

Stability Analysis STA 12+400 – WBL South Side Widening

Figure A22

Material Name	Unit Weight (kN/m ³)	Cohesion (kPa)	Friction Angle (°)
New Rock Fill	19	-	40
Existing Granular Fill	20	-	35
Peat	12	1	27
Backfill	12	1	27
Silty Clay to Clay (Above Elev. 235 m)	16.6	18	-
Silty Clay to Clay (Below Elev. 235 m)	16.6	18 – 40	-
Silt	18	-	28
Sand and Silt to Sand	18	-	28

FOS = 2.33

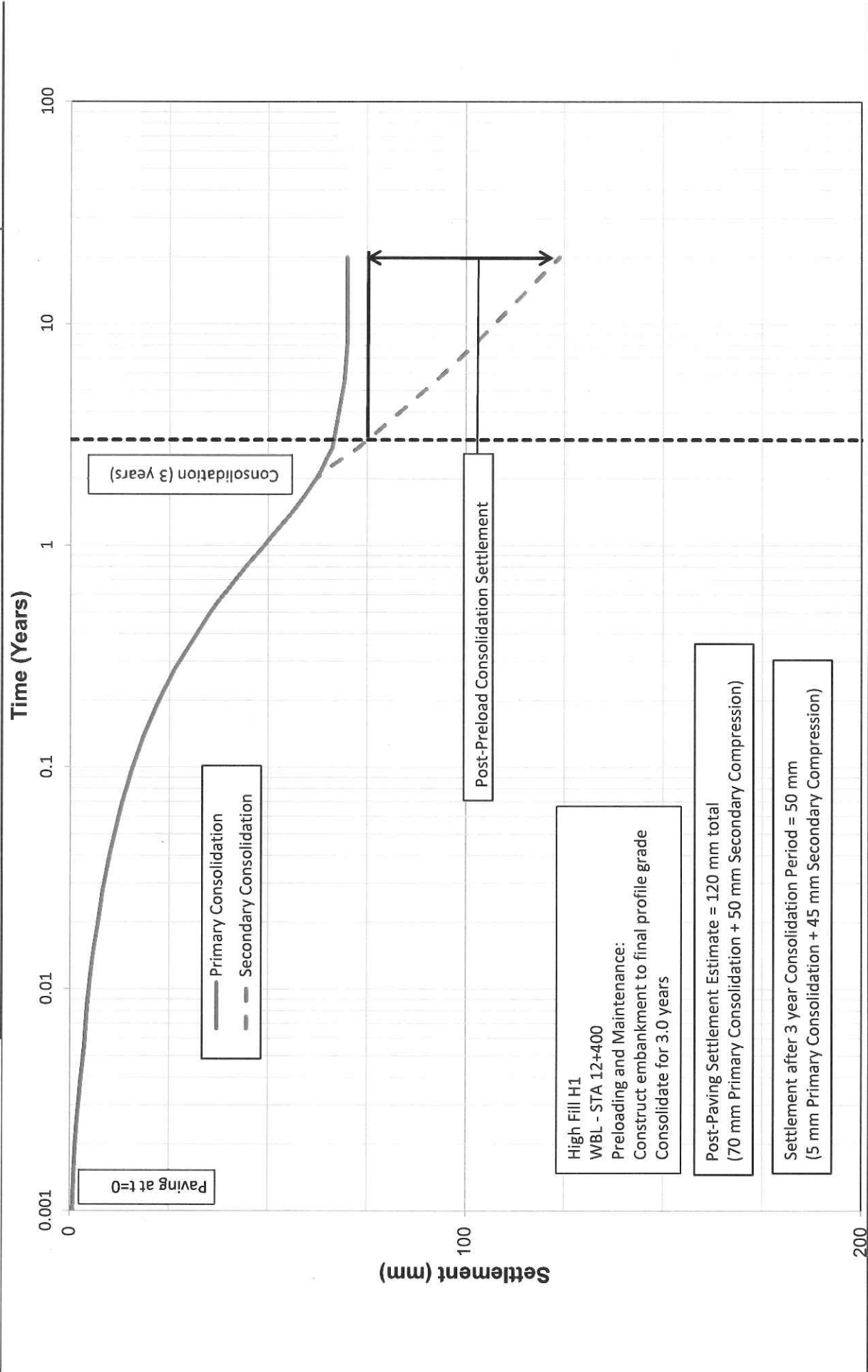
The diagram illustrates a cross-section of a road and its surrounding soil layers. The vertical axis represents Elevation (m) from 220 to 250, and the horizontal axis represents Offset (m) from -70 to 30. The soil layers are identified as follows: Silty Clay to Clay (Above Elev. 235 m), Silty Clay to Clay (Below Elev. 235 m), Silt, and Sand and Silt to Sand. The diagram also shows the Existing Ground Surface, New Rock Fill, Existing Granular Fill, Peat, and Backfill. A failure surface is indicated by a dashed line, and the Factor of Safety (FOS) is given as 2.33. Key points H1-8, H1-9, H1-23, and H1-24 are marked. Dimensions of 4.4 m, 1.25 m, and 1 m are indicated. A contour plot is shown in the upper left corner.

Date July 6, 2015

Project No: 11-1191-0007-01

Analysis By: DAM

Reviewed By: SEMP

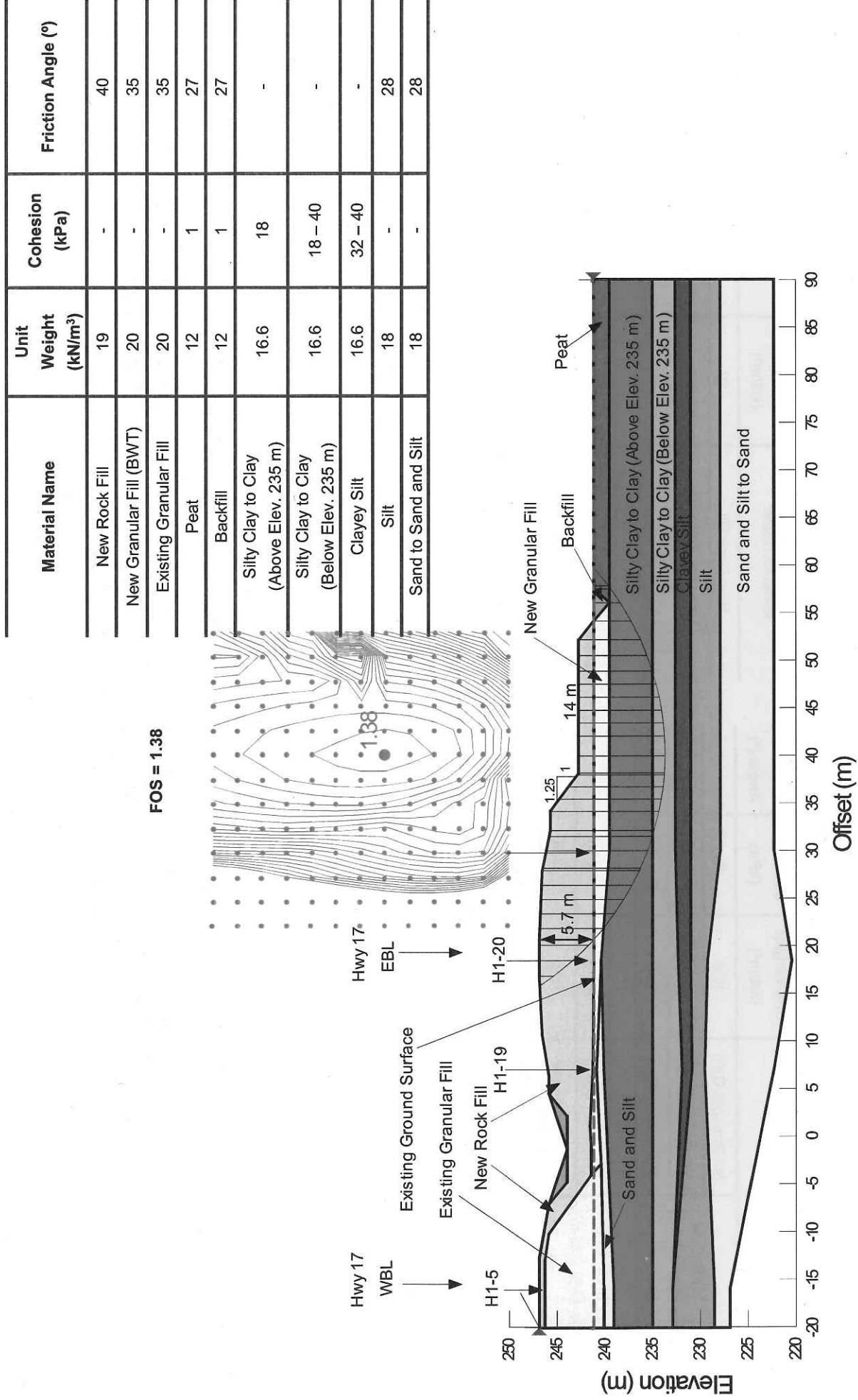




Stability Analysis

STA 12+320 – EBL South Side
Stage 1 - Embankment Height (14 m Toe Berms)

Figure A24



Date July 6, 2015

Project No: 11-1191-0007-01

Analysis By: DAM Reviewed By: SEMP





Stability Analysis
STA 12+320 – EBL South Side
Stage 2 – 1.3 m Surcharge with Strength Gain

Figure A25

Material Name		Unit Weight (kN/m ³)	Cohesion (kPa)	Friction Angle (°)
Silty Clay to Clay (Above Elev. 235 m)	No Strength Gain	16.6	18	-
	Strength Gain	16.6	25 - 32	-
	½ Strength Gain	16.6	21 - 25	-
Silty Clay to Clay (Below Elev. 235 m)	No Strength Gain	16.6	18 - 32	-
	Strength Gain	16.6	32 - 36	-
	½ Strength Gain	16.6	25 - 34	-
Clayey Silt	No Strength Gain	16.6	32 - 40	-
	Strength Gain	16.6	36 - 40	-
	½ Strength Gain	16.6	25 - 40	-

Material Name	Unit Weight (kN/m ³)	Cohesion (kPa)	Friction Angle (°)
New Rock Fill	19	-	40
New Granular Fill	21	-	35
New Granular Fill (BWT)	20	-	35
Existing Granular Fill	20	-	35
Peat	12	1	27
Backfill	12	1	27
Silt	18	-	28
Sand to Sand and Silt	18	-	28

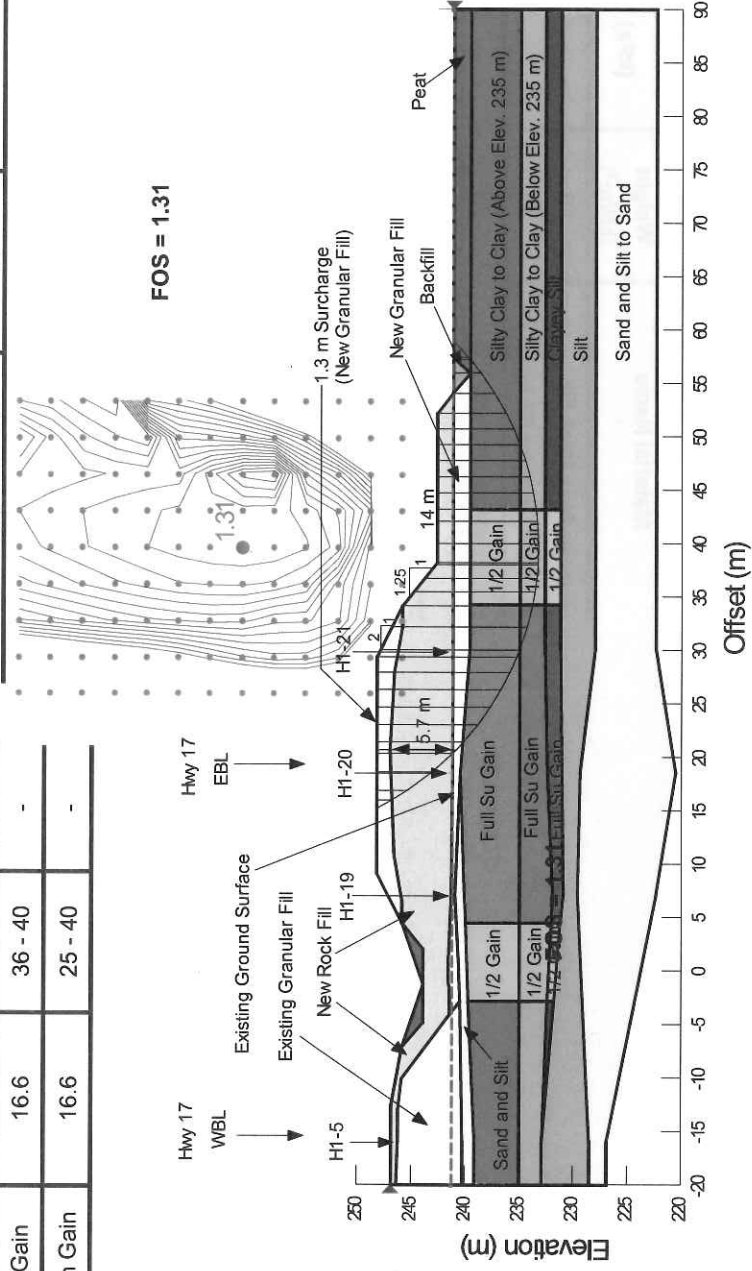


Table B1: Evaluation of Settlement Mitigation Options
Highway 17 – STA 13+140 to 13+390 (High Fill Area H2)
[EBL/WBL and St. Pothier Road Embankments Constructed Concurrently]

Stability/Settlement Mitigation Option ¹	Option No.	Rank	Advantages	Disadvantages	Relative Costs	Risks/Consequences
Staged Construction and 2 m Surcharge with Wick Drains and Toe Berms <ul style="list-style-type: none"> ■ 1st stage 4.4 m high for EBL/WBL and 2.9 m high for SPR for 10 months ■ 2nd stage 2.7 m fill for EBL/WBL and 1.5 m fill for SPR for 10 months ■ 1.7 years total surcharge period ■ 10 m wide toe berms (WBL and SPR), "toe berm" connection between EBL and SPR 	A	1	<ul style="list-style-type: none"> ■ 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 	<ul style="list-style-type: none"> ■ 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. ■ Re-grading is required prior to final pavement structure construction. 	<ul style="list-style-type: none"> ■ Rock fill toe berm material and associated sub-excavation and replacement of organic deposits below toe berm (\$320,000) ■ Granular backfill for peat sub-excavation required to facilitate wick drain installation. (\$232,000 more than rock fill) ■ Surcharge material (Granular B). (\$236,250) ■ Detail wick drain investigation and design. (\$50,000) ■ Installation of wick drains including pre-drilling, instrumentation and associated monitoring program. (\$805,000) 	<ul style="list-style-type: none"> ■ 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.
Full Sub-Excavation (up to approximately 15 m below ground surface) <ul style="list-style-type: none"> ■ 6 to 12 month preload period required to reduce post-construction settlement of rock fill. 	B	2	<ul style="list-style-type: none"> ■ Reduces total settlement of foundations soils as soft compressible material has been removed. 	<ul style="list-style-type: none"> ■ 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. 	<ul style="list-style-type: none"> ■ Sub-excavation, disposal and replacement of weak/soft, compressible deposits. ■ 256,500 – 50,000 m³ x \$14/m³ (sub-excavation and replacement with rock "supply" fill) = \$2,891,000. ■ Cost for disposal not quantified. 	<ul style="list-style-type: none"> ■ 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.



Table B1: Evaluation of Settlement Mitigation Options
Highway 17 – STA 13+140 to 13+390 (High Fill Area H2)
[EBL/WBL and St. Pothier Road Embankments Constructed Concurrently]

Stability/Settlement Mitigation Option ¹	Option No.	Rank	Advantages	Disadvantages	Relative Costs	Risks/Consequences
Partial Preload with Lightweight Fill (EPS) (no Wick Drains, no Toe Berms) ■ 1.8 year preload period ■ 1.5 m of EPS on WBL and 1 m on St. Pothier Road (no EPS on EBL) ■ Surcharge required for EBL	C	3	■ Reduces total load on subsoils thereby reducing total settlement of foundations soils. ■ Toe berms are not required ■ Rock fill can be used to backfill peat sub-excavation.	■ 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. ■ Restricted thickness that can be used dependent on overall thickness of embankment and groundwater/water level. ■ 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. ■ $13,400 \text{ m}^3 \times \$200/\text{m}^3 = \$2,680,000$. (which assumes 44 m^2 for a 250 m length for WBL & 12 m^2 for 200 m length for SPR EPS) ■ Surcharge material for EBL (Granular B). (\$225,000)	■ There will be a very high 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).
2 m Surcharge with Wick Drains and Toe Berms ■ 9 month surcharge period ■ 14 m wide toe berm WBL, 22 m wide toe berm St. Pothier Rd., "toe berm" connection between EBL and SPR	D	\$	■ Reduced time for primary consolidation when compared to not using wick drains ■ One stage construction.	■ Very large toe berms required for embankment stability including additional peat sub-excavation and backfilling. ■ Increased handling of surcharge fills upon completion of surcharge period. ■ 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. ■ Re-grading is required prior to final pavement structure construction.	■ Rock fill toe berm material excluding granular backfill for wick drains. (\$84,000) ■ Granular backfill for peat sub-excavation required to facilitate wick drain installation. (\$250,000 more than if rock fill is used) ■ Surcharge material (Granular B). (\$216,000) ■ Detail wick drain investigation and design. (\$50,000) ■ Installation of wick drains including pre-drilling, instrumentation and associated monitoring program. (\$865,000)	■ 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 B1: Evaluation of Settlement Mitigation Options
Highway 17 – STA 13+140 to 13+390 (High Fill Area H2)
[EBL/WBL and St. Pothier Road Embankments Constructed Concurrently]

Stability/Settlement Mitigation Option ¹	Option No.	Rank	Advantages	Disadvantages	Relative Costs	Risks/Consequences
2 m Surcharge with Toe Berms (no Wick Drains) ■ 2.5 year surcharge period ■ 12 m wide toe berm WBL, 20 m wide toe berm St. Pothier Rd. and a "toe berm" connection between EBL and SPR	E	5	■ Standard construction operation. ■ Rock fill can be used to backfill peat sub-excavation.	■ Very large toe berms required for embankment stability including additional peat sub-excavation and backfilling. ■ Significant wait period is required (since wick drains not being utilized). ■	■ Rock fill toe berm material and associated sub-excavation and replacement of organic deposits below toe berm. (\$84,000) ■ Use of rock fill as backfill instead of granular fill as in Option C creates a savings of \$250,000 ■ Surcharge material (Granular B). (\$216,000)	■ There will be a very high impact on the construction schedule. ■ Property issues may arise due to the size of the toe berms.
Partial Sub-Excavation and Preloading	F	NF	■ Reduces total settlement of foundations soils as soft compressible material has been removed. ■ Specialized equipment (i.e. dragline) may not be required compared to sub-excavation to the full depth.	■ 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 unexpected post-construction settlements (i.e. long term rock fill settlement).
Ground Improvement ■ Dry/wet soil mixing ■ Geopiers (rammed aggregate)	G	NF	■ Reduces future creep settlement of clay (and potentially peat) by improving strength and stiffness of the material.	■ 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 mitigation options assume that the peat/organics is sub-excavated and replaced with backfill.

Prepared By: SEMC Reviewed By: JMAC

Table B2: Evaluation of Settlement Mitigation Options
Highway 17 – STA 13+140 to 13+390 (High Fill Area H2)
EBL/WBL and St. Pothier Road Embankments Constructed at Different Times

Stability/Settlement Mitigation Option	Option No.	Rank	Advantages	Disadvantages	Relative Costs	Risks/Consequences
Partial Preload with Lightweight Fill (EPS) (no Wick Drains, no Toe Berms) ■ 1.8 year preload period ■ 3 m of EPS on EBL/WBL, 1 m of EPS on St. Pothier Road	A	1	■ Reduces total load on subsoils thereby reducing total settlement of foundations soils. ■ Toe berms are not required ■ Rock fill can be used to backfill peat sub-excavation	■ 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. ■ Restricted thickness that can be used dependent on overall thickness of embankment and groundwater/water level. ■ Removal of preload material required prior to EPS installation ■ The option of surcharging the EBL instead of using EPS is not available without building the St. Pothier Road embankment.	■ Relative cost of EPS fill is about an order of magnitude higher than fill required for the other options. ■ $21,000 \text{ m}^3 \times \$200/\text{m}^3 = \$4,200,000$.	■ There will be a very high 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). ■ High risk that construction of SPR at a later time will induce settlement under EBL/WBL embankment.
2 m Surcharge with Wick Drains and Toe Berms ■ 10 month surcharge period ■ 14 m wide toe berm WBL, 35 m wide toe berm EBL	B	NP	■ Reduced time for primary consolidation when compared to not using wick drains ■ One stage construction.	■ Very large toe berms required for embankment stability including additional peat sub-excavation and backfilling. ■ Increased handling of surcharge fills upon completion of surcharge period. ■ 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 period required to assess end of surcharge period. ■ Increased handling of surcharge fills upon completion of surcharge period. ■ Re-grading is required prior to final pavement structure construction.	■ Rock fill toe berm material and associated sub-excavation and replacement of organic deposits below toe berm. ■ Granular backfill for peat sub-excavation required to facilitate wick drain installation. ■ Surcharge material (Granular B). ■ Detail wick drain investigation and design. ■ Installation of wick drains including pre-drilling, instrumentation and associated monitoring program.	■ 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. ■ The sizes of toe berms necessary are roughly equivalent to the St. Pothier Road embankment (and connecting toe berm). ■ Not practical to build a toe berm of an equivalent size to St. Pothier Road and not build that embankment at the same time.

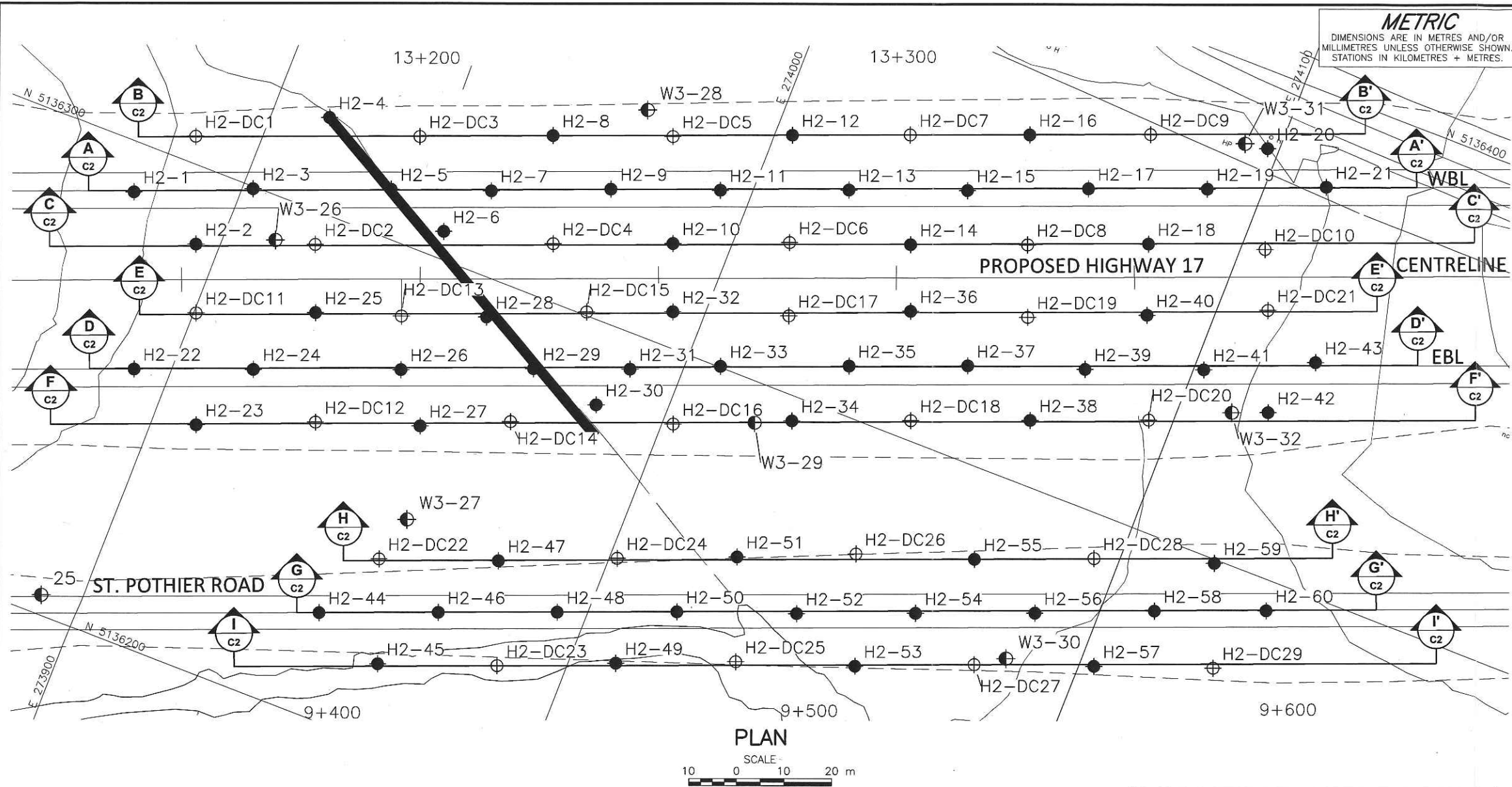


Table B2: Evaluation of Settlement Mitigation Options
Highway 17 – STA 13+140 to 13+390 (High Fill Area H2)
EBL/WBL and St. Pothier Road Embankments Constructed at Different Times

Stability/Settlement Mitigation Option	Option No.	Rank	Advantages	Disadvantages	Relative Costs	Risks/Consequences
2 m Surcharge with Toe Berms ■ 2.5 year surcharge period ■ 12 m wide toe berm WBL, 35 m wide toe berm EBL	C	NP	■ Standard construction operation. ■ Rock fill can be used to backfill peat sub-excavation.	■ Very large toe berms required for embankment stability including additional peat sub-excavation and backfilling. ■ Significant wait period is required (since wick drains not being utilized).	■ Rock fill toe berm material and associated sub-excavation and replacement of organic deposits below the toe berm. ■ Surcharge material (Granular B).	■ There will be a very high impact on the construction schedule ■ Property issues may arise due to the size of the toe berms ■ The sizes of toe berms necessary are roughly equivalent to the St. Pothier Road embankment (and connecting toe berm). ■ Not practical to build a toe berm of an equivalent size to St. Pothier Road and not build that embankment at the same time.

NP: Not Practical
Note: 1. All of these mitigation options assume that the peat/organics is sub-excavated and replaced with backfill.

Prepared By: SEMC Reviewed By: JMAC



CONT No.
GWP No. 156-98-00

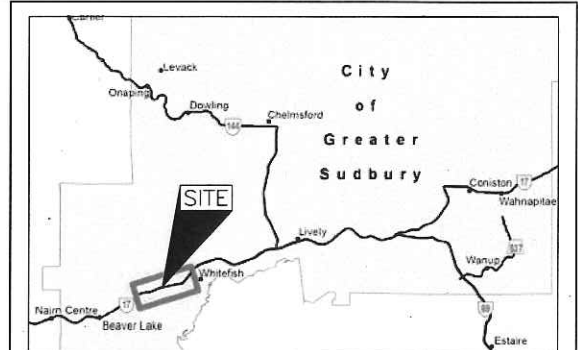


HIGHWAY 17 4 LANING
HWY 17 WBL - STA 13+140 TO 13+390
HWY 17 EBL - STA 13+140 TO 13+390
ST. POTHIER RD. - STA 9+400 TO 9+600
BOREHOLE LOCATIONS

SHEET



Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA



KEY PLAN

10 0 10 20 km

LEGEND

- Borehole - Current Investigation
- ⊕ Dynamic Cone Penetration Test - Current Investigation
- ⊙ Previous Investigation (by others)

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.

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
H2-1	240.7	5136289.9	273879.1
H2-2	239.7	5136284.4	273895.2
H2-3	239.8	5136299.6	273902.2
H2-4	239.7	5136319.3	273911.6
H2-5	239.8	5136309.9	273929.2
H2-6	239.8	5136305.7	273942.7
H2-7	239.9	5136317.2	273949.0
H2-8	239.9	5136332.8	273956.8
H2-9	239.8	5136326.6	273972.2
H2-10	239.8	5136320.7	273988.4
H2-11	239.8	5136334.7	273993.6
H2-12	239.9	5136351.0	274003.6
H2-13	239.9	5136344.5	274018.8
H2-14	239.8	5136338.5	274035.1
H2-15	239.9	5136353.5	274042.1
H2-16	240.0	5136369.1	274050.0
H2-17	239.9	5136363.0	274065.6
H2-18	240.1	5136356.7	274081.7
H2-19	240.2	5136372.0	274089.0
H2-20	240.4	5136384.5	274097.7
H2-21	240.3	5136381.4	274112.1
H2-22	240.3	5136255.2	273892.6

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
H2-23	239.6	5136249.0	273909.0
H2-24	239.6	5136264.2	273916.0
H2-25	239.7	5136280.0	273923.8
H2-26	239.7	5136275.4	273944.9
H2-27	239.7	5136265.8	273952.9
H2-28	239.8	5136292.2	273957.6
H2-29	239.8	5136285.6	273970.8
H2-30	239.7	5136283.3	273985.8
H2-31	239.7	5136292.8	273989.6
H2-32	239.8	5136307.3	273993.6
H2-33	239.8	5136300.2	274007.1
H2-34	239.7	5136295.0	274025.3
H2-35	239.7	5136310.1	274032.3
H2-36	239.8	5136325.5	274040.2
H2-37	239.9	5136319.2	274055.5
H2-38	239.8	5136313.2	274071.8
H2-39	239.8	5136327.3	274078.6
H2-40	240.0	5136342.7	274086.8
H2-41	239.8	5136336.3	274102.1
H2-42	241.8	5136332.8	274117.9
H2-43	242.1	5136346.2	274123.4
H2-44	239.6	5136221.5	273947.3

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
H2-45	239.5	5136216.0	273962.7
H2-46	239.5	5136230.7	273970.8
H2-47	239.5	5136245.4	273978.6
H2-48	239.5	5136239.8	273994.0
H2-49	239.6	5136234.2	274009.3
H2-50	239.5	5136248.9	274017.3
H2-51	239.5	5136264.2	274024.9
H2-52	239.5	5136257.6	274040.9
H2-53	239.5	5136251.8	274056.3
H2-54	239.6	5136266.7	274064.2
H2-55	239.7	5136281.8	274071.6
H2-56	239.7	5136275.8	274087.5
H2-57	239.6	5136269.9	274103.0
H2-58	239.6	5136285.3	274110.8
H2-59	239.7	5136299.2	274118.9
H2-60	239.8	5136293.8	274132.6
H2-DC1	239.6	5136305.5	273887.0
H2-DC2	239.7	5136293.3	273918.5
H2-DC3	239.8	5136322.4	273930.8
H2-DC4	239.7	5136311.6	273965.1
H2-DC5	239.8	5136341.6	273980.2
H2-DC6	239.8	5136329.7	274011.2

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
H2-DC7	239.9	5136360.0	274026.6
H2-DC8	239.8	5136347.4	274058.0
H2-DC9	240.0	5136378.3	274073.7
H2-DC10	240.0	5136364.5	274104.8
H2-DC11	239.6	5136270.9	273900.5
H2-DC12	239.7	5136258.6	273932.1
H2-DC13	239.7	5136285.9	273940.9
H2-DC14	239.6	5136273.5	273970.3
H2-DC15	239.7	5136300.8	273976.8
H2-DC16	239.7	5136285.3	274002.2
H2-DC17	239.8	5136315.3	274016.6
H2-DC18	239.7	5136304.1	274048.6
H2-DC19	240.0	5136333.2	274063.5
H2-DC20	239.7	5136322.3	274095.1
H2-DC21	240.3	5136352.8	274110.0
H2-DC22	239.5	5136236.6	273955.0
H2-DC23	238.9	5136224.7	273986.3
H2-DC24	239.5	5136254.8	274001.6
H2-DC25	239.8	5136243.6	274032.6
H2-DC26	239.6	5136273.8	274048.0
H2-DC27	239.6	5136261.1	274079.6
H2-DC28	239.6	5136291.0	274094.8
H2-DC29	239.6	5136278.6	274126.6



NO.	DATE	BY	REVISION
Geocres No. 411-323			
HWY. 17		PROJECT NO. 11-1191-0007	
SUBM'D. EC	CHKD.	DATE: APR 2015	SITE:
DRAWN: TB	CHKD. SEMP	APPD. JMAC	DWG. B1

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 WBL - STA 13+140 TO 13+390
SOIL STRATA

SHEET



Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA

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
H2-1	240.7	5136289.9	273879.1
H2-3	239.8	5136299.6	273902.2
H2-4	239.7	5136319.3	273911.6
H2-5	239.8	5136309.9	273929.2
H2-7	239.9	5136317.2	273949.0
H2-8	239.9	5136332.8	273956.8
H2-9	239.8	5136326.6	273972.2
H2-11	239.8	5136334.7	273993.6
H2-12	239.9	5136351.0	274003.6
H2-13	239.9	5136344.5	274018.8
H2-15	239.9	5136353.5	274042.1
H2-16	240.0	5136369.1	274050.0
H2-17	239.9	5136363.0	274065.6
H2-19	240.2	5136372.0	274089.0
H2-20	240.4	5136384.5	274097.7
H2-21	240.3	5136381.4	274112.1
H2-DC1	239.6	5136305.5	273887.0
H2-DC3	239.8	5136322.4	273930.8
H2-DC5	239.8	5136341.6	273980.2
H2-DC7	239.9	5136360.0	274026.6
H2-DC9	240.0	5136378.3	274073.7

NOTES

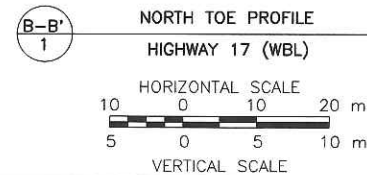
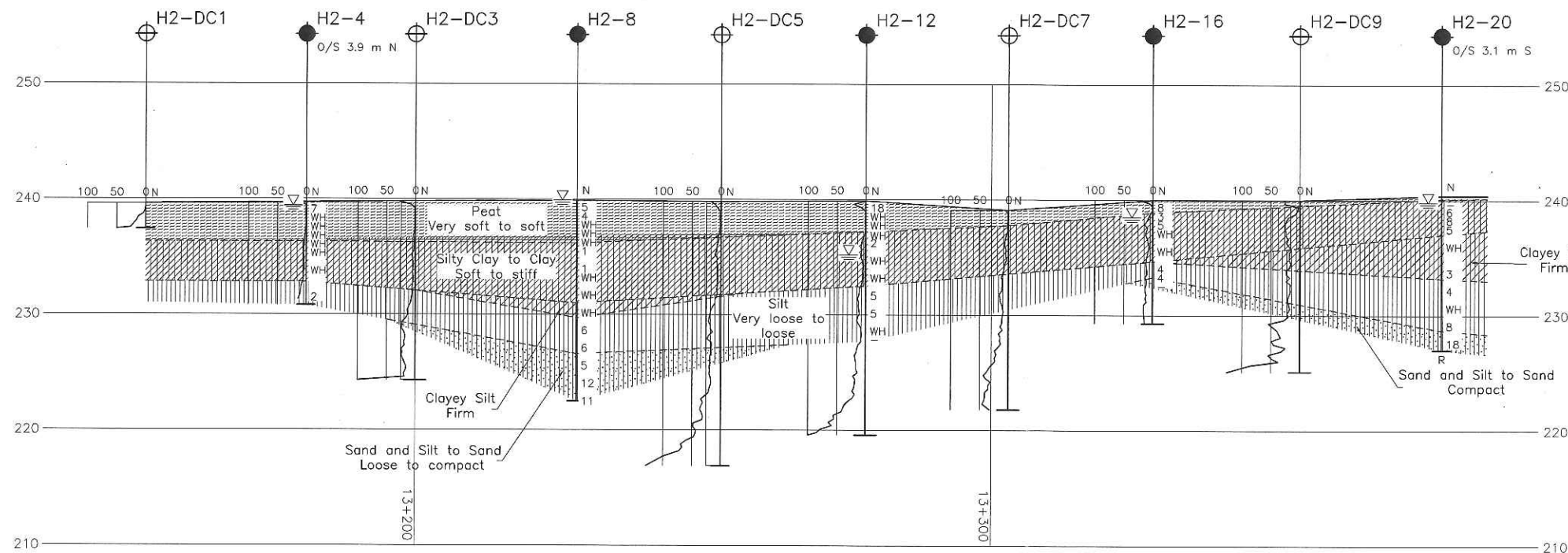
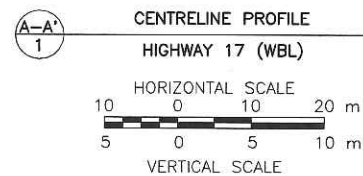
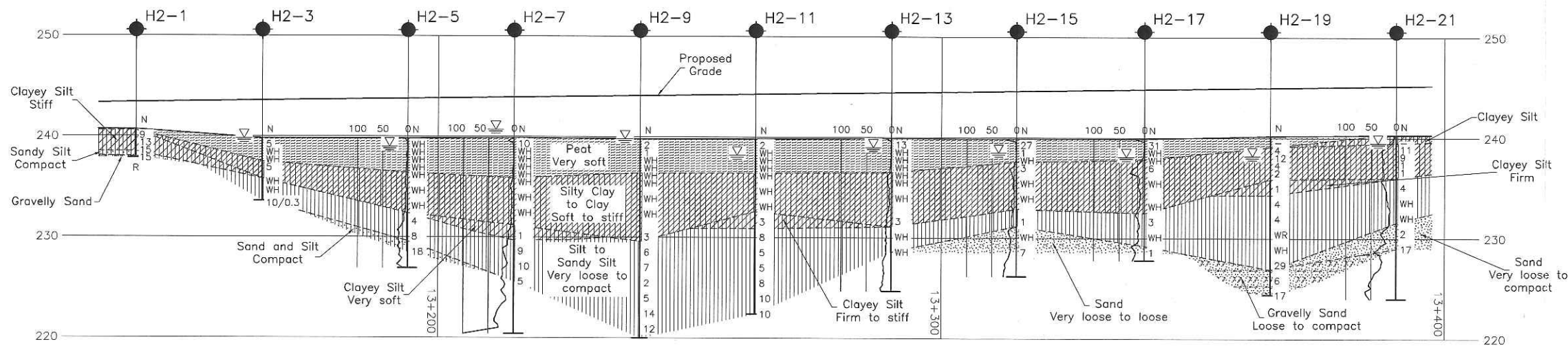
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REFERENCE

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
1	APR 15, 2015	JMAC	REVISED FOR SUBMITTAL
2	APR 15, 2015	JMAC	REVISED FOR SUBMITTAL
3	APR 15, 2015	JMAC	REVISED FOR SUBMITTAL
4	APR 15, 2015	JMAC	REVISED FOR SUBMITTAL
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7	APR 15, 2015	JMAC	REVISED FOR SUBMITTAL
8	APR 15, 2015	JMAC	REVISED FOR SUBMITTAL
9	APR 15, 2015	JMAC	REVISED FOR SUBMITTAL
10	APR 15, 2015	JMAC	REVISED FOR SUBMITTAL

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 WBL - STA 13+140 TO 13+390
HWY 17 EBL - STA 13+140 TO 13+390
SOIL STRATA

SHEET



Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA

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
H2-2	239.7	5136284.4	273895.2
H2-6	239.8	5136305.7	273942.7
H2-10	239.8	5136320.7	273988.4
H2-14	239.8	5136338.5	274035.1
H2-18	240.1	5136356.7	274081.7
H2-22	240.3	5136255.2	273892.6
H2-24	239.6	5136264.2	273916.0
H2-26	239.7	5136275.4	273944.9
H2-29	239.8	5136285.6	273970.8
H2-31	239.7	5136292.8	273989.6
H2-33	239.8	5136300.2	274007.1
H2-35	239.7	5136310.1	274032.3
H2-37	239.9	5136319.2	274055.5
H2-39	239.8	5136327.3	274078.6
H2-41	239.8	5136336.3	274102.1
H2-43	242.1	5136346.2	274123.4
H2-DC2	239.7	5136293.3	273918.5
H2-DC4	239.7	5136311.6	273965.1
H2-DC6	239.8	5136329.7	274011.2
H2-DC8	239.8	5136347.4	274058.0
H2-DC10	240.0	5136364.5	274104.8

NOTES

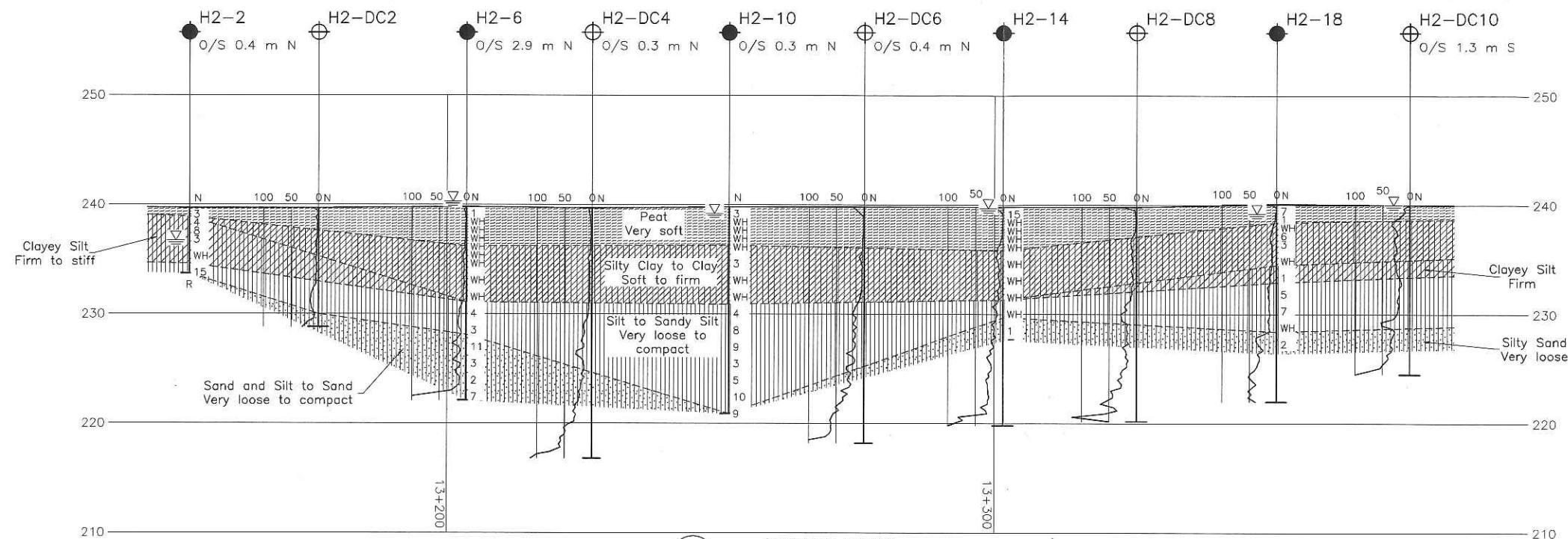
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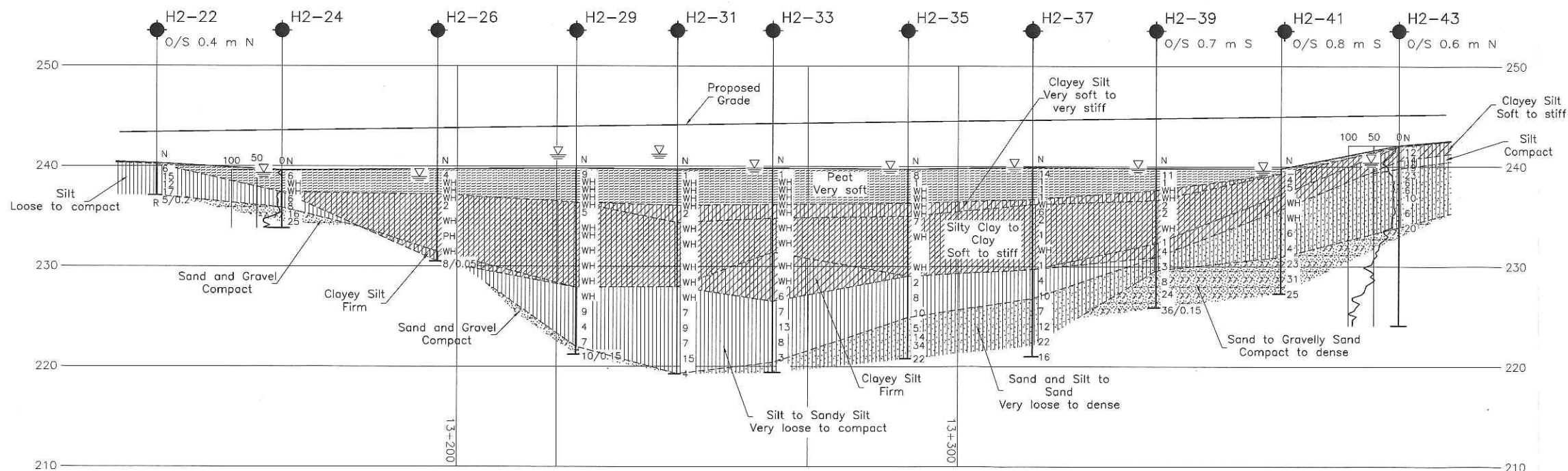
REFERENCE

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



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

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



D-D'
1
CENTRELINE
HIGHWAY 17 (EBL)

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



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Geocres No. 411-323

HWY. 17 PROJECT NO. 11-1191-0007 DIST.

SUBM'D. EC CHKD. DATE: APR 2015 SITE:

DRAWN: TB CHKD. SEMP APPD. JMAC DWG. B3

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 13+140 TO 13+390
SOIL STRATA

SHEET



Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA

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
H2-23	239.6	5136249.0	273909.0
H2-25	239.7	5136280.0	273923.8
H2-27	239.7	5136265.8	273952.9
H2-28	239.8	5136292.2	273957.6
H2-30	239.7	5136283.3	273985.8
H2-32	239.8	5136307.3	273993.6
H2-34	239.7	5136295.0	274025.3
H2-36	239.8	5136325.5	274040.2
H2-38	239.8	5136313.2	274071.8
H2-40	240.0	5136342.7	274086.8
H2-42	241.8	5136332.8	274117.9
H2-DC11	239.6	5136270.9	273900.5
H2-DC12	239.7	5136258.6	273932.1
H2-DC13	239.7	5136285.9	273940.9
H2-DC14	239.6	5136273.5	273970.3
H2-DC15	239.7	5136300.8	273976.8
H2-DC16	239.7	5136285.3	274002.2
H2-DC17	239.8	5136315.3	274016.6
H2-DC18	239.7	5136304.1	274048.6
H2-DC19	240.0	5136333.2	274063.5
H2-DC20	239.7	5136322.3	274095.1
H2-DC21	240.3	5136352.8	274110.0

NOTES

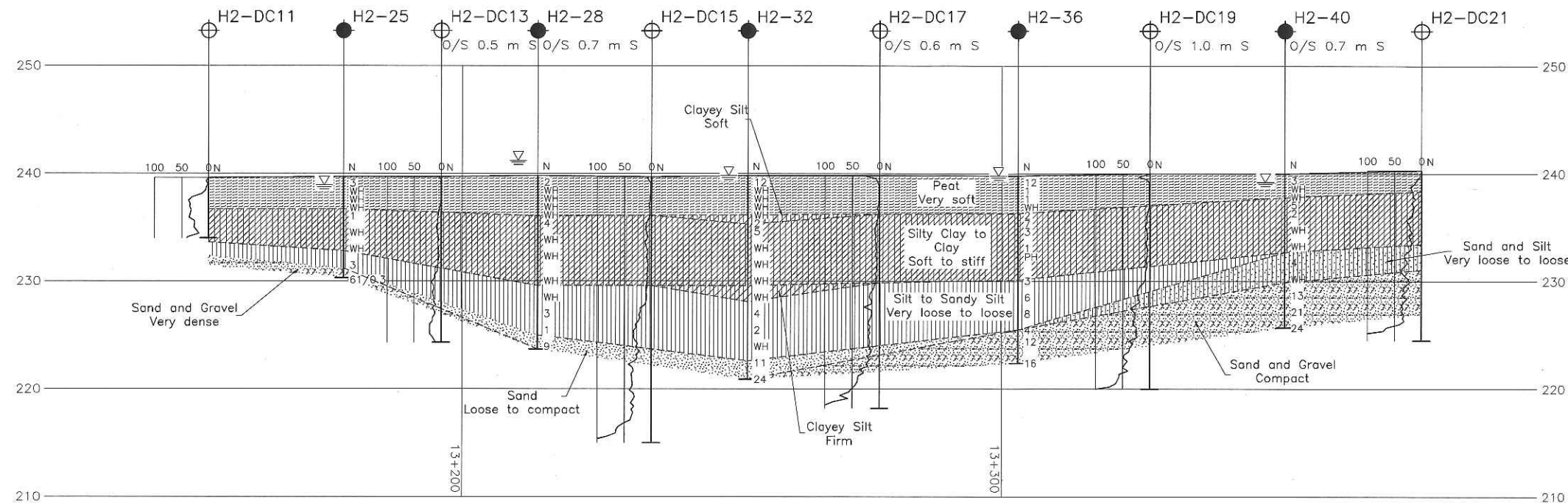
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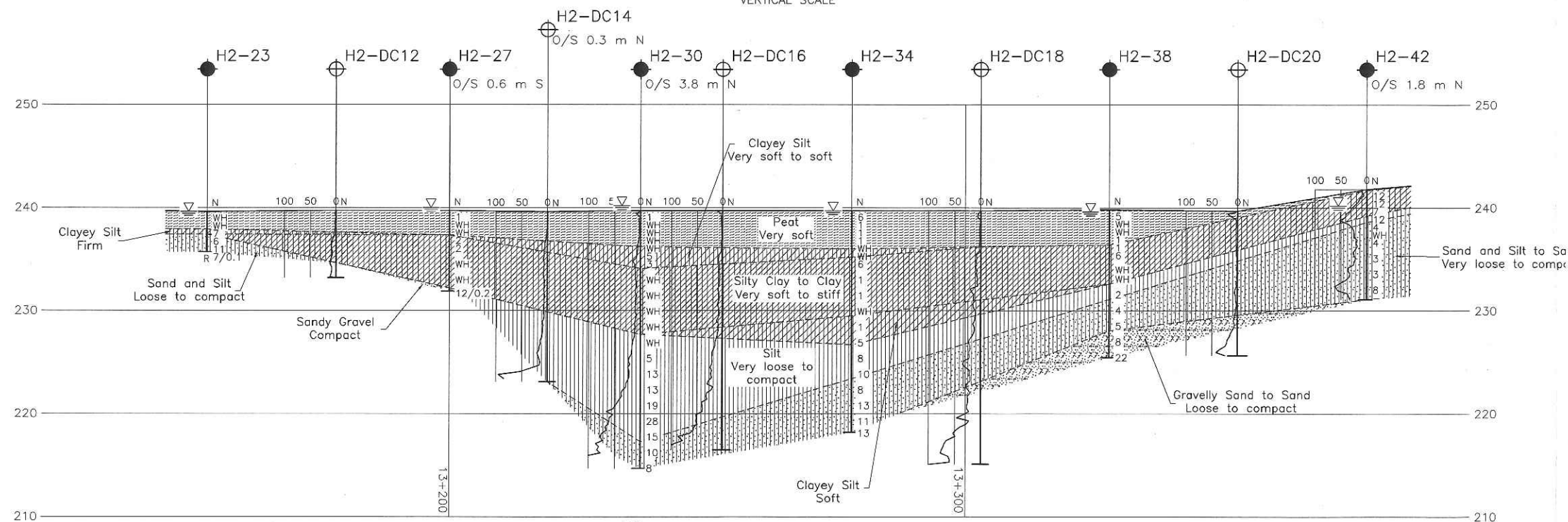
REFERENCE

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.



NORTH TOE PROFILE
HIGHWAY 17 (EBL)

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



SOUTH TOE PROFILE
HIGHWAY 17 (EBL)

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



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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
ST. POITIER RD. - STA 9+400 TO 9+600
SOIL STRATA

SHEET



Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA

LEGEND

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

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
H2-44	239.6	5136221.5	273947.3
H2-46	239.5	5136230.7	273970.8
H2-47	239.5	5136245.4	273978.6
H2-48	239.5	5136239.8	273994.0
H2-50	239.5	5136248.9	274017.3
H2-51	239.5	5136264.2	274024.9
H2-52	239.5	5136257.6	274040.9
H2-54	239.6	5136266.7	274064.2
H2-55	239.7	5136281.8	274071.6
H2-56	239.7	5136275.8	274087.5
H2-58	239.6	5136285.3	274110.8
H2-59	239.7	5136299.2	274118.9
H2-60	239.8	5136293.8	274132.6
H2-DC22	239.5	5136236.6	273955.0
H2-DC24	239.5	5136254.8	274001.6
H2-DC26	239.6	5136273.8	274048.0
H2-DC28	239.6	5136291.0	274094.8

NOTES

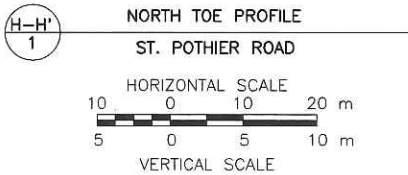
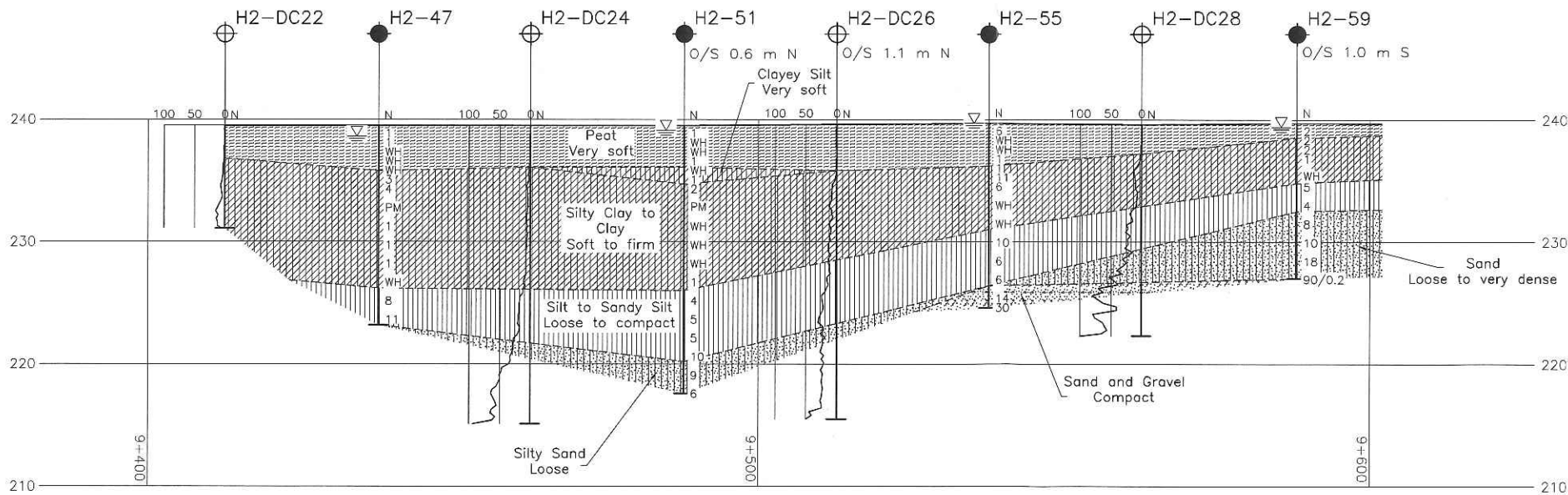
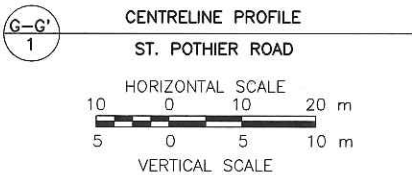
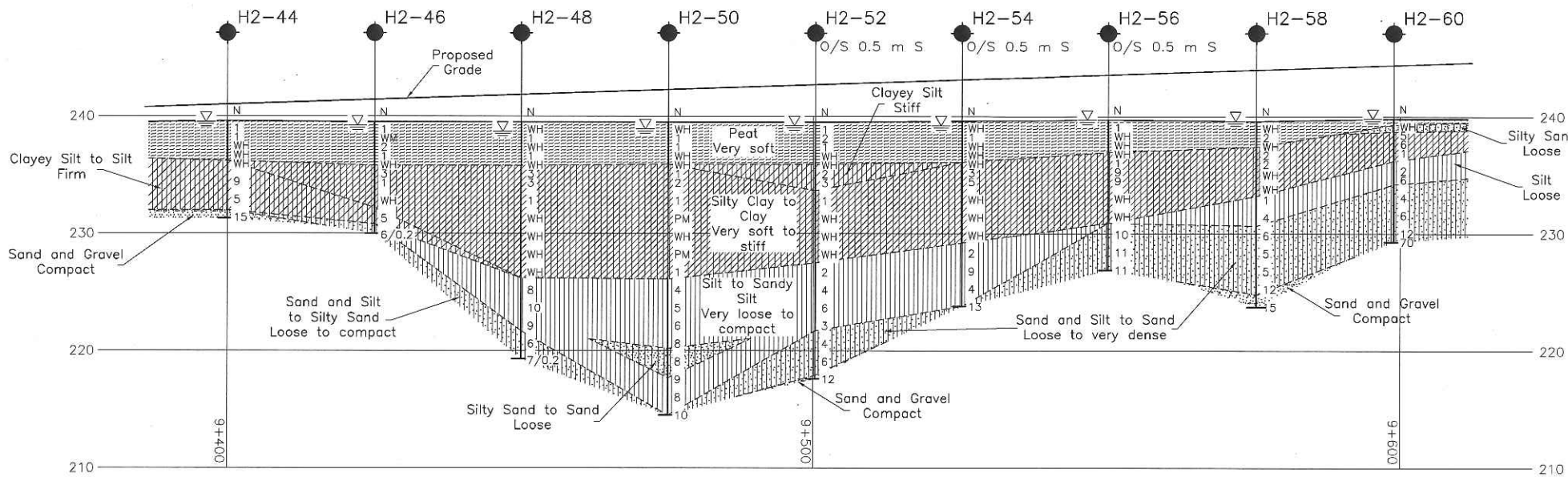
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REFERENCE

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NO.	DATE	BY	REVISION
1	APR 15, 2015	JMAC	ISSUED FOR CONSTRUCTION
2	APR 15, 2015	JMAC	REVISED
3	APR 15, 2015	JMAC	REVISED
4	APR 15, 2015	JMAC	REVISED
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100	APR 15, 2015	JMAC	REVISED

METRIC
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STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 156-98-00

HIGHWAY 17 4 LANING
ST. POTHIER RD. - STA 9+400 TO 9+600
SOIL STRATA



Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA

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
H2-45	239.5	5136216.0	273962.7
H2-49	239.6	5136234.2	274009.3
H2-53	239.5	5136251.8	274056.3
H2-57	239.6	5136269.9	274103.0
H2-DC23	238.9	5136224.7	273986.3
H2-DC25	239.8	5136243.6	274032.6
H2-DC27	239.6	5136261.1	274079.6
H2-DC29	239.6	5136278.6	274126.6

NOTES

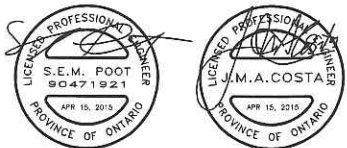
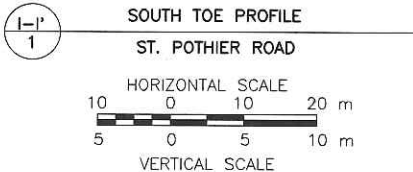
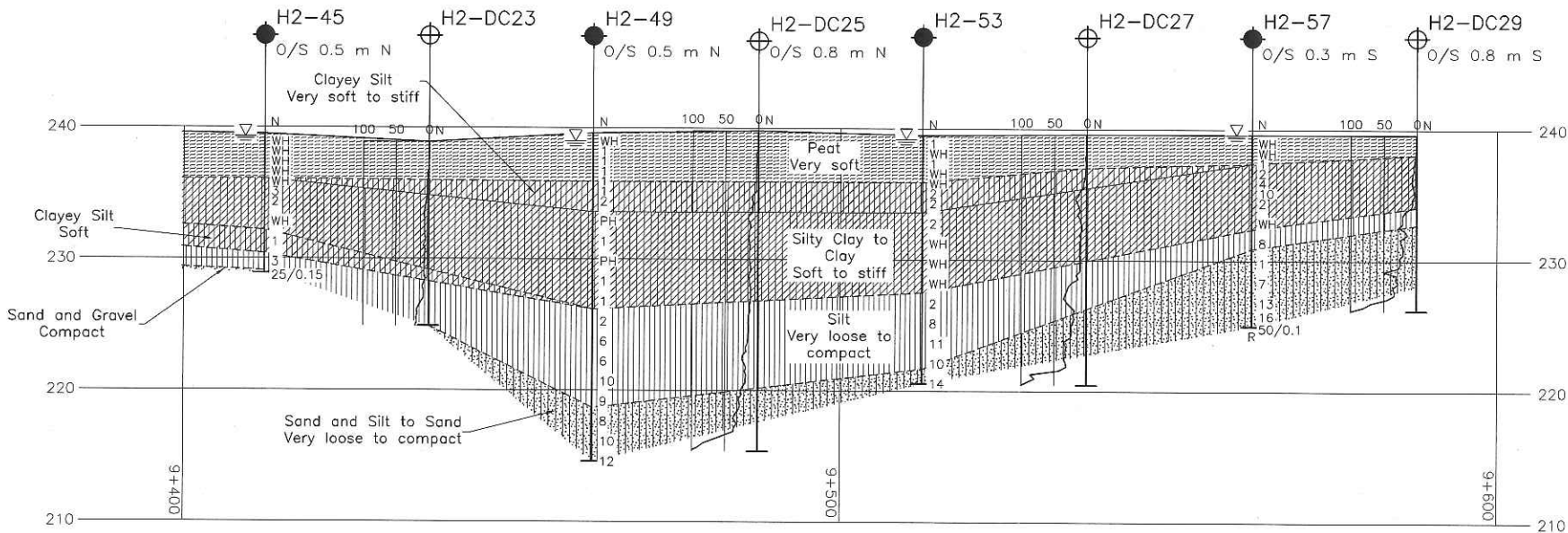
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REFERENCE

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NO.	DATE	BY	REVISION
HWY. 17			PROJECT NO. 11-1191-0007
SUBM'D. EC	CHKD.	DATE: APR 2015	SITE:
DRAWN: TB	CHKD. SEMP	APPD. JMAC	DWG. B6

