



Final Inspection Report

**Neustadt Flood Control Works
Meux Creek**

**Municipality of West Grey,
Grey County, Ontario**

D.M. Wills Project Number 22-5540



D.M. Wills Associates Limited

Partners in Engineering, Planning and
Environmental Services
Peterborough

December 2022

**Prepared for:
Saugeen Valley
Conservation Authority**



Summary of Revisions

Rev. No.	Revision Title	Date	Summary of Revisions
1	Draft Report	December 12, 2022	Issued for Client Review
2	Final Report	December 22, 2022	Issued as Final

This report has been formatted considering the requirements of the Accessibility for Ontarians with Disabilities Act.

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1.0 Introduction

1.1 Purpose and Objectives

The Saugeen Valley Conservation Authority's (SVCA's) jurisdiction, the Saugeen watershed, covers an area of approximately 4,675 km² and encompasses the counties of Bruce, Dufferin, Grey, Huron and Wellington as well as the Saugeen River, Penetangore River, Teeswater River, Pine River and the shoreline of Lake Huron. Within this jurisdiction, the SVCA's mandate is to undertake watershed-based programs to protect people and property from floods and other natural hazards and to conserve natural resources for economic, social and environmental benefits. This includes the management of flood and erosion control structures.

In cooperation with their municipal partners and regulatory agencies, the SVCA maintains a number of flood and erosion control projects within their jurisdiction. The SVCA is currently responsible for coordinating the inspection, maintenance and repair of 21 flood and erosion control projects, including 10 dam and dyke projects, 4 slope stability and erosion control projects and 4 flood control channelization projects.

D.M. Wills Associates Limited (Wills) was retained by the SVCA to undertake the inspection of 20 flood and erosion control structures. In the past, annual inspections of the SVCA's flood and erosion control structures have been completed in-house by the SVCA; however, it is understood that past inspection documentation has ranged from photo records to the completion of a site inspection form. Given the importance of ensuring that this infrastructure is in good condition and to plan for future maintenance and repairs, the SVCA has recognized that a more formal inspection of the flood and erosion control infrastructure is required in order to re-establish a baseline condition for each structure.

The purpose of these inspections is to thoroughly document the existing condition of the flood and erosion control structures through a visual inspection, including the completion of an underwater inspection where possible, identify operator and public safety deficiencies, and provide a prioritized list of recommendations for the remediation of the identified deficiencies, including the development of budget-level cost estimates and a recommended timeline for the completion of each measure.

The subject of this report is the Neustadt Flood Control Works – Meux Creek. The inspection of the Neustadt Flood Control Works – Meux Creek was completed on September 20, 2022, in the presence of SVCA staff. At the request of the SVCA, the inspection excludes the gabion baskets on the east side of the creek upstream of Queen Street. It is understood that there is already a project ongoing to address the issues associated with this side of the creek.

1.2 Site Location and Access

The Neustadt Flood Control Works – Meux Creek are located in the Town of Neustadt, Municipality of West Grey, Ontario include two separate sites, the Meux Creek Weir and

the Meux Creek Gabion Flood Control Wall. The Meux Creek Weir is located along Meux Creek in Neustadt Lions Park approximately 440 m downstream of Queen Street. The weir accessible through the roadway system within the park and on foot from the parking area. The site is publicly accessible. The Meux Creek Gabion Flood Control Wall is located along Meux Creek immediately upstream (south) of Queen Street. The site is accessible on foot from Queen Street and parking is available in a driveway on the southwest side of the bridge crossing. The site location is shown in **Figure 1**.

1.3 Site Description

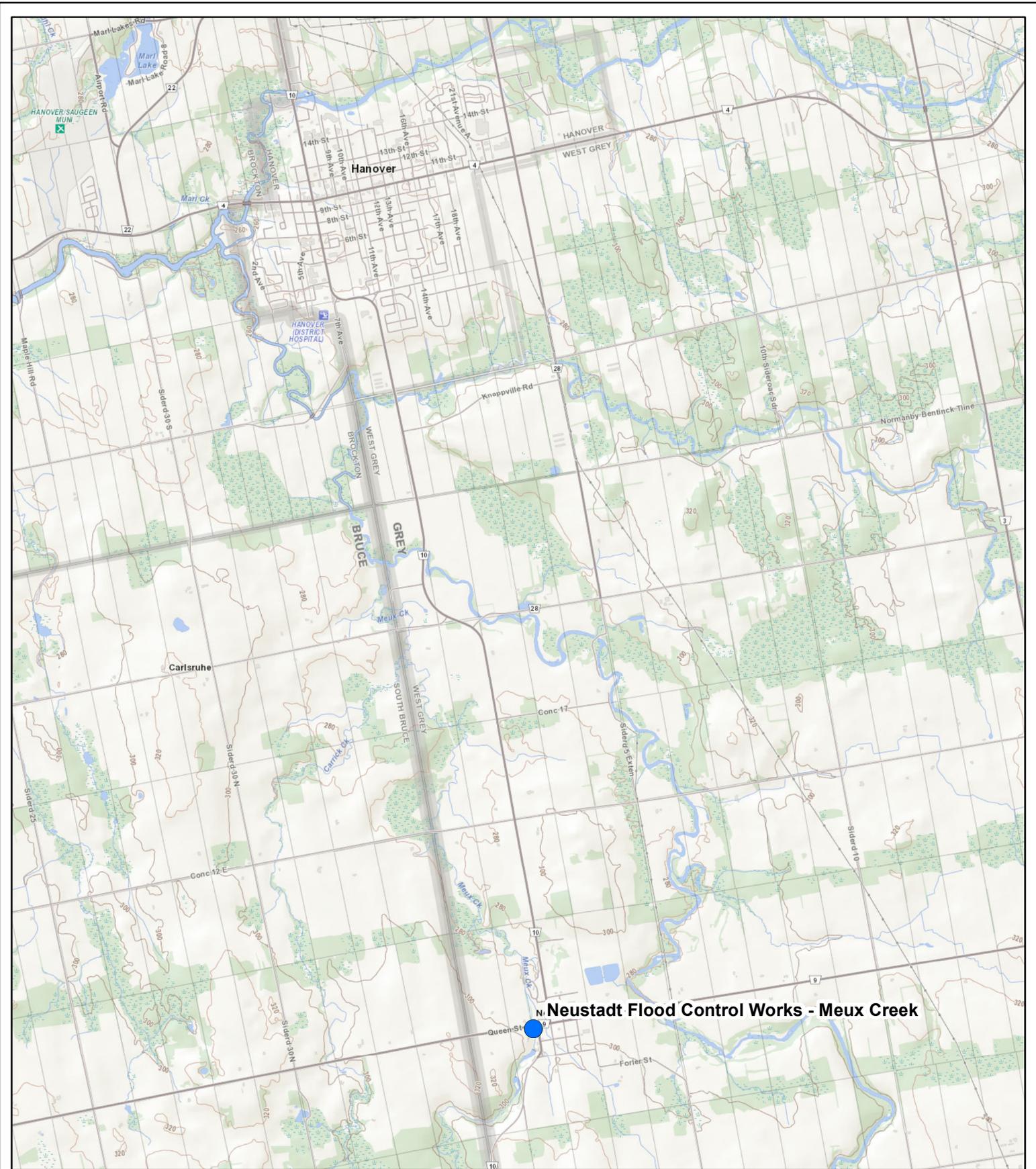
The Neustadt Flood Control Works – Meux Creek were constructed in 1980 to stabilize the watercourse banks and protect several homes and municipal infrastructure. This flood control project consisted of widening the existing channel, providing gabion and gobi mat bank protection and restoration of adjacent properties. A portion of this project also included the diversion of Meux creek, westerly into its current location. The site plan is shown in **Figure 2**. The location of the site features is referenced left to right facing upstream.

The Meux Creek Weir in Neustadt Lions Park is a small control structure that is comprised of gabion baskets and concrete. A concrete apron has been poured on top of the gabion baskets and forms the top and downstream faces of the weir. The gabion baskets extend upstream and downstream of the weir on both sides of Meux Creek. Large round stones have been placed on the downstream side of the weir to act as erosion protection. The purpose of the weir is to provide energy dissipation in the creek downstream of the flood control works.

The Meux Creek Gabion Flood Control Wall is an approximately 90 m long gabion basket wall that extends upstream (south) from the Queen Street. The first portion of the wall on the right (west) side of the channel is comprised of 12 partial height baskets. The outlet of a culvert running parallel to Queen Street is located at the end of the first section of partial height baskets and does not appear to play a role in the function of the flood control works. The remainder of the wall that continues along the right bank is two gabion baskets high. The gabion basket wall on the left (east) side of the creek is generally three full height gabion baskets, except at the bridge where up to three partial height gabion baskets have been added to help retain the bridge abutment. At the request of the SVCA, the gabion basket wall on the left side of the channel was not included in the inspection.

1.4 Description of Operations

There are no operations required at the Meux Creek Weir in Neustadt Lions Park as it is a self-regulating fixed overflow structure. Similarly, there are no operable components associated with the Meux Creek Gabion Flood Control Wall.



N Neustadt Flood Control Works - Meux Creek

Legend

● Site Location



Data Sources
Land Information Ontario 2022
Created In: ArcMap 10.7

NAD 1983 UTM Zone 17N 1:50,000

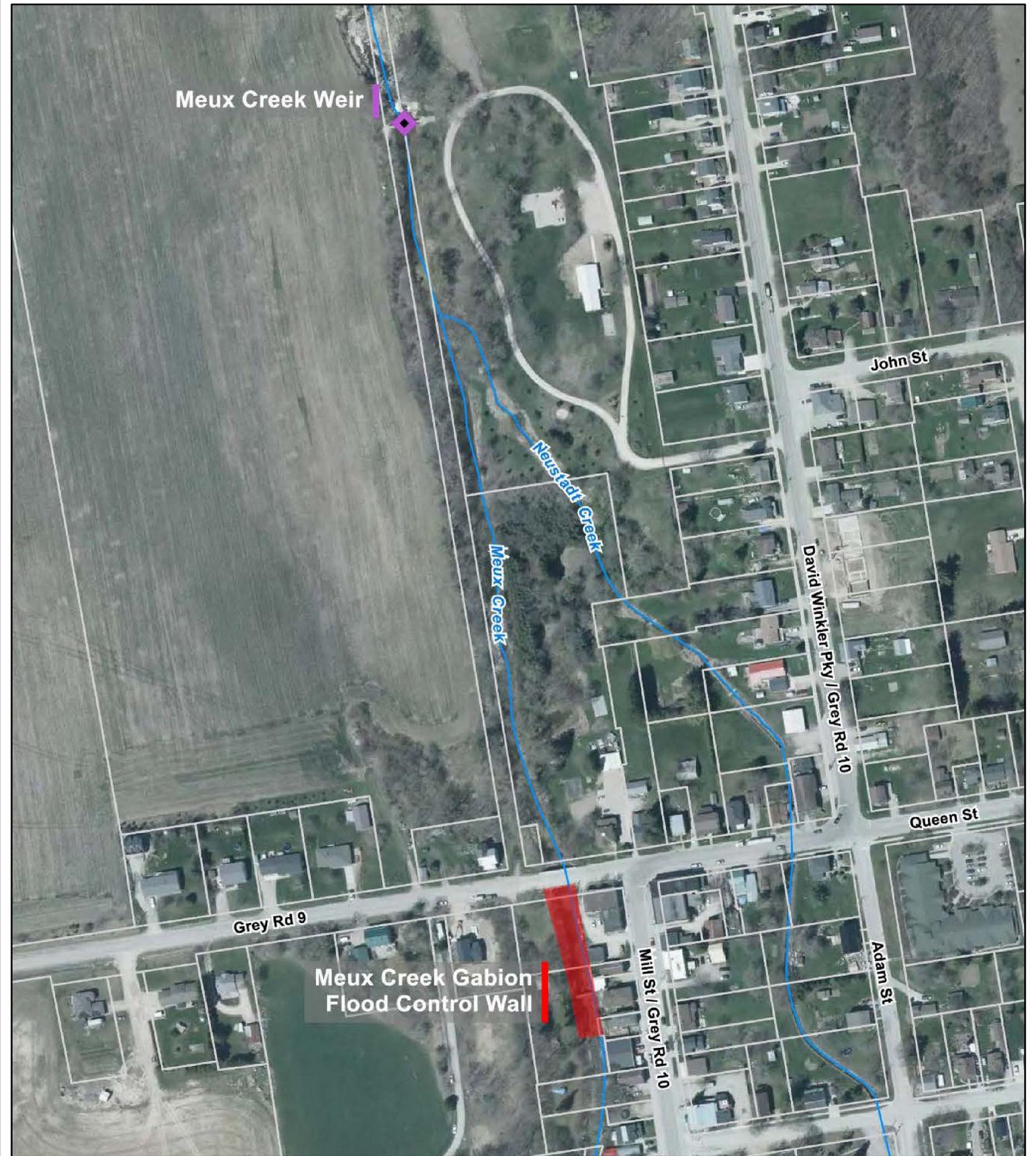
Figure 1 - Location Plan

Drawn By:	GB
Checked By:	DG
Map Date:	12/12/22
Project Number:	22-5540
Map File Number	Figure 1



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Data Sources
 Saugeen Valley Conservation Authority
 Created In: ArcMap 10.7
 Scale: N.T.S

- Legend**
-  Weir
 -  Permanent Watercourse
 -  Parcel Fabric
 -  Flood Control Wall

Figure 2 - Site Plan

Drawn By:	GB
Checked By:	DG
Map Date:	12/05/22
Project Number:	22-5540
Map File Number	Figure 2



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2.0 Inspection Methodology

2.1 Background Review and Fieldwork Preparation

A review of the background information provided by the SVCA was completed prior to Wills' field inspection. This information included available drawings, site access plans, photographs, inspection records and reports. The background review and fieldwork preparation consisted of the following tasks:

- Coordination of access to the site with SVCA staff.
- Review of the available background information.
- Set-up of Modified MNRF Form B-2 (Inspection Form).
- Preparation of a Site-Specific Health and Safety Plan.
- Printing inspection forms and available drawings.

2.2 Site Condition Assessment

Wills performed a visual and non-destructive inspection of the flood control works. The methodology for this inspection is summarized as follows:

- Visual inspection, along with recording and classification, of all observable deficiencies according to the Ontario Structure Inspection Manual (OSIM).
- Georeferenced photographs of all aspects of the site.
- Where possible, aerial imagery of the site and up and downstream areas collected using a Remotely Piloted Aircraft System.
- Where possible, underwater video was collected using a pole mounted GoPro camera.
- Review of previously identified deficiencies and their digression over time.
- Completion of Modified MNRF Form B-2 (Inspection Form).

Wills classified the deficiencies, including those in embankment/dyke, slopes, erosion protection, concrete, etc., based on the 2008 OSIM. The OSIM reference checklist used for the inspection is provided in **Appendix C**.

2.3 Assessment of Public and Operator Safety Measures

Wills' inspection of the site included a thorough visual inspection of all public and operator safety measures. The methodology for the inspection and review of the public and operator safety measures is summarized below:

- Visual inventory and inspection of all signage.
- Visual inspection of access route(s).
- Visual inspection of existing public safety measures (i.e. railings).

- Visual inspection of existing operator safety measures (i.e. railings).

The inspection of the public safety measures was carried out in accordance with the methodologies and requirements described in the Ontario Building Code (OBC). The inspection of the operator safety measures was carried out in accordance with the Occupational Health and Safety Act (OSHA) and the Industrial Establishments Regulation.

3.0 Inspection Findings

3.1 Condition Assessment

Wills performed the inspection of the Neustadt Flood Control Works – Meux Creek on September 20, 2022. At the time of the inspection, the weather was sunny and approximately 12 °C

The inspection results are documented in the photographic record in **Appendix A** and the Modified MNRF Form B2 in **Appendix B**. Digital copies of all photographs and videos from the inspection will be provided to the SVCA by digital file transfer.

In general, both the Meux Creek Weir in Neustadt Lions Park and the Meux Creek Gabion Flood Control Wall upstream of Queen Street were observed to be in poor condition. The Meux Creek Weir in Neustadt Lions Park has signs of concrete deterioration (cracking and spalling), the gabion baskets are corroded, and there is erosion/slope failure upstream and downstream of the structure. The Meux Creek Gabion Flood Control Wall upstream of Queen Street has corroded gabion baskets along the bottom of the channel as well as tree growth behind the wall.

Wills developed the following rating scale in order to provide the SVCA with a high-level assessment of the condition of the various components at the site:

- **1 – Very Poor** – Major deficiencies throughout the component. The structural integrity of the component is likely compromised and/or the component does not function as intended.
- **2 – Poor** – Significant deficiencies throughout component and the component may not function as intended under certain conditions.
- **3 – Fair** – Some deficiencies throughout component that may affect the ability of the component to function as intended if not corrected.
- **4 – Good** – Some localized deficiencies that do not affect the ability of the component to function as intended.
- **5 – Very Good** – No significant deficiencies throughout the component. Only slight imperfections may exist.

Similar to the condition rating system described above, Wills developed the following rating scale in order to provide the SVCA with a high-level understanding of the risk of failure of the various components at the site:

- **1 – Low** – Failure of the component could occur but only in rare/unforeseen events or circumstances.
- **2 – Moderate** – Failure of the component may occur in extreme events or circumstances but is unlikely to occur during normal operations.
- **3 – High** – Failure of the component may occur during normal operations.

A detailed list of the site's components along with the identification of deficiencies, condition ratings and risk ratings is provided in **Table 1**.

3.2 Assessment of Public Safety Measures

Flood and erosion control structures present a number of potential hazards to the public. Protecting the public from these potential hazards is an important element of an owner's due diligence. Public safety should be considered throughout all stages of a project's life cycle, from design to decommissioning; however, this is most important during the operational phase of the project.

No public safety measures were identified at the Meux Creek Weir in Neustadt Lions Park or the Meux Creek Gabion Flood Control upstream of Queen Street. Based on our site investigation, Wills identified the following potential public safety issues:

- No public safety signage present at the site.
- The creek channel and weir would be hazardous during high flow events.

3.3 Assessment of Operator Safety Measures

Operator safety measures are regulated under the Occupational Health and Safety Act (OHSA). The OHSA and its associated regulations are used to assess the adequacy of operator safety measures. There are two primary operator safety measures, railings and fall protection, the requirements for which depend on specific site conditions.

The Industrial Establishments Regulation of the OHSA (O.Reg. 851) requires a guard rail at the open side of any raised surface. The guard rail must have a top rail located not less than 910 mm and not more than 1070 mm above the surface to be guarded, have a mid rail, have a toe-board that extends at least 125 mm from the surface if tools or other objects may fall on other workers below, be free of splinters and protruding nails and be constructed to meet the structural requirements for guards as set out in the Ontario Building Code. No railings are present at the Meux Creek Weir in Neustadt Lions Park Weir or the Meux Creek Gabion Flood Control Wall upstream of Queen Street and none would be expected to be required.

O.Reg. 851 requires a fall arrest system where a worker is exposed to the hazard of falling and the surface to which they might fall is more than 3 m below the position where they are situated. Based on our understanding of the site, there is no potential fall height greater than 3 m; therefore, fall arrest is not required.

Potential operator safety issues include:

- Working around water may require the use of a life jacket or PFD.
- The creek channel and weir would be hazardous during high flow events.

Table 1 – Summary of Inspection Results

Structure	Location	Deficiency / Description	Condition Rating	Risk Rating
Earth Retaining Structures				
Meux Creek Gabion Flood Control Wall	Upper Section of Baskets	Baskets are slightly bulging but there is little corrosion on the steel wire (Photos: 20, 24, 28)	2	2
	Lower Section of Baskets	The steel has corroded and is broken. Ballast is being displaced to the watercourse causing the baskets to settle and the whole wall to shift (Photos: 24-25)	2	2
	Throughout	Areas where the basket is absent, leaving just embankment and ballast behind (Photo: 27)	2	2
	Back of Gabon Basket Wall	Tree growth near the back of the gabion basket wall. (Photo: 28)	3	1
Flow Conveyance Systems and Structures				
Meux Creek Weir in Neustadt Lions Park	Concrete Weir Structure	Cracking and spalling (Photo: 4)	2	2
	Gabion Baskets	The steel has corroded and is broken. Ballast is being displaced to the watercourse causing the baskets to shift and sag (Photos: 3-7)	2	2
Meux Creek Channel	Upstream of Queen Street	None (Photo: 34)	4	1

Structure	Location	Deficiency / Description	Condition Rating	Risk Rating
Erosion, Seepage and Leakage				
Meux Creek Weir in Neustadt Lions Park	Gabion Baskets	Seepage between the edge of the embankment and the baskets (Photo: 4)	2	1
	Upstream and Downstream Left and Right Banks	Erosion and slope failure (Photos: 2, 8-9, 11-13)	2	2
	Right Bank Approximately 65 m Downstream of Weir	Severe erosion (Photo: 8)	2	2
Meux Creek Gabion Flood Control Wall	Left Side of the Creek Upstream of Gabion Baskets	Severe erosion (Photos :32-33)	2	2

4.0 Recommendations

The inspection recommendations along with prioritization and cost estimates for each recommendation are provided in **Table 2**. The degree of accuracy for the cost estimates is approximately +/-50% and are based the best information available at the time of report production. The priorities are classified as “Immediate”, “High”, “Medium”, “Low” and “Ongoing” and are defined as follows:

- **Immediate** – Remedial action that needs to be carried out as soon as possible because the deficiency is an immediate high-risk hazard with a high likelihood of occurrence of loss of life and/or serious environment and/or serious economic consequences.
- **High** – Remedial action is required within the next two years to meet current regulations and is a high-risk hazard.
- **Medium** – These items may include additional work that could improve the performance or issues that may become serious deficiencies. These items typically should be addressed within five years.
- **Low** – These are opportunities to improve safety or deficiencies that may only become a serious deficiency in the long term. The recommendation can be carried out at the SVCA's convenience, or the recommended remedial action is expected to be required six years from now or later.
- **Ongoing** – These items may need to be reviewed and completed on a regular basis to ensure that the function of the structure and public safety measures is maintained.

The recommendations are prioritized based on the risk of occurrence, the significance of potential negative impacts and the resources (cost, time, effort) required to implement. The recommendations have been categorized as Management System, Public Safety, Operator Safety, Minor Maintenance (repairs < \$100,000) and Major Maintenance (repairs > \$100,000).

Table 2 – Inspection Recommendations

Recommendation	Description of Deficiency	Priority	Estimated Cost	Additional Comments
Management System				
1. Establish a regular frequency for engineering inspections (i.e., annually or bi-annually) as well as routine inspections by staff (i.e., monthly).	There were no records of past routine inspections, other than photos taken in 2013, 2014, 2016, 2017 and 2018. The SVCA would benefit from establishing a regular frequency of engineering inspections (i.e. annually or bi-annually) as well as routine inspections by staff (i.e. monthly).	Immediate	\$2,500	The estimated cost shown is for the completion of an annual or bi-annual inspection by a qualified consulting engineering firm and assumes that the SVCA would have a number of flood and erosion control structures inspected as part of the same contract. The cost for a standalone inspection of the Meux Creek structures would be estimated as \$5,000. It is assumed that the routine inspections would be completed by SVCA staff as part of their regular duties.
2. Monitor the gabion baskets on the right bank of Meux Creek upstream of Queen Street and implement modifications/repairs as required but before they begin to fail and restrict flows within the channel.	The steel on the bottom of the gabion baskets on the right bank of Meux Creek upstream of Queen Street are in poor condition and will continue to deteriorate over time.	Ongoing	\$0	It is assumed that this would be completed as part of the routine inspections completed by SVCA staff as part of their regular duties.
Public Safety				
4. Install public safety signage at the Meux Creek Weir in Neustadt Lions Park. The signage should be installed in accordance with the Best Management Practices for Public Safety Around Dams (MNR, 2011) and the Guidelines for Public Safety Around Dams (CDA, 2011).	There are no public safety signs installed at the Meux Creek Weir in Neustadt Lions Park and the area could be hazardous under certain conditions.	High	\$2,000	It is assumed that the SVCA would purchase the signs and posts but that the labour would be provided by SVCA staff as part of their regular duties.
Minor Maintenance				
10. Remove all trees and other woody vegetation growing within 1 m of the top/back of the gabion basket wall on the right bank of Meux Creek upstream of Queen Street.	There were trees noted growing behind the gabion basket wall on the right bank of Meux Creek upstream of Queen Street. Over time, root growth could contribute to the deterioration and movement of the gabion baskets.	Medium	\$0	It is assumed that this would be completed as part of the routine inspections completed by SVCA staff as part of their regular duties.

Recommendation	Description of Deficiency	Priority	Estimated Cost	Additional Comments
Major Maintenance				
12. Carry forward with the planned rehabilitation work of the gabion baskets on the left bank of Meux Creek upstream of Queen Street.	The gabion baskets on the left bank of Meux Creek upstream of Queen Street were noted to be in poor condition and it was understood that there is project underway to make the required repairs.	High	Per Engineer's Estimate	It is assumed that a detailed cost estimate for this work has already been prepared by the design engineer.
13. Replace the Meux Creek Weir in Neustadt Lions Park and provide appropriate erosion protection and stabilization measures within the creek channel and on the upstream and downstream creek banks.	Meux Creek Weir in Neustadt Lions Park is in poor condition with deteriorating concrete and corroded and broken gabion baskets.	Low	\$200,000	This cost estimate is provided for high level budget preparation only. The final cost will depend on the selected design and construction methodology. Estimate includes \$50,000 for engineering, permitting and tendering.

5.0 Conclusion

Wills completed this Inspection Report to provide the SVCA with an understanding of the overall existing condition of the structure, address any potential public or operator safety concerns and provide recommendations to better direct the SVCA with respect to long term management of the structure.

In general, both the Meux Creek Weir in Neustadt Lions Park and the Meux Creek Gabion Flood Control Wall upstream of Queen Street were observed to be in poor condition. The Meux Creek Weir in Neustadt Lions Park has signs of concrete deterioration (cracking and spalling), the gabion baskets are corroded, and there is erosion/slope failure upstream and downstream of the structure. The Meux Creek Gabion Flood Control Wall upstream of Queen Street has corroded gabion baskets along the bottom of the channel as well as tree growth behind the wall. The flood control works should continue to be monitored for future deterioration and remedial action should be completed on an as needed basis.

The detailed inspection findings are presented in **Section 3.0** and the recommendations are presented in **Section 4.0**. The following highlights the Urgent, Important and Future priority items for the structure:

Urgent Priority Items

- None.

Important Priority Items

- Establish a regular frequency for engineering inspections (i.e. annually or bi-annually) as well as routine inspections by staff (i.e. monthly).
- Carry forward with the planned rehabilitation work of the gabion baskets on the left bank of Meux Creek upstream of Queen Street.
- Monitor the gabion baskets on the right bank of Meux Creek upstream of Queen Street and implement modifications/repairs as required but before they begin to fail and restrict flows within the channel.
- Remove all trees and other woody vegetation growing within 1 m of the top/back of the gabion basket wall on the right bank of Meux Creek upstream of Queen Street.
- Install public safety signage at the Meux Creek Weir in Neustadt Lions Park. The signage should be installed in accordance with the Best Management Practices for Public Safety Around Dams (MNR, 2011) and the Guidelines for Public Safety Around Dams (CDA, 2011).

Future Priority Items

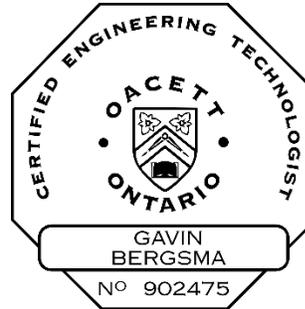
- Replace the Meux Creek Weir in Neustadt Lions Park and provide appropriate erosion protection and stabilization measures within the creek channel and on the upstream and downstream creek banks.

If you have any questions with regards to the information contained herein, please do not hesitate to contact the undersigned.

Respectfully Submitted,



David Green, P.Eng.
Group Leader, Dam Engineering



Gavin Bergsma, C.E.T.
Project Designer,
Water Resources Engineering

DG/GB/af

Appendix A

Photographic Record





Photo 1 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Meux Creek Weir from Upstream Left Bank



Photo 2 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Downstream Left Bank



Photo 3 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Gabion Baskets on Downstream Left Side of Wier



Photo 4 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Downstream Side of Wier



Photo 5 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Downstream Side of Wier

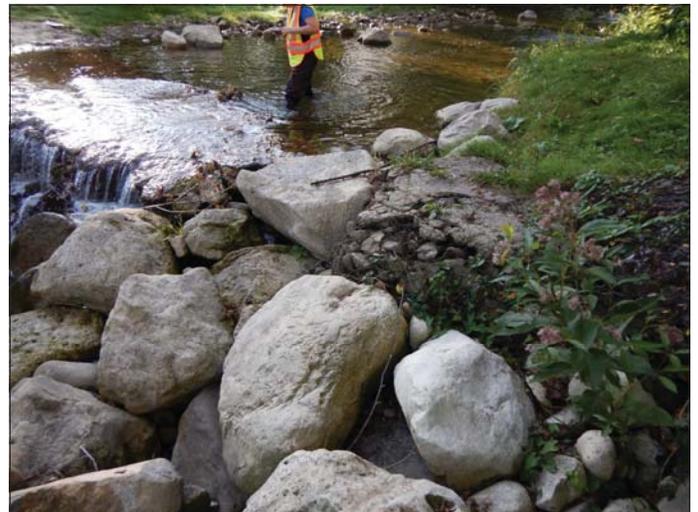


Photo 6 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Right Side of Wier



Photo 7 - September 20, 2022
Neustadt Flood Control Works - Meux Creek

Gabion Baskets on Downstream Right Side of Wier



Photo 8 - September 20, 2022
Neustadt Flood Control Works - Meux Creek

Downstream Watercourse



Photo 9 - September 20, 2022
Neustadt Flood Control Works - Meux Creek

Pedestrian Bridge Upstream of Wier

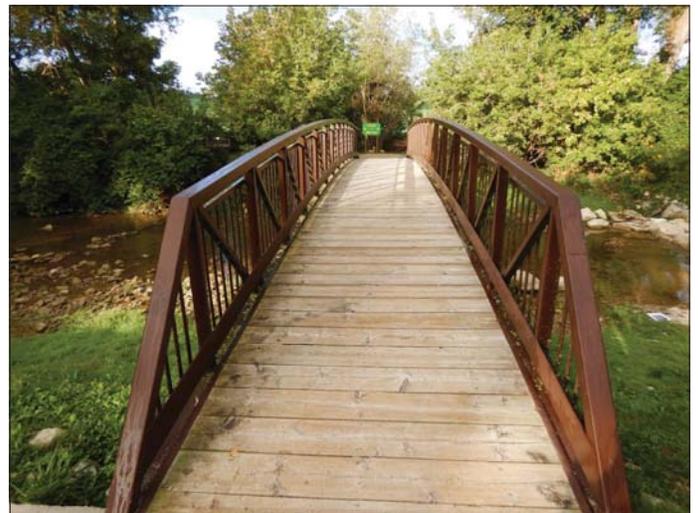


Photo 10 - September 20, 2022
Neustadt Flood Control Works - Meux Creek

Pedestrian Bridge Deck



Photo 11 - September 20, 2022
Neustadt Flood Control Works - Meux Creek

Meux Creek looking Upstream towards Queen Street



Photo 12 - September 20, 2022
Neustadt Flood Control Works - Meux Creek

Upstream Left Bank



Photo 13 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Upstream Right Bank



Photo 14 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Upstream Side of Queen Street Bridge



Photo 15 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Culvert Outlet on Right Bank



Photo 16 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Interior of Culvert on Right Bank



Photo 17 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Road Ditch above Culvert and Parking Area



Photo 18 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Culvert Inlet



Photo 19 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Queen Street Bridge



Photo 20 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Gabion Baskets on Right Bank Upstream of Bridge



Photo 21 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Gabion Baskets on Left Bank Upstream of Bridge



Photo 22 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Right Bank of Meux Creek Channel



Photo 23 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Typical Gabion Baskets on Right Bank



Photo 24 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Typical Gabion Baskets on Right Bank



Photo 25 - September 20, 2022
Neustadt Flood Control Works - Meux Creek

Rip-Rap at Base of Gabion Baskets on Right Bank



Photo 26 - September 20, 2022
Neustadt Flood Control Works - Meux Creek

Vegetation Growth on Right Bank



Photo 27 - September 20, 2022
Neustadt Flood Control Works - Meux Creek

Vegetation Growth on Right Bank



Photo 28 - September 20, 2022
Neustadt Flood Control Works - Meux Creek

Top of Gabion Baskets Looking Downstream, Right Bank



Photo 29 - September 20, 2022
Neustadt Flood Control Works - Meux Creek

Vegetation on Top of Gabion Baskets, Right Bank



Photo 30 - September 20, 2022
Neustadt Flood Control Works - Meux Creek

Right Bank Upstream of Gabion Baskets



Photo 31 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Upstream Watercourse



Photo 32 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Erosion on Left Bank



Photo 33 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Erosion on Left Bank



Photo 34 - September 20, 2022
Neustadt Flood Control Works - Meux Creek
Looking Downstream to Queen Street



Appendix B

Modified MNR Form B2





Date:	Tuesday, September 20, 2022
Name:	Neustadt Flood Control Works – Meux Creek
Municipality:	Municipality of West Grey, County of Grey
Location:	Lot 2, Concession 13, Geographic Township of Normanby
GPS Coordinates:	499710.00 m E, 4880499.00 m N, UTM Zone 17T
Inspected By:	David Green, P.Eng., Alex Payette, EIT
Weather:	Sunny, 12°C

The Neustadt Meux Creek Flood Control Works include the gabion basket retaining walls south of the Queen Street bridge (approximately 90 m long) and a weir structure located approximately 440 m downstream of Queen Street in Neustadt Lions Park. At the request of the SVCA, the inspection excludes the gabion baskets on the left side of the creek upstream of Queen Street.

1 – Earth Embankments

There are no earth embankments associated with the Neustadt Meux Creek Flood Control Works.

2 – Earth Retaining Structures (concrete, gabion baskets, sheetpile, etc.)

Gabion Baskets (South of Queen Street) – Directly upstream of the bridge, there are gabion basket walls to retain the channel banks. On the right side of the creek, the wall is twelve baskets high. These baskets are partial height baskets and are generally in good condition. The upper levels of baskets are slightly bulging but there is little corrosion on the steel wire basket. The bottom courses, which would be submerged during flood events, are in poor condition. The steel in the baskets has corroded and is broken. Ballast is being displaced to the watercourse. Due to the displaced ballast material, the bottom courses are settling and causing the whole wall to shift. There is a culvert outlet upstream of this wall section. The culvert does not appear to play a role in the function of the flood control works but is in good condition.

Downstream of the culvert outlet, the gabion basket wall continues along the right bank in a two basket height. Generally, the bottom basket is in poor condition and is corroded/broken allowing the ballast to escape. The lost ballast is reducing the strength of the wall and causing the top course to rotate inwards. In some areas, the basket is absent, leaving just embankment and ballast behind. There appeared to be a type of cable concrete to protect the earth bank above the gabion basket wall. The majority of this erosion protection was buried under vegetation and soil. It is noted that there was some tree growth near the back of the wall.



3 – Flow Conveyance Systems (channels, pipes, etc.)

Upstream of Queen Street, the Meux Creek channel is clean and straight with little build-up of sediment, vegetation, or debris. The condition is similar immediately adjacent to the weir in Neustadt Lions Park.

4 – Catch Basins / Manholes

There are no catch basins / manholes associated with the Neustadt Meux Creek Flood Control Works.

5 – Flap Gates

There are no flap gates associated with the Neustadt Meux Creek Flood Control Works.

6 – Weirs

Concrete Weir Structure (Neustadt Lions Park) – The control structure is a small weir created by gabion baskets and concrete. A concrete apron was placed on top of the gabion baskets and extends to the embankments of the watercourse. The concrete is cracking in several areas as the gabion baskets are shifting below the apron slab. The concrete above the gabion baskets in the centre of the watercourse is being eroded which is spalling some sections.

Gabion Baskets (Neustadt Lions Park) – Gabion baskets are in place to create the weir structure. There are several baskets protruding above the ground and the baskets are severely corroded. Due to the concrete apron, the top of the gabion baskets were not visible. The downstream sill portion was inspected and showed that all of the baskets are broken due to excessive corrosion of the steel mesh. Stone ballast is observed escaping through the broken sections. A sag is noted in the baskets at the centre of the watercourse. On the left side of the control structure water was observed seeping between the edge of the embankment and the baskets. Large round stones are in place downstream of the weir wall to act as armouring. During flood conditions, it was explained that these stones become displaced downstream.

7 – Erosion Protection Measures (rock protection, rip-rap, turf reinforcement mat, etc.)

There are large round field stones to provide support to the gabion basket weir wall and combat erosion within the creek in Neustadt Lions Park. These stones appear to be stable but it was noted by SVCA staff that during flood events, some of the smaller stones get deposited downstream.



8 – Erosion

Erosion and slope failure was noted on the upstream and downstream left and right banks around the weir structure in Neustadt Lions Park. There is severe erosion on the right bank on the channel approximately 65 m downstream of the weir.

There was minimal erosion in the creek itself upstream of Queen Street; however, the banks are severely eroded on the left side of the creek upstream of where the gabion baskets end.

9 – Seepage or Leaks

Seepage is present through the gabion baskets at the weir structure in Neustadt Lions Park. It is especially apparent on the left side of the structure and can be seen actively flowing between the embankment and the baskets.

10 – Access Route (location of gate keys, winch handles and keys)

The weir in Neustadt Lion Park was accessed through the roadway system within the park and on foot from the parking area. The site is publicly accessible.

The gabion baskets south of Queen Street were accessed on foot from Queen Street. Parking was in a driveway on the southwest side of the bridge crossing. The site is publicly accessible.

10 – Safety Issues (public and operator)

No major safety issues were identified at the time of the inspection; however, it is noted that the Meux Creek channel and the weir would be hazardous during high flow events.

12 – Signage

There is no signage located at either the weir in Neustadt Lions Park or at the gabion basket walls south of Queen Street.

13 – Divestment and/or Decommissioning Opportunities

There are likely limited divestment or decommissioning opportunities for the Neustadt Meux Creek Flood Control Works.

14 – General Remarks

The gabion baskets on the left (east) side of Meux Creek upstream of Queen Street were excluded from the inspection, and therefore the recommendations, at the request of the SVCA. It is understood that there is already a project ongoing to address the issues associated with this side of the creek



15 – Recommendations

- Establish a regular frequency for engineering inspections (i.e. annually or bi-annually) as well as routine inspections by staff (i.e. monthly).
 - Carry forward with the planned rehabilitation work of the gabion baskets on the left bank of Meux Creek upstream of Queen Street.
 - Monitor the gabion baskets on the right bank of Meux Creek upstream of Queen Street and implement modifications/repairs as required but before they begin to fail and restrict flows within the channel.
 - Remove all trees and other woody vegetation growing within 1 m of the top/back of the gabion basket wall on the right bank of Meux Creek upstream of Queen Street.
 - Replace the Meux Creek Weir in Neustadt Lions Park and provide appropriate erosion protection and stabilization measures within the creek channel and on the upstream and downstream creek banks.
 - Install public safety signage at the Meux Creek Weir in Neustadt Lions Park. The signage should be installed in accordance with the Best Management Practices for Public Safety Around Dams (MNR, 2011) and the Guidelines for Public Safety Around Dams (CDA, 2011).
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Appendix C

OSIM Inspection Deficiency Classifications



OSIM Checklist

Concrete		
Scaling - loss of portion of concrete surface or mortar due to freeze thaw. Common with non-air entrained concrete or poorly finished concrete.	Light	Loss of mortar up to 5 mm
	Medium	6 to 10 mm, some coarse aggregate visible
	Severe	11 to 20 mm aggregate pocking
	Very Severe	More than 20 mm
Disintegration - breakdown of concrete. Starts as scaling and its disintegration when it's beyond the level of very severe scaling.	Light	Loss of depth up to 25 mm
	Medium	25 to 50 mm
	Severe	50 to 100 mm
	Very Severe	More than 100 mm
Erosion - deterioration of concrete by water, sand or gravel scrubbing against the surface.	Light	Loss of depth up to 25 mm
	Medium	25 to 50 mm
	Severe	50 to 100 mm
	Very Severe	More than 100 mm
Corrosion of Reinforcement	Light	Rust stains on concrete surface
	Medium	Exposed reinforcement, loss of section 10%
	Severe	Loss of reinforcing steel section 10% to 20%
	Very Severe	Loss of section more than 20%
Delamination - discontinuity of the surface concrete, which becomes substantially separated but not completely detached. Hollow sounding when tapped.	Light	Measured area less than 150 mm in any direction
	Medium	150 mm to 300 mm
	Severe	300 mm to 600 mm
	Very Severe	More than 600 mm
Spalling - fragments of concrete become detached.	Light	Measured area less than 150 mm in any direction, or less than 25 mm deep
	Medium	150 mm to 300 mm, or 25 mm to 50 mm deep
	Severe	300 mm to 600 mm, or 50 mm to 100 mm deep
	Very Severe	More than 600 mm, or greater than 100 mm in depth
Crack - linear fracture.	Hairline	Less than 0.1 mm
	Narrow	0.1 mm to 0.3 mm
	Medium	0.3 mm to 1.0 mm
	Wide	More than 1.0 mm
AAR - aggregate reaction with the alkalis in cement, product is highly expansive substance called alkali-silica gel. The expansion of the gel and aggregate under damp conditions causes cracking.	Light	Hairline cracks, widely spaced, no visible expansion of concrete mass
	Medium	Narrow pattern cracks, closely spaced, with visible expansion of concrete mass
	Severe	Medium to wide pattern cracks, closely spaced, with visible expansion and deterioration of concrete
	Very Severe	Wide pattern cracks, closely spaced, with extensive expansion and deterioration of concrete

OSIM Checklist

Concrete Surface Defects

Stratification - separation of concrete into horizontal layers in over wetted or over vibrated concrete.

Segregation - differential concentration of the components of mixed concrete resulting in non-uniform properties in mass. Caused by concrete falling from height, with the coarse aggregate setting to the bottom and fine aggregate to the top.

Cold Joints - caused from delay between placements of successive pours of concrete and incomplete bond develops.

Deposits - water percolates through the concrete and dissolves or leaches chemicals from it and deposits them on the surface.	Efflorescence	A deposit of salts, usually white and powdery
	Exudation	A liquid or gel-like discharge through pores or cracks in the surface
	Incrustation	A hard crust or coating formed on the concrete surface
	Stalactite	A downward pointing formation hanging from the concrete surface, usually shaped like an icicle

Honeycombing - improper or incomplete vibration, which leaves voids in the concrete where mortar failed to completely fill the space between aggregate.	Light	Measured area less than 150 mm in any direction
	Medium	150 mm to 300 mm
	Severe	300 mm to 600 mm
	Very Severe	more than 600 mm

Pop-outs - shallow, conical depressions caused by small portions of concrete surface breaking away due to frost or expansion of aggregate.	Light	Holes up to 25 mm diameter
	Medium	25 mm to 50 mm
	Severe	50 mm to 100 mm
	Very Severe	More than 100 mm

Abrasion - vehicles or snow plow blades scraping against concrete.

Wear- dynamic and/or friction forces from vehicles, dirt, debris, sand, water & ice. Surface appears polished.

Slippery- as a result of polishing of concrete deck by vehicular traffic.

Steel

Corrosion - deterioration of steel by chemical or electro-chemical reaction.	Light	Loose rust formation, no noticeable section loss
	Medium	Loose rust with scales or flakes. Up to 10% sectional loss
	Severe	Stratified rust with pitting of metal. 10% to 20% section loss
	Very Severe	Localized perforation or rusting through. More than 20% section loss

Permanent Deformation - bending, buckling, twisting or elongation, or any combination thereof.

Note location of deformation

Crack - a linear fracture in the surface of steel or weld.

Cracks perpendicular to direction of stress are critical

Loose Connections - caused by corrosion of connector plates or fasteners, excessive vibration, overstressing, cracking or the failure of the individual fasteners.	Light	up to 5% of fasteners loose or missing
	Medium	5% to 10
	Severe	10% to 20%
	Very Severe	more than 20%

OSIM Checklist

Wood		
Weathering, Checks, Splits and Shakes - deterioration of wood due to sun, rain, wind, frost and atmospheric pollutants.	Light	tissue separation short and extends less than 5% into member
	Medium	separation long and 5% to 10% into member
	Severe	10% to 20%
	Very Severe	more than 20%
Rot and Decay - breakdown of wood by microorganisms.	Light	slight change in colour, wood cannot be penetrated by sharp object
	Medium	surface discolored with black and brown streak. Hollow sounding when tapped
	Severe	surface fibrous, checked or crumbly with fungal fruiting growing on it
	Very Severe	wood can be crumbled and disintegrated with ease
Insect Damage - tunneling and boring by larvae or mature insects.	Light	occasional exit or entrance hole
	Medium	several entrances and exit holes
	Severe	extensive tunneling and holes
	Very Severe	extensive tunneling, holes and larvae insects present
Abrasion and Wear - deterioration caused by vehicles or snowplow blades scarping against wood.	Light	5% section loss
	Medium	5% to 10% section loss
	Severe	10% to 20%
	Very Severe	more than 20%
Cracking, Splintering, Crushing and Shattering - physical damage from vehicular collision or overloading of member.	Light	5% section loss
	Medium	5% to 10% section loss
	Severe	10% to 20%
	Very Severe	more than 20%
Fire and Chemical Damage - charring.	Light	slight charring and 5% section loss
	Medium	5% to 10% section loss
	Severe	10% to 20%
	Very Severe	more than 20%
Loose Connections - loosened due to repetitive or dynamic loading, wear or decay.	Light	up to 5% of fasteners loose or missing
	Medium	5% to 10
	Severe	10% to 20%
	Very Severe	more than 20%
Masonry		
Crack - incomplete separation into one or more parts with or without space between.	Hairline	less than 0.1 mm
	Narrow	0.1 mm to 0.3 mm
	Medium	0.3 mm to 1.0 mm
	Wide	more than 1.0 mm
Splitting, spalling and disintegration - opening of seams, chipping away of pieces of stones or gradual breakdown of stone.	Light	hairline cracks and minor loss of stone surface up to 50 mm section loss
	Medium	narrow cracks and 50 mm to 100 mm section loss
	Severe	spalling and disintegration of stone with 100 mm to 150 mm section loss
	Very Severe	extensive spalling and disintegration of stone with 100 mm to 150 mm section loss
Loss of mortar and stone - loss of mortar due to frost, erosion, plant	Light	loss of mortar from joints of depth up to 20 mm
	Medium	20 to 50 mm

OSIM Checklist

growth or softening by water containing dissolved sulfate or chlorides.	Severe	extensive loss of mortar resulting in loss of stone
	Very Severe	extensive loss of stones jeopardizing the stability of structure
Aluminum		
Corrosion - gradual oxidation of the surface in the presence of moisture.	Light	loose rust formation, no noticeable section loss
	Medium	loose rust with scales or flakes. Up to 10% sectional loss
	Severe	stratified rust with pitting of metal. 10% to 20% section loss
	Very Severe	localized perforation or rusting through. More than 20% section loss
Crack - a linear fracture which may extend partially or completely through the material		
Loose Connections - may occur in bolted or riveted connection.	Light	up to 5% of fasteners loose or missing
	Medium	5% to 10
	Severe	10% to 20%
	Very Severe	more than 20%
Coatings		
Coating Related Defects		Adhesion Related Defects
Checking or crazing		Undercutting
Cracking		Blisters
Alligatoring		Intercoat delamination
Chemical attack		Peeling
Chalking		Underfilm corrosion
Coating Related Defects		
Bridging	Pinholing	
Edge effects	Runs	
Shadows	Sags	
Overspray	Pinpoint rusting	