Peto MacCallum Ltd.
CONSULTING ENGINEERS

TEST PIT INVESTIGATION
SEVEN TOWNHOMES
760 MOSLEY STREET
WASAGA BEACH, ONTARIO
for
ADA HOMES LTD.

PETO MacCALLUM LTD.
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PML Ref.: 16BF078
Report: 1
December 2016

December 7, 2016

PML Ref.: 16BF078
Report: 1

Mr. Andrew Adamak
ADA Homes Ltd.
1 Channen Court
Barrie, Ontario
L4M 6T4

Dear Mr. Adamak

Test Pit Investigation
Seven Townhomes
760 Mosley Street
Wasaga Beach, Ontario

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation recently completed at the above noted project site. Authorization for the work was provided by Mr. A. Adamak, verbally, and by reception of a full retainer.

It is understood that the property at 760 Mosley Street is slated for a seven unit townhouse development. The building will be three stories slab-on-grade, without basement. PML was requested to attend the site to witness and log test pits to be excavated around the proposed building. It is understood that a furniture store previously occupied the now vacant site, which has since been demolished and removed.

The purpose of this investigation was to explore the subsurface soil and ground water conditions at the site, and based on the findings, provide comments and geotechnical recommendations for foundation design.

Geoenvironmental assessment of the site, observations, recording, testing or assessment of the environmental conditions of the site and ground water was not within the Terms of Reference and no work has been carried out in this regard. If excess materials requiring off-site disposal are generated during construction, a program of soil sampling and testing will be needed to determine the chemical properties of the material and evaluate options for off-site disposal.

The comments provided in this report are based on the site conditions at the time of the investigation, and are applicable only to the proposed works as described in the report. Any changes in plans, will require review by PML to assess the applicability of the report, and may require modified recommendations, additional analysis and/or investigation.

INVESTIGATION PROCEDURES

The field work for this investigation was carried out on December 2, 2016 and consisted of Test Pits 1 to 3 excavated to 1.7 to 2.1 m depth around the proposed townhome at the locations as shown on Drawing 1, attached.

Co-ordination of clearances of public and private underground utilities was provided by the Client.

The test pits were advanced using a rubber track miniature excavator, supplied and operated by a local excavating contractor working under the direction of the Client.

Ground water conditions in the test pits were closely monitored during the course of the field work.

The test pit locations were established in the field by PML, after consultation with the Client, and cognizant of existing underground utilities.

The surface elevation of the test pit was established based on a Temporary Bench Mark (BM) provided by the client, described as follows:

TBM: Temporary Bench Mark

Top of Top Nut of Fire Hydrant, at North Corner of Site

Elevation 100.00 (Metric, Assigned)

SUMMARIZED SUBSURFACE CONDITIONS

Reference is made to the appended Log of Test Pit sheets for details of the subsurface conditions, including soil classifications, and ground water observations.

A 100 to 200 mm layer of granular base was encountered at the surface of all three test pits.

Below the granular base, sand fill was observed to 0.7 to 1.3 m depth (elevation 97.7 to 98.35). Trace organics were noted in Test Pit 1; plastic pieces in Test Pit 2; and topsoil pockets, roots, concrete blocks, pipe pieces and bricks were observed in Test Pit 3.

Below the fill in all three test pits, a native sand deposit was encountered to the 1.7 to 2.1 m depth of excavation. The sand was judged to be compact and was observed to be moist.

Upon completion of excavation, no water or wet cave was observed in any of the test pits.

Ground water levels will fluctuate seasonally, and in response to variations in precipitation.

GEOTECHNICAL ENGINEERING CONSIDERATIONS

It is understood that the property at 760 Mosley Street is slated for a seven unit townhouse development. The building will be three stories slab-on-grade with no basement. The site is pictured below:

Photograph 1 **–** The site, view from the east corner, looking northwest. It is understood that a furniture store previously occupied the now vacant site, which has since been demolished and removed.

Photograph 2 - Test Pit 3 showing upper fill containing construction debris.

It is assumed that the finished floor slab-on-grade will be just above existing ground grade, with exterior footings at about 1.5 m depth, cognizant of the normal earth cover for frost protection, and interior footings at about 0.5 m depth.

Based on the test pits, there is existing fill to 0.7 to 1.3 m depth, with compact native sand below. The upper existing fill is not suitable for supporting footings or floor slab-on-grade.

It is necessary to remove all existing fill down to the native soil (encountered at 0.7 to 1.3 m depth in the test pits) and replace it with engineered fill, comprising select soil placed in maximum 300 mm thick lifts and compaction to 100% Standard Proctor maximum dry density.

It is cautioned that, due to the old furniture store that was demolished, the extent of fill and construction debris could be variable across the site.

The engineered fill pad must extend at least 1 m beyond the edge of the perimeter footings, then downward at no steeper than 1 Horizontal: 1 Vertical, to meet the underlying native soil.

Excavated site soil will be suitable for reuse on a select basis only, subject to moisture content control and exclusion of organics, construction debris and other deleterious materials.

Full time field review by geotechnical personnel will be needed to approve subgrade preparation, backfill materials, placement procedures and ensure the specified compaction is achieved throughout.

Reference is made in Appendix A for General Guidelines for Engineered Fill Construciton.

Provided the site is improved with engineered fill as discussed above, then the building can be supported on standard spread and strip footings at normal design depth, founded on engineered fill or native soil, whichever is first encountered. A geotechnical bearing resistance at SLS of 150 kPa and factored geotechnical resistance at ULS of 225 kPa are available for design.

The geotechnical bearing resistance at SLS is based on 25 mm of settlement in the bearing stratum. Differential settlement should not exceed 75% of this value.

Footings subject to frost action should be provided with 1.2 m of earth cover or equivalent.

Prior to placement of concrete for footings, the subgrade surface must be examined by PML to check the design bearing capacity is available and/or assess areas where a reducing bearing capacity may be necessitated.

Floor slab-on-grade can be constructed on the engineered fill. A minimum of 150 mm of clear stone (19 mm nominal size) or Granular A compacted to 100% Standard Proctor maximum dry density is recommended as a moisture barrier under the concrete floor slab. The floor slab should be at least 150 mm above the outside ground grade, which should be sloped to promote surface drainage away from the building.

The site soils should be considered as Type 3 soil requiring excavation sidewalls to be constructed at no steeper than one horizontal to one vertical (1H:1V) from the base of the excavation in accordance with the Occupational Health and Safety Act.

Ground water was not encountered during excavation of the test pits. Accordingly, conventional sump pumping techniques should be adequate to handle any nuisance ground water seepage quantities, if encountered.

The comments and recommendations provided in the report are based on the information revealed in the test pits. Conditions away from the test pits may vary, particularly where service trenches exist. Geotechnical review during construction should be on going to confirm the subsurface conditions are substantially similar to those encountered in the test pit, which may otherwise require modification to the original recommendations.

CLOSURE

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to call our office.

Sincerely

Peto MacCallum Ltd.

LICENSED PROFESSIONAL ENGINEER
R. R. BLAIR
100222748
Dec. 7, 2016
PROVINCE OF ONTARIO

Richard Blair, P.Eng.
Project Engineer

LICENSED PROFESSIONAL ENGINEER
T. LEE-BUN
26277509
Dec 7/16
PROVINCE OF ONTARIO

Turney Lee-Bun, P.Eng.
Vice-President

RB/TLB:tc

Enclosures:
List of Abbreviations
Log of Test Pit Nos. 1 to 3
Drawing 1 - Test Pit Location Plan
Appendix A – Guidelines for Engineered Fill

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

CONSISTENCY	N (blows/0.3 m)	c (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		

WTPL	Wetter Than Plastic Limit
APL	About Plastic Limit
DTPL	Drier Than Plastic Limit

TYPE OF SAMPLE

SS	Split Spoon	ST	Slotted Tube Sample
WS	Washed Sample	TW	Thinwall Open
SB	Scraper Bucket Sample	TP	Thinwall Piston
AS	Auger Sample	OS	Oesterberg Sample
CS	Chunk Sample	FS	Foil Sample
GS	Grab Sample	RC	Rock Core

PH	Sample Advanced Hydraulically
PM	Sample Advanced Manually

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF TEST PIT NO. 1

PROJECT Test Pit Investigation - Seven Townhomes
LOCATION 760 Mosley Street, Wasaga Beach, Ontario
EXCAVATION METHOD Excavator
BORING DATE December 2, 2016
PML REF. 16BF078
ENGINEER TLB
TECHNICIAN RB

DEPTH / ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa)	WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	SURFACE ELEVATION 99.10									
	SURFACE GRANULAR: 100 mm granular base, moist									
99.00	FILL: Brown, sand, some silt, trace gravel, trace organics, moist					99				
0.80 / 98.30	SAND: Compact, light brown, sand, trace silt, stratified, moist					98				
2.1 / 97.0	TEST PIT TERMINATED AT 2.1 m					97				Upon completion of excavating No seepage No sidewall sloughing

Legend: SHEAR STRENGTH (kPa): + FIELD VANE, △ TORVANE, ○ Qu, ▲ POCKET PENETROMETER, ○ Q (50, 100, 150, 200); DYNAMIC CONE PENETRATION ×, STANDARD PENETRATION TEST ● (20, 40, 60, 80); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30, 40)

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF TEST PIT NO. 2

PROJECT Test Pit Investigation - Seven Townhomes
LOCATION 760 Mosley Street, Wasaga Beach, Ontario
EXCAVATION METHOD Excavator
BORING DATE December 2, 2016
PML REF. 16BF078
ENGINEER TLB
TECHNICIAN RB

DEPTH / ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / PENETRATION	WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	SURFACE ELEVATION 99.05									
0.15	SURFACE GRANULAR: 150 mm granular base, moist					99				
98.90	FILL: Brown, sand, some silt, trace gravel, plastic pieces, moist									
0.70 / 98.35	SAND: Compact, light brown, sand, trace silt, stratified, moist					98				
1.7 / 97.4	TEST PIT TERMINATED AT 2.1 m									Upon completion of excavating No seepage No sidwall sloughing

Legend: SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q (50, 100, 150, 200); DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● (20, 40, 60, 80); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30, 40)

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF TEST PIT NO. 3

PROJECT Test Pit Investigation - Seven Townhomes
LOCATION 760 Mosley Street, Wasaga Beach, Ontario
EXCAVATION METHOD Excavator
BORING DATE December 2, 2016
PML REF. 16BF078
ENGINEER TLB
TECHNICIAN RB

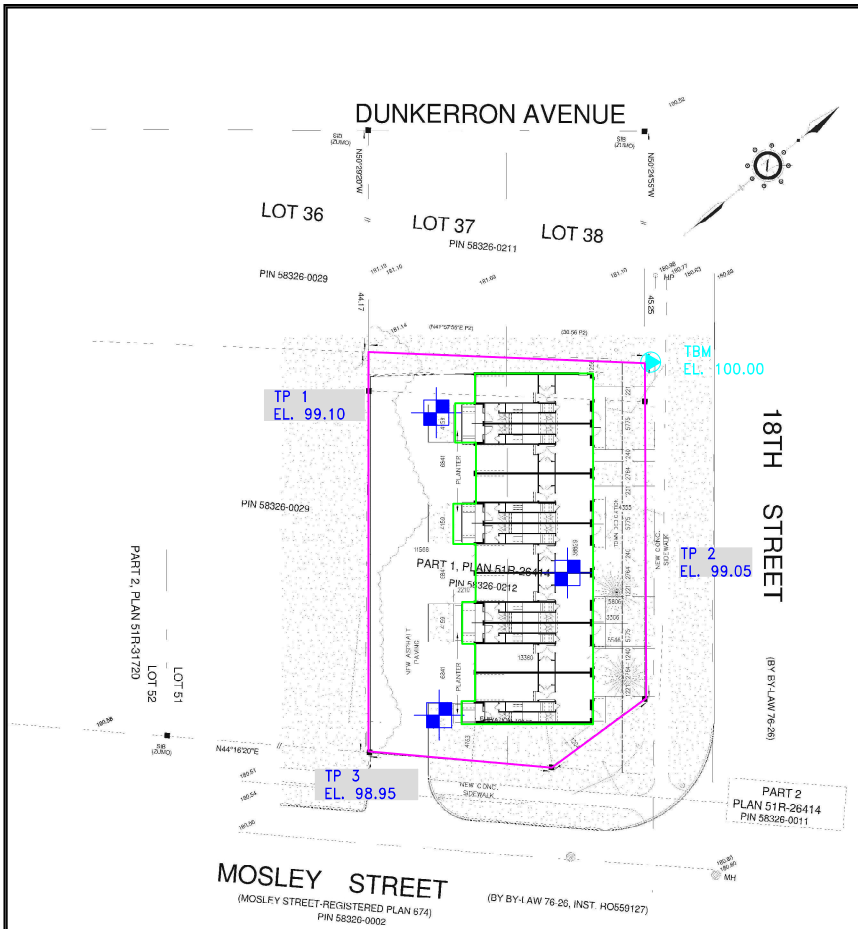
DEPTH / ELEV (metres)	SOIL PROFILE: DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT; WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS; GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	SURFACE ELEVATION 98.95									
	SURFACE GRANULAR: 200 mm granular base, moist									
0.20 / 98.75	FILL: Brown, sand, some silt, trace gravel, topsoil pockets, roots, concrete blocks, pipe pieces, bricks, moist					98				
1.3 / 97.7	SAND: Compact, light brown, sand, trace silt, stratified, moist									
1.7 / 97.3	TEST PIT TERMINATED AT 2.1 m									Upon completion of excavating No seepage No sidewall sloughing

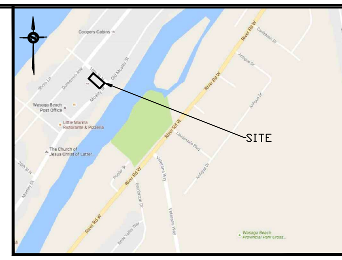
Shear strength legend: + FIELD VANE, △ TORVANE, ○ Qu, ▲ POCKET PENETROMETER, ○ Q; scale 50 100 150 200. Dynamic cone penetration ×; Standard penetration test ●; scale 20 40 60 80. Water content scale 10 20 30 40; w_P, w, w_L.

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0

NOTES

[illegible]





KEY PLAN
WASAGA BEACH, ONTARIO

LEGEND:

- PROPOSED SITE LIMITS
- PROPOSED BUILDING
- TP 1 EL. 99.10 — TEST PIT 1 SURFACE ELEVATION
- TBM EL. 100.00 — TEMPORARY BENCH MARK TOP OF TOP NUT OF FIRE HYDRANT, AT NORTH CORNER OF SITE ELEVATION 100.00 (METRIC, ASSIGNED)

REFERENCE:
BASE PLAN PROVIDED BY CLIENT.

0m 20 40 60 80 100
SCALE

TEST PIT LOCATION PLAN

TEST PIT INVESTIGATION – SEVEN TOWNHOMES
760 MOSLEY STREET
WASAGA BEACH, ONTARIO

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

		DATE	SCALE	PML REF.	DRAWING NO.
DRAWN	RB	DEC. 2016	AS SHOWN	16BF078	1
CHECKED	TLB				
APPROVED	TLB				

APPENDIX A

Guidelines for Engineered Fill

The information presented in this appendix is intended for general guidance only. Site specific conditions and prevailing weather may require modification of compaction standards, backfill type or procedures. Each site must be discussed, and procedures agreed with Peto MacCallum Ltd. prior to the start of the earthworks and must be subject to ongoing review during construction. This appendix is not intended to apply to embankments. Steeply sloping ravine residential lots require special consideration.

For fill to be classified as engineered fill suitable for supporting structural loads, a number of conditions must be satisfied, including but not necessarily limited to the following:

1. Purpose

The site specific purpose of the engineered fill must be recognized. In advance of construction, all parties should discuss the project and its requirements and agree on an appropriate set of standards and procedures.

2. Minimum Extent

The engineered fill envelope must extend beyond the footprint of the structure to be supported. The minimum extent of the envelope should be defined from a geotechnical perspective by:

- at founding level, extend a minimum 1.0 m beyond the outer edge of the foundations, greater if adequate layout has not yet been completed as noted below; and

- extend downward and outward at a slope no greater than 45° to meet the subgrade

All fill within the envelope established above must meet the requirements of engineered fill in order to support the structure safely. Other considerations such as survey control, or construction methods may require an envelope that is larger, as noted in the following sections.

Once the minimum envelope has been established, structures must not be moved or extended without consultation with Peto MacCallum Ltd. Similarly, Peto MacCallum Ltd. should be consulted prior to any excavation within the minimum envelope.

3. Survey Control

Accurate survey control is essential to the success of an engineered fill project. The boundaries of the engineered fill must be laid out by a surveyor in consultation with engineering staff from Peto MacCallum Ltd. Careful consideration of the maximum building envelope is required.

During construction it is necessary to have a qualified surveyor provide total station control on the three dimensional extent of filling.

4. Subsurface Preparation

Prior to placement of fill, the subgrade must be prepared to the satisfaction of Peto MacCallum Ltd. All deleterious material must be removed and in some cases, excavation of native mineral soils may be required.

Particular attention must be paid to wet subgrades and possible additional measures required to achieve sufficient compaction. Where fill is placed against a slope, benching may be necessary and natural drainage paths must not be blocked.

5. Suitable Fill Materials

All material to be used as fill must be approved by Peto MacCallum Ltd. Such approval will be influenced by many factors and must be site and project specific. External fill sources must be sampled, tested and approved prior to material being hauled to site.

6. Test Section

In advance of the start of construction of the engineered fill pad, the Contractor should conduct a test section. The compaction criterion will be assessed in consultation with Peto MacCallum Ltd. for the various fill material types using different lift thicknesses and number of passes for the compaction equipment proposed by the Contractor.

Additional test sections may be required throughout the course of the project to reflect changes in fill sources, natural moisture content of the material and weather conditions.

The Contractor should be particularly aware of changes in the moisture content of fill material. Site review by Peto MacCallum Ltd. is required to ensure the desired lift thickness is maintained and that each lift is systematically compacted, tested and approved before a subsequent lift is commenced.

7. Inspection and Testing

Uniform, thorough compaction is crucial to the performance of the engineered fill and the supported structure. Hence, all subgrade preparation, filling and compacting must be carried out under the full time inspection by Peto MacCallum Ltd.

All founding surfaces for all buildings and residential dwellings or any part thereof (including but not limited to footings and floor slabs) on structural fill or native soils must be inspected and approved by PML engineering personnel prior to placement of the base/subbase granular material and/or concrete. The purpose of the inspection is to ensure the subgrade soils are capable of supporting the building/house foundation and floor slab loads and to confirm the building/house envelope does not extend beyond the limits of any structural fill pads.

8. Protection of Fill

Fill is generally more susceptible to the effects of weather than natural soil. Fill placed and approved to the level at which structural support is required must be protected from excessive wetting, drying, erosion or freezing. Where adequate protection has not been provided, it may be necessary to provide deeper footings or to strip and recompact some of the fill.

9. Construction Delay Time Considerations

The integrity of the fill pad can deteriorate due to the harsh effects of our Canadian weather. Hence, particular care must be taken if the fill pad is constructed over a long time period.

It is necessary therefore, that all fill sources are tested to ensure the material compactability prior to the soil arriving at site. When there has been a lengthy delay between construction periods of the fill pad, it is necessary to conduct subgrade proof rolling, test pits or boreholes to verify the adequacy of the exposed subgrade to accept new fill material.

When the fill pad will be constructed over a lengthy period of time, a field survey should be completed at the end of each construction season to verify the areal extent and the level at which the compacted fill has been brought up to, tested and approved.

In the following spring, subexcavation may be necessary if the fill pad has been softened attributable to ponded surface water or freeze/thaw cycles.

A new survey is required at the beginning of the next construction season to verify that random dumping and/or spreading of fill has not been carried out at the site.

10. Approved Fill Pad Surveillance

It should be appreciated that once the fill pad has been brought to final grade and documented by field survey, there must be ongoing surveillance to ensure that the integrity of the fill pad is not threatened.

Grading operations adjacent to fill pads can often take place several months or years after completion of the fill pad.

It is imperative that all site management and supervision staff, the staff of Contractors and earthwork operators be fully aware of the boundaries of all approved engineered fill pads.

Excavation into an approved engineered fill pad should never be contemplated without the full knowledge, approval and documentation by the geotechnical consultant.

If the fill pad is knowingly built several years in advance of ultimate construction, the areal limits of the fill pad should be substantially overbuilt laterally to allow for changes in possible structure location and elevation and other earthwork operations and competing interests on the site. The overbuilt distance required is project and/or site specified.

Iron bars should be placed at the corner/intermediate points of the fill pad as a permanent record of the approved limits of the work for record keeping purposes.

11. Unusual Working Conditions

Construction of fill pads may at times take place at night and/or during periods of freezing weather conditions because of the requirements of the project schedule. It should be appreciated therefore, that both situations present more difficult working conditions. The Owner, Contractor, Design Consultant and Geotechnical Engineer must be willing to work together to revise site construction procedures, enhance field testing and surveillance, and incorporate design modifications as necessary to suit site conditions.

When working at night there must be sufficient artificial light to properly illuminate the fill pad and borrow areas.

Placement of material to form an engineered fill pad during winter and freezing temperatures has its own special conditions that must be addressed. It is imperative that each day prior to placement of new fill, the exposed subgrade must be inspected and any overnight snow or frozen material removed. Particular attention should be given to the borrow source inspection to ensure only nonfrozen fill is brought to the site.

The Contractor must continually assess the work program and have the necessary spreading and compacting equipment to ensure that densification of the fill material takes place in a minimum amount of time. Changes may be required to the spreading methods, lift thickness, and compaction techniques to ensure the desired compaction is achieved uniformly throughout each fill lift.

The Contractor should adequately protect the subgrade at the end of each shift to minimize frost penetration overnight. Since water cannot be added to the fill material to facilitate compaction, it is imperative that densification of the fill be achieved by additional compaction effort and an appropriate reduced lift thickness. Once the fill pad has been completed, it must be properly protected from freezing temperatures and ponding of water during the spring thaw period.

If the pad is unusually thick or if the fill thickness varies dramatically across the width or length of the fill pad, Peto MacCallum Ltd. should be consulted for additional recommendations. In this case, alternative special provisions may be recommended, such as providing a surcharge preload for a limited time or increase the degree of compaction of the fill.