

PW Report No. 09-2021

# COMMUNITY SERVICES COMMITTEE July 12<sup>th</sup>, 2021

#### PIPER STREET SLOPE STABILITY ANAYLSIS

#### RECOMMENDATION

The Director of Public Works recommends:

- 1. THAT PW Report No. 09-2021 be received;
- 2. AND THAT Staff be directed to proceed with the Geotechnical Investigation of Piper Street as outlined in the proposal from SAFFA Engineering dated June 8, 2021;
- 3. AND THAT the Treasurer be authorized to fund Phase 1 and 2 of the workplan from the Infrastructure Reserve Account in the amount of \$ 44,110 (plus HST) and that the work be completed in the immediate time period;

# 4. AND that Phase 3 of the workplan be included as part of the 2022 Capital Budget.

#### 1. PURPOSE

The purpose of the Report is to seek Council direction in regard to the slope erosion on Piper Street adjacent to the Nith River.

#### 2. BACKGROUND

Piper Street in the vicinity of the Nith River has been subject to erosion for many years. There have been antidotal reports that Township staff have historically placed material over the bank to deter the erosion. In some locations, the bank deterioration and erosion is in the boulevard and the vicinity of the travelled portion of the right of way.

The area of focus in this Report conceptually extends on the Nith River side of the Piper Street road allowance between 230 Piper Street and 326 Piper Street as illustrated on Attachment No. 1 to this Report.

As erosion will continue to occur, it is important to determine the rate of erosion and to establish a monitoring program for the erosion. This program will allow the Township to

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plan for remedial work and provide sufficient time to obtain any approvals that may be necessary to mitigate against this risk.

The currently installed guard rails require maintenance and Staff wish to extend the limits of the guard rails. Due to the erosion there are concerns that this maintenance and construction activities may have an adverse impact to the slope stability. Staff require geotechnical information in order to ensure the activities are undertaken in a manner that minimizes the impact to the slope.

#### 3. OPTIONS AND ANALYSIS

The slope adjacent to the Piper Street right of way is naturally subject to erosion. The combination of native material and the flow of the Nith River will continue to cause erosion in the area.

The guard rail system is in need of maintenance and extension. Due to the erosion, it is important to determine the correct methodology to ensure the activities do not cause premature slope failure.

The Piper Street right of way is an integral part of the Township's linear asset network and should be preserved. It is important to develop the appropriate measures to ensure the protection of this corridor. In order to do so, it is important that we characterize the slope and ensure we have provided for any remedial work as part of the Capital Forecast. The information that will be obtained from the Phase 2 and 3 works will be integral to the formulation of the capital plan.

In order to obtain the information needed, Staff have requested a proposal from our Geotechnical consultant. The proposal can be found in Attachment 2.

The proposal has been broken down into 3 phases. Phase 1 consists of the field work and reporting necessary to facilitate the installation and maintenance of guard rails. Phase 2 consists of the topographical survey and field visit to characterize the slope. Phase 3 consists of the field work and reporting necessary to monitor the slope for a one year duration.

The completion of Phase 1 will allow staff to proceed with the maintenance of the existing guard rails and installation of additional guard rails. The cost to complete Phase 1 is \$24,310 plus HST. Staff are recommending that Phase 1 be completed immediately. Upon completion of Phase 1, Staff will be able to undertake the required work.

The completion of Phase 2 will provide the characterization of the slope, provide detailed record of existing conditions and provide for the background to develop the model of the slope. The cost for Phase 2 is \$19,800.00 plus HST. Staff are recommending that Phase

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2 also be completed in 2021 as it is important to obtain an accurate record of existing conditions.

The completion of Phase 3 is a year long monitoring program that will consist of the installation of monitoring equipment and a monitoring program. The cost for Phase 3 is \$63,980.00 plus HST. Staff are recommending that Phase 3 be authorized to proceed while acknowledging that the cost would be recognized and included in the 2022 Capital Budget.

#### 4. FINANCIAL IMPLICATIONS

The work program to retain an outside Consultant as outlined in this Report was not included in the 2021 Budget.

Staff are seeking authorization to expend a total of \$44,110 (plus HST) to undertake the initial stages of the slope stability analysis as outlined in Phase 1 and 2 of the workplan. It is recommended by Staff that funding to complete Phase 1 and 2 would be drawn from the Infrastructure Reserve Account.

Phase 3, at a projected cost of \$63,980 (plus HST), would be included in the 2022 Capital Budget.

#### 5. ATTACHMENTS

- 1. Location Map Extent of Geotechnical Investigation Analysis Along Piper Street
- 2. Geotechnical Investigation Proposal

For further information on the contents of this Report, please contact Lee Robinson, Director of Public Works, via email at <u>lrobinson@northdumfries.ca</u>.

Report Prepared By:

Lée Robinson, P.Eng. Director of Public Works

Reviewed By:

Andrew McNeely, Chief Administrative Officer





## **ATTACHMENT 2**



June 08, 2021

Geotechnical Investigation of Piper Street

The Corporation of the Township of North Dumfries North Dumfries Community Complex 2958 Greenfield Road P.O. Box 1060 Ayr, Ontario N0B 1E0

#### Re: Geotechnical Investigation of Piper Street

Attention: Lee Robinson Director of Public Works

#### INTRODUCTION

SAFFA Engineering Inc (SAFFA) is very pleased to submit this proposal to the Township of North Dumfries (the Town) for the Slope Investigation of Piper Street located in the Community of Ayr. The section of Piper Street under this investigation is between Rose St and Gladstone Rd. The slope along this section of Piper Street is very steep and occupied by dense vegetation.

SAFFA understands that the Town is looking into the options for installation of guard rail on southern side of Piper Street. This would provide protection to the commuting traffic and the public at large. In this regard, SAFFA has been asked to provide complete workplan required to ensure that the installation of guard rail is safe and would not pose any instability to the existing slope.

Furthermore, the Town has observed erosion at the bend on Piper Street near the toe end of the slope close to the Nith River. As per the information made available to SAFFA from the Town, this erosion is an ongoing phenomenon and has been occurring for several years. The town has asked SAFFA to conduct slope stability investigation for the area to assess the existing slope stability and to provide the ongoing monitoring plan with clearly defined trigger points.

#### SCOPE OF WORK

It is our understanding that both activities are interconnected being the former study more comprehensive as it would provide more insight into existing stability of the slope,





therefore, SAFFA has proposed the following scope of field investigations that consists of Phase I and Phase II. Upon completion of the Phase I scope of work, SAFFA can start working on the report preparation for installation of the guard rail and upon completion of the Phase II scope of work, a slope stability analysis can be carried out to assess and analyse the existing slope and a report will be prepared.

SAFFA also suggests a long-term monitoring plan (Phase III) of the slope using instrumentations to be installed on crest of the slope.

The field scope of work are as follows,

#### Phase I

- Drilling and sampling of five (5) boreholes at Piper Street on southern shoulder to investigate subsurface soil conditions and measure groundwater levels. The borehole will be drilled up to 15 m below grade.
- 2. If possible, drilling of five (5) shallow boreholes with hand augur and sampling at the toe end of the slope to investigate soil conditions near the eroded portion of the slope.
- 3. Installation of three (3) vibrating wire piezometers (VWP) to measure long-term stabilized groundwater level in the borehole drilled at the crest of the slope (Piper Street shoulder).

#### Phase II

- 1. Carryout topographic survey of the proposed area to establish slope gradients and use this information in the analysis.
- 2. Stabilized groundwater measurement in VWP, to be used in slope stability model.
- 3. To carry out a site visit by geotechnical expert to observe salient slope feature to be identified in the report.

#### Phase III

1. Installation of slope inclinometers in the boreholes drilled at the crest of the slope.





- 2. Horizontal control for installed inclinometers and measurement of base readings.
- 3. Inclinometer measurements, will be carried out at a frequent time interval to categorize slope movement. The monitoring plan can be continued until it is assured that the slope is inactive and no further movements in the slope are expected. For this quote, the following scheme of measurements is considered.
  - a. Six (6) once a week reading including horizontal control;
  - b. Six (6) once bi-weekly readings including horizontal control; and
  - c. Nine (9) once monthly readings including horizontal control.
- 4. Each measurement will include travel to/from the site, inclinometer reading, horizontal control reading using survey crew, and a factual data report. The data report will be submitted a week after the field measurement. However, the information will be conveyed verbally within a 24-hour period or right away if needed and/or movement in the slope is expected to reach the alert limit.

Since instrumentation to be installed at top of the slope near road shoulder, the inclinometer will monitor the deep-seated slope failure only. No localized slope failures are expected to occur near top of the slope; therefore, inclinometer may not detect localized deflection along the slope. The localized failures do not occur in isolation but are somewhat related to overall geometry of the slope, therefore, occurrence of localized failure should not be ignored, rather should be considered as initial triggering point.

#### **FIELD WORK**

Prior to drilling, SAFFA will make arrangements with Ontario-One-Call to mark any underground services owned by Crown corporations so that they can be avoided during borehole drilling. A pre-job safety meeting will also be conducted by SAFFA with site personnel to outline the scope of work, chemical and physical hazards, required personal protective equipment and drill rig safety.

Sampling will consist of a combination of SPT and disturbed auger samples with pocket penetrometer tests completed on all cohesive soils encountered. Groundwater,





sloughing and seepage conditions will be documented. Soil samples will be classified according to the Modified Unified Soil Classification system.

All drilling will be supervised by experienced field personnel who will record the subsurface conditions and collect soil samples that will be placed in sealed plastic bags for transport to SAFFA laboratory in Markham, ON. All boreholes other than the inclinometer boreholes will be backfilled upon completion with drill cuttings, and seal with bentonite chips.

A laboratory testing program will be undertaken after the completion of the field work and will include moisture content testing and supplementary visual classifications for all soil samples. SAFFA will select the appropriate no of samples to determine soil classification and its properties. The lab tests will include moisture content tests, Atterberg limit test and hydrometer/gradation.

#### DELIVERABLES

Upon completion of the geotechnical field work and laboratory testing program, a report will be submitted at the end of Phase I field work. The Phase I report will consist of the following sections:

- Site description;
- Borehole location plan;
- Methods and procedures;
- Laboratory tests;
- Borehole logs (gINT);
- Restoration and reconstruction of boreholes;
- Subsurface soil information
- Description of conditions of soils, groundwater (Ground water table), bedrock (if any), etc.
- Methodology for the installation of guard rail and comparison of various guard rail options and feasibility of the best option.

A report for slope stability investigation will be completed at the end of completion of Phase I and Phase II field work. This report will include the following sections.



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- Site description;
- Borehole location plan;
- Methods and procedures;
- Laboratory tests;
- Borehole logs (gINT);
- Restoration and reconstruction of boreholes;
- Subsurface soil information
- Description of conditions of soils, groundwater (Ground water table), bedrock (if any), etc.
- Long-term monitoring of groundwater level measured from VWP.
- Methodology for installation of inclinometers and measurement of zero readings.
- Selection of soil and groundwater parameters for the slope stability calculations.
- Topographic drawing and layout of different slope sections
- 2D slope models for the selected critical slope section(s) that could be representative of the site conditions.
- Analysis of 2D slope model using Phase 2D software of RocScience to estimate factor of safety for existing slope conditions.
- Carryout sensitivity analysis to see the effect of various parameters used in the analysis.
- Carry out back analysis of existing erosion to calibrate soil and groundwater parameters.
- To Identify trigger points and provide a plan to carry out monitoring of these point and different levels of severity.

Both reports will be stamp and certified by a Professional Engineer Ontario.

#### WORKPLAN AND SCHEDULE

The schedule for completion of the field work may be affected by weather conditions and availability of the test drilling rig. The work will be scheduled; dependent on rig availability, locates clearances and after written authorization to proceed is received.

The following schedule is anticipated, extending from the date of SAFFA arrival on site:

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- Project Initiation •
- Field investigation •
- Laboratory testing
- Phase I report
- Phase II report

### Immediately after award

- Earliest availability of Drill Rig
- 2 weeks after field investigation.
- 3 weeks after completion of Phase I field work
- 3 weeks after completion of Phase I report

### **PROJECT COST**

The lump sum cost of the project includes marking BH on site for locate clearance. locate request, field drilling, installation of inclinometers, measurement readings, survey, lab testing, and report writing. The lump sum cost for the job is CAD \$108,090.00 plus HST.

Break down of the lumpsum prices are as follow,

<ul> <li>b. Phase I Report \$6,000</li> <li>c. Topographic Survey by a Surveyor \$9,800</li> <li>d. Phase II Report \$10,00</li> <li>e. Supplies and Installation of Inclinometers \$15,48</li> <li>f. 21 Base Readings of the Inclinometers by a Surveyor \$27,50</li> <li>g. Inclinometer Readings (Monitoring period for a year) \$21,00</li> </ul>	a.	Drilling boreholes, Lab testing, Water Level Measurements	\$ 18,310.00
<ul> <li>c. Topographic Survey by a Surveyor</li> <li>d. Phase II Report</li> <li>e. Supplies and Installation of Inclinometers</li> <li>f. 21 Base Readings of the Inclinometers by a Surveyor</li> <li>g. Inclinometer Readings (Monitoring period for a year)</li> <li>\$ 21,00</li> </ul>	b.	Phase I Report	\$ 6,000.00
<ul> <li>d. Phase II Report \$10,00</li> <li>e. Supplies and Installation of Inclinometers \$15,48</li> <li>f. 21 Base Readings of the Inclinometers by a Surveyor \$27,50</li> <li>g. Inclinometer Readings (Monitoring period for a year) \$21,00</li> </ul>	C.	Topographic Survey by a Surveyor	\$ 9,800.00
<ul> <li>e. Supplies and Installation of Inclinometers</li> <li>f. 21 Base Readings of the Inclinometers by a Surveyor</li> <li>g. Inclinometer Readings (Monitoring period for a year)</li> <li>\$ 21,00</li> </ul>	d.	Phase II Report	\$ 10,000.00
f. 21 Base Readings of the Inclinometers by a Surveyor\$ 27,50g. Inclinometer Readings (Monitoring period for a year)\$ 21,00	e.	Supplies and Installation of Inclinometers	\$ 15,480.00
g. Inclinometer Readings (Monitoring period for a year) \$21,00	f.	21 Base Readings of the Inclinometers by a Surveyor	\$ 27,500.00
	g.	Inclinometer Readings (Monitoring period for a year)	\$ 21,000.00

#### SAFETY POLICY

SAFFA is committed to providing a safe and healthy environment for all of its workers and general public. We consider effective safety, health and environmental management to be of prime importance to our business and, therefore we are committed to continuous improvement in performance in all these areas. It's our policy and highest priority to conduct all operations and services safely and in a manner, that will prevent injuries to persons and damage to property and the environment.

SAFFA will:





- Comply with all legislative requirements pertaining to safety, health and the environment as its minimum standard.
- Pursue high standards of safety, health and environmental management by ensuring our decisions take proper account of safety, health and environmental implications.
- Work in consultation with all companies involved in the project to minimize the negative and maximize the positive environmental impacts.
- Employ a consistent framework for the management of health, safety and environmental issues across all of its operations (H.S.E. Management System)
- Strictly enforce our health, safety and environmental program.
- Maintain, review and report on safety, health, and environmental performance indicators.

We believe that this proposal addresses all the requirements of geotechnical investigation for this project. If you have any questions on the proposal, please feel free to contact our office.

Respectfully submitted, **SAFFA Engineering Inc** 

Submitted by

5. Anah

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