

PW Report No. 33-2022

## COMMUNITY SERVICES COMMITTEE DECEMBER 12<sup>th</sup>, 2022

## PIPER STREET SLOPE STABILITY ANAYLSIS UPDATE

## RECOMMENDATION

The Director of Engineering & Public Works recommends:

# 1. THAT PW Report No. 33-2022 be received for the purposes of information.

## 1. PURPOSE

The purpose of the Report is to present updated information in regard to the slope erosion and the analysis undertaken to date 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 in 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.

It is accepted that without intervention erosion along portions of the valley embankment will continue to occur. In this context it is then important to determine the rate of erosion, and, to establish a monitoring program for the erosion. This program will allow the Township to plan for remedial work and provide sufficient time to obtain any approvals that may be necessary to mitigate against this risk.

The installed guard rails along Piper Street adjacent the Nith River valley require maintenance and Staff wish to extend the limits of the guard rails from a road safety / risk management perspective. Due to the presence of erosion there are concerns that this type of maintenance and construction activity 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. To address these concerns, Township Staff took forward a report to Council in July 2021 which authorized the commencement of a slope stability analysis.

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Community Services Committee
PW Report No. 33-2022
December 12<sup>th</sup>,2022
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The slope stability analysis was broken down into 3 phases. Phase 1 consisted of field work and reporting necessary to facilitate the installation and maintenance of guard rails. Phase 2 consisted 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 Phases 1 and 2 are now completed and this report discusses the findings.

## 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 was obtained from the Phase 1 and 2 work program will be integral to the formulation of the Capital plan going forward.

Phase 1 has been completed and the geotechnical engineer (Saffa Engineering) has determined that W-Beam guard rail can be installed with the use of a conical driving ends. These types of driving ends allow for the installation without the need for heavy hammering in the vicinity of the slope. An allocation of \$100,000 was set aside in the approved 2022 Capital Budget for the installation of the new guard rail system at this location. The work has not been completed and is shown as a carry forward project for delivery in 2023.

Phase 2 has been completed and the geotechnical engineer (Saffa Engineering) has undertaken the necessary analysis and the development of recommendations. The summary of the consultant's recommendations include:

 The results of the stability analyses, considering long-term parameters, indicate that the Factor of Safety against instability of a failure surface initiating near the crest is just over unity. In simple terms this means that there is no immediate risk of failure or instability of the slope, however, it is appropriate given the safety margin to start to assess longer term design and mitigation measures to protect the Piper Street road allowance; Community Services Committee PW Report No. 33-2022 December 12<sup>th</sup>,2022

- Based on the results of the stability analyses and site observations, the slope is considered to be just more than marginally stable under current site conditions;
- The site reconnaissance identified an area of slope instability/sloughing at the toe of the bank slope generally all along the proposed section in immediate proximity to the Nith River;
- Based on the slope configuration and the results of the stability analyses, the slope southern bank slope is considered to be susceptible to ongoing instability in the future. This may include continuing slope movement in the area of the currently identified instability and/or sloughing/instability of the slope face in new areas;
- A deep-seated failure may destroy the Piper Street completely/partially, depending upon the curvature and initiation point of the failure line. Therefore, remedial works are recommended to improve the long-term stability of the slope;
- Due to space limitation within the Piper Street road allowance and the valley wall, flattening of the slope is not an option. Therefore, slope stabilization by intervention is recommended;
- Stabilizing the toe of the slope will protect it from sloughing and also will shift the failure line further deeper into the slope;
- Additional monitoring is recommended at 3 locations as follows:
  - Six (6) once a week reading including horizontal control
  - Six (6) once bi-weekly readings including horizontal control
  - Nine (9) once monthly readings including horizontal control
- Additional monitoring would be summarized in a report to the Township.

The report indicates that the Factory of Safety is 1.15 and is not desirable in the long term. Ideally a Factor of Safety would be 1.5. As such, while not imminent, the Township should be preparing for future slope stability works. Staff are recommending that these works be included in the 10 year Capital forecast. The draft 2023 to 2032 Ten Year Capital Forecast recommends Engineering Design work to be undertaken in 2030 with Construction to be completed in 2032.

As a portion of the stability of the slope is dependant on the flow of the Nith River, Staff are recommending proceeding with ongoing monitoring. This will permit the Township to make an informed decision as to when remedial work is required. The Phase 3 monitoring is ongoing and sufficient funds were carried in the 2022 budget for the monitoring. The funds necessary will be carried forward from the 2022 Capital Budget in the 2023 budget.

Community Services Committee PW Report No. 33-2022 December 12<sup>th</sup>,2022

The Region of Waterloo has both water and wastewater infrastructure in the existing Piper Street right of way. Township Staff are of the opinion that they should be contributing to the future cost of any slope stabilization activities. We forwarded a copy of the report to the Region and suggested they include 33% of the costs to their capital forecast. The Region has advised that as the Factory of Safety for the slope is 1.15, they do not believe it is necessary to participate in cost sharing. Township Staff believe this not in keeping with current best practice asset management practices. If on going monitoring indicates the slope is maintaining the existing Factor of Safety, the forecasted works can be "pushed out" to a future date. At this time, Staff are recommending that upon the annual monitoring report, it be forwarded to the Region with another request to include future works in their capital forecast.

## 4. FINANCIAL IMPLICATIONS

The monitoring program was fully funded in the 2022 Capital budget. The funds required for 2023 will be carried forward into 2023.

## 5. ATTACHMENTS

- 1. Location Map Extent of Geotechnical Investigation Analysis Along Piper Street
- 2. Region of Waterloo response

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

**Report Prepared By:** 

Lee Robinson, P.Eng. Director of Engineering & Public Works

Respectfully Submitted By:

Andrew McNeely, Chief Administrative Officer





### Lee Robinson

From:	Kevin Dolishny <kdolishny@regionofwaterloo.ca></kdolishny@regionofwaterloo.ca>
Sent:	Thursday, September 22, 2022 5:19 PM
То:	Lee Robinson
Cc:	Pam Law; Nancy Kodousek
Subject:	RE: Piper Street Slope Stability
Attachments:	phase II_piper st_ayr_north dumfries_20220725_draft.pdf

Hi Lee,

Staff in Water Services have reviewed the report titled Geotechnical Investigation, Erosion and Slope Stability at Piper Street, Ayr, North Dumfries prepared by Saffa Engineering Inc. dated July 2022. The report contains recommendations for slope stability measures to mitigate the risks of further erosion of the banks of the Nith River. However, the report does not identify a risk to the Region's water and sanitary infrastructure on Piper St, Ayr due to slope instability. Therefore, under careful consideration it has been determined that cost sharing for the Nith River erosion control is not appropriate.

#### Kevin Dolishny, P. Eng. | Senior Engineer

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From: Lee Robinson <lrobinson@northdumfries.ca>
Sent: August-04-22 8:25 AM
To: Kevin Dolishny <KDolishny@regionofwaterloo.ca>
Subject: Piper Street Slope Stability

Hi Kevin,

The Township has been concerned about the slope stability on Piper Street in Ayr. As such, we have commissioned a three phase study to evaluate the stability of the slope.

The Phase 2 draft report is complete. In general the slope has a Factor of Safety of 1.15 which is deemed slightly stable. The desired Factor of Safety would be 1.5. The report further recommends remedial action to protect the integrity of the road and infrastructure. We have attached a copy of the draft report.

The Township is including the following in our capital budget forecast.

- 2030 Engineering \$65,000 in 2022 dollars
- 2032 Construction \$475,000 in 2022 dollars

The Township believes that the Region should be contributing to these costs to protect their sewer and watermain infrastructure. We believe 33% of the costs would be reasonable.

I'd like to schedule a meeting to discuss further. Can you please provide some availability in the next few weeks and I'll set up a Teams meeting for us?

Thank you.

Lee Robinson, P.Eng. Director of Engineering & Public Works

The Corporation of the Township of North Dumfries

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NOTE:

Email is the most efficient way to contact myself.

Please note that the Township Administration Office is OPEN to the Public with access consistent with COVID-19 pandemic protocols. Township Administrative business continues and services can be accessed through our website, by email or by telephone. Meetings will be arranged through scheduled appointments and can be accommodated through either virtual platforms or in-person.

#### Website: www.northdumfries.ca

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