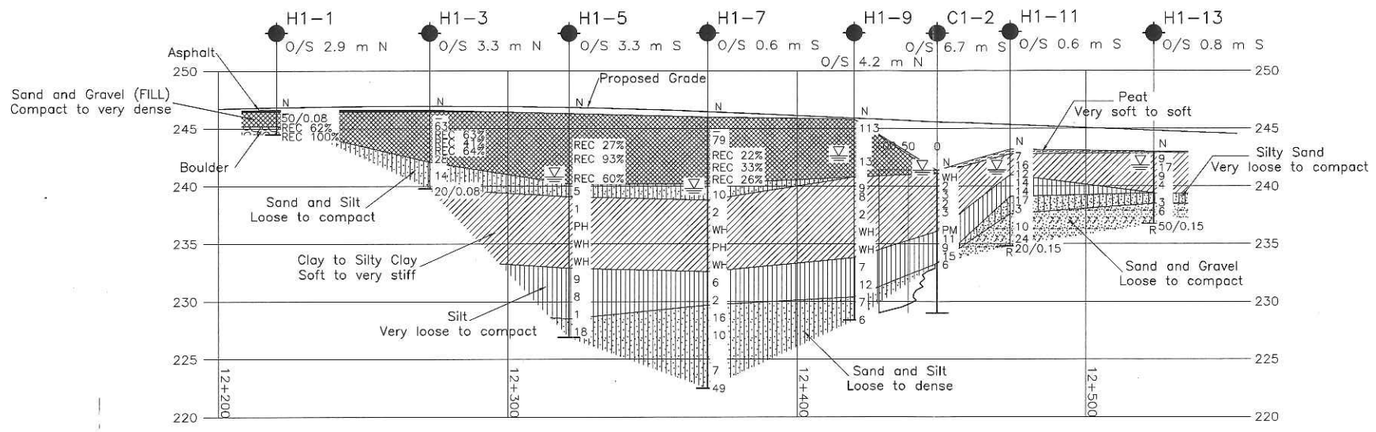
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 156-98-00

HIGHWAY 17 4 LANING
HWY 17 EBL – STA 12+220 TO 12+570
HWY 17 WBL – STA 12+220 TO 12+570
BOREHOLE LOCATIONS

SHEET

Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA



A-A' / 1 — CENTRELINE PROFILE
HIGHWAY 17 (WBL)

HORIZONTAL SCALE
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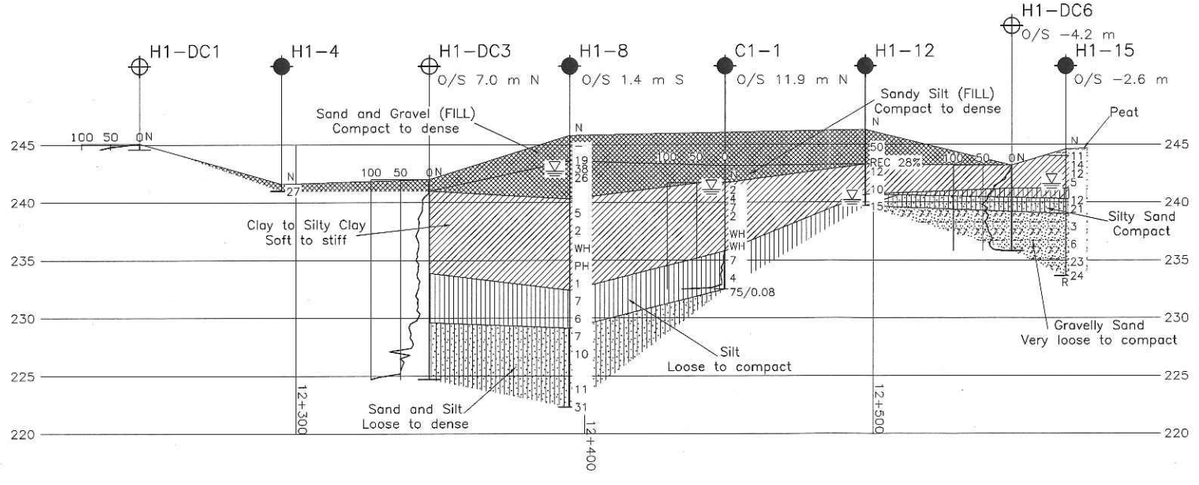
5 0 5 10 m
VERTICAL SCALE



B-B' / 1 — NORTH TOE PROFILE
HIGHWAY 17 (WBL)

HORIZONTAL SCALE
20 0 20 40 m
5 0 5 10 m
VERTICAL SCALE

LEGEND

- Borehole
- Dynamic Cone Penetration Test
- N — Standard Penetration Test Value
- 16 — Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- REC — Recovery (%)
- R — Refusal
- WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
C1-1	241.7	5136117.1	273222.2
C1-2	241.4	5136085.0	273225.8
H1-1	246.6	5136074.1	272996.9
H1-3	246.6	5136079.0	273049.7
H1-4	241.6	5136088.7	273071.0
H1-5	246.3	5136076.5	273098.2
H1-7	246.0	5136083.3	273145.8
H1-8	245.8	5136097.6	273170.5
H1-9	245.8	5136092.6	273195.7
H1-11	243.2	5136094.7	273250.1
H1-12	246.3	5136111.9	273271.9
H1-13	243.0	5136102.1	273299.0
H1-15	244.6	5136121.3	273340.6
H1-DC1	245.1	5136084.5	273021.1
H1-DC3	242.0	5136100.9	273120.1
H1-DC6	243.2	5136117.6	273321.3

NOTES

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LICENCED PROFESSIONAL ENGINEER — S.E.M. POOT — 90471921 — APR 15, 2015 — PROVINCE OF ONTARIO

LICENCED PROFESSIONAL ENGINEER — J.M.A.COSTA — APR 15, 2015 — PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION

Geocres No. 41I-323

HWY. 17		PROJECT NO. 11-1191-0007	DIST.
SUBM'D. EC	CHKD.	DATE: APR 2015	SITE:
DRAWN: TB	CHKD. SEMP	APPD. JMAC	DWG. A2

MINISTRY OF TRANSPORTATION, ONTARIO

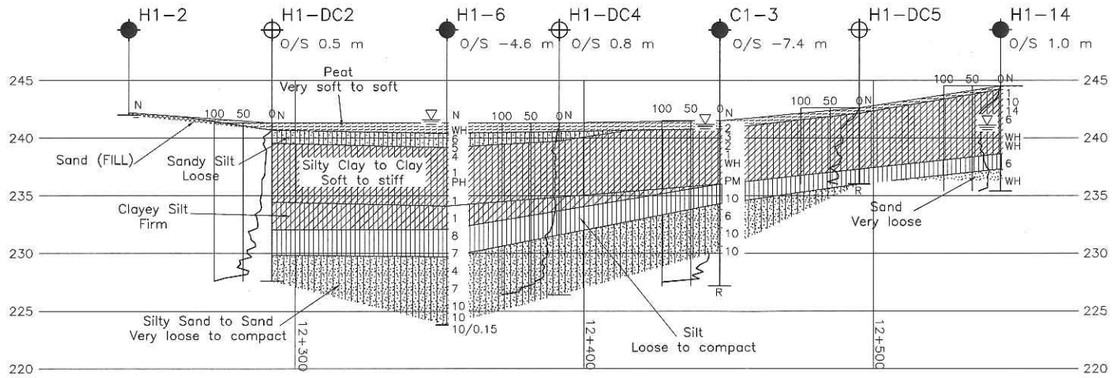
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 156-98-00

HIGHWAY 17 4 LANING
HWY 17 EBL – STA 12+220 TO 12+570
HWY 17 WBL – STA 12+220 TO 12+570
BOREHOLE LOCATIONS

SHEET

Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA



C-C' / 1 SOUTH TOE PROFILE
HIGHWAY 17 (WBL)

HORIZONTAL SCALE
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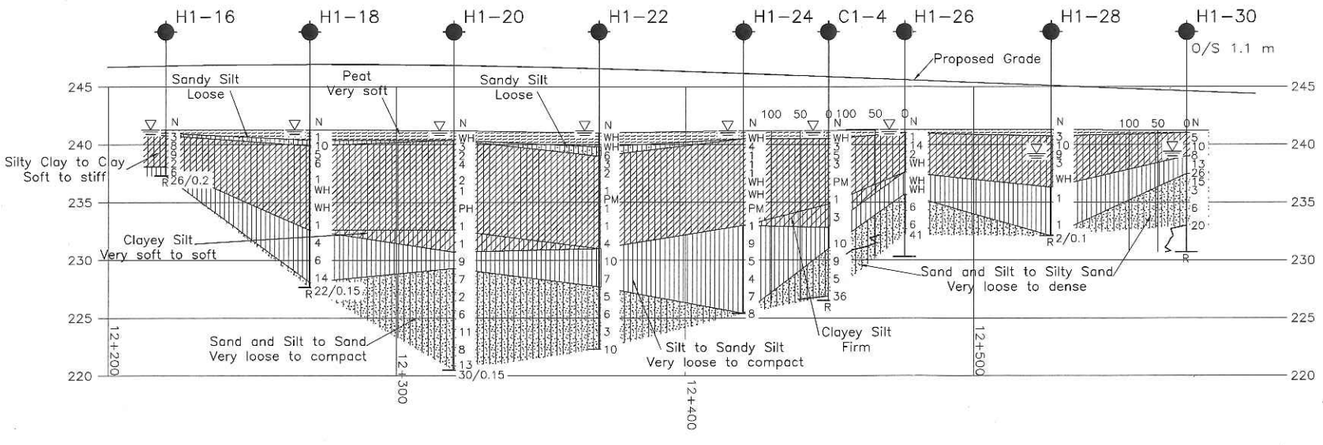
5 0 5 10 m
VERTICAL SCALE



D-D' / 1 CENTRELINE PROFILE
HIGHWAY 17 (EBL)

HORIZONTAL SCALE
20 0 20 40 m
5 0 5 10 m
VERTICAL SCALE

LEGEND

- Borehole
- Dynamic Cone Penetration Test
- N — Standard Penetration Test Value
- 16 — Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- REC — Recovery (%)
- R — Refusal
- WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
H1-2	242.2	5136061.6	273023.1
H1-6	241.3	5136066.4	273133.1
H1-14	244.5	5136094.6	273323.0
H1-16	241.3	5136034.1	273000.3
H1-18	241.3	5136038.3	273050.1
H1-20	241.2	5136042.5	273099.9
H1-22	241.0	5136046.5	273149.8
H1-24	241.2	5136051.4	273199.8
H1-26	241.3	5136058.0	273255.1
H1-28	241.3	5136065.6	273305.1
H1-30	241.2	5136075.0	273351.3
H1-DC2	241.3	5136060.1	273070.4
H1-DC4	241.3	5136072.3	273172.7
H1-DC5	242.6	5136086.8	273276.3
C1-3	241.5	5136073.1	273227.8
C1-4	241.2	5136054.4	273229.2

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Base plans provided in digital format by DM Wills, drawing files 581_base.dwg, GWP156-98-00_B & C Plans.dwg and 581_contours.dwg received Jan 17, 2012.

LICENCED PROFESSIONAL ENGINEER S.E.M. POOT 90471921 APR 15, 2015 PROVINCE OF ONTARIO

LICENCED PROFESSIONAL ENGINEER J.M.A.COSTA APR 15, 2015 PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION

Geocres No. 41I-323

HWY. 17		PROJECT NO. 11-1191-0007	DIST.
SUBM'D. EC	CHKD.	DATE: APR 2015	SITE:
DRAWN: TB	CHKD. SEMP	APPD. JMAC	DWG. A3

PLOT DATE: June 30, 2015
FILENAME: \\golder.gds\gal\Sudbury\CAD-GIS\CAD\Projects\2011\11-1191-0007 HWY 17 4 Laning\11191100704001_LH.dwg

MINISTRY OF TRANSPORTATION, ONTARIO

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

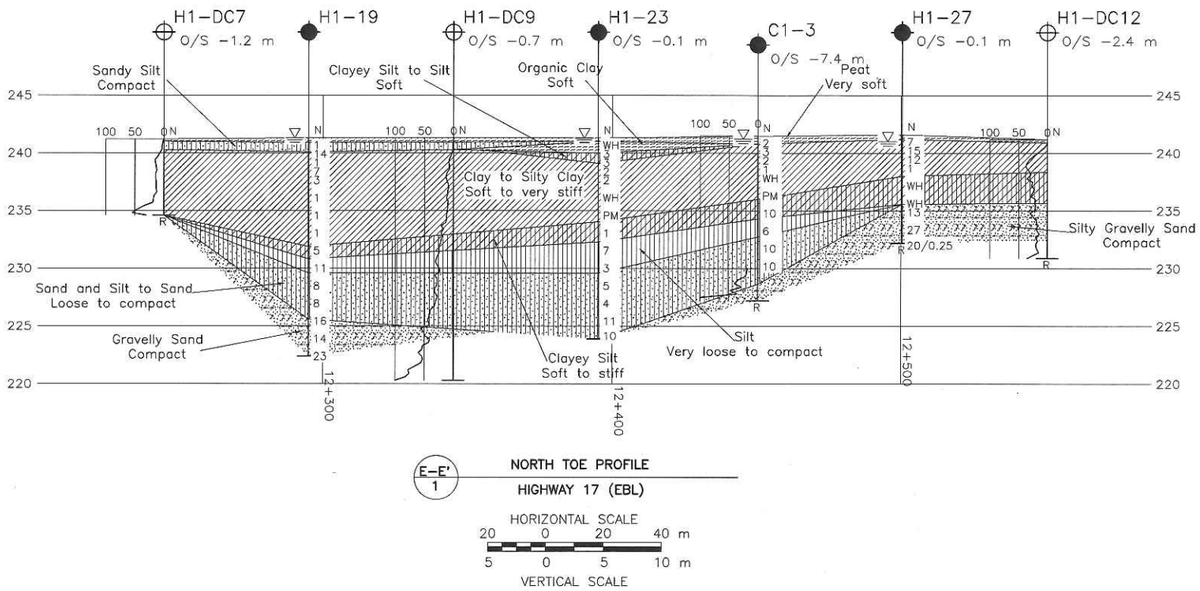
CONT No.
GWP No. 156-98-00

HIGHWAY 17 4 LANING
HWY 17 EBL – STA 12+220 TO 12+570
HWY 17 WBL – STA 12+220 TO 12+570
BOREHOLE LOCATIONS

SHEET

Golder Associates

Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA



E-E' / 1 — NORTH TOE PROFILE
HIGHWAY 17 (EBL)

HORIZONTAL SCALE
20 0 20 40 m
5 0 5 10 m
VERTICAL SCALE

LEGEND

- Borehole
- Dynamic Cone Penetration Test
- N — Standard Penetration Test Value
- 16 — Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- R — Refusal
- WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
H1-17	241.3	5136024.7	273026.2
H1-19	241.3	5136051.9	273074.1
H1-21	241.0	5136033.1	273125.8
H1-23	241.3	5136060.4	273173.8
H1-25	241.2	5136037.4	273232.1
H1-27	241.6	5136073.0	273278.4
H1-29	241.3	5136058.6	273332.0
H1-DC7	241.2	5136047.6	273024.2
H1-DC8	241.2	5136028.9	273076.0
H1-DC9	241.3	5136056.1	273123.9
H1-DC10	241.2	5136037.5	273175.7
H1-DC11	241.0	5136050.2	273281.8
H1-DC12	241.2	5136081.2	273327.9
C1-3	241.5	5136073.1	273227.8

NOTES

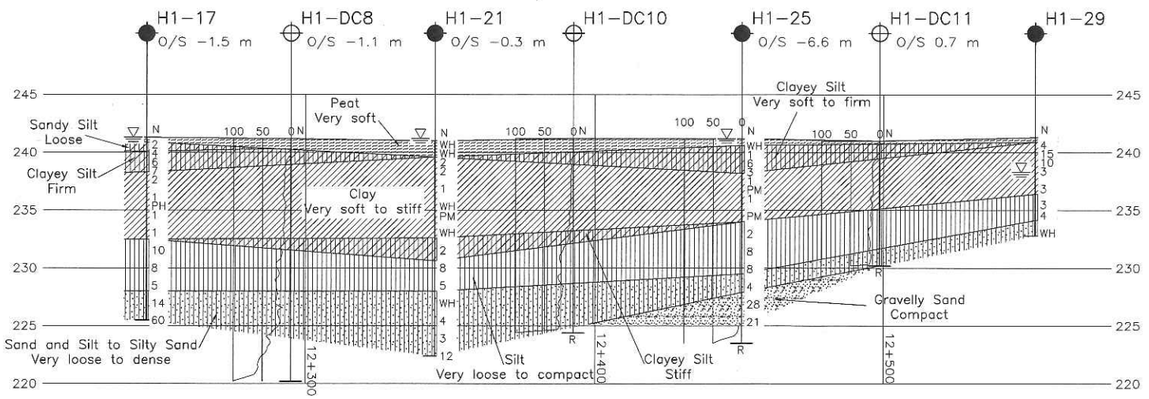
This drawing is for subsurface information only. The proposed details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

REFERENCE

Base plans provided in digital format by DM Wills, drawing files 581_base.dwg, GWP156-98-00_B & C Plans.dwg and 581_contours.dwg received Jan 17, 2012.



F-F' / 1 — SOUTH TOE PROFILE
HIGHWAY 17 (EBL)

HORIZONTAL SCALE
20 0 20 40 m
5 0 5 10 m
VERTICAL SCALE

LICENCED PROFESSIONAL ENGINEER
S.E.M. POOT
90471921
APR 15, 2015
PROVINCE OF ONTARIO

LICENCED PROFESSIONAL ENGINEER
J.M.A.COSTA
APR 15, 2015
PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION

Geocres No. 41I-323

HWY. 17	PROJECT NO. 11-1191-0007		DIST.
SUBM'D. EC	CHKD.	DATE: APR 2015	SITE:
DRAWN: TB	CHKD. SEMP	APPD. JMAC	DWG. A4

PLOT DATE: June 30, 2015
FILENAME: \\golder.gds\gal\Sudbury\CAD-GIS\GIS\Projects\2011\11-1191-0007 HWY 17 4 Laning\11119100070M001_J11.dwg

Golder Associates

RECORD OF BOREHOLE No H1-1

1 OF 1 **METRIC**

PROJECT 11-1191-0007
G.W.P. 156-98-00 LOCATION N 5136074.1; E 272996.9 ORIGINATED BY LK
DIST HWY 17 BOREHOLE TYPE 108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing and Wash Boring COMPILED BY EC
DATUM Geodetic DATE July 4, 2011 CHECKED BY SEMP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
246.6	GROUND SURFACE										
0.0	ASPHALT (130 mm)										
0.1	Sand and gravel, containing blast rock (FILL) Dense Brown Moist		1	AS	-		246				
			2	SS	50/0.08						
245.2			3	RC	REC 62%						
1.4	Boulder/rock Fill Possible bedrock or boulder cored from 1.4 m depth to 2.1 m depth.		4	RC	REC 100%		245				
244.5											
2.1	END OF BOREHOLE Note: 1. Borehole dry upon completion of drilling.										

$+^{3}$, $\times^{3}$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SUD-MTO 001 11-1191-0007.GPJ GAL-MISS.GDT 17/03/14 DATA INPUT:

Golder Associates

RECORD OF BOREHOLE No H1-2

1 OF 1 **METRIC**

PROJECT 11-1191-0007
G.W.P. 156-98-00 LOCATION N 5136061.6; E 273023.1 ORIGINATED BY GM
DIST HWY 17 BOREHOLE TYPE Hand Equipment COMPILED BY EC
DATUM Geodetic DATE June 11, 2012 CHECKED BY SEMP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
242.2	GROUND SURFACE										
0.0	Sand, some gravel, trace organics (FILL) Brown Moist	⊠	1	CS	-		242				
0.2	END OF BOREHOLE SHOVEL REFUSAL										
	Note: 1. Hand digging carried out at borehole location to expose boulders/rock fill. 2. Borehole dry upon completion of drilling.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SUD-MTO 001 11-1191-0007.GPJ GAL-MISS.GDT 17/03/14 DATA INPUT:

Golder Associates

RECORD OF BOREHOLE No H1-3

1 OF 1 **METRIC**

PROJECT 11-1191-0007 | G.W.P. 156-98-00 | DIST | HWY 17 | DATUM Geodetic

LOCATION N 5136079.0; E 273049.7 | BOREHOLE TYPE 108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing and Wash Boring | DATE July 6, 2012

ORIGINATED BY LK | COMPILED BY EC | CHECKED BY SEMP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
246.6	GROUND SURFACE										
0.0	ASPHALT (130 mm)										
0.1	Sand and gravel, trace to some silt containing blast rock (FILL) Compact to very dense Brown to grey Moist to wet		1	AS	-		246				
			2	SS	63				○		38 51 (11)
			3	REC	REC 63%		245				
			4	REC	REC 41%		244				
			5	REC	REC 64%						
			6	SS	28		243				
242.1											
4.5	SAND and SILT, trace gravel, trace clay Compact Brown Wet		7	SS	14		242		○		3 63 33 1
							241				
239.8			8	SS	20/0.08		240				
6.8	END OF BOREHOLE SPOON REFUSAL (HAMMER BOUNCING) Note: 1. Borehole dry upon completion of drilling.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SUD-MTO 001 11-1191-0007.GPJ GAL-MISS.GDT 17/03/14 DATA INPUT:

Golder Associates

RECORD OF BOREHOLE No H1-4

1 OF 1 **METRIC**

PROJECT 11-1191-0007
G.W.P. 156-98-00 LOCATION N 5136088.7; E 273071.0 ORIGINATED BY GM
DIST HWY 17 BOREHOLE TYPE Portable Equipment COMPILED BY EC
DATUM Geodetic DATE June 11, 2012 CHECKED BY SEMP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
241.6	GROUND SURFACE										
0.0 241.0	Sand and gravel, some silt, trace organics (FILL) Compact Brown Wet		1	SS	27		241				
0.6	END OF BOREHOLE SPOON REFUSAL (HAMMER BOUNCING)										

Note:

1. Borehole dry upon completion of drilling.

2. Split-spoon sample obtained by driving with a 1/2 weight hammer. SPT 'N' values have been adjusted to the inferred values that would be obtained using a standard weight hammer.

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No H1-5

1 OF 2 **METRIC**

PROJECT 11-1191-0007
G.W.P. 156-98-00 LOCATION N 5136076.5; E 273098.2 ORIGINATED BY LK
DIST HWY 17 BOREHOLE TYPE 108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing and Wash Boring COMPILED BY EC
DATUM Geodetic DATE July 9 and 10, 2012 CHECKED BY SEMP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS
246.3	GROUND SURFACE					
0.0	Sand and gravel containing blast rock (FILL) Grey Moist to wet		1	RC	REC 27%	
			2	RC	REC 93%	
			3	RC	REC 60%	▽
240.2						
6.1	SAND and SILT, trace gravel, trace clay Loose Grey Wet		4	SS	5	
239.1						
7.2	CLAY, varved Soft to stiff Grey Wet		5	SS	1	
			6	TO	PH	
			7	SS	WH	
			8	SS	WH	
232.9						
13.4	SILT, some clay, trace sand Very loose to loose Grey Wet		9	SS	9	

ELEVATION SCALE: 246, 245, 244, 243, 242, 241, 240, 239, 238, 237, 236, 235, 234, 233, 232

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × REMOULDED
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
20 40 60

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

9: 0 1 86 13

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No H1-5

2 OF 2 **METRIC**

PROJECT 11-1191-0007 | G.W.P. 156-98-00 | LOCATION N 5136076.5; E 273098.2 | ORIGINATED BY LK

DIST _____ HWY 17 | BOREHOLE TYPE 108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing and Wash Boring | COMPILED BY EC

DATUM Geodetic | DATE July 9 and 10, 2012 | CHECKED BY SEMP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × REMOULDED)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---							20 40 60 80 100	20 40 60		
	SILT, some clay, trace sand Very loose to loose Grey Wet		10	SS	8		231				
							230				
			11	SS	1		229				
228.5											
17.8	SAND and SILT Compact Grey Wet		12	SS	18		228		○		0 69 31 0
226.9							227				
19.4	END OF BOREHOLE REFUSAL TO FURTHER CASING ADVANCEMENT Note: 1. Water level at a depth of 5.5 m below ground surface (Elev. 240.8 m) upon completion of drilling.										

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No H1-6

1 OF 2 **METRIC**

PROJECT 11-1191-0007
G.W.P. 156-98-00 LOCATION N 5136066.4; E 273133.1 ORIGINATED BY GM
DIST HWY 17 BOREHOLE TYPE Portable Equipment, NW Casing, Wash Boring COMPILED BY EC
DATUM Geodetic DATE June 6 and 7, 2012 CHECKED BY SEMP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS
241.3	GROUND SURFACE					
0.0	PEAT (Fibrous) Very soft Black Wet		1	SS	WH	
240.4						
0.9	SAND and SILT Loose Brown to grey Wet		2	SS	6	
			3	SS	5	
239.2						
2.1	SILTY CLAY, varved Soft to stiff Grey Wet		4	SS	4	
			5A	SS	1	
			5B	TO	PH	
			6	SS	1	
234.1						
7.2	CLAYEY SILT Firm Grey Wet		7	SS	1	
232.5						
8.8	SILT, trace to some clay Loose Grey Wet		8	SS	8	
			9	SS	7	
229.7						
11.6	Silty SAND, trace clay, trace gravel Loose Grey Wet		10	SS	4	
			11	SS	7	

ELEVATION SCALE: 241, 240, 239, 238, 237, 236, 235, 234, 233, 232, 231, 230, 229, 228, 227

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × REMOULDED
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No H1-6

2 OF 2 **METRIC**

PROJECT 11-1191-0007
G.W.P. 156-98-00
DIST _____ HWY 17
DATUM Geodetic

LOCATION N 5136066.4; E 273133.1
BOREHOLE TYPE Portable Equipment, NW Casing, Wash Boring
DATE June 6 and 7, 2012

ORIGINATED BY GM
COMPILED BY EC
CHECKED BY SEMP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	— CONTINUED FROM PREVIOUS PAGE —										
	Silty SAND, trace clay, trace gravel Loose Grey Wet		12	SS	10		226		○		1 68 28 3
							225				
223.8	Approximated 0.2 of heave encountered at 17.4 m depth.		13	SS	10		224				
			14	SS	10/0.15						
17.5	END OF BOREHOLE SPOON REFUSAL (HAMMER BOUNCING)										

Note:

1. Water level at 0.3 above ground surface (Elev. 241.6 m) upon completion of drilling.

2. Moved 1.0 m east of Borehole H1-6 and advanced a shelby tube at 4.6 m depth (Sample 5B).

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No H1-7

1 OF 2 **METRIC**

PROJECT 11-1191-0007
G.W.P. 156-98-00
DIST _____ HWY 17
DATUM Geodetic
LOCATION N 5136083.3; E 273145.8
BOREHOLE TYPE 108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing and Wash Boring
DATE July 10 and 11, 2012
ORIGINATED BY LK
COMPILED BY EC
CHECKED BY SEMP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
246.0	GROUND SURFACE										
0.0	Sand and gravel, containing blast rock (FILL) Very dense Grey Moist		1	AS	-		245				
			2	SS	79		244				
			3	RC	REC 22%		243				
			4	RC	REC 33%		242				
			5	RC	REC 26%		241				
240.2											
5.8	SAND and SILT, some clay Loose Grey Moist		6	SS	10	▽	240		○		0 40 37 23
238.8							239				
7.2	CLAY to SILTY CLAY, varved Firm to stiff Grey Wet		7	SS	2		238	3 +			
			8	SS	WH		237				
			9	TO	PH		236	4 +			
			10	SS	WH		235	4 +	○		0 0 61 39
232.6							234				
13.4	SILT, trace sand, trace clay Very loose to loose Grey Wet		11	SS	6		233	3 +			
							232				

Continued Next Page

$+^{3}, \times^{3}$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No H1-7

2 OF 2 **METRIC**

PROJECT 11-1191-0007
G.W.P. 156-98-00
DIST HWY 17
DATUM Geodetic
LOCATION N 5136083.3; E 273145.8
BOREHOLE TYPE 108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing and Wash Boring
DATE July 10 and 11, 2012
ORIGINATED BY LK
COMPILED BY EC
CHECKED BY SEMP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × REMOULDED)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---							20 40 60 80 100	20 40 60		
	SILT, trace sand, trace clay Very loose to loose Grey Wet		12	SS	2				○		0 5 90 5
229.7							230				
16.3	SAND and SILT, trace clay Loose to dense Grey Wet		13	SS	16		229				
							228				
			14	SS	10				○		0 45 54 1
							227				
							226				
							225				
			15	SS	7		224				
222.5			16	SS	49		223				
23.5	END OF BOREHOLE Note: 1. Water level at a depth of 6.2 m below ground surface (Elev. 239.8 m) upon completion of drilling.										

$+^3, \times^3$: Numbers refer to Sensitivity $\circ^{3\%}$ STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No H1-8

1 OF 2 **METRIC**

PROJECT 11-1191-0007
G.W.P. 156-98-00
DIST _____ HWY 17
DATUM Geodetic

LOCATION N 5136097.6; E 273170.5
BOREHOLE TYPE 108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing and Wash Boring
DATE July 5, 2012

ORIGINATED BY LK
COMPILED BY EC
CHECKED BY SEMP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
245.8	GROUND SURFACE										
0.0	Sand and gravel, containing blast rock (FILL) Compact Brown Moist		1	AS	-		245				
243.6			2	SS	19		244				
2.2	Sandy silt, some gravel, trace to some clay, containing blast rock (FILL) Compact to dense Brown Moist to wet		3	SS	38		243				
			4	SS	26	▽			○		17 25 52 6
	Spoon refusal at 4.6 m depth.						242				
240.3							241				
5.5	CLAY, trace sand Soft to firm Grey Wet		5	SS	5		240				
			6	SS	2		239				
			7	SS	WH		238	+ 2			0 1 31 68
			8	TO	PH		237	+ 2			
			9	SS	1		236	+ 3			
232.4							235	+			
13.4	SILT, trace to some clay, trace sand Loose Grey Wet		10	SS	7		234		○	NP	0 1 91 8
							233				
							232				
							231				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No H1-8

2 OF 2 **METRIC**

PROJECT 11-1191-0007 | G.W.P. 156-98-00 | LOCATION N 5136097.6; E 273170.5 | ORIGINATED BY LK
DIST _____ HWY 17 | BOREHOLE TYPE 108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing and Wash Boring | COMPILED BY EC
DATUM Geodetic | DATE July 5, 2012 | CHECKED BY SEMP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	— CONTINUED FROM PREVIOUS PAGE —										
	SILT, trace to some clay, trace sand Loose Grey Wet		11	SS	6		230				
229.5											
16.3	SAND and SILT, trace clay Loose to dense Grey Wet		12	SS	7		229				
							228				
			13	SS	10		227		○		0 53 44 3
							226				
							225				
			14	SS	11		224				
							223				
222.3			15	SS	31						
23.5	END OF BOREHOLE Note: 1. Water level at a depth of 3.1 m below ground surface (Elev. 242.7 m) upon completion of drilling.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No H1-9

1 OF 2 **METRIC**

PROJECT 11-1191-0007 | G.W.P. 156-98-00 | LOCATION N 5136092.6; E 273195.7 | ORIGINATED BY EHS

DIST | HWY 17 | BOREHOLE TYPE NW Casing and Wash Boring | COMPILED BY MT

DATUM Geodetic | DATE January 8 and 9, 2014 | CHECKED BY SEMP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
245.8	GROUND SURFACE						
0.0	Sandy gravel to sand and gravel, containing blast rock (FILL) Very dense to compact Grey Frozen to wet		1	SS	113		245
			2	SS	13	▽	244
							243
							242
240.8							241
5.0	SILTY CLAY, trace sand Firm to stiff Grey Wet		3	SS	9		240
			4	SS	8		239
	Trace organics in Sample 5.		5	SS	2		238
			6	SS	WH		237
							236
	Varved below 10.7 m depth. Approximately 5 mm thick varves encountered from 10.7 m to 12.0 m depth.		7	SS	WH		235
233.8							234
12.0	SILT, trace to some clay Loose to compact Grey Wet		8	SS	7		233
			9	SS	12		232
							231

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH kPa (20 40 60 80 100)
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × REMOULDED

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%) (20 40 60)

>100

3

6

UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
NP	0	0	82	18

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No H1-9

2 OF 2 **METRIC**

PROJECT 11-1191-0007 | G.W.P. 156-98-00 | DIST | HWY 17 | DATUM Geodetic

LOCATION N 5136092.6; E 273195.7 | BOREHOLE TYPE NW Casing and Wash Boring | DATE January 8 and 9, 2014

ORIGINATED BY EHS | COMPILED BY MT | CHECKED BY SEMP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × REMOULDED)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---							20 40 60 80 100	20 40 60		
230.4											
15.4	SAND and SILT Loose Grey Wet		10	SS	7		230		○		0 48 49 3
							229				
228.4			11	SS	6						
17.4	END OF BOREHOLE Note: 1. Water level at a depth of 3.2 m below ground surface (Elev. 242.6 m) upon completion of drilling.										

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE