



THURBER ENGINEERING LTD.



August 28, 2017

File: 20454

Lac Ste. Anne County
Box 219, 4928 Langston Street
Sangudo, AB T0E 2A0

Attention: Mr. Mike Primeau, CLGM
County Manager

**LAC ST ANNE COUNTY ADMINISTRATION BUILDING
SLAB HEAVING CONCERNS**

Dear Sir,

Further to our meeting at the Lac Ste. Anne County Administration Building on August 22, 2017, this letter presents a summary of our initial observations and recommendations for future work related to the floor slab heaving issues at the above noted site.

It is a condition of this letter that Thurber's performance of its professional services will be subject to the attached Statement of Limitations and Conditions.

1. BACKGROUND

It is understood that the Administration Building was built during 2016-17 and was recently opened during early summer 2017.

The building is founded on screw piles and concrete grade beams and has a concrete floor slab on grade that supports numerous interior non-load bearing partition walls. We have not reviewed the structural drawings to date.

The building is situated over thick deposits of high plastic clay. Thick topsoil deposits were excavated from under the building and high plastic clay fill obtained locally was used to backfill under the building to floor slab elevation.

Slab heaving and drywall cracking has been noticed throughout the building which is symptomatic of the results of swelling of the high plastic clay.

2. REPORTS REVIEWED

We have obtained and reviewed the following information to date as provided by the Lac Ste Anne County (LSA):

1. Geotechnical Investigation Report, prepared by P. Machibroda Engineering Ltd. for LSA dated December 17, 2014
2. Numerous Field Density test reports on clay fill below building floor slab taken between April and June 2016

3. Numerous Field Density test reports on final gravel below building taken between July and November 2016
4. Project Progress Report Meeting prepared by Colliers dated March 22, 2016
5. Structural Contemplated Change Notice ST1 prepared by Arrow dated May 3, 2016
6. Site Review Visit Report by A&E dated May 8, 2017
7. Letter from Casman Building Solutions to LSA dated May 15, 2017
8. Letter from P. Machibroda Engineering Ltd. to LSA dated May 16, 2017
9. Memorandum from Colliers to LSA dated August 14, 2017.

3. OBSERVATIONS

Following are the main observations based on the recent site visit by Mr. Robin Tweedie, P. Eng of Thurber on August 23, 2017 and our review of the above noted documents:

- The building is underlain by thick high plastic clay deposits that are prone to swelling when they gain access to water.
- The fill that was placed under the building in 2016 also consisted of high plastic clay. The field density tests indicate that the majority of the clay fill was placed at moisture contents below the Optimum Moisture Content, which makes the clay more prone to swelling.
- Interim site grading during construction was understood to be poor, resulting in ponding of water at some locations around the building.
- Subdrains were not installed initially around the exterior of the building. They have since been retrofitted by LSA.
- Interior subdrains were placed around the grade beams inside the two courtyard areas; however, the subdrains were placed at relatively shallow depth and are above the bottom of the grade beams.
- The May 8th Site Review Visit Report by the design architect/engineer (A&E) dated May 8, 2017 referred to various amounts of slab-on-grade heave and drywall cracking throughout the building. The report also noted deficiencies with the exterior drainage including finished grades that did not slope consistently at 2 percent away from the building, some areas of negative slope, flat areas, dips in backfill, and splash pads from roof drains that were pointing towards the building.
- Several test pits that were dug against the grade beams in the courtyard areas to expose the subdrain pipes in 2017 produced water, and water was noted flowing below the grade beams emanating from the gravel base layer inside the building, indicating that the gravel base layer below the interior slab on grade is saturated in some areas;

- The floor slab heave and drywall cracking was also observed during our site visit of August 22, 2017. Poor site grading was also noted on the north side of the building just outside the main entrance.

4. COMMENTS AND RECOMMENDATIONS

The observations indicate that the slab movement and drywall cracking are caused by swelling of the high plastic clay and high plastic clay fill that underlies the building slab. Swelling occurs when the clay is dry of its equilibrium condition and has access to free water. It is believed that the swelling has been exacerbated by poor surface drainage during the building construction that has resulted in ponding of water within the gravel base layer (i.e. saturated conditions) over the top of the clay. This water provides a source for ongoing swelling of the clay and hence drainage of any trapped water below the floor slab and improvement of the surface drainage should be top priorities to improve the current conditions.

The following items should be addressed as soon as practical;

1. Re-grade the landscape around the building with generous slopes away from the building. The grades are noted to be poor on the north side of the building due to the elevation of the adjacent concrete sidewalk, and it would be beneficial to provide a drainage swale in the grassed boulevard to provide better drainage away from the north building wall.
2. Improve the surface and subsurface drainage in the two courtyard areas inside the building, including providing a more robust subdrainage system placed below the base of the grade beams, to lower the water table and potentially drain excess water that may be currently trapped in the gravel base layer under the slabs on grade inside the buildings. The subdrains will need to be tied into a sump and removed by gravity or pumping as necessary to the drainage ditch south of the building.
3. Redirect all roof drains so that the discharge is far enough from the building exterior to prevent back flow to the building which would impact the moisture content near the building footprint.
4. Provide permanent roof drain collection system in the two courtyard areas to collect and drain all roof water and prevent ponding of water in the courtyard areas.
5. Consider removing any door aprons and rebuild them as a structural slab to prevent heave and buckling of the exterior cladding that currently rests on the slabs at some locations.
6. Additional investigation including drilling core holes at strategic locations inside the building would be beneficial to document the existing groundwater conditions and check the effectiveness of the above noted surface and subsurface drainage measures. We will be pleased to provide further information and inspect these investigations on your behalf.
7. Retro-fitting of subdrains inside the building to improve subsurface drainage is expected to be very disruptive and expensive and hence is likely not a practical approach; however, installation of sumps in strategic locations could be considered to supplement the



subdrains where high water conditions are noted. The need for these should however be determined based on further investigation (per (6) above).

8. Leakage of underground pipes and utilities would be detrimental to future floor slab performance and any measure to identify and deal with potential leaks would also be a prudent measure.
9. It should be noted that the swelling is a long-term process and further swelling can occur which will result in further damage to the building. Implementing the above measures should reduce but not necessarily eliminate the ongoing swelling.

We trust this satisfies your present requirements. We will be pleased to provide further recommendations as necessary including any on-site inspections to document subsurface conditions. Please contact us if you require further information.

Yours very truly,
Thurber Engineering Ltd.
Renato Clementino, Ph. D, P, Eng.
Review Principal

A handwritten signature in cursive script that reads 'Robin Tweedie'.

Robin Tweedie, P.Eng.
Review Principal
/s/

Attachments

- Statement of Limitations and Conditions
- Site plan



STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

LEGEND

GENERAL NOTES

LAC STE ANNE COUNTY

**NEW ADMINISTRATION BLDG.
LAC STE ANNE COUNTY, AB**

MAIN FLOOR PLAN

DATE: 10/15/11
 DRAWN BY: [Name]
 CHECKED BY: [Name]
 PROJECT NO.: [Number]
 SHEET NO.: [Number] OF [Total]
 SCALE: [Scale]

