

The Corporation of the Village of Cumberland  
Committee of the Whole Meeting Agenda

Monday, February 23, 2026, 3:00 p.m.  
Cultural Centre  
2674 Dunsmuir Avenue



We are honoured to gather on the unceded traditional territory of the K'ómoks First Nation.  
The public may view the meeting live on the [Village of Cumberland YouTube channel](#)

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Pages

1. Call to Order

2. Agenda

2.1 Agenda for Committee of the Whole meeting, February 23, 2026

**Recommendation:**

THAT the Committee approve the Agenda for the February 23, 2026  
Committee of the Whole Meeting.

3. Delegations

4. Reports

4.1 No. 2 Dam Design – Hydrology Assessment  
Prepared by Jason Wallace, Manager of Municipal Projects

3

**Recommendation:**

THAT the Committee of the Whole support staff continuing to move forward with Option 3, which includes upgrading both No. 2 Dam and Henderson Lake Dam as indicated in the Cumberland No. 2 Dam & North Branch Perseverance Creek Rehabilitation Design – Hydrology Assessment dated February 17, 2026.

5. Question Period

A member of the public may only inquire about items included on the Agenda for that meeting during a question period.

- Please send questions by email to [info@cumberland.ca](mailto:info@cumberland.ca) using subject line "Question Period" ; Note: please limit to questions only - comments will not be read.

6. Closed Portion

**Recommendation:**

THAT Council close the meeting to the public pursuant to Section 90 of the *Community Charter* to consider:

(e) the acquisition, disposition or expropriation of land or improvements, if the

council considers that disclosure could reasonably be expected to harm the interests of the municipality;

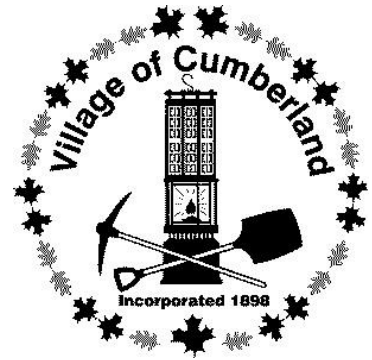
(i) the receipt of advice that is subject to solicitor-client privilege, including communications necessary for that purpose;

**7. Adjournment**

**Recommendation:**

THAT the Committee adjourn the meeting.

# COMMITTEE OF THE WHOLE REPORT



File No. 5600-12

REPORT DATE: February 10, 2026  
 MEETING DATE: February 23, 2026

TO: Mayor and Councillors

FROM: Jason Wallace, Manager of Municipal Projects

SUBJECT: No. 2 Dam Design – Hydrology Assessment

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## RECOMMENDATION

THAT the Committee of the Whole support staff continuing to move forward with Option 3, which includes upgrading both No. 2 Dam and Henderson Lake Dam as indicated in the Cumberland No. 2 Dam & North Branch Perseverance Creek Rehabilitation Design – Hydrology Assessment dated February 17, 2026.

## PURPOSE

To summarize the findings of the recent hydrology assessment for the Cumberland No. 2 Dam and North Branch Perseverance Creek and to outline the recommended approach—proceeding with *Option 3*—to address dam safety concerns and reduce ongoing erosion impacts along the North Branch.

## PREVIOUS COUNCIL DIRECTION

Date	Resolution
Nov 24, 2025	<p>THAT Council indicates its support for the proposed activities outlined in the application for funding of \$2,700,000 from the Strategic Priorities Fund under the Canada Community Building Fund in British Columbia for the No. 2 Dam Replacement Project;</p> <p>THAT Council indicates its willingness to provide overall grant management for the funding received through the Strategic Priorities Fund under the Canada Community Building Fund in British Columbia;</p> <p>THAT Council indicates its support for any cost overruns associated with the No. 2 Dam Replacement Project beyond the amounts approved under the funding program.</p>
June 9, 2025	<p>THAT Council approve the submission of grant funding application for \$2,700,000 for the No 2 Dam Project to the Strategic Priorities Fund under the new 2024-2034 Canada Community Building Fund agreement.</p>

May 26, 2025	<p>THAT Council receives the No. 2 Dam DRAFT Project Climate Hazard Assessment and Updated Cost Estimates reports for information.</p> <p>THAT Council direct staff to continue with the RFP for Design and Engineering services.</p>
January 27, 2025	THAT Council approve a design bid build procurement methodology for the No. 2 Dam Replacement Project including issuing an RFP for design services for this project.
March 25, 2024	THAT Council direct staff to review the scope for No. 2 Dam Project to include increasing storage capacity, trickle for fish, and updated cost estimates for the project.
January 8, 2024	THAT Council direct staff to consider Perseverance Creek, fish habitat, and environmental flows during the pre-design of the No. 2 Dam project, and report back to Council with more detailed information, whether environmental flows can be achieved, and impacts to the drinking water supply.
December 12, 2022	THAT Council receive a presentation on the No. 2 Dam project from Tim Ennis of Latitude Conservation Solutions, Village consultant for engagement services for project.
September 28, 2020	<p>THAT Council direct staff to submit an application for grant funding for the No. 2 Dam Rebuild through the Investing in Canada Infrastructure Program – Rural and Northern Communities.</p> <p>THAT Council supports the project and commits to its share of the project costs, which would only include costs not covered under the program or cost overruns beyond the project costs applied for, as this grant program under the Rural and Northern Communities intake is for 100% funding.</p>

## BACKGROUND

Tetra Tech as a subconsultant to ISL Engineering has completed the hydrology assessment for the No. 2 Dam and associated systems, including Henderson Lake Dam and the North Branch of Perseverance Creek. The review confirms that both dams have spillway capacity deficiencies under modern hydrologic design criteria, and that current flow routing practices exacerbate erosion in the North Branch channel.

The study evaluated three enhancement options to address dam safety and channel erosion issues. Option 3 was identified as the most suitable because it balances dam safety upgrades while significantly reducing the frequency of flow releases to the North Branch of Perseverance Creek.

### Key Findings from the Hydrology Assessment

- Under existing conditions, **No. 2 Dam overtops during events  $\geq 100$ -year**, with an overtopping depth of up to 0.28 m during the 1,000-year event.

- Henderson Lake Dam also experiences overtopping even during the **10-year event**, confirming inadequate spillway capacity.
- Current operations route nearly all major flows from No. 2 Lake toward **North Branch Perseverance Creek**, where significant erosion has been documented.
- Rehabilitation of the North Branch channel to safely convey major flood flows is **not financially feasible at this time**, necessitating an alternative approach. This is due to the fact that the extent of the erosion has increased significantly since the last report was created, as well as extremely limited access that at this time no practical cost effective solution to mobilizing in this corridor has been identified.

### **Option 1**

Proposed maintaining Henderson Lake Dam in its current state and continuing to route all major flows from No. 2 Lake toward the North Branch of Perseverance Creek. While this option would address dam safety concerns at No. 2 Dam, it would not resolve the significant conveyance deficiency at Henderson Lake Dam and would leave the Village exposed to continued—and worsening—erosion impacts along the North Branch.

### **Option 2**

Involved upgrading Henderson Lake Dam and spillway sufficiently to accommodate only the flows from its own direct drainage basin (i.e., the 100-year event), while maintaining No. 2 Lake’s south channel as the primary outlet during larger flood events. Although this option addresses dam safety at both structures, it would still result in frequent discharges to the North Branch, meaning that erosion concerns would remain largely unmitigated.

### **Recommended Path Forward – Option 3**

Option 3 includes upgrading both No. 2 Dam and Henderson Lake Dam to redistribute and better manage flood flows:

1. **Upgrade Henderson Lake Dam and spillway** to safely pass the 100-year event with freeboard and route the 1,000-year event without freeboard.
2. **Add a main spillway at No. 2 Dam** to direct more frequent flows ( $\leq 10$ -year events) toward Cumberland Creek rather than toward the North Branch.
3. **Retain the south channel as an auxiliary spillway**, operating only during large flood events ( $> 10$ -year), greatly reducing erosion pressure on the North Branch.

Together, these upgrades:

- Resolve dam safety deficiencies at *both* No. 2 Dam and Henderson Lake Dam.
- **Substantially reduce** the frequency and volume of flows routed into North Branch Perseverance Creek.

- Allow the Village to manage risk without undertaking the currently cost-prohibitive remediation of the North Branch channel.

While there has been conversation about the need to review long term water supply sustainability and the possibility of rebuilding the Hamilton Lake Dam structure this would not negate the need to move forward with this work.

Staff have reviewed the hydrology assessment and confirm that **Option 3 is the most practical and effective solution** to advance. While the upgrades to Henderson Dam and spillway require additional capital, the alternative—full remediation of the North Branch—is not feasible at this time and will be added to future upgrades when funding allows. Option 3 allows the Village to meet dam safety obligations, reduce erosion risk, and responsibly manage long-term infrastructure costs.

Review of the attached report by the PWI group was not yet be completed prior to this report. Further review of this project and integration with the work being completed by the PWI is still ongoing.

### **FINANCIAL IMPLICATIONS**

Updated cost estimates are being prepared for review in the future.

In fall 2022, the Village received confirmation of funding in the amount of \$4,475,000 from the province’s “Investing in Canada Infrastructure Program” for the reconstruction of Dam #2 and adjacent works.

Earlier in 2025, the Village submitted a grant funding application for \$2,700,000 for the Strategic Priorities Fund under the 2024-2034 Canada Community Building Fund agreement. A response is expected by July 2026.

A contribution of \$95,000 is funded from the Growing Community Funds for non-eligible costs.

Staff continue to review funding opportunities to support continued efforts on this project.

### **OPERATIONAL IMPLICATIONS**

There are no operational implications arising from this updated resolution. The operational implications of the actual project will be better understood once the detailed design is developed by the successful engineering firm.

### **CLIMATE CHANGE IMPLICATIONS**

There are no climate change implications that arise from the topic discussed within this report.

### **ALTERNATIVES**

1. That Council choose to move forward with a different option as indicated in the report and/or choose not to move forward with the project at this time.

**STRATEGIC OBJECTIVE**

- Diverse and Health Community
- Sustainable Service Delivery and Asset Management
- Community Planning

**ATTACHMENTS**

1. Cumberland No. 2 Dam & North Branch Perseverance Creek Rehabilitation Design – Hydrology Assessment, February 17, 2026, Tetra Tech Canada Inc.

**CONCURRENCE**

David Dougherty, Director of Engineering and Public Works **DD**

Annie Bérard-Ball, Director of Corporate Services **ABB**

Respectfully submitted,

***J. Wallace***

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Jason Wallace  
Manager of Municipal Projects

***M. Mason***

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Michelle Mason  
Chief Administrative Officer

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**To:** Mike Elliott, Mid-Island Lead, ISL Engineering and Land Services

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**Cc:** Jason Wallace, Manager of Municipal Projects, Village of Cumberland,

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**From:** Mohammad Mohammadi, M.Sc., E.I.T., Hydrotechnical Engineer-in-Training  
Babak Alinejad, P.Eng, MBA, Hydrotechnical Lead  
Jennifer Sinclair, P.Eng, Project Manager/Dam Practice Manager

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**Date:** February 17, 2026

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**Subject:** Cumberland No. 2 Dam & North Branch Perseverance Creek Rehabilitation Design – Hydrology Assessment

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*This 'Issued for Review' document is provided solely for the purpose of client review and presents our interim findings and recommendations to date. Our usable findings and recommendations are provided only through an 'Issued for Use' document, which will be issued subsequent to this review. Final design should not be undertaken based on the interim recommendations made herein. Once our report is issued for use, the 'Issued for Review' document should be either returned to Tetra Tech Canada Inc. (Tetra Tech) or destroyed.*

## 1.0 INTRODUCTION

ISL Engineering and Land Services (ISL) has engaged Tetra Tech Canada Inc. (Tetra Tech) on behalf of the Village of Cumberland through a subconsultant agreement, to complete preliminary rehabilitation designs for Cumberland No. 2 Lake Dam and resulting upgrade requirements to Henderson Lake Dam due to cascading effects. It was understood that the scope was to be limited to updating the dams but also to consider minimizing impacts to erosion occurring along the North Branch of Perseverance Creek. The scope of this memo includes the initial hydrology work completed to assess the existing hydrological conditions to current standards of practice and develop a conceptual model for rehabilitation. Future work and report are planned to further develop this concept and detail the planned rehabilitation design. Preliminary baseplan drawings for the project are attached in Appendix A.

## 2.0 DATA COLLECTION AND INFORMATION REVIEW

### 2.1 AVAILABLE INFORMATION SOURCES

- Hayco, Cumberland Water Supply Reservoir Dam Safety Review – 1000 yr Flood Estimate and Spillway Capacity Analysis, 2003.
- Tetra Tech EBA, Cumberland Dam Breach Inundation Study, 2015.
- Tetra Tech EBA, Cumberland Dams – Consequence Classification, 2016.
- Tetra Tech, Village of Cumberland Hydrotechnical Assessment for Henderson and No.2 Lake Dams, 2019.

## 2.2 MAPPING DATA

- Government of Canada, [Geospatial Data Extraction Tool](#), Canadian Digital Elevation Model.
- Topography from ISL Engineering and Land Services Ltd., October 2025.

## 2.3 STAGE-STORAGE

Reservoir storage values are based on the available information from the previous DBIS (Tetra Tech EBA, 2015) and the topography provided by ISL.

Table 2-1: Stage-Storage Information

Elevation (m)	Storage (dam <sup>3</sup> )	Note
<b>Stevens Lake</b>		
618.5	136.0	FSL, Tetra Tech EBA, 2015
620.8	231.0	ToD, Tetra Tech EBA, 2015
625.0	404.5	Estimated
<b>Hamilton Lake</b>		
548.9	15.0	FSL, Estimated
550.0	45.4	ToD, Tetra Tech EBA, 2015
555	168.4	Estimated
<b>Cumberland No.2 Lake</b>		
454.6	61.0	Tetra Tech EBA, 2015, topography
456.7	98.4	ToD (Tetra Tech EBA, 2015, topography)
460.0	161	Estimated based on topography
<b>Henderson Lake</b>		
256.5	3.0	Tetra Tech EBA, 2015, Topography
258.0	4.9	ToD (Tetra Tech EBA, 2015, topography)
260.1	13.1	Estimated based on topography

## 2.4 DISCHARGE CAPACITY

Spillway widths were taken from the Tetra Tech 2019 Hydrotechnical Assessment. All dam overtopping and spillways are assumed to be broad-crested with a weir coefficient of  $1.6 \sqrt{m/s}$ , except for No.2 Lake South Channel Outlet and Henderson Lake spillway. A rating curve was developed for No.2 Lake South Channel Outlet based on open channel calculation, with an assumed slope of 1% and a manning's n value of 0.07. The cross section is based on topography. A sharp-crested weir was assumed for Henderson Lake with a coefficient of  $1.8 \sqrt{m/s}$ . Dam overtopping elevation and width for the No.2 Lake Dam and Henderson Lake Dam were defined based on the non-level overflow method using the dam cross sections from the topography.

Table 2-2: Discharge Capacity

Parameter	Steven’s Lake		Hamilton Lake		Cumberland No. 2 Lake		Henderson Lake	
	Spillway	Overtop	Spillway	Overtop	Outlet	Overtop	Spillway	Overtop
Invert El. (m)	618.5	620.8	548.9	550.0	See Figure 2-1	Cross Section	256.67	Cross Section
Width (m)	8.0	52.0	8.0	19.0			3.1	

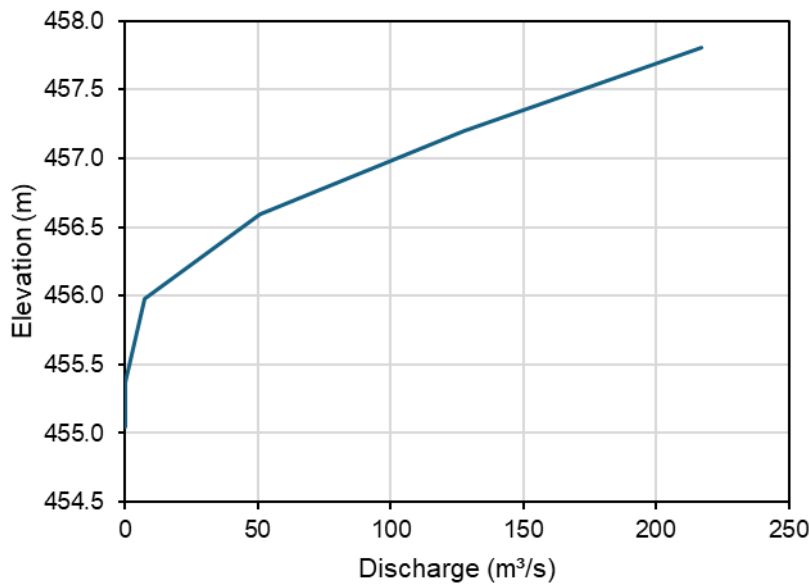


Figure 2-1: Existing Cumberland South Outlet Channel Discharge Capacity

## 3.0 HYDROLOGY

### 3.1 RAINFALL

BC MetPortal was developed based on the work completed between 2018 and 2021 for the province by collaboration of the government of British Columbia, technical advisors, and consultants. The information from the portal meant to supplements available hydrology and hydrometeorological data with the goal was to improve the quality and accessibility of data about extreme flood events in B.C., according to the website.

IDF CC Tool is another source of hydrologic information available which was developed by the Western University for the country.

Rainfall information is available from BC MetPortal<sup>1</sup> and IDF\_CC Tool<sup>2</sup>. Table 3-1 provides 24-hr rainfall depths for various events for the study area.

Table 3-1: 24-hr Rainfall Depth (mm) for Various Return Periods

Event	BC MetPortal	IDF_CC Tool	Hayco 2003
10-yr	149	112	-
20-yr	166	127	-
50-yr	188	146	-
100-yr	204	161	-
200-yr	220	-	-
500-yr	241	-	-
1000-yr	257	-	174.2
PMP	437	-	-

BC MetPortal values are relatively higher and will be used in this study as the most recent industry approach. The selected 1,000-yr rainfall depth in this study is 48% more than the Hayco 2003 study.

Soil Conservation Service (SCS) of the United States Department of Agriculture (USDA) developed rainfall distribution for different geographical locations and runoff assessment for different type of soil. There is no guideline for selecting a rainfall distribution type in BC. A general approach is Type IA storm would be appropriate for the south coastal and the adjacent south-west interior, Type II within the interior of BC, and Type I for north coast and areas adjacent to Alaskan pan handle. However, there is a study by M. Robert which contradicts this assumption<sup>3</sup>. Based on Robert’s study, SCS Type I was determined to be a better representative of the rainfall based on the data from Vancouver YVR station (Robert, 2017).

Thus, to determine the rainfall distribution for the area, rainfall depths were plotted against various SCS storm distributions (See Figure 3-1). The information for the project site is based on the IDF\_CC\_Tool as it provides the data for various rainfall durations. SCS Type I and IA temporal rainfall distribution seem to match the observed rainfall characteristics of the region. SCS Type I distribution is selected in this study as it is a better match for longer rainfall durations and also generally provides better representation of the project site data.

<sup>1</sup> MTI International. BC MetPortal. URL: [https://rti-metportal.shinyapps.io/bc\\_region/](https://rti-metportal.shinyapps.io/bc_region/). Date Accessed: 2025-12-02.

<sup>2</sup> Western Canada University. IDF\_CC Tool 8.0. Computerized Tool for the Development of Intensity-Duration-Frequency Curves under Climate Change – Version 8.0. URL: <https://www.idf-cc-uwo.ca/>. Date Accessed: 2025-12-02.

<sup>3</sup> M. Robert, SCS Storm Type Selection for Estimating Design Flows in British Columbia, 2017.

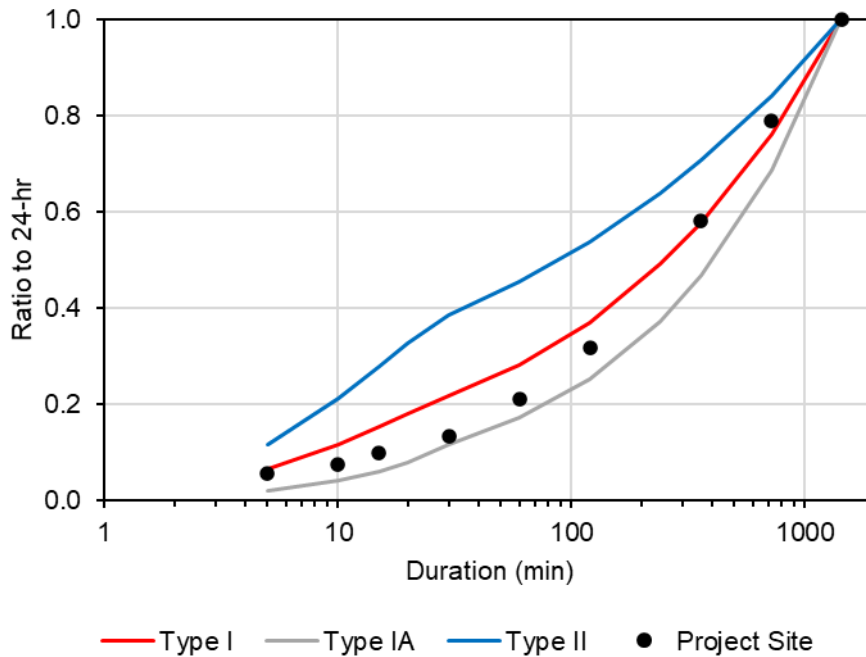


Figure 3-1: Comparison of the SCS Storm Types with the Project Site

### 3.2 SNOWMELT

Snowmelt is estimated using the generalized basin snowmelt equations developed by USACE. The following equation provides the daily snowmelt for heavily forested areas (over 80% cover) during rainfall periods:

$$M = (0.074 + 0.007P_r)(T_a - 32) + 0.05$$

Where:

M = Daily Snowmelt (in/day)

$P_r$  = Rainfall Intensity (in/day)

$T_a$  = Temperature of Saturated Air at 10-ft level (°F)

This method assumes there is enough snow available to melt, hence it provides an upper envelope.

Table 3-2 provides estimated snowmelt values. The estimated snowmelt values are based on a temperature of 9.5°C. This is based on the daily maximum temperature for April from the Comox Climate Normals dataset (12.9°C), and assuming a 6.5°C/1000m decrease in temperature at the project location. The estimated snowmelt values were added to corresponding rainfall event and distributed over time using SCS Type I.

Table 3-2: Snowmelt Estimation

Return Period	Rainfall Depth		Snowmelt		Total Precipitation (mm)
	(mm)	(in)	(in)	(mm)	
10	149	5.9	2.0	51	200
100	204	8.0	2.3	58	262
200	220	8.7	2.4	60	280
500	241	9.5	2.4	62	303
1000	257	10.1	2.5	64	321

The Hayco 2003 study estimated the snowmelt for the 1,000-yr event at 54.3 mm and it was added to rainfall depth and distributed over 24 hours using SCS Type IA distribution.

## 4.0 HYDROLOGIC MODEL

### 4.1 MODEL SETUP

A hydrologic model was developed using Hydrologic Engineering Center – Hydrologic Modelling System (HEC-HMS). HEC-HMS, developed by the United States Army Corp of Engineers (USACE), is an industry standard hydrologic modelling software which is freely available. Version 6.4.1 was used in this study.

The hydrologic model developed in this study includes all the lakes and structures upstream of the Cumberland No.2 Lake to account for attenuation and flow release from upstream lakes. Figure 4-1 shows the model schematic.

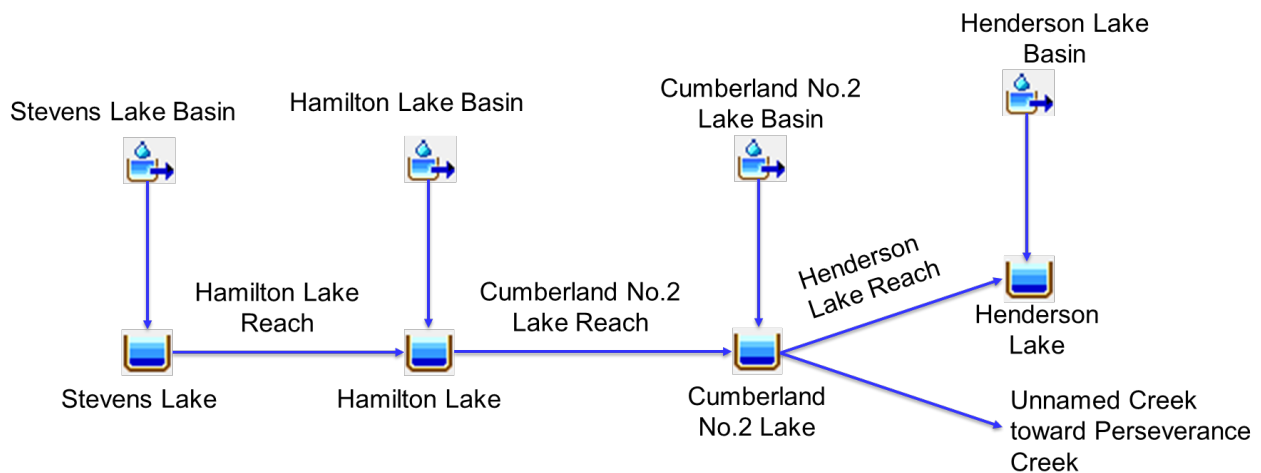


Figure 4-1: HEC-HMS Model Schematic

The watershed delineation and basin and reach characteristics were completed in HEC-HMS using the Canadian Digital Elevation Model. Table 4-1 and Table 4-2 provide the physical characteristics of the basins and reaches. Channel geometry for reaches is based on the High-Resolution Lidar provided by ISL.

Table 4-1: Basin Characteristics

Parameter	Stevens Lake Basin	Hamilton Lake Basin	Cumberland No.2 Lake Basin	Henderson Lake Basin
Direct Drainage Area (km <sup>2</sup> )	3.00	1.80	1.44	0.75
Total Drainage Area (km <sup>2</sup> )	3.00	4.80	6.24	6.99
Longest Flow Path Length (km)	3.3	2.4	2.7	1.6
Longest Flow Path Slope (%)	10.8	6.2	8.0	15.8
Basin Slope (%)	19.3	14.2	14.8	25.5

Table 4-2: Reach Characteristics

Parameter	Hamilton Lake Reach	Cumberland No.2 Lake Reach	Henderson Lake Reach
Length (km)	1.5	1.8	1.1
Slope (%)	4.9	5.3	18.0
Channel Bottom Width (m)	6.0	6.0	5.0
Channel Side Slope (xH:IV)	1.0	1.0	1.0
Channel Manning's n	0.05	0.05	0.05

## 4.2 MODEL PARAMETERS

Model parameters used in this study are summarized in Table 4-3.

Table 4-3: Model Parameters

Loss	<ul style="list-style-type: none"> <li>SCS Curve Number (CN) Method</li> <li>A soil with moderate infiltration was chosen for all the basins (hydrologic soil group B).</li> <li>Antecedent Moisture Condition (AMC) III was considered for the base model. AMC represents the preceding relative moisture prior to rainfall. AMC III assumes high moisture and heavy rainfall over the preceding days.</li> <li>Equivalent curve number for AMC III is estimated using the following formula:                             <math display="block">CN(III) = \frac{23CN(II)}{10 + 0.13CN(II)}</math> </li> </ul> <p>Where:</p> <p>CN(II) = Curve Number based on AMC II (average moisture condition)</p> <ul style="list-style-type: none"> <li>AMC II Curve Number = 55 (This is based on woods that are protected from grazing, and litter and brush adequately cover the soil for a moderate infiltration soil.)</li> <li>Estimated AMC III Curve Number = 74. This value will be used in this assessment.</li> </ul>
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Transform	<ul style="list-style-type: none"> <li>SCS Unit Hydrograph Method</li> <li>Lag time was estimated based on the selected curve number and basin geometry using the following formula:                     <math display="block">T_l = \frac{L^{0.8} \times (S + 1)^{0.7}}{1900Y^{0.5}}</math>                     Where:                     <ul style="list-style-type: none"> <li>T<sub>l</sub> = Lag Time, hr</li> <li>L = Flow Length, ft</li> <li>S = Maximum Potential Retention, S = 1000/CN - 10</li> <li>Y = Average Basin Slope, %</li> </ul> </li> <li>See Table 4-1 for basin characteristics.</li> <li>Estimated lag times are provided in Table 4-4.</li> </ul>
Reach Routing	<ul style="list-style-type: none"> <li>Normal Depth method</li> <li>A representative channel geometry was selected for each reach and used for the entire reach. See Table 4-2 for reach characteristics.</li> </ul>
Meteorology	<ul style="list-style-type: none"> <li>Type I SCS rainfall distribution was selected.</li> <li>Rainfall depths are based on BC MetPortal values provided in Table 3-1.</li> </ul>

Table 4-4: Estimated Basin Lag Times (min)

Stevens Lake Basin	Hamilton Lake Basin	Cumberland No.2 Lake Basin	Henderson Lake Basin
35	32	34	18

## 5.0 RESULTS

### 5.1 GENERAL

Four scenarios were simulated for 10-, 100-, 200- and 1,000-yr return periods. Figure 5-1 shows the inflow hydrographs to the Cumberland No.2 Lake. Peak inflows are provided in Table 5-1.

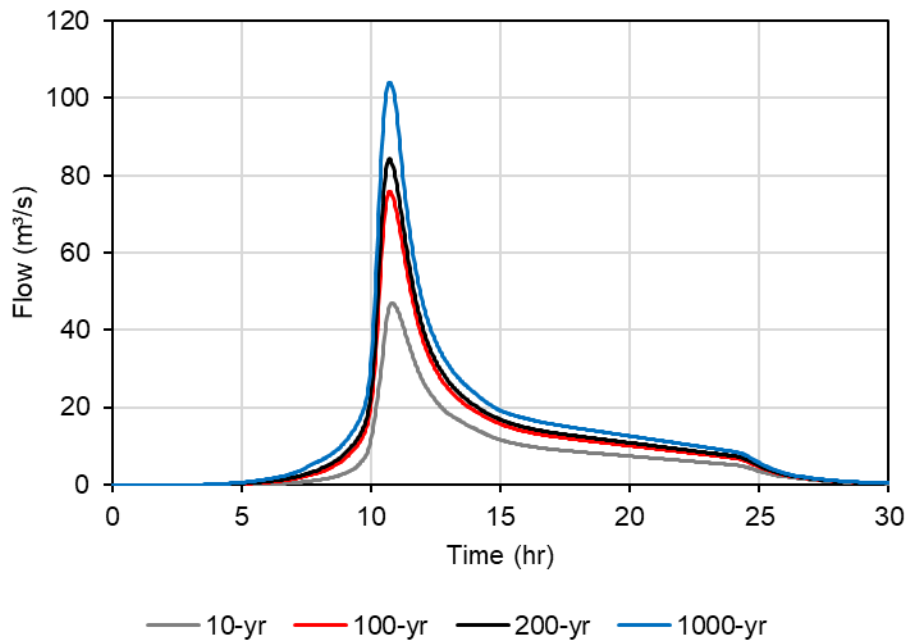


Figure 5-1: Inflow Hydrograph to Cumberland No.2 Lake

Table 5-1: Peak Inflow Estimates

Event	Peak Inflow (m <sup>3</sup> /s)
10-yr	47.0
100-yr	75.8
200-yr	84.3
1,000-yr	104.1

Table 5-2 shows the routing results for all the structures based on the existing condition.

For all the scenarios, it was assumed that initial lake levels are at FSL. Top of dam is based on the 2019 study for Stevens Lake and Hamilton Lake Dams. Lidar was used for No. 2 Lake Dam and Henderson Lake Dam.

Stevens Lake and Hamilton Lake were only included to account for flood attenuation, and the results will not be discussed in this study as these two lakes are out of scope of this work.

The results show that Cumberland No.2 Dam currently can safely pass up to 10-yr flood but will overtop for 100-yr and higher events. Overtopping depth is 0.28 m during the 1,000-yr flood event. The overtopping discharge towards Henderson is estimated to be 0.5 m<sup>3</sup>/s to 4.2 m<sup>3</sup>/s during 100- to 1,000-yr events respectively. The south channel discharge towards Perseverance Creek is estimated to be 46.7 m<sup>3</sup>/s to 99.5 m<sup>3</sup>/s from 10-, to 1,000-yr flood events respectively.

Henderson Lake Dam overtops even during the 10-yr event with a peak inflow of 12.0 m<sup>3</sup>/s which is from its direct drainage basin. There is no discharge towards Henderson Lake Dam from No.2 Lake during the 10-yr event. Overtopping depth varies from 0.13 m to 0.38 m during 10- to 1,000-yr events.

Table 5-2: Routing Results Based on Existing Condition

Event	Lake	Initial Lake Level (m)	Top of Dam (m)	Max Lake Level (m)	Available Freeboard (m)	Peak Inflow (m <sup>3</sup> /s)	Peak Spillway Discharge (m <sup>3</sup> /s)	Peak Overtop Discharge (m <sup>3</sup> /s)
10-yr	Stevens <sup>1</sup>	618.50	620.80	619.99	0.81	33.2	23.2	0.0
	Hamilton <sup>2</sup>	548.90	550.00	550.49	-0.49	37.2	25.5	10.7
	No.2 Lake <sup>3</sup>	455.04	456.70	456.53	0.17	47.0	46.7	0.0
	Henderson <sup>4</sup>	256.67	258.00	258.13	-0.13	12.0	9.8	1.9
100-yr	Stevens	618.50	620.80	620.52	0.28	49.4	36.7	0.0
	Hamilton	548.90	550.00	550.84	-0.84	58.8	34.3	23.2
	No.2 Lake	455.04	456.70	456.78	-0.08	75.8	74.9	0.5
	Henderson	256.67	258.00	258.27	-0.27	17.8	11.3	6.4
200-yr	Stevens	618.50	620.80	620.66	0.14	54.1	40.7	0.0
	Hamilton	548.90	550.00	550.93	-0.93	65.2	36.5	27.1
	No.2 Lake	455.04	456.70	456.84	-0.14	84.3	82.5	1.3
	Henderson	256.67	258.00	258.30	-0.30	19.5	11.5	7.9
1,000-yr	Stevens	618.50	620.80	620.94	-0.14	65.0	47.9	4.1
	Hamilton	548.90	550.00	551.15	-1.15	81.8	42.3	37.4
	No.2 Lake	455.04	456.70	456.98	-0.28	104.1	99.5	4.2
	Henderson	256.67	258.00	258.38	-0.38	23.4	12.4	10.9

<sup>1</sup> Significant Consequence Dam (2016 Consequence Classification)

<sup>2</sup> Low Consequence Dam (2016 Consequence Classification)

<sup>3</sup> Significant Consequence Dam (2016 Consequence Classification)

<sup>4</sup> Low Consequence Dam (2016 Consequence Classification)

## 5.2 COMPARISON WITH PREVIOUS STUDY

Table 5-3 provides a comparison of the peak inflow to Cumberland No.2 Lake.

Table 5-3: Peak Inflow Comparison (m<sup>3</sup>/s)

Event	Hayco 2003	Tetra Tech 2019	Tetra Tech, 2025
100-yr	-	23.2	75.8
1,000-yr	34.6	41.0	104.1

The main reason for the difference in peak flow is the selection of rainfall distribution and the magnitude of the design event provided in the more recent MetPortal data. In this study, SCS Type I distribution was selected, while it was SCS Type IA in the previous study. SCS Type I distribution has higher rainfall depth for shorter periods, which translates to higher intensity of rain and hence it tends to produce higher peak inflows than SCS Type IA distribution.

A scenario based on SCS Type IA was completed for the 1,000-yr event. The estimated peak flow for the 1,000-yr event based on SCS Type IA is 60.0 m<sup>3</sup>/s which is 40% percent lower than estimated peak based on SCS Type I. However, the flood volume, 1460 dam<sup>3</sup>, matches for both distributions since the total rainfall depths are the same for both distributions.

Table 5-4 compares the routing results for the 1,000-yr event.

Table 5-4: 1,000-yr Routing Results Comparison

Parameter	Study	No.2 Lake	Henderson Lake
Freeboard above FSL (m)	Hayco 2003	1.84	1.28
	Tetra Tech 2019	3.10	1.20
	Tetra Tech 2025	1.66	1.33
Peak Inflow (m <sup>3</sup> /s)	Hayco 2003	34.6	8.7
	Tetra Tech 2019	41.0	21.0
	Tetra Tech 2025	104.1	23.4
Peak Outflow, Spillway + Overtop (m <sup>3</sup> /s)	Hayco 2003	34.5	8.6
	Tetra Tech 2019	34.0	12.0
	Tetra Tech 2025	103.8	23.3
Depth Over Spillway Invert (m)	Hayco 2003	1.61	0.66
	Tetra Tech 2019	3.30	1.50
	Tetra Tech 2025	1.94	1.71
Available Freeboard (m)	Hayco 2003	0.23	0.62
	Tetra Tech 2019	<b>-0.20</b>	<b>-0.25</b>
	Tetra Tech 2025	<b>-0.28</b>	<b>-0.38</b>

The available freeboard for No.2 Lake and Henderson Lake Dams was corrected in this study based on Lidar. The difference in Peak flow is primarily due to different rainfall distribution as explained above.

The current study has a significantly larger inflow to No.2 Lake Dam (154% higher) and half the available freeboard compared to the Tetra Tech 2019 study; however, overtopping depth is relatively similar between the two studies. The reason is that the Tetra Tech 2019 study may not have considered the entire conveyance capacity of the south channel as the report mentions a 3 m width for the south channel. In this study, the entire conveyance capacity of the south channel was included (See Figure 2-1 for the discharge capacity).

The following limitations to the current hydrological model comparison to historical work include:

- There is no clear understanding of the stage-storage values used in the previous studies so this comparison is not possible. However, LiDAR data was used for the lower two reservoirs. Since the reservoirs are assumed to be at FSL during a flood, the bathymetry data and total storage volume are not required for the assessment.
- Spillway discharge curves were developed in the previous works, but the curves were not provided so could not be compared. The discharge curves developed to complete the current work are based on recommended industry methodologies and somewhat conservative assumptions.
- It is not clear if flow overtopping was included as part of the previous works.
- Henderson Lake drainage area is reported to be 0.75 km<sup>2</sup>, while this is only correct if there is no discharge from Cumberland Number 2 Dam.

There is also discrepancy between the reported elevations and available freeboard above FSL in Hayco 2003 and Tetra Tech 2019 reports. The current study uses the more recent information from Tetra Tech 2019 for Stevens Lake Dam and Hamilton Lake Dam. Topographic/LiDAR information is used in modelling Cumberland No.2 Dam and Henderson Lake Dam.

## 6.0 ENHANCEMENT OPTIONS

Since the existing spillway for Henderson Lake Dam is designed for its local catchment area, any additional flood discharge from future Cumberland No 2 Dam will require modification to Henderson Lake Dam. Hence, the enhancement options for Cumberland No 2 are developed based on the modifications to Henderson Lake Dam:

### 1) No change to Henderson

- a) Under this scenario, Henderson Lake Dam cannot safely pass the 10-yr flood event (based on the updated hydrology).
- b) This scenario requires diverting 100% of the No.2 Lake flood flows towards Perseverance Creek, as current practice.
  - i) This option resolves the dam safety deficiencies of Cumberland Dam #2 without addressing Henderson Lake Dam conveyance capacity deficiency and Perseverance Creek erosion issue.

### 2) Upgrade the Henderson Lake Dam and Spillway to Accommodate 100-year event (Direct Drainage Basin Only)

- a) The 100-yr event for the Henderson Lake direct drainage basin has a peak inflow of 17.8 m<sup>3</sup>/s (12 m<sup>3</sup>/s without snowmelt).
- b) Raising the dam by 1.0 m would provide 17.8 m<sup>3</sup>/s, while maintaining adequate freeboard. Expanding the spillway or combination of additional spillway and dam raise can be considered as well.

- c) Limit the outflow to Cumberland Creek to match the Henderson spillway capacity:
  - i) This would result in no outflow to Perseverance Creek during normal operation and potentially up to 2-year flood; however, the South spillway would be used frequently during flood events larger than 2-year event.
  - ii) This option addresses the dam safety deficiency of the No.2 Lake Dam and conveyance capacity at Henderson Dam, but does not provide a solution for reducing erosion along Perseverance Creek.

**3) Upgrade the Henderson Lake Dam and Spillway to Reduce the frequency of No.2 Lake Discharge to Perseverance Creek**

Upgrade Henderson Lake dam to safely pass the 100-year with adequate freeboard and route the 1,000-yr event without freeboard.

Upgrade No.2 Lake Dam to convey less frequent events ( $\leq 10$ -yr) towards Henderson Lake:

- i) This would result in less frequent outflow to Perseverance Creek during flood events, with the South spillway operating only during large flood events ( $> 10$ -yr).
- ii) This option would also reduce erosion issues along Perseverance Creek by reducing the frequency of flow release towards Perseverance Creek.

## 7.0 PROPOSED OPTION

Following discussion with the ISL Engineering and Land Services and Village of Cumberland, it was determined that the project goals are to address dam safety deficiencies at both the No.2 Lake Dam and the Henderson Lake Dam, while reducing erosion along Perseverance Creek within the limits of the dam footprints. Thus, Option 3 was identified as the most suitable option.

The hydrology assessment was updated to achieve the objectives of Option 3 enhancement. Following a few iterations of dam and spillway configurations, the preliminary configuration provided in Table 7-1 was determined best meet the requirements of this project through Option 3.

Table 7-1: Proposed Dam and Spillway Configuration

Structure	Scenario	No.2 Lake Dam	Henderson Lake Dam
Dam	Existing	<ul style="list-style-type: none"> <li>Dam crest at 456.7 based on the Lidar.</li> </ul>	<ul style="list-style-type: none"> <li>Dam crest at 258.0 m elevation.</li> </ul>
	Proposed	<ul style="list-style-type: none"> <li>Dam crest at 456.6 m elevation (approx. 0.1 m lower than the existing structure).</li> </ul>	<ul style="list-style-type: none"> <li>Raise Henderson Dam by approx. 1.1 m to an elevation of 259.1 m on the left side of the existing spillway.</li> </ul>
Spillway	Existing	<ul style="list-style-type: none"> <li>No spillway on the main dam</li> <li>Channel located south of the lake towards Perseverance Creek.</li> </ul>	<ul style="list-style-type: none"> <li>Concrete spillway, 3.1 m wide with a weir elevation of 256.67 m.</li> </ul>
	Proposed	<ul style="list-style-type: none"> <li>Main dam overflow rock chute spillway with a 25 m width and 454.95 m crest elevation (Approx. 0.15 m lower than current FSL).</li> <li>Fuse plug on the south channel at an elevation of 456.1 m.</li> </ul>	<ul style="list-style-type: none"> <li>Maintain the existing concrete spillway as is (3.1 m wide with a weir elevation of 256.67 m).</li> <li>A 12 m wide overflow rock chute spillway on the right side of the concrete spillway at weir elevation of 257.0 m.</li> </ul>

Results of routing based on the proposed design is provided in Table 7-2. The South Channel for Cumberland Lake No 2 is renamed to auxiliary spillway in this table.

Table 7-2: Proposed Option Routing Results

Event	Lake <sup>1</sup>	Initial Lake Level (m)	Top of Dam (m)	Max Lake Level (m)	Available Freeboard (m)	Peak Inflow (m <sup>3</sup> /s)	Peak Main Dam Discharge (m <sup>3</sup> /s)	Peak Auxiliary Discharge (m <sup>3</sup> /s)
10-yr	No.2 Lake	454.95	456.60	456.06	0.54	47.0	46.5	0.00
	Henderson	256.67	259.10	258.51	0.59	49.8	49.7	-
100-yr	No.2 Lake	454.95	456.60	456.24	0.36	75.8	58.3	22.70
	Henderson	256.67	259.10	258.85	0.25	66.2	66.1	-
1,000-yr	No.2 Lake	454.95	456.60	456.35	0.25	104.1	66.3	37.65
	Henderson	256.67	259.10	259.07	0.03	78.0	77.9	-

## 8.0 LIMITATIONS OF MEMO

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## 9.0 CLOSURE

We trust this technical memo meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,  
Tetra Tech Canada Inc.

FILE: 704-ENG.DAMS03068-01  
**ISSUED FOR REVIEW**  
FILE: 704-ENG.DAMS03068-01

February 17, 2026

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Mohammad Mohammadi, M.Sc., E.I.T.  
Hydrotechnical Engineer-in-Training  
Direct Line: 403-723-1527  
[mohammad.mohammadi@tetrattech.com](mailto:mohammad.mohammadi@tetrattech.com)

FILE: 704-ENG.DAMS03068-01  
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FILE: 704-ENG.DAMS03068-01

February 17, 2026

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Babak Alinejad, P.Eng, MBA  
Hydrotechnical Lead  
Direct Line: 403-508-1560  
[babak.alinejad@tetrattech.com](mailto:babak.alinejad@tetrattech.com)

FILE: 704-ENG.DAMS03068-01  
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February 17, 2026

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Jennifer Sinclair, P.Eng.  
Dam Practice Manager – Western Canada  
Mobile (250) 802-8597  
Office (250) 756-2256  
[Jennifer.Sinclair@tetrattech.com](mailto:Jennifer.Sinclair@tetrattech.com)

## APPENDIX A

### PRELIMINARY BASEPLAN DRAWINGS

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**NOTES**

1. TOPOGRAPHY FROM ISL ENGINEERING AND LAND SERVICES LTD. DATED, OCT 2025.
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<b>DRAWING STATUS</b>			

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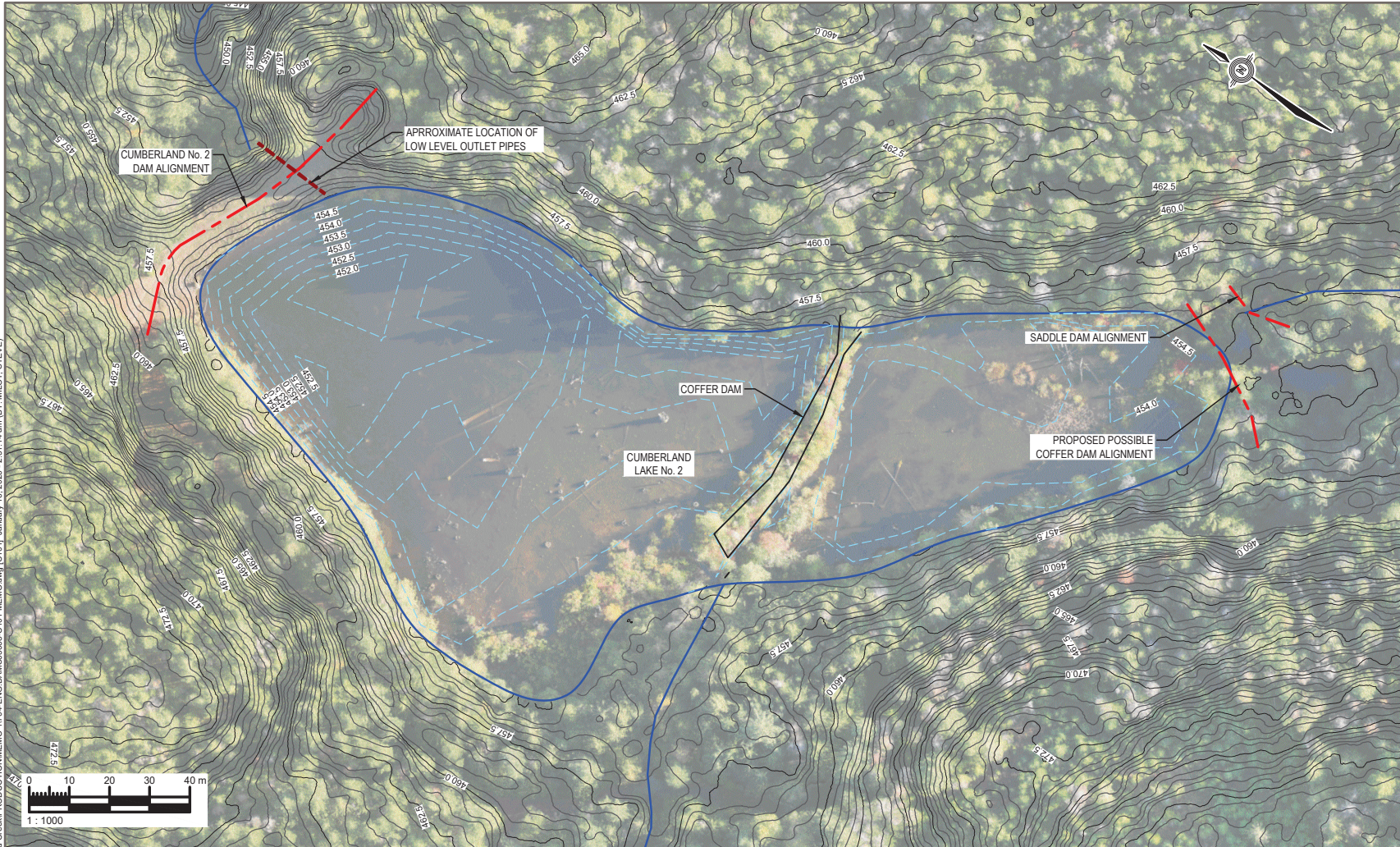
**VILLAGE OF CUMBERLAND**



**CUMBERLAND DAM No. 2 PRESERVANCE CREEK REHABILITATION**

**GENERAL SITE PLAN**

PROJECT No. 704-ENG.DAMS03068-01	OFFICE VANC	DES LW	CKD JS	REV 0	DRAWING
DATE: Dec. 5, 2025	SHEET No. 1 of 1	DWN SM	APP JS	STATUS A	<b>C100</b>



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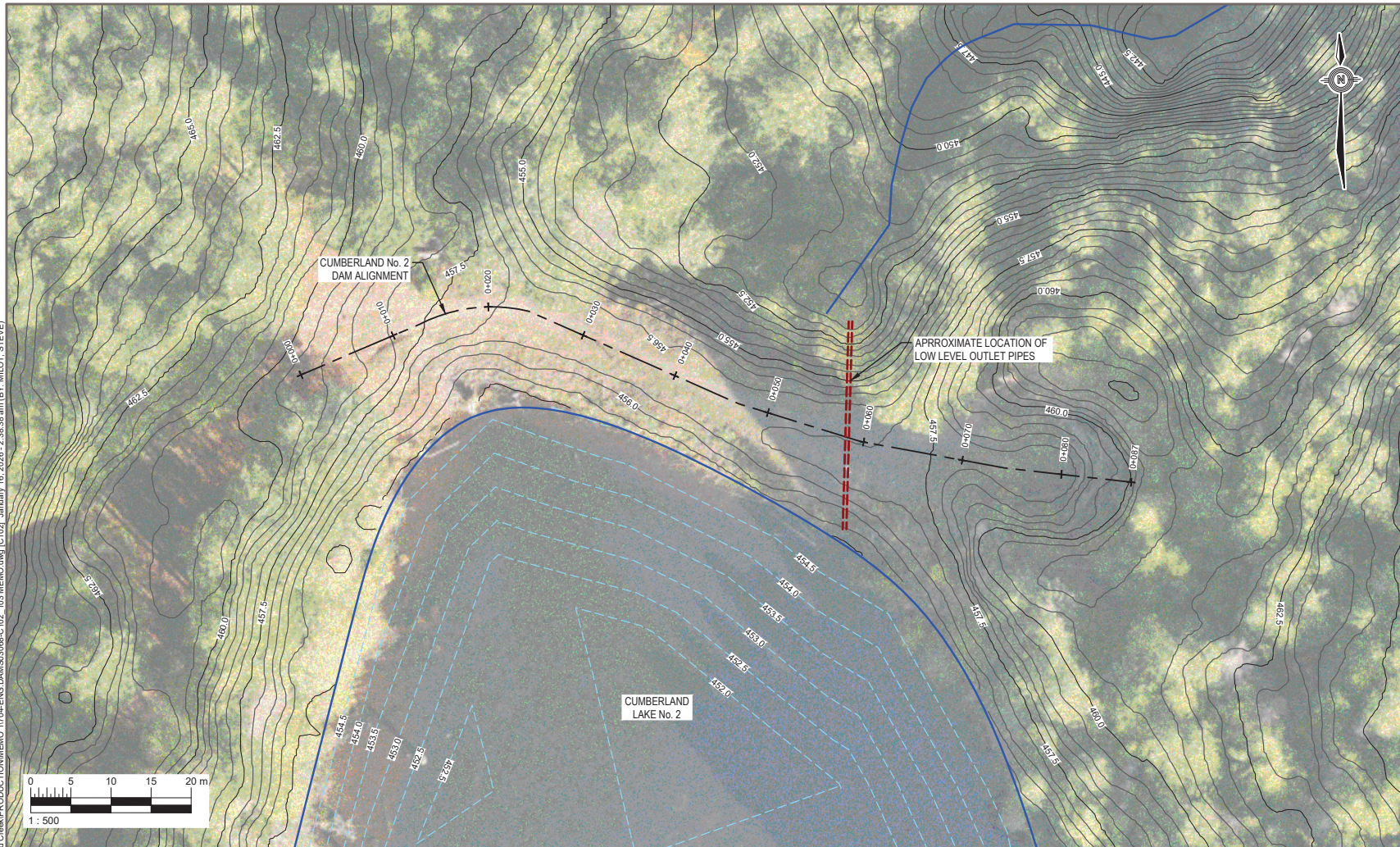


**CUMBERLAND LAKE No. 2  
PRESERVANCE CREEK REHABILITATION**

**CUMBERLAND No. 2 LAKE  
LAYOUT PLAN**

PROJECT No. 704-ENG.DAMS03068-01	OFFICE VANC	DES LW	CKD JS	REV 0	DRAWING
DATE: Dec. 5, 2025	SHEET No. 1 of 1	DWN SM	APP JS	STATUS A	<b>C101</b>

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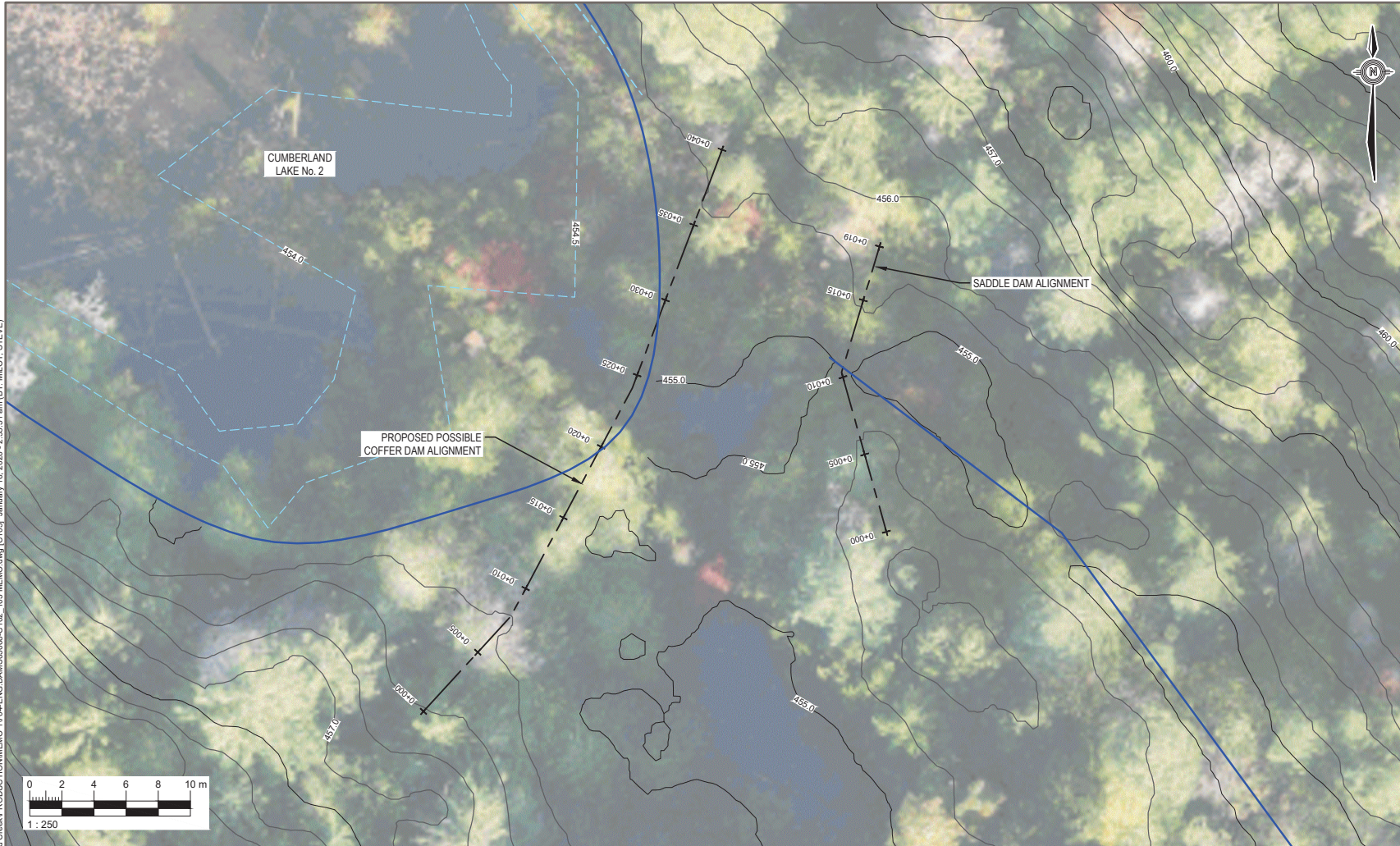


**CUMBERLAND LAKE No. 2  
PRESERVANCE CREEK REHABILITATION**

**CUMBERLAND No. 2 DAM  
PLAN**

PROJECT No. 704-ENG.DAMS03068-01	OFFICE VANC	DES LW	CKD JS	REV 0	DRAWING
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**CUMBERLAND LAKE No. 2  
PRESERVANCE CREEK REHABILITATION**

**CUMBERLAND No.2 SOUTHEND  
POTENTIAL SADDLE DAM LOCATION**

PROJECT No. 704-ENG.DAMS03068-01	OFFICE VANC	DES LW	CKD JS	REV 0	DRAWING
DATE: Dec. 5, 2025	SHEET No. 1 of 1	DWN SM	APP JS	STATUS A	<b>C103</b>

## APPENDIX B

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# LIMITATIONS ON USE OF THIS DOCUMENT

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