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Municipal Council Meeting Agenda

Tuesday, October 10, 2023 – 9:00 a.m.

MODL Council Chambers – 10 Allée Champlain Drive, Cookville

- 1. Call to Order**
 - 1.1 Mi'kma'ki Territorial Acknowledgement
- 2. Announcements, Acknowledgements, Recognition**
- 3. Public Input (15 Minutes)**
- 4. Changes/Approval of Agenda (as circulated)**
- 5. Approval of Minutes - Special Council of August 15 and 29, 2023; Public Hearing and Council of September 12, 2023**
- 6. Business Arising from Minutes**
- 7. Awarding of Tenders/RFPs - Nil**
- 8. Presentations/Scheduled Times**
 - 8.1 FoodCycler Municipal Solutions, Kassia Régnier, Program Coordinator 9:15 a.m. 1-10
 - 8.2 In Camera Presentation 11:30 a.m.
- 9. Consideration of Correspondence - Nil**
- 10. Recommendations from Committees & Boards - Nil**
- 11. Staff Reports**
 - 11.1 Administration**
 - 11.1.1 Petite Riviere Flood Mitigation Phase III Report..... 11-94
 - 11.2 Engineering & Public Works**
 - 11.2.1 J Class Road Paving Priorities 2024/2025 95-96
 - 11.2.2 Construction and Installation of EV Chargers..... 97-99
- 12. Mayor's/Deputy Mayor's/Councillors' Matters**
 - 12.1 MJSB Update
 - 12.2 LCLC Update
 - 12.3 Police Association Conference – Update (Councillor Bell)
 - 12.4 Request for Review of Potential Nuisance By-law (Councillor Greek) 100
 - 12.5 Deputy Mayor's Update

- 12.6 Mayor's Update
- 12.7 Appointment of Nominating Committee

13. Added Items

14. In Camera

- 14.1 Contract Negotiations under Section 22(2)(e) of the MGA
- 14.2 Contract Negotiations under Section 22(2)(e) of the MGA

15. Adjournment



FOODCYCLER™ MUNICIPAL SOLUTIONS

The Future of Food Waste

Council
Item: #8.1
Date: October 10, 2023
Authorization: T. MacEwan



ABOUT US

Food Cycle Science

- Canadian company based out of Ottawa, ON
- Founded in Cornwall in 2011 – Company is 100% focused on Food Waste Diversion Solutions
- Products available in North America through FoodCycler Municipal / Vitamix and internationally through network of distributors & OEM partners
- Finalists in Impact Canada/AAFC's Food Waste Reduction Challenge
- Globe & Mail Canada's Top Growing Companies (2021 & 2022)
- Deloitte Fast 50 CleanTech award winners (2021)
- Approved supplier with Canoe Procurement Group of Canada



107
Municipal
Partnerships
Across North
America

MUNICIPAL IMPACT

Waste is a municipal responsibility

LANDFILL + WASTE COSTS

- ~**25-50%** of household waste is organic waste
- Landfills are filling up fast, creating cost and environmental issues
- Hauling, transfer, and disposal services are a major cost factor and environmental contributor

ENVIRONMENT

- Landfilled organic waste produces methane, which is **25 times** more harmful than CO₂
- 1 tonne of food waste is equivalent to 1 car on the road for one year



COMMUNITY

Food in the garbage:

- More frequent collection or trips to the disposal site
- Unpleasant odours
- Animals, pests & other visitors



Removing food waste from garbage:

- Volume is reduced by up to **50%**
- Less frequent collection, fewer trips to disposal site, save on bag tags
- Keeps odours out, makes garbage much less “interesting” for animals

“HAVEN’T WE SOLVED THIS ALREADY?”



GREEN BINS

- Major capital expenditure to invest in processing & collection infrastructure
- Contamination is an ongoing challenge
- GHG emissions and safety concerns from collection vehicles
- Participation rates are often lower than desired, particularly in multi-residential dwellings

BACKYARD COMPOST

- Space, ability, and know-how are limiting factors
- Most users do not compost in winter or inclement weather
- May attract pests/animals or create unpleasant odors
- Participation rates are relatively low and stagnant
- Can produce methane if done incorrectly

LANDFILL

- Easiest solution and often perceived as the most cost-effective in the short term
- Waste is typically out of sight and out of mind for consumers
- High levels of GHG emissions, particularly methane
- Long-term environmental hazard requires monitoring / maintenance
- Landfill capacity is quickly running out



THE FOODCYCLER PILOTS

The results are in.

Completed* pilots in:

6,000+
Households

50+
Municipalities



Participation Rate 98%

- 98% of pilot participants will continue using the FoodCycler after the pilot period

Recommendation Rate 96%

- 96% of users would recommend the FoodCycler to friends/family/neighbours

User Experience Rating 4.6/5

- 4.6 out of 5-star rating for the overall user experience of the FoodCycler

Net New Diversion 300 kg

- Each participating household diverts approximately 300 kg of food waste per year

Awareness + Prevention 77%

- 77% of pilot participants resolved to waste less food as a result of increased awareness

FOOD WASTE REDUCTION CHALLENGE

Impact Canada Finalists

Federal Funding

- ✓ Semi-Finalists in Stage 1 received \$100,000
- ✓ Finalists in Stage 2 received \$400,000
- Finalists will compete in Stage 3 to win one of two Grand Prizes of up to \$1,500,000



PILOT PROGRAM

12 Weeks from Start to Finish

PILOT TIMELINE

START

Residents purchase FoodCycler at a subsidized rate from Municipal Office (or other designated location)

12 WEEKS

Participants use the unit for a period of 12 weeks.

Number of cycles per week are tracked to estimate total diversion achieved.

END

Participants fill out an exit survey, providing their review of the program and any other feedback.

Survey results used to evaluate program success.

NEXT STEPS

Tailored program design and implementation.

Grants may be available, with support from Food Cycle Science.

FUNDED PILOT PROGRAM OPTIONS

Municipal Subsidy Model



FOODCYCLER™
FC-30

\$ 500

-\$ 200

-\$ 50

\$ 100

\$ 150

RETAIL PRICE

MUNICIPAL
DISCOUNT

IMPACT CANADA
INVESTMENT

* MUNICIPAL
SUBSIDY *

RESIDENT
COST

\$ 800

-\$ 250

-\$ 150

\$ 100

\$ 300



FOODCYCLER™
Eco-5

FUNDED PILOT PROGRAM OPTIONS

Pilot Scope Recommendations

Municipality Population	Pilot Scope	Municipal Investment
< 2,500 Residents	50 Households	\$5,000
2,500 – 10,000 Residents	100 Households	\$10,000
10,000 – 20,000 Residents	200 Households	\$20,000
> 20,000 Residents	250+ Households	\$25,000+

Plus shipping costs and applicable taxes





Municipality of the District of Lunenburg

Request for Decision

Report to: Council
Submitted by: Alex Dumaresq, Deputy CAO
Date: October 10, 2023
Re: Petite Riviere Flood Mitigation Project, Phase III Report

Recommendation

Move that Municipal Council proceed with the Building Resiliency Option to mitigate flood risk in the Lower Petite Riviere Watershed area.

Background

In May of 2005 there was a significant flooding event on the Petite Riviere watershed. A total of 383 mm of rain fell over a course of 2 weeks, which caused overland flooding in a number of communities. A local state of emergency was declared and 100 people were evacuated. Ultimately, a total of \$1,447,904 in Disaster Assistance payments were made. The major amount of rain falling, combined with the elevated water level in Hebb Lake led to a concern that a dam between Hebb and Fancy Lake could fail. As a result, the Bridgewater Public Service Commission (BPSC) released a large volume of water into Fancy Lake over a short period.

In 2019, at the request of the Hebbville Village Commission, MODL agreed to investigate flood risk and mitigation options, engaging the consulting firm CBCL to conduct the necessary research. In Phase one of the project, CBCL delineated the flood risk of a one in one-hundred year rain event, identifying a total of 27 structures (including both primary and accessory buildings such as sheds) that would be affected by a flood event in the Fancy Lake area. In Phase two of the project, CBCL explored potential mitigation options and recommended three options for further study: building resiliency, increasing conveyance capacity, and constructing a flow control structure.

Phase three of the project consisted of a more detailed exploration of the three preferred options and also included: stakeholder meetings with the Bridgewater Public Service

Commission (BPSC), the Hebbville Village Commission, Federal and provincial regulators, correspondence with indigenous groups, a public open house, and a public survey. In June, CBCL delivered a final report for Phase three of the project, which is summarized below.

Synopsis

Building Resiliency

The first option focuses on monitoring weather forecasts and water levels and using this information to provide advance warning to residents of possible flooding. This could include the construction of a water level monitoring station or stations in Fancy Lake but in any scenario would involve communication and cooperation with the BPSC, who monitor water levels in the upper Petite watershed and operate Hebb's Dam. The approach also includes examining emergency response planning to ensure appropriate contingency plans are in place. This option is the lowest cost option and has the least environmental impact of any option. This option does not reduce the risk of flooding happening rather, it reduces the impacts should a flood occur.

Building Resilience	
Capital Cost range	0-\$500,000
Annual Cost Range	0-\$100,000

Increasing Conveyance Capacity

The second option involves either dredging or widening the outflow of Fancy Lake. By increasing the outflow from the lake, it is possible to reduce the risk of a flood occurring in the Fancy Lake area. Further study of this option would be required to determine the impact of the increased conveyance on downstream flooding in the lower Petite riviere. Widening the outlet results in the slight lowering of the year-round Fancy Lake's water level. An alternative approach to the outlet widening is dredging the first 750 metres of the Petite Riviere at the outflow of Fancy lake. The dredging results in a lower outlet for the lake, meaning there could be as much as a 2-metre reduction of the lake level. Both of these alternatives come at considerable capital cost, some annual operating costs and would result in significant environmental impact. CBCL identifies 7 likely regulatory approval processes, which would be required for this option:

- Land survey;
- Fish habitat assessment;
- Wetland delineation;
- Wetland functional assessment;

- Hydraulic assessment for water velocity;
- Hydraulic assessment for fish passage;
- Fish habitat assessment; and
- Fish rescue plan

The consultants also note that the Petite Riviere is protected by the Federal Species at Risk Act due to the recorded observances of the Atlantic Whitefish, further reducing the likelihood of securing regulatory approval for an intrusive option.

Increasing Conveyance Capacity	
Capital Cost Range	\$3M - \$7M
Annual Cost Range	0-\$100,000

Flow Control

The third option involves creating a flow control structure either adjacent to the existing outlet or as a separate bypass to the natural river outlet. This option does reduce the risk of a flood occurring in the Fancy Lake area and would not reduce the average water level of the lake as the flow control structure would only be used to lower high water levels in advance of a significant rain event. As with the conveyance option, further study would be required once more detailed design was complete to determine downstream flooding impacts of the flow control structure.

The flow control options have the highest capital cost estimates and highest annual operating costs. Like the conveyance capacity options, there are seven likely regulatory approval processes, requiring the same list of studies and the same habitat considerations for the endangered whitefish.

Flow Control	
Capital Cost Range	Over \$12M
Annual Cost Range	\$100,000+

Engagement Activities

The consultants held meetings with the Federal Department of Fisheries and Oceans and the Nova Scotia Department of Environment and Climate Change. Several relevant points were relayed from the regulators:

- Options that result in the least alterations to the environment would be preferred
- Modifications for recreational purposes alone would not be viewed favourably
- Of the intrusive options, options that limit intervention in the river such as the control structure on a bypass channel would be preferred.

The consultants also held meetings, and exchanged correspondence with representatives from the Hebbville Village Commission. The Commission members input to the consultants helped shape the final options considered. Throughout the consultation the Commission made clear they are opposed to any option that reduces lake levels. They have also communicated that raising the level of the lake during dry periods is a primary objective of their committee in conjunction with reducing flood risk.

Broader public engagement provided some further input on options including the use of a stop log system in a flow control structure and a dam structure used in Queens County which is akin to the widening of the river outlet, but included a raised outlet. In a preliminary review the consultants confirmed a stop log system could be put in place instead of a gate, and would not significantly change the cost estimate for construction or operation of the flow control structure. The consultants indicated that further analysis would be required to determine if the widened outlet combined with a raised outflow would have a similar positive effect in reducing flood risk. Further analysis of this suggestion was not possible at this time without an expansion of the scope of work.

CBCL presented their draft exploration of the three options at an open house in February of 2023. Citizens were also encouraged to complete a survey on the proposed options. 73 responses were received to the survey. 63 respondents indicated their preference was for the municipality to do nothing or to increase resiliency. 7 respondents indicated support for some form of intrusive option. Also of note, Greater than 50% of respondents opposed any option that would reduce the lake level, and finally, over a third requested further engagement on any flood mitigation work.

Discussion & Analysis

The analysis provided by the consultants indicates that increasing the conveyance capacity and/or introducing a control structure at the outlet of Fancy Lake is not a recommended approach for addressing flood risk in the area of study. The primary reasons include: the anticipated environmental impact of construction; the major regulatory hurdles that would be associated with this type of alteration of a watercourse; and the high cost of such an infrastructure project.

In terms of community engagement, the Hebbville Village Commission has been vocal in their support for a dam or some other flow control structure at the outlet of Fancy Lake. However,

fewer than 10% of respondents to the public engagement survey supported any form of flow control or increased conveyance options. Over 85% of survey respondents supported the non-intrusive resiliency option or taking no action at all in response to the identified flood risk. Based on both the consultant's information and the public input, staff recommend that Council adopt the approach of increasing resiliency to the risk of flooding. The key elements of increasing resiliency are outlined as follows:

Increased Cooperation with PSC

Since the beginning of Phase 3 of this project, MODL has been in closer communication with staff at the Bridgewater Public Service Commission (BPSC) who operate Hebb's dam at the inlet of Fancy Lake. The BPSC staff have explained operating procedures and have agreed to share more information about when water is released from the dam. This has aided in public communication over the past year. The Utility will be sharing further information on dam operations and their emergency plan to increase MODL's understanding of the dam's regulation and operations. In addition, the BPSC and its consultants are prepared to develop an improved and standardized public communication tool to assist in public education and understanding of the dam's operation, and to advise if there is any flood risk due to forecasted conditions. This greater engagement from the Utility will improve REMO decision making for example in future potential evacuation situations, and help reduce future risk.

Increased Public Communication

CBCL's report recommends the development of a standardized communication protocol where flood risk is elevated. This would include:

- An internal protocol based on weather forecasts, current conditions and information from the BPSC to create consistent criteria for when messaging to the public is provided.
- Standard information to be included in public communication including timing of a possible flood event, potential impact of a flood event, and preparedness messaging.
- Standardized communication channels including direct email, websites, social media and/or general media. The type of communication may vary depending on the severity of the flood risk.

Increased Public Preparedness for Emergencies

Currently MODL promotes residents being prepared for emergencies through our Regional Emergency Management Organization (REMO). Comprehensive information can be found on the REMO website (<https://www.lunenburgremo.ca/preparedness.html>). Key features of preparedness include knowing the risks in your community, having an emergency plan for your household, and being prepared to shelter in place for at least 72 hours after an events like hurricane or flooding events.

In addition to the regular REMO education and communication work, MODL can invest in additional public outreach to increase the resiliency of residents in the face of more frequent flooding and other climate related emergencies.

Pre-Planning for an Evacuation

REMO currently has a range of contingency plans for likely events in Lunenburg County, including both hurricane and flooding/storm surge events. It is recommended that MODL invest in the development of a community-specific contingency plan in the event of flooding in the lower Petite watershed area. In addition to the communication protocol noted above, the plan would include: triggers specific to the watershed to identify when different levels of action are required, evacuation zones based on CBCL's flood mapping data, predetermined routes and shelter locations, and preliminary recovery planning.

Water Level Monitoring Station for Fancy Lake

There are currently water level gauges upstream of Fancy Lake operated by the BPSC. Combined with forecast information from Environment Canada, MODL has been able to improve communication to residents about flood risk.

One of the elements explored by CBCL would be to add water level monitoring in Fancy Lake. The station would provide data on the water level and therefore storage capacity of the lake which would help in communicating flood risk to residents.

A monitoring station generally includes a wet well, a level measuring device, a solar panel and a data transmitter. CBCL notes that selecting an appropriate site is necessary, which may involve land or easement negotiations, and some environmental permitting will be required as construction will occur in a watercourse. CBCL estimates a construction cost of \$214,500, with an additional \$235,000 in environmental studies, geotechnical design and engineering work, for a total of approximately \$450,000 (This estimate does not include land acquisition costs and are uncertain without site selection being completed).

It should be noted that constructing a monitoring station in Fancy Lake may improve, but will not perfect, forecasting and public communication about flood risk in the Petite Riviere. For example, the flashfloods experienced in July of 2023 far exceeded the forecasted amounts; a monitoring station in Fancy Lake would not have improved MODL's ability to predict and warn residents of a flood. Additional water level monitoring in the Petite Riviere watershed may help improve our understanding of the impacts associated with different rainfall amounts, or with the release of water from Hebb's Dam. However flooding impacts of a single forecasted event will remain difficult to pinpoint due to meteorological variability, ground saturation leading up to the event, and snow and ice melt conditions, among other factors.

Given that water level monitoring could improve flood forecasting and therefore public communication, but construction costs of a monitoring station remain uncertain, further investigation should be pursued before determining whether or not to invest in this infrastructure.

SUMMARY OF RECOMMENDED STEPS

- Encourage BPSC to continue with the development of a public communication process;
- Develop and implement a communications protocol for flood risk in the Petite Riviere;
- Invest in more emergency preparedness education in MODL; and
- Create a contingency plan specifically for the lower Petite watershed area.

Budget Implications

The Phase 3 project budget was set at 146,000, 50% of which is funded by a provincial flood mitigation grant. The consulting costs for this phase of the project have been \$89,800 to date. Using the estimate of 10% of construction costs, it is anticipated that site selection and pre-design work for a monitoring station could be completed within the remaining budget should council wish to pursue this element of the building resiliency options. Detailed design and construction costs for a water level monitoring station remain uncertain without site selection and design.

Work plan/Timeline

It is anticipated that enhancing public communication and completing additional education on emergency preparedness can be completed within existing staffing and can begin this fiscal year. Developing a contingency plan for flooding in the Petite Riviere may involve procuring outside resources and would be completed in 2024/25. With Council approval, Staff would begin more detailed pre-design work including potential site selection in this fiscal year. Should a water level monitoring station be created, construction would take place not sooner than the 2024/25 fiscal year.

Alternatives

Phase II of the project identified that establishing land use planning will reduce the impact of future flood events by limiting or prohibiting development in flood prone areas. Council is currently pursuing comprehensive land-use planning as part of the MODL 2040 project.

Council could decide to further pursue the investigation of an intrusive option that would expand the capacity of Fancy Lake to release water and reduce potential flooding impacts. For the reasons noted above, this approach is not recommended.

Conclusion

The Consultant’s analysis indicates that there are intrusive options to reduce floodrisk by controlling the release of water out of Fancy Lake, however these options are not recommended given environmental impacts, issues with federal and provincial approval, high capital cost, ongoing operational costs, and uncertainty as to their downstream impacts. Building resilience through improved communication and emergency preparedness provides a more cost-effective method to reduce the impact of flooding in the lower Petite Riviere.

Report Preparation	
Department	Administration
Report Prepared by	Alex Dumaresq, Deputy CAO
Report Approved by	October 4, 2023
Date Reviewed by CAO	




Petite Rivière Watershed Flood Mitigation Concept Development

Final Report



211107.00 • June 2023

04	Final Report Revised	A. Baillie A. Wilson	2023/06/20	M. Rutherford
03	Final Report	A. Baillie M. Browne A Wilson L Hardwick	2023/05/24	M. Rutherford Y. Zhang
02	Draft Report	A. Baillie M. Browne A Wilson	2022/05/20	V. Fernandez M. Rutherford Y. Zhang
01	Draft Report	A. Baillie M. Browne	2022/03/04	V. Fernandez M. Rutherford Y. Zhang
Issue or Revision		Reviewed By:	Date	Issued By:
		<p>This document was prepared for the party indicated herein. The material and information in the document reflect CBCL Limited's opinion and best judgment based on the information available at the time of preparation. Any use of this document or reliance on its content by third parties is the responsibility of the third party. CBCL Limited accepts no responsibility for any damages suffered as a result of third party use of this document.</p>		

Project No. 211107.00



June 20, 2023

Alex Dumaresq
Deputy CAO
Municipality of the District of Lunenburg
10 Champlain Drive
Cookville, NS B4V 9E4

Dear Mr. Dumaresq:

RE: Municipality of the District of Lunenburg (MODL) Flood Mitigation Concept Development for the Petite Rivière Watershed

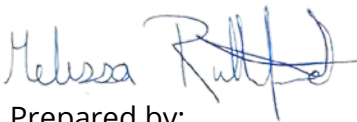
CBCL Limited is pleased to present our final report for Flood Mitigation Concept Development for the Petite Rivière Watershed for the Municipality of the District of Lunenburg (MODL). This report builds off of the Phase I and II flood modelling and risk assessment findings and provides a conceptual options analysis, and summary of engagement activities, so that MODL can select a flood mitigation concept that is best suited to the needs of the Petite Rivière Watershed.

We would like to thank you for the opportunity to work on this extremely interesting and important project.

Should you have any questions regarding the content of this report, please do not hesitate to contact me.

Yours very truly,

CBCL Limited



Prepared by:
Melissa Rutherford, B.Sc. P.Biol., R.P.Bio.
Project Manager
Direct: 902-717-8487
E-Mail: mrutherford@cbcl.ca

Project No: 211107.00

Executive Summary

The Municipality of the District of Lunenburg (MODL) is investigating the magnitude and extents of flood risks in the Petite Rivière Watershed. The watershed is approximately 244 km²; the main watercourse, the Petite Rivière, flows through various rural communities; one of the most populated areas within the watershed is around Fancy Lake. The area around Fancy Lake includes approximately 320 residential dwellings and 700 residents. During Phase 1 and Phase 2, CBCL identified regions with high risk of flooding within the Petite Rivière Watershed, particularly Fancy Lake. The flood delineation indicates that a significant portion of infrastructure and buildings are at risk of flooding. Within the Fancy Lake area, approximately 27 buildings are at risk of inundation under present climate conditions.

This Project includes the development of conceptual options (Phase 3) focused on high-risk regions, specifically the Fancy Lake Area, based on the flood lines evaluated in Phase 1, consultation with MODL, and information collected in the public and stakeholder meetings. Since the conclusion of Phase 2, MODL has begun land use planning to meet provincial standards, which includes scoping of approved activities within floodplains. MODL decided not to explore elevating roads and bridges as the area includes largely private infrastructure, not municipally-owned roads. Three mitigation approaches are being advanced to conceptual design for evaluation in Phase 3:

1: Monitoring and Warning Systems:

- A) Fixed Forecasting Framework
- B) Real Time Flood Mapping

2: Conveyance Capacity:

- A) Widening River Channel – Outlet of Fancy Lake
- B) Dredged River Channel – Outlet of Fancy Lake

3: Flow Control Measures:

- A) Dredged River Channel with Flow Control (Bypass Channel) – Outlet of Fancy Lake
- B) Natural River Bypass – Outlet of Fancy Lake

The Report includes identification of capital and operational requirements, and opinion of probable construction costs at the conceptual level. The required timelines for design, construction, and associated capital and operational cost will depend on the selected option. Table A.1 provides a comparison of timelines and probable capital and operating cost for the proposed mitigation approach concepts.

Table A.1 Petite Rivière Watershed Flood Mitigation Summary

	Option 1: Monitoring and Warning Systems		Option 2: Conveyance Capacity		Option 3: Flow Control Measures	
	A) Fixed Forecasting Framework	B) Real-time Flood Mapping	A) Widening River Channel	B) Dredged River Channel	A) Dredged River Channel with Flow Control	B) Natural River Bypass
Timelines for Engineering Studies, Design	1 year	1 year	2-3 years	2-3 years	2-3 years	2-3 years
Timelines for Construction	3 months	3 months	1-2 years	1-2 years	1-2 years	1-2 years
Estimated Total timeline	1 – 1.5 years	1 – 1.5 years	3-4 years	3-4 years	4-5 years	4-5 years
Capital Construction Cost Estimate*	\$ 450,000	\$ 470,000	\$3,720,000	\$7,370,000	\$12,170,000	\$11,240,000
Maintenance Annual Cost Estimate*	\$20,000	\$50,000	\$20,000	\$25,000	\$125,000	\$120,000

* Conceptual Level Opinions of Probable Construction Costs

Stakeholder and public engagement efforts showed that options that result in the least amount of water alterations would be most preferable, such as water level monitoring or doing nothing. Regulatory agencies noted that any submitted applications for intrusive options (flow control or increasing conveyance capacity) will require quantification of flood protection abilities and documentation of projected flow abilities for the proposed project.

The outcome of Phase 3 will allow the MODL to assess which flood mitigation concept is the most suitable within the Petite Rivière Watershed and which option, if any, should be implemented.

Contents

1	Introduction	1
1.1	Background	1
1.2	Flooding Risk Assessment.....	3
1.3	Approach	6
2	Concept Development.....	7
2.1	Option 1: Water Level Monitoring and Warning System.....	7
2.1.1	Description of Concept.....	8
2.1.2	Anticipated Regulatory Approvals, Including Required Studies, and Estimated Timelines for the Water Level Monitoring Station	12
2.1.3	Timelines for Engineering Studies, Design, and Implementation of the Water Level Monitoring and Early Warning System	13
2.1.4	Capital and Operating Requirements.....	14
2.1.5	Specific Aspects of Option A vs. Option B.....	15
2.2	Option 2: Increasing Conveyance Capacity	16
2.2.1	Description of Concept.....	16
2.2.2	Anticipated Regulatory Approvals, Including Required Studies, and Estimated Timelines.....	17
2.2.3	Timelines for Engineering Studies, Design, and Construction	19
2.2.4	Capital and Operating Requirements.....	19
2.3	Option 3: Implementing Flow Control	20
2.3.1	Description of Concept.....	21
2.3.2	Anticipated Regulatory Approvals, Including Required Studies, and Estimated Timelines.....	22
2.3.3	Timelines for Engineering Studies, Design, and Construction	24
2.3.4	Capital and Operating Requirements.....	25
2.4	Opinion of Probable Cost for Concepts.....	27
2.4.1	Capital Costs	27
2.4.2	Operational Costs	30
2.4.3	Opinion of Probable Cost for Concepts Summary	31
3	Engagement Activities.....	32
3.1	Stakeholder Groups	32

3.1.1	Bridgewater Public Service Commission	32
3.1.2	Regulatory Agencies	33
3.1.3	Hebbville Village Commission	35
3.2	Public Consultation.....	38
3.2.1	Open House	38
3.2.2	Public Survey.....	39
3.3	First Nation Engagement	40
3.4	Summary of Key Themes	40
	4 Summary and Closure	44
4.1	Summary of Concepts.....	44
4.2	Summary of Environmental Requirements.....	48
4.3	Closure.....	50
	5 References.....	52

List of Figures

Figure 1.1:	100yr CC Flood Line Downstream of Hebb Lake Dam (Left) and around Fancy Lake (Right) (CBCL, 2020b). Dark blue is existing shorelines or waterways, light blue denotes 100yr CC Flood Line.....	3
Figure 1.2:	100yr CC Flood Line Downstream of Fancy Lake and near the Outlet of Petite Rivière (CBCL, 2020b). Dark blue is existing shorelines or waterways, light blue denotes 100yr CC Flood Line.....	4
Figure 2.1:	Schematic of Water Level Monitoring Station.....	9
Figure 2.2:	Potential Locations for Water Level Monitoring Stations.....	10

List of Tables

Table 1.1:	Summary of Potential Effects from Flooding (CBCL, 2020a).....	5
Table 1.2:	Mitigation Approach and Project for Conceptual Development	6
Table 2.1:	Option 1 Water Level Monitoring: Regulatory Considerations.....	12
Table 2.2:	Option 1 Water Level Monitoring: Approximate Durations for Engineering Studies, Design, and Construction	14
Table 2.3:	Option 1 Water Level Monitoring: Capital and Operating Requirements	14
Table 2.4:	Option 2 Conveyance Capacity: Regulatory Considerations.....	18

Table 2.5:	Option 2 Conveyance Capacity: Approximate Durations for Engineering Studies, Design, and Construction	19
Table 2.6:	Option 2 Conveyance Capacity: Capital and Operating Requirements	19
Table 2.7:	Option 3 Flow Control: Regulatory Considerations	23
Table 2.8:	Option 3 Flow Control: Approximate Durations for Engineering Studies, Design, and Construction.....	24
Table 2.9:	Option 3 Flow Control: Capital and Operating Requirements.....	26
Table 2.10:	Opinion of Probable Capital Cost for Proposed Mitigation Approach Concepts	29
Table 2.11:	Opinion of Probable Operational Cost for Proposed Mitigation Approach Concepts	30
Table 2.12:	Summary of Timelines and Probable Costs for Proposed Mitigation Approach Concepts	31
Table 4.1:	Mitigation Options for Fancy Lake Area and Corresponding Mitigation Effects	44
Table 4.2:	Petite Rivière Watershed Flood Mitigation Summary of Concept Options.....	46
Table 4.3:	Petite Rivière Watershed Flood Mitigation Summary of Timelines for Construction and Probable Capital and Operating Costs	48
Table 4.4:	Petite Rivière Watershed Flood Mitigation Environment Studies Summary and Associated Level of Effort.....	49
Table 4.5:	Petite Rivière Watershed Flood Mitigation Regulatory Considerations Summary of Requirements and Level of Effort.....	50

Appendices

- A Conceptual Sketches
- B Open House Poster Boards

1 Introduction

The Municipality of the District of Lunenburg (MODL) is investigating the magnitude and extents of flood risks in the Petite Rivière Watershed, focused on Fancy Lake. As part of Flood mitigation strategies, MODL is developing planning policies and identifying mitigation options, as discussed in this report. These are supported by flood mapping and subsequently by flood mitigation measures completed in Phases 1 and 2, which identified potential flooding risk around Fancy Lake during 1 in 100 rainfall events. Under present climate conditions, this risk included flooding of 21 km² of land, erosion risks, as well as flooding to 87 buildings in the watershed, including those around the perimeter of Fancy Lake. Concerns from residents were noted about the importance of investigating flood mitigation options to reduce risks of flooding homes in the area.

This report presents conceptual options for the flood mitigation measures that were selected in Phase 2 for further investigation. The development of these options is considered to be Phase 3 of the overall flooding risk assessment. The outcome of Phase 3 will allow the MODL to assess which flood mitigation concept is the most suitable within the Petite Rivière Watershed and which option, if any, should be implemented.

1.1 Background

With a surface area of approximately 244 km², the Petite Rivière Watershed is located south and southwest of the Town of Bridgewater. The Petite Rivière is approximately 40 km in length and descends 120 m in elevation from the headwaters of the river at Birch Brook, to the river's mouth located in Green Bay. The main watercourse runs through various rural communities; one of the most populated areas within the watershed is around Fancy Lake, with approximately 320 residential dwellings and 700 residents.

MODL's flood risk management assessment strategy has been divided into multiple phases. From 2019 through 2020, CBCL Limited (CBCL) supported the initial steps of mitigation strategies development including Flood Risk Assessment (Phase 1) and the Flood Mitigation Planning (Phase 2).

In Phase 1, the hydrologic and hydraulic regime within the Petite Rivière Watershed was assessed to estimate flood extents based on the modelling of various flood scenarios. Flooding risks were identified around Fancy Lake during assessments in Phases 1 and 2.

This phase involved the development of flood maps and 3D renderings for future planning. High-risk regions were identified based on estimated flood extents, consultation with MODL, and information collected in public and stakeholder meetings. To support future selection of potential flood mitigation strategies, Phase 1 also involved public and stakeholder engagement and the evaluation of potential impacts of flooding hazards. In addition, regulatory considerations and environmental impacts that may limit possible future mitigation options were also included.

As Part of Phase 2, CBCL conducted an assessment of potential flood mitigation options, including (CBCL, 2020b):

- ▶ Land use planning and development controls
- ▶ Flow control measures
- ▶ Conveyance capacity increase
- ▶ Flood protection measures, such as berms
- ▶ Relocation and/or raising of vulnerable structures at risk
- ▶ Accepting risks and building resilience

CBCL proposed the implementation of a ranking system based on the combination of each measure's effectiveness in reducing flood risks around Fancy Lake, project costs, operational costs, management requirements, environmental considerations, regulatory requirements, economic impacts, and social acceptance. The effectiveness of each measure was evaluated by re-assessing flood lines with the mitigation measures in place. Based on the ranking system, along with the consultation with MODL, the following top 5 mitigation options were selected for more detailed consideration in Phase 3:

- 1 Land use planning
- 2 Building community resilience
- 3 An operated flow control structure at the outlet of Fancy Lake (flow control)
- 4 River channel widening at the outlet of Fancy Lake (increased conveyance capacity)
- 5 Elevated roads and bridges

Since the conclusion of Phase 2, MODL has begun land use planning to meet provincial standards, which includes scoping of approved activities within floodplains. MODL decided not to explore elevating roads and bridges as the area includes largely private infrastructure, not municipally-owned roads. The following three mitigation options were selected to advance to Phase 3 concept development:

- ▶ Support community resilience through water level monitoring and flood warning systems
- ▶ Increase conveyance capacity
- ▶ Flow control

1.2 Flooding Risk Assessment

The river runs through and adjacent to several communities and residential areas within the watershed before it connects with the ocean, including Hebbville, Conquerall Mills, and Crousetown. During Phase 1 and Phase 2, CBCL identified regions with high risk of flooding within the Petite Rivière Watershed.

The flood delineation indicates that a significant portion of infrastructure and buildings are at risk of flooding. For example, under the 1 in 100 year event, for present climate conditions, approximately 87 buildings are at risk of inundation, and this value increases to 130 under the projected climate change scenarios. Figure 1.1 and Figure 1.2, show areas of interests within the Petite Rivière Watershed located downstream of Hebb Lake Dam, around Fancy Lake, and downstream of Fancy Lake. These are areas of higher density with approximately 27 buildings at risk of inundation under present climate conditions.

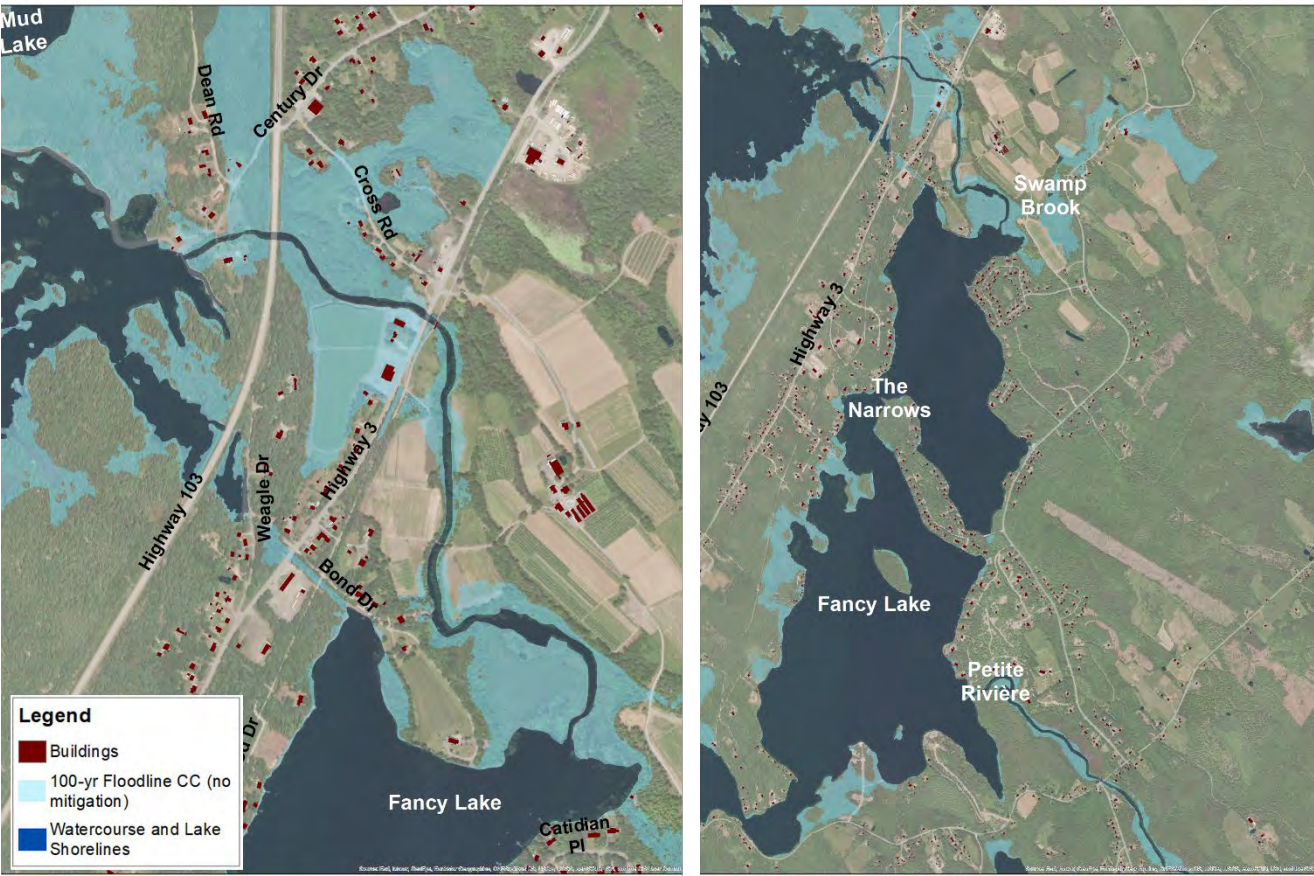


Figure 1.1: 100yr CC Flood Line Downstream of Hebb Lake Dam (Left) and around Fancy Lake (Right) (CBCL, 2020b). Dark blue is existing shorelines or waterways, light blue denotes 100yr CC Flood Line.

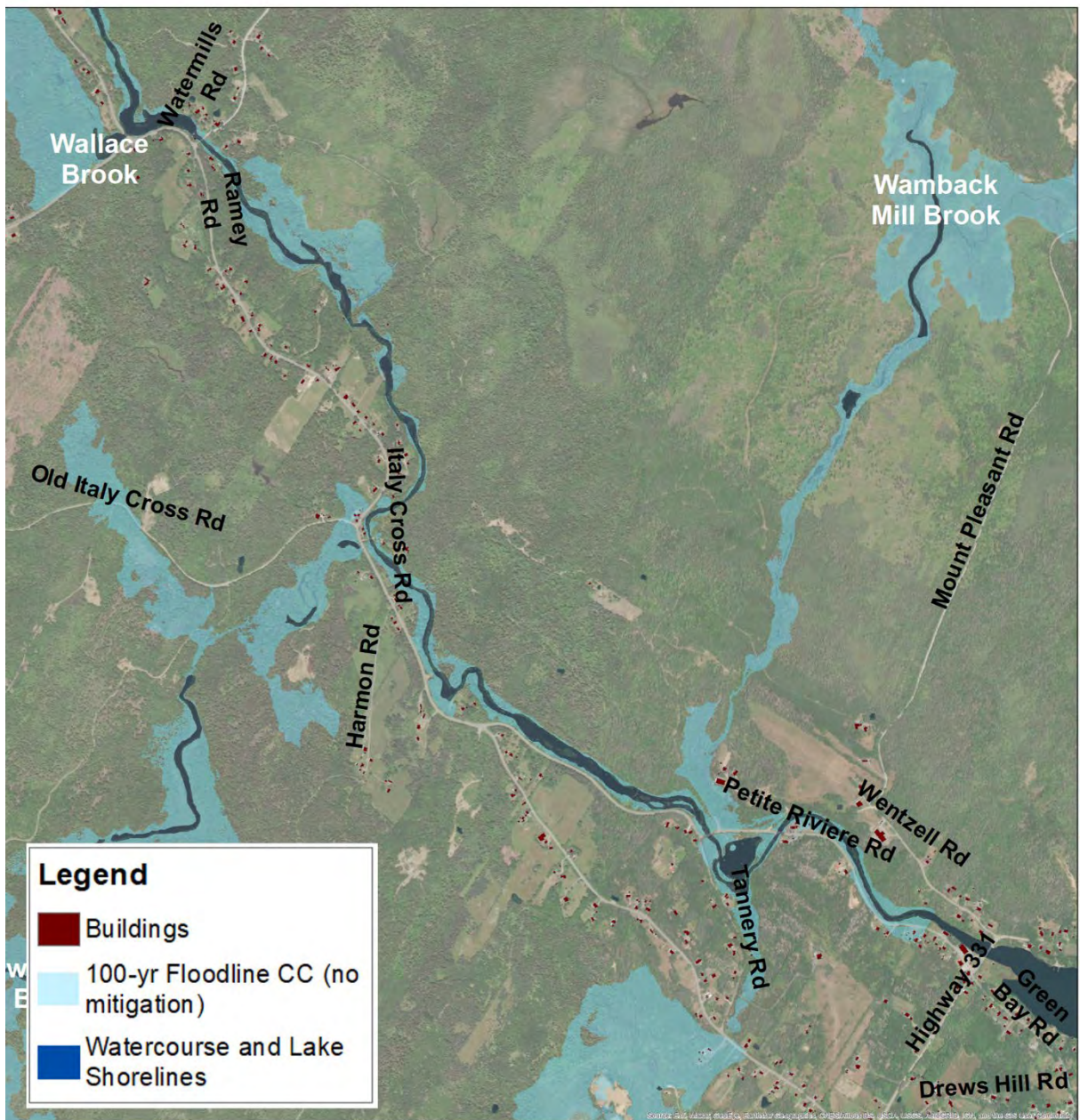


Figure 1.2: 100yr CC Flood Line Downstream of Fancy Lake and near the Outlet of Petite Rivière (CBCL, 2020b). Dark blue is existing shorelines or waterways, light blue denotes 100yr CC Flood Line.

Understanding the potential effects of flooding allows for the identification of potential problems before they occur and supports the need for flooding risk management options and the assessment of potential mitigation solutions. The potential effects could include effects to important components, such as people, economy, structures, and network. Table 1.1 summarizes potential effects that may relate to Petite Rivière and Fancy Lake Area.

Table 1.1: Summary of Potential Effects from Flooding (CBCL, 2020a)

Component	Potential Effects of Flooding
Natural Environment	<ul style="list-style-type: none"> • Release of sediment and deleterious substances due to the increase of movement of water, water levels, and interaction with land-based activities or abandoned mines, which may degrade water quality. • Fluctuations of water level, which may affect environmental resources such as vegetation, wetlands, fish species, protected and endangered species, and wildlife. • Temporary loss or alteration of habitat due to direct flooding. • Temporary displacement of species from their habitat or temporary relocation due to flooding. • Damage to wetlands by over inundation or water movement due to flooding. • Reduction in groundwater quality as a result of interaction of flooding with private wells.
People	<ul style="list-style-type: none"> • Effects to human safety as a result of flooding and water management. • Damage or loss to personal properties, such as properties homes, watercrafts, automobiles, and private wells. • Temporary displacement as a result of flooding. • Permanent displacement as a result of damage. • Distress to individuals as a result of damage to personal property, access to properties, or emergency measures, such as temporary or permanent displacement. • Multiple stakeholder and stakeholder interests, which may result in different priorities in terms of water management. • Reduction in groundwater quality as a result of interaction of flooding with private wells. • Recommissioning of private water wells, such as testing, rehabilitation and alternative water sources.
Economy	<ul style="list-style-type: none"> • Loss of income due to flooding; such as farming and limiting access. • Damage to properties due to flooding, such as commercial properties and farms.
Structures and Networks	<ul style="list-style-type: none"> • Temporary loss of access to structures and networks such as roads and bridges. • Damage to structures due to flooding; impact from debris as a result of flooding. • Overloading structures and networks during emergency measures.

Component	Potential Effects of Flooding
	<ul style="list-style-type: none"> Existing structures may affect the system's ability to pass water, such as the former Conquerall Mills Dam, and Crousetown Dam. Effects to water management abilities, due to safety of structures and other objectives. Loss of private wells due to interaction with flooding.

1.3 Approach

The three mitigation approaches are being advanced to concept design for evaluation in Phase 3. A summary description of these mitigation approaches is provided in Table 1.2.

Table 1.2: Mitigation Approach and Project for Conceptual Development

Mitigation Approach	Tentative Project for Conceptual Development
Building Community Resilience	1: Monitoring and Warning Systems: A) Fixed Forecasting Framework B) Real Time Flood Mapping
Increase Conveyance Capacity	2: Conveyance Capacity: A) Widening River Channel over 200 m– Outlet of Fancy Lake B) Dredged River Channel over 750 m– Outlet of Fancy Lake
Flow Control	3: Flow Control Measures: A) Dredged River Channel over 750 m with Flow Control (Bypass Channel) – Outlet of Fancy Lake B) Natural River Bypass – Outlet of Fancy Lake

Key information about the mitigation options is provided in Chapter 2, including:

- ▶ High-level description of the concept
- ▶ Outline of capital and operating requirements
- ▶ Estimated timelines for engineering studies and design
- ▶ Estimated time for construction
- ▶ Anticipated regulatory approvals, including required studies and estimated timelines
- ▶ Class D cost estimates for option

Engagement activities have occurred through Phases 1, 2 and 3, including two public meetings, stakeholder engagement, and indigenous engagement. As part of Phase 3, engagement activities included discussions with key stakeholders during the concept development process, a public meeting, and initiation of indigenous engagement regarding the concepts. Stakeholder engagement results are summarized in Chapter 3 for consideration in the decision-making process.

2 Concept Development

The development of concept designs for flood management approaches around Fancy Lake involved a review of the hydrologic and hydraulic calculations, conducted during Phase 2; an evaluation of the anticipated regulatory requirements; an estimation of the timelines for engineering studies, design, and construction; and an estimation of the probable capital and operational costs associated with each concept.

The concepts evaluated in the following subsections included:

- 1 Water Level Monitoring and Warning Systems:
 - A) Fixed Forecasting Framework
 - B) Real Time Flood Mapping
- 2 Increase Conveyance Capacity:
 - A) Widening River Channel over 200 m – Outlet of Fancy Lake
 - B) Dredged River Channel over 750 m– Outlet of Fancy Lake
- 3 Flow Control:
 - A) Dredged River Channel with Flow Control (Bypass Channel) – Outlet of Fancy Lake
 - B) Natural River Bypass – Outlet of Fancy Lake

2.1 Option 1: Water Level Monitoring and Warning System

Water level monitoring and warning systems are fundamental components for the effective management of flooding risks. Flood risk mitigation infrastructure, or flood defense infrastructure, provides limited protection from events exceeding their design capacity. Extreme events such as the 1 in 20 year and the 1 in 100 year event, which have been the standard criteria for delineating areas at risks of flooding in Canada, may be exceeded at any time and do not represent worst possible events. Water level monitoring is a feasible risk management approach that allows the timely implementation of flood resiliency measures (sand bags, temporary flood barriers, and in extreme cases, evacuation), reducing the risks of property damage, as well as injury and loss of life.

2.1.1 Description of Concept

The structure and complexity of a flood warning system depends on:

- ▶ The area at risk, i.e., land uses, population distribution, consequences of damage
- ▶ The cause of the flooding risks, (ice jams, hydraulic restrictions, storm surges)

A water level monitoring and warning system can also be customized and scaled to provide different degrees of monitoring depending on the risk and frequency of events. Generally, the implementation of this type of system requires the following specific components:

- ▶ Weather Forecast Data from a reliable source (e.g., Environment and Climate Change Canada)
- ▶ Water Level Monitoring
- ▶ Flood Forecasting Framework and Computation System
- ▶ Communication Strategy
- ▶ Operational team and Emergency Staff

A description of the implementation of these components to the Fancy Lake system is presented in the following subsections. For comparison, two flood forecasting approaches were evaluated, which are described individually in the Flood Forecasting Framework and Computation System section:

- A) Fixed Forecasting Framework
- B) Real Time Flood Mapping

Weather Forecast Data

Every 6 hours, Environment and Climate Change Canada issues a detailed weather forecast that includes an estimate of the upcoming precipitation events for the next 48 hours, broken down in 1-hour increments. These forecasts are the results of sophisticated meteorological models, updated every 6 hours. This forecast can be downloaded and used as input into a hydrologic/hydraulic model that can be run to estimate the flows and water levels associated to the forecasted event.

Water Level Monitoring

Water level measurements within the Fancy Lake watershed allows for estimates of the available storage within the lake before a forecasted event. This information, in combination with the precipitation forecast and the hydrologic and hydraulic model of the Fancy Lake system, allows the generation of an estimate of the potential flooding risk associated with a forecasted rainfall event.

Another key part of the hydraulic system is the lake upstream of Fancy Lake, Hebb Lake, which also stores large volumes of water, and is itself receiving water from several other lakes. Hebb Lake is a source of drinking water for the Town of Bridgewater, and as such, its level is managed to ensure a safe drinking water supply. It is managed by the Bridgewater Public Service Commission (BPSC), which owns and operates a water level monitoring

network for Hebb Lake, which does not extend to Fancy Lake. The BPSC has agreed to share the Hebb Lake water level information for use in the proposed early warning system.

To allow the transmission of this data to the MODL system the BPSC system will require information technology (IT) system upgrades, including potential updates to SCADA software, implementation of security settings, increasing data storage capacity, and implementation of remote access safety protocols. Steps required for this collaboration include submission of additional information to the BPSC for review, such as the following:

- ▶ Description of how the BPSC data will be used and how it is going to be shared. For example, a system that is developed to support the Regional Emergency Management Organization (REMO) and focused on providing warnings, is preferred over the sharing of raw data.
- ▶ Preparation of a summary of the recommended system for review with a request for approval of the data sharing.
- ▶ Development of agreements around costs, legalities, and other practical matters.

Data from the BPSC water level monitoring network will be very helpful to provide information to the forecasting system. Water levels in Fancy Lake, however, will also be needed, and since monitoring of Fancy Lake is not part of the BPSC network, obtaining this information will require additional instrumentation.

At Fancy Lake, the installation of a water level monitoring station, complete with telemetry, would allow the automatic collection and transmission of water level data. This information would be used to evaluate the risk of flooding based on the current water levels and the forecasted rainfall event.

The monitoring station would consist of a wet well with a level measuring device (pressure transducer or similar) that is powered with a solar panel (Figure 2.1). The data collected would be transmitted to a central receiving system owned and operated by MODL.

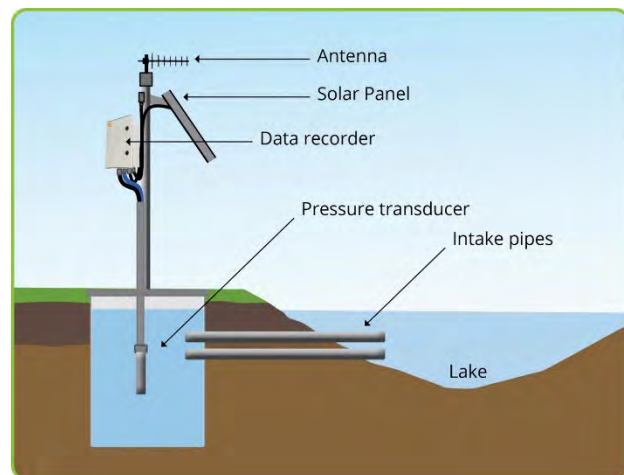


Figure 2.1: Schematic of Water Level Monitoring Station.

Preliminary options of locations for the proposed station are shown in Figure 2.2 and described as follows:

- ▶ **Location A - Fancy Lake Outlet:** This site is located at the outlet of Fancy Lake on provincial property. This tentative location was selected as historical air photos suggest that this location is less likely to sustain ice build up which may cause disruptions to the recording of water levels or to be impacted by backwater effects associated with ice

build up. Site access would be required, such as a trail or access road to allow frequent inspection and maintenance of the station.

- ▶ **Location B – End of Rachel’s Lane:** This site is located close to Rachel’s Lane on private property. Even though it is located close to the Fancy Lake Outlet, it may be prone to some ice build up. Access would require construction of a short road or trail for inspection and maintenance of the station.
- ▶ **Location C – Along Conquerall Road:** This site is located off Conquerall Road and is located on private property. Similar to Location B, this site may be prone to ice build up during the winter season. However, due to the proximity to the road, it is not expected to require major construction work to provide access to the station.
- ▶ **Location D – End of McBunt Drive:** This site is located close to the end of McBunt Drive on private property. The site may be prone to ice build up.



Figure 2.2: Potential Locations for Water Level Monitoring Stations.

The final location of the proposed station would be a function of the following criteria:

- ▶ Safe access to lake shore and site conditions (presence of stable slopes, dry soils, and accessible vegetation cover).
- ▶ Reduced local influence of flow constrictions or sudden flow releases from Hebb Lake.
- ▶ Proximity to access roads.

- ▶ Land ownership. Priority would be given to publicly owned land, however a preliminary assessment of land titles in the area indicates that most parcels belong to private owners.

Flood Forecasting Framework

Approaches to flood forecasting range from pre-determined relations between amount of rainfall and water levels to real time hydrologic and hydraulic models. The existing hydraulic and hydrologic model of the Fancy Lake system provided a basis for the development of a flood forecasting framework that is based on a computer simulation of the Fancy Lake watershed.

This assessment evaluates two different options, presented below, to develop a flood forecasting system using the existing model. In both cases, monitoring of water levels, discharged flows, and rainfall events under different seasonal conditions would be required to allow calibration of the model and validation of flood forecasts throughout the year. Both options also assume that the development of a flood forecasting framework requires professional services, and that this framework is updated periodically to account for changes in land uses and climate.

- A. **Fixed Forecasting Framework:** This option assumes the implementation of a flood forecasting framework based on a one-time simulation of multiple rainfall and water level scenarios to develop a matrix that relates water levels at the lake, seasonal conditions, rainfall events and flooding risks. This would result in a fixed reference that would be used by the operators of the program to evaluate flooding risks based on the water level at the lake and the forecasted rainfall. Municipal staff would be responsible for the interpretation of water level data and flooding risks.
- B. **Real Time Flood Mapping:** This option assumes the ongoing operation of the existing hydrologic and hydraulic model of the Fancy Lake system updated automatically with the rainfall forecast provided by Environment Canada and water level readings from the water level monitoring stations. At the end of the simulation automatic flood lines are generated and published to a website (not accessible to the public) allowing the evaluation of flooding risks based on real-time inundations maps.

Communication Strategy

Effective flood warning systems require the development of a communication strategy that defines the following:

- ▶ Protocols to issue public warnings about timing, location, and potential impact of a flooding event.
- ▶ Means and format of communication through social media, websites, and general media.
- ▶ Standard and consistent messages across the different platforms of communication with the general public.
- ▶ Protocols of communications with stakeholders, and different levels of Government.

This concept assumes that this component of the early warning system will be developed with the advice of professionals in this area and implemented by MODL.

Operational Team and Emergency Staff

This concept assumes that the Municipality would review and update their emergency response strategies as needed and implement an emergency response plan with existing resources.

2.1.2 Anticipated Regulatory Approvals, Including Required Studies, and Estimated Timelines for the Water Level Monitoring Station

The anticipated legislation and regulatory approvals, environmental studies and their associated timelines are presented in Table 2.1. Environmental studies should focus on characterizing the location of the water monitoring station. Environmental studies should be undertaken by a qualified environmental professional. This information will be used as part of the application requirements and should be completed prior to submission of the applications. The regulatory requirements will be dependant on the preliminary design, proposed locations of the water level meters and proposed construction methodology. There may be additional requirements following development of the detailed design package.

Table 2.1: Option 1 Water Level Monitoring: Regulatory Considerations

Act / Regulations	Permits, Approvals, Authorizations, or Action	Required Environmental Studies	Anticipated Regulatory Timelines*
Nova Scotia Environment Act – Activities Designation Regulations	Watercourse Alteration Approval	<ul style="list-style-type: none"> Fish Habitat Assessment. 	Watercourse Alteration: 60 business days
	Wetland Alteration Approval**	<ul style="list-style-type: none"> Wetland Delineation. Wetland Functional Assessment. 	Wetland Alteration: 60 business days**
Nova Scotia Environment Act – Hebb, Milipsigate and Minamkeak Lake Watershed Protected Water Area Regulations	Not anticipated as not proposing to install instrument within Hebb, Milipsigate and Minamkeak Lake.	<ul style="list-style-type: none"> Not Anticipated. 	
Nova Scotia Crown Lands Act	Lease or Easement	<ul style="list-style-type: none"> Land Survey. 	Time required depends on the complexity of the request.

Act / Regulations	Permits, Approvals, Authorizations, or Action	Required Environmental Studies	Anticipated Regulatory Timelines*
Federal Fisheries Act	<i>Fisheries Act</i> Request for Review <i>Fisheries Act</i> Authorization for the harmful alteration, disruption or destruction of fish habitat (HADD, subsection 35.1).	<ul style="list-style-type: none"> Fish Habitat Assessment. 	Request for Review: DFO Review: no legislated timeline, based on experience approximately 30 days. Fisheries Act Authorization (if required) ^{***} : Up to 150 days ^{****}
Federal Species at Risk Act (SARA)	Species at Risk Permit if works are likely to interfere with Atlantic Whitefish.	<ul style="list-style-type: none"> Fish Habitat Assessment. 	DFO Review: ~90 days
Federal Canadian Navigable Water Act	Notification of Work / Approval	<ul style="list-style-type: none"> No Additional Surveys 	Public Comment Period: 30 days Navigation Protection Program Review: ~90 business days ^{****}

Notes:

* Regulatory timelines and does not include the time for the preparation of applicable or associated activities.

** The locations identified as potential locations for the water level monitoring system are not located within mapped locations of wetland. If during finalized selection of the monitoring system a wetland is identified, a Wetland Alteration may be required.

***Timeline does not include the development of an Offsetting Project and assumes a suitable Offsetting Project may be available for an existing community group for inclusion in the Fisheries Act Application.

**** Indigenous consultation efforts required for the Transport Canada Approval, and the DFO Fisheries Act Authorization (should an Authorization be required), may be delayed as a result of COVID-19. It should also be noted that the regulatory agency provided review times are noted in the table; however, there is no set time limit if the application is found to be incomplete, the regulatory clock is stopped due to information requests, for the development of a DFO accepted Offsetting Plan, or for secondary reviews, such as that undertaken by the Aboriginal Consultation Unit of Transport Canada or DFO.

2.1.3 Timelines for Engineering Studies, Design, and Implementation of the Water Level Monitoring and Early Warning System

The estimated timeline required for the engineering, design and implementation of the Water Level Monitoring and Warning System are provided in Table 2.2.

Table 2.2: Option 1 Water Level Monitoring: Approximate Durations for Engineering Studies, Design, and Construction

Option Component	Estimated Time to Complete Task
Engineering /Design:	
- Design of Monitoring Station.	12-16 months
- Collaboration with Stakeholder such as BPSC.	
- Connection with SCADA System.	
- Development of a flood forecasting framework (Option A: 3 months – Option B: 8 months).	
- Development of a communication strategy.	
- Set up of communication channels: mailing list, websites, radio broadcasting, etc.	
- Development of preparedness and response strategies consistent with the assessment of flooding risks.	
Environmental:	
- Studies.	1 month (completed during design)
- Approvals, Permits and Authorizations.	Approximately 3 to 6 months
Tendering and Construction:	
- Tendering/award.	2 months
- Installation of water level monitoring station and IT upgrades.	3 months
Total Time	1-1.5 years

2.1.4 Capital and Operating Requirements

The proposed capital and operating requirements for the Water Level Monitoring and Warning System are provided in Table 2.3.

Table 2.3: Option 1 Water Level Monitoring: Capital and Operating Requirements

Option 1 Monitoring and Warning Systems	
Capital Requirements	<p>Engineering Requirements</p> <ul style="list-style-type: none"> • Design and installation of IT system upgrades at BPSC to allows for sharing of data. • Design and installation of water level monitoring station. • Development of a flood forecasting framework: <ul style="list-style-type: none"> - Option 1A: Multiple scenarios run to relate rainfall amounts and duration with water levels and flooding risks. - Option 1B: Real Time Flood Mapping. • Maintenance: <ul style="list-style-type: none"> - Option 1A: Model update at least every 5 years update climatic changes and when major land use changes take place. - Option 1B: model update when major land use changes are identified.

Option 1 Monitoring and Warning Systems	
	<ul style="list-style-type: none"> • Development of a communication strategy and set up of communication channels: mailing list, websites, radio broadcasting, etc. • Development of preparedness and response strategies consistent with the assessment of flooding risks. <p>Environmental Requirements</p> <ul style="list-style-type: none"> • Environmental Studies and Applications as defined in Section 2.1.2.
Operating Requirements	<p>Engineering Requirements</p> <ul style="list-style-type: none"> • Biweekly inspection of water level gauging stations. • Periodic update to flood forecasting frameworks to changes in land use and climate. • Documentation of flood events. • Ongoing collaboration with stakeholders. • Ongoing technical development of staff in collaboration with Federal and Provincial agencies supporting and developing flood forecasting systems. • Monitoring equipment upgrades/replacement.

2.1.5 Specific Aspects of Option A vs. Option B

As shown on the tables above, Options 1A and 1B have many common aspects, in particular the water level monitoring system, which will be the same. The main difference lies in the framework and computing system.

Option 1A, the fixed forecasting framework, will only involve comparing total amounts of rainfall expected in the following 48 hours, and identify a flood map that corresponds to that total amount. Variations in the rainfall during the 48 hours will not be taken into account. The initial water level in the lakes prior to the event will be taken into account but will be generalized to a fixed set of scenarios. The rainfall amount prior to the forecasted event, the soils wetness, the flow in the various tributary watercourses to the lakes, for example, will not be taken into consideration. These aspects make Option 1A a valid forecasting system, but not as representative of the hydrology of the watershed as Option 1B, since it would not capture seasonal differences for example.

Option 1B, a real time flood forecasting system, leverages the work that has been done in Phases 1 and 2, where a hydrologic and hydraulic model were assembled and calibrated. The hydrologic and hydraulic models have been specifically adjusted to represent the hydrologic system of each tributary watershed, as well as the system of lakes, and how they interact with each other. The models directly use as input the hourly rainfall data, the forecasted temperature, the initial water levels of the lakes, and can also run the past rainfall to set the current hydrologic conditions before the forecasted rainfall is modelled. Each model run will therefore be unique and tailored to the current conditions and to the full details of the rainfall forecast. Snowfall and snowmelt, for example, can be modelled in winter conditions, which often create the most critical conditions for risks of flooding.

Option 1B has therefore a much greater degree of reliability and would indeed figure within the most advanced systems in the country, principally because it would be based on a calibrated hydrologic and hydraulic model. It would also allow knowledge about the system's behaviour to be gained with time, and modification could be applied as the knowledge evolves. Further refinements could be included in the future if desired, such as further calibration for a range of different conditions.

2.2 Option 2: Increasing Conveyance Capacity

Phases 1 and 2 of the Project identified that the channel at the outlet of Fancy Lake has narrowed over time due to the accumulation of rocks (CBCL 2020a,b). In addition, the bathymetric survey shows 2 meters of potential sediment accumulation at the outlet of the lake, which creates a natural restriction of flow from the lake. Increasing conveyance capacity at the outlet of Fancy Lake, by removing these restrictions, is likely to reduce flooding risk but it will also result in a lower water level in the lake. It is noted that modelling of rainfall conditions throughout the year 2020 indicate that under current conditions water levels at the lake would be lower than they currently are with each conveyance capacity option having a different impact lake level.

2.2.1 Description of Concept

Hydrologic and hydraulic modelling results (CBCL 2020b), indicate that increasing conveyance capacity at the outlet of Fancy Lake would decrease flooding risks under the 1 in 100 year rainfall event. The calculations also indicate that conveyance capacity at the outlet can be increased by either widening the outlet channel or dredging the riverbed. For this concept, the following alternatives were evaluated:

- A. Widening River Channel – Outlet of Fancy Lake
- B. Dredged River Channel – Outlet of Fancy Lake

Descriptions of the two conveyance capacity options evaluated are as follows:

A) Widening River Channel – Outlet of Fancy Lake

Option 2A consists of widening the channel by 5 m along the south riverbank for 200 m. CBCL (2020b) identified that widening the river channel at the outlet of Fancy Lake would increase the drainage (or conveyance) capacity of the outlet. For the 1 in 100 year rainfall event, the computer model showed a 0.7 m drop in the lake water level compared to the lake water level with the existing outlet conditions. Downstream of the outlet calculations show a water level increase ranging between 0.05 and 0.10 m. However, this increase does not result in additional flooding of existing infrastructure.

This option would result in slightly lower water levels at the lake all year round. Following the widening of the channel, model results indicate that the water levels could be approximately 0.1 m less than the water level under average conditions. This reduction generally remains constant throughout the year. Water level fluctuations (the difference

between the maximum and the minimum levels observed in one year) could decrease by 0.25 m. Further design and assessments, including detailed bathymetry and modelling, could support refinement of the anticipated change in water levels.

B) Dredged River Channel – Outlet of Fancy Lake

Alternatively, maintaining the current width and dredging the river by 2 m increases the discharge capacity at the outlet and reduces flooding risk around Fancy Lake for the 1 in 100 year flow, according to model results, by approximately 0.7 m. Given the riverbed elevation downstream of the outlet, to reduce backwater effects, dredging of the river is required for approximately 750 m. This option would result in lower water levels at the lake all year round including the dry season. Following the dredging of the channel, the water levels could be approximately 2.0 m less than the water level under average conditions, mainly because the lake outlet elevation is lowered by 2 m in this option. Water level fluctuations (the difference between the maximum and the minimum levels observed in one year) remain in the order of 0.80 m. Further design and assessments, including detailed bathymetry and modelling, could support refinement of the anticipated change in water levels.

2.2.2 Anticipated Regulatory Approvals, Including Required Studies, and Estimated Timelines

The anticipated legislation and regulatory approvals, environmental studies and their associated timelines are presented in Table 2.4. The regulatory requirements required for each option will be similar; however, the effort required for the environmental studies and permits is anticipated to increase from Option 2A to 2B as the project area is notably increased. Fish habitat studies, wetland assessments, and fish passage assessments will be required within a broader area (within Fancy Lake and the general watershed). Some study areas may be smaller and contained within the project areas, other studies, such as fish habitat and vegetation assessment, could require multi-season/year studies to fully understand the ecosystem to provide adequate information to the regulators for environmental assessment and permitting purposes. An anticipated required mitigation measure during construction includes fish rescues prior to in-water construction activities. Fish rescues include the capture, removal, and relocation fish from work areas prior to in-water construction activities. Fish rescues should be undertaken by a qualified environmental practitioner, with the appropriate licenses and approvals, such as a Licence Issued Pursuant to Section 52 of the *Fishery (General) Regulations*.

Generally, options with more in-water works often require more permitting than those that stay above water marks. Less intrusive works are typically of preference to regulatory agencies. There may be additional requirements following development of detailed design or discussion with regulatory agencies.

Table 2.4: Option 2 Conveyance Capacity: Regulatory Considerations

Act / Regulations	Permits, Approvals, Authorizations, or Action	Required Environment Studies	Anticipated Regulatory Timelines*
Nova Scotia Environment Act – Environmental Assessment Regulations	Environmental Assessment Registration	<ul style="list-style-type: none"> Fish Habitat Assessment. Wetland Delineation. Wetland Functional Assessment. Vegetation Assessment. Hydraulic Assessment – Water Velocity. Hydraulic Assessment – Fish Passage. 	EA Review Process 50 to 275+ days: <ul style="list-style-type: none"> Class I Registration: ~50 business days Class II Registration: ~275 business days Focus Report Approval: ~208 business days EA Report Approval: ~275 business days More information addendum: ~50 business days
Nova Scotia Environment Act – Activities Designation Regulations	Watercourse Alteration Approval	<ul style="list-style-type: none"> Fish Habitat Assessment. Fish Rescues. 	Watercourse Alteration: 60 business days
	Wetland Alteration Approval	<ul style="list-style-type: none"> Wetland Delineation. Wetland Functional Assessment. 	Wetland Alteration 60 business days
Nova Scotia Crown Lands Act	Lease or Easement	<ul style="list-style-type: none"> Land Survey. 	Time required depends on the complexity of the request.
Federal Fisheries Act	<i>Fisheries Act</i> Authorization subsection 35.1) (HADD) or any activity which damages or obstructs a fishway or prevents or hinders fish from passing through a fishway (subsection 34.3).	<ul style="list-style-type: none"> Fish Habitat Assessment. Hydraulic Assessment – Water Velocity. Hydraulic Assessment – Fish Passage. Fish Rescues. 	Fisheries Act Authorization and Offsetting **: Up to 150 days***
Federal Species at Risk Act (SARA)	Species at Risk Permit if works are likely to interfere with Atlantic Whitefish.	<ul style="list-style-type: none"> Fish Habitat Assessment. 	DFO Review: ~90 days
Federal Canadian Navigable Water Act	Approval	<ul style="list-style-type: none"> No Additional Surveys. 	Public Comment Period: 30 days Navigation Protection Program Approval: ~90 business days**

Notes:

* Regulatory timelines and does not include the time for the preparation of applicable or associated activities.

**Indigenous consultation efforts required for the Transport Canada Approval, and the DFO Fisheries Act Authorization (should an Authorization be required), may be delayed as a result of COVID-19. It should also be noted that the regulatory agency provided review times are provided in the table; however, there is no set time limit if the application is found to be

incomplete, the regulatory clock is stopped due to information requests, for the development of a DFO accepted Offsetting Plan, or for secondary reviews, such as that undertaken by the Aboriginal Consultation Unit of Transport Canada or DFO. ***Timeline does not include the identification and development of an Offsetting Project and assumes a suitable Offsetting Project may be available for an existing community group for inclusion in the Fisheries Act Application.

2.2.3 Timelines for Engineering Studies, Design, and Construction

The estimated timeline required for engineering, design and construction of the Conveyance Capacity Options are provided in Table 2.5.

Table 2.5: Option 2 Conveyance Capacity: Approximate Durations for Engineering Studies, Design, and Construction

Option Component	2: Conveyance Capacity	
	A) Widening River Channel - Outlet of Fancy Lake	B) Dredged River Channel - Outlet of Fancy Lake
Engineering Design:		
- Bathymetric Survey.		
- Geotechnical Survey.	1 year	1 year
- Design.		
Environmental:		
- Studies.	1 to 2 years	1 to 2 years
- Approvals, Permits and Authorizations.	1 year	1 year
Tendering and Construction:		
- Tendering and Award.	3 months	3 months
- Construction.	1-2 years	1-2 years
Total Time	3-4 years	3-4 years

2.2.4 Capital and Operating Requirements

Identification of the capital and operating requirements for the Conveyance Capacity Options are provided in Table 2.6.

Table 2.6: Option 2 Conveyance Capacity: Capital and Operating Requirements

Capital Requirements	2: Conveyance Capacity	
	A) Widening River Channel - Outlet of Fancy Lake	B) Dredged River Channel - Outlet of Fancy Lake
Engineering Requirements	Engineering Requirements	Engineering Requirements
<ul style="list-style-type: none"> Detailed Bathymetry (over 200 m). Topographic Survey. Geotechnical Investigation. Design and construction of earth works. Design and construction of access road. 	<ul style="list-style-type: none"> Detailed Bathymetry (over 750 m). Topographic Survey. Geotechnical Investigation. Design and construction of earth works. Design and construction of access road. 	<ul style="list-style-type: none"> Detailed Bathymetry (over 750 m). Topographic Survey. Geotechnical Investigation. Design and construction of earth works. Design and construction of access road.

2: Conveyance Capacity		
	A) Widening River Channel - Outlet of Fancy Lake	B) Dredged River Channel - Outlet of Fancy Lake
	<p>Environmental Requirements</p> <ul style="list-style-type: none"> • Environmental Studies and Applications as defined in Section 2.2.2. • Fish rescues within dewatered work area prior to construction by a qualified professional. • Fish rescues during commissioning in low/drained locations around the lake, where possible. <p>MODL Requirements</p> <ul style="list-style-type: none"> • Negotiate with landowners as required. • Purchase land. 	<p>Environmental Requirements</p> <ul style="list-style-type: none"> • Environmental Studies and Applications as defined in Section 2.2.2. • Fish rescues within dewatered work area prior to construction by a qualified professional. • Fish rescues during commissioning in low/drained locations around the lake, where possible. <p>MODL Requirements</p> <ul style="list-style-type: none"> • Negotiate with landowners as required. • Purchase land.
Operating Requirements	<ul style="list-style-type: none"> • Once this work is complete the river will be returned to a natural state and no ongoing operation is required. However, there may be a period of time following construction that will require some monitoring of the re-established habitat to confirm that the reinstated condition is supportive of the species using the habitat. • Maintenance dredging, and associated approvals.* • Monitoring of the lake levels prior to extreme rainfall events. 	<ul style="list-style-type: none"> • Once this work is complete the river will be returned to a natural state and no ongoing operations is required. However, there may be a period of time following construction that will require some monitoring of the re-established habitat to confirm that the reinstated condition is supportive of the species using the habitat. • Maintenance dredging, and associated approvals.* • Monitoring of the lake levels prior to extreme rainfall events.

*Depending on the time period from construction to the time of dredging, and the extent of dredging, the permitting requirements may vary. If the dredging works can be undertaken following DFO requirements, such as Codes of Practice, and they meet the requirements of Transport Canada's *Minor Work Order*, a NSECC Watercourse Alteration Approval is anticipated to be required. If work is undertaken after a period of 10-years and/or requires dredging outside of the initially altered area, the anticipated approvals, permits and authorizations include Watercourse Alteration Approval, Fisheries Act Authorizations, and Transport Canada Approval.

2.3 Option 3: Implementing Flow Control

The riverbed elevation at the outlet of Fancy Lake naturally influences the discharge rate at which the lake can drain. As described in Option 2, increasing the drainage capacity of the lake outlet would result in lower water levels at the lake. The installation of a flow control structure, such as an operated gate or stop logs, allows the lake levels to be maintained during low flow season and also allows the lake level to be intentionally lowered before and during a large rainfall event to reduce flooding risks. This would allow lake levels to be

maintained near historic lake operating levels with the lake only being lowered prior to a forecasted rainfall event that could cause flooding.

2.3.1 Description of Concept

The flow control structure can be operated to allow for lowering of the lake water levels in anticipation of an extreme rainfall event to provide additional storage capacity in the lake. This additional storage reduces the potential risk of flooding. The timing of the lake drawdown by allowing additional water through the flow control structure would depend on the lake water levels at the time of the forecast and the forecasted rainfall amount. For example, the preliminary analysis conducted in the previous phases indicate that two days would be required to lower water levels by 0.75 m before a 1 in 100-year rainfall event. Additional time could be required for storing larger events, lowering lake levels when the water level is higher than average, allowing for snowmelt flows or for reducing risks of erosion downstream during drawdown.

This concept requires the development of operation rules that will be used to decide the timing and duration of the lake drawdown. These rules will be developed based on hydrologic and hydraulic modelling of the system for numerous storm and water level events. The timing and duration of the drawdown of the lake is an important issue, as draining too little water would allow flooding risks to remain high, while draining too much water would leave lake levels too low following an event, which would impact fish habitat and residents. Therefore, this option also requires the implementation of a monitoring program that could consist of intermittent manual lake level gauging or more complex level monitoring such as the real time flood forecasting described in Option 1B.

For this concept, the following alternatives were evaluated:

- A. Dredged River Channel over 750 m with short Bypass Channel and Flow Control Gate, and
- B. Natural River Bypass channel outside of the natural river channel, over approximately 600 m, that allows further draining of the lake and minimizes alteration of the existing watercourse.

Under equal climatic and lake conditions, the operation and lake level impact of both alternatives is very similar. The level of impact on water levels when the flow control structure is open would depend on the amount of forecasted rainfall and the water elevation at the time of draining the lake. Additional analysis would be required to establish the rules of operation of the gates. Constructability, regulatory requirements, and potential environmental impacts are the main factors that could favor the selection of one alternative over the other.

A) Dredged River Channel with Flow Control (Bypass Channel) – Outlet of Fancy Lake

The installation of a flow control structure at this location requires widening the channel by approximately 35 m to increase the discharge capacity and allow for the installation of a

flow control structure. It also requires the excavation of a 1.8 m deep bypass channel that merges into the existing river at an elevation that is two meters lower than the existing riverbed elevation. Consequently, to reduce backwater effects, dredging of the river is required for approximately 750 m (similar to Option 2B) to reach a point that is at a sufficiently low elevation to allow free drainage.

This option requires a significant amount of channel dredging and considerations related to its potential impact on fish habitat.

B) Natural River Bypass – Outlet of Fancy Lake

This option includes the excavation of a 500 to 600 m long, 17 m wide earth channel, connecting to the Petite Riviere. The proposed channel has its own inlet, outside of the natural channel inlet, and merges with the existing river channel at the natural riverbed elevation; therefore, it does not require the same scale of alteration identified for Option 3A. The flow control structure will be placed on the upstream side of the channel, by the lake. Given that the flow control structure remains closed most of the time, this option would not impact the existing river hydraulics, or change any of the natural lake water levels, or natural flows, under normal conditions. The gates would open only when extreme water levels are forecasted to occur in the lake.

2.3.2 Anticipated Regulatory Approvals, Including Required Studies, and Estimated Timelines

The regulatory requirements will be dependent on the preliminary design, proposed locations of works and proposed construction methodology. The anticipated legislation and regulatory approvals, environmental studies, and their associated timelines are included in Table 2.7. The environmental study extents will vary depending on work area and the area of potential effects. For example, fish habitat studies, wetland assessments, and fish passage assessment will be required within a broader area within Fancy Lake and the general watershed. While some study areas may be smaller and contained within the project areas, some studies such as fish habitat and vegetation assessments could require multi-season/year studies to fully understand the ecosystem to provide adequate information to the regulators for environmental assessment and permitting purposes. For flow control structures, regulatory agencies will want to confirm through the regulatory process that operation of the flow control structure will not result in additional flows or flooding in areas up and down stream from the structure, and that flows proposed will allow fish passage. Generally, options which require less intrusive impacts, especially for in-water works, would likely be of preference to regulatory agencies. There may be additional requirements following development of detailed design or discussion with regulatory agencies.

Table 2.7: Option 3 Flow Control: Regulatory Considerations

Act / Regulations	Permits, Approvals, Authorizations, or Action	Required Environment Studies	Anticipated Regulatory Timelines*
Nova Scotia Environment Act – Environmental Assessment Regulations	Environmental Assessment Registration	<ul style="list-style-type: none"> • Fish Habitat Assessment. • Wetland Delineation. • Wetland Functional Assessment. • Vegetation Assessment. • Hydraulic Assessment – Water Velocity. • Hydraulic Assessment – Fish Passage. 	EA Review Process 50 to 275+ days: <ul style="list-style-type: none"> • Class I Registration: ~50 business days • Class II Registration: ~275 business days • Focus Report Approval: ~208 bus days • EA Report Approval: ~275 business days More information addendum: ~50 business days
Nova Scotia Environment Act – Activities Designation Regulations	Watercourse Alteration Approval	<ul style="list-style-type: none"> • Fish Habitat Assessment. • Fish Rescues. 	Watercourse Alteration: 60 business days
	Wetland Alteration Approval	<ul style="list-style-type: none"> • Wetland Delineation. • Wetland Functional Assessment. 	Wetland Alteration 60 business days.
Nova Scotia Crown Lands Act	Lease or Easement	<ul style="list-style-type: none"> • Land Survey. 	Time required depends on the complexity of the request.
Federal Fisheries Act	<i>Fisheries Act</i> Request for Review <i>Fisheries Act</i> Authorization subsection 35.1) (HADD) or any activity which damages or obstructs a fishway or prevents or hinders fish from passing through a fishway (subsection 34.3).	<ul style="list-style-type: none"> • Fish Habitat Assessment. • Hydraulic Assessment – Water Velocity. • Hydraulic Assessment – Fish Passage. • Fish Rescues. 	Request for Review: approximately 30 days Fisheries Act Authorization and Offsetting ***: Up to 150 days**
Federal Species at Risk Act (SARA)	Species at Risk Permit if works are likely to interfere with Atlantic Whitefish.	<ul style="list-style-type: none"> • Fish Habitat Assessment. 	DFO Review: ~90 days
Federal Canadian Navigable Water Act	Approval	<ul style="list-style-type: none"> • No Additional Surveys. 	Public Comment Period: 30 days Navigation Protection Program Approval: ~90 business days**

Notes:

* Regulatory timelines. Timelines do not include the time for the preparation of applicable or associated activities.

**Indigenous consultation efforts required for the Transport Canada Approval, and the DFO Fisheries Act Authorization (should an Authorization be required), may be delayed as a result of COVID-19. It should also be noted that the regulatory agency-provided review times are presented in the table; however, there is no set time limit if the application is found to be incomplete, the regulatory clock is stopped due to information requests, for the development of a DFO accepted Offsetting Plan, or for secondary reviews, such as that undertaken by the Aboriginal Consultation Unit of Transport Canada or DFO.

***Timeline does not include the identification and development of an Offsetting Project and assumes a suitable Offsetting Project may be available for an existing community group for inclusion in the Fisheries Act Application.

Fish Rescues, including the capture, removal, and relocation of fish from work areas prior to in-water construction activities, is anticipated to be a mitigation measure during construction. Similarly, fish rescues will likely be required to support the operation of the flow control structures in advance of a flooding event. As the water is drawn down in advance of a storm, areas of Fancy Lake could become dry or isolated. As a mitigation measure to minimize effects to fish for a drawdown event, fish rescues may be required in portions of the lake. The area where rescues would be required will depend on the water elevation prior to a drawdown event, and the bathymetry of the lake. This requirement will need to be further refined through further consultation with DFO. If fish rescues are required prior to each event, they will need to be undertaken by a qualified environmental practitioner.

2.3.3 Timelines for Engineering Studies, Design, and Construction

The estimated timeline required for engineering, design and construction for the Flow Control options are provided in Table 2.8.

Table 2.8: Option 3 Flow Control: Approximate Durations for Engineering Studies, Design, and Construction

Option Component	3: Flow Control Measures	
	A) Dredged River Channel with Flow Control (Bypass Channel) – Outlet of Fancy Lake	A) Dredged River Channel with Flow Control (Bypass Channel) – Outlet of Fancy Lake
Engineering Design:		
- Bathymetric Survey.	1 to 2 years	1 to 2 years
- Geotechnical Investigation.		
- Topographic Survey.		
- Design.		
Environmental:		
- Studies.	1 to 2 years	1 to 2 years
- Approvals, Permits and Authorizations.	1 year	1 year
Tendering and Construction:		
- Tendering and Award.	3 months	3 months

Option Component	3: Flow Control Measures	
	A) Dredged River Channel with Flow Control (Bypass Channel) – Outlet of Fancy Lake	A) Dredged River Channel with Flow Control (Bypass Channel) – Outlet of Fancy Lake
- Construction.	1-2 years	1-2 years
Total Time	4-5 years	4-5 years

Note: The environmental studies and design activities would happen concurrently so the overall project could take about 3 years to complete design and obtain environmental permits.

2.3.4 Capital and Operating Requirements

The proposed capital and operating requirements for the Option 3 Flow Control are provided in Table 2.9. The Natural River Bypass mostly allows for larger portions of the construction to be completed outside of the watercourse, minimizing the overall work area within the watercourse, which eases environmental requirements.

Table 2.9: Option 3 Flow Control: Capital and Operating Requirements

3: Flow Control Measures		
	A) Dredged River Channel with Flow Control (Bypass Channel)	B) Natural River Bypass – Outlet of Fancy Lake
Capital Requirements	<p>Engineering Requirements</p> <ul style="list-style-type: none"> Detailed Bathymetry. Topographic Survey. Geotechnical Investigation. Design and construction of earth works. Design and construction of access road. Design and construction of site power. Design and construction of flow control structure. <p>Environmental Requirements</p> <ul style="list-style-type: none"> Environmental Studies and Applications as defined in Section 2.3.2. Fish Rescues within work area prior to construction by a qualified professional. <p>MODL Requirements</p> <ul style="list-style-type: none"> Negotiate with landowners as required. Purchase land. 	<p>Engineering Requirements</p> <ul style="list-style-type: none"> Detailed Bathymetry. Topographic Survey. Geotechnical Investigation. Design and construction of earth works. Design and construction of access road. Design and construction of site power. Design and construction of flow control structure. <p>Environmental Requirements</p> <ul style="list-style-type: none"> Environmental Studies and Applications as defined in Section 2.3.2. Fish Rescues within work area prior to construction by a qualified professional. <p>MODL Requirements</p> <ul style="list-style-type: none"> Negotiate with landowners as required. Purchase land.
Operating Requirements	<p>Engineering Requirements</p> <ul style="list-style-type: none"> Monitoring and lowering of the lake levels prior to extreme rainfall events. Monthly control structure operations check. Structure and equipment replacements. Weekly site visits. Annual inspection of culverts. Maintenance excavation and dredging. <p>Environmental Requirements</p> <ul style="list-style-type: none"> Fish surveys or rescues in Fancy Lake to initiate drawdown and during the drawdown, by a qualified professional. Work will need to occur in low/drained locations around the lake. Monitoring of affected wetlands after an event as defined in regulatory approvals following an event by a qualified professional. Post construction monitoring of the restored river. 	<p>Engineering Requirements</p> <ul style="list-style-type: none"> Monitoring and lowering of the lake levels prior to extreme rainfall events. Monthly control structure operations check. Structure and equipment replacements. Weekly site visits. Annual inspection of culverts. Maintenance excavation and dredging. <p>Environmental Requirements</p> <ul style="list-style-type: none"> Fish surveys or rescues in Fancy Lake to initiate drawdown and during the drawdown, by a qualified professional. Work will need to occur in low/drained locations around the lake. Monitoring of affected wetlands after an event as defined in regulatory approvals following an event by a qualified professional. Post construction monitoring of the restored river.

*Depending on the time period from construction to the time of dredging, and the extent of dredging the permitting requirements may vary. If the dredging works can be undertaken following DFO requirements, such as Codes of Practice and meets the requirements of Transport Canada's *Minor Work Order*, a NSECC Watercourse Alteration Approval is anticipated to be required. If work is undertaken after a period of 10-years and/or requires dredging outside of the initially altered area, the

2.4 Opinion of Probable Cost for Concepts

This section provides a Class D opinion of probable costs for the proposed mitigation approach concepts. Please note that any opinions of probable cost are presented on the basis of experience, qualifications, and best judgement. They have been prepared in accordance with acceptable principles and practices. Sudden market trends, non-competitive bidding situations, unforeseen labour and material adjustments, and the like are beyond the control of CBCL, and as such, we cannot warrant or guarantee that actual costs will not vary significantly from the opinion provided.

2.4.1 Capital Costs

This section identifies fixed or one-time expenses associated with the implementation of the options evaluated in this study. The costs estimated for each option have been developed based on the concept plans at this stage of the project. The cost estimate is summarized for each Project in Table 2.10 and includes a conceptual breakdown of key items included in construction. A description of the key items included in the cost summary table includes the following:

- ▶ **Earthworks:** This item includes the cost of clearing and grubbing, as well as earth cut and fill, including off-site removal of excess material, needed to complete construction of each option.
- ▶ **Monitoring Station:** This item is specific to Option 1 and includes costs to construct a monitoring station based on the concept presented. It was assumed that the station would be located in an accessible area and that no access road and minimal site access would be needed.
- ▶ **Structures:** This item covers installation of the concrete control structures, such as concrete box culverts, control gates, and actuators.
- ▶ **Access Road:** This item includes cost to provide a gravel road and power (if required) to the construction site. Power requirements have been included for Options 3A and 3B. A right of way would be required to build this road. The cost to negotiate and procure the right of way is not included in this price.
- ▶ **Environmental Protection:** This item includes environmental protection costs associated with the construction of the access road, dewatering/bypass pumping during construction at the project site, environmental monitoring for sediment management during construction, and water management costs, such as settling ponds.
- ▶ **Habitat Reinstatement:** Includes the cost to rehabilitate areas altered during construction such as watercourses and regions around the monitoring station.
- ▶ **Design Development Contingency:** This allowance is to account for uncertainty in construction costs due to undefined design scope.
- ▶ **Engineering:** Cost allowance for engineering design.

- ▶ **Survey and Geotechnical:** Cost allowance for surveying, and geotechnical assessments.
- ▶ **Environmental Studies and Permitting Allowance:** Cost allowance for environmental studies and associated permits, approvals, and authorizations described in Sections 2.1.2, 2.2.2 and 2.3.2.
- ▶ **Program Development:** Includes the engineering and consultancy service costs associated with developing the hydraulic and hydrologic analyses, the operation rules and the communication strategy necessary for the delivery and administration of the early warning system described in Option 1; and the operation of the flow control gates described in Option 3 (hydrology and hydraulic analysis only).

It is noted that land purchase to acquire lands within the footprint of the projects, as well as for suitable access, is not included in the cost estimates. There is significant inherent variability in land costs which would not be suitably portrayed in the presented cost estimates.

Table 2.10: Opinion of Probable Capital Cost for Proposed Mitigation Approach Concepts

	Option 1: Monitoring and Warning Systems		Option 2: Conveyance Capacity		Option 3: Flow Control Measures	
	A) Fixed Forecasting Framework	B) Real-time Flood Mapping	A) Widening River Channel	B) Dredged River Channel	A) Dredged River Channel with Flow Control	B) Natural River Bypass
Construction						
Earthworks	\$15,000	\$15,000	\$120,000	\$935,000	\$1,090,000	\$2,550,000
Monitoring Station	\$70,000	\$70,000	-	-	-	-
BPSC Upgrades	\$30,000	\$30,000				
Structures (Gates/Controls)	-	-	-	-	\$2,395,000	\$1,570,000
Roadwork	-	-	\$95,000	\$95,000	\$205,000	\$205,000
Environmental Protection	\$25,000	\$25,000	\$1,660,000	\$1,395,000	\$1,540,000	\$2,495,000
Habitat Reinstatement	\$10,000	\$10,000	\$200,000	1,890,000	\$2,080,000	\$45,000
Design Development Allowance (~30%)	\$45,000	\$45,000	\$622,500	\$1,294,500	\$2,193,000	\$ 2,059,500
Construction Contingency	\$19,500	\$19,500	\$269,750	\$560,950	\$950,300	\$892,450
Subtotal – Construction	\$214,500	\$214,500	\$2,967,250	\$6,170,450	\$10,453,300	\$9,816,950
Engineering and Approvals						
Engineering Program	\$35,000	\$35,000	\$350,000	\$450,000	\$550,000	\$550,000
Development Survey and Geotechnical	\$150,000	\$170,000			\$70,000	\$70,000
Environmental Studies and Permitting Allowance	-	-	\$50,000	\$50,000	\$100,000	\$100,000
Subtotal Engineering and Approvals	\$235,000	\$255,000	\$ 750,000	\$1,200,000	\$ 1,720,000	\$1,420,000
Other						
Land Purchases	TBD	TBD	TBD	TBD	TBD	TBD
Subtotal Other	TBD	TBD	TBD	TBD	TBD	TBD
TOTAL (HST Excluded)	\$449,500	\$469,500	\$3,717,250	\$7,370,450	\$12,173,300	\$11,236,950

Note: Capital estimate does not include land acquisition costs.

2.4.2 Operational Costs

This section identifies operational and maintenance expenses associated with the implementation of the options evaluated in this study. The cost estimates for each option have been developed based on the concept plans at this stage of the project and do not include net present value calculations. The cost estimate is summarized for each concept in Table 2.11 and a description of the key items included in the cost summary table are identified below:

- ▶ **Real time model operation:** Includes consultancy fees associated with operation and maintenance of the real-time flood mapping system.
- ▶ **Model update:** Includes consultancy fees associated with periodic updates to the model to account for changes in land uses and in the case of Option 1A, rainfall patterns and their impact on water levels and flooding risk.
- ▶ **Gauging station repairs:** Annualized cost of repair and replacement of the gauging station components due to wear and tear.
- ▶ **Environmental Monitoring:** This includes a per-event estimate associated with fish surveys or rescues in Fancy Lake to initiate drawdown by a qualified professional.
- ▶ **General Site Maintenance:** Annual cost for upkeep of access road, snow removals, and general site maintenance.
- ▶ **Gate/Structure Maintenance:** Annualized cost of replacing and/or maintaining the gate/structures due to wear and tear. Assumed life span: 50 years.
- ▶ **Maintenance Excavation:** Includes maintenance excavation required to mitigate sediment accumulation at the outlet of the lake.

Table 2.11: Opinion of Probable Operational Cost for Proposed Mitigation Approach Concepts

	Option 1: Monitoring and Warning Systems		Option 2: Conveyance Capacity		Option 3: Flow Control Measures	
	A) Fixed Forecasting Framework	B) Real-time Flood Mapping	A) Widening River Channel	B) Dredged River Channel	A) Dredged River Channel with Flow Control	B) Natural River Bypass
Real Time Model Operation	-	\$20,000	-	-	-	-
Flood Forecasting Model Update	\$10,000	\$20,000	-	-	-	-
Gauging Station Repairs	\$5,000	\$5,000	-	-	-	-
Environmental Monitoring	-	-	-	-	\$50,000	\$50,000
General Site Maintenance	\$5,000	\$5,000	\$15,000	\$15,000	\$15,000	\$15,000
Gate/Structure Maintenance	-	-	-	-	\$50,000	\$50,000
Maintenance Excavation	-	-	\$5,000	\$10,000	\$10,000	\$5,000
Annual Estimate	\$20,000	\$50,000	\$20,000	\$25,000	\$125,000	\$120,000

Note: The administration of Options 1, 2 and 3, have not been included in the annual cost.

2.4.3 Opinion of Probable Cost for Concepts Summary

The required timelines for design, construction, and associated capital and operational cost will depend on the selected option. A summary of the timelines and associated costs are provided in Table 2.12.

Table 2.12: Summary of Timelines and Probable Costs for Proposed Mitigation Approach Concepts

	Option 1: Monitoring and Warning Systems		Option 2: Conveyance Capacity		Option 3: Flow Control Measures	
	A) Fixed Forecasting Framework	B) Real-time Flood Mapping	A) Widening River Channel	B) Dredged River Channel	A) Dredged River Channel with Flow Control	B) Natural River Bypass
Estimated Total timeline	1 – 2 years	1 – 2 years	3-4 years	3-4 years	4-5 years	4-5 years
Capital Estimate	\$420,900	\$440,900	\$3,717,250	\$7,370,450	\$12,173,300	\$11,236,950
Maintenance Annual Estimate	\$20,000	\$50,000	\$20,000	\$25,000	\$125,000	\$120,000

Note: Capital estimate does not include land acquisition costs.

3 Engagement Activities

This chapter summarizes MODL and CBCL's engagement activities as part of this scope of works. Activities included:

- ▶ Stakeholder engagement with key stakeholders and regulatory agencies
- ▶ Open House
- ▶ First Nation Engagement

3.1 Stakeholder Groups

Engagement sessions were held with the Bridgewater Public Service Commission (BPSC); Hebbville Village Commission; and regulatory agencies, Nova Scotia Environment and Climate Change (NSECC) and Fisheries and Oceans Canada (DFO). The engagement sessions included a summary of the overall need for the project, description of potential mitigation options, and discussion of considerations and concerns. Summaries of discussions are provided in the following subsections.

3.1.1 Bridgewater Public Service Commission

CBCL and MODL met with BPSC on November 23, 2021. The objective was to exchange information on the proposed concepts, with focused discussion on the Water Level Monitoring and Warning System.

BPSC undertakes water level management activities year-round following internal operational procedures. The 2015/2016 updated procedures were put into place in consultation with DFO. The water levels of the upstream lakes vary depending on the month. From October to May, the upstream water levels in Hebb Lake are lowered. As part of their monitoring procedures, BPSC maintains a series of monitoring stations to document the upstream water levels which are recorded in a SCADA system and used for management of the protected watershed areas and operation of the water treatment facility. Water levels are also periodically checked manually during heavy rain events.

BPSC could provide MODL with further information on upstream water levels and the operational protocols as they continue with the development of the concepts. Agreements would need to be developed before information could be shared, such as data sharing agreements.

If agreements could not be put into place, MODL could consider placement of their own monitoring equipment upstream of the Hebb Lake Dam. Installation of new equipment will require regulatory approvals. However, BPSC advised that some residents have expressed concerns over increased traffic in the areas near their water monitoring equipment. Therefore, there may be added benefit to the local residents if MODL and BPSC consider data sharing over the option to install additional equipment.

Follow-up discussions on November 24, 2021, with the SCADA contact, confirmed data sharing may be possible through the SCADA System. Access to the system would require an initial set-up cost and ongoing costs for maintenance. BPSC would prefer a water level monitoring and warning system that utilized REMO and focused on providing warnings, rather than raw data. Additional information from MODL will be required as part of BPSC's evaluation of the proposition. The following information will be required from MODL for BPSC's further evaluation:

- 1 Description of how the data is going to be used and how it is going to be shared.
- 2 Present the recommended system to the BPSC and seek approval for the data sharing.
- 3 Develop agreements around costs, legalities, and other practical matters.

3.1.2 Regulatory Agencies

As the identified concepts are likely to require regulatory approvals, early engagement of regulatory authorities is an important consideration in evaluation of potential options. MODL and CBCL initiated early discussions with NSECC and DFO on December 6, 2021, to provide a summary of the high-level concepts, and create a forum to express concerns and considerations. Representatives from regulatory agencies included the following:

- ▶ Kelly Fraser and Jeremy Brome, DFO
- ▶ Michael G. MacDonald and Mark Greenwood, NSECC

Generally, the regulatory agencies appreciated the early engagement and requested that additional information be provided when available to undertake further regulatory assessment of the concepts. Key highlights included:

- ▶ The options that result in the least in water alterations would be most preferable, such as water level monitoring.
- ▶ Submitted applications for intrusive options (flow control or increasing conveyance capacity) will require quantification of flood protection abilities for the proposed project and document projected flow abilities. Water control structures for recreational purposes alone would not be viewed favourably.
- ▶ A clear understanding is required of flow control structure ownership, operation and maintenance procedures, and compliance requirements with dam safety regulations.
- ▶ When considering the more intrusive options, there was a preference for the Natural River Bypass – Outlet of Fancy Lake. This concept would include construction mostly outside of the natural channel and would be more representative of natural conditions outside of flooding events.

- ▶ In the designs and construction methods there should be consideration for prevention of entrapment and entrainment of fish, including pumping of water, operation of a flow control structure, and areas which may be dewatered during drawdown activities or following use of the structure.
- ▶ The project is located in close proximity to Atlantic Whitefish Critical Habitat; a fishway has been installed at the Hebb Lake Dam to allow for the return of the anadromous lifecycle for the existing landlocked population.

Both regulatory agencies identified that permits, approvals, and authorizations would be required depending on the concept. Both agencies identified the importance of Indigenous engagement as part of the regulatory process and suggested early engagement with the Mi'kmaq of Nova Scotia should be considered. MODL and CBCL identified, as part of this scope of work, that initial concepts are proposed to be shared with Kwilmu'kw Mawklusuaqn Negotiation Office (KMKNO), Acadia First Nation, Sipekne'katik First Nation, Membertou First Nation, and Millbrook First Nation. A summary for each agency is provided in the following sections.

NSECC

NSECC identified that the need for applying for approvals is anticipated for each of the concepts and the required information will vary depending on the complexity of the project. For options that alter the flow, applications will be required to document that the change in the hydrological flows will not result in additional effects upstream or downstream from the proposed project such as flooding or reduction of water flow and availability. NSECC also noted that changes in water levels that affect wetlands in excess of two hectares could prompt the need for a Class 1 Environmental Assessment from the province.

DFO

DFO stated that they would review any projects that affect fish and fish habitat. Approvals could include a *Fisheries Act* Authorization or a *Species at Risk Act* Permit. Preference would be to avoid affecting fish and fish habitat. Applications should include approaches to avoid effects to fish and fish habitats, such as alternatives assessed; mitigation measures to reduce potential effects; and approaches to reduce temporary and permanent footprints. As the proposed project occurs in close proximity to Atlantic Whitefish Critical habitat, any project proposed must be in compliance with the Recovery Plan for Atlantic Whitefish. Observations of adult Atlantic Whitefish, in the area, were reported as recently as 2018. DFO is working on the development of a streamside / restocking recovery program, which could be in place as soon as Spring 2022. The location of the release / facility is not known and could be located downstream of Hebb Lake Dam. Additionally, there is a Chain Pickerel control program ongoing with partner, Coastal Action.

Environmental surveys should include riparian areas and wetlands, and may be required to confirm if Atlantic Whitefish reside within the watercourse, or if suitable habitat exists. Studies to document the changes in the flow regime would also be required to support the

applications. During construction and operation of the structure, DFO advised that fish passage must be maintained for all species.

3.1.3 Hebbville Village Commission

Phase 3 of the project included two engagement sessions with the Hebbville Village Commission.

3.1.3.1 Session 1

The first session was held on July 21, 2022. The objective was to exchange information on the proposed conceptual options. The meeting included a summary of each conceptual option, capital and operational requirements, timelines, environmental approvals, and opinion of probable costs for concepts. The required timelines for design, construction, and associated capital and operational cost are variable depending on the selected option. Throughout the presentation and meeting, the Hebbville Village Commission highlighted the following potential concerns and points of interest for consideration:

General

- ▶ There is a lot of natural variability within Fancy Lake.
- ▶ Fancy Lake is used a water source for some residents.
- ▶ Within the project area, there could be pyritic slate. This could result in acid rock concerns if areas of the lake bottom were exposed.
- ▶ Selection of an option should be done in consultation with stakeholders and rights holders.

Land Use Policies

- ▶ Concerns about the development of the Land Use Policy, and it's effects on real estate and insurance requirements.

Non-Intrusive Options

- ▶ If monitoring stations are pursued, multiple stations should be considered for redundancy.
- ▶ Suggestion was provided that one location could be located north of the causeway.
- ▶ There could be perceptions that the monitoring approach alone may not be enough, or is too complicated.
- ▶ The group identified that monitoring should also be supported and involve the BPSC.

Intrusive Options

- ▶ Concerns were identified about options that will reduce the water levels, particularly during summertime low flow periods.
- ▶ Concerns were identified about effects to property values, if the lake water level is lower.
- ▶ Concerns were identified whether if intrusive options could further exacerbate effects from flooding downstream, particularly with conveyance capacity.
- ▶ Options could result in significant effects to fish and fish habitat within the dredging area, and drained areas.
- ▶ As Fancy Lake is used a water source for some residents, lower water levels may pose a risk to water intakes.

- ▶ Concerns were identified with operation of a structure outside of its purpose, such as further reducing lake levels or flows.
- ▶ Options should consider increasing the lake level during dry seasons.
- ▶ Options across the entire river outlet should be considered, such as enhancing the location where there is presently an increased bottom elevation, referred to as the bump.
- ▶ A flow control structure with stop logs is preferred, as it is perceived to be easier to operate.

A letter was received from Hebbville Village Commission on September 2, 2022, stating that they strongly opposed the conveyance capacity and flow control options. They also stated that it was unlikely that the public would want any intervention that will lower lake levels. They noted that lower lake levels could result in other negative effects on components such as water quality, biological communities, Atlantic Whitefish, water use, and recreational use. They identified that it was important to balance the effects from a 1 in 100 flood event and the effects of lower water levels. Based on the information provided HVC supported Option 1, Monitoring and Warning Systems (Lake Water Level Monitoring Stations). However, they encouraged MODL to consider a flow control structure that would be oriented over the existing watercourse to consider if it would be less expensive to construct than a flow control structure located to the side of the existing watercourse.

3.1.3.2 Session 2

The second meeting was held on December 6, 2022. The purpose of the meeting was to share an initial analysis of the requested option and provide a comparison with Options 3A and 3B. Similar to Options 3A and 3B, a flow control structure across the outlet could be operated to allow for lowering of the lake water levels in anticipation of an extreme rainfall event to provide additional storage capacity in the lake. Different than the other options, the structure could be used to maintain a higher water level in Fancy Lake outside of storm events; however, operation this way could change the natural conditions around Fancy Lake and flow from Fancy Lake. Conceptual Options 3A and 3B were developed to allow the continuous passage of fish through the existing river following construction. The overall project costs are anticipated to be higher than the cost of 3A or 3B as it would require additional studies, engineering, fishway structure, fishways monitoring, and maintenance. Based on discussion with regulatory agencies, the options that result in the least in water alterations would be most preferable, such as water level monitoring, and water control structures for recreational purposes alone would not be viewed favourably.

Throughout the presentation and meeting, the Hebbville Village Commission highlighted the following potential concerns and points of interest for consideration:

General

- ▶ Lake levels have been at record lows over the last few years.
- ▶ There could be risk to water intakes if the waterbody was drained in advance of an event.
- ▶ Acid rock concerns and if operation result in areas of the lake bottom was exposed.

Options

- ▶ Concerns were identified about options that will reduce the water levels.
- ▶ Concerns were identified with the challenging operational conditions as weather predictions can greatly vary, and what conditions would necessitate the operations of the flow control structure.
- ▶ Concerns were identified about the operational requirements that may result in lowering the water level below existing conditions.
- ▶ Options should consider increasing the lake level during dry seasons. A suggestion was identified to further increase the riverbed bottom at the location where there is presently an increased bottom elevation, referred to as the bump, to increase water levels.
- ▶ A flow control structure with stop logs is preferred, as it's perceived to be easier to operate.
- ▶ If monitoring stations are considered, two stations would be a good idea as there are two sections of the lake.

3.1.3.3 Public Meeting Follow-up Correspondence

A subsequent communication was provided from the Hebbville Village Commission on March 5, 2023, including a concept that was discussed with members of the commission. The Hebbville Village Commission requested that MODL consider further assessment of the suggested concept. The concept included the widening of the outflow from Fancy Lake where there is presently a higher bottom elevation, referred to as the bump, where materials have been deposited in the past to maintain water levels. The Hebbville Village Commission recommended that the size should be double the existing width of the low-water outflow. They noted the structure would require an engineered design but was proposed to include a permanent solid overflow structure, and that it should be built to the height of the desirable ecological average low water mark. The Hebbville Village Commission suggested an overflow structure, with no gates or chutes to operate or maintain. The structure was suggested to be built approximately 12 inches higher than the existing bump. It was suggested that fish passage be provided via a channel, approximately 2 to 4 feet wide, oriented approximately 6 inches higher than the existing berm/bump. An example of this structure was identified on the Mersey River in Milton, NS upstream from the bridge. Based on their opinion, this option could have the potential to address low water levels and would increase the potential outflow from the Fancy Lake in flood conditions. They felt that the new conceptual option would have no negative effect on the Petite Riviere, as inflow and outflow from the lake remains unchanged.

This concept was not assessed as part of the present scope of work, including assessment of hydraulic flows and flood mapping. However, typically constructability, regulatory requirements, and potential environmental impacts are the main factors that could favour the selection of one alternative over the other.

An assessment of how the structure would operate, and associated changes to hydrology and flooding potential would be required to understand how the structure could interact

with the hydraulic river system. The assessment of the concept should be able to demonstrate that the change in the hydraulic control will not result in additional effects upstream or downstream from the proposed project such as flooding or reduction of water flow and availability. It was noted that the structure would be twice as wide as the alternative flow control structures, so it would enhance the ability to discharge water more quickly. The release of higher flows, or volume of water during an event, would be likely to result in higher flows or associated flooding downstream. Defining how the structure would work will be important to minimize potential effects from the increase in hydraulic capacity.

Regulatory applications will also require documentation to support the selection of an option. Based on discussion with regulatory agencies, the options that result in the least in-water alterations would be most preferable. Options which minimize the footprint of alteration, effects from the construction and operation, and flooding potential, while maintaining ecological maintenance flows and fish passage quality should be considered first.

The *Fisheries Act* has provisions in place to maintain the free passage of fish and protection of fish and fish habitat. Restricting the regular flow to maintain higher water levels could negatively affect the free passage of fish, as well as reduce access to water downstream for fish habitat. Any proposed project would be required to provide flow from the outlet to maintain ecological maintenance flows for fish and fish habitat.

For these reasons, the proposed concept ranks lower than the other concepts put forward, and as such, is not likely to be accepted by the regulatory bodies for consideration.

3.2 Public Consultation

As a continuation of the Public and Stakeholder Engagement Program initiated in Phase 1, further sessions were held to convey information and receive feedback from the community. The program for Phase 3 included a Public and Stakeholder Engagement Open House and an open house survey. Further information on each major component is discussed in the following sections.

3.2.1 Open House

MODL and CBCL hosted a Public and Stakeholder Engagement Open House on February 28, 2023, from 6:00 pm to 7:30 pm, at the Municipal Services Building in Cookville, NS. The Public and Stakeholder Engagement Open House was advertised on the MODL Engage website.

The first purpose of the Public and Stakeholder Engagement Open House was to provide the public with further information on the three mitigation approaches evaluated further (water level monitoring, conveyance capacity, and flow control), including:

- ▶ Summary of the flood risk identified from the previous phases
- ▶ Identification of the six flood mitigation strategies initially assessed
- ▶ High level summary of the three conceptual options examined, including summary of change to the following:
 - Conveyance capacity or average water levels
 - Project footprint size
 - Environmental Approvals requirements
 - Timeline for Design, Approvals, and Construction
 - Construction Cost and Annual Cost

The second purpose of the Public and Stakeholder Engagement Open House was to obtain public feedback on the three conceptual options.

During the Public and Stakeholder Engagement Open House, the public had the opportunity to visit four stations, where poster boards were set up (Appendix B). To address the high attendance at the meeting, MODL provided a verbal description of the intent of the session and a summary of the options. Following the summary, participants were encouraged to review the boards, ask questions, and complete a survey. Comments and concerns were documented using paper survey, online survey, and by the presenters.

Generally, there was great interest in the session. This could have been attributed to information on one of the options sent out to residents a few days prior to the meeting. Generally, the public was very concerned about any option that would lower existing lake levels, including within the context of providing flood protection. It was clear that the community is interested in knowing and evaluating the effects associated with lower water levels on aspects such as the environment, farming activities, species at risk, recreational users, and water use. Separate from flood mitigation, there was general interest in maintaining higher water levels in Fancy Lake, including higher than existing.

3.2.2 Public Survey

Seventy-three submissions were received through the paper survey, online survey, and through email submissions. The following highlights the key points noted by the residents:

- ▶ 63 of the 73 respondents identified their first preference was to not undertake intrusive measures such as constructing large structures or dredging. Instead, measures such as implementing of Water level monitoring (40) or to do nothing (23) were supported.
- ▶ 7 of 73 respondents identified intervention at the outlet of Fancy Lake as their preference, including flow control options as proposed, or modification of a flow control option.
- ▶ Over half of the respondents noted that increasing conveyance capacity or reducing water levels should not be considered.
- ▶ Approximately one third of the respondents requested further engagement on the options.

Through the survey process, other conceptual options, similar to the flow control structure, were suggested by survey participants. These included alternative flow control structure configurations to be considered, such as a structure across the outlet of Fancy Lake with a fishway, and a structure located further downstream from the outlet with a spillway. These options were not assessed as part of the present scope of work, however, general responses to variation on flow control options are provided in Section 3.4.

3.3 First Nation Engagement

Local Indigenous groups were notified about MODL’s intent to investigate the magnitude and extents of flood risks in the Petite Rivière Watershed, particularly in the Fancy Lake area. A letter was provided summarizing the concepts that are being evaluated that either accept risk and build resiliency or reduce flooding risks through improvements of conveyance capacity and flow control. The following Indigenous groups were sent Project Notification Letters on March 9, 2023, via email and mailed letters:

- ▶ Kwilmu’kw Maw-klusuaqn Negotiation Office (KMKNO)
- ▶ Acadia First Nation
- ▶ Sipekne’katik First Nation
- ▶ Membertou First Nation
- ▶ Millbrook First Nation

No comments or questions on the study were received by MODL or CBCL from the Indigenous groups notified. A representative from Acadia First Nation did acknowledge receipt of the letter, and noted the letter was to be provided to council for their review and it will be entered into the record at their next meeting at the end of March. Acadia First Nation also stated that they will defer any consultation to KMKNO on their behalf, and noted the letter was also provided to KMKNO.

3.4 Summary of Key Themes

Throughout the engagement activities, key themes of questions regarding the concepts were identified. The following section highlights the responses to the main themes. Questions about funding, and other operations and projects in the vicinity of the Fancy Lake area, are not included within this summary.

Theme	Topic	Summary
Surveys	Completion of surveys (i.e., bathymetric and biological)	Initial bathymetry has been completed to identify concepts. Further surveys have been identified to advance each of the conceptual options, including bathymetric and biological surveys.

<p>Flood Mitigation Approaches</p>	<p>How were the approaches selected?</p> <p>What flood event was considered when developing the concepts?</p>	<p>This project is a continuation of previously completed phases. In Phase 2, six approaches were evaluated. The concepts included in this phase included the top three approaches after land-use modifications.</p> <p>Concepts were evaluated against the 1 in 100 year event conditions.</p>
<p>Water Level Monitoring</p>	<p>Monitoring Station locations</p> <p>Will the BPSC be involved with monitoring of water levels?</p>	<p>Locations have been selected conceptually and would need to be finalized following discussion with landowners.</p> <p>Engagement with BPSC has been initiated, both groups will continue to work together as this option is further assessed.</p>
<p>Conveyance Capacity</p>	<p>Why were concepts of conveyance capacity that reduced water levels evaluated as part of this process?</p> <p>The conveyance capacity options could result in a slight increase of flow velocity downstream and flood extents, why were they considered?</p>	<p>Flood mitigation projects that could reduce the flood effects around Fancy Lake were identified, and this included a range of approaches. Increasing conveyance was identified as having a positive return on investment with regards to potential damage from flooding. Reducing water levels (temporarily or permanently) in the lake is part of a set of options that would reduce flooding risks at the lake and downstream. The associated requirements and potential environmental impacts varied depending on the conceptual option.</p> <p>Changes in flows and flood extents were considered in evaluating potential conceptual options. Modelling was used to simulate how the watershed could behave during an event. Downstream of the outlet, calculations showed that reducing water levels in the lake by increasing conveyance could result in a downstream water level increase ranging between 0.05 and 0.10 m. However, this increase did not result in additional flooding of existing infrastructure but could influence the overall floodplain, therefore was included as a conceptual option for evaluation.</p>

<p>Flow Control</p>	<p>Could the flow control structure include stop logs as opposed to a gate?</p> <p>Why is the structure next to the outlet and not across the watercourse?</p> <p>Does the structure need to be located directly at the outlet of Fancy Lake?</p> <p>Why was wasn't draining more during an event considered?</p> <p>Why can't a flow control structure be designed to maintain higher water levels all year (such as during summer) and mitigate flooding by providing more</p>	<p>The flow control structure could include various approaches, such as a gate or stop logs. For the concept and costs, a structure that would minimize the operational requirements was selected. The overall costs for construction and operations were estimated for evaluation of the concepts.</p> <p>The proposed conceptual options have been developed to support flood mitigation. Regulatory applications for intrusive options (flow control or increasing conveyance capacity) will require quantification of flood protection abilities and document projected flow abilities. Flow from the outlet will be required to maintain ecological maintenance flows for fish and fish habitat. The conceptual options could be designed without stopping flow from the outlet of Fancy Lake; therefore, they were not selected as options to be evaluated further within the Scope of Work.</p> <p>If constructed, the locations will be determined based on hydrological conditions, flooding risk, geotechnical conditions, access, and landownership. The structure could be located within the vicinity of the outlet.</p> <p>Regulatory applications will require documentation that the change in the hydrological flows will not result in additional effects upstream or downstream from the proposed project, such as flooding or reduction of water flow and availability. Increasing the flows could result in additional effects downstream which could be detrimental. Conceptual options that could result in significant additional flooding impacts downstream did not meet the selection criteria for further evaluation, therefore, they were not evaluated further.</p> <p>A structure could support overall water level management. The <i>Fisheries Act</i> has provisions in place to maintain the free passage of fish and protection of fish and fish habitat. The regulatory agencies stated that water control structures for recreational purposes alone would not be viewed</p>
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drainage out of Fancy Lake (water flow) during an event.

favourably in the approval process. Additionally, flow from the outlet will be required to maintain ecological maintenance flows for fish and fish habitat.

Regulatory applications will require documentation that the change in the hydrological flows will not result in additional effects upstream or downstream from the proposed project such as flooding or reduction of water flow and availability. Stopping regular flow to maintain higher water levels could restrict the free passage of fish, as well as reduce access to water downstream for fish habitat. A release of higher flows, or volume of water during an event, could result in higher flows or associated flooding downstream. Conceptual options that could result in significant additional flooding impacts downstream did not meet the selection criteria for further evaluation, therefore, they were not evaluated further.

4 Summary and Closure

The proposed concepts will require a different array of engineering requirements, timelines of design and construction, and environmental requirements. To support MODL’s evaluation and selection of the potential concept, the following Chapter provides a summary of the three mitigation approaches.

- 1 Monitoring and Warning Systems:
 - A) Fixed Forecasting Framework.
 - B) Real Time Flood Mapping.
- 2 Conveyance Capacity:
 - A) Widening River Channel – Outlet of Fancy Lake.
 - B) Dredged River Channel – Outlet of Fancy Lake.
- 3 Flow Control Measures:
 - A) Dredged River Channel with Flow Control (Bypass Channel) – Outlet of Fancy Lake.
 - B) Natural River Bypass – Outlet of Fancy Lake.

4.1 Summary of Concepts

Table 4.1 presents a summary of the proposed concepts over flooding risks around the Fancy Lake area, impacts of each measure over the average water levels at the lake. Generally physical interventions feature similar mitigation levels under the 1 in 100 year storm event. Differences between options lay mainly on their potential environmental impact as well as their capital and operational costs.

Table 4.1: Mitigation Options for Fancy Lake Area and Corresponding Mitigation Effects

Mitigation Option	Water Level Monitoring	Channel Widening	Channel Dredged by 2 m (with or without control gates)
Option ID	Option 1	Option 2A	Options 2B, 3A and 3B
Estimated Decrease in Water Depths of Fancy Lake before a rain event	None	0.1 m	2 m
Impact on Annual Lake Level Fluctuation (difference between maximum and	None	Decrease by 0.30 m	Slight decrease by 0.02 m

Mitigation Option	Water Level Monitoring	Channel Widening	Channel Dredged by 2 m (with or without control gates)
minimum water levels observed in a year)			
Decrease in Peak Water Elevation of Fancy Lake under the 1 in 100 year storm scenario	None	0.77 m	0.77 m
Decrease of Water Levels during low flow season	None	0 m	2 m without flow control 0 m with flow control.
Average Decrease in Maximum Flood Extents around Fancy Lake (for the 1 in 100 year event)	None	11%	14%
Impacts to Downstream Areas of Fancy Lake	Allows preparation of emergency response and temporary mitigation of impacts over multiple infrastructure areas	Slight increase in water levels (0.05 to 0.1 m), flood extents and flow velocity in some sections for events up to the 1 in 100 year. The increase does not result in additional flooding of existing infrastructure	Slight decrease in flood extents and flow velocity for events up to the 1 in 100 year.
Changes in the Number of Potentially Flood-impacted Houses and Buildings (under the 1 in 100 year event)	Allows preparation of emergency response and temporary mitigation of impacts over multiple infrastructure	Decrease to 3 (compared to 27 in the condition of no mitigation).	Decrease to 3 (compared to 27 in the condition of no mitigation).

Table 4.2 provides a summary of the concept, engineering requirements, summary of timelines and cost of the following for comparison.

Table 4.2: Petite Rivière Watershed Flood Mitigation Summary of Concept Options

	Option 1 Monitoring and Warning Systems		Option 2: Conveyance Capacity		Option 3: Flow Control Measures	
	A) Fixed Forecasting Framework	B) Real-time Flood Mapping	A) Widening River Channel	B) Dredged River Channel	A) Dredged River Channel with Flow Control (Bypass Channel)	B) Natural River Bypass
Summary of Concept	<ul style="list-style-type: none"> Monitor the lake levels in consideration with forecasted rainfall. Weather and rainfall predictions. Water level monitoring stations. Post-processing of data for use for emergency planning, and communication of risks. 	<ul style="list-style-type: none"> Extend the width of the river by 5 m for approximately 160 m in length. Will result in a 0.10 m drop in water level under average conditions. The increase in hydraulic capacity decreases the water backup effect at the lake. 	<ul style="list-style-type: none"> Dredging 2 m of depth for approximately 700 m along existing channel starting at outlet of Fancy Lake. Will result in a 2 m lake level drop under average conditions. The extra capacity will be used to store stormwater to reduce flooding potential. 	<ul style="list-style-type: none"> Dredging of appropriately 700 m long section from the outlet of Fancy Lake. Installation of a flow control structure and a 17 m wide bypass channel next to the existing stream. Lowering the lake water level ahead of a large rainfall event. Culvert closed in normal conditions. 	<ul style="list-style-type: none"> Installing a culvert approximately 17 m wide, 2 m deep, and 3 m to 10 m* long. Lowering the lake water level ahead of a large rainfall event. Culvert closed in normal conditions. 	
Capital and Operating Requirements	<p>Capital Requirements</p> <ul style="list-style-type: none"> Design and installation of water level monitoring station. Design and installation of IT system upgrades at BPSC to allows for sharing of data. Development of a flood forecasting framework Development of a communication strategy up of communication channels: mailing list, websites, radio broadcasting, etc. 	<p>Capital Requirements</p> <ul style="list-style-type: none"> Detailed Bathymetry. Topographic Survey. Geotechnical Investigation. Design and construction of earth work. Design and construction of access road. Environmental Studies and Applications. Fish Rescues within dewatered work area prior to construction by a qualified professional. Fish Rescues during commissioning in low/draind locations around the lake, where possible. 	<p>Capital Requirements</p> <ul style="list-style-type: none"> Detailed Bathymetry. Topographic Survey. Geotechnical Investigation. Design and construction of earth work. Design and construction of access road. Design and construction of site power. Design and construction of flow control structure. Environmental Studies and Applications. Fish Rescues within dewatered work area prior to construction by a qualified professional. 			

	Option 1 Monitoring and Warning Systems		Option 2: Conveyance Capacity		Option 3: Flow Control Measures	
	A) Fixed Forecasting Framework	B) Real-time Flood Mapping	A) Widening River Channel	B) Dredged River Channel	A) Dredged River Channel with Flow Control (Bypass Channel)	B) Natural River Bypass
	<ul style="list-style-type: none"> Development of preparedness and response strategies consistent with the assessment of flooding risks. Environmental Studies and Applications. <p>Operating Requirements</p> <ul style="list-style-type: none"> Biweekly inspection of water level gauging stations. Update to Forecasting. Documentation of flood events. Ongoing collaboration with stakeholders. Ongoing technical development of staff in collaboration with Federal and Provincial agencies supporting and developing flood forecasting systems. 		<p>MODL Requirements</p> <ul style="list-style-type: none"> Negotiate with landowners as required. Purchase land. <p>Operating Requirements</p> <ul style="list-style-type: none"> Habitat Monitoring. Monitoring of effected wetlands. Post construction monitoring of the restored river. 		<p>MODL Requirements</p> <ul style="list-style-type: none"> Negotiate with landowners as required. Purchase land. <p>Operating Requirements</p> <ul style="list-style-type: none"> Monitoring and lowering of the lake levels prior to extreme rainfall events. Monthly control structure operations check. Structure and equipment replacements. Weekly site visits. Annual inspection of concrete structures. Maintenance excavation and dredging. Environmental Requirements. Fish surveys or rescues in Fancy Lake to initiate drawdown and during the drawdown. Monitoring of effected wetlands. Post construction monitoring of the restored river. 	
Timelines for Engineering Studies, Design	1 -2 years		2-3 years		2-3 years	
Timelines for Construction	3 months		1-2 years		1-2 years	
Estimated Cost	\$450,000	\$ 470,000	\$3,720,000	\$7,370,000	\$12,170,000	\$11,240,000

Note: *Capital estimate does not include cost for land acquisition

The required timelines for design, construction, and associated capital and operational cost will depend on the selected option. Table 4.3 provides a comparison of timelines and Probable Capital and Operating Cost for Proposed Mitigation Approach Concepts.

Table 4.3 Petite Rivière Watershed Flood Mitigation Summary of Timelines for Construction and Probable Capital and Operating Costs

	Option 1: Monitoring and Warning Systems		Option 2: Conveyance Capacity		Option 3: Flow Control Measures	
	A) Fixed Forecasting Framework	B) Real-time Flood Mapping	A) Widening River Channel	B) Dredged River Channel	A) Dredged River Channel with Flow Control	B) Natural River Bypass
Timelines for Engineering Studies, Design	1 year	1 year	2-3 years	2-3 years	2-3 years	2-3 years
Timelines for Construction	3 months	3 months	1-2 years	1-2 years	1-2 years	1-2 years
Estimated Total timeline	1 – 1.5 years	1 – 1.5 years	3-4 years	3-4 years	4-5 years	4-5 years
Capital Estimate*	\$450,000	\$470,000	\$3,720,000	\$7,370,000	\$12,170,000	\$11,240,000
Maintenance Annual Estimate	\$20,000	\$50,000	\$20,000	\$25,000	\$125,000	\$120,000

Note: Capital estimate does not include land acquisition costs.

4.2 Summary of Environmental Requirements

The environmental and regulatory requirements for each of the options are scaled depending on the area of effects and the regulatory thresholds.

Development of the options will require various environmental studies and scales, depending on the surface areas of potential effect (Table 4.4). Options 2 and 3 result in the larger areas of potential effects, both directly in the Project area, and indirectly through the reduction of water levels in the Fancy Lake areas. Environmental studies required to support design and regulatory applications are anticipated to include:

- ▶ Fish Habitat Assessment.
- ▶ Wetland Delineation.
- ▶ Wetland Functional Assessment.
- ▶ Vegetation Assessment.
- ▶ Hydraulic Assessment – Water Velocity.
- ▶ Hydrology Assessment – Fish Passage.
- ▶ Fish Rescues.

Environmental studies will also be required to support the operation of the flow control structures in advance of a flooding event. Fish rescues will be required in areas where the drawdown temporarily removes fish habitat within Fancy Lake as part of the drawdown process. The fish rescues will be required prior to each event and will need to be undertaken by a qualified environmental practitioner.

Table 4.4: Petite Rivière Watershed Flood Mitigation Environment Studies Summary and Associated Level of Effort

Environment Studies Anticipated	Stage of Project	Option 1	Option 2: Conveyance Capacity		Option 3: Flow Control Measures	
		Monitoring and Warning Systems	A) Widening River Channel	B) Dredged River Channel	A) Dredged River Channel with Flow Control	B) Natural River Bypass
Fish Habitat Assessment	Approvals	● Small	● Large			
Wetland Delineation	Approvals		● Large			
Wetland Functional Assessment	Approvals		● Large			
Vegetation Assessment	Approvals	● Small	● Small	● Medium	● Medium	● Medium
Hydraulic Assessment- Water Velocity	Approvals		● Medium			
Hydrology Assessment – Fish Passage	Approvals		● Large			
Fish Rescues	Construction		● Small	● Medium	● Medium	● Small
	Operations				● Large	
Notes:						
	Large Effort – Studies required within Fancy Lake or Watershed					
	Medium Effort – Studies required within project and access area greater than 1,000 m ² , or desktop exercise which have already been initially developed (i.e., hydrology modelling)					
	Small Effort – Studies required with project and access area less than 1,000 m ²					

The environmental approvals, permits and authorizations requirements are greater for the more intrusive Options 2 and 3 (Table 4.5). If an Environmental Assessment is required, the Project must be released from the environmental assessment process, receiving a Minister's approval, before other approvals, authorizations, or permit will be issued from other regulatory agencies.

**Table 4.5: Petite Rivière Watershed Flood Mitigation Regulatory Considerations
Summary of Requirements and Level of Effort**

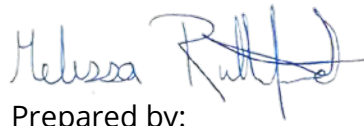
Environment Approvals, Permits, and Authorizations	Option 1	Option 2: Conveyance Capacity		Option 3: Flow Control Measures	
	Monitoring and Warning Systems	A) Widening River Channel	B) Dredged River Channel	A) Dredged River Channel with Flow Control	B) Natural River Bypass
Nova Scotia <i>Environment Act</i> – Environmental Assessment		● Large	● Large	● Large	● Large
Nova Scotia <i>Environment Act</i> – Watercourse Alteration	● Small	● Medium	● Medium	● Medium	● Medium
Nova Scotia <i>Environment Act</i> – Wetland Alteration		● Medium	● Medium	● Medium	● Medium
Nova Scotia <i>Crown Lands Act</i> – Lease or Easement	● Small	● Medium	● Medium	● Medium	● Medium
Federal <i>Fisheries Act</i> Authorization		● Large	● Large	● Large	● Large
Federal <i>Species at Risk Act</i> (SARA) SARA Permit		● Small	● Small	● Small	● Small
Federal <i>Canadian Navigable Waters Act</i> - Notification	● Small				
Federal <i>Canadian Navigable Waters Act</i> - Approval		● Small	● Small	● Small	● Small
Notes					
	Large Effort – Complex application process with effects assessment				
	Medium Effort – Typical application process – Complex Intrusive project				
	Small Effort – Typical application process - Non-complex / Minor project				

4.3 Closure

The findings and recommendations are based on information collected to date at the time of writing, with uncertainties associated with the lack of river bathymetry data at the outlet of Fancy Lake, as well as modelling approximations inherent to this type of study. We recommend that the projected flood elevations be revisited by the Municipality as new information becomes available.

We would like to thank you again for the opportunity to work on this very interesting study.

Yours very truly,



Prepared by:

Melissa Rutherford, B.Sc. P.Biol., R.P.Bio.

Project Manager

Direct: 902-717-8487

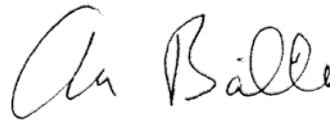
E-Mail: mrutherford@cbcl.ca



Reviewed by:

Alexander Wilson, M.Eng., P.Eng.

Senior Technical Specialist, Water Resources



Reviewed by:

Aaron Baillie, P.Eng.

Manager, Municipal Engineering

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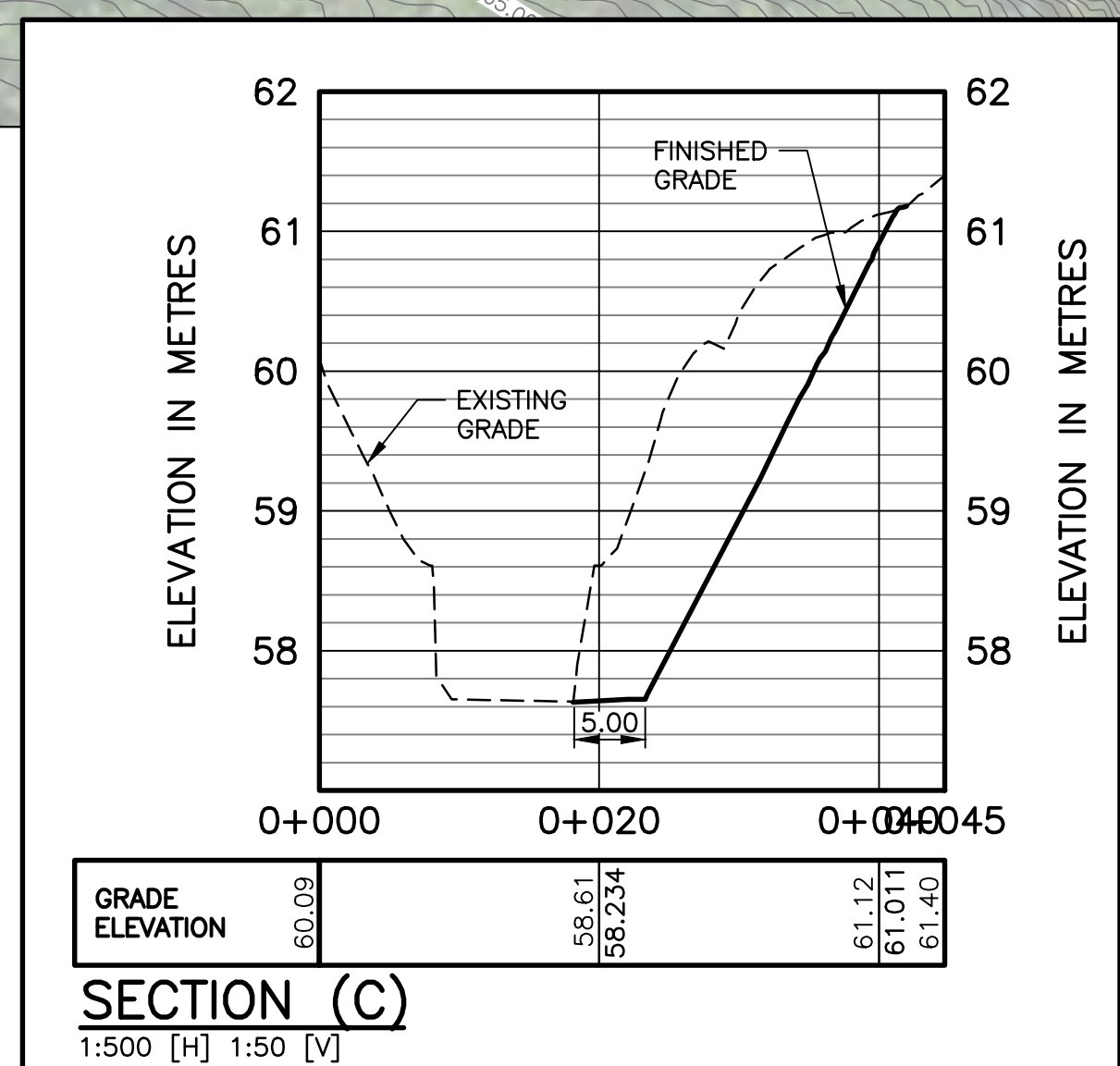
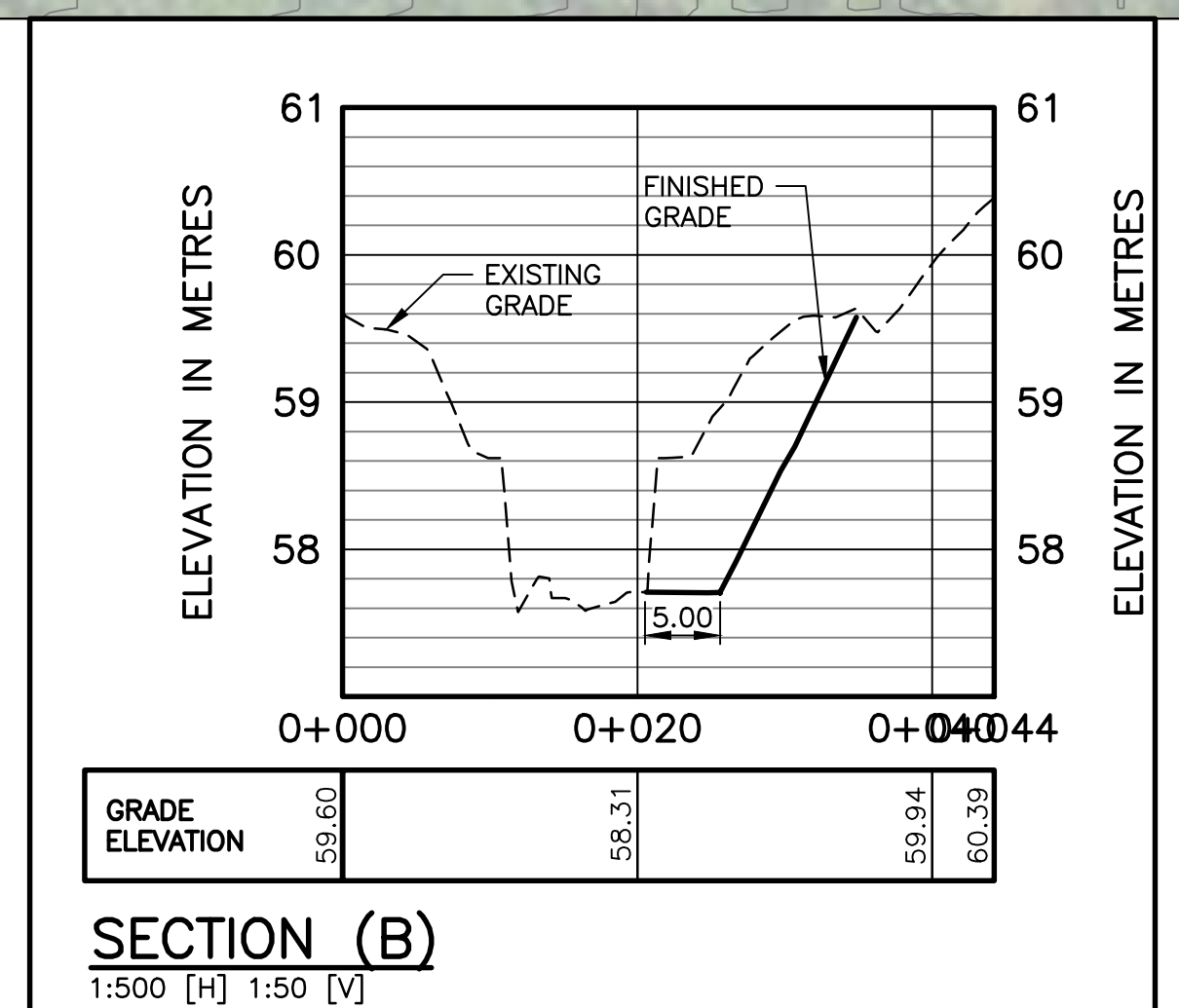
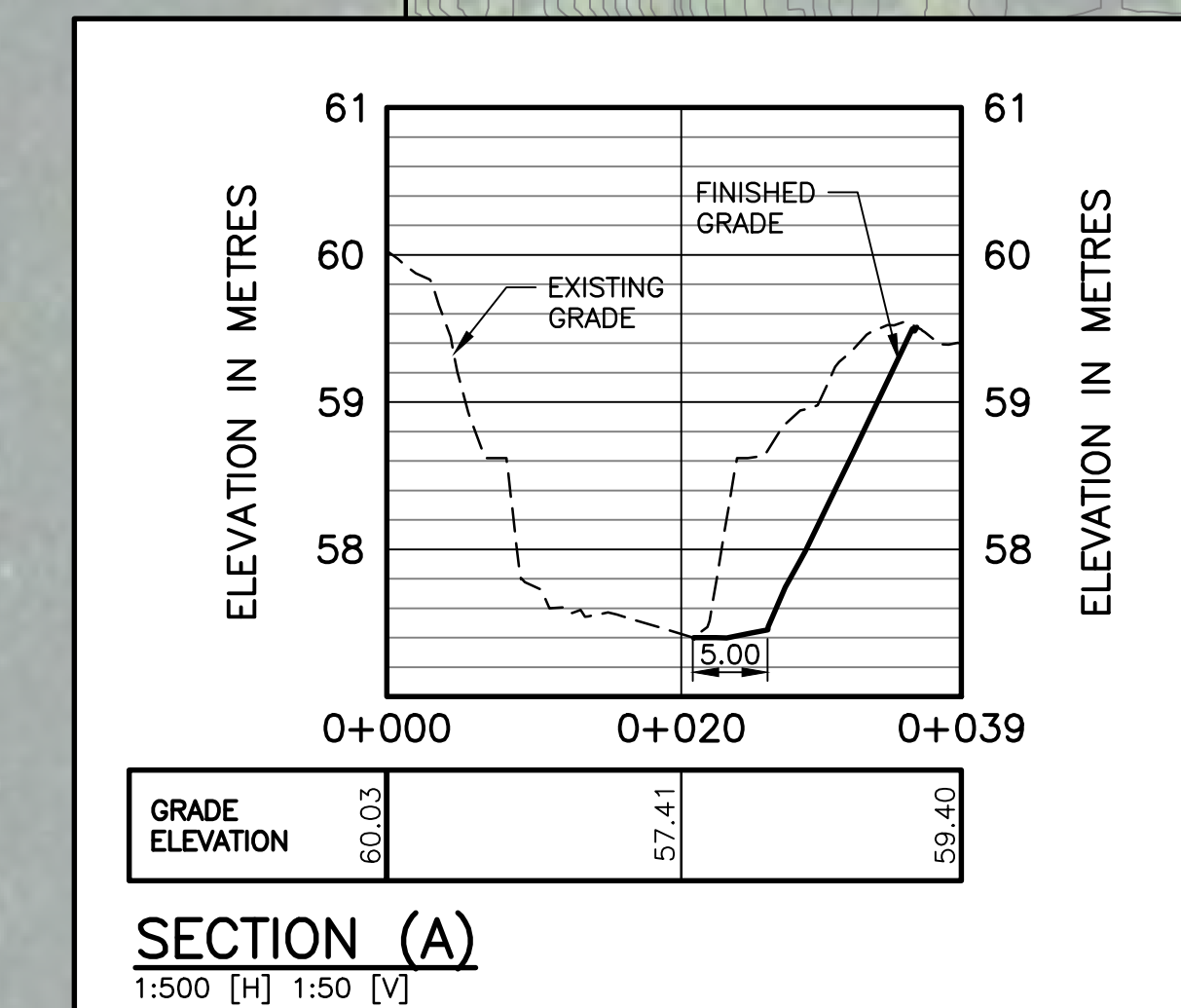
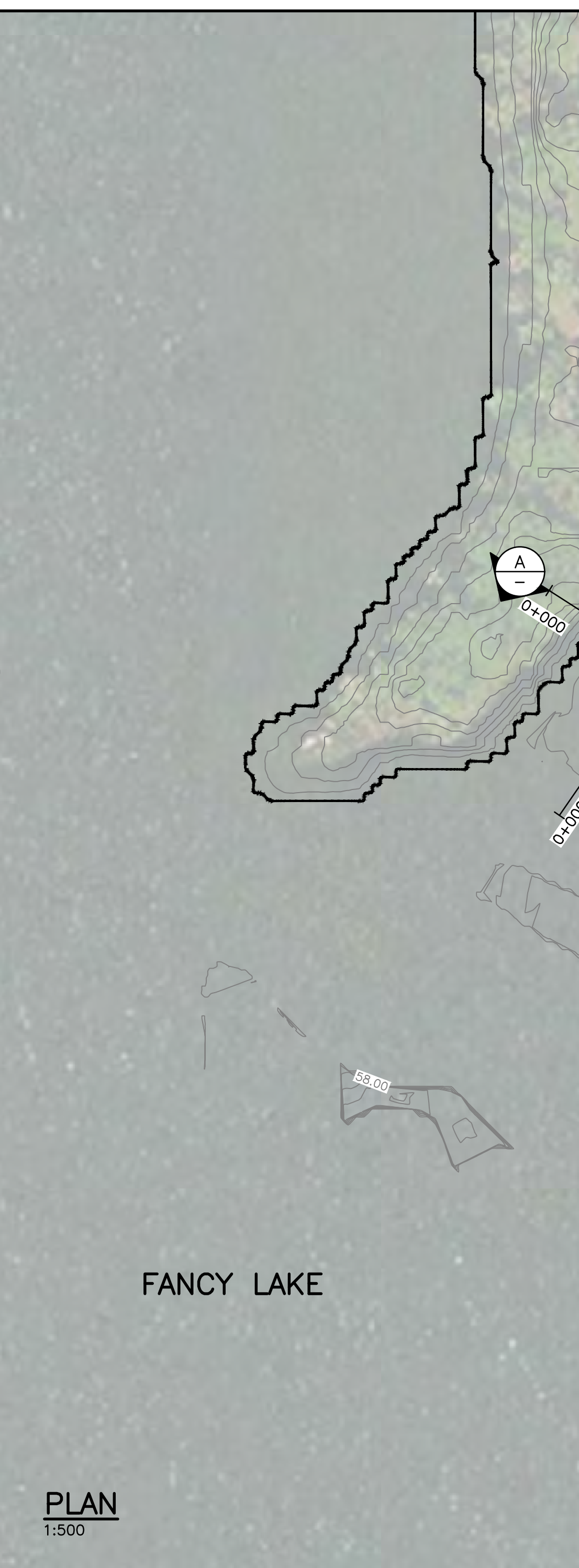
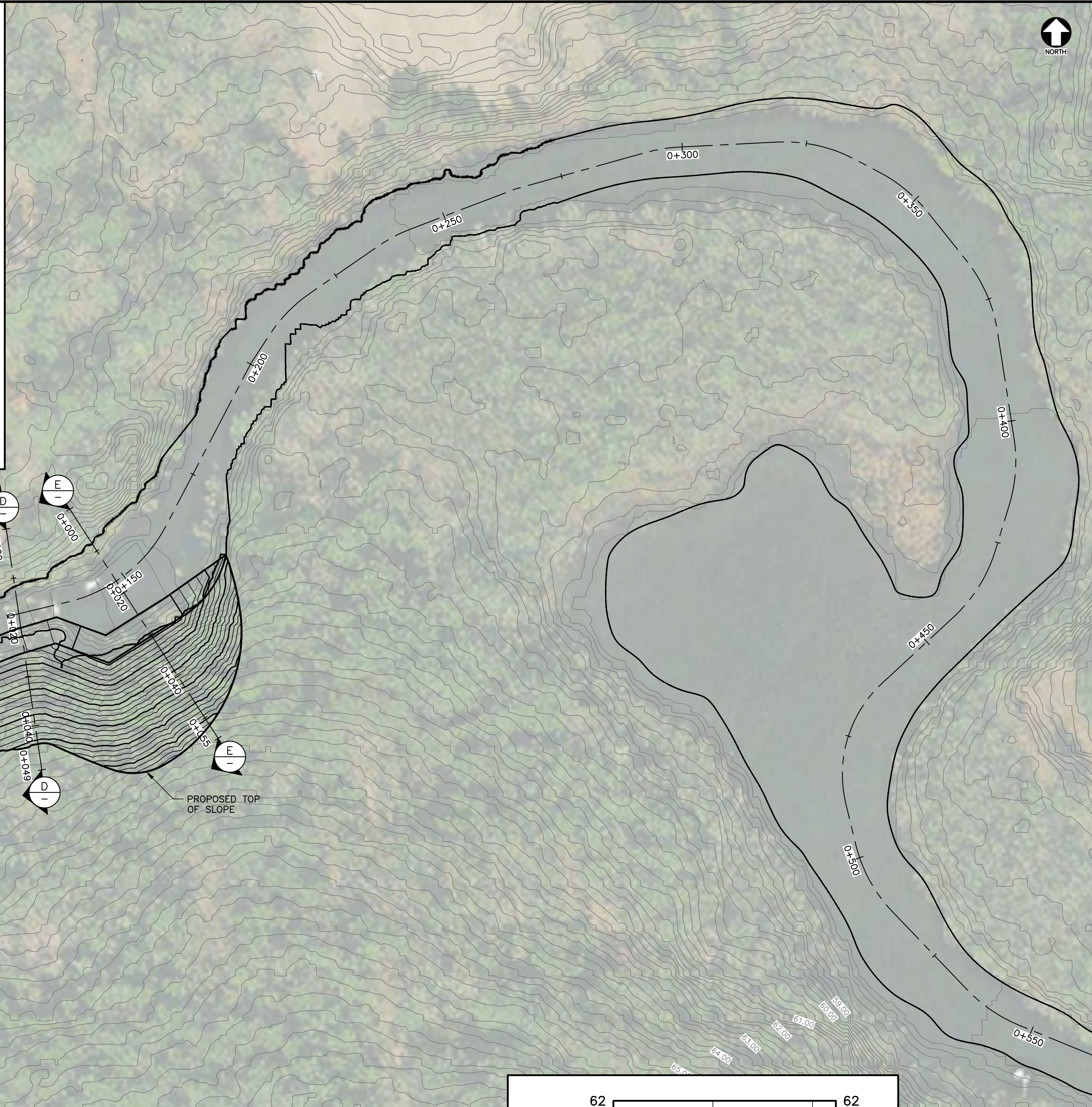
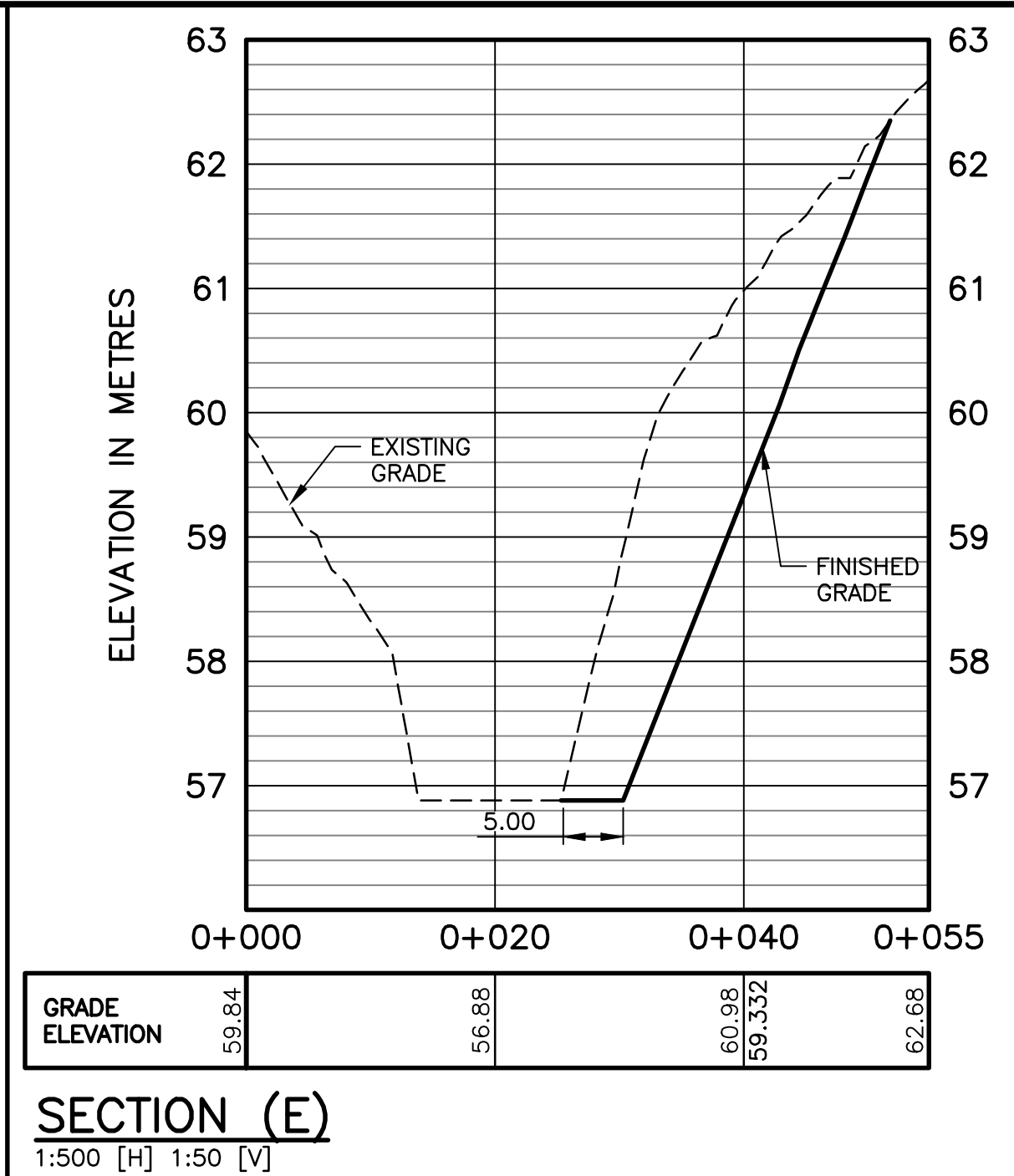
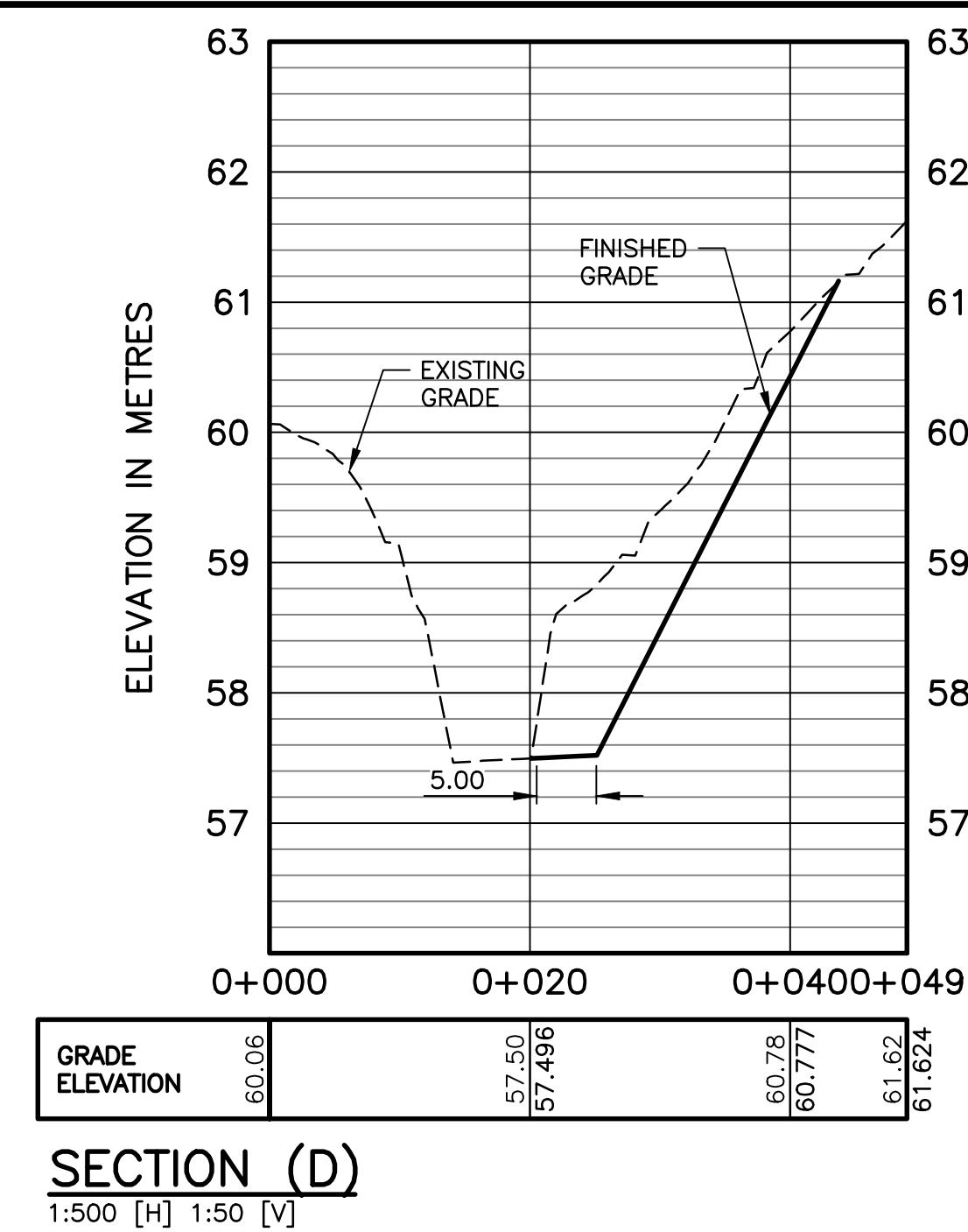
5 References

CBCL.2020a. Petite Rivière Watershed Flood Risk Assessment and Flood Mitigation Study Final Report. October 2020. Report Prepared for Municipality of the District of Lunenburg (MODL) by CBCL Limited, Halifax, NS.

CBCL.2020b. Petite Rivière Watershed Flood Mitigation Study Final Report. November 2020. Report Prepared for Municipality of the District of Lunenburg (MODL) by CBCL Limited, Halifax, NS.

APPENDIX A

Conceptual Sketches



CONCEPT DRAWING

No.	Description	Date	By
A	ISSUED FOR REVIEW	MAR 04/22	

Revision or Issue
File No. ####

LUNENBURG FLOOD MITIGATION PHASE 3

CIVIL
OPTION 2A - WIDENING RIVER CHANNEL PLAN AND SECTIONS



Contract No.	Date	Scale	
####	NOV 2021	AS NOTED	
Designed	Drawn	Checked	Approved
Sheet No. 1 of 6			
Drawing No. C01			



**CONCEPT
DRAWING**

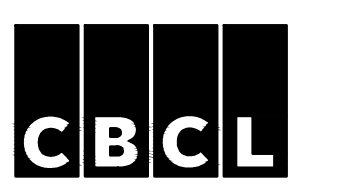
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A	ISSUED FOR REVIEW	MAR 04/22	

Revision or Issue

File No. ###

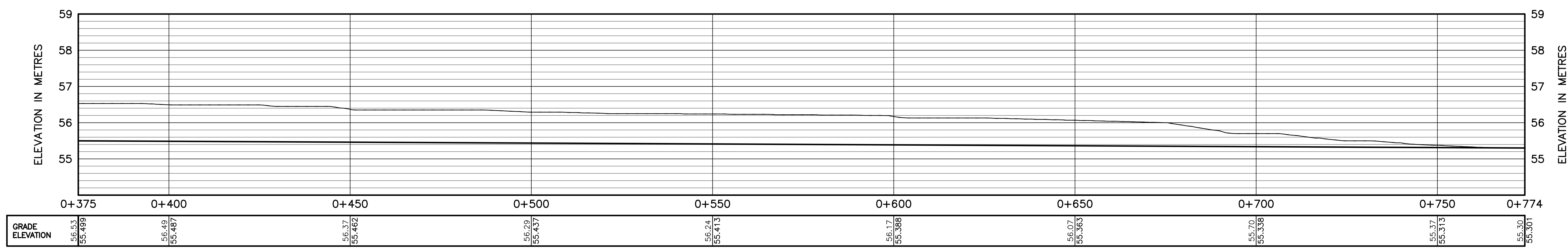
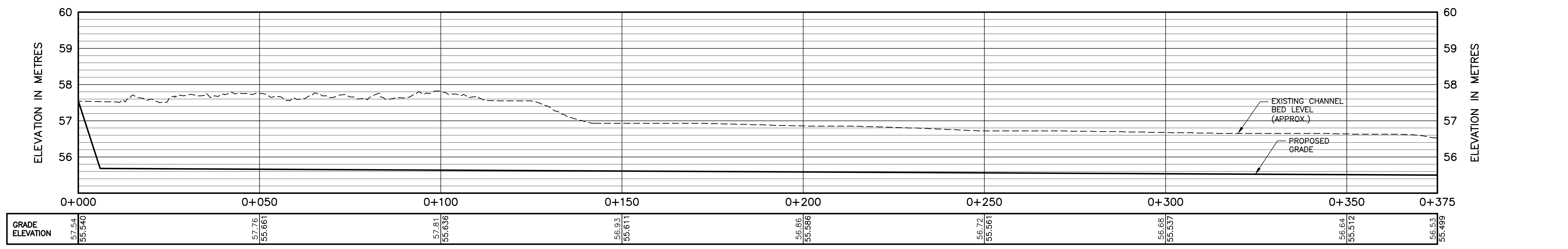
**LUNEBURG FLOOD MITIGATION
PHASE 3**

CIVIL
**OPTION 2B - DREDGED
RIVER CHANNEL
PLAN**

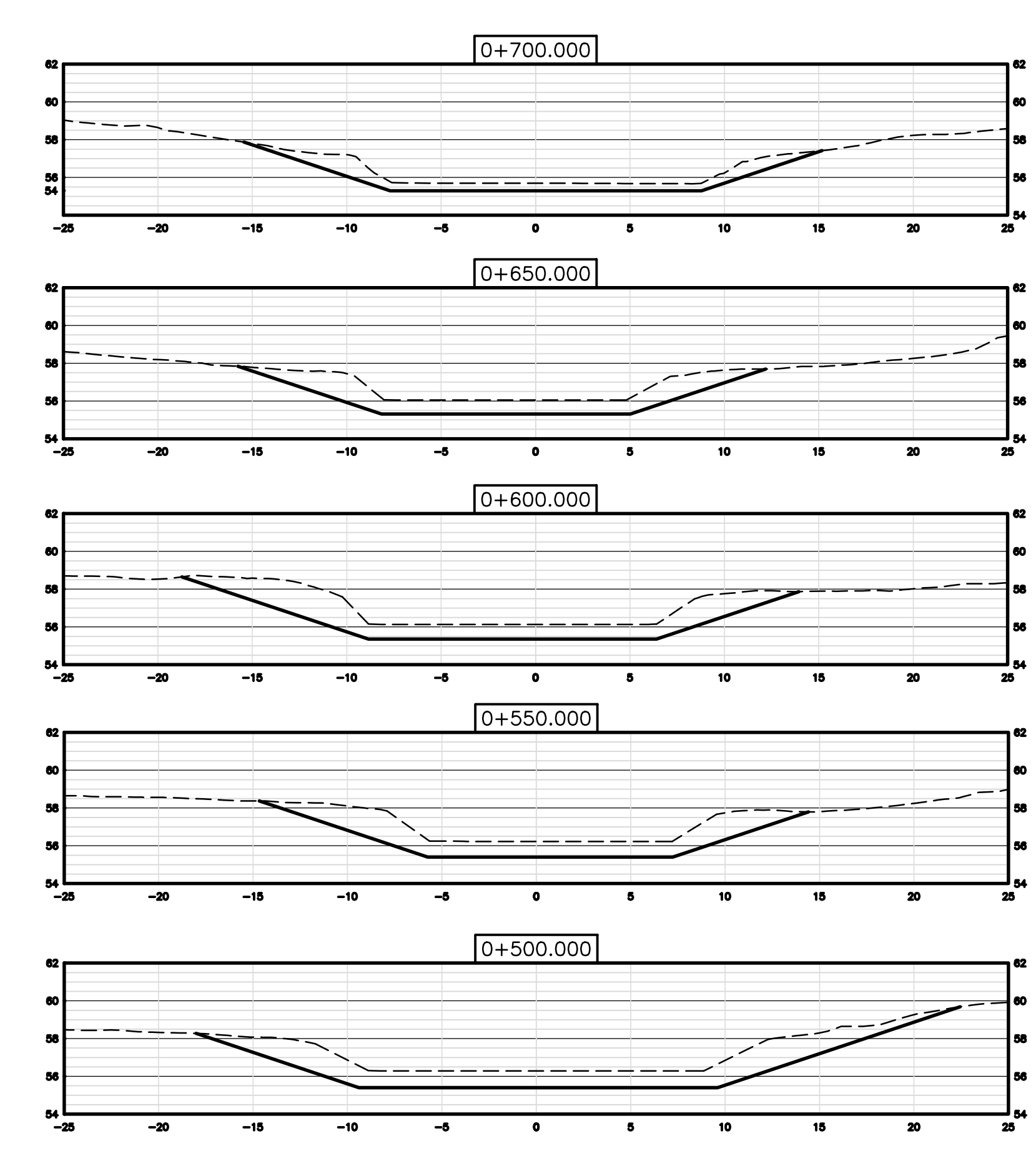
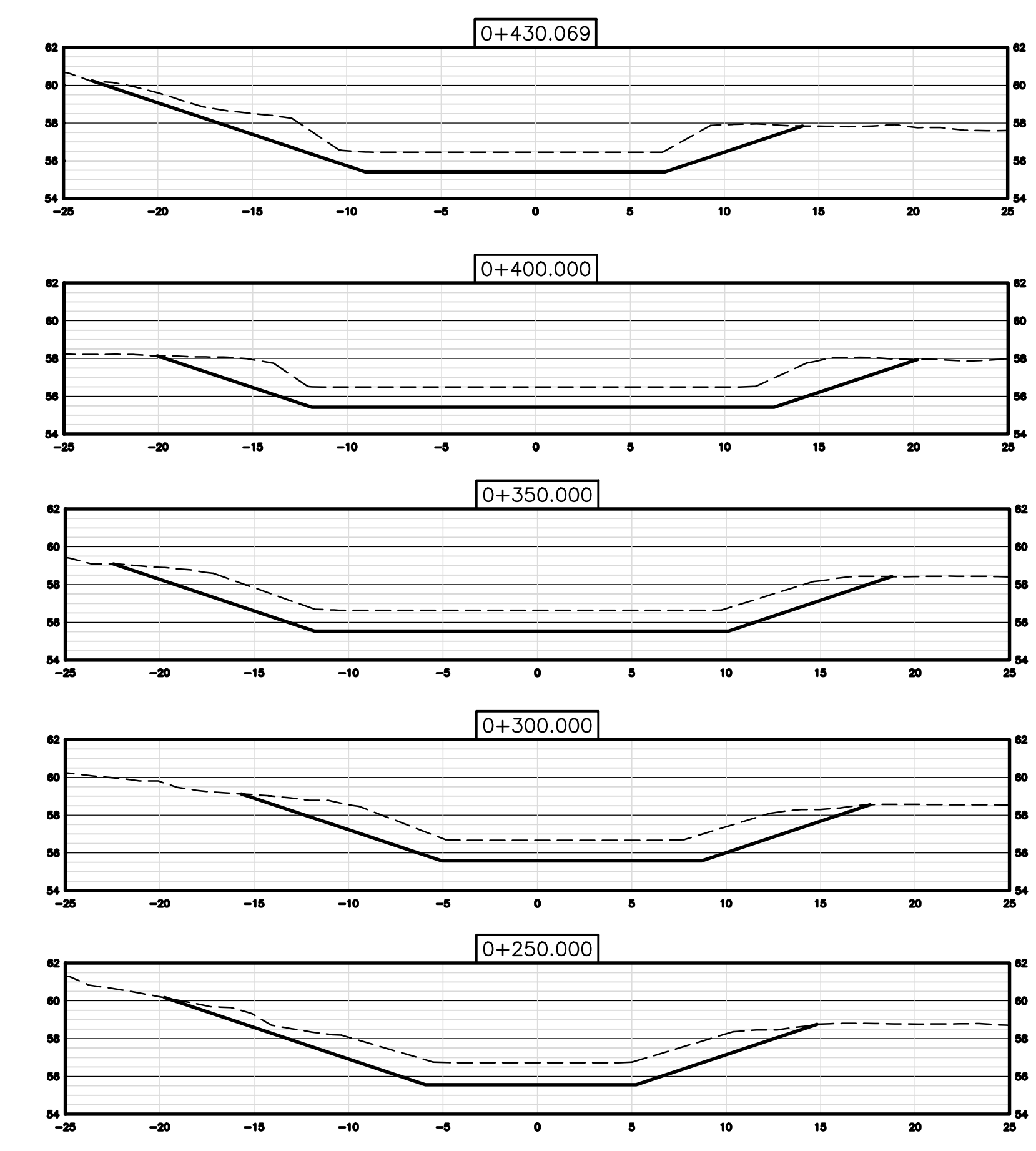
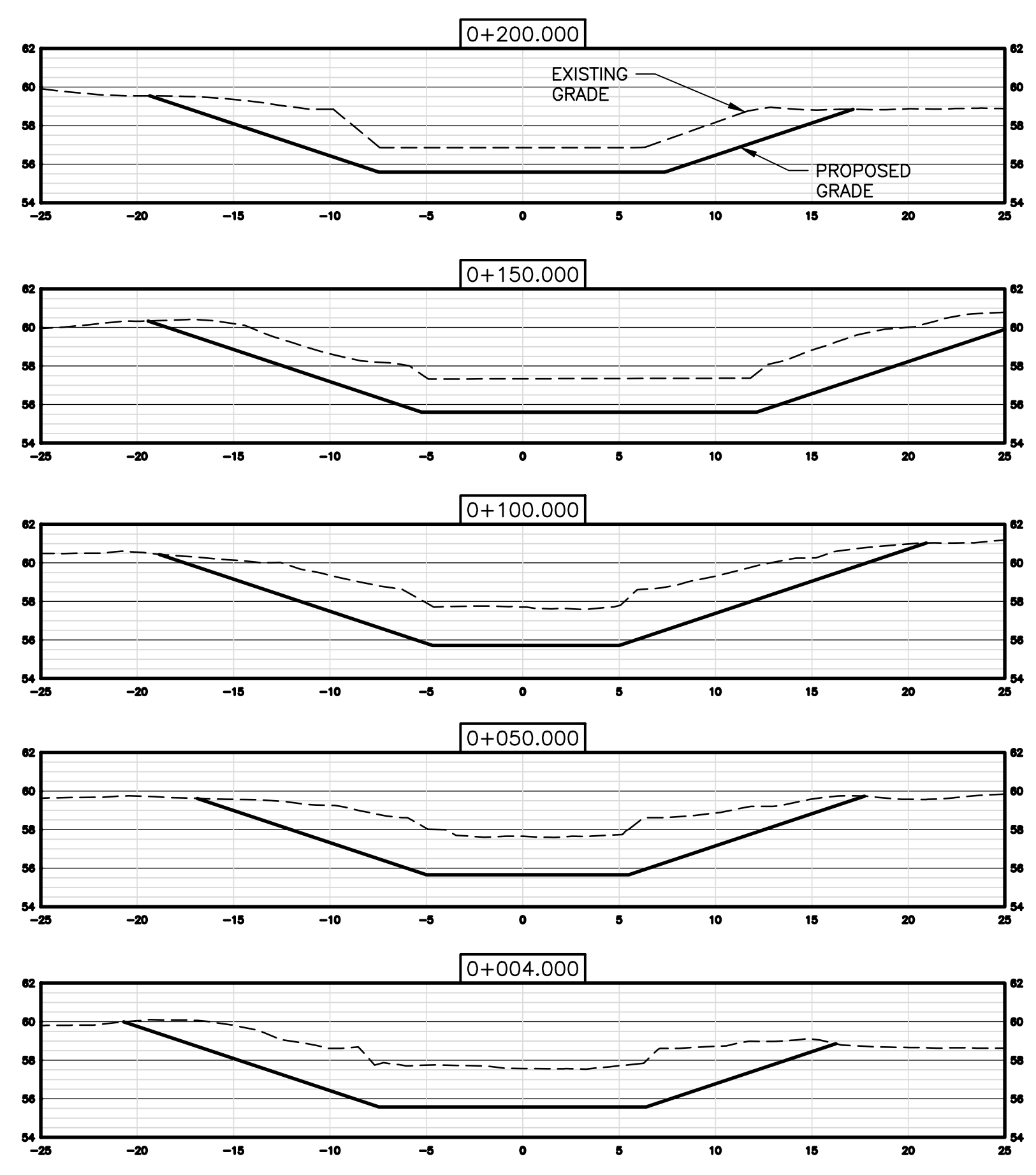


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Sheet No. 2 of 6		Drawing No. C02	

PLAN
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PROFILE
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SECTIONS
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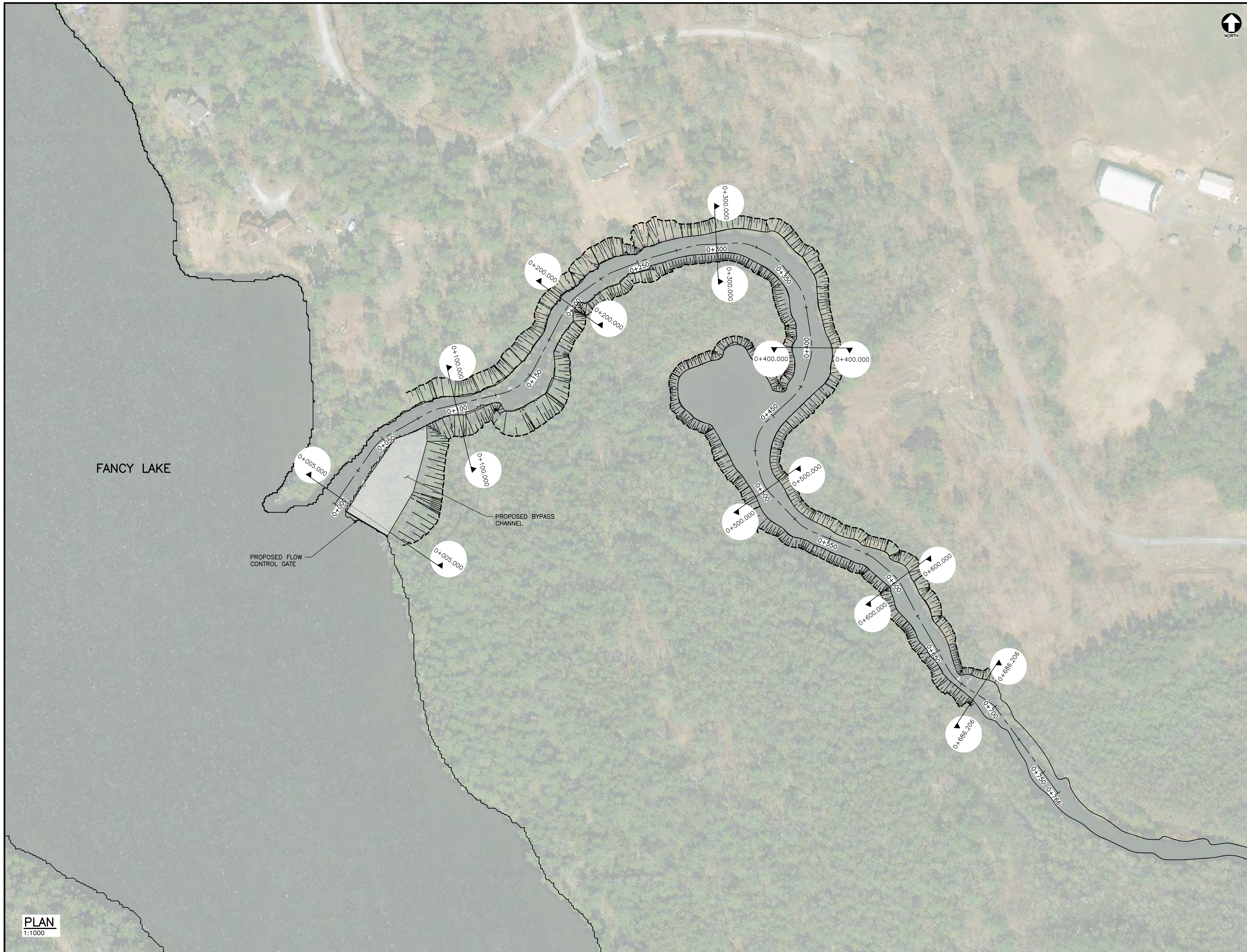
Revision of Issue
File No. ####

LUNENBURG FLOOD MITIGATION
PHASE 3

CIVIL
OPTION 2B - DREDGED
RIVER CHANNEL
SECTIONS



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		Checked	Approved
Sheet No.		3 of 6	
Drawing No.		C03	



**CONCEPT
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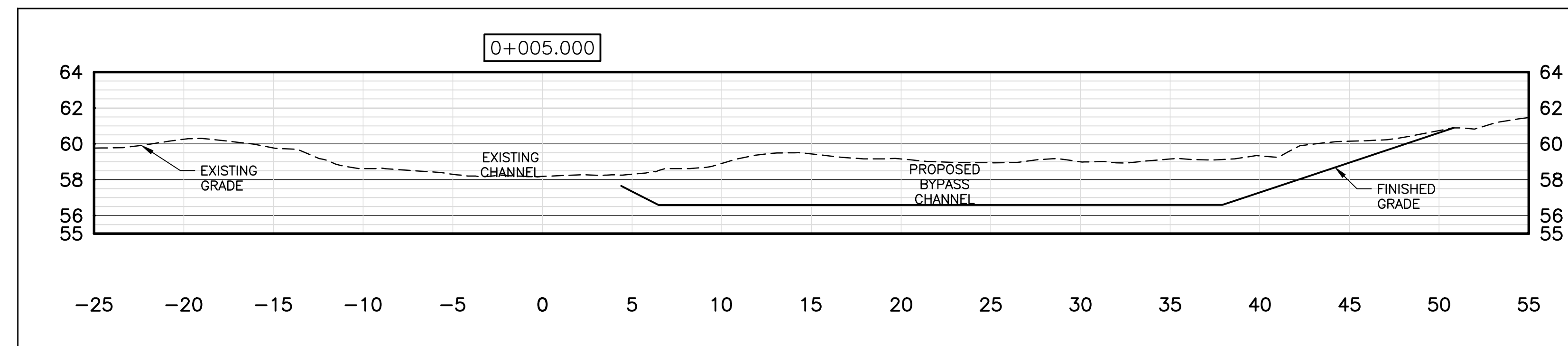
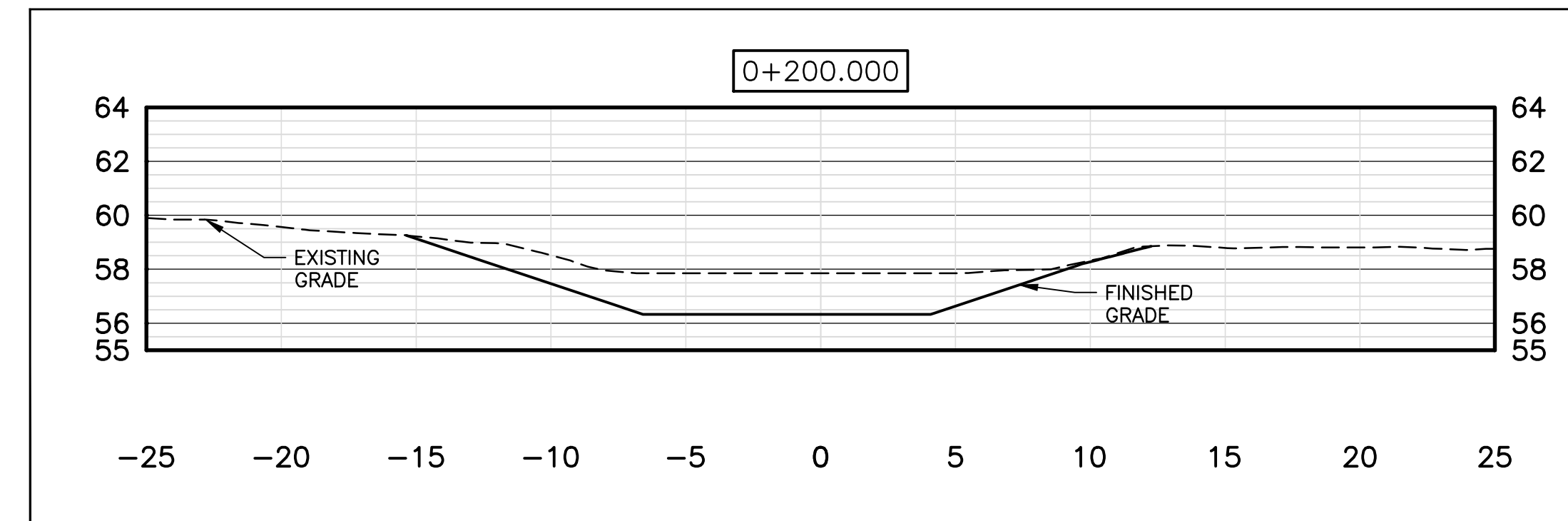
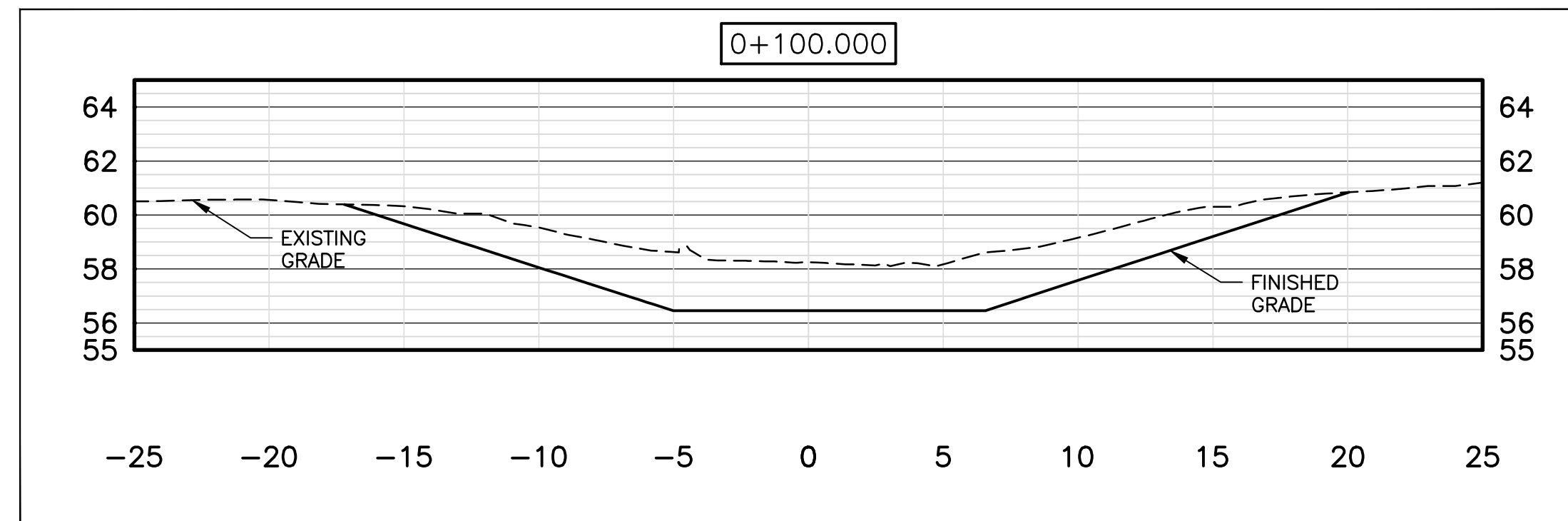
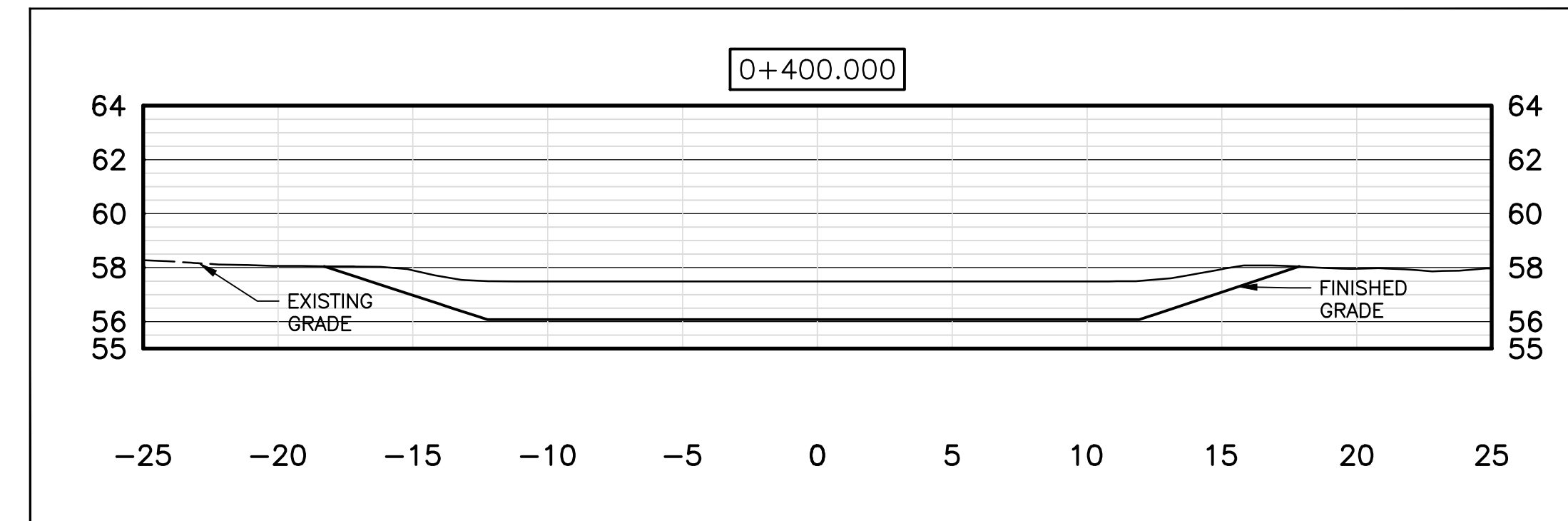
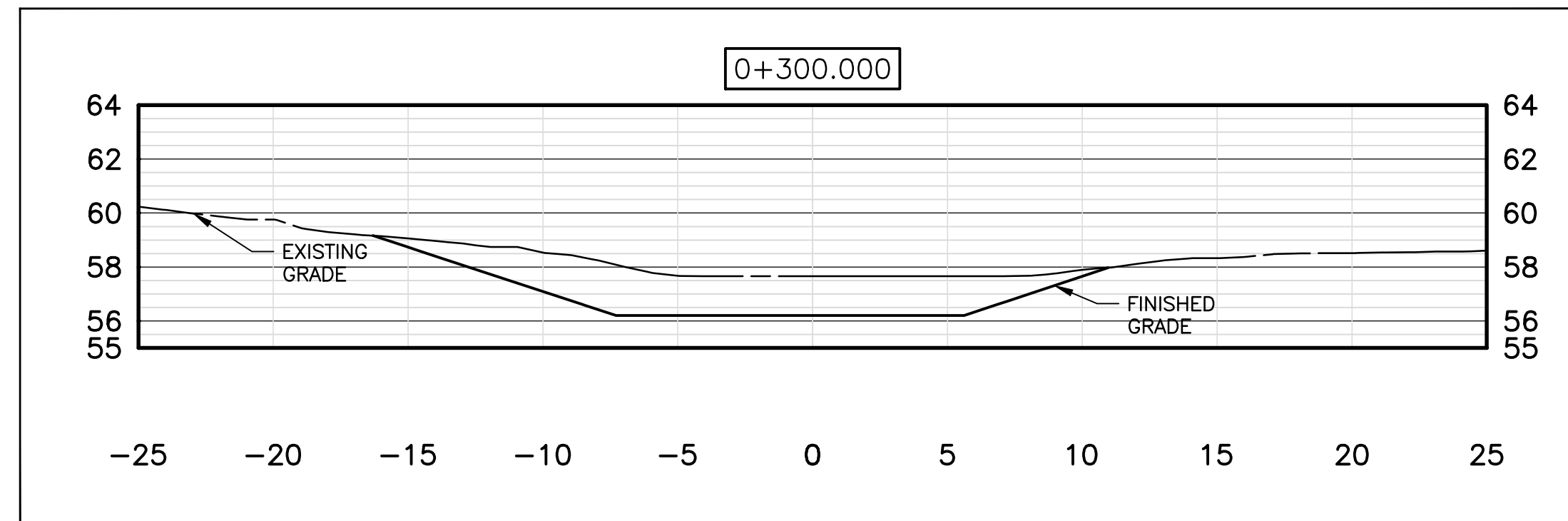
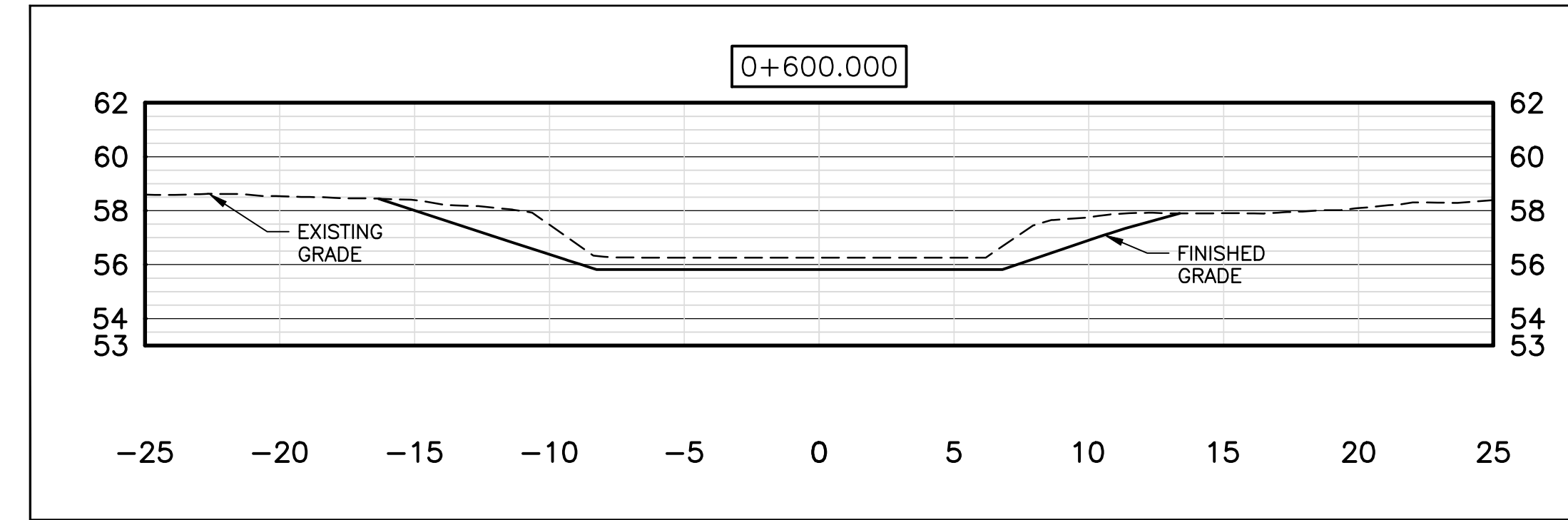
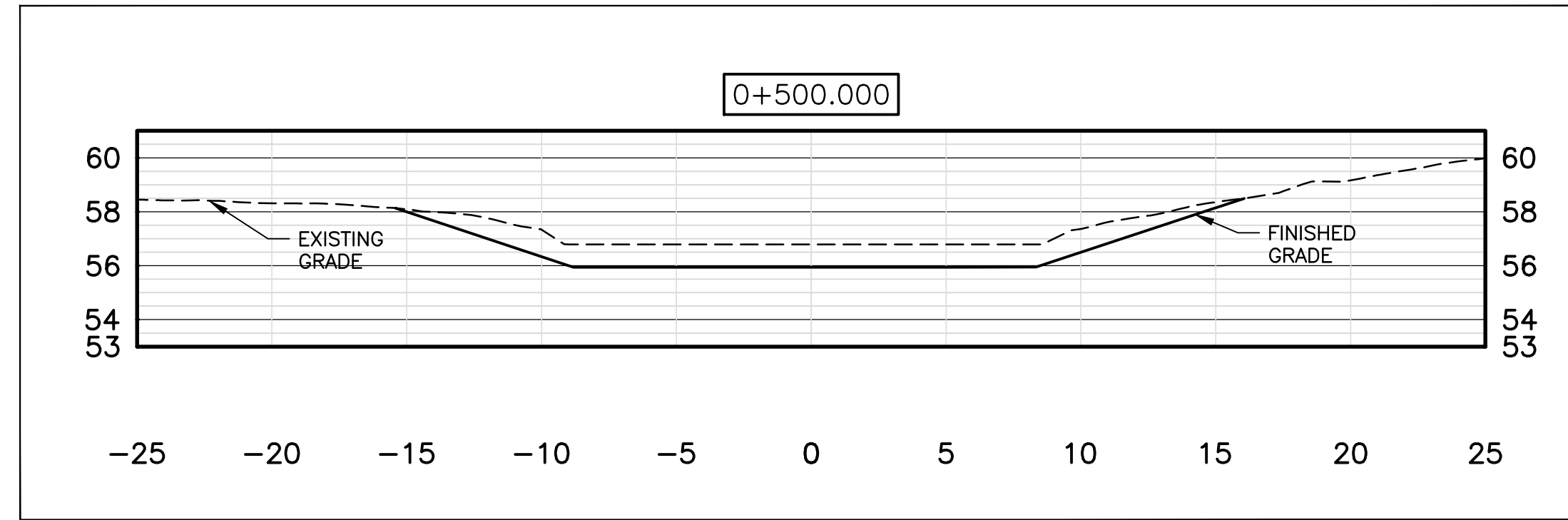
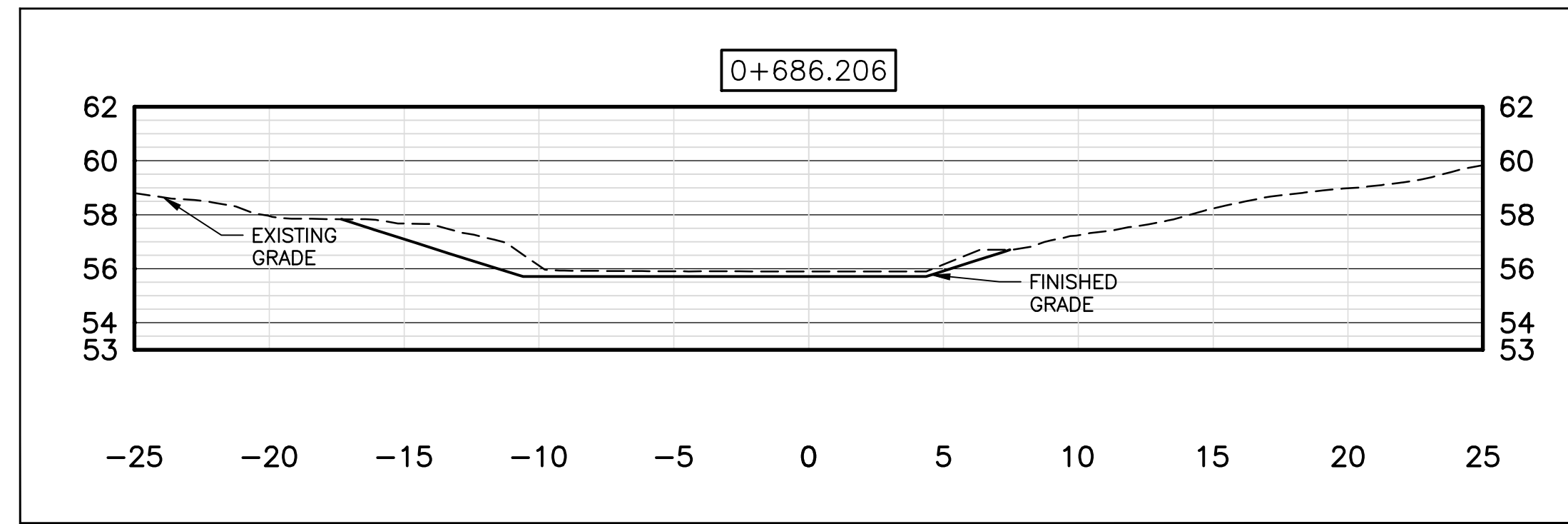
**LUNEBURG FLOOD MITIGATION
PHASE 3**

CIVIL
**OPTION 3A - DREDGED RIVER
CHANNEL WITH FLOW CONTROL
(BYPASS CHANNEL)
PLAN**



CBCL No.	Contract No.	Date	Scale
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Drawing No.		C04	

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SECTIONS
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**CONCEPT
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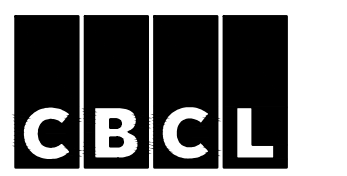
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A	ISSUED FOR REVIEW	MAR 04/22	

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LUNEBURG FLOOD MITIGATION
PHASE 3

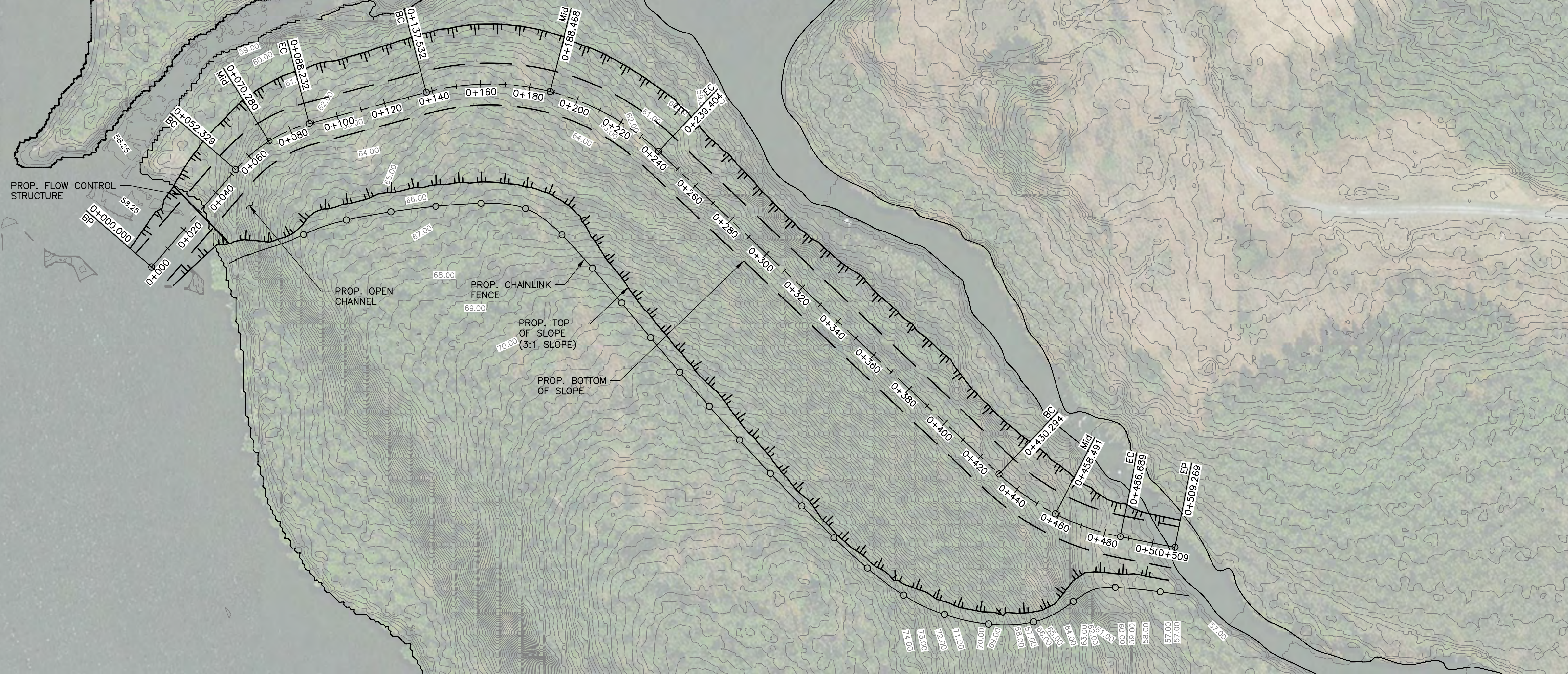
CIVIL
OPTION 3A - DREDGED RIVER
CHANNEL WITH FLOW CONTROL
(BYPASS CHANNEL)
SECTIONS



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		C05	



FANCY LAKE



PLAN
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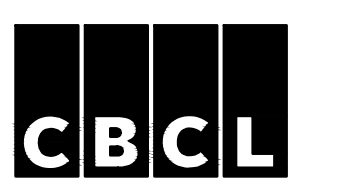
CONCEPT
DRAWING

A		ISSUED FOR REVIEW	MAR 04/22
No.	Description	Date	By
Revision or Issue			

File No. ####

LUNEBURG FLOOD MITIGATION
PHASE 3

CIVIL
OPTION 3B - NATURAL
RIVER BYPASS
PLAN & PROFILE

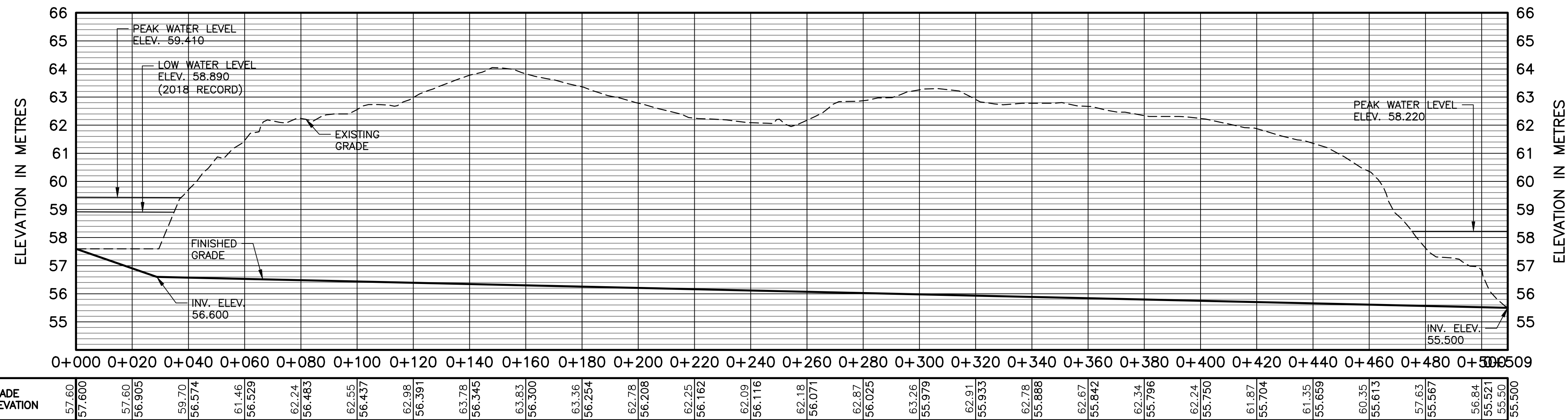


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Sheet No. 6 of 6

Drawing No. C06

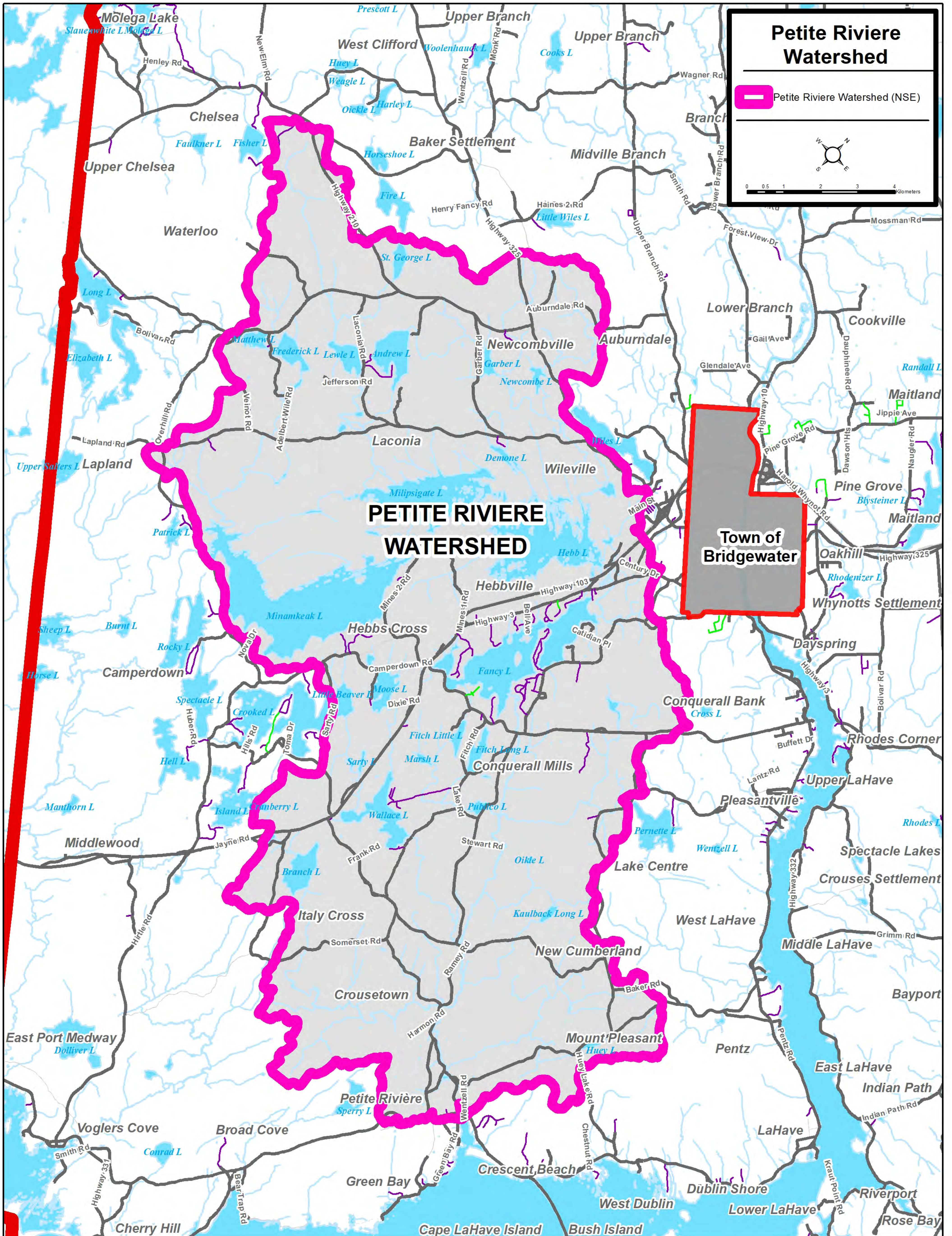
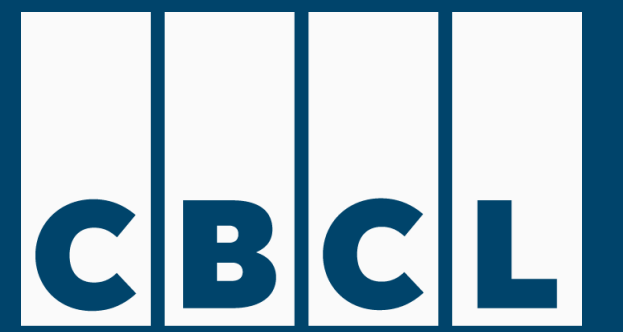


PROFILE
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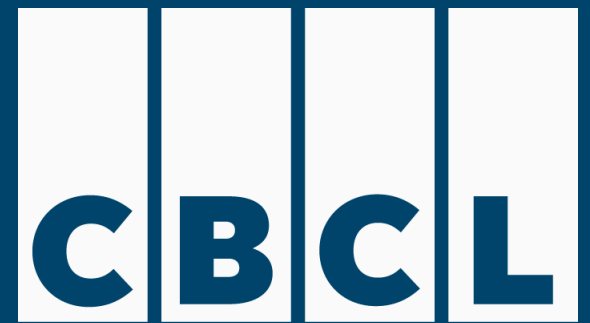
APPENDIX B

Open House Poster Boards

Petite Rivière Watershed Map



Petite Rivière Watershed Mitigation Strategies Assessment



Strategies for Further Evaluation	
1	Land use planning options and development controls
2	Flow control measures Examples such as weirs
3	Conveyance capacity increase through channel geometry changes Examples such as culverts or bridges
4	Flood protection measures Examples such as berms
5	Relocation and or/raising of vulnerable structures at risk
6	Accepting risks and building resilience Examples such as forecasting and early warning system, EMO emergency plans, and preparing for flooding and recovery



Strategies will be evaluated using 3 Key Themes. The three most suitable solutions will be assessed for their feasibility.

Petite Rivière Watershed

Area of interest – Around Fancy Lake



Regions at risk were identified is based on the 100yr CC floodline, consultation with MODL, and the collected feedback from the Public and Stakeholder Meetings in 2019.

- Focus on Areas of higher density:**
- ▶ Downstream of Hebb lake Dam
 - ▶ Fancy Lake Area
 - ▶ Downstream of Fancy Lake

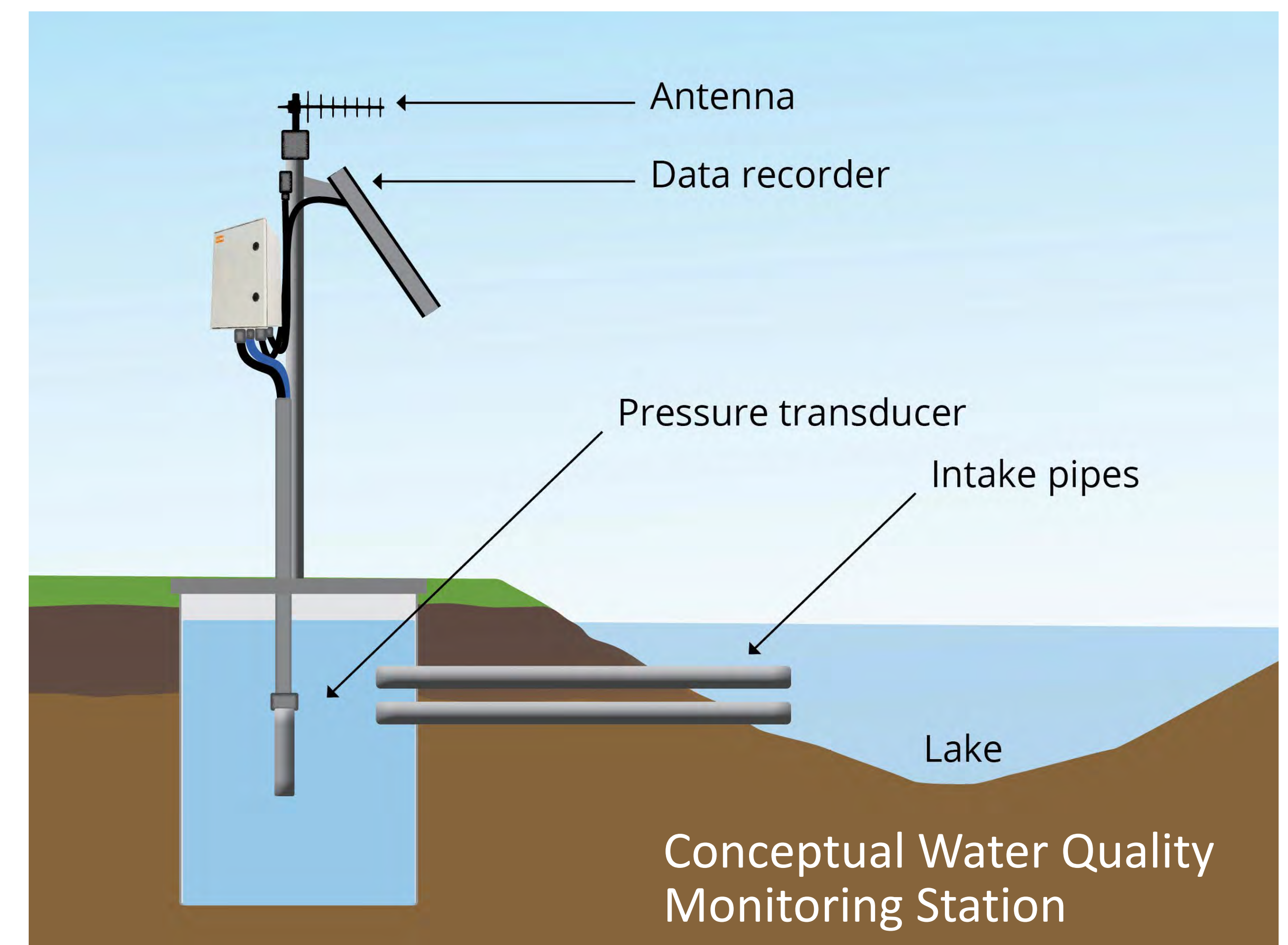
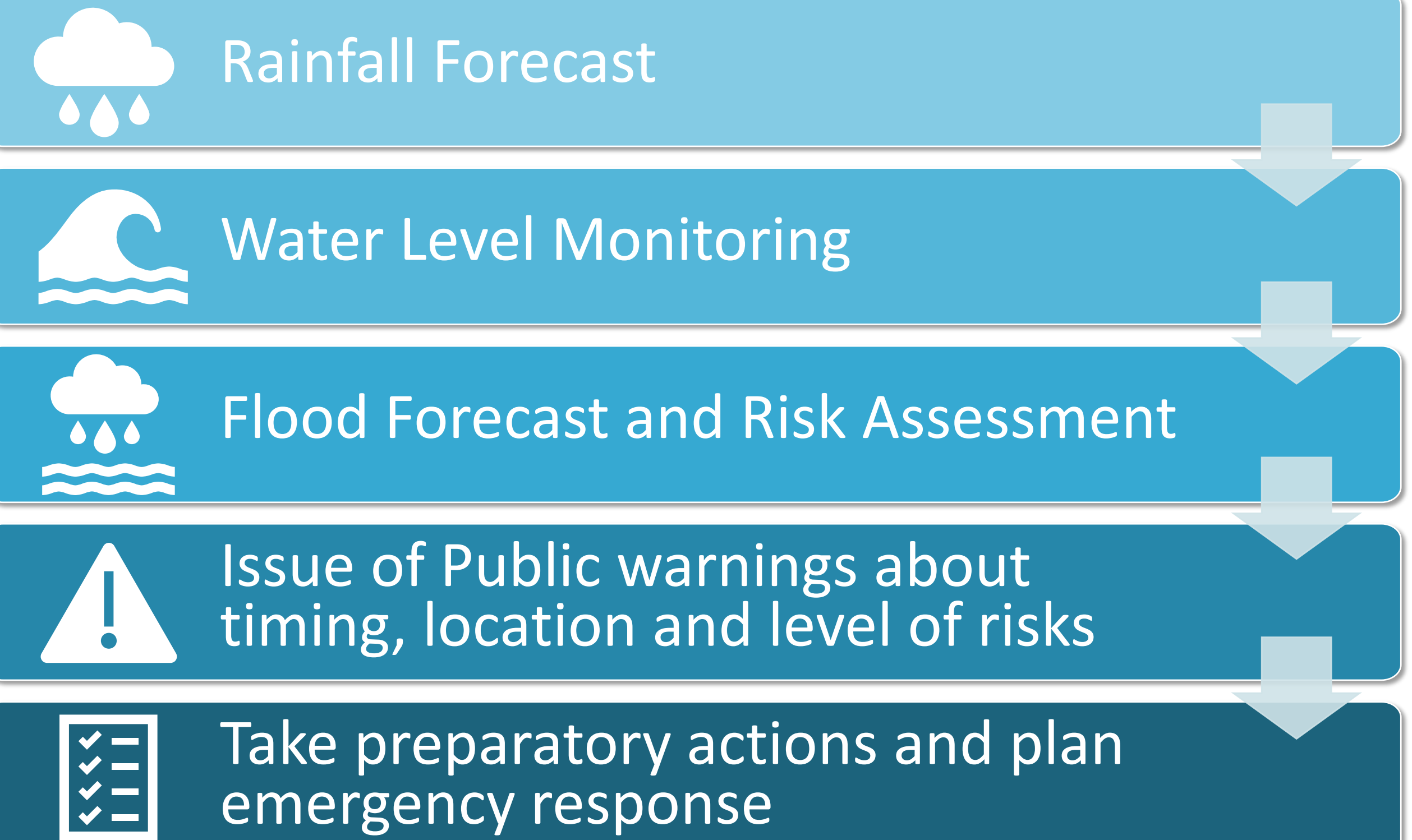
These areas include approximately 27 buildings at risk of inundation with 100yr CC floodline.



100yr CC Floodline at Hebb Lake Dam Area and Fancy Lake Area

Summary of Conceptual Option: Water Level Monitoring and Warning System

- ▶ **Monitoring Station
Flood Modelling
Notification System**
- ▶ **No Change in peak water level and flood extents around Fancy Lake for the 1 in 100 year event**
- ▶ **No Change to conveyance capacity**
- ▶ **No Change to average water levels**
- ▶ **Small Project Footprint and associated environmental effects**
- ▶ **Environmental Approvals requirements minimal**
- ▶ **Timeline for Design, Approvals and Construction : 1 – 2 years**
- ▶ **Cost: Less than \$500,000 ; Annual Cost – less than \$100,000**



Increasing Conveyance Capacity - Outlet of Fancy Lake Widening River Channel or Dredging



Summary of Conceptual Option: Increasing Conveyance Capacity Widening River Channel

- ▶ Extend the width of the river by 5m for approximately 160m in length
- ▶ Decrease peak water level and flood extents around Fancy Lake for the 1 in 100 year event
May result in a slight increase of flow velocity downstream and flood extents
- ▶ Likely to decrease average water levels by approximately 0.0 - 0.5 metres
- ▶ Medium project footprint and associated environmental effects
- ▶ Environmental Approvals required including Fish Habitat Offsetting
- ▶ Timeline for Design, Approvals and Construction : 3 – 4 years
- ▶ Cost – Greater than \$3,000,000 | Annual Cost – less than \$100,000

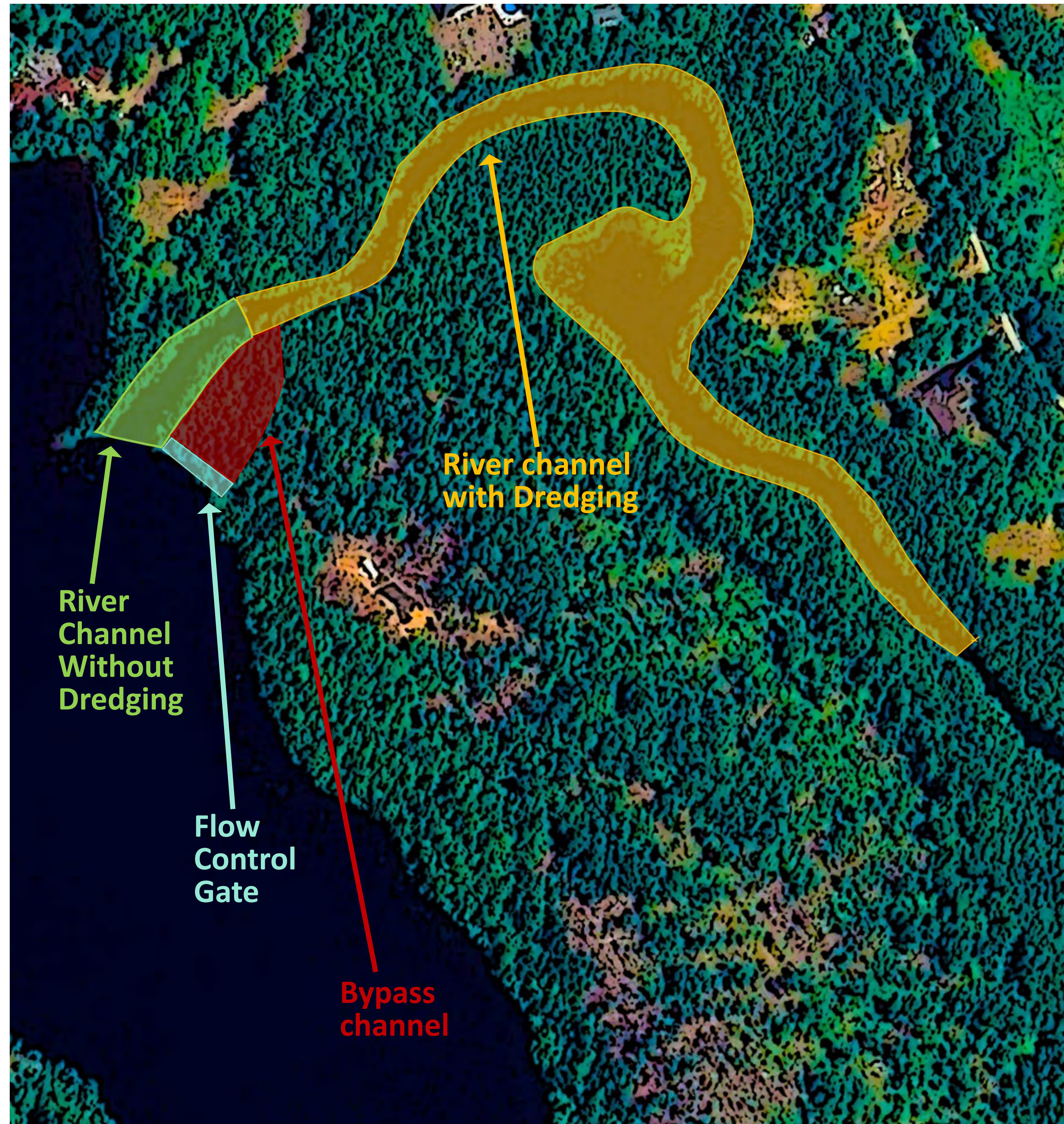


Summary of Conceptual Option: Increasing Conveyance Capacity Dredging

- ▶ Dredge / excavate appropriately 700m long section from the outlet of Fancy Lake
- ▶ Decrease peak water level and flood extents around Fancy Lake for the 1 in 100 year event
May result in an increase of flow velocity downstream and flood extents
- ▶ Likely to decrease average water levels approximately 0.1 to 2.0 metres
- ▶ Large project footprint and associated environmental effects
- ▶ Environmental Approvals required including Fish Habitat Offsetting
- ▶ Timeline for Design, Approvals and Construction : 3 – 4 years
- ▶ Cost – Greater than \$7,000,000 | Annual Cost – less than \$100,000

Flow Control - Outlet of Fancy Lake

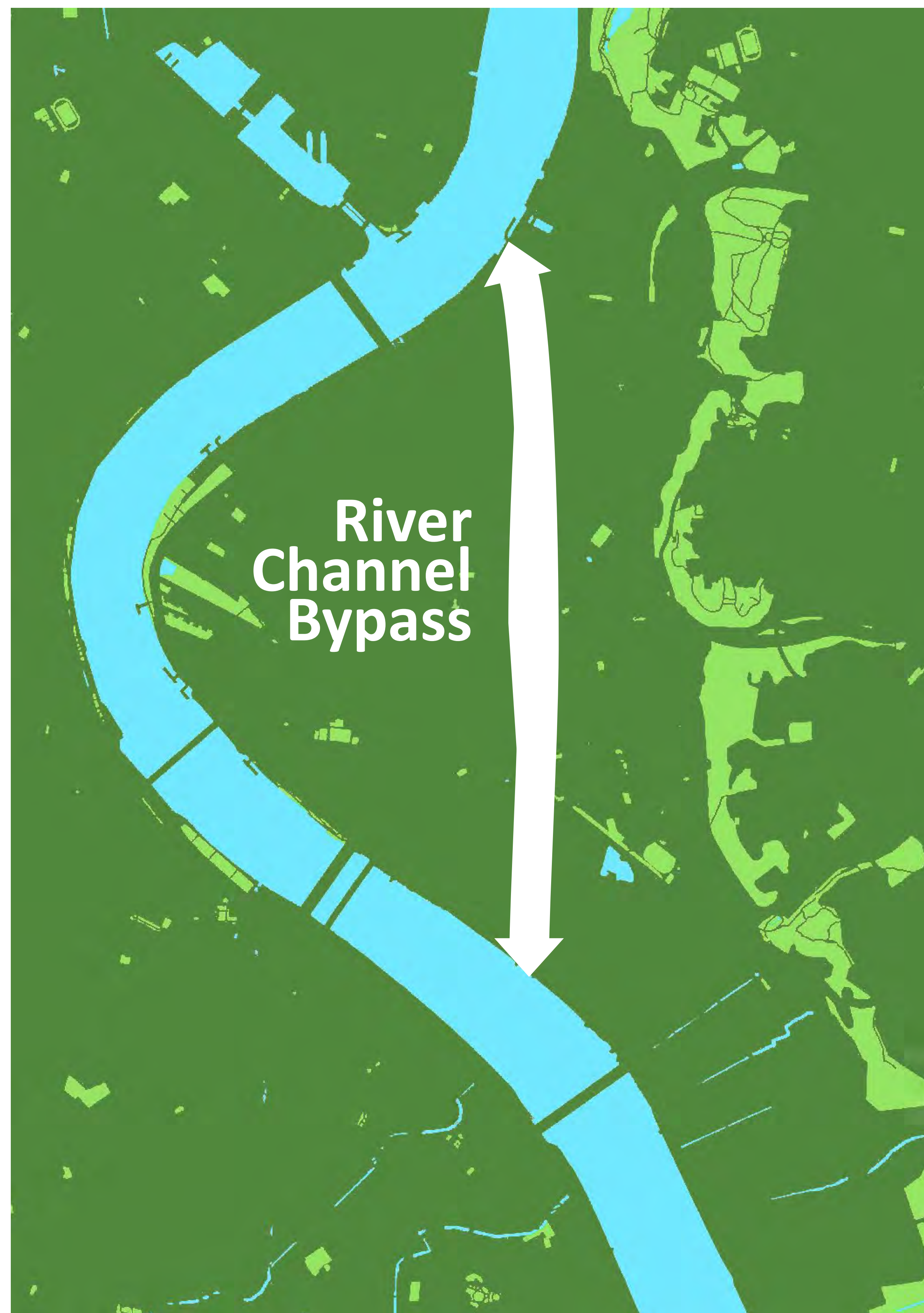
Dredged River Channel with Flow Control



Summary of Conceptual Option: Flow Control Dredging and Flow Control Gate in outlet Bypass Channel

Dredging - appropriately 700m long section from the outlet of Fancy Lake

- ▶ Installation of a flow control gate and a 30m wide bypass channel next to the existing stream.
Decrease water levels in advance of a storm event
- ▶ Decrease peak water level and flood extents around Fancy Lake for the 1 in 100 year event
- ▶ The flow control gate would be closed in normal conditions and does not affect the existing hydraulics at the outlet
- ▶ No change to average water levels
- ▶ Large Project footprint and associated environmental effects
- ▶ Environmental Approvals required including Fish Habitat Offsetting
- ▶ Timeline for Design, Approvals and Construction : 4 – 5 years
- ▶ Cost – Greater than \$12,000,000, Annual Cost – Greater than \$100,000



Summary of Conceptual Option: Natural River Bypass

Constructing new Flow Control structure and River Channel Bypass to shortcut the natural meander

- ▶ Existing waterway intact
- ▶ Install flow control gate and an open channel (approximately 17m wide, 1m deep, and 500-600m long) connecting to the watercourse
- ▶ Decrease water levels in advance of a storm event
- ▶ Decrease peak water level and flood extents around Fancy Lake for the 1 in 100 year event
- ▶ The flow control gate would be closed in normal conditions and does not affect the existing hydraulics at the outlet in normal conditions
- ▶ No change to average water levels
- ▶ Large Project Footprint and associated environmental effects
- ▶ Preserves fish habitat during construction and regular conditions
- ▶ Environmental Approvals required including Fish Habitat Offsetting
- ▶ Timeline for Design, Approvals and Construction : 4 – 5 years
- ▶ Cost Construction – Greater than \$11,000,000, Annual Cost – Greater than \$100,000



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Municipality of the District of Lunenburg

Request for Decision

Report to: Council

Submitted by: Stephen W. Pace, Director of Engineering & Public Works

Date: October 10, 2023

Re: J Class Road Paving Priorities 2024/2025

Recommendation

That Council authorize staff to submit to the Nova Scotia Department of Public Works the following roads as J Class Road paving priorities, in this order:

1. Darby's Head Road (0.45 Km)
2. St. Augustines Road (0.13 Km)
3. Riverside Heights (0.10 Km)
4. Freeman Crescent (0.37 Km)
5. Riverview Drive (0.18 Km)
6. Church Road (0.25 Km)

Executive summary

As part of the Municipal Service Exchange Agreement, the Province will cost share 50% of the expense to upgrade (pave) "J Class" roads within the Municipality. NS Department of Public Works is asking the Municipality to submit its paving priorities for the 2024/2025 fiscal year. As per the agreement those roads that did not get paved this year, will be carried forward to the following year. Only one of the J Class roads submitted for paving in the 2023/2024 period was addressed (The Point Road); therefore, the remaining roads were carried forward.

The Road Improvement Policy, MDL-75, Section 4, was used to select the following roads that meet the criteria for road improvement: Darby's Head Road, Riverside Heights, Freeman Crescent, Riverview Drive, and Church Road.

Discussion

Nova Scotia Department of Public Works has given MODL a deadline to make submissions for J Class Road paving priorities. The criteria outlined in MDL-75, Section 4 provided guidance in evaluating and prioritizing J Class roads to be upgraded.

Budget implications

The MODL five-year financial strategy includes \$350,000, including net HST, for the year 2023/2024 capital budget for both J Class Road improvements and municipally-owned road improvements.

Conclusion

Council authorize staff to submit to the Nova Scotia Department of Public Works the following roads as J Class paving priorities, in this order:

1. Darby’s Head Road
2. St. Augustines Road
3. Riverside Heights
4. Freeman Crescent
5. Riverview Drive
6. Church Road

Report Preparation		
Department	Engineering and Public Works	
Report Prepared by	Jamie Burgess, P. Eng.	
Report Approved by	Stephen Pace, MBA, P. Eng.	
Date Reviewed by C.A.O.		

Council
Item: #11.2.2
Date: October 10, 2023
Authorization: T. MacEwan



Municipality of the District of Lunenburg

Request for Decision

Report to: Council
Submitted by: Jamie Burgess, P.Eng., Municipal Engineer
Date: October 10, 2023
Re: Construction and Installation of EV Chargers

Recommendation

Council authorize staff to use Alternative Procurement to award the Construction and Installation of EV Chargers to Black and McDonald and Dexter Construction for a combined estimated cost of \$386,014.63, including net HST.

Executive summary

The Municipality of the District of Lunenburg (MODL) in an effort to reduce green house gas emissions has purchased several electric vehicles. The number of electric vehicles (EV) now out number the number of chargers available at the MODL Municipal Services Building. Council and staff have included this project in the 2023/24 Capital Budget.

Background

MODL's Local Climate Change Action Plan 2030 (LCCAP2030) is guiding the Municipality of the District of Lunenburg towards achieving net-zero emissions by 2050. As part of this plan, MODL is transitioning its Municipal fleet to electric vehicles (EVs) to reduce carbon emissions by approximately 20 tonnes.

Currently, MODL has introduced five EVs in its fleet and has installed two dual-level 2 chargers in the staff parking lot. However, the current two dual level-2 chargers fall short of meeting the charging needs of both the existing EVs in the fleet and the future EVs that MODL plans to procure. The Municipality has set a goal to fully transition its entire fleet to EVs by 2030.

To address this challenge and facilitate the transition to an all-EV fleet, MODL proposes the installation of three additional dual-level 2 chargers in the staff parking area. This proactive step will not only support the current EVs but also accommodate the growing number of EVs that MODL plans to add to its fleet. It's a pivotal step aligning with MODL's commitment to sustainability and aligns with the LCCAP2030 objectives.

Discussion

Black and McDonald and Dexter Construction have provided cost estimates, using alternative procurement as prescribed in MODL Policy No. 33 Section 19.1.1, to have 6 charging stations installed and the conduits, bollards, and charging bases for 18 future charging stations, as well as sidewalk, curb, and asphalt work. The following table shows the prices submitted for the work:

Description	Contractor	Unit Price
Install conduit, 3 charge stations (6 spots), Transformer pad, electrical enclosures, and services. Install conduit Bollards and charger bases for 2(4 spots) future charging heads.	Black & McDonald Limited	\$235,000
Install conduit, Sono tube bases and bollards for 7(14) future charge stations	Black & McDonald Limited	\$45,100
Asphalt reinstatement, 230 feet Curb, 230 feet Sidewalk, and Landscape Reinstatement	Dexter Construction Ltd.	\$56,400
Contingency		\$33,650
Subtotal		\$370,150
Net HST		\$15,864.63
Total		\$386,014.63

Budget implications

This project has been included in the 2023/24 Capital Budget at an estimated cost of \$120,000. This estimated budget cost did not include criteria such as:

- ability for future expansion,
- types of chargers needed for larger trucks,
- power source/new underground service/pad mount transformer
- accessibility,
- or snow removal/safety issues.

These issues became apparent as the design work evolved, which has increased the cost significantly from the initial budget value.

The over expenditure can be funded by: using \$25,000 from the EV Charger study, a \$30,000 grant has been applied for and the remainder will come from General Operating Reserves.

Strategic plan

This project aligns well with Council’s Strategic Priorities for Climate Change Action Plan achieving net-zero emissions for the Municipal fleet.

Work plan

This work will be completed in the 2023/24 fiscal year.

Alternatives

Council could postpone this work and consider it in a future budget year.

Conclusion

Council authorize staff use Alternative Procurement to award the Construction and Installation of EV Chargers to Black and McDonald and Dexter Construction for a combined estimated cost of \$386,014.63 including net HST.

Report Preparation	
Department	Engineering and Public Works
Report Prepared by	Jamie Burgess, P. Eng.
Report Approved by	Stephen Pace, MBA, P. Eng.
Date Reviewed by C.A.O.	Tom MacEwan

Request for Agenda Items under Mayor's/Deputy Mayor's/Councillors' Matters

TO: Chief Administrative Officer
FROM: Michelle Mreek
DATE: October 3rd 2023

1. Agenda Item
Nuisance bylaw

2. On what agenda do you want the item placed?
Council - October 10th 2023

3. Do you have written material to circulate with the agenda? Yes No

If you do, please attach it to this form. If you do not, please explain.

many nuisance bylaw examples are online.
- Seeking a staff report

4. What is its relevance to Council or the committee?

On Sept 12th 2023, a group of residents attended Council to support an individual speaking detailing Public Input on behalf of the group regarding a resident causing an ongoing nuisance in their neighbourhood. if a nuisance bylaw was created for model, the RCMP would have one more tool in their hands for ongoing situations such as the one we heard about on Sept. 12th.

5. What outcome(s) are you seeking?

Staff to present what a nuisance bylaw could look like for model. Thank you.

M. Mreek
Councillor's Signature

Oct 3, 2023
Date

Approval for agenda: Yes No

Reason for Denial:

Mayor or Chair of Committee

Date