Final Dam Inspection Report

Durham Lower Dam and Dyke

Municipality of West Grey,
County of Grey, Ontario

D.M. Wills Project Number 22-5540

D.M. Wills Associates Limited
Partners in Engineering, Planning and Environmental Services
Peterborough

February 2023

Prepared for:
Saugeen Valley Conservation Authority

Summary of Revisions

Rev. No.	Revision Title	Date	Summary of Revisions
1	Draft Report	January 2, 2023	Issued for Client Review
2	Final Report	February 3, 2023	Issued as Final

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

Table of Contents

Figures

Tables

Appendices

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 km^2 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, 7 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 dams 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 Durham Lower Dam and Dyke. The inspection of the Durham Lower Dam and Dyke was completed on September 19, 2022, in the presence of SVCA staff.

1.2 Site Location and Access

The Durham Upper Dam and Dyke is located within the limits of the Town of Durham, Ontario, downstream of Lambton Street East on the Saugeen River. The dam is accessed via the public road system and is generally publicly accessible. There is a municipal parking area located on the west side of Queen Street, just north of Saddler Street West. The dam can be accessed on foot from this location. The dam deck / pedestrian walkway gates are generally locked in the open position; however, keys

from the SVCA may be required to access the deck and cross the river if the gates are locked in the closed position. The location of the dam is shown in **Figure 1**.

1.3 Dam Description

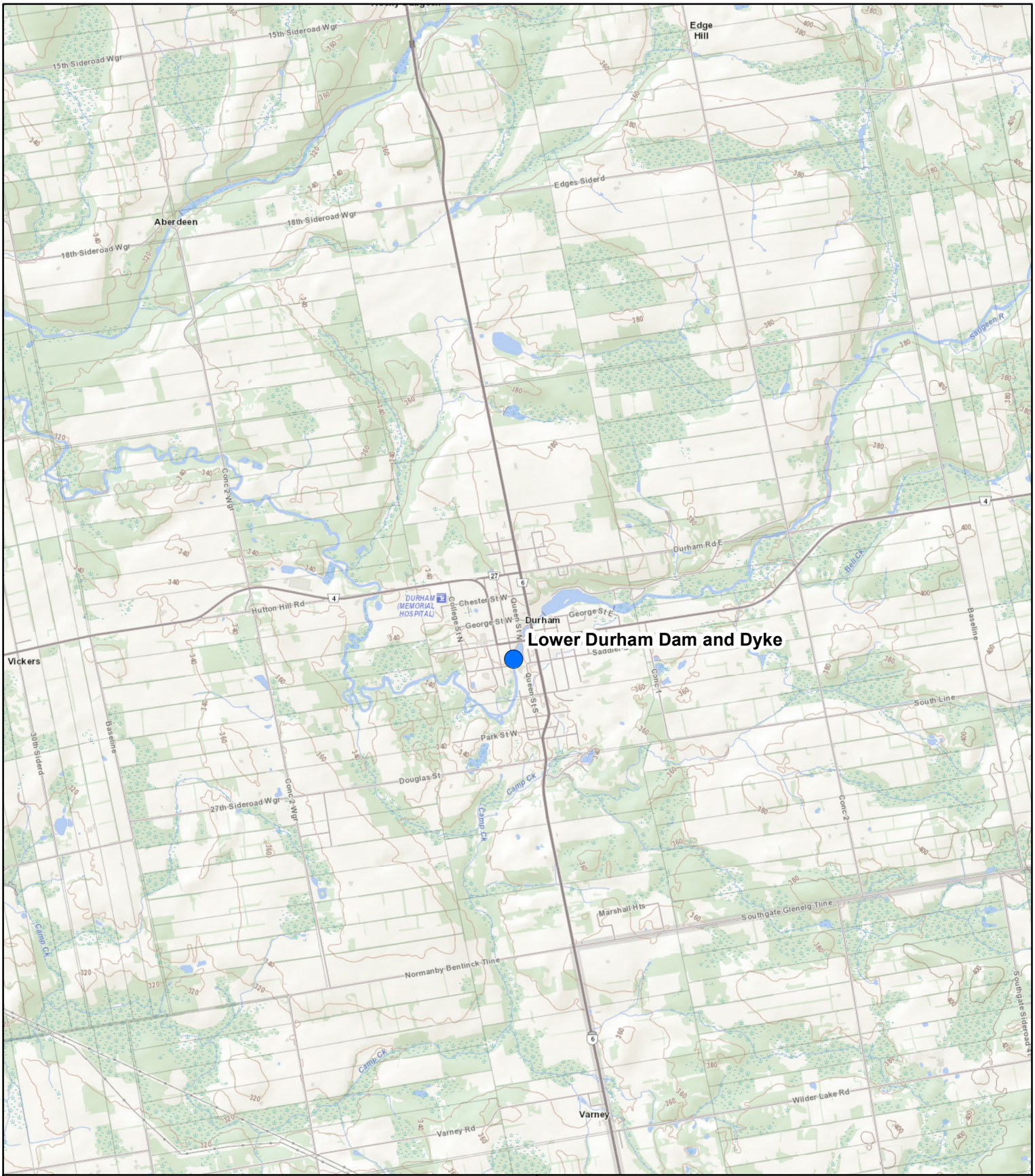
The original date of construction of the Durham Lower Dam is unknown; however, major rehabilitation works, including work on the concrete section of the dam and the installation of erosion protection on the earth embankment, were completed in the early 1980's.

The existing dam is approximately 145 m long and is comprised of a concrete control structure and an earth embankment on the right side of the river. The concrete control structure is approximately 40 m wide and includes five 7.7 m wide sluices made up of two abutments and four piers.

The earth embankment was constructed along the right (east) bank of the Saugeen River to prevent floodwater from leaving the reservoir. The dyke is connected to the dam; however, it is unknown if it is keyed into the structure itself. A rip rap, emergency spillway was constructed through the earth embankment in around 2005 to direct water back into the river during ice jam events. The site plan is shown in **Figure 2**. The location of site features is referenced left to right facing upstream.

1.4 Description of Operations

The Durham Lower Dam is used to assist with the control of frazil ice during the winter months. Dam operations are carried out manually by SVCA staff by removing and replacing stoplogs and flashboards in the sluices. The flashboards are typically installed in mid-May and are put into winter configuration in mid-October.



Legend

- Dam Location

Meters
0 650 1,300 2,600

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:	12/02/22
Project Number:	22-5540
Map File Number	Figure 1

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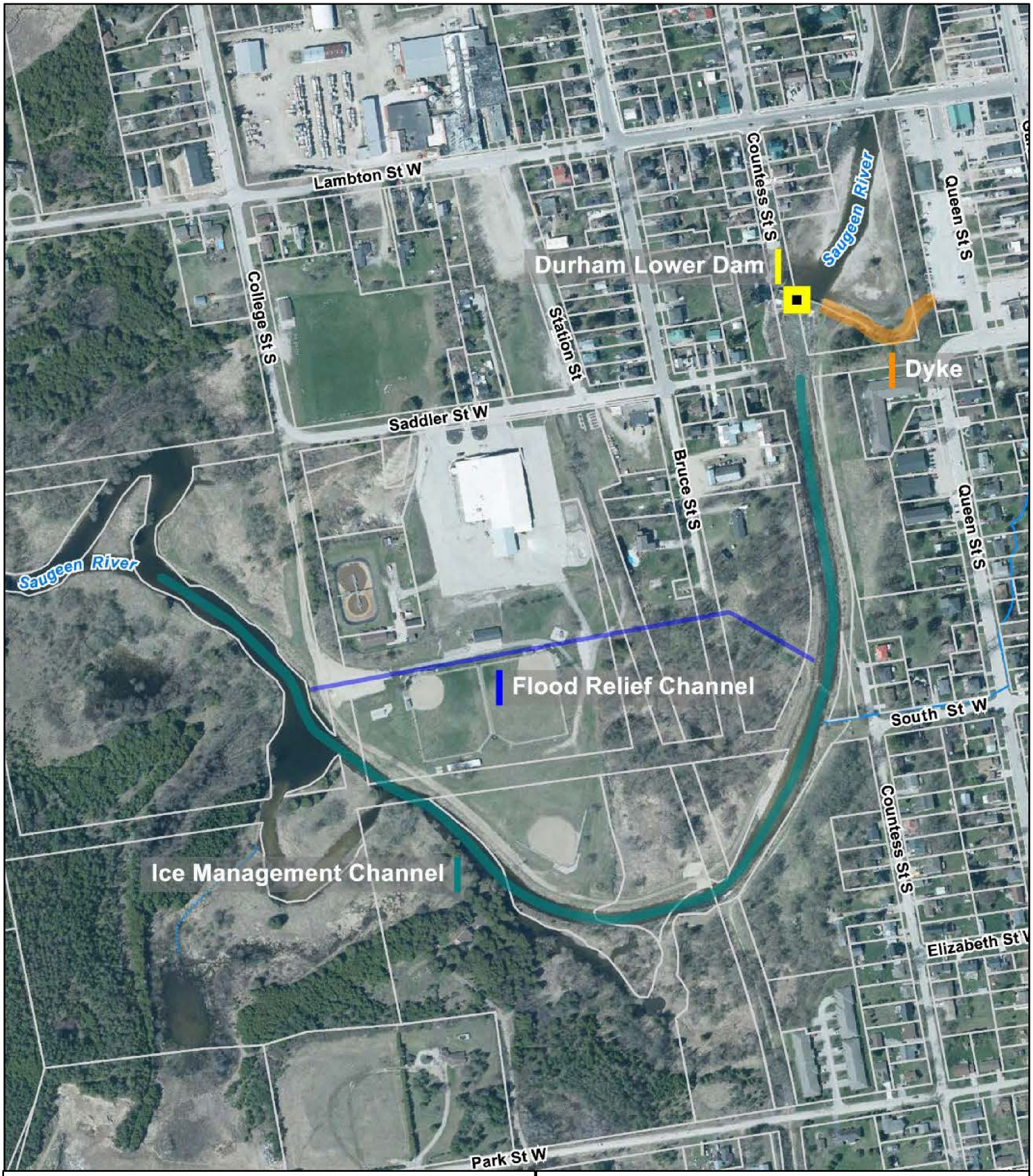

N

Legend

- Dam
- Parcel Fabric
- Permanent Watercourse
- Dyke
- Flood Relief Channel
- Ice Management Channel

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

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

2.2 Dam Condition Assessment

Wills performed a visual and non-destructive structural inspection of the dam. 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 dam.
- Where possible, aerial imagery of the dam and up and downstream areas collected using a Remotely Piloted Aircraft System.
- Where possible, underwater video of the underwater faces of the dam collected using a pole mounted GoPro camera.
- Review of previously identified deficiencies and their digression over time.
- Completion of MNRF Form B-2 (Dam Inspection Form).

Wills classified the structural deficiencies, including those in concrete, steel and wood, 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 at the dam. 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 dam access route(s).
- Visual inspection of existing public safety measures (railings, booms, buoys, etc.).

- Visual inspection of existing operator safety measures (railings, fall arrest).

The inspection of the public safety measures was carried out in accordance with the methodologies and requirements described in the Best Management Practices for Public Safety Around Dams (MNR, 2011), the Guidelines for Public Safety Around Dams (CDA, 2011) and 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 Dam Condition Assessment

Wills performed the inspection of the Durham Lower Dam and Dyke on September 19, 2022. At the time of the inspection, the weather was sunny and approximately 17°C.

The dam inspection results are documented in the photographic record in **Appendix A** and the Dam Inspection 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, the dam was observed to be in fair to good condition with areas of concrete deterioration (cracking, efflorescence and scaling) throughout the abutments and piers. The railings are in fair condition with extensive coating loss throughout and light corrosion developing in areas where coating is not present. The chain link fence installed on the railing is in poor condition with light to medium corrosion as well as broken and damaged sections. The earth embankment and erosion protection are generally in good condition; however, there is significant tree growth on the downstream slope. The emergency spillway is in good condition.

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

Dams, and their associated structures and operational practices, present a number of potential hazards to the public. Protecting the public from these potential hazards is an important element of a dam owner's due diligence. Public safety should be considered throughout all stages of a dam's life cycle, from design to decommissioning; however, this is most important during the operational phase of the project. In Ontario, public safety around dams is managed in accordance with the Best Management Practices for Public Safety Around Dams (MNR, 2011).

The public safety measures that have been installed at the site include:

- Railings along either side of the dam deck / pedestrian bridge.
- Public safety signage present at the site.

Based on our site investigation, Wills identified the following potential public safety issues:

- There is no public safety boom present at the site.
- There is public safety signage present and in fair to good condition, but they do not meet Best Management Practices for Public Safety Around Dams (MNR, 2011).
- The railing is in fair to good condition with extensive coating loss throughout. There is light corrosion developing in areas where coating is not present.
- The chain link fence is in poor condition with light to medium corrosion as well as broken and damaged sections.

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. For the majority of dam sites, there are two (2) 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 extents 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. The existing railing generally meets the requirements for a guard rail under O.Reg. 851.

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 the drawings provided, the potential fall height is less than 3 m; therefore, a fall arrest system for dam operators is not required if the stoplog gain covers are removed.

Potential operator safety issues include:

- Working around the water may require the use of a life jacket or PFD.
- Installation/ removal of stoplogs/ flashboards.
- Clearing of ice in the winter/spring.

Table 1 – Summary of Inspection Results

Structure	Location	Deficiency / Description	Condition Rating	Risk Rating
Earth Embankment				
Earth Embankment	Upstream Slope	None (Photos: 86, 88)	4	1
	Downstream Slope	Some sections are heavily treed with exposed soils on steep slopes (Photos: 89-90)	3	1
Concrete Structures				
Piers	Pier 1	Medium to severe scaling, efflorescence staining and wide cracking (Photos: 26, 62)	3	1
	Pier 2	Medium to severe scaling, efflorescence staining and wide cracking (Photos: 22-24, 56-59)	3	1
	Pier 3	Scouring, localized spalling and concrete disintegration (Photos: 18-20, 50-53)	3	2
	Pier 4	Scouring, localized spalling and concrete disintegration (Photos: 13-15, 44-47)	3	2
Deck/Soffit	Top of Deck	Minor weathering and staining. Longitudinal efflorescence-stained cracks (Photos: 75, 77)	4	1
	Soffit	Wet staining and efflorescence adjacent to the fascia (Photo: 76)	3	1
Abutments	Top of Abutments at Deck Soffit	Wide cracking and spalling (Photos: 4, 26)	3	1
Apron	Downstream	Minor to moderate scaling (Photos: 12, 29-31)	3	1

Structure	Location	Deficiency / Description	Condition Rating	Risk Rating
Wooden and Metal Structures				
Retaining Walls	Upstream Left	Armour stone retaining wall in good condition with possibly some movement (Photo: 64)	3	1
	Downstream Left	Armour stone retaining wall in good condition with possibly some movement, undercutting at the downstream end and vegetation growth behind (Photo: 27)	3	1
	Downstream Right	Gabion baskets are corroded and the ballast is being displaced. The top course of the wall is overturning as middle of wall settles (Photo: 3)	3	2
Walkway Railing	Throughout	Extensive coating loss, light to medium corrosion. Broken and damaged sections of chain link (Photos: 78-80)	3	2
Flow Control Equipment				
Stop logs and Reinforcing Posts	Throughout	Light weathering, rot and decay of the stoplogs (Photos: 11, 37, 43, 55)	3	1

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 dam safety 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/or dam safety requirements and is a high-risk dam safety hazard.
- **Medium** – These items may include additional work that could improve the performance or issues that may become serious dam 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 dam safety 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 dam 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 Dam Safety Management, Public Safety, Operator Safety, Minor Maintenance (repairs < $100,000) and Major Maintenance (repairs > $100,000).

Table 2 – Dam Inspection Recommendations

Recommendation	Description of Deficiency	Priority	Estimated Cost	Additional Comments
Dam Safety Management				
1. Complete a Dam Safety Assessment/Review for the Durham Lower Dam prior to, or as part of, any major decisions regarding the management and maintenance of the dam. The Dam Safety Assessment/Review should be completed in accordance with the Lakes and Rivers Improvement Act Technical Bulletins and Best Management Practices (MNR, 2011).	There is no dam safety information available for the Durham Lower Dam. The SVCA may benefit from having updated Dam Safety information available when making decisions related to the future management and maintenance of the Durham Lower Dam.	Medium	$75,000	The estimated cost assumes that the SVCA would retain the services of a qualified consulting engineering firm to complete a full Dam Safety Review. Cost efficiencies would be gained by completing the Dam Safety Review for the Durham Upper and Lower Dams at the same time. The SVCA may want to consider completing Hazard Potential Classification studies for all of their dams before full Dam Safety Reviews so that the full Dam Safety Reviews can be prioritized for the High hazard structures. The cost of completing the Hazard Potential Classification study would be approximately $30,000 for this structure. The scope of work would include a hydrology study, the development of a hydraulic model, a dam breach assessment and an incremental loss assessment. The price per structure could be reduced if several Hazard Potential Classification studies are completed by the same consultant at the same time.
2. Establish a regular frequency for engineering inspections (i.e. annually or bi-annually) as well as routine inspections by staff (i.e. monthly).	The records of past engineering inspections included reports completed by B.M. Ross in 2015 and 2021. There were no records of past routine inspections, other than photos taken in 2017, 2018, 2019, 2020 and 2021. 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 dam inspection would be estimated as $10,000. It is assumed that the routine inspections would be completed by SVCA staff as part of their regular duties.

Recommendation	Description of Deficiency	Priority	Estimated Cost	Additional Comments
3. Monitor the large woody vegetation on the earth embankment and consider removing damaged or dead trees. Do not allow additional trees to be planted within 5 m of the toe of the embankment or on the embankment itself. Where trees are removed, remediate the root systems to reduce the risk of piping and establish stable ground cover vegetation (i.e. grass).	There are some sections of the downstream slope of the earth embankment that are heavily treed with exposed soil on the steep slopes. The issues that could result from this include: • Root systems weaken the soil and have the potential to cause piping through the embankment. • Tree cover generally leads to poor growing conditions for grass under the tree canopy leading to exposed soils and increasing the potential for erosion. • Trees have large root balls. If a tree is blown over during a storm event, the removal of the root ball could compromise the dyke, increasing the risk of failure and an inability to provide the required flood protection.	Ongoing	$0	It is assumed that this would be completed by SVCA staff as part of their regular duties.
4. Monitor the armour stone retaining walls on the upstream and downstream left sides of the dam to check for movement and deterioration and undertake repairs as required.	The armour stone retaining walls on the upstream and downstream sides of the dam show some signs of deterioration.	Ongoing	$0	It is assumed that this would be completed by SVCA staff as part of their regular duties. Costs to replace the armour stone retaining walls could be in the $10,000 range.
5. Monitor the gabion baskets on the downstream right side of the dam to check for movement and deterioration and undertake repairs as required.	The gabion baskets on the downstream right side of the dam show signs of deterioration.	Ongoing	$0	It is assumed that this would be completed by SVCA staff as part of their regular duties. Costs to replace the gabion basket retaining wall could be in the $5,000 range.
6. Monitor the scour pool on the downstream side of the apron and provide additional rock protection in the event that undermining of the apron occurs.	It appears as though a scour pool has formed downstream of the apron; however, no undercutting was identified during the inspection.	Ongoing	$0	It is assumed that this would be completed by SVCA staff as part of their regular duties. Costs for additional rock protection could be in the $7,500 range.

Recommendation	Description of Deficiency	Priority	Estimated Cost	Additional Comments
Public Safety				
7. Complete a Public Safety Risk Assessment and prepare a Public Safety Plan for the Durham Lower Dam and implement appropriate public safety measures (i.e. railings, fencing, signage, public safety boom/buoys). This work should be completed 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 is no Public Safety Risk Assessment or Public Safety Plan for the Durham Lower Dam and it is evident that there is a significant public presence at the site.	High	$15,000	The cost estimate assumes that the SVCA would retain the services of a qualified consulting engineering firm to complete this work; however, this could be completed by SVCA staff if they have the appropriate knowledge and experience. The appropriate public safety measures and their costs would be identified as part of the Public Safety Risk Assessment.
Minor Maintenance				
8. Replace the staff gauge on the downstream side of the dam and install a staff gauge on the upstream side of the dam.	The staff gauge on the downstream side of the dam is in poor condition and there is no staff gauge on the upstream side of the dam.	High	$2,000	It is assumed that this would be completed by SVCA staff as part of their regular duties with purchased materials.
Major Maintenance				
9. Complete patching and repairs to the concrete piers, deck, abutments, and apron.	The concrete sections of the dam are showing signs of deterioration and repairs will ultimately be required to preserve the service life of the structure.	Medium	$250,000	It is assumed that the SVCA would retain a qualified contractor to undertake this work. The cost estimate includes a detailed concrete condition assessment and detailed design by a professional engineer.

5.0 Conclusion

Wills completed this Dam 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, the dam was observed to be in fair to good condition with areas of concrete deterioration (cracking, efflorescence and scaling) throughout the abutments and piers. The railings are in fair condition with extensive coating loss throughout and light corrosion developing in areas where coating is not present. The chain link fence installed on the railing is in poor condition with light to medium corrosion as well as broken and damaged sections. The earth embankment and erosion protection are generally in good condition; however, there is significant tree growth on the downstream slope. The emergency spillway is in good condition.

The dam 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 dam:

Urgent Priority Items

- None.

Important Priority Items

- Complete a Dam Safety Assessment/Review for the Durham Lower Dam prior to, or as part of, any major decisions regarding the management and maintenance of the dam. The Dam Safety Assessment/Review should be completed in accordance with the Lakes and Rivers Improvement Act Technical Bulletins and Best Management Practices (MNR, 2011).
- Establish a regular frequency for engineering inspections (i.e. annually or bi-annually) as well as routine inspections by staff (i.e. monthly).
- Complete a Public Safety Risk Assessment and prepare a Public Safety Plan for the Durham Lower Dam and implement appropriate public safety measures (i.e. railings, fencing, signage, public safety boom/buoys). This work should be completed in accordance with the Best Management Practices for Public Safety Around Dams (MNR, 2011) and the Guidelines for Public Safety Around Dams (CDA, 2011).
- Replace the staff gauge on the downstream side of the dam and install a staff gauge on the upstream side of the dam.
- Monitor the large woody vegetation on the earth embankment and consider removing damaged or dead trees. Do not allow additional trees to be planted within 5 m of the toe of the embankment or on the embankment itself. Where

trees are removed, remediate the root systems to reduce the risk of piping and establish stable ground cover vegetation (i.e. grass).

- Monitor the armour stone retaining walls on the upstream and downstream left sides of the dam to check for movement and deterioration and undertake repairs as required.
- Monitor the gabion baskets on the downstream right side of the dam to check for movement and deterioration and undertake repairs as required.
- Monitor the scour pool on the downstream side of the apron and provide additional rock protection in the event that undermining of the apron occurs.

Future Priority Items

- Complete patching and repairs to the concrete piers, deck, abutments, and apron.

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

Alex Payette, EIT
Structural Engineer in Training

James Chambers
Project Designer,
Water Resources Engineering

DG/JC/

Appendix A

Photographic Record

Photo 1 - September 19, 2022
Durham Lower Dam and Dyke
Aerial View of Downstream Side of Dam

Photo 2 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Right Side of Dam

Photo 3 - September 19, 2022
Durham Lower Dam and Dyke
Gabion Baskets on Downstream Right Side of Dam

Photo 4 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Right Wingwall and Left Side of Pier 6

Photo 5 - September 19, 2022
Durham Lower Dam and Dyke
Staff Gauge on Downstream Right Wingwall

Photo 6 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Sluiceway 5

Photo 7 - September 19, 2022
Durham Lower Dam and Dyke
Right Side of Pier 5

Photo 8 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Pier 5

Photo 9 - September 19, 2022
Durham Lower Dam and Dyke
Left Side of Pier 5

Photo 10 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Sluiceway 4

Photo 11 - September 19, 2022
Durham Lower Dam and Dyke
Stoplogs in Sluiceway 4

Photo 12 - September 19, 2022
Durham Lower Dam and Dyke
Crack in Apron Below Sluiceway 4

Photo 13 - September 19, 2022
Durham Lower Dam and Dyke
Right Side of Pier 4

Photo 14 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Pier 4

Photo 15 - September 19, 2022
Durham Lower Dam and Dyke
Left Side of Pier 4

Photo 16 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Facing Public Safety Sign Above Pier 4

Photo 17 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Sluiceway 3

Photo 18 - September 19, 2022
Durham Lower Dam and Dyke
Right Side of Pier 3

Photo 19 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Pier 3

Photo 20 - September 19, 2022
Durham Lower Dam and Dyke
Left Side of Pier 3

Photo 21 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Sluiceway 2

Photo 22 - September 19, 2022
Durham Lower Dam and Dyke
Right Side of Pier 2

Photo 23 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Pier 2

Photo 24 - September 19, 2022
Durham Lower Dam and Dyke
Left Side of Pier 2

Photo 25 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Sluiceway 1

Photo 26 - September 19, 2022
Durham Lower Dam and Dyke
Right Side of Pier 1 and Downstream Left Wingwall

Photo 27 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Left Bank

Photo 28 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Left Bank

Photo 29 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Apron

Photo 30 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Apron

Photo 31 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Apron

Photo 32 - September 19, 2022
Durham Lower Dam and Dyke
Aerial View of Upstream Side of Dam

Photo 33 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Right Wingwall

Photo 34 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Right Wingwall

Photo 35 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Pier 6

Photo 36 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Sluiceway 5

Photo 37 - September 19, 2022
Durham Lower Dam and Dyke
Stoplogs on Upstream Side of Sluiceway 5

Photo 38 - September 19, 2022
Durham Lower Dam and Dyke
Right Side of Pier 5

Photo 39 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Pier 5

Photo 40 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Pier 5

Photo 41 - September 19, 2022
Durham Lower Dam and Dyke
Left Side of Pier 5

Photo 42 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Sluiceway 4

Photo 43 - September 19, 2022
Durham Lower Dam and Dyke
Stoplogs on Upstream Side of Sluiceway 4

Photo 44 - September 19, 2022
Durham Lower Dam and Dyke
Right Side of Pier 4

Photo 45 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Pier 4

Photo 46 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Pier 4

Photo 47 - September 19, 2022
Durham Lower Dam and Dyke
Left Side of Pier 4

Photo 48 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Sluiceway 3

Photo 49 - September 19, 2022
Durham Lower Dam and Dyke
Stoplogs on Upstream Side of Sluiceway 3

Photo 50 - September 19, 2022
Durham Lower Dam and Dyke
Right Side of Pier 3

Photo 51 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Pier 3

Photo 52 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Pier 3

Photo 53 - September 19, 2022
Durham Lower Dam and Dyke
Left Side of Pier 3

Photo 54 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Sluiceway 2

Photo 55 - September 19, 2022
Durham Lower Dam and Dyke
Stoplogs on Upstream Side of Sluiceway 2

Photo 56 - September 19, 2022
Durham Lower Dam and Dyke
Right Side of Pier 2

Photo 57 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Pier 2

Photo 58 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Pier 2

Photo 59 - September 19, 2022
Durham Lower Dam and Dyke
Left Side of Pier 2

Photo 60 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Sluiceway 1

Photo 61 - September 19, 2022
Durham Lower Dam and Dyke
Stoplogs on Upstream Side of Sluiceway 1

Photo 62 - September 19, 2022
Durham Lower Dam and Dyke
Right Side of Pier 1

Photo 63 - September 19, 2022
Durham Lower Dam and Dyke
Right Side of Pier 1

Photo 64 - September 19, 2022
Durham Lower Dam and Dyke
Stone Retaining Wall on Upstream Left Bank

Photo 65 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Watercourse

Photo 66 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Dam and Emergency Spillway

Photo 67 - September 19, 2022
Durham Lower Dam and Dyke
Overhead View of Dam and Emergency Spillway

Photo 68 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Emergency Spillway

Photo 69 - September 19, 2022
Durham Lower Dam and Dyke
Emergecy Spillway

Photo 70 - September 19, 2022
Durham Lower Dam and Dyke
Emergency Spillway

Photo 71 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Emergency Spillway

Photo 72 - September 19, 2022
Durham Lower Dam and Dyke
Overhead View of Dam Deck

Photo 73 - September 19, 2022
Durham Lower Dam and Dyke
Dam Deck and Pedestrian Walkway from Right Bank

Photo 74 - September 19, 2022
Durham Lower Dam and Dyke
Right Facing Public Safety Sign

Photo 75 - September 19, 2022
Durham Lower Dam and Dyke
Dam Deck and Pedestrian Walkway

Photo 76 - September 19, 2022
Durham Lower Dam and Dyke
Typical Railing Anchor and Deck Soffit

Photo 77 - September 19, 2022
Durham Lower Dam and Dyke
Typical Concrete Joint on Dam Deck

Photo 78 - September 19, 2022
Durham Lower Dam and Dyke
Fence on Downstream Left Wingwall

Photo 79 - September 19, 2022
Durham Lower Dam and Dyke
Dam Deck and Pedestrian Walkway from Left Side

Photo 80 - September 19, 2022
Durham Lower Dam and Dyke
Dam Deck and Pedestrian Walkway from Left Bank

Photo 81 - September 19, 2022
Durham Lower Dam and Dyke
Left Facing Public Safety Sign

Photo 82 - September 19, 2022
Durham Lower Dam and Dyke
Roadway on Left Bank

Photo 83 - September 19, 2022
Durham Lower Dam and Dyke
Aerial View of Dyke

Photo 84 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Dyke at Control Structure

Photo 85 - September 19, 2022
Durham Lower Dam and Dyke
Crest of Dyke

Photo 86 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Dyke

Photo 87 - September 19, 2022
Durham Lower Dam and Dyke
Walking Path on Crest of Dyke

Photo 88 - September 19, 2022
Durham Lower Dam and Dyke
Upstream Side of Dyke

Photo 89 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Dyke

Photo 90 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Dyke

Photo 91 - September 19, 2022
Durham Lower Dam and Dyke
Downstream Side of Dyke

Photo 92 - September 19, 2022
Durham Lower Dam and Dyke
Aerial View of Upstream Side of Dam and Dyke

Appendix B

Dam Inspection Form B2

Form B2

Dam Inspection Form

Date:	Monday, September 19, 2022
Name of Dam:	Durham Lower Dam and Dyke
Municipality:	Municipality of West Grey, County of Grey
Location:	Lot 26, Concession 1, West of Owen Sound Road Geographic Township of Bentinck
GPS Coordinates:	514312.00 m E, 4891276.00 m N, UTM Zone 17T
Inspected By:	David Green, P.Eng., Alex Payette, EIT
Weather:	Sunny, 15°C

1 – Earth Embankment

There is an earth embankment on the right side of the concrete control structure. The embankment starts at the right abutment and runs along the edge of the waterline to a public parking area. The earth embankment acts as a dyke and is part of the flood management plan for the Town of Durham.

The upstream side of the embankment is gently sloped and consists of various types of vegetation, grasses, and trees towards the parking area. Towards the control structure, there is round rip-rap placed on the upstream side of the embankment that extends into the watercourse. Some larger round rocks are also present on the upstream side. A granular path runs along the crest of the embankment to provide access across the dam. The path is in good condition with no apparent areas of erosion.

The downstream side of the embankment is generally covered in closely cut grass; however, there are some sections of the downstream slope that are heavily treed with exposed soil on the steep slopes. Adjacent to the control structure, there is an emergency spillway. The spillway has angular rip-rap beside the crest of embankment. At the end of the spillway, towards the watercourse, an articulating block system is implemented. Grass is growing between the articulating concrete units. No erosion was observed in the emergency spillway area.

Generally, both the upstream and downstream sides of the embankment showed little signs of erosion.

2 – Concrete Structures (wingwalls, piers, deck, spillways, apron, etc.)

Piers/Abutments – Water levels and the sill configuration allowed full access to the concrete piers. A sounding hammer was used in conjunction with visual inspection to determine concrete condition and map deterioration. The pier faces are all experiencing similar deterioration patterns. Medium to severe scaling is noted towards the bottom of all piers at the apparent high-water line, efflorescence staining above the waterline and wide cracking and spalling at the top of the pier adjacent to the walkway are also present. Piers 3 and 4 are exhibiting areas of scouring and

concrete disintegration at the base. These same piers have localized areas of spalling. The pier toes on all piers are in fair to poor condition. Generally, they are showing spalling and delamination, severe scaling with some concrete disintegration and various cracking.

Deck/Soffit – The concrete deck is a walkway that runs along the length of the control structure to provide access for dam operators to manipulate the stoplogs and allow members of the public to reach the other side of the river. The top of the deck is in good condition with minor weathering and staining on the outer edges and longitudinal efflorescence-stained cracks. The deck soffit is in good condition with efflorescence and wet staining adjacent to the fascia. Where the soffit meets the abutments, the concrete is showing wide cracking and spalling. The deck is bearing on this deteriorating concrete at the abutments.

Apron – Water flow limited the physical testing of the apron and downstream face. A visual inspection revealed minor to moderate scaling across the topside of the apron. A pole mounted GoPro camera was used to photograph the vertical face of the apron. Inspection was difficult due to the falling water, but the face appears to be in good condition with light scaling. Within Sluiceways 3 and 4, it appears as though extra concrete was placed on the apron. This has caused these sluiceways to be raised and at the joint where the raised section meets the normal sluiceway, there is a large gap. The joint is being eroded by constant water flow and was approximately 125 mm in width. No undermining of the apron was identified from the underwater inspection and some rock protection was in place even though there was an apparent scour pool downstream of the dam.

3 – Wooden, Metal and Masonry Structures (decks, gains, railings, conduits, etc.)

Retaining Walls – Armour stone retaining walls exist on the left abutment, on the upstream and downstream sides of the control structure. The stone units appear to be square and no settlement or overturning is present. There is a gabion basket retaining wall on the downstream right side of the control structure between the overflow spillway and the edge of the watercourse. The bottom course of gabion baskets are corroded and ballast is being displaced. The top course of the wall is overturning as the middle of the wall is settling.

Walkway Railing – The metal pipe railing consists of vertical posts attached to the fascia of the walkway with horizontal pipe members connecting the posts. Chain link fence is attached to the inside of the railing. The railing is in fair to good condition with extensive coating loss throughout. There is light corrosion developing in areas where coating is not present. The chain link fence is in poor condition with light to medium corrosion as well as broken and damaged sections.

4 – Gates and/or Stop Logs

Stoplogs and Reinforcing Posts – The stoplogs consist of 35 mm x 140 mm dimensional timber stacked on edge. To reinforce the stoplogs there are two 140 mm x 140 mm vertical posts placed behind the stoplogs to prevent excessive deflection of the

stoplogs. The stoplogs and posts are exhibiting light weathering, rot, and decay, consistent with the environment in which they are being used.

5 – Water Level Gauge (reading and condition)

There is manual staff gauge mounted to the downstream left side of the right abutment. right section of the abutment pier. The staff gauge is in poor condition with flaking of the paint, corrosion, and corrosion staining. The staff gauge is also bent.

6 – Winches (type and number)

There are no winches associated with the Durham Lower Dam.

7 – Valves (type and number)

There are no valves associated with the Durham Lower Dam.

8 – Boom (driftwood, chains, anchors)

There is no public safety boom associated with the Durham Lower Dam.

9 – Erosion (upstream and downstream)

There is a small scour pool downstream of the apron; however, there does not appear to be any undermining of the structure as there is still some rock protection in place. No major erosion was identified at the site.

10 – Seepage or Leaks

No seepage or leaks were identified at the time of the inspection.

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

The dam is accessed via the public road system and is generally publicly accessible. There is a municipal parking area located on the west side of Queen Street, just north of Saddler Street West. The dam can be accessed on foot from this location. The dam deck/pedestrian walkway gates are generally locked in the open position; however, keys from the SVCA may be required to access the deck and cross the river if the gates are locked in the closed position.

12 – Safety Issues (public and operator)

Public Safety – The chain link fencing material attached to the railings is in poor condition, there is no public safety boom, and there is inadequate public safety signage. Prior to implementing additional public safety measures, a Public Safety Risk Assessment should be completed so that the SVCA can understand the public activities and hazards at the dam site in order to ensure that appropriate public safety measures are implemented. A Public Safety Plan that outlines how the SVCA will manage public safety at the dam should also be prepared.

Operator Safety – Operator safety issues that were identified by Wills through conversation with SVCA staff were the installation/removal of stoplogs/flashboards and the clearing of ice in the winter/spring.

13 – Signage

There are small (18 inch by 24 inch) public safety signs mounted to the railings on the upstream and downstream sides of the dam. The signs read "DANGER, NO TRESPASSING, Access Beyond This Point May Result in Drowning" and includes the old SVCA logo as well as the address of the dam and instructions to call 911 in an emergency. The signs are in good condition; however, they are not the correct signs for facing upstream and downstream.

There are "PRIVATE PROPERTY, USE AT OWN RISK" signs mounted to the fencing on the left and right abutments. The signs appear to be hand painted and are in fair to good condition. The signs do not meet the requirements of the Best Management Practices for Public Safety Around Dams (MNR, 2011).

14 – Divestment and/or Decommissioning Opportunities

It is understood that the dam is used to assist with the control of frazil ice during the winter months; therefore, unless this need changes, there are likely limited opportunities for divestment or decommissioning.

15 – General Remarks

There is no dam safety information available for the Durham Lower Dam. The SVCA may benefit from having updated Dam Safety information available when making decisions related to the future management and maintenance of the Durham Lower Dam.

B.M. Ross and Associates Limited completed a structural review of the dam in 2021 and recommended that concrete patching and repairs be completed within the next five years.

A Public Safety Risk Assessment and Public Safety Plan have not been provided for the Durham Lower Dam and there is a significant public presence at the site.

The records of past engineering inspections included reports completed by B.M. Ross in 2015 and 2021. There were no records of past routine inspections, other than photos taken in 2017, 2018, 2019, 2020 and 2021. 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).

16 – Recommendations

- Complete a Dam Safety Assessment/Review for the Durham Lower Dam prior to, or as part of, any major decisions regarding the management and maintenance of the dam. The Dam Safety Assessment/Review should be completed in accordance with the Lakes and Rivers Improvement Act Technical Bulletins and Best Management Practices (MNR, 2011).
- Establish a regular frequency for engineering inspections (i.e. annually or bi-annually) as well as routine inspections by staff (i.e. monthly).

- Complete a Public Safety Risk Assessment and prepare a Public Safety Plan for the Durham Lower Dam and implement appropriate public safety measures (i.e. railings, fencing, signage, public safety boom/buoys). This work should be completed in accordance with the Best Management Practices for Public Safety Around Dams (MNR, 2011) and the Guidelines for Public Safety Around Dams (CDA, 2011).
- Replace the staff gauge on the downstream side of the dam and install a staff gauge on the upstream side of the dam.
- Monitor the large woody vegetation on the earth embankment and consider removing damaged or dead trees. Do not allow additional trees to be planted within 5 m of the toe of the embankment or on the embankment itself. Where trees are removed, remediate the root systems to reduce the risk of piping and establish stable ground cover vegetation (i.e. grass).
- Complete patching and repairs to the concrete piers, deck, abutments, and apron.
- Monitor the armour stone retaining walls on the upstream and downstream left sides of the dam to check for movement and deterioration and undertake repairs as required.
- Monitor the gabion baskets on the downstream right side of the dam to check for movement and deterioration and undertake repairs as required.
- Monitor the scour pool on the downstream side of the apron and provide additional rock protection in the event that undermining of the apron occurs.

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	