



Climate Change

ADAPTATION PLAN

April 2026



Photo by: Sipprell's Aerial Imaging



Report Prepared By: Dillon Consulting Limited

Report Submitted to: The District of Carleton North and the New Brunswick
Department of Environment and Local Government





This project was made possible with support from the New Brunswick Department of Environment and Local Government. It was completed through the collaborative efforts of the District of Carleton North and its dedicated partners.



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April 10, 2026

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Attention: Josh Fox
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Re: District of Carleton North Climate Change Adaptation Plan

We are pleased to submit the Climate Change Adaptation Plan report for the District of Carleton North. This report summarizes the project objectives, methodology and results, highlighting climate-related vulnerabilities alongside adaptation measures and recommendations to improve the District of Carleton North's resiliency to climate change.

We would like to thank the District of Carleton North staff and Steering Committee for their valuable contributions and collaboration throughout the development of this plan.

Sincerely,

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Executive Summary

Dillon Consulting Limited (Dillon) worked collaboratively with the District of Carleton North (District of Carleton North or DCN) to secure funding from the New Brunswick Department of Environment and Local Government (NB DELG) to develop a Climate Change Adaptation Plan (CCAP or Plan). The main objectives of this CCAP are to identify the climate change vulnerabilities of specific community infrastructure assets and components and to develop strategic adaptation measures that will increase DCN's resilience to climate change impacts.

This CCAP includes a review of past work completed by DCN, specifies the infrastructure vulnerabilities that are expected due to climate change and focuses on developing viable adaptation measures for each infrastructure vulnerability identified. It also provides funding options to support infrastructure or program-based recommendations, based on the strategic priorities identified by the community.

The development of this CCAP included four main steps:

- **Background Review** – literature review and flooding elevation review to determine the initial list of vulnerabilities;
- ♦ **Targeted Interviews** – one-on-one interviews with key District of Carleton North stakeholders to verify identified vulnerabilities from previous work completed and help prepare content for the adaptation planning process;
- **Vulnerability Identification** – evaluated risk scores of identified vulnerabilities to present a hierarchy of risks to be addressed in the adaptation planning process;
- **Adaptation Planning** – prioritized list of vulnerabilities and adaptation risk response options and developed adaptation measures for each high and moderate risk vulnerability which was reviewed and agreed upon by the focus group; and
- **Reporting** – included a draft CCAP and compilation of funding opportunities.

The Vulnerability Identification step classified risks into the following categories:

- **Projected asset interactions:** twenty-six (26) moderate and eighty-seven (87) low risks;
- **Projected service interactions:** thirty-five (35) moderate and forty-eight (48) low risks; and
- **Spatial assessment:** seven (7) “at-risk” assets.

Following this assessment, high and moderate risks were then prioritized in the adaptation planning process.

Adaptation options were assigned to each of the risk interactions identified for the District of Carleton North's infrastructure to increase DCN's resilience and the capacity to deal with and respond to future climate events. Upon completion of the vulnerability assessment process, adaptation options were developed taking into account the risk scores calculated during the vulnerability assessment as well as input from District of Carleton North's stakeholders.

The resulting adaptation options aim to manage the impacts of climate change, specifically focusing on extreme temperatures, drought, heavy precipitation, flooding, freezing rain, high wind gusts and sustained winds and freeze-thaw cycles, through a combination of physical and policy-based measures.

This CCAP identifies a path forward for the District of Carleton North to proactively prepare for the anticipated impacts of climate change. As time progresses, new climate information and modelling science will emerge. As a result, this plan will adhere to Best Practices in ISO 31000 Risk Management Guidelines that call for ongoing monitoring and periodic review of the risk assessment findings and recommended adaptation measures outlined in Section 3.0 of this report.



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Acronyms, Abbreviations, Definitions

2050s	30-year record covering the years 2041 to 2070, collectively referred to as “2050’s”.	GUDI	Groundwater Under the Direct Influence (of surface water)
2080s	30-year record covering the years 2071 to 2100, collectively referred to as “2080’s”.	HARS	Heat Alert and Response System
AHCCD	Adjusted and Homogenized Canadian Climate Data	HDD	Heating Degree Days
CCAP	Climate Change Adaptation Plan	HMA	Hot Mix Asphalt
CCS	Climate Change Secretariat	HMI	Human Machine Interface
CCTV	Closed Circuit Television	HVAC	Heating, Ventilation and Air Conditioning
CDD	Cooling Degree Days	I&I	Inflow and Infiltration
CO₂	Carbon Dioxide	ISO	International Organization for Standardization
DCN	District of Carleton North	LLCA	Local Leadership for Climate Adaptation
DELG	Department of Environment and Local Government	LTC	Long Term Care
DMAF	Disaster Mitigation and Adaptation Fund	MBE	Minimum Building Elevations
ECCC	Environment and Climate Change Canada	mm	Millimetre
EAP	Emergency Action Plan	NASSCO	National Association of Sewer Service Companies
e.g.	Exempli gratia (for example)	NB	New Brunswick
EMP	Emergency Management Plan	NBDTI	Department of Transportation and Infrastructure
EMO	Emergency Measures Organization	PIEVC	Public Infrastructure Engineering Vulnerability Committee (CCRA Framework)
ETF	Environmental Trust Fund	PLC	Programmable Logic Controllers
FCM	Federation of Canadian Municipalities	QA/QC	Quality Assurance/Quality Control
FR	Flood Risk Area	RCP	Representative Concentration Pathway
GCM	Global Climate Model	SCADA	Supervisory Control and Data Acquisition
GHG	Greenhouse Gasses	TMR	Trunked Mobile Radio
GIS	Geographic Information System	U/G	Underground
GMF	Green Municipal Fund	UV	Ultraviolet
GNB	Government of New Brunswick		

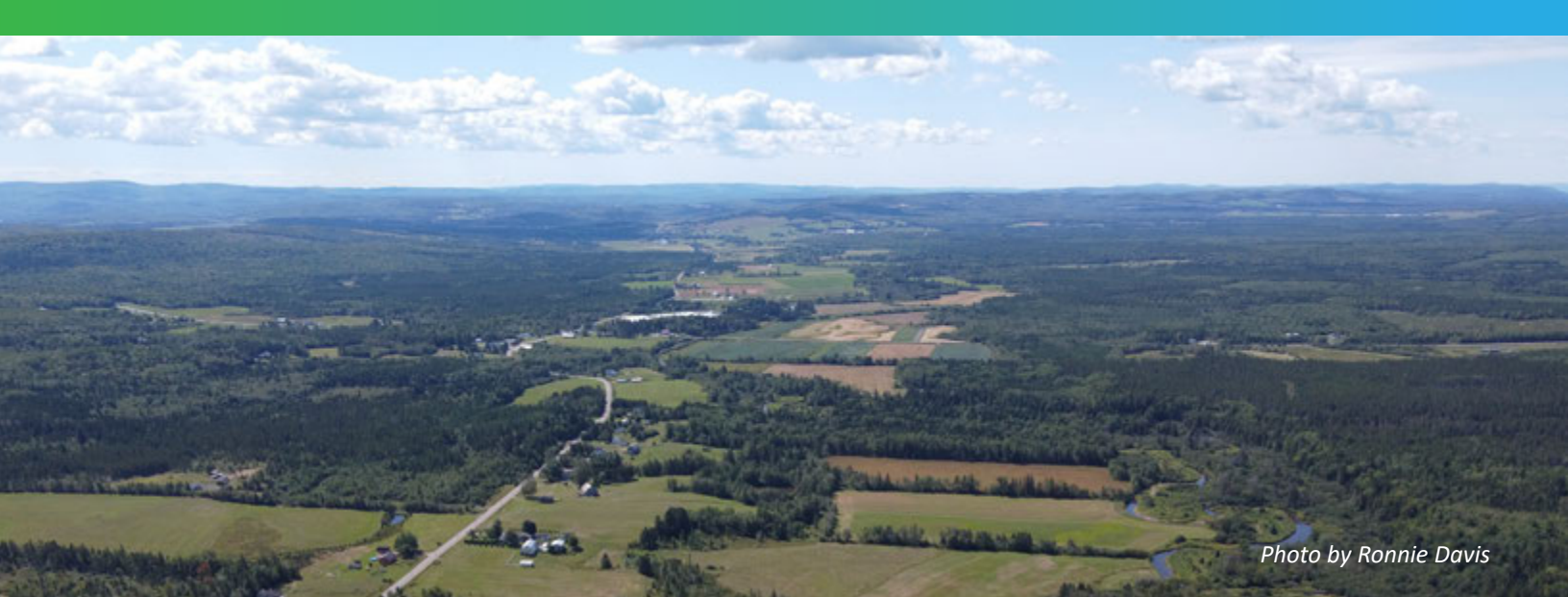


Photo by Ronnie Davis

1.0 INTRODUCTION

1.1 Project Background

The District of Carleton North (District of Carleton North or DCN) is a newly formed local government in New Brunswick (NB or the Province), established as part of the Province's local governance reforms on January 1, 2023, and is a part of the Western New Brunswick Service Commission. The region is defined by its significant watercourses, natural landscapes, farmland and managed woodlands. The District of Carleton North is currently experiencing climate change impacts consistent with the inland regions of the province, including rising temperatures and shifting precipitation patterns.

To proactively manage these risks, Dillon Consulting Limited (Dillon) was engaged by the Government of New Brunswick's Department of Environment and Local Government (GNB DELG) to develop a Climate Change Adaptation Plan (CCAP). This project aligns with the provincial goal to have adaptation plans completed for all local governments by 2030. The CCAP is designed to identify vulnerabilities in critical infrastructure and core services. Representatives from the Climate Change Secretariat (CCS), who support provincially-funded climate change-related projects, were involved throughout the project.

In light of New Brunswick's local governance reforms requiring unified land-use plans by 2028, the District of Carleton North has already reached a significant milestone by adopting its new Municipal Plan and Zoning By-law as of March 10, 2026. While the development of these documents began prior to the CCAP, they are designed as living documents. This flexibility allows them to be updated and amended to incorporate the specific land-use recommendations and adaptation strategies identified within the CCAP report, ensuring that the Municipal Plan and Zoning By-law serve as the formal land use framework for DCN's long-term resilience and growth.

The overall objective of this plan is to strengthen District of Carleton North's resilience to climate change through the development of data-driven and community informed measures that protect resident health and safety while limiting future social and economic costs.

1.2 Project Approach and Methodology

The CCAP development process consists of two primary phases: a vulnerability assessment phase and an adaptation planning phase. The vulnerability assessment phase utilizes both quantitative and qualitative approaches to determine the degree of risk climate hazards pose on DCN assets and services. This includes a technical risk scoring method and a mapping exercise to understand flooding impacts using provincial projections.



Throughout the project, Dillon collaborated closely with the Steering Committee, which provided a critical role in reviewing the identified vulnerabilities and validating the proposed adaptation measures. The Steering Committee members included:

- Amy McIntosh (Chief Administrative Officer/Clerk, District of Carleton North);
- Josh Fox (Director of Operations, District of Carleton North);
- John Nigro (Municipal Projects Coordinator, District of Carleton North);
- Tristan Sipprell (Public Safety Manager, District of Carleton North);
- Andrew Cogle (Florenceville-Bristol Fire Department, Fire Chief); and
- Fred Thompson-Brown (Director of Environmental Health & Public Safety, Western Valley Regional Service Commission).

The adaptation planning phase focuses on identifying feasible strategies, including engineered (gray), nature-based and non-structural solutions, to mitigate identified moderate and high risks. The specific tasks associated with the project scope are summarized below in **Table 1**.

Table 1: Project Scope Summary

Phase	Task	Subtasks
Vulnerability Assessment	Background Review & Data Collection	Reviewed community infrastructure data and compiled an asset inventory.
		Compiled existing regional climate data and future projections for the 2050s and 2080s.
		Compiled existing regional climate data and future projections for the 2050s and 2080s.
		Reviewed provincial flood hazard mapping.
	Targeted Interviews	Conducted one-on-one interviews with three (3) local government representatives to gather detailed local knowledge.
		Identified initial vulnerabilities and documented local climate impacts.
	Vulnerability Assessment	Facilitated a technical workshop with the Steering Committee to evaluate climate impacts on services.
		Completed an interaction matrix between hazards and critical infrastructure.
		Produced a prioritized risk assessment matrix identifying High, Moderate and Low-risk interactions.
	Community Online Survey	Developed and launched a public survey to share objectives, gather public knowledge and build community support.
Adaptation Planning	Adaptation Strategy Development	Reviewed the prioritized list of infrastructure and service vulnerabilities.
		Developed adaptation measures and other recommendations to address the high and moderate risk interactions identified from the vulnerability assessment.
		Created a distilled list of adaptation measures and additional considerations to be considered for final reporting.
	Adaptation Workshop	Reviewed adaptation measures with the Steering Committee (in an in-person workshop) to validate and refine the draft implementation plan.
	Final Reporting	Prepared and submitted a draft and final CCAP document to the Council for approval.



1.3 Background Review Process

The background review component of this project involved the review of past planning initiatives undertaken by DCN. As a result of this review, an infrastructure component listing was established and a prioritized list of infrastructure vulnerabilities were compiled ([Section 2.3](#)). A complete infrastructure component listing can be found in [Appendix A – District of Carleton North Infrastructure Listing](#). The background review process also included a review of the climate hazards that could impact District of Carleton North's infrastructure or disrupt its services.

The component listing compiled for this project was informed by several sources, namely:

- **Town of Florenceville-Bristol Asset Management Plan (2018)**, which contains general information related to asset class, location, performance and improvement costs within the previous Community of Florenceville-Bristol;
- **Village of Centreville Asset Management Plan (2018)**, which contains general information related to asset class, location, performance and improvement costs within the previous Community of Centreville;
- **Village of Bath Asset Management Plan (2018)**, which contains general information related to asset class, location, performance and improvement costs within the previous Community of Bath;
- **District of Carleton North Emergency Response Plan (2025)**, which outlines the District of Carleton North's Municipal Emergency Response Plan, detailing emergency management procedures, responsibilities and hazard assessments;
- **District of Carleton North Flooding Review (2025)**, which identifies the primary flooding risks as Saint John River (Wolastoq) riparian flooding (from ice damming/thaw) and inland microburst flash flooding;
- **District of Carleton North Fire Review (2025)**, which identifies high wildfire risk from lightning and human activity in unmanaged forested areas, recommending preventative actions like 'Fire smarting' and building code updates, along with a review of high-risk escape routes and critical infrastructure fire suppression;
- **District of Carleton North Heat Wave Review (2025)**, which outlines a three-level Heat Alert and Response System (HARS) for coordinating cooling opportunities and opening air-conditioned cooling stations, with escalating measures for vulnerable persons, municipal staff and critical infrastructure based on the heat alert level; and
- **District of Carleton North Ice-Winter Storm Review (2025)**, which identifies the risks of prolonged road closures and power outages from ice storms and heavy snow, recommending a full review of road maintenance, power infrastructure vulnerability and critical infrastructure resilience.



This background review concluded with the recognition of a significant milestone: the District of Carleton North's adoption of a new Municipal Plan and Zoning By-law on March 10, 2026. Although the development of these documents preceded the CCAP process, they are established as living documents. This inherent flexibility ensures that the specific land-use recommendations and adaptation strategies emerging from this CCAP report can be seamlessly integrated through future amendments.

Specific infrastructure components were identified within broader infrastructure categories dictated by their asset classification (transportation, water/wastewater, etc.), which helped to guide the assessment. The infrastructure components considered as part of this assessment are shown in [Table 2](#), below.



Table 2: Infrastructure Component Listing

Infrastructure Category	Infrastructure Component
Transportation Assets	Asphalt Roadways and Parking Lots
	Gravel Roadways and Parking Lots
	Asphalt and Concrete Sidewalks
	Gravel or Natural Pedestrian Trails
	Boardwalk (Wooden)
	Bridges
Water, Wastewater and Stormwater Assets	U/G Sanitary Sewers
	U/G Storm Sewers
	Maintenance Holes (Maintenance Holes, Catch Basins)
	Wastewater Treatment Lagoons (3)
	Septic Tanks
	Watermains
	Steel Water Reservoir
	Private and Public Groundwater Wells
	Culverts and Drainage Ditches
	Fire Supply/Water Hydrants
Community Structures – Building Components	Foundation/Structure
	Roof (shingles)
	Roof (flat)
	Exterior Finishes
	Mechanical/ Electrical
Community Structures – Building Services	Emergency and Public Safety (Fire, Police, etc.)
	Healthcare and Wellness (Hospitals, Urgent Care, LTC/Nursing Homes)
	Education (Schools, Libraries, etc.)
	Recreation (Community Centers)
	Administration
	Social and Support (Shelters, Food Banks, etc.)
	Utility and Infrastructure
Parks and Recreational Assets	Parks (Soccer Field, Ball Fields, Tennis Courts, Playgrounds, Gazebos)
	Pools
	Forested and Vegetated Areas
	Rivers/Watercourses
Additional Elements	Farmland
	Power/Communication/Utility Cables/Substations
	SCADA
	Industrial Facilities
	Fleet and Equipment



In addition to the literature review of past climate change strategies and detailed assessments conducted on behalf of DCN, this project reviewed provincially available flood mapping as part of a spatial assessment to identify infrastructure vulnerabilities. The resulting maps generated through this assessment are shown in **Appendix B – Spatial Assessment Mapping**.

1.4 Review of Climate Hazards

Using publicly available climate toolkits and studies, historical and projected climate data were collected to inform our understanding of anticipated changes in the climate in the District of Carleton North. Historical conditions were compiled for the period 1981 to 2010. Climate change projections were then calculated for the time periods “2050s” (2041 – 2070) and “2080s” (2071 – 2100) using an average of various Global Climate Models (GCMs) with an emission scenario using the Representative Concentration Pathway (RCP) 8.5, demonstrating a “business as usual” scenario, with continued fossil fuel consumption going forward. The use of a large combination of models provides a good estimate of climate change since the average of the combination is the standard best practice methodology for climate change projections. The following sources were utilized:

- **Climate Data Canada**, an online climate data portal produced collaboratively by Canada’s leading climate organizations and supported, in part, by the Government of Canada. It uses Adjusted and Homogenized Canadian Climate Data (AHCCD). This dataset consists of records from Environment and Climate Change Canada (ECCC) stations that have been adjusted to account for shifts in instrumentation, station relocation and observing practices, ensuring that historical trends accurately reflect long-term climate changes rather than localized technical interference. The closest active ECCC stations to the District of Carleton North is Aroostook (Climate ID: 8100300) and Woodstock Newbridge (Climate ID: 8105603);
- **“Possible Impacts of Climate Change of Wind Gusts under Downscaled Future Climate Conditions: Updated for Canada” by Cheng et al.**, a research article exploring future projections of wind gust events across various Canadian regions;
- **“Possible Impacts of Climate Change on Freezing Rain Using Downscaled Future Climate Scenarios: Updated for Eastern Canada” by Cheng et al.**, a research article exploring future projections of freezing rain events across eastern Canada; and
- **GeoNB Data Catalogue (Service New Brunswick)**, a publicly available data catalogue which contains a list of geographic datasets.

Drought conditions were assessed qualitatively based on available data for dry days and the longest period of consecutive +30°C days obtained from Climate Data.

Past climate change reporting identified several climate change hazards of concern (**Table 3**), namely extreme high temperatures, heavy rainfall events, high wind events, drought conditions and freezing rain/ice storms, all of which are expected to increase in the future. While these hazards are expected to increase in frequency and severity, climatic conditions can vary across the geography of the District of Carleton North.

Flooding events have been associated with heavy rainfall events, warmer weather, ice jams and/or the annual spring freshet and were spatially assessed using data from the GeoNB Data Catalogue.

A more in-depth look into DCN’s climate profile can be found in **Appendix C – District of Carleton North Climate Profile**.



Table 3: Climate Data Projections

Climate Hazard	Definition/Threshold	Historical Average (1981 – 2010)	Projected Values 2050s	Projected Values 2080s	Projected Trend
Heat/ Drought	Very Hot Days Average number of days per year with a maximum temperature $\geq 30^{\circ}\text{C}$	3.9	21.5	48.1	↑
	Cooling Degree Days¹ Average number of cooling demand per year against the baseline of 18°C	92.1	302.9	564.0	↑
	No. of Heat Waves² Average number of heat waves per year	0.0	1.6	5.3	↑
	Average Length of Heat Waves Average length of heat waves in days	0.0	4.4	20.7	↑
	No. of Periods with > 6 Consecutive Dry Days Average number of periods per year with more than 5 consecutive days with precipitation below 1 mm/day	9.3	9.2	9.6	↑
Cold	Winter Days Average number of days per year with minimum temperatures $< -15^{\circ}\text{C}$	53.1	22.0	6.8	↓
	Heating Degree Days³ Average number of heating demand per year against the baseline of 18°C	5157.2	4047.0	3376.0	↓
	Ice Days Average number of days per year with a maximum temperature $\leq 0^{\circ}\text{C}$	90.0	59.4	37.8	↓
Heavy Precipitation	Total Annual Precipitation Average total annual precipitation in the form of rainfall and snow	1228.0	1371.8	1444.1	↑
	Wet Days ≥ 20 mm Average number of days per year with precipitation ≥ 20 mm (rain and snow combined)	11.2	14.8	17.0	↑
	Maximum 5-Day Precipitation Average amount of precipitation that falls over a consecutive 5-day period	80.0	90.2	98.0	↑
Freeze-Thaw	Freeze-Thaw Cycles⁴ Average number of freeze-thaw cycles per year	82.2	75.3	71.2	↓

¹ Cooling Degree Days is a metric used to quantify cooling demand. CDD is calculated by subtracting 18°C from the average daily temperature for each day of a specified time period. Increases in CDD indicate increasing cooling needs due to an increase in average daily temperatures.

² Heat waves occur when at least 2 days in a row reach or exceed 30°C and minimum temperatures exceed 18°C .

³ Heating Degree Days is a metric used to quantify heating demand. HDD is calculated by subtracting the average daily temperature from 18°C for each day of a specified time period. Decreases in HDD indicate decreasing heating needs due to an increase in average daily temperatures.

⁴ A freeze-thaw cycle occurs when the daily maximum temperature exceeds 0°C and the daily minimum temperature is less than or equal to -1°C .



Climate Hazard	Definition/Threshold	Historical Average (1981 – 2010)	Projected Values 2050s	Projected Values 2080s	Projected Trend
High Wind Gusts	High Winds $\geq$ 50 km/h Average number of days per year with wind gusts $\geq$ 50 km/h	16.8	N/A	18.4	↑
	High Winds $\geq$ 70 km/h Average number of days per year with wind gusts $\geq$ 70 km/h	2.5	N/A	3.2	↑
Freezing Rain	Freezing Rain $\geq$ 6 hrs Average number of days per year with freezing rain lasting $\geq$ 6 hrs	0.9	N/A	1.0	↑
	Freezing Rain $\geq$ 4 hrs Average number of days per year with freezing rain lasting $\geq$ 4 hrs	2.0	N/A	2.2	↑
	Freezing Rain $\geq$ 1 hrs Average number of days per year with freezing rain lasting $\geq$ 1 hrs	7.8	N/A	8.6	↑

1.4.1 Extreme Weather Events

Some of the most drastic impacts of climate change arise from climate hazards or events that are the hardest to predict within the limitations of current modelling and forecasting capabilities. Events such as ice storms, tropical cyclones and hurricanes can bring serious and often life-threatening impacts to a community and therefore require consideration in developing an effective response.

A major challenge with extreme weather is that impacts often cascade across interconnected infrastructure and community services. This creates a wide range of potential failures across transportation, energy and water and wastewater systems. The District of Carleton North has experienced this vulnerability firsthand through several historic events over the last fifteen (15) years:

- **Post-Tropical Storm Arthur (July 2014):** This storm caused massive tree damage and extended power outages across the region, serving as a key benchmark for wind vulnerability in DCN;
- **Heavy Rainfall Event (September 29-October 1, 2015):** The storm resulted in the worst road flooding and washouts of 2015 with drainage systems becoming overwhelmed in many places and there were many reports of localized flooding;
- **2017 Ice Storm (January 24–26, 2017):** A major ice storm struck New Brunswick, leaving 33% of households without power, with some outages lasting days to weeks. Prolonged freezing rain caused extensive damage to overhead infrastructure (electricity, communications), transportation networks and tree canopies. The additional load of wind on ice accumulations (ice accretion) accelerated these impacts. Such widespread damage can greatly impair DCN 's ability to function and presents residents with considerable risks to their security, health and safety;
- **Spring Freshet Floods (2018 & 2019):** Consecutive years of historic flooding overwhelmed the Saint John River (Wolastoq) system. These events isolated residences, closed key transportation routes and overwhelmed wastewater infrastructure, highlighting the critical "High-Risk" vulnerabilities identified in this report's spatial assessment; and
- **Drought Conditions (Summer 2025):** District of Carleton North experienced a period of sustained low precipitation and high temperatures during the summer of 2025. This event strained local private wells and increased the "High-Risk" designation for wildfire.



The uncertainty surrounding the frequency and intensity of these extreme climatic events highlights the critical need for an Emergency Management Plan (EMP) that accounts for these specific contingencies.

1.4.2 Data Limitations

The data gathered depicts the average of statistically downscaled data from twenty-four (24) climate models. It is standard practice in climatological studies to use data from a range of models (as opposed to a single model) to represent the uncertainty associated with the modeling process. It is important to acknowledge that there will invariably be an element of uncertainty associated with the projections provided by climate models regarding the anticipated changes in our climate.

Furthermore, it is challenging to predict with absolute certainty the specific outcomes of climate change. However, the level of confidence in potential impacts varies on a case-by-case basis, depending on the type of climate change associated with the impact and the nature of the relationship between the change and its resulting effects.

For example, there may be a higher degree of confidence when suggesting that an increase in the frequency of hot days will likely lead to an increased number of heat strokes (unless proactive adaptation measures are implemented), but a lower degree of confidence that the increased number hot days will increase the severity of thunderstorms (which require specific kinds of meteorological conditions). Therefore, while there exists a relatively straightforward cause-and-effect relationship between elevated outdoor temperatures and heat-related illnesses, the development of thunderstorms involves a more complex interplay of meteorological variables.

1.5 Stakeholder Engagement Process

The approach taken towards the development of this CCAP was driven by historical and projected climate data combined with an engagement process designed to facilitate stakeholder collaboration and community-wide participation. Recognizing that effective engagement is a cornerstone of a robust plan, Dillon and the District of Carleton North involved community members and local organizations in the process to foster a sense of ownership.

Table 4, below, summarizes the various tools, workshops and meetings that contributed to this project. Each stakeholder session was designed in a manner that maximizes the input gathered at key stages of the project, such as identifying local climate events and vulnerabilities. The community survey was designed to confirm the findings of the vulnerability assessment and adaptation planning workshops while gathering feedback to foster dialogue on climate impacts. This survey also provided an educational component to inform community members about the project and District of Carleton North's commitment to increasing preparedness and resilience in the face of direct climate risks. The engagement generated meaningful feedback from key stakeholders, resulting in an engagement-driven CCAP development process.



Table 4: Project Scope Summary

Phase	Engagement Session/Meeting	Date	Engaged Group	Purpose
Project Initiation	DELG/Local Government Discovery Meeting	November 4, 2025	District of Carleton North Staff, Dillon and DELG	Discussed project scope, objectives and administrative requirements to ensure alignment from the outset.
	District of Carleton North Kick-Off Meeting	December 10, 2025	District of Carleton North Staff, Dillon and DELG	Provided a detailed project overview and confirmed the proposed methodology and timeline.
Phase 1: Vulnerability Assessment	Targeted Interviews	February 2026	Three (3) Key Stakeholders	One-on-one interviews to identify local climate events, specific vulnerabilities and potential adaptation measures.
	Vulnerability Assessment Workshop	January 27, 2026	Climate Change Steering Committee	A virtual technical session to evaluate climate impacts on infrastructure using New Brunswick's Guideline for Climate Change Adaptation Planning.
	Community Survey	February 1- 28, 2026	Online	Shared initial findings and gathered valuable local knowledge on climate impacts from residents.
Phase 2: Adaptation Planning	Climate Adaptation Workshop	February 12, 2026	Climate Change Steering Committee	An in-person workshop to review, validate and refine the draft adaptation strategies and implementation plan.
Reporting and Presentation to Council	Council Presentation	Scheduled for April 14, 2026	District of Carleton North Council	Presentation of final findings to facilitate the formal adoption and implementation of the CCAP.



2.0 VULNERABILITY ASSESSMENT

As previously described, the approach to the vulnerability assessment phase involved a background review to develop an infrastructure component listing and the compilation of relevant climate data. This phase was driven by consultation with subject matter experts and project stakeholders to assess the specific vulnerabilities of the District of Carleton North's infrastructure and services. The assessment is conducted using two distinct methods:

- **Infrastructure and Service Assessment:** Focuses on the interactions between DCN infrastructure or services and projected climate hazards such as high temperatures, high wind gusts and heavy precipitation.
- **Spatial Assessment:** Focuses on the interactions between DCN infrastructure and specific flood hazards, particularly along the Saint John River (Wolastoq) and catchment areas.

The methodology for these assessments is designed to be easy to understand for non-technical individuals and aligns with New Brunswick's Guideline for Climate Change Adaptation Planning. The methodology employed for each assessment is expanded upon in [Section 2.1](#) and [2.2](#).

2.1 Infrastructure and Service Assessment Methodology

The methodology used for this assessment is in alignment with the Public Infrastructure Engineering Vulnerability Committee (PIEVC) High Level Screening Procedure (ICLR, 2016) and the International Standards Organisation (ISO) 31000:2018 Risk Management Guidelines and the risk management process described within. The process required executing four key steps to complete the vulnerability assessment of DCN infrastructure which:

- Identified potential **risk interactions** between infrastructure components and climate hazards;
- Calculated the **likelihood of occurrence** for climate hazards using current climate data and future climate projections;
- Determined the **severity of an impact** of each feasible interaction between a climate hazard and an infrastructure component; and
- Calculated the risk score corresponding to defined risk levels (i.e. negligible, low, moderate, or high) by multiplying the probability of occurrence with the severity of the impact.



The calculation of the interaction risk score is based on the following fundamental equation:

Risk = Probability x Severity

Where:

- **Probability** is the statistical frequency/probability of specific climate hazard thresholds being reached historically and in the future; and
- **Severity** is a measurement of the climate hazard’s consequence of impact on a particular asset, should that hazard occur.

2.1.1 Identifying Risk Interactions

Possible risk interactions between the studied climate hazards and the District of Carleton North’s infrastructure were identified and recorded using an interaction matrix. The interaction matrix was then further expanded through the formation of vulnerability statements which provided initial general descriptions of the expected impacts as a result of the risk interaction. For example, one initially identified interaction was between asphalt roadways and high temperatures and the corresponding vulnerability statement for this interaction identified a concern regarding the rutting from the softening and deterioration of asphalt surfaces due to heat stress. The matrix and vulnerability statements were then distilled during the Internal Vulnerability Assessment Workshop and then confirmed at the District of Carleton North Focus Group Climate Change Vulnerability Assessment Confirmation (January 27, 2026). The completed interaction matrix for this assessment is provided in **Appendix D – Vulnerability Interaction Matrices**.

2.1.2 Likelihood of Occurrence

For the purposes of this project, the probability scores spanned a scale of 0 to 7, with 0 considered to be of the lowest probability (Negligible or Not Applicable) and 7 being the highest probability (Often; Highly Probable). The probability scoring criteria was tailored for the project by Dillon and was informed by criteria successfully applied on similar assessments and adapted from ISO 31000’s Risk Management Guidance. To assign a probability score, the historical and future occurrence probability values were obtained from the climate data sources for each climate hazard (**Section 1.4**). Historical climate data was assigned a score from 0-7 based on professional judgement using the criteria outlined in **Table 5**, below. Historical climate data was assigned a score of “Occasional” (3) or “Moderate; Possible; Normal” (4). Assigning a future probability score for each climate hazard required a simple calculation to relate the future projection back to the historical climate value. The calculation required taking the average future climate projection value (average occurrences per year), dividing it by the historical climate hazard value and multiplying by 0.5, which is the median probability value for “Moderate; Possible; Normal” score.

Table 5: Likelihood of Occurrence

Likelihood Score	Descriptor	Probability of event occurring in a year (%)
0	Negligible/Not Applicable	>0 to 0.01
1	Highly Unlikely/Improbable	0.01 to 0.05
2	Remotely Possible	0.05 to 0.1
3	Occasional	0.1 to 0.25
4	Moderate/Possible/Normal	0.25 to 0.75
5	Likely/Frequent	0.75 to 1.25
6	Probable	1.25 to 2
7	Often/Highly Probable	>2



2.1.3 Severity of Impacts

The severity of climate change impacts was assessed during the internal vulnerability assessment workshop. The workshop participants discussed the potential consequences of the event, which in turn helped provide a rationale for the scores assigned. Professional assessment and judgement informed the determination of which severity rating category applied for each consequence and accordingly, its corresponding Severity Score.

Table 6 and **Table 7** display the scales used to score the severity of the interactions for asset impacts. Assigning severity scores was based on two criteria:

- **Asset impacts** which focused on the physical impacts to the infrastructure components; and
- **Service impacts** which focused on the impacts to each component's capacity to provide specific functions, services and operations.

Table 6: Severity of Climate Hazard Asset Impacts

Severity Scale	Descriptor	Severity Ratings
0	No effect	Negligible; Not applicable
1	Measurable	Very low, Superficial damage
2	Minor	Low, Minor repairs required, Increased maintenance
3	Moderate	Moderate, Repairs required, No impact on budget, Increased maintenance
4	Major	Some loss of function, Major repairs required, Some budget impacts
5	Serious	Loss of function, Significant impact on budget but can be repaired
6	Hazardous	Loss of asset, Partial asset loss, Major capital intervention required
7	Catastrophic	Complete loss of asset requiring full replacement

Table 7: Severity of Climate Hazard Service Impacts

Severity Scale	Descriptor	Public and Employee Safety	Environmental	Economical/Financial
0	No Effect	No impact or recordable event.	No detectable change to the environment.	No financial impact.
1	Measurable	Near miss; documented but no injuries.	Short-term, localized impact; stays onsite.	Trace costs; easily absorbed in daily budget.
2	Minor	Localized reputation impact; loss of confidence.	Small scale (< 1 month); minimal offsite impact.	Minor maintenance and repairs required.
3	Moderate	Public inconvenience and temporary displacement.	Repairable impact; duration up to 1 year.	Significant maintenance and repairs required.
4	Major	Significant displacement; loss of livelihood.	Extended range; regeneration takes up to 10 years.	Significant capital costs to restore infrastructure.
5	Serious	Health and safety risks for staff/ public; medical treatment.	Long-term severe impact; range extends beyond site.	Financial impact on proponents and stakeholders.
6	Hazardous	Severe health risks; potential for life-altering injury.	Severe irreparable impact over extended range.	Partial asset loss; major capital intervention required.
7	Catastrophic	Life-threatening safety risks; multiple fatalities.	Permanent, widespread environmental destruction.	Complete loss of asset(s) requiring full replacement.



2.1.3.1 Interaction Risk Score

Following principles of ISO 3100:2018, probability and severity scores were plotted on a risk matrix. The Risk Matrix is a standard tool for considering probability and impact severity to assess risk for a given hazard. Each risk level is associated with a different colour and warrants different responses. **Figure 1**, below, shows the risk tolerance thresholds used in evaluating the risk score for this vulnerability assessment.

Figure 1: Risk Scoring Criteria

Likelihood	7	0	7	14	21	28	35	42	49
	6	0	6	12	18	24	30	36	42
	5	0	5	10	15	20	25	30	35
	4	0	4	8	12	16	20	24	28
	3	0	3	6	9	12	15	18	21
	2	0	2	4	6	8	10	12	14
	1	0	1	2	3	4	5	6	7
		0	1	2	3	4	5	6	7
		Severity							

Risk Score	Definition
High Risk	Immediate action required
Moderate Risk	Action may be required; manage by continuous improvement
Low Risk	Manage with existing measures
Negligible Risk	Neutral or positive impact

A negligible score (i.e., green square in the matrix above) signifies a negligible risk event that does not require further consideration. A low score (i.e., yellow square) signifies a low risk where existing measures are sufficient to manage the risks, but continuous monitoring should be a consideration. A moderate score (i.e., orange square) signifies a moderate risk where action may be required, or risks may be managed by continuous improvement. A high score (i.e., red square) signifies a high or unacceptable risk where high priority or immediate action is required. The results of the risk scoring process are discussed further in **Section 2.3**.

2.2 Spatial Assessment Methodology

Flooding is among the most serious natural hazards facing New Brunswick today. Inland flooding is a type of flood event caused by heavy rainfall or a combination of rainfall and snowmelt. Flood risks are especially high during the spring, when contributions from melt of the winter snow and ice pack create peak runoff conditions that exceed local drainage capacities.

To assess flood risks, the Dillon team conducted a spatial assessment to visually determine which regions of District of Carleton North are vulnerable to flooding under two (2) flooding scenarios:

1. The present day 1-in-100-year flood event; and
2. 2100 1-in-100-year flood event (with climate change).



For the present day and 2100 scenario, Dillon utilized the latest flood maps published by the Government of New Brunswick to inform this assessment. Assets that are found to be within flood limits are considered to be vulnerable. The spatial assessment was completed qualitatively through the review of flood extents using a DCN map and component listing. Assets from **Table 2** were located on the map and assigned a risk level of either high, moderate, or low depending on their proximity to the flood extents:

3. Inside the flood zone, it is deemed a **high risk**;
4. Close to the flood zone, it is deemed a **moderate risk**; and
5. Outside the flood zone, it is deemed **low risk**.

Additionally, assets identified through community interviews and workshops as having experienced historical flooding were noted as "at-risk," even if they fell outside the formally identified flood extents. The maps showing flood extents are shown in **Appendix B**.

2.3 Vulnerability Assessment Results

Following the confirmation of infrastructure and climate hazard interactions, a preliminary list of vulnerability statements was developed to describe the interactions. Based on the results of the infrastructure and service assessment and spatial assessments, a total of **twenty-six (26) moderate risk** projected asset interactions, **thirty-five (35) moderate risk** projected service interactions, and **seven (7) "at-risk"** projected flooding interactions were identified. The high and moderate risks are presented in **Section 2.3.1** and **2.3.2** below.

To validate the pre-identified vulnerabilities, Dillon hosted a confirmation workshop with the technical focus group, followed by three (3) targeted interviews with DCN stakeholders. These engagement sessions gathered critical local input to help pinpoint specific climate change vulnerabilities within DCN. A "What We Heard" memorandum summarizing the workshops' findings can be found in **Appendix E – "What We Heard" Memorandum**. The stakeholders interviewed are listed in **Table 8** below:

Table 8: Interviewees

Name	Date	Role
Conor Tripp	February 9, 2026	Planning Director, Western Valley Regional Service Commission
Fred Thompson-Brown	February 9, 2026	Director of Environmental Health & Public Safety, Western Valley Regional Service Commission
Andrew Cogle	February 9, 2026	Florenceville-Bristol Fire Department, Fire Chief

Interviews were tailored to the participants' respective areas of expertise to maximize the value of the input gathered. The interviews included questions directed towards the identification of past climate change impacts to specific infrastructure assets that Dillon identified during the background review process. Participants were also asked about any adaptation measures that have been considered or implemented in the past to protect DCN infrastructure.

2.3.1 Infrastructure and Service Assessment Results

In **Table 9** below, yellow-shaded cells signify low risks and orange-shaded cells signify moderate risks. No high risks were identified as part of this infrastructure assessment. Please refer to **Appendix D** for a complete list of all infrastructure assessment risks.



Table 9: Infrastructure and Service Assessment Results

Infrastructure	Hazard	Vulnerability	Infrastructure		Service	
			Current Risk	Future Risk	Current Risk	Future Risk
Transportation Assets						
Asphalt Roadways and Parking Lots	High Temperature	Premature deterioration of asphalt surfaces (softening) leading to increased maintenance.	6	14	0	0
	Freezing Rain	Slippery road conditions- safety issues and strain on operations and maintenance staff.	0	0	8	16
Gravel Roadways and Parking Lots	Freezing Rain	Slippery road conditions- safety issues and strain on operations and maintenance staff.	0	0	8	16
Asphalt and Concrete Sidewalks	Freezing Rain	Slippery Conditions- safety issues and strain on operations and maintenance staff. Could lead to increased legal fees due to increased slips/trips/falls claims.	0	0	10	20
Bridges	High Temperature	Expansion joints reaching max capacity; thermal stress on bearings.	6	14	0	0
	Heavy Precipitation	Increased "scour" around piers; increased water levels (significant damage or washout); debris accumulation at water level.	24	30	4	5
	Freezing Rain	Increased load on structure due to ice accumulation on structure. Slippery road conditions- safety issues and strain on operations and maintenance staff.	6	12	8	16
	High Wind Gusts	Structural vibration; closure of long-span bridges to high-profile traffic.	18	24	0	0
Water, Wastewater, Stormwater Assets						
U/G Sanitary Sewers	Heavy Precipitation	Inflow and Infiltration (I&I) causing surcharging and backups.	0	0	12	15
Wastewater Treatment Lagoon	High Temperature	Algae bloom, reduced dissolved oxygen, increased odours, risk to environmental compliance.	6	14	0	0
	Heavy Precipitation	Risk of overtopping, erosion of berms, increased odours.	12	15	4	5
Watermains	Low Temperature	Frost penetration leads to main breaks; significant repair costs. Potentially leading to break or boil water advisory.	16	4	16	4
	Freeze-Thaw Cycles	High frequency of breaks due to "frost loading" and shifting soil. Potentially leading to break or boil water advisory.	16	16	16	16
Steel Water Reservoir	High Temperature	Increased water demand leading to rapid drawdown; potential for water quality issues (e.g., bacterial growth) if tank temperatures rise significantly.	0	0	6	14
	Low Temperature	Risk of ice formation within the tank or freezing of inlet/outlet pipes, leading to a total loss of water supply to DCN.	20	5	12	3



Infrastructure	Hazard	Vulnerability	Infrastructure		Service	
			Current Risk	Future Risk	Current Risk	Future Risk
Private and Public Groundwater Wells	High Temperature	Increased pumping rates; Dropping water tables due to high demand/low recharge; water shortage.	15	35	15	35
	Low Temperature	Risk of frozen wellheads or surface piping if not properly housed.	16	4	0	0
	Heavy Precipitation	Surface runoff contamination risks; potential for turbidity spikes; If GUDI, turbidity increases or runoff leading to contamination to water supply.	8	10	20	25
	Drought Conditions	Aquifer depletion; pump burnout; complete loss of water source.	10	15	10	15
Culverts and Drainage ditches	Heavy Precipitation	Increased "scour" around culvert; increased water levels (significant damage or washout). Blockages from debris leading to overtopping and road damage.	24	30	0	0
Fire Supply/Water Hydrants	Low Temperature	Risk of hydrants freezing if not drained, higher difficulty operating nuts on hydrant.	16	4	12	3
	Drought Conditions	Potentially unusable if supply is restricted.	0	0	10	15
Community Structures – Building Components						
Foundation/Structure	High Temperature	Soil shrinkage (especially in clay) causing settlement or cracks.	6	14	-	-
	Heavy Precipitation	Hydrostatic pressure causing seepage or basement flooding.	12	15	-	-
Roof (shingles)	High Temperature	Accelerated UV degradation and "blistering"; shortened lifespan.	6	14	-	-
Roof (flat)	High Temperature	High temperatures causing premature cracking and blistering of rubber sealant/ covering.	6	14	-	-
	Freezing Rain	Ice formation in drainage systems causing ponding and potential leaks indoors.	8	16	-	-
Mechanical/Electrical	High Temperature	Heavy HVAC use leading to premature motor failure or outages.	9	21	-	-
Community Structures – Building Services						
Emergency and Public Safety (Fire, Police, etc.)	Heavy Precipitation	Heavy rainfall obstructing access routes and delaying transit; surge in emergency calls regarding rising water levels and rain-related hazards.	-	-	20	25
	Freezing Rain	Loss of power to dispatch and communication systems; road blockages from downed trees/lines preventing emergency access.	-	-	10	20
	High Wind Gusts	Loss of power to dispatch and communication systems; road blockages from downed trees/lines preventing emergency access.	-	-	15	20
	Drought Conditions	Reduced water availability/pressure for firefighting; significantly increased risk of wildfires in vegetated or rural areas.	-	-	10	15



Infrastructure	Hazard	Vulnerability	Infrastructure		Service	
			Current Risk	Future Risk	Current Risk	Future Risk
Healthcare and Wellness (Hospitals, Urgent Care, LTC/Nursing Homes, etc.)	High Temperature	Surge in patient admissions for heatstroke and dehydration; critical health risks to elderly residents if HVAC systems fail.	-	-	15	35
	Heavy Precipitation	Potential for basement flooding affecting laundry, food service, or mechanical systems; staff shortages due to commute disruptions.			12	15
	Freezing Rain	Dependence on backup generators for life-saving equipment; potential loss of temperature-controlled medical supplies.	-	-	8	16
	High Wind Gusts	Dependence on backup generators for life-saving equipment; potential loss of temperature-controlled medical supplies.	-	-	12	16
Education (Schools, Libraries, etc.)	High Temperature	Closure of schools, daycares or libraries without modern A/C; cancellation of outdoor youth sports and recreation programs.	-	-	6	14
Administration	High Temperature	Increased demand on social centers to serve as "Cooling Centers" for the public; reduced staff productivity in older buildings.	-	-	6	14
Social and Support (Shelters, Food Banks, etc.)	High Temperature	Increased demand on social centers to serve as "Cooling Centers" for the public; reduced staff productivity in older buildings.	-	-	6	14
	Low Temperature	Critical surge in demand for warming centers and social support services during extreme cold events.	-	-	20	5
	Freezing Rain	Loss of power- unable to provide services to the public.	-	-	8	16
	High Wind Gusts	Loss of power- unable to provide services to the public.	-	-	12	16
Utility and Infrastructure	Freezing Rain	Direct damage to overhead lines and poles leading to widespread, multi-day outages for residents and businesses.	-	-	10	20
	High Wind Gusts	Direct damage to overhead lines and poles leading to widespread, multi-day outages for residents and businesses.	-	-	12	16
Parks and Recreational Elements						
Forested and Vegetated Area	High Wind Gusts	High wind can lead to uprooted trees or damaged branches- increase in costs/labour to maintain the trees and trails.	6	12	12	16
Rivers/Watercourses	High Temperature	Reduced oxygen (invasive species, algae blooms); potential fish kills.	9	21	0	0
	Heavy Precipitation	Rapid rise in water levels; bank erosion; loss of habitat.	12	15	0	0



Infrastructure	Hazard	Vulnerability	Infrastructure		Service	
			Current Risk	Future Risk	Current Risk	Future Risk
Additional Elements						
Farmland	High Temperature	Crop heat stress; reduced yields; increased irrigation demand. Changes in temperatures causing changes in growing seasons, could impact hobby farms as residents move towards increasing food security.	12	28	6	14
	Heavy Precipitation	Soil erosion; nutrient runoff; localized crop drowning/standing water; Heavy rainfall causing runoff leading to contamination. Private wells (if GUDI) could be compromised in the area.	12	15	16	20
	Drought Conditions	Total crop failure; soil erosion; significant revenue losses.	10	15	8	12
Power/Utility/ Communication Cables	High Temperature	Line sagging due to heat; reduced efficiency/transmission capacity; higher A/C loads during high temperatures leading to large scale outages/ brown outs.	15	35	15	35
	Low Temperature	Higher heating loads (baseboard heaters) during low temperatures could lead to brown outs.	20	5	20	5
	Freezing Rain	Ice accretion on utility lines causing damage or total failure- loss of service.	10	20	12	24
	High Wind Gusts	Line failure due to fallen trees or pole snapping; widespread outages.	15	20	18	24
SCADA	High Temperature	Makes voltage drop on lines to equipment, which affects efficiency/ power usage. Long durations would lead to motor burn outs or device failures and increased maintenance needs. Lag in I/O's not switching quick enough and showing it as a fault for maintenance.	12	28	3	7
	Low Temperature	Higher heating loads during low temperatures could lead to outages and increased maintenance needs.	16	4	4	1
	Freeze-Thaw Cycles	Ground heave shears conduits and service feeders at building entries, causing total power failure. Leads to critical service outages and safety risks; repair requires major capital excavation. (High risk at frost-susceptible entry points).	12	12	24	24
	Freezing Rain	Line snapping due to heavy wet snow accumulation/ice loading.	8	16	0	0
Fleet and Equipment	Heavy Precipitation	Reduced visibility and hydroplaning risks; fleet unable to access areas with significant road washouts.	0	0	16	20
	Freezing Rain	Slippery road conditions- safety issues and strain on operations and maintenance staff.	0	0	10	20

Note:

¹Drought risks are evaluated based on the following metrics: Number of heatwaves, average length of heatwaves and the number of periods with more than 5 consecutive dry days.



2.3.2 Spatial Assessment Results

The qualitative spatial assessment aimed to categorize DCN assets into high-, moderate-, or low-risk based on their proximity to flood-prone areas, with moderate and high-risk classifications prioritized for immediate adaptation planning. Detailed results are documented in the section below and **Appendix B**. Notably, while DCN assets do not appear within provincial predictive flood risk mapping, some are located within areas known to have flooded historically. Because provincial mapping did not capture these historical events, risk profiles for these assets were derived exclusively from background documents, targeted interviews and internal vulnerability workshops and categorized as “at-risk”.

Furthermore, stakeholders noted a significant data gap along the Saint John (Wolastoq) River between Bath and Bristol, where flood mapping is currently missing.

2.3.2.1 Critical Infrastructure & Asset Risks

The assessment highlights that flooding poses a threat to connectivity within the DCN, particularly concerning access roads and bridges that serve as vital lifelines for emergency services and evacuation routes.

As mentioned in community interviews, the potential loss of access to the Florenceville Bridge (Highway 130) is a critical concern, as it serves as a primary link across the Saint John River (Wolastoq). This vulnerability is further exacerbated by stakeholder concerns regarding significant bank erosion in the Florenceville and Bristol areas, as well as known data gaps in provincial flood mapping between Bath and Bristol. These qualitative observations from the community highlight the high priority of these locations for future monitoring and study. Additional “at-risk” assets identified during the workshops are listed below.

- **Structures:** Home Hardware (9079 Main Street, Florenceville);
- **Water, Wastewater:** Bristol Lagoon, Florenceville Lagoon; and
- **Transportation:** Main Street, Tapley Road (during spring high water), Juniper Road, and Route 105.

2.3.3 Transportation Assets

Transportation elements, such as roadways, parking lots and bridges facilitate the essential connectivity and mobility of DCN. These assets face a diverse range of anticipated climate hazards, including temperature extremes (high and low), high wind gusts, heavy precipitation, freezing rain and freeze-thaw cycles. However, it is important to note that many of these critical transportation assets, including primary north and south routes, fall under the jurisdiction of the provincial Department of Transportation and Infrastructure (NBDTI). As a result, they are largely beyond the direct operational scope of the District of Carleton North. This presents a risk, as the District of Carleton North’s climate resilience is heavily dependent on proactive maintenance and consistent communication from provincial authorities.

The assessment identified that critical assets are vulnerable to riverine and overland flooding. Specific assets at risk include:

- Main Street;
- Tapley Road;
- Juniper Road; and
- Route 105.

This vulnerability poses a significant challenge to residents and business owners, as localized flooding threatens essential access. Crucially, these disruptions compromise emergency response capabilities, as the road network is vital for service delivery throughout DCN.

Beyond surface inundation, heavy precipitation poses a persistent threat to structural integrity, specifically through increased “scour” around bridge piers and debris accumulation. Stakeholder interviews highlighted that in



certain bad windstorms, communities can be cut off for 24 hours due to fallen trees blocking routes. Furthermore, as mentioned in community interviews, the potential loss of access to the Florenceville Bridge (Highway 130) is a critical concern, as it serves as a primary link across the Saint John River (Wolastoq).

The assessment also highlighted a critical disconnect between road maintenance and emergency response; while the north-south routes are fairly robust, the east-west routes and primary roads running adjacent to the Saint John River (Wolastoq) are susceptible to heavy precipitation events. This can result in delayed medical responses, where residents may be cut off with no escape route.

Freeze-thaw cycles negatively impact roadway and bridge components, causing frost heaves and surface cracking. Repetitive heaving and settling causes premature deterioration, leading to increased maintenance costs. Residents noted that heavy trucks, primarily from logging and industrial operations, damage DCN roads during these cycles, causing major potholes and cracks.

2.3.4 Emergency Connectivity and Evacuation

The road network's design should account for both natural barriers, such as the Saint John River (Wolastoq) and human-made barriers like rail lines, which can become impassable during extreme weather. Because key roads are anticipated to be affected by flooding, the potential for a total loss of connectivity necessitates robust emergency management. Ensuring that emergency vehicles maintain a clear path through DCN is essential to mitigate the risks associated with road washouts or structural bridge failures.

Reported vulnerabilities in the utility and telecommunication networks of District of Carleton North represent a significant threat to public safety. Frequent NB Power outages, poor cellular service and the "dead zone" nature of the region can result in a loss of emergency connectivity. While the Fire Department utilizes the TMR (Trunked Mobile Radio) system, these infrastructure gaps reduce the ability of DCN to receive timely alerts through systems like Voyant Alert if residents lack cell or landline access. Redundant communication is critical, as residents could remain isolated during washouts or flooding.

2.3.5 Water, Wastewater and Stormwater Assets

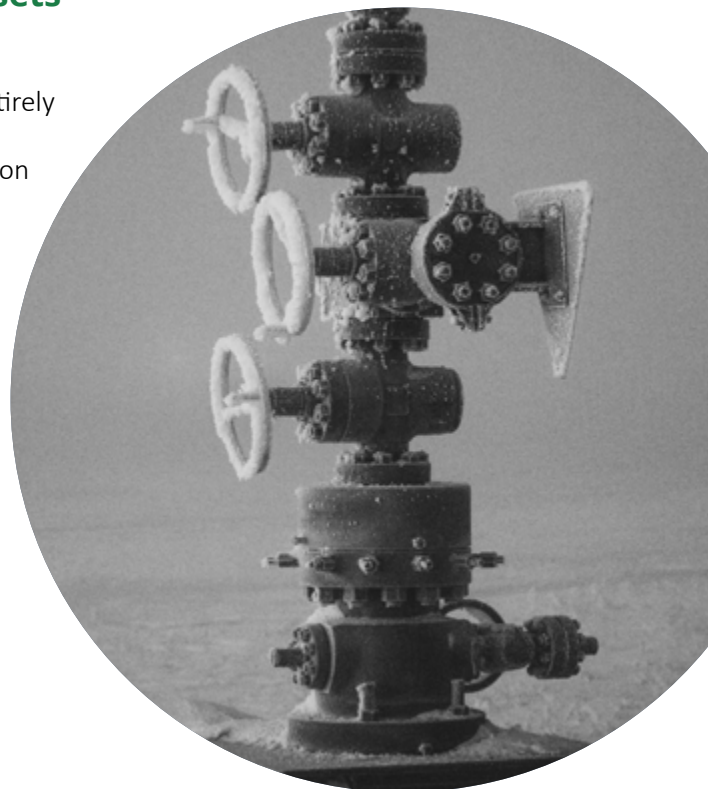
2.3.5.1 Water

Water infrastructure within the District of Carleton North relies entirely on water supply wells. The vulnerability of well water quality to flooding has been identified as a high-risk interaction. Contamination can occur if flood elevations breach wellheads or, in case of wells under direct influence of groundwater (GUDI), heavy rainfall carrying contaminants can impact well water quality.

Drought and water supply reliability constitute another high-risk area. High temperatures drive increased water usage, leading to dropping water tables and wells going dry, which has already been reported to have occurred in Bristol. Drought poses a secondary threat by reducing the available water for fire hydrants, necessitating proactive investigation into new water sources.

2.3.5.2 Wastewater

The wastewater treatment systems components assessed as part of this study included the wastewater treatment lagoons (within Centreville, Bath, Florenceville and Bristol), lift stations and





the underground collection system and piping within DCN. The Bristol and Florenceville Lagoons are explicitly classified as an at-risk asset, as they have experienced historical flooding. High water levels and ice jams remain a threat to shoreline integrity near this asset.

Specific operational vulnerabilities include lift stations that currently lack backup generators, posing a risk of overflow during the widespread power outages associated with severe storms. Wastewater underground piping is also vulnerable to freeze-thaw cycles, where repetitive heaving and settling place stress on the collection system, exacerbating inflow and infiltration concerns. Additionally, warmer summers may trigger algae blooms and reduce dissolved oxygen in lagoons, however there are currently no reported operational issues of this kind.

2.3.5.3 Stormwater

Stormwater management system components, comprising culverts, storm sewers and open ditching, were assessed and found to be highly vulnerable to flooding, heavy precipitation, freeze-thaw cycles and ice jams. Generally, inundation from spring freshets and ice jams poses a physical threat, causing material displacement that reduces the structural integrity of these systems.

Heavy rainfall events frequently result in existing drainage infrastructure exceeding capacity. Stakeholders noted that many municipal roads lack proper ditching and culverts were historically designed solely for water conveyance and are now undersized for the debris and sediment loads as well as increased flow associated with modern high-intensity rainfall. This limitation leads to blockages, overtopping and significant road damage. Specific areas of concern identified include Tapley Road, Juniper Road and roads adjacent to the Saint John River (Wolastoq).

Furthermore, freeze-thaw cycles interact detrimentally with stormwater structures. The repetitive heaving of saturated soil can cause culvert misalignment, cracking and joint separation accelerating infrastructure failure.

2.3.6 Community Structures – Building Components

Risk scores for building components are increasing due to rising temperatures and freezing rain. High temperatures are projected to increase settlement and cracking in foundations due to soil shrinkage. Roofing systems face accelerated UV degradation and "blistering," shortening their operational lifespan.

Mechanical and Electrical systems face a failure risk projected to more than double. Extreme heat places heavy strain on HVAC units, while freezing rain threatens flat roofs by causing ice buildup in drainage systems, leading to indoor leaks.

2.3.7 Community Structures – Building Services

The spatial assessment and stakeholder feedback identified that critical hubs currently lack sufficient backup power. Recommendations include installing generators for the R.G. "Bun" Veysey Active Living Centre, Western Valley Multiplex and Town Hall.

Risks for Emergency and Public Safety services from freezing rain and high winds are expected to double, endangering dispatch systems and blocking access via downed lines. Communication failures are a top disruptive risk, compounded by cellular unreliability and the dependence of seniors on medical alert systems. Furthermore, the Bath Hospital—which is opening a new dementia facility—is a priority for resilience upgrades.

2.3.8 Parks and Recreational Elements

Forested and vegetated areas face increased costs and labor due to uprooted trees and damaged trails from high wind gusts. Rivers and watercourses are vulnerable to high temperatures, which can cause reduced oxygen and algae blooms, while heavy precipitation leads to rapid rises in water levels and bank erosion.



2.3.9 Additional Elements

The risks associated with utilities, agriculture, recreational areas, commercial forestry, forested areas and riverine infrastructure are undergoing a significant transition, where historical cold-weather vulnerabilities are being replaced by escalating threats from extreme heat, ice build-up and moisture-driven structural failure.

2.3.9.1 Farmland

Farmland faces heightened thermal stress, threatening reduced yields and animal health. Agriculture also faces risks from soil erosion and nutrient runoff during heavy precipitation. Local stakeholders noted that droughts and floods have already diminished livestock feed yields.

2.3.9.2 Power, Utilities & Communications

High temperatures are set to become a primary risk; heat-induced line sagging and surging cooling demands increase the likelihood of brownouts. Freezing rain risks are projected to double, while high wind gusts pose an increasing threat to poles and lines from falling trees. Outages caused by falling trees remain a critical regional issue that could be mitigated through enhanced vegetation management.

2.3.9.3 SCADA

DCN's SCADA systems are increasingly vulnerable to climate-driven electrical and physical stressors. These systems are vital for remote monitoring of water and wastewater assets and their failure during an emergency may require manual operations or could lead to assets failing.

2.3.9.4 Fleet and Equipment

The operational reliability of DCN's fleet and maintenance equipment is critical for emergency response and infrastructure repair, yet these assets face significant mobility and safety challenges during extreme weather.

Intense rainfall and localized washouts can prevent the fleet from accessing areas with significant road damage, particularly in rural or low-lying zones. These challenges are compounded during "ice days" and freezing rain, which create treacherous road conditions that place a high strain on operations and maintenance staff. Residents have noted that unmaintained secondary roads frequently become impassable during these events, further restricting the movement of essential vehicles.



Beyond weather-driven mobility issues, the fleet's integrity is threatened by the condition of the road network itself. While the Province's Winter Weight Program and vehicle load restrictions are intended to protect infrastructure, residents reported that heavy industrial trucks, such as those used in logging, often run overweight. This damages town roads and creates massive potholes that can lead to premature wear and damage for both the municipal fleet and private vehicles.

Logistically, fire departments face specific hurdles during drought conditions; as flowing streams and the Saint John River (Wolastoq) run low, fire engines with limited water capacity must travel significantly further to resupply at accessible stations like McCains or Metal Fab. Furthermore, steering committee feedback highlighted that DCN currently shares street-sweeping infrastructure with the Town of Woodstock, emphasizing a reliance on regional cooperation for basic fleet services.

2.3.10 Risk Prioritization Summary

The vulnerability statements from both assessments were then carried over into the Adaptation Planning phase (**Section 3.0**) where adaptation and preventative measures were developed for each high and moderate-risk climate hazard and infrastructure interaction.

In total, the following prioritized risks were carried over into the adaptation planning phase:

- **Seven (7)** "at-risk" projected flooding interactions;
- **Twenty-six (26)** moderate-risk projected asset interactions; and
- **Thirty-five (35)** moderate-risk projected service interactions.

The risks identified are discussed in greater detail in the sections that follow.



3.0 ADAPTATION PLANNING

3.1 Adaptation Planning Methodology

Potential adaptation options for **high-** and **moderate-risk** interactions identified during the vulnerability assessment were discussed and developed at the vulnerability confirmation and adaptation planning workshops.

Adaptation options in the context of this report are characterized primarily by the physical adaptation of infrastructure through repairing, rebuilding, relocating, retrofitting actions or through changes to policy, direction and the goals of DCN to better mitigate the impacts of climate change. Adaptation options were divided into two categories:

- **Adaptation measures** – representing physical adaptations where infrastructure is modified, upgraded, or constructed to mitigate a climate-related vulnerability; and
- **Preventative measures** – representing policy-based adaptations where procedures, policies or plans are reviewed, updated, or created.

To ensure these measures are enforceable, the District of Carleton North can utilize its recently adopted land use by-law as the primary vehicles for preventative action. While the CCAP identifies vulnerabilities, the Municipal Plan and Zoning By-law provide the legislative framework to enforce adaptation strategies through formal land-use regulations. By integrating CCAP data into these by-laws, DCN can effectively mandate that new developments avoid high-risk areas, ensuring that DCN's growth is aligned with long-term climate resilience.

The high and moderate-risk interactions were classified by climate hazard of concern. Participants then identified and discussed potential adaptation measures to help mitigate impacts associated with the climate hazards of concern.

The proposed adaptation options are presented in **Table 10**, below. The recommendations listed in the table address the moderate risks identified throughout the vulnerability assessment and are a culmination of strategies that have been assessed and confirmed by DCN stakeholders. Ongoing review and update of this ranked list is recommended as this CCAP moves forward in time. The ongoing review and update permits integration of new information into adaptation planning, including observations on how effective adaptation measures are after their initial implementation. Furthermore, it is recommended that the implementation of adaptation measures involve community members, community-led groups, and non-governmental organizations as much as possible to promote community buy-in and the long-term success of the developed options.



3.2 Adaptations

A finalized list of adaptation measures, highlighting both physical infrastructure (Adaptation) and policy-driven initiatives (Preventative), is summarized in **Table 10**, below. These measures are categorized by the climate hazard they address, with associated estimated timelines and resource requirements included. To provide a consistent framework for implementation, the following criteria are used to define the project scope:

- **Timeline:** Indicates the anticipated window for initiation and completion:
 - ♦ **Ongoing:** Continuous or recurring actions (e.g., annual maintenance);
 - ♦ **Short-term:** Within 1–2 years;
 - ♦ **Mid-term:** Within 3–5 years; and
 - ♦ **Long-term:** 5+ years or dependent on major capital funding.
- **Level of Effort:** Represents the relative intensity of resources required, including staff time, specialized expertise and budget:
 - ♦ **Low:** Can be managed within existing operational budgets and staff schedules;
 - ♦ **Moderate:** Requires dedicated project planning, internal coordination, or modest external funding; and
 - ♦ **High:** Requires significant capital investment, inter-departmental cooperation, or complex provincial advocacy.

The complete, detailed matrix of all identified measures, including a comprehensive description of each adaptation option, can be found in **Appendix F – District of Carleton North’s Adaptation Measures**. Potential funding opportunities for the measures have been identified in **Section 4.0**.





Table 10: Adaptation (Physical) and Preventative (Policy) Measures for Moderate Risks

No.	Adaptation Options	Adaptation Type	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
High Temperatures/Drought Conditions								
1	Pavement Material Upgrades	Physical	High Temperature Asphalt Roadways/ Parking Lots	Moderate	NBDTI	District of Carleton North, Engineering Consultants	Ongoing	Low
2	Construction QA/QC	Policy/Planning			NBDTI	District of Carleton North, Engineering Consultants	Ongoing	Low
3	Road Inspection & Maintenance Plan	Policy/Planning			NBDTI	District of Carleton North	Ongoing	Low
4	Bridge Inspection & Maintenance Plan	Policy/Planning	High Temperatures Bridges	Moderate	NBDTI	District of Carleton North, Engineering Consultants	Ongoing	Moderate
5	Bridge Condition Assessment	Policy/Planning		Moderate	NBDTI	District of Carleton North, Engineering Consultants	Ongoing	Moderate
6	Inspection & Maintenance Plan	Policy/Planning	High Temperature Wastewater Lagoon	Moderate	District of Carleton North	Engineering Consultants	Short-term	Moderate
7	Operational Repairs	Physical		Moderate	District of Carleton North	Engineering Consultants	Midterm	High
8	Groundwater Management	Policy/Planning	High Temperature/ Drought Conditions Groundwater Wells Fire Supply / Water Hydrants	Moderate	DELG/ District of Carleton North	Engineering Consultants, Watershed groups	Short-term	Moderate
9	Updated Emergency Action Plan (EAP)	Policy/Planning	High Temperature Community Structures (Building Components): Foundation/ Structure Roof (Shingles) Roof (Flat) Mechanical/ Electrical	Moderate	District of Carleton North	EMO, Fire Departments, DELG	Short-term	Low
10	Building Envelope Review	Policy/Planning		Moderate	District of Carleton North	Engineering Consultants	Midterm	Moderate
11	Building Inspections	Policy/Planning		Moderate	District of Carleton North	Engineering Consultants	Midterm	Moderate
12	Roof Construction Alternatives	Physical		Moderate	District of Carleton North	Engineering Consultants	Midterm	High
13	Passive Survivability Retrofits	Physical		Moderate	District of Carleton North	Engineering Consultants	Midterm	High



No.	Adaptation Options	Adaptation Type	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
14	Emergency Preparedness and Backup Power	Policy/Planning	High Temperature/ Drought Conditions Community Structures (Services): Emergency and Public Safety Education Administration Social and Support Utility and Infrastructure	Moderate	District of Carleton North	Engineering Consultants	Short-term	Moderate
15	Dry Hydrant Installation	Physical		Moderate	District of Carleton North	Fire Departments	Short-term	Moderate
16	Ecological Preservation	Physical/ Policy		Moderate	District of Carleton North	Public Works	Ongoing	Low
17	Agricultural Adaptation	Policy/Planning		Moderate	Community Members	District of Carleton North	Long-term	High
18	Agricultural Waste Solutions	Policy/Planning	High Temperature/ Drought Conditions Farmland	Moderate	District of Carleton North	Engineering Consultants	Long-term	High
19	Emergency Preparedness and Backup Power	Physical/ Policy	High Temperature Power/Utility/ Communication Cables/ Substations	Moderate	District of Carleton North	NB Power	Short-term	Moderate
20	Grid Capacity Assessment	Policy/Planning		Moderate	NB Power	District of Carleton North	Mid-term	High
21	System Integrity Monitoring	Policy/Planning	High Temperature SCADA	Moderate	District of Carleton North	Engineering Consultants, Operators	Mid-term	Moderate
Heavy Precipitation/Flooding								
1	Bridge Inspection & Maintenance Plan	Policy/Planning	Heavy Precipitation Bridges	Moderate	NBDTI	District of Carleton North, Engineering Consultants	Ongoing	Low
2	Bridge Condition Assessment	Policy/Planning			NBDTI	District of Carleton North, Engineering Consultants	Ongoing	Low
3	Flushing and CCTV Program	Physical	Heavy Precipitation U/G Sanitary Sewers U/G Storm Sewers	Moderate	District of Carleton North	Operators	Short-Term	Low
4	I&I Study	Policy/Planning			District of Carleton North	Engineering Consultants	Short-Term	Moderate



No.	Adaptation Options	Adaptation Type	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
5	Inspection & Maintenance Plan	Policy/Planning	Heavy Precipitation Wastewater Lagoon	Moderate	District of Carleton North	Engineering Consultants	Short-term	Moderate
6	Infrastructure Upgrades & Mitigation	Physical			District of Carleton North	Engineering Consultants	Midterm	High
7	Flash Flood Response Plan	Policy/Planning			District of Carleton North	Engineering Consultants, EMO, Fire Departments	Short-term	Moderate
8	Well Integrity Inspection	Policy/Planning	Heavy Precipitation Groundwater Wells	Moderate	DELG/ District of Carleton North	Engineering Consultants	Short-term	Moderate
9	Wellhead Upgrades	Physical			DELG/ District of Carleton North	Engineering Consultants	Long-term	High
10	Stormwater Management Plan	Policy/Planning	Heavy Precipitation Culverts and Ditching	Moderate	NBDTI/ District of Carleton North	Engineering Consultant	Short-term	Moderate
11	Green Infrastructure	Physical			District of Carleton North	Engineering Consultants	Long-term	Moderate
12	Drainage System Upgrades	Physical			NBDTI, District of Carleton North	District of Carleton North	Long-term	High
13	Road Raising	Physical			NBDTI, District of Carleton North	Engineering Consultants, District of Carleton North	Midterm	High
14	Inspection & Maintenance Plan	Policy/Planning			NBDTI/ District of Carleton North	Engineering Consultants	Ongoing	Low
15	Emergency Preparedness and Backup Power	Physical/Planning	Heavy Precipitation Community Structures (Services): Emergency and Public Safety Healthcare and Wellness	Moderate	District of Carleton North	NB Power, Engineering Consultant, NB EMO	Short-term	Moderate
16	Isolation Route Maintenance	Physical			NBDTI, District of Carleton North	District of Carleton North	Ongoing	Low
17	Wind-Driven Rain Assessment	Policy/Planning	Heavy Precipitation Community Structures (Building Components)	Moderate	District of Carleton North	Engineering Consultants	Long-term	Moderate
18	Shoreline Erosion Study Plan and Planting Initiatives	Physical	Heavy Precipitation Rivers/Watercourses	Moderate	District of Carleton North	St. John River Society	Midterm	Moderate
19	Agricultural Best Management	Policy/Planning	Heavy Precipitation Farmland	Moderate	District of Carleton North	Community Members, Engineering Consultants	Midterm	Moderate



No.	Adaptation Options	Adaptation Type	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
20	Emergency Preparedness and Backup Power	Policy/Planning	Heavy Precipitation Power/Utility/ Communication Cables/ Substations	Moderate	District of Carleton North	NB Power	Short-term	Moderate
21	Stormwater Management Plan	Policy/Planning	Heavy Precipitation Fleet and Equipment	Moderate	NBDTI/ District of Carleton North	Engineering Consultant	Short-term	Moderate
22	Drainage System Upgrades	Physical			NBDTI/ District of Carleton North	Engineering Consultants	Long-term	High
23	Zoning & Land-use Alignment	Policy/Planning	Heavy Precipitation Land Use Regulation	Moderate	District of Carleton North	Planning Consultants	Midterm	Low
24	Flood Plain Mapping	Policy/Planning	Heavy Precipitation	Moderate	District of Carleton North	Engineering Consultants	Short-term	Low
Low Temperatures/Freezing Rain/Freeze-Thaw Cycles								
1	Pavement Material Upgrades	Physical	Low Temperatures / Freezing Rain Asphalt Roadways and Parking Lots Gravel Roadways and Parking Lots Sidewalks Pedestrian Trails Fleet and Equipment	Moderate	NBDTI	District of Carleton North, Engineering Consultant	Ongoing	Moderate
2	Construction QA/QC	Policy/Planning			DCN/NBDTI	District of Carleton North, Engineering Consultant	Ongoing	Low
3	Road Inspection & Maintenance Plan	Policy/Planning			NBDTI	District of Carleton North	Ongoing	Low
4	Winter Maintenance	Policy/Planning			NBDTI/District of Carleton North	District of Carleton North, Public Works	Ongoing	Low
5	Bridge Inspection & Maintenance Plan	Policy/Planning	Low Temperatures/ Freezing Rain/Freeze-Thaw Cycles/ High Wind Gusts Bridges	Moderate	NBDTI/District of Carleton North	Engineering Consultants	Midterm	Moderate
6	Bridge Condition Assessment	Policy/Planning			NBDTI/District of Carleton North	Engineering Consultants, Watershed Associations	Midterm	Moderate
7	Winter Maintenance	Policy/Planning			District of Carleton North	Public Works	Ongoing	Low
8	Well System Winterization	Physical	Low Temperature Private and Public Groundwater Wells	Moderate	DELG, District of Carleton North	District of Carleton North, Engineering Consultant	Ongoing	Low



No.	Adaptation Options	Adaptation Type	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
9	Seasonal Building Maintenance	Policy/Planning	Freezing Rain Community Structures (Building Components): Roof	Moderate	District of Carleton North	Public Works	Ongoing	Low
10	Emergency Preparedness and Backup Power	Physical/Planning	Low Temperatures/ Freezing Rain/High Wind Gusts Community Structures (Services): Emergency and Public Safety Healthcare and Wellness Social and Support Utility and Infrastructure	Moderate	District of Carleton North	NB Power, Engineering Consultant, NB EMO	Short-term	Moderate
11	Remote Community Hub Generators	Physical			District of Carleton North	NB Power, Engineering Consultant	Short-term	Moderate
12	Vegetation Health Monitoring	Policy/Planning	Low Temperatures/ High Wind Gusts Parks Forested Areas	Moderate	District of Carleton North	Public Works	Ongoing	Low
13	Emergency Preparedness and Backup Power	Policy/Planning	Low Temperatures/ Freezing Rain/High Wind Gusts Power/Utility/ Communication Cables	Moderate	District of Carleton North	NB Power, NB EMO	Short-term	Moderate
14	Proactive Vegetation Management	Physical			District of Carleton North/ NBDTI	Public Works	Ongoing	Low
15	Infrastructure Security	Physical/Policy			NB Power	District of Carleton North	Mid-term	High
16	Infrastructure Upgrades	Physical	Low Temperatures/ Freeze-Thaw Cycles Sewer Mains SCADA Systems	Moderate	District of Carleton North	Engineering Consultants	Long-term	High



3.2.1 Preventative Measures Summary

Preventative measures are policy-based measures characterized by changes to policy, direction and the goals of DCN to better mitigate the impacts of climate change.

3.2.1.1 General Emergency Preparedness

DCN should prioritize an **Updated Emergency Action Plan (EAP)** to establish clear jurisdictional roles for Council and staff during declared emergencies and provide specialized responses for hazards such as flash flooding, wildfire evacuation and prolonged power outages. By maintaining an updated plan, DCN will promote a coordinated and scalable response to climate-driven disruptions that exceeds the scope of individual local service districts.

3.2.1.2 High Temperatures or Drought Conditions

High temperatures or prolonged drought conditions can increase the demand for water while simultaneously reducing water levels, potentially resulting in a shortage of potable water. To address this, **Groundwater Management** strategies should be adopted, including conducting aquifer assessments, monitoring environmental conditions and establishing formal communication protocols and groundwater study requirements for future subdivision agreements.

Beyond water management, increased heat and UV exposure can result in the premature deterioration of asphalt and bridge assets. Resilience should be addressed by implementing rigorous **Construction QA/QC** protocols and regularly scheduled **Road Inspection & Maintenance Plans** and **Bridge Inspection & Maintenance Plans** in coordination with NBDTI to identify early structural deterioration. For DCN structures, a **Building Envelope Review** and regularly scheduled **Building Inspections** should be conducted to address minor issues like settlement cracking before they escalate. Additionally, DCN should prioritize **Emergency Preparedness and Backup Power** planning to review the specific electricity needs of shelters and establish formal warming and cooling center protocols for vulnerable residents.

A **Grid Capacity Assessment** could be completed to evaluate the electrical infrastructure's ability to handle "Peak Cooling Demand" across all building types, as air conditioning loads are projected to become the primary service risk. For municipal utilities, **System Integrity Monitoring** actions should be implemented via SCADA to track effluent concentration levels and maintain regulatory compliance during high-heat events.

Finally, the municipality should develop comprehensive **Agricultural Waste Solutions** to provide disposal alternatives following the cessation of municipal farm garbage collection. Alongside agriculture waste solutions, **Ecological Preservation** strategies should be implemented to monitor vegetation health and manage the impacts of severe evaporation, such as toxic algal blooms. These efforts should include a formal communication framework with the St. John River Society to leverage their monitoring of cyanobacteria (blue-green algae), allowing DCN to provide residents with timely public warnings when toxic blooms are detected in local watercourses.

3.2.1.3 Heavy Precipitation

Several impacts related to heavy precipitation have been identified in DCN, including poor stormwater conveyance due to overwhelmed and potentially undersized culverts and ditches, localized flooding from ponding and the potential erosion of rail bed material. To address these vulnerabilities, a comprehensive **Stormwater Management Plan** is recommended to identify chronic drainage concerns, blockages and priority low-lying areas. Complementing this, a **Wetland Functional Assessment** is proposed to evaluate the capacity of nearby wetlands to assist with stormwater storage and conveyance.

For underground sanitary and storm sewers, DCN should implement a **Flushing and CCTV Program** following NASSCO standards and a formal **Inflow and Infiltration Study** to quantify extraneous water entering the system



and ensure long-term hydraulic efficiency. Together, these planning measures will equip DCN with the data needed to integrate the appropriate infrastructure upgrades into future capital plans.

Furthermore, DCN should develop and implement an internal **Inspection & Maintenance Plan** for culverts and roads. This plan will enable DCN to identify premature structural deterioration and advocate for NBDTI roads categorized as "Designated Highways" for proactive roadside ditching and potential culvert upgrades under the provincial program, as well as for all roads and culverts within DCN under the local maintenance and upgrade program.

Specific administrative attention is required for the wastewater treatment lagoons (specifically the Bristol and Florenceville Lagoons), which are vulnerable to high flood levels, erosion and ice damage. Preventative measures include the immediate prioritization of an **Inspection & Maintenance Plan** to assess berm structural integrity and the impact of surrounding vegetation on stability.

For emergency operations, DCN should develop a **Flash Flood Response Plan**, establishing real-time level monitoring and communication protocols via the Voyent Alert system. This coordination includes **Isolation Route Maintenance** to identify and prioritize secondary back roads that serve as the only egress points when main low-lying routes flood.

Similarly, **Agricultural Best Management** strategies should be promoted through community education programs, encouraging the use of vegetative buffer strips to reduce sediment transport and nutrient runoff. DCN should also coordinate **Planting Initiatives** with the St. John River Society to stabilize shorelines through riparian restoration in Florenceville and Bristol.

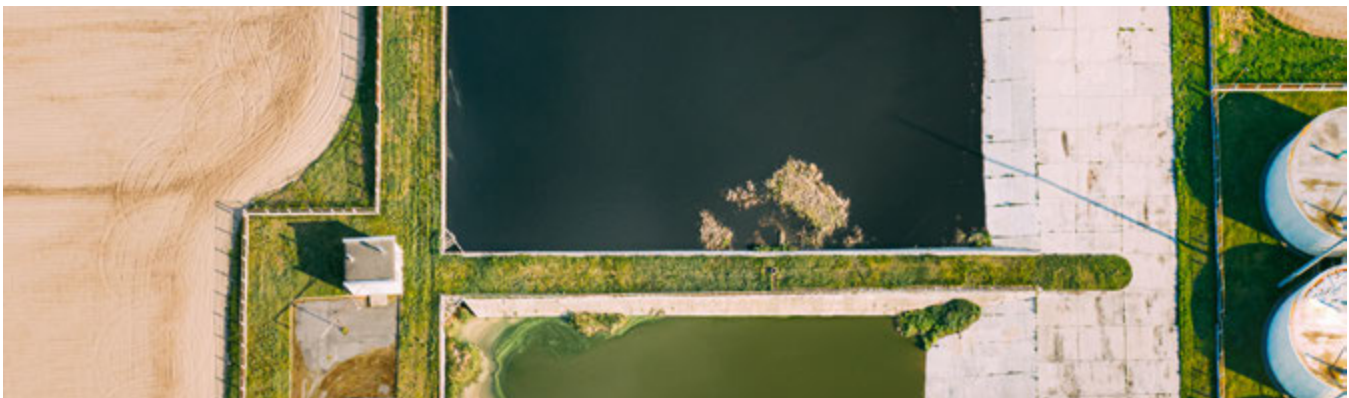
Finally, building resilience will be supported through a **Wind-Driven Rain Assessment** to evaluate and upgrade community-owned building envelopes against hidden mold and rot caused by high-velocity precipitation.

3.2.1.4 Flooding

Land Use Planning

To effectively mitigate escalating flood risks, the District of Carleton North can leverage its recently adopted Zoning By-law, specifically the Flood Risk Area (FR) Overlay Zone established in Section 12.1. While this framework is already in place, Section 12.1.1(1)(a) presents a key opportunity for refinement by updating the current "minimum known flood extent" to the 2100 1-in-100-year flood projection, DCN can provide a more concrete, science-based metric for **Zoning & Land-use Alignment**.

This adjustment would facilitate the formal codification of Minimum Building Elevations (MBE) and mandated horizontal setbacks for all new construction near flood-prone areas. This dual-layered approach offers comprehensive protection:





- **Vertical Protection (MBE):** Ensures finished floor levels remain above the 2100 1-in-100-year projected flood line.
- **Horizontal Protection (Setbacks):** Creates a physical buffer between structures and fluctuating watercourse edges, protecting against both immediate inundation and long-term bank erosion.

Furthermore, these setbacks preserve the natural riparian buffer, which acts as a vital sponge to absorb and slow runoff. By refining the existing Overlay Zone, the District gains the authority to limit footprint expansions in floodways and enforce strict usage standards for sensitive shorelines. Utilizing the Section 12.1 Flood Risk Area (FR) Overlay allows DCN to apply these essential protective requirements to specific properties based on risk, regardless of their primary zoning.

Finally, the District of Carleton North should undertake a project to develop consistent **Flood Mapping** for areas where provincial data is currently absent or inadequate, specifically targeting the gaps between Bath and Florenceville Bristol and other critical zones. DCN would benefit from developing an interactive, Online Flood Risk Mapping Tool. By incorporating localized GIS development data, this tool would provide a more precise, high-resolution supplement to existing provincial flood maps.

Infrastructure Resilience

The vulnerability assessment identified that severe flooding events pose a significant threat to DCN structures, wastewater assets and road networks, potentially resulting in infrastructure loss. To maintain operational continuity during such disasters, the District of Carleton North should prioritize **Emergency Preparedness and Backup Power** to evaluate the power requirements of its designated emergency shelters. This includes investigating decentralized backup power solutions for critical systems, such as solar panels, standby generators, or quick-connect generator hookups. Specific locations should include the R.G. "Bun" Veysey Active Living Centre, assisted living/senior homes, former Northern Carleton Hospital in Bath, Western Valley Multi-Plex, Town Hall and fire halls. To protect against moisture damage, a **Wind-Driven Rain Assessment** should be conducted to assess and upgrade DCN-owned building envelopes to withstand high winds that force water into structures.

Water, Wastewater and Stormwater Management

To support the safety of the local water supply, DCN should act as a regional information hub, sharing provincial public health guidelines and GNB incentive programs with residents. By promoting existing **Well Inspection** programs, DCN can help residents manage their private systems more effectively and reduce the risk of water-borne illnesses without assuming direct oversight of private infrastructure.

For stormwater, completing a **Stormwater Management Plan**, including a wetland functional assessment will help identify low-lying priority areas and evaluate the capacity of natural infrastructure to store or convey excess water.

For underground sanitary and storm sewers, completing a **Flushing and CCTV Program** and an **Inflow and Infiltration Study** will assist in maintaining the long-term structural integrity and hydraulic efficiency of the network. Implementation of a flushing and CCTV program, adhering to NASSCO standards, will allow for the proactive identification of defects and debris, while a comprehensive I&I study will help quantify extraneous water entering the system. Together, these initiatives minimize the risk of backups, reduce unnecessary treatment costs and provide a data-driven foundation for future infrastructure upgrades.

Additionally, physical shoreline vulnerabilities should be addressed through a **Shoreline Erosion Study Plan** and **Planting Initiatives** coordinated with the St. John River Society to stabilize shorelines in Florenceville and Bristol.





3.2.1.5 Low Temperatures and Freeze-Thaw Cycles

To address vulnerabilities from freeze-thaw cycles and extreme cold, DCN should coordinate with NBDTI and Engineering Consultants to strictly enforce **Construction QA/QC** protocols during the construction phase to ensure long-term surface integrity. A regularly scheduled **Road Inspection & Maintenance Plan** should be developed and maintained to identify changes in road conditions for targeted repairs. To address severe road degradation caused by heavy industrial traffic, DCN should petition NBDTI for stricter weight restrictions on specific vulnerable routes that serve as vital connectors for residents and services and better monitoring of weight limit restrictions. Additionally, **Winter Maintenance** options include reviewing and updating municipal de-icing policies to utilize less corrosive agents.

To address structural impacts on regional connectivity, NBDTI's **Bridge Inspection & Maintenance Plan** should be reviewed in coordination with NBDTI to identify early signs of premature structural deterioration caused by ice accumulation, freeze-thaw cycles or thermal stress. DCN's **Emergency Preparedness and Backup Power** plan should include clear protocols for large-scale winter disruptions, allowing designated shelters and critical hubs to have the necessary redundancy to remain functional. This planning extends to creating a robust power outage response within the EAP to manage building electricity needs during prolonged service losses.

To protect parks and forested areas from tree damage due to ice loading or wind events, the District of Carleton North should prioritize **Vegetation Health Monitoring** to provide necessary tending or removal of damaged limbs and prevent secondary hazards. This proactive approach is complemented by **Proactive Vegetation Management**, which shifts from reactive to scheduled tree trimming programs along power lines in coordination with NB Power and NBDTI to prevent widespread outages. Finally, DCN should evaluate **Infrastructure Upgrades** for sensitive equipment, such as SCADA systems, by monitoring high-risk frost-susceptible entry points for signs of premature deterioration.

3.2.2 Adaptation Measures Summary

Adaptation Measures are physical adaptations of infrastructure through repairing, rebuilding, relocating, or retrofitting actions.

3.2.2.1 Heavy Precipitation and Flooding

To mitigate overland flooding and erosion, **Drainage System Upgrades** involve physical capital projects in coordination with NBDTI to construct proper ditches along all designated highway, municipal roads and resize undersized culverts to updated climate specifications. At the community level, implementing **Green Infrastructure**, such as vegetated rooftops, roadside planting and absorbent gardens, can increase natural stormwater catchment capacity. Physical transportation adaptations include **Road Raising** in coordination with NBDTI to lift roadbed elevations above anticipated flood levels, particularly on critical primary and secondary gravel roads that serve as essential access points. Based on formal **Bridge Condition Assessments** in coordination with NBDTI, physical reinforcement of bridge piers may be required to withstand increased "scour" and washouts caused by rapid rises in water levels.

Specific capital attention is required for the wastewater treatment lagoons. **Infrastructure Upgrades & Mitigation** as well as **Operational Repairs** are recommended for both the wastewater lagoons and the pump/lift stations, which could include installing holding tanks to manage surge volumes, maintaining high-capacity diversion pumps on-site and installing permanent backup power generation to prevent overflow during power outages. To protect the potable water supply, **Well Inspections Integrity Inspections and Wellhead Upgrades** involve capital repairs to re-seal or physically raise well casings to block contaminated surface runoff from entering the water supply.

Finally, **Planting Initiatives** should be implemented to address significant bank erosion concerns in Florenceville and Bristol through targeted riparian restoration. By implementing these initiatives in coordination with the St. John River Society, DCN can stabilize shorelines, enhance local biodiversity and mitigate the long-term impacts of soil loss along the riverbanks.



3.2.2.2 High Temperatures and Drought Conditions

Extreme heat leads to the premature softening of asphalt. **Pavement Material Upgrades** may involve physical repaving using high-heat resistant asphalt binder grades or modified Hot/Warm Mix Asphalt (WMA/HMA). As NBDTI is the primary governing body for asphalt in the province, DCN should monitor their recommendations and adopt any changes to asphalt specifications accordingly.

To improve energy efficiency and reduce HVAC demand, DCN facilities should undergo physical retrofits utilizing **Roof Construction Alternatives**, such as the installation of light-colored shingles or green roofs to reduce heat absorption. To protect residents during heatwaves accompanied by power failures, building retrofits should prioritize **Passive Survivability Retrofits** to maintain safe internal temperatures without active mechanical cooling.

To combat severe water scarcity during droughts and winter freezes, physical infrastructure should be expanded through **Groundwater Management** strategies including conducting comprehensive aquifer assessments and groundwater studies, such as groundwater study requirements for future subdivision agreements, monitoring environmental conditions during dry spells, enforcing temporary water use limitations and establishing formal communication protocols for the public. Also, **Dry Hydrant Installation** at strategic rural locations will ensure reliable water access for fire services. Notable existing water sources include the fill station at McCains and a cistern at Metal Fab, though Glassville and Lakeville lack adequate accessibility.

Finally, on agricultural lands, physical adaptations include supporting the transition to drought-resistant crop varieties via **Agricultural Adaptation** and planting perennials for community flowers.

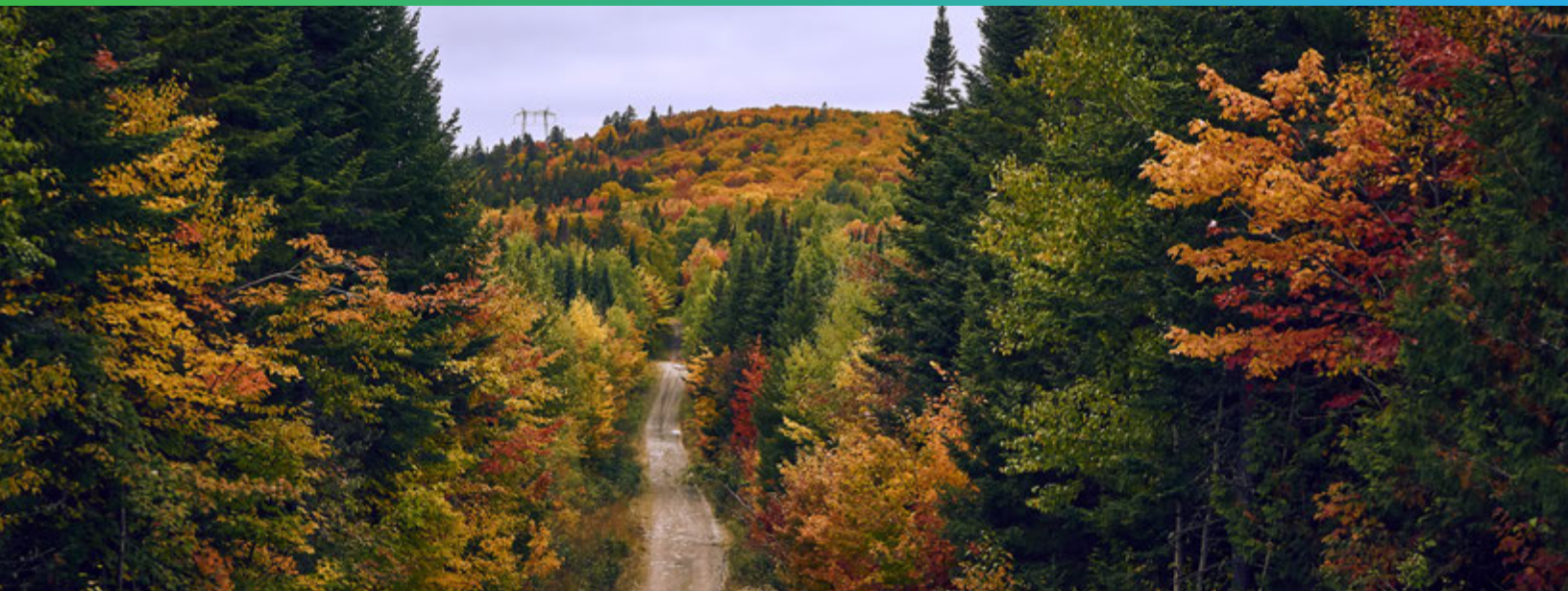
3.2.2.3 Low Temperatures and Freeze-Thaw Cycles

To protect the Communities water and wastewater reliability against extreme cold, **Well System Winterization** involves the physical installation of upgrades to protect well heads and surface/shallow piping from freezing. For the collection network, **Infrastructure Upgrades** require the physical excavation and deep burial of all new water and sewer mains below the frost line to prevent breaks from frost loading. For DCN buildings, **Seasonal Building Maintenance** physical retrofits to address freezing rain include upgrading flat roof drainage systems to prevent ice damming and subsequent indoor leaks.

To protect critical communications and utilities, **Infrastructure Upgrades** involve physically upgrading sensitive SCADA equipment to climate-controlled enclosures and actively monitoring high-risk frost-susceptible entry points for signs of premature deterioration.

To reduce power outages caused by ice accumulation, **Proactive Vegetation Management** (structural pruning and tree removal), in coordination with NB Power, is required along critical power line corridors. Additionally, **Infrastructure Security** measures must be physically implemented to protect communication lines (copper/fiber) from theft.

Finally, the physical hardening of remote community hubs remains a capital priority; this includes the continued maintenance and installation of **Remote Community Hub Generators** and satellite internet hardware (e.g., Starlink). For long-term protection against high winds and ice accretion, DCN should advocate for and explore major capital initiatives to physically bury power lines in high-risk zones.



4.0 FUNDING OPPORTUNITIES

This CCAP identified adaptation measures representing physical adaptations to DCN infrastructure through repairing, rebuilding, relocating, or retrofitting actions. To support the implementation of these adaptation measures, this report highlights several funding opportunities currently available that are geared towards infrastructure maintenance. Potential funding avenues are described below.

4.1 Provincial Funding

4.1.1 The Environmental Trust Fund (ETF)

The Environmental Trust Fund (ETF) is a fund that prioritizes strategic initiatives that mitigate climate risks and facilitate long-term adaptation in the province of New Brunswick. Managed by the Province of New Brunswick, the ETF provides financial assistance for projects that align with key environmental pillars. Eligible initiatives include the development of localized adaptation and mitigation plans, the execution of nature-based solutions and critical research into regional climate impacts.

The ETF directs funding toward projects that address at least one of the following core mandates:

- **Protecting our Environment:** Conservation of biodiversity and natural resources;
- **Managing Waste:** Implementing sustainable waste reduction and diversion strategies; and
- **Climate Change:** Enhancing community preparedness and reducing provincial carbon footprints.

4.1.1.1 Recommended Projects for Application

Based on the priorities identified in **Section 3.0**, the following CCAP measures are strong candidates for ETF support:

- **Stormwater Management Plan:** Funding to evaluate the capacity of local wetlands to buffer stormwater and prevent overland flooding (Protecting our Environment);
- **Groundwater Management:** Comprehensive aquifer studies and assessments to monitor water table levels and environmental conditions during drought events (Climate Change);
- **Riparian Restoration and Planting Initiatives:** Funding to address bank erosion in Florenceville and Bristol through targeted shoreline stabilization in coordination with the St. John River Society (Protecting our Environment);



- **Inflow and Infiltration Study:** A formal study to quantify extraneous water entering the sanitary sewer system during wet weather events, ensuring optimal treatment capacity and environmental compliance (Climate Change); and
- **Vegetation Health Monitoring Program:** Developing a proactive monitoring strategy for parks and forested areas to manage the impacts of severe evaporation and prevent secondary hazards from damaged limbs (Protecting our Environment).

4.2 Federal Funding

4.2.1 Build Communities Strong Fund (BCSF)

The Build Communities Strong Fund (BCSF) is a \$51 billion, 10-year initiative launched in April 2026 to modernize public infrastructure and serves as the primary federal funding for community growth. This fund is delivered through three distinct streams, including the Direct Delivery Stream, which provides \$6 billion for climate adaptation and regionally significant projects accessible directly by municipalities. Additionally, the Community Stream (formerly the Canada Community-Building Fund) provides predictable yearly funding for 19 project categories, while the Provincial and Territorial Stream focuses on housing-enabling infrastructure and health projects.

4.2.1.1 Recommended Projects for Application

Based on the priorities identified in **Section 3.0**, the following CCAP measures are strong candidates for BCSF support:

- **Emergency Preparedness and Backup Power (Hub Redundancy):** Establishing decentralized backup power (solar/generators) and satellite internet at critical community hubs and emergency shelters to ensure "Passive Survivability" during prolonged power outages;
- **Bridge Condition Assessments and Reinforcements:** Conducting formal assessments of municipal bridge assets and implementing structural reinforcements to withstand increased ice loading and high-flow events;
- **Isolation Route Maintenance & Upgrading:** Capital investment to grade, ditch, and pave secondary back roads that serve as critical egress points when primary low-lying routes are flooded; and
- **Grid Capacity and Peak Cooling Assessment:** Collaborating with NB Power to fund a detailed engineering study on the electrical grid's ability to handle projected 2050 "Peak Cooling Demand."

4.2.2 Canada Housing Infrastructure Fund (CHIF)

The Canada Housing Infrastructure Fund (CHIF) is a \$6 billion fund designed to accelerate the construction and rehabilitation of housing-enabling infrastructure. The program focuses specifically on water, wastewater and stormwater projects that directly support the creation of new housing supply. Its primary mandate is to unlock housing availability by removing infrastructure bottlenecks that currently prevent increased residential density within communities.

4.2.2.1 Recommended Projects for Application

Based on the priorities identified in **Section 3.0**, the following CCAP measures are strong candidates for CHIF support:

- **Wastewater Lagoon Infrastructure Upgrades:** Raising and strengthening lagoon berms and upgrading aeration efficiency to ensure treatment capacity remains compliant as the population grows and temperatures rise;



- **Drainage System and Culvert Resizing:** Systematic replacement of undersized culverts with climate-resilient specifications to prevent overland flooding from damaging existing residential areas and new development sites;
- **Aquifer Assessment for Subdivision Planning:** Implementing the recommended groundwater studies and aquifer assessments specifically to inform future subdivision agreements and ensure water security for new housing; and
- **Sanitary Sewer Capacity Upgrades:** Implementation of operational repairs and capacity increases for underground sanitary sewers to prevent back-ups during heavy precipitation.

4.2.3 Investing In Canada Infrastructure Fund (ICIP)

The Investing in Canada Infrastructure Program (ICIP) is a long-term, cost-shared program delivered through bilateral agreements between the federal government and the Province of New Brunswick. This program prioritizes projects that support a transition to a low-carbon economy and increase community resilience to the impacts of climate change. Through the Green Infrastructure and Rural and Northern Communities streams, the ICIP aims to improve the long-term sustainability of public infrastructure across the province.

4.2.3.1 Recommended Projects for Application

Based on the priorities identified in **Section 3.0**, the following CCAP measures are strong candidates for ICIP support:

- **Road Raising and Pavement Upgrades:** Elevating road surfaces in chronic flood zones and upgrading asphalt binders to "High-Temperature" or "Low-Temperature" modified mixes to extend the lifecycle of transportation assets;
- **Passive Survivability Retrofits:** Major retrofits to municipal buildings and schools to include high-efficiency building envelopes, UV-protective coatings, and passive cooling to reduce the carbon footprint and reliance on mechanical HVAC;
- **Dry Hydrant Installation Program:** Installing a network of dry hydrants at strategic water sources to ensure fire suppression capabilities remain intact during extreme drought or when ponds are frozen; and
- **SCADA System Climate-Control Enclosures:** Upgrading sensitive electronic monitoring equipment with climate-controlled enclosures to ensure system integrity during freeze-thaw cycles and heatwaves.



4.2.4 Natural Infrastructure Fund (NIF)

The Natural Infrastructure Fund (NIF) supports projects that use natural or hybrid approaches to protect the environment and support community resilience. The fund focuses on the restoration and enhancement of natural assets such as wetlands, rain gardens, and urban forests. By leveraging these nature-based solutions, the NIF aims to mitigate natural hazards like flooding while providing significant community co-benefits, including improved local biodiversity and expanded recreational opportunities.



4.2.4.1 Recommended Projects for Application

Based on the priorities identified in **Section 3.0**, the following CCAP measures are strong candidates for NIF support:

- **Shoreline Erosion Study and Riparian Restoration:** A comprehensive project to stabilize the banks of the Saint John River (Wolastoq) in Florenceville and Bristol using native plantings and bio-engineering instead of traditional rip-rap;
- **Green Infrastructure Stormwater Pilot:** Implementing absorbent gardens, bioretention ponds, and enhanced swales along municipal roadways to capture and filter runoff before it reaches the sewer system;
- **Ecological Preservation and Shading:** Enhancing urban forestry and park vegetation to provide natural cooling ("Heat Island" mitigation) and preserve local flora against drought conditions; and
- **Roof Construction Alternatives (Green Roofs):** Pilot projects for green roofs on municipal structures to manage stormwater at the source and reduce building heat absorption.

4.2.5 Disaster Mitigation and Adaptation Funding (DMAF)

Communities across Canada have experienced and will continue to experience significant weather-related events or disasters triggered by climate change. The Disaster Mitigation and Adaptation Fund (DMAF) was launched by the Government of Canada to invest in structural and natural infrastructure projects to increase the resilience of communities impacted by natural disasters.

Projects must have a minimum of \$1 million in total eligible costs to be considered for funding. This makes DMAF suitable for bundling multiple smaller projects or addressing large-scale structural deficits.

4.2.5.1 Recommended Projects for Application

Given the high capital costs associated with structural reinforcement, the following CCAP measures are candidates for DMAF (potentially as a bundled application):

- **Flood Plain Mapping and Data Development:** A comprehensive project to fill the critical flood mapping data gaps between Bath and Florenceville-Bristol, providing the high-resolution data necessary for large-scale structural planning;
- **Comprehensive Drainage System Upgrades:** A large-scale project to resize undersized culverts and construct proper ditching along all municipal roads to withstand modern high-intensity rainfall.

4.3 Non-For Profit

4.3.1 Federation of Canadian Municipalities (FCM)

The Federation of Canadian Municipalities (FCM) provides funding for municipal environmental projects through the Green Municipal Fund (GMF), specifically the Local Leadership for Climate Adaptation (LLCA) initiative.

Funding is categorized to support the full project lifecycle:

- **Decision-Making & Strategy:** Grants to support the development of climate-focused asset management strategies and community-wide risk assessments; and
- **Operational & Infrastructure Improvements:** Implementation grants for projects such as stormwater management, waste-to-energy systems and infrastructure hardening. With the formal completion of this CCAP, District of Carleton North is now eligible to apply for this capital funding to construct physical adaptation measures.



4.3.1.1 Recommended Projects for Application

The following CCAP adaptation measures align with FCM's focus on municipal innovation and resilience:

- **Stormwater Management Plan (Decision-Making & Strategy):** A collaborative, watershed-specific study to assess complex flood impacts and develop targeted drainage upgrades that can extend to protecting private properties. FCM has identified a strong interest in funding multi-jurisdictional, watershed-level initiatives;
- **Green Infrastructure Implementation (Operational & Infrastructure Improvement):** Capitalizing on the completed CCAP to fund the physical construction of adaptation measures, such as the installation of rain gardens, bioswales and retention ponds to manage runoff at DCN facilities;
- **Passive Survivability Retrofits (Operational & Infrastructure Improvement):** Funding to physically retrofit critical community hubs (e.g., schools, halls) to maintain safe internal temperatures during power outages without mechanical cooling;
- **Remote Community Hub Generators (Operational & Infrastructure Improvement):** Installation of backup power and satellite communication (Starlink) systems at isolated locations;
- **Well System Winterization (Operational & Infrastructure Improvement):** Funding for the physical installation of upgrades to protect wellheads and surface piping from freezing, ensuring continuous water access during extreme cold;
- **Dry Hydrant Installation (Operational & Infrastructure Improvement):** Capital funding to install dry hydrants at strategic rural locations, particularly in underserved areas like Glassville and Lakeville, to ensure reliable fire suppression during drought or freezes; and
- **Building Envelope Review & Retrofits (Decision-Making & Strategy):** Conducting audits of municipal buildings to optimize energy efficiency and transitioning to UV-protective coatings or lighter-colored roofing materials to combat extreme heat.



5.0 CONCLUSION

In summary, the climate change vulnerability assessment for the District of Carleton North identified significant risks across DCN assets and services. The assessment confirmed **twenty-six (26) moderate-risk projected asset interactions and thirty-five (35) moderate-risk projected service interactions**. Furthermore, the spatial assessment revealed **seven (7) “at-risk” flooding interactions**, highlighting the vulnerability of numerous road segments and DCN buildings to flood events. These high- and moderate-risks were prioritized and advanced to the adaptation planning process.

As the global climate destabilizes, the frequency and severity of extreme weather events are expected to increase. While predicting these events remains challenging, their potential for significant disruption necessitates a robust and comprehensive EMP.

In response, a total of **sixty-one (61)** adaptation options have been identified to bolster climate resilience within DCN. This Climate Change Adaptation Plan provides a proactive path forward for the District of Carleton North to prepare for anticipated regional impacts and the development of future policy. Recognizing that climate science and modeling technologies will continue to evolve, this plan is designed as a living document, requiring ongoing monitoring and review of the adaptation measures outlined in **Section 3.0**.

5.1 Limitations

The climate change hazards used in this project were obtained from several sources, each using separate projection models with inherent limitations. Generally, the uncertainty found in climate projections can be divided into three main categories:

1. Natural climate variability (i.e., the natural fluctuations of the climate on timescales ranging from days to decades);
2. Models (i.e., different parameterizations in models can lead to somewhat different climate change signals or properties); and
3. Scenarios (i.e., future CO₂ emissions, representative concentration pathways).

The uncertainty in categories 1 and 2 relate to the use of large ensembles of models. Using a large ensemble will ultimately help develop a measure of the natural climate variability, which is related to the spread of the simulations estimated by looking at the 10th, 25th, 75th and 90th percentiles for each climate indicator.



The uncertainty in category 3 is covered by using the most realistic RCP scenarios (namely RCP 8.5) to align with the current progress of global GHG emission reductions. RCP 8.5 aligns with the current “business as usual” trend of no significant reduction in global GHG emissions and a possibility of continued growth in atmospheric loadings of global GHGs.

This report was prepared by Dillon Consulting Limited for the sole benefit of the District of Carleton North for the purposes outlined in our approved scope of work. The material in it reflects Dillon's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.



6.0 REFERENCES

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APPENDIX A

Infrastructure Listing



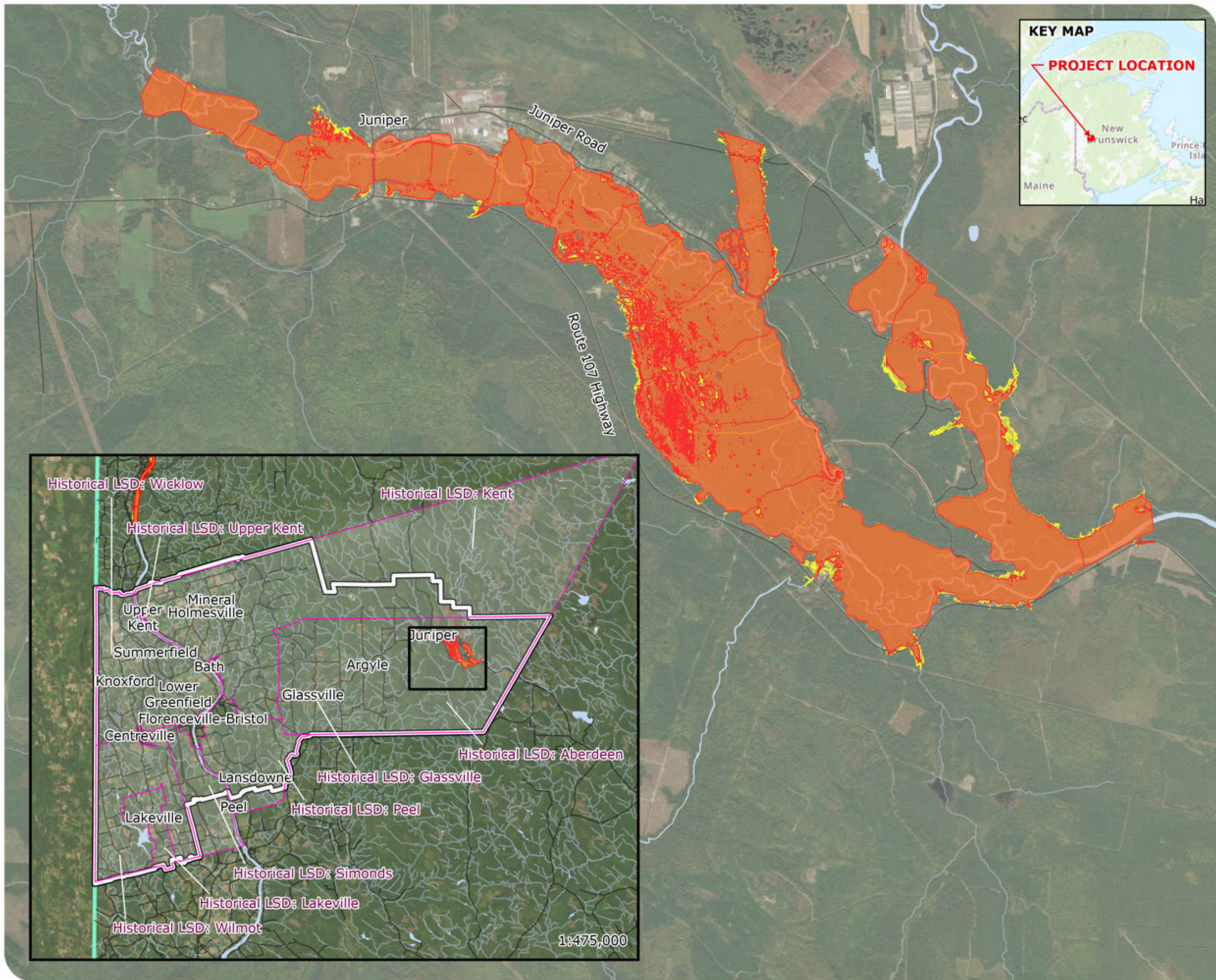
<i>Infrastructure</i>	<i>General Location</i>	<i>Civic Address</i>
Community Structures		
Fire Station	Centreville	836 Central Street
Western Valley Multi-Plex/ Centreville Office	Centreville	698 Central St, Centreville, NB E7K 2M5.
Western Valley Regional Service Commission	Centreville	3143 Main Street, Unit 2, Centreville, NB E7K 3E8
Vault Building	Centreville	758 Central Street
Shed (Central St)	Centreville	836 Central Street
Shed (Rogers Rd)	Centreville	110 Rogers Road
Storage Building	Centreville	14 Burt Street
Village Office (Government Building)	Bath	161 School Street, Bath, NB
Fire Station	Bath	121 Church street
Town Hall	Florenceville-Bristol	19 Station Road
Dental Clinic	Florenceville-Bristol	19 McCain Street
Fire Hall	Florenceville-Bristol	4724 Juniper Road, Florenceville-Bristol
Community Hall	Florenceville-Bristol	8696 Main Street, Florenceville-Bristol, NB E7L 3G8
Library & Gallery	Florenceville-Bristol	8 McCain St unit 1, Florenceville-Bristol, NB E7L 3H6
Northern Carleton Civic Centre	Florenceville-Bristol	40 McCain St, Florenceville-Bristol, NB E7L 3J4
Shogomoc Railway and Welcome Centre	Florenceville-Bristol	9195 Main Street (Train Inn)
Train Inn	Florenceville-Bristol	9195 Main Street
Storage Building (Quonset)	Florenceville-Bristol	19 Station Road
Storage Shed (at school)	Florenceville-Bristol	9208 Main Street
Storage Shed	Florenceville-Bristol	40 McCain Street
Centreville Village Hall	Florenceville-Bristol	836 Central St. Centreville
Bath Community School	Bath	112 School St, Bath, NB E7J 1C4
Bath Fire Training Station	Bath	117 Church St, Bath, NB E7J 1A5
Bristol Elementary School	Florenceville-Bristol	9208 Main St, Florenceville-Bristol, NB E7L 2A9
Carleton North High School	Florenceville-Bristol	30 School St, Florenceville-Bristol, NB E7L 2G2
R. G. "Bun" Veysey Active Living Centre	Florenceville-Bristol	40 McCain Street, Florenceville-Bristol, NB E7L 3J4
Ambulance NB	Florenceville-Bristol	154 Burnham Road, Florenceville
Water and Wastewater, and Stormwater Assets		
Wastewater Treatment Facility Building (Centreville)	Centreville	110 Rogers Road, Centreville
Wastewater Treatment Facility Lagoon (Centreville)	Centreville	110 Rogers Road, Centreville
Sewer Lift Stations #1 (Centreville)	Centreville	
Sewer Lift Stations #2 (Centreville)	Centreville	
Sewer Lift Stations #3 (Centreville)	Centreville	
Sewer Lift Station #1 (SLS#1) (Utility)	Bath	Main Street
Sewer Lift Station #2 (SLS#2) (Utility)	Bath	Main/Mechanic Street
Sewer Lift Station #3 (SLS#3) (Utility)	Bath	Water Street
Sewer Lift Station #4 (SLS#4) (Utility)	Bath	Mechanic Street
Sewer Lift Station #5 (SLS#5) (Utility)	Bath	Fairgrounds
Wastewater Treatment Facility (WWTF) - Building (Utility)	Bath	46.499377, -67.578939
Wastewater Treatment Facility (WWTF) - Lagoon (Utility)	Bath	46.499377, -67.578939
Well House #1 (Utility)	Bath	School Street (front of Pool)
Well House #3 (Utility)	Bath	School Street (front of Pool)
Booster Pump Station #1 (BPS#1) (Utility)	Bath	Unknown (General Utility Asset)
Booster Pump Station #2 (BPS#2) (Utility)	Bath	Unknown (General Utility Asset)
Steel Reservoir (Utility)	Bath	46°30'38.0"N 67°34'54.4"W (Water Storage Standpipe)
Generator Building (WH#3) (Utility)	Bath	Beside Well House #3 (General Utility Asset)
WWTP #1	Florenceville-Bristol	24 Waugh Rd, Florenceville-Bristol, NB E7L 4H7
WWTP #2	Florenceville-Bristol	9227 Main street, Bristol
Sewer Lift Stations #1 - 12	Florenceville-Bristol	

<i>Parks and Recreational Elements</i>		
Centreville Pool House	Centreville	751 Central Street, Centreville, NB E7K 2M6
Splash Pad (Centreville)	Centreville	18 Burnt Street
Gazebo (Centreville)	Centreville	Central Street
School Park	Centreville	751 Central St, Centreville, NB E7K 2M6
Soccer Field	Centreville	
Victory Park	Centreville	741 Central St, Centreville, NB E7K 2M4
Burt Street Park	Centreville	
Central Street Park	Centreville	
Mill Street Park	Centreville	
Bath Fair Grounds	Bath	200 Main Street, Bath, NB E7J 1H1
(Recreation/Cultural)	Bath	128 School Street, Bath, NB
Ball Fields	Bath	200 Main St, Bath, NB E7L 2B6
Shogomoc Railway Site	Florenceville-Bristol	9189 Main Street, Florenceville-Bristol, NB E7L 2Y3
Shiktehawk Trail	Florenceville-Bristol	
Riverside Park NB Trail	Florenceville-Bristol	
Boardwalk	Florenceville-Bristol	
Sam's Place Park	Florenceville-Bristol	141 Perkins Way, Florenceville-Bristol, NB E7L 2Z6
Riverside Park	Florenceville-Bristol	9173 Main St, Florenceville-Bristol, NB E7L 2Y3
Boardwalk Picnic Shelters	Florenceville-Bristol	
Shiktehawk Trail Picnic Shelter	Florenceville-Bristol	9249 Main St, Bristol, NB E7L 2C4
Cenotaph	Florenceville-Bristol	
Pools	Florenceville-Bristol	40 McCain St, Florenceville-Bristol, NB E7L 3J4
Curtis Road Cemetery	Florenceville-Bristol	575-329, NB-103, Florenceville-Bristol, NB
Bristol Community Park	Florenceville-Bristol	4724 Juniper Road, Florenceville-Bristol, NB E7L 2W9
Ball Fields	Florenceville-Bristol	4724 Juniper Rd, Florenceville-Bristol, NB E7L 2W9
Tennis Courts	Florenceville-Bristol	40 McCain St, Florenceville-Bristol, NB E7L 3J4
Playgrounds	Florenceville-Bristol	4724 Juniper Rd, Florenceville-Bristol, NB E7L 2W9
<i>Additional Elements</i>		
Sub station (NB Power)	Florenceville-Bristol	362 NB-110, East Centreville, NB E7K 3C2
Beechwood Generating Station (NB Power)	Florenceville-Bristol	10219 NB-105, Beechwood, NB E7J 2A7

APPENDIX B

Spatial Assessment Mapping





DISTRICT OF CARLTON NORTH

CLIMATE CHANGE ADAPTATION PLAN

FLOOD PREDICTION MODELS - PRESENT DAY

FIGURE 1

- Road (GeoNB)
- Watercourse (GeoNB)
- Waterbody (GeoNB)
- Present Day (5% Annual Exceedance Probability)
- Present Day (1% Exceedance Probability)
- District of Carlton North Boundary
- Historical Local Service District (GeoNB)
- New Brunswick Provincial Boundary (GeoNB)

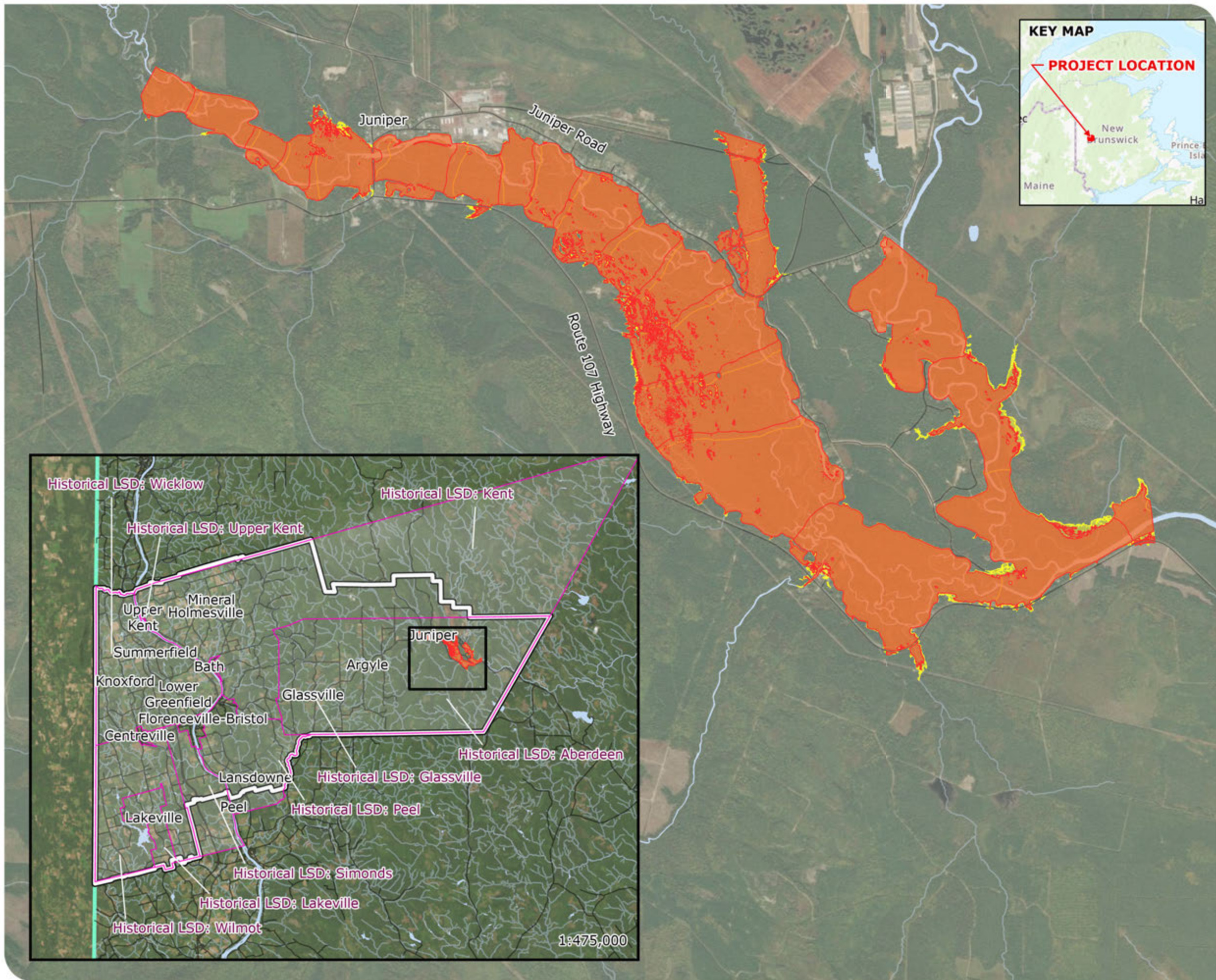


MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB AND ESRI

MAP CREATED BY: HF
MAP CHECKED BY: JH/KE
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic



PROJECT: 25-2522
STATUS: FINAL
DATE: 2026-04-09



DISTRICT OF CARLTON NORTH
CLIMATE CHANGE ADAPTATION PLAN
FLOOD PREDICTION MODELS -
CLIMATE CHANGE 2100
FIGURE 2

- Road (GeoNB)
- Watercourse (GeoNB)
- Waterbody (GeoNB)
- Climate Change 2100 (5% Annual Exceedance Probability)
- Climate Change 2100 (1% Annual Exceedance Probability)
- District of Carlton North Boundary
- Historical Local Service District (GeoNB)
- New Brunswick Provincial Boundary (GeoNB)

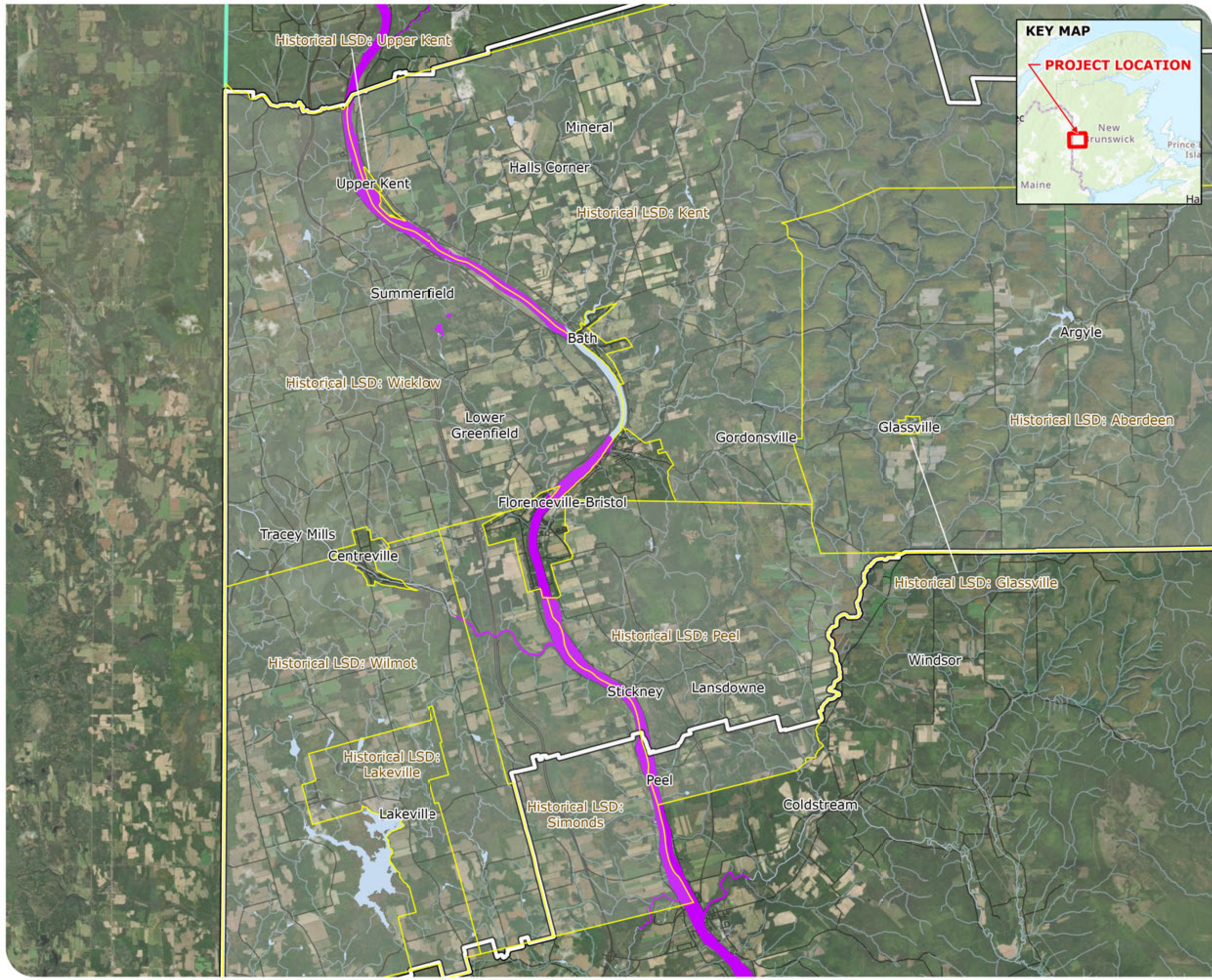


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DATA PROVIDED BY GEONB AND ESRI

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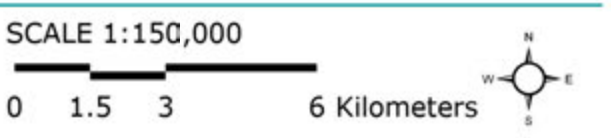
PROJECT: 25-2522
STATUS: FINAL
DATE: 2026-04-09



DISTRICT OF CARLTON NORTH
NORTH
CLIMATE CHANGE ADAPTATION PLAN

PREVIOUS FOOD EXTENT (UPPER SAINT JOHN)
FIGURE 3

- Road (GeoNB)
- Watercourse (GeoNB)
- Waterbody (GeoNB)
- Flood Extents 2008 Upper Saint John (GeoNB)
- District of Carlton North Boundary
- New Brunswick Provincial Boundary (GeoNB)
- Historical Local Service District (GeoNB)



MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB AND ESRI

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MAP CHECKED BY: JH/KE
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic



DILLON
CONSULTING

PROJECT: 25-2522
STATUS: FINAL
DATE: 2026-04-09

DISTRICT OF CARLTON NORTH

CLIMATE CHANGE ADAPTATION PLAN

PRESENT DAY FLOOD PREDICTION MODELS & COMMUNITY INFRASTRUCTURE PART I

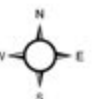
FIGURE 4A



- Community Structure
- Parks & Recreation
- Water and Wastewater, and Stormwater Asset
- Road (GeoNB)
- Watercourse (GeoNB)
- Waterbody (GeoNB)
- Present Day (5% Annual Exceedance Probability)
- Present Day (1% Exceedance Probability)
- District of Carlton North Boundary

SCALE 1:6,500

0 65 130 260 Meters



MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB, DILLON CONSULTING, AND ESRI

MAP CREATED BY: HF
MAP CHECKED BY: JH/KE
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic



PROJECT: 25-2522
STATUS: FINAL
DATE: 2026-04-09

DISTRICT OF CARLTON NORTH

CLIMATE CHANGE ADAPTATION PLAN

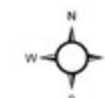
PRESENT DAY FLOOD PREDICTION MODELS & COMMUNITY INFRASTRUCTURE PART II

FIGURE 4B

- Community Structure
- Other
- Parks & Recreation
- Water and Wastewater, and Stormwater Asset
- Road (GeoNB)
- Watercourse (GeoNB)
- Waterbody (GeoNB)
- Present Day (5% Annual Exceedance Probability)
- Present Day (1% Exceedance Probability)
- District of Carlton North Boundary

SCALE 1:20,000

0 200 400 800 Meters

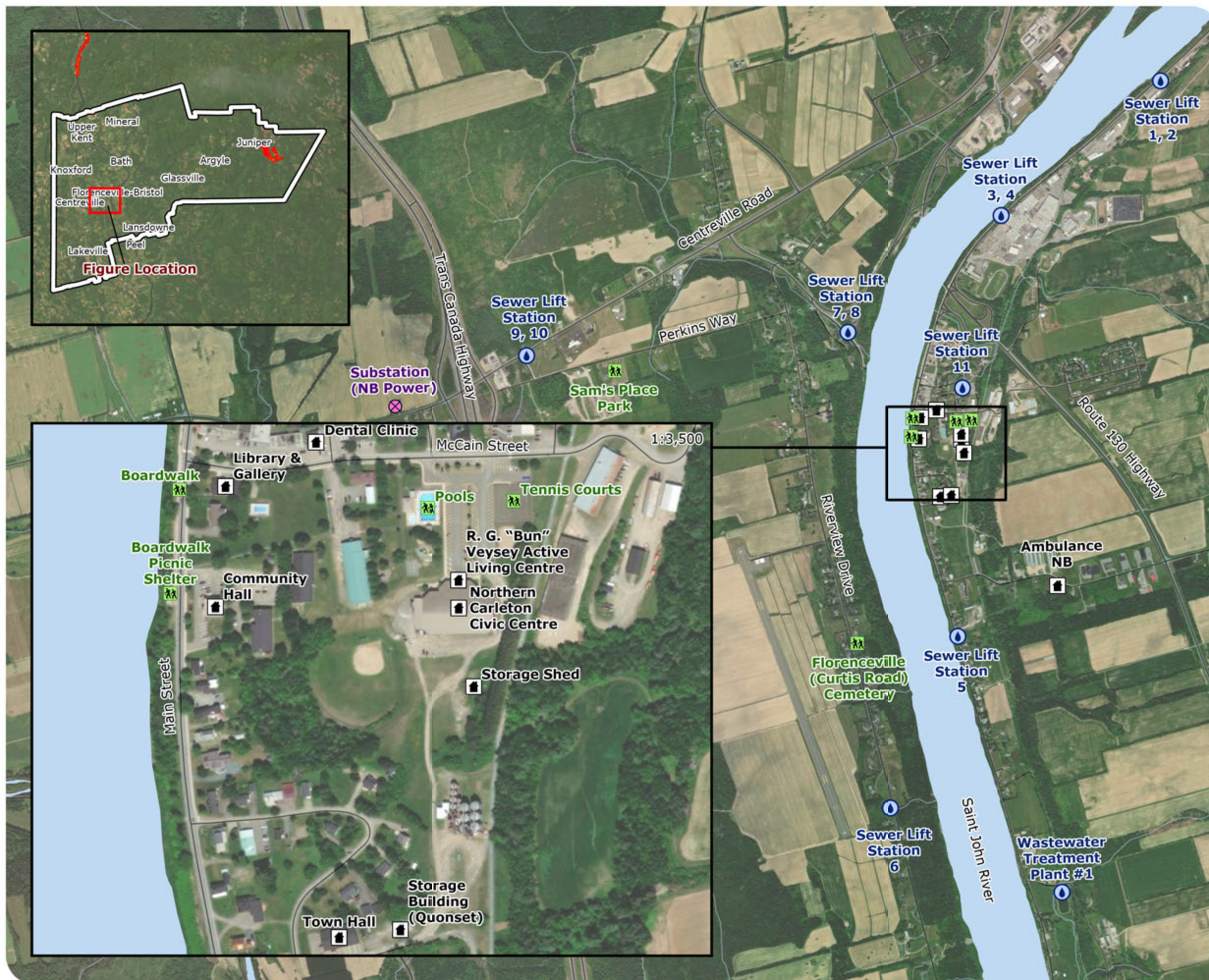


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DATA PROVIDED BY GEONB, DILLON CONSULTING, AND ESRI

MAP CREATED BY: HF
MAP CHECKED BY: JH/KE
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic



PROJECT: 25-2522
STATUS: FINAL
DATE: 2026-04-09



DISTRICT OF CARLTON NORTH

CLIMATE CHANGE ADAPTATION PLAN

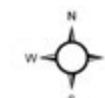
PRESENT DAY FLOOD PREDICTION MODELS & COMMUNITY INFRASTRUCTURE PART III

FIGURE 4C

-  Community Structure
-  Parks & Recreation
-  Water and Wastewater, and Stormwater Asset
-  Road (GeoNB)
-  Watercourse (GeoNB)
-  Waterbody (GeoNB)
-  Present Day (5% Annual Exceedance Probability)
-  Present Day (1% Exceedance Probability)
-  District of Carlton North Boundary

SCALE 1:4,500

0 45 90 180 Meters



MAP DRAWING INFORMATION:
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MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic



PROJECT: 25-2522
STATUS: FINAL
DATE: 2026-04-09



DISTRICT OF CARLTON NORTH

CLIMATE CHANGE ADAPTATION PLAN

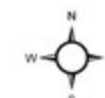
PRESENT DAY FLOOD PREDICTION MODELS & COMMUNITY INFRASTRUCTURE PART IV

FIGURE 4D

-  Community Structure
-  Other
-  Parks & Recreation
-  Water and Wastewater, and Stormwater Asset
-  Road (GeoNB)
-  Watercourse (GeoNB)
-  Waterbody (GeoNB)
-  Present Day (5% Annual Exceedance Probability)
-  Present Day (1% Exceedance Probability)
-  District of Carlton North Boundary

SCALE 1:40,000

0 375 750 1,500 Meters

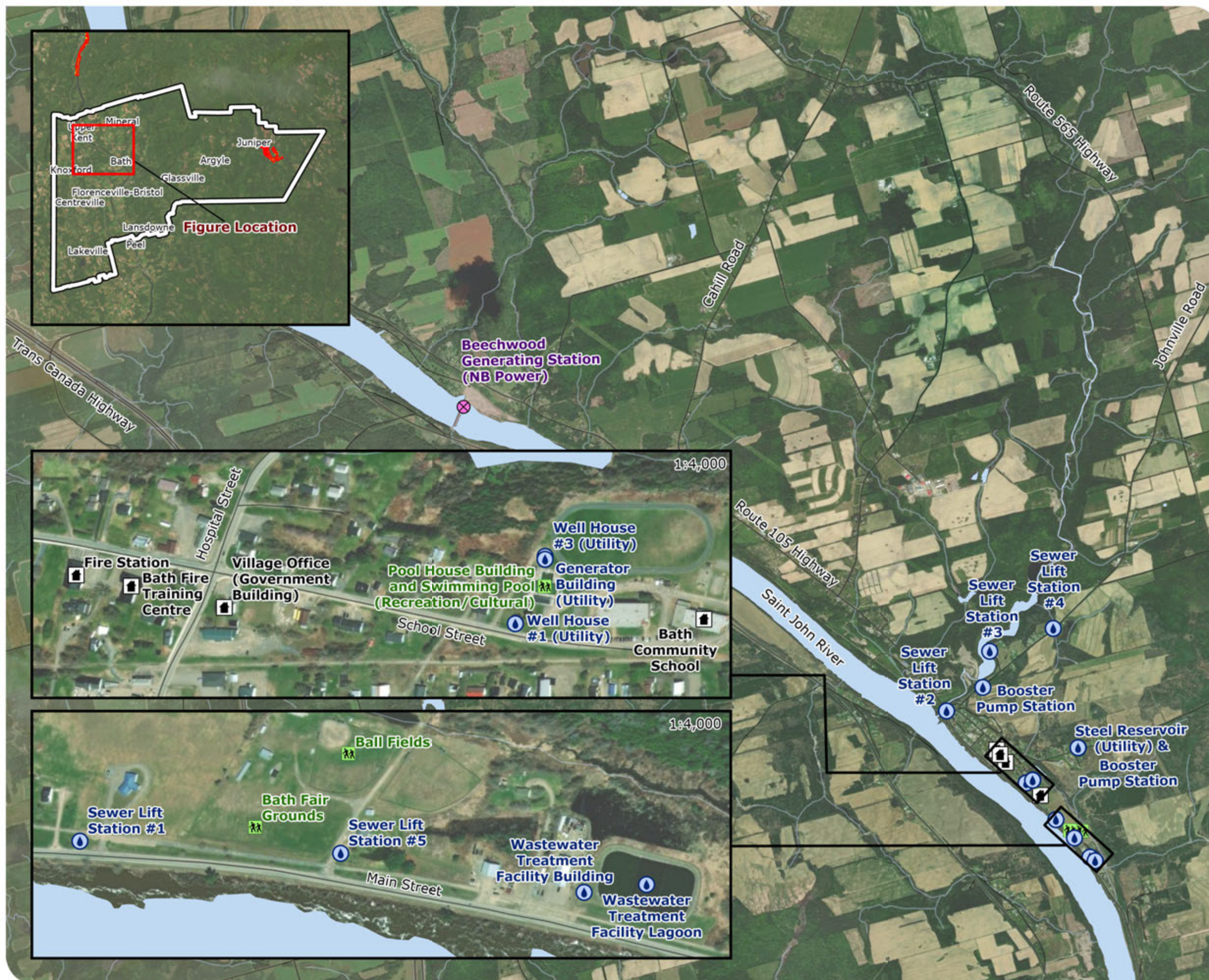


MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB, DILLON CONSULTING, AND ESRI

MAP CREATED BY: HF
MAP CHECKED BY: JH/KE
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic



PROJECT: 25-2522
STATUS: FINAL
DATE: 2026-04-09



DISTRICT OF CARLTON NORTH

CLIMATE CHANGE ADAPTATION PLAN

CLIMATE CHANGE 2100 FLOOD PREDICTION MODELS & COMMUNITY INFRASTRUCTURE PART I

FIGURE 5A



- Community Structure
- Parks & Recreation
- Water and Wastewater, and Stormwater Asset
- Road (GeoNB)
- Watercourse (GeoNB)
- Waterbody (GeoNB)
- Climate Change 2100 (5% Annual Exceedance Probability)
- Climate Change 2100 (1% Annual Exceedance Probability)
- District of Carlton North Boundary

SCALE 1:6,500

0 65 130 260 Meters



MAP DRAWING INFORMATION:
DATA PROVIDED BY GEON-B, DILLON CONSULTING, AND ESRI

MAP CREATED BY: HF
MAP CHECKED BY: JH/KE
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic



PROJECT: 25-2522
STATUS: FINAL
DATE: 2026-04-09

DISTRICT OF CARLTON NORTH

CLIMATE CHANGE ADAPTATION PLAN

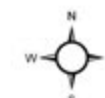
CLIMATE CHANGE 2100 FLOOD PREDICTION MODELS & COMMUNITY INFRASTRUCTURE PART II

FIGURE 5B

- Community Structure
- Other
- Parks & Recreation
- Water and Wastewater, and Stormwater Asset
- Road (GeoNB)
- Watercourse (GeoNB)
- Waterbody (GeoNB)
- Present Day (5% Annual Exceedance Probability)
- Present Day (1% Exceedance Probability)
- District of Carlton North Boundary

SCALE 1:20,000

0 200 400 800 Meters



MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB, DILLON CONSULTING, AND ESRI

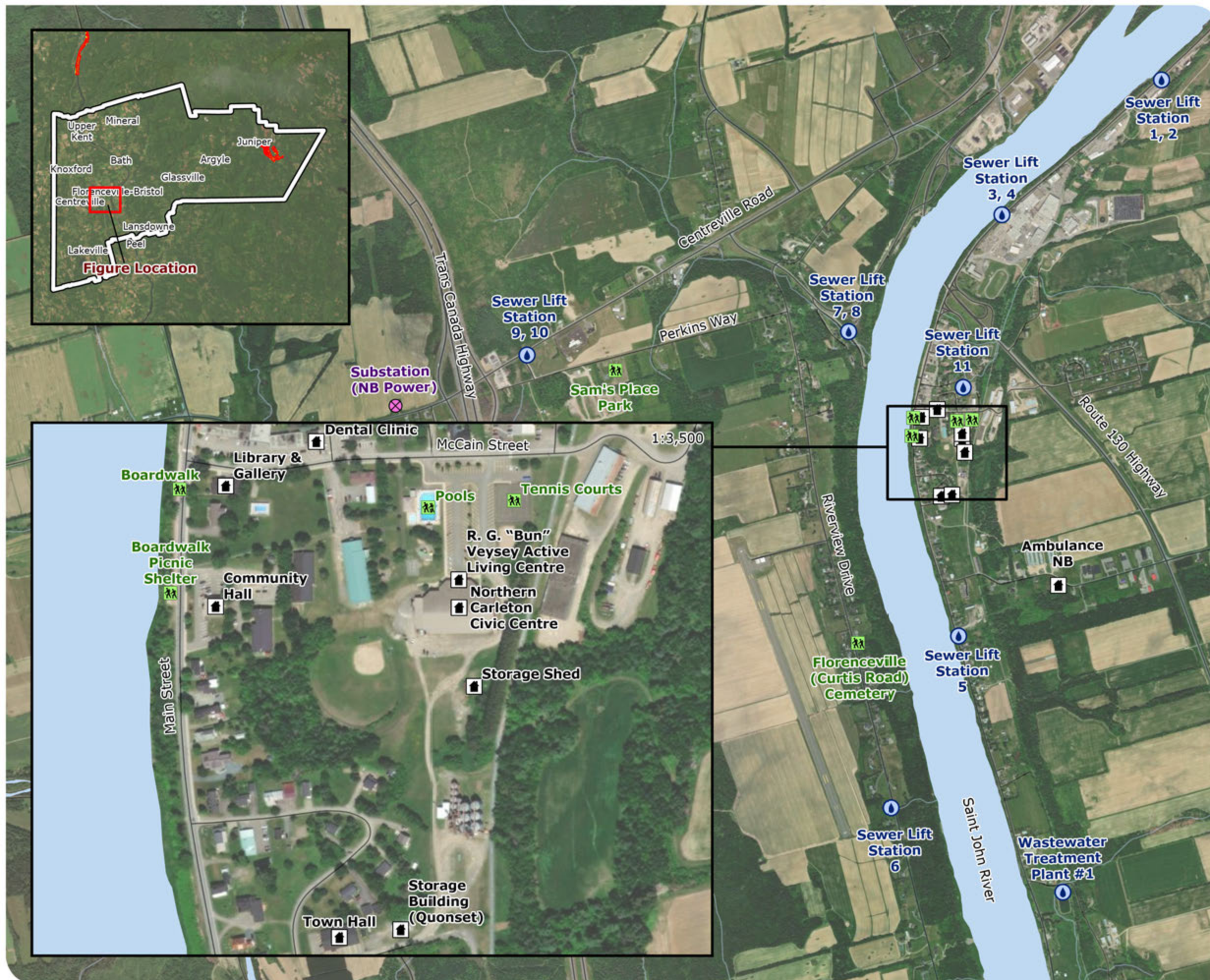
MAP CREATED BY: HF
MAP CHECKED BY: JH/KE
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic



PROJECT: 25-2522

STATUS: FINAL

DATE: 2026-04-09





**DISTRICT OF CARLTON
NORTH**
CLIMATE CHANGE ADAPTATION PLAN

**CLIMATE CHANGE 2100 FLOOD
PREDICTION MODELS &
COMMUNITY INFRASTRUCTURE
PART III**
FIGURE 5C

- Community Structure
- Parks & Recreation
- Water and Wastewater, and Stormwater Asset
- Road (GeoNB)
- Watercourse (GeoNB)
- Waterbody (GeoNB)
- Climate Change 2100 (5% Annual Exceedance Probability)
- Climate Change 2100 (1% Annual Exceedance Probability)
- District of Carlton North Boundary

SCALE 1:4,500
0 45 90 180 Meters

MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB, DILLON CONSULTING, AND ESRI

MAP CREATED BY: HF
MAP CHECKED BY: JH/KE
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic



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STATUS: FINAL
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DISTRICT OF CARLTON NORTH

CLIMATE CHANGE ADAPTATION PLAN

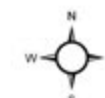
CLIMATE CHANGE 2100 FLOOD PREDICTION MODELS & COMMUNITY INFRASTRUCTURE PART IV

FIGURE 5D

-  Community Structure
-  Other
-  Parks & Recreation
-  Water and Wastewater, and Stormwater Asset
-  Road (GeoNB)
-  Watercourse (GeoNB)
-  Waterbody (GeoNB)
-  Present Day (5% Annual Exceedance Probability)
-  Present Day (1% Exceedance Probability)
-  District of Carlton North Boundary

SCALE 1:40,000

0 375 750 1,500 Meters

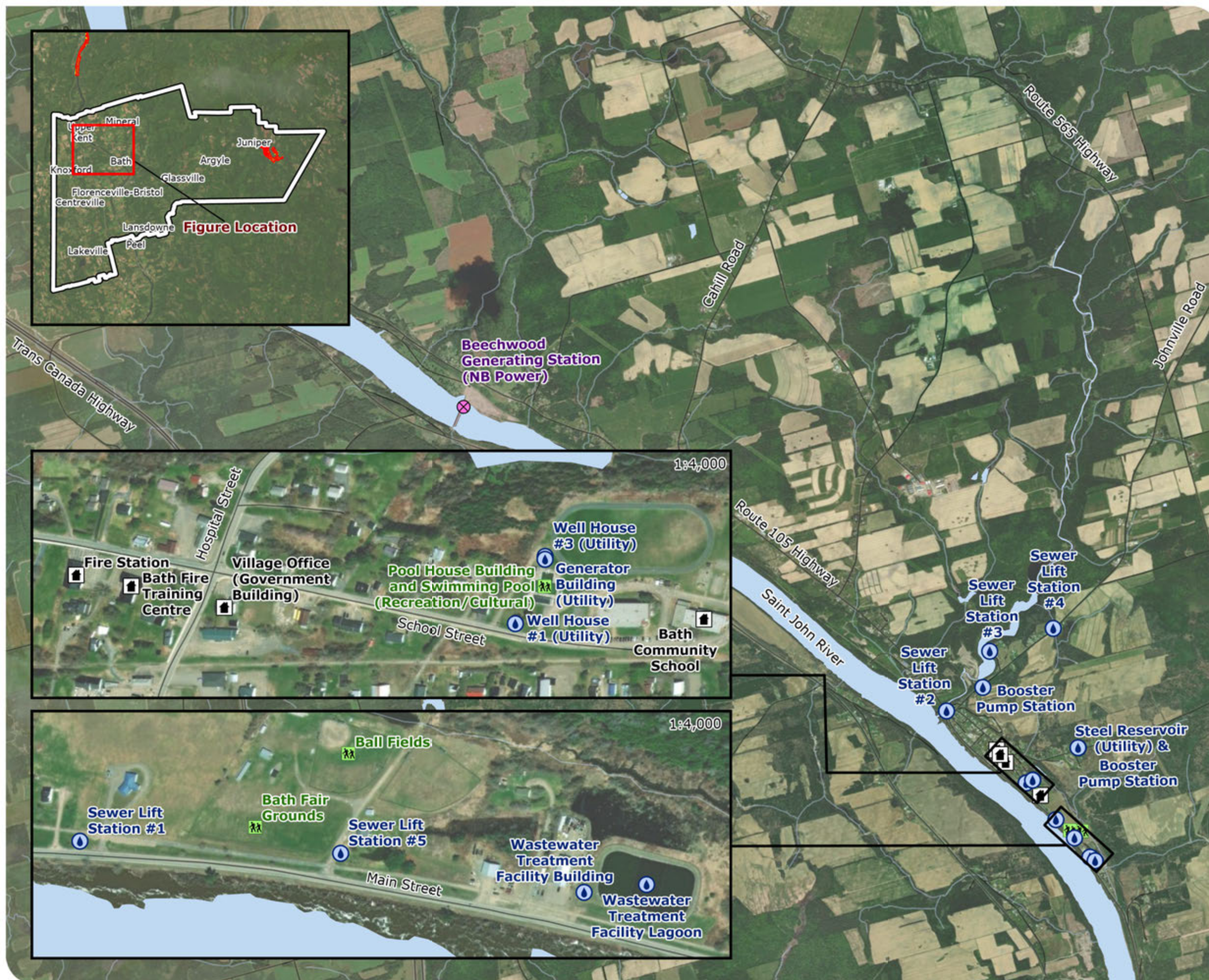


MAP DRAWING INFORMATION:
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MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic



PROJECT: 25-2522
STATUS: FINAL
DATE: 2026-04-09



HISTORICAL FLOOD EXTENTS &
COMMUNITY INFRASTRUCTURE
PART I

FIGURE 6A



- Community Structure
- Parks & Recreation
- Water and Wastewater, and Stormwater Asset
- Road (GeoNB)
- Watercourse (GeoNB)
- Waterbody (GeoNB)
- Flood Extents 2008 Upper Saint John (GeoNB)
- District of Carlton North Boundary
- New Brunswick Provincial Boundary (GeoNB)

SCALE 1:6,500

0 65 130 260 Meters

MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB, DILLON CONSULTING, AND ESRI

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MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

DILLON
CONSULTING

PROJECT: 25-2522

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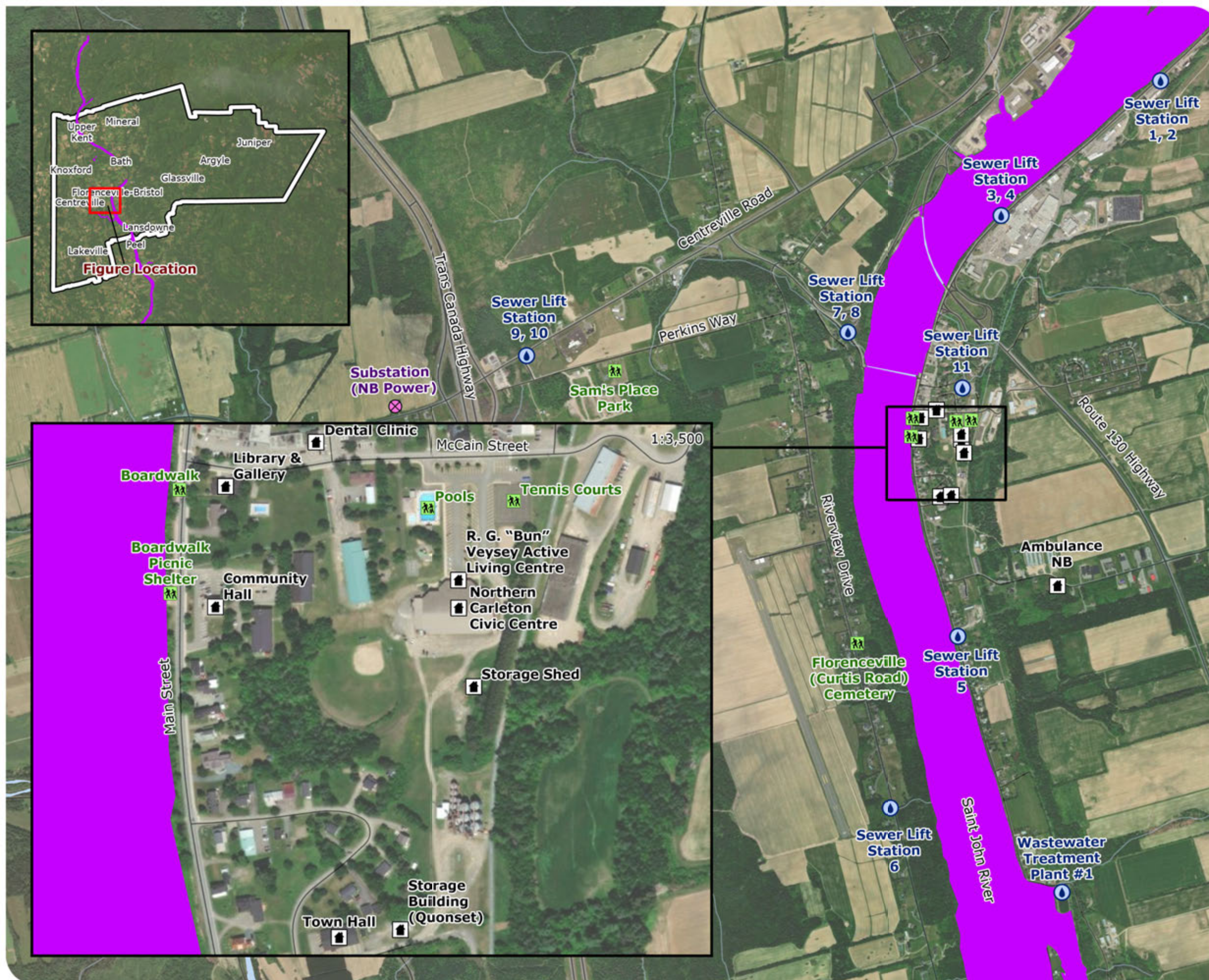
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DISTRICT OF CARLTON NORTH

CLIMATE CHANGE ADAPTATION PLAN

HISTORICAL FLOOD EXTENTS & COMMUNITY INFRASTRUCTURE PART II

FIGURE 6B



- Community Structure
- Other
- Parks & Recreation
- Transportation
- Water and Wastewater, and Stormwater Asset
- Road (GeoNB)
- Watercourse (GeoNB)
- Waterbody (GeoNB)
- Flood Extents 2008 Upper Saint John (GeoNB)
- District of Carlton North Boundary
- New Brunswick Provincial Boundary (GeoNB)

SCALE 1:20,000
0 200 400 800 Meters



MAP DRAWING INFORMATION:
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DISTRICT OF CARLTON NORTH

CLIMATE CHANGE ADAPTATION PLAN

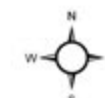
HISTORICAL FLOOD EXTENTS & COMMUNITY INFRASTRUCTURE PART III

FIGURE 6C

- Community Structure
- Other
- Parks & Recreation
- Transportation
- Water and Wastewater, and Stormwater Asset
- Road (GeoNB)
- Watercourse (GeoNB)
- Waterbody (GeoNB)
- Flood Extents 2008 Upper Saint John (GeoNB)
- District of Carlton North Boundary
- New Brunswick Provincial Boundary (GeoNB)

SCALE 1:4,500

0 45 90 180 Meters



MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB, DILLON CONSULTING, AND ESRI

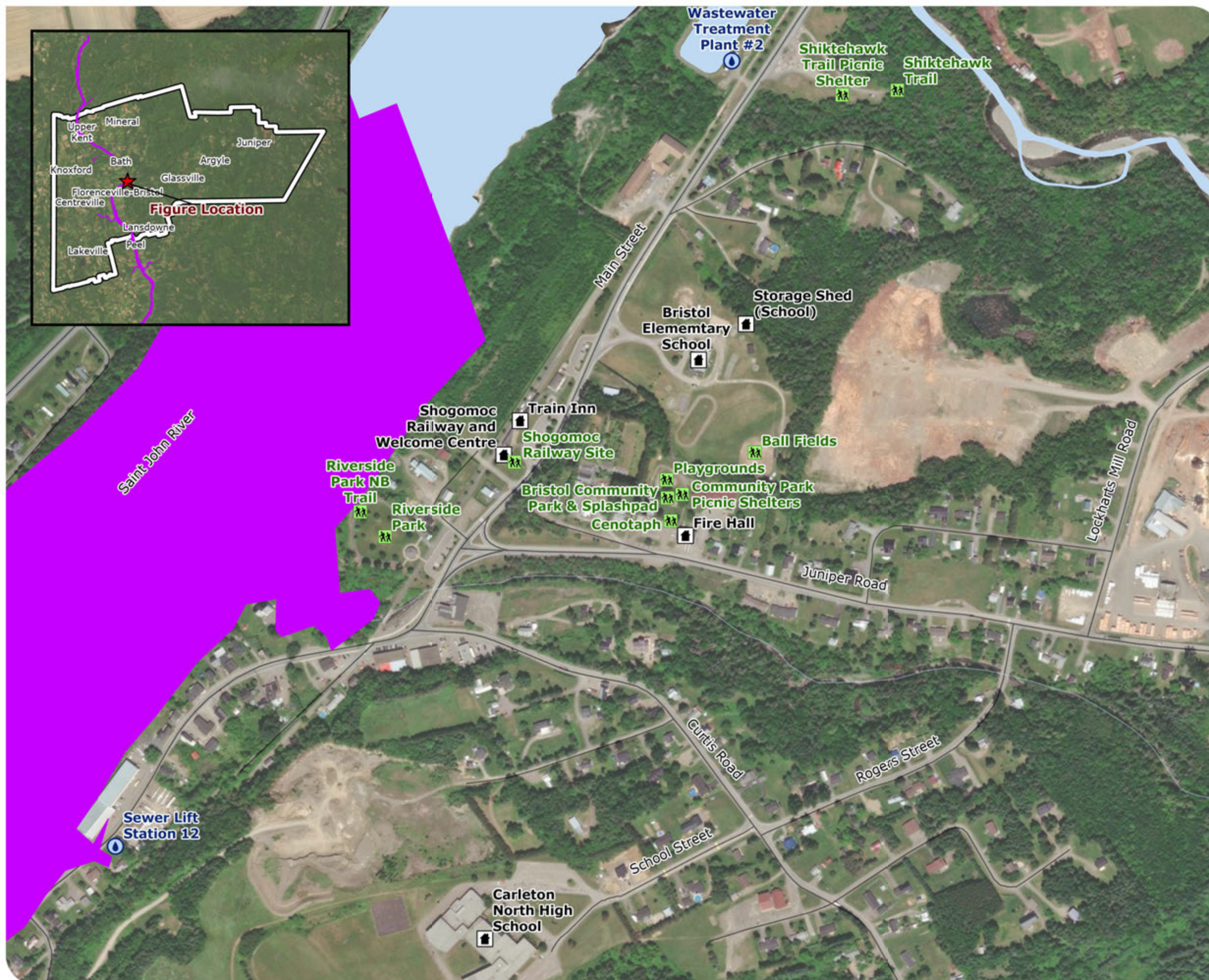
MAP CREATED BY: HF
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MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic



PROJECT: 25-2522

STATUS: FINAL

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DISTRICT OF CARLTON NORTH

CLIMATE CHANGE ADAPTATION PLAN

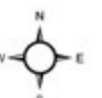
HISTORICAL FLOOD EXTENTS & COMMUNITY INFRASTRUCTURE PART IV

FIGURE 6D

- Community Structure
- Other
- Parks & Recreation
- Water and Wastewater, and Stormwater Asset
- Road (GeoNB)
- Watercourse (GeoNB)
- Waterbody (GeoNB)
- Flood Extents 2008 Upper Saint John (GeoNB)
- District of Carlton North Boundary
- New Brunswick Provincial Boundary (GeoNB)

SCALE 1:40,000

0 375 750 1,500 Meters

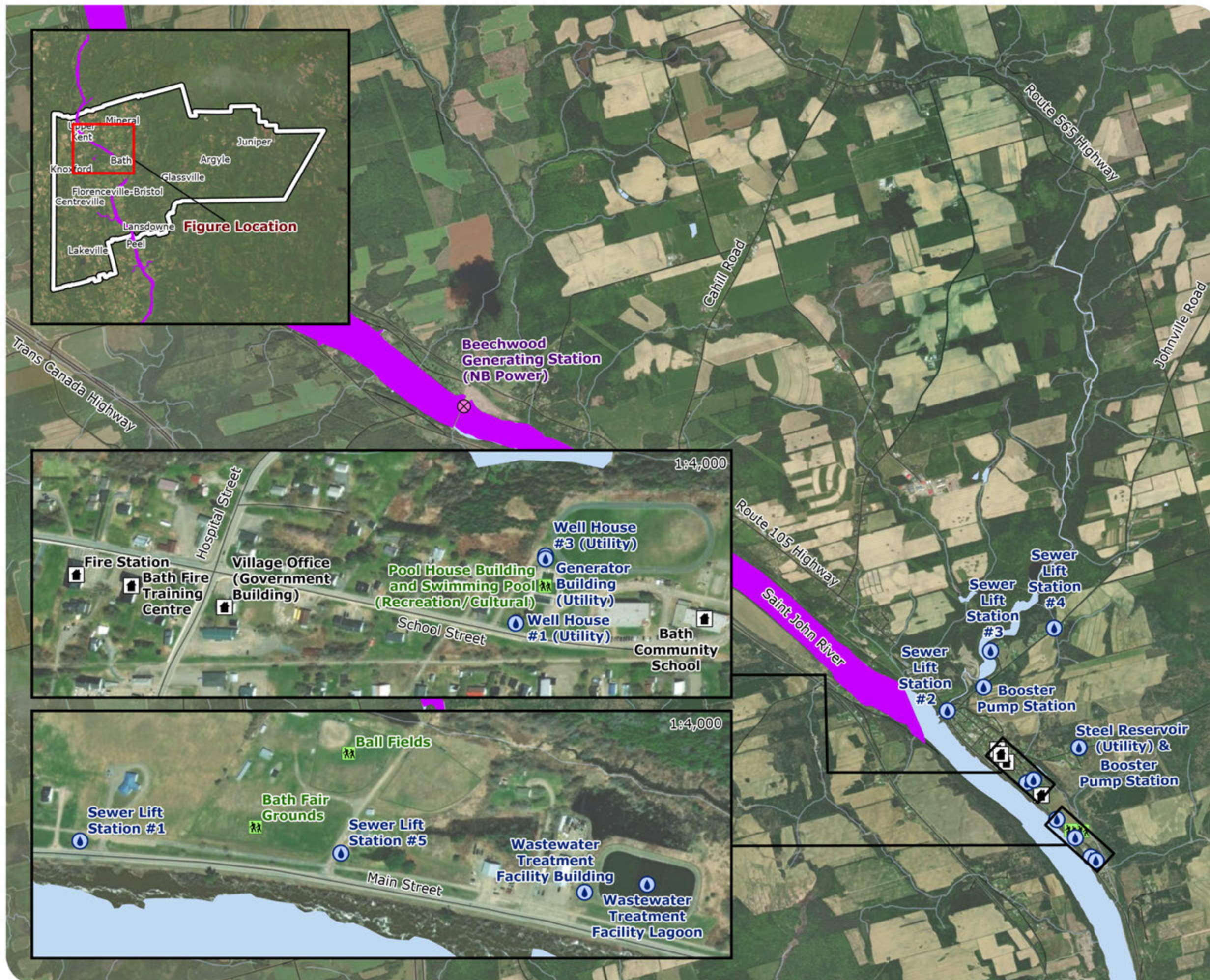


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Appendix C

District of Carleton North Climate Profile





District of Carleton North Climate Profile

Climate change is a global and local challenge that will increasingly impact environmental, social and built systems. DCN has a responsibility to respond to, prepare for and adapt to the impacts of climate change.

The changing climate poses evolving risk to all in DCN and decisions made today on urban form have long term consequences that strongly affect a community's capacity to respond to climate hazards over time. Thus, community planning and design have a critical role to play in DCN response to climate change. Actions that reduce risk from climate hazards should be integrated at all urban scales.

Greenhouse gas reduction (known as mitigation) and adaptation are complementary approaches for reducing the risks of climate change impacts over different time scales. Mitigation, in the near term and through the next half-century, can substantially reduce climate change impacts in the latter decades of the 21st century and beyond. Climate change adaptation is a risk management strategy to reduce the negative impacts of climate change that cannot be avoided.

The intent of this document is to help DCN understand which climate hazards and how climate risk, may affect them.

District of Carleton North Climate Hazards

The District of Carleton North experiences a multitude of climate hazards, most of which are expected to increase in frequency, intensity and duration in a changing climate. To better understand the climate hazards in the District of Carleton North's changing future, climate projections for the 2050s and 2080s from publicly available sources were analyzed. The following section summarizes some of the key trends and impacts of the identified climate hazards on infrastructure, human life and activities.

High Temperatures & Dry Conditions

Table C-1: Hot and Dry Weather Projections

Climate Variables	Unit	Baseline (1981 – 2010)	Mid-term Projection (2050s)	Long-term Projection (2080s)	Overall Trend
Very Hot Days Average number of days per year with a maximum temperature $\geq 30^{\circ}\text{C}$	Days/Year	3.9	21.5	48.1	↑
Cooling Degree Days Average number of cooling demand per year against the baseline of 18°C	CDD/Year	92.1	302.9	564.0	↑
No. of Heat Waves Average number of heat waves per year	Heat waves/Year	0.0	1.6	5.3	↑
Average Length of Heat Waves Average length of heat waves in days	Days/Heat wave	0.0	4.4	20.7	↑
No. of Periods with > 6 Consecutive Dry Days Average number of periods per year with more than 6 consecutive days with precipitation below 1 mm/day	Periods/Year	9.3	9.2	9.6	↑



Increased annual temperatures, a longer season of cooling degree days (CDD) and higher extreme warm temperatures impact air conditioning needs and costs for buildings to maintain thermal comfort. While there may be less energy expended for heating in a warming climate, increased cooling needs should be considered.

Extreme heat can also impact built infrastructure, the natural environment and people's health and wellbeing. This has implications for building heating and cooling system design, thermal comfort and the health and safety of site users and staff. Extreme heat can lead to heat-related illnesses, including heat stroke and increase morbidity and mortality in vulnerable individuals, such as outdoor workers, the elderly and those with pre-existing health conditions (Eyquem and Feltmate, 2022). It can also contribute to less-than-optimal performance of HVAC and mechanical systems (Eyquem and Feltmate, 2022). The increase in high temperature events compounded with dry days can increase risk of drought events. Droughts can impact infrastructure through its effects on soil moisture, compaction and lead to shifting and inability in foundations and roadbeds which could cause issues during infrastructure development.

Low Temperatures

Table C-2: Cold Weather Projections

Climate Variables	Unit	Baseline (1981 – 2010)	Mid-term Projection (2050s)	Long-term Projection (2080s)	Overall Trend
Winter Days Average number of days per year with minimum temperatures <-15°C	Days/Year	53.1	22.0	6.8	↓
Heating Degree Days Average number of heating demand per year against the baseline of 18°C	HDD/Year	5157.2	4047.0	3376.0	↓
Ice Days Average number of days per year with a maximum temperature <= 0°C	Days/Year	90.0	59.4	37.8	↓

The effects of extreme cold events include an increased risk of workers experiencing significant health issues such as hypothermia, frostbite, windburn and heart and respiratory issues (CCOHS, 2023). People engaged in outdoor activity and elderly populations who are chronically exposed to colder indoor temperatures are primarily at risk. Equipment and materials exposed to outdoor environments, can be impacted by colder temperatures. Cold temperatures can cause equipment components to not function properly, to strain and possibly wear out. For example, hydraulic fluids can become less viscous under low temperatures which can lead to increased wear and potential failure of equipment (Jackson T., 2022). Furthermore, batteries do not operate as efficiently in cold weather, which can also lead to issues surrounding starting up equipment or maintaining sufficient power throughout operation (CCOHS, 2023). Extreme cold, heavy snowfall, high winds and ice can significantly disrupt various operations across different sectors. Cold temperatures can damage power lines and cause power outages which can lead to failures in heating infrastructure, while also halt construction projects due to materials freezing (NB Power, 2026). However, the frequency and severity of low temperatures are anticipated to decrease over the decades as average annual temperatures rise.



Heavy Precipitation (Rain and Snow)

Table C-3: Precipitation Projections

Climate Variables	Unit	Baseline (1981 – 2010)	Mid-term Projection (2050s)	Long-term Projection (2080s)	Overall Trend
Total Annual Precipitation Average total annual precipitation in the form of rainfall and snow	mm/Year	1228.0	1371.8	1444.1	↑
Wet Days >= 20 mm Average number of days per year with precipitation >= 20 mm (rain and snow combined)	Days/Year	11.2	14.8	17.0	↑
Maximum 5-Day Precipitation Average amount of precipitation that falls over a consecutive 5-day period	mm/Year	80.0	90.2	98.0	↑

Snow forecasting remains a difficult challenge for climate scientists and meteorologists. One reason is that during intense snows, the heaviest snowfall can occur on a smaller scale than observing networks and forecast zones can capture. Furthermore, the extremely small temperature differences that define the boundary line between rain and snow make large differences in snow forecasts. As average winter temperatures continue to approach the 0°C threshold, the region will continue to experience winter storm hazards but could experience more freezing rain and rain-on-snow events. As winters become warmer and precipitation shifts to more rainfall events, annual snowfall totals are expected to decrease (DeBeer, 2016).

On average, winter days and ice days can be anticipated to face a decrease while total annual precipitation and number of wet days are anticipated to increase. These compounding trends may point towards a greater proportion of precipitation falling in the form of rain instead of snow. However, snow events which do occur may be heavier in nature due to increased moisture content and accompanied or followed by rainfall, resulting in extremely heavy loading on trees and overhead infrastructure, including roofs and powerlines (Zarzycki, 2018). Winter snow loading and moisture content of snow events should continue to be analyzed and considered for roof and overhead infrastructure (i.e., powerlines) design. There is uncertainty in how well the available data captures intense and localized events, such as a snowstorm. Therefore, we have lower confidence in stating that there will be a decrease in precipitation as snow in the future.



Freeze-Thaw

Table C-4: Freeze-Thaw Cycle Projections

Climate Variables	Unit	Baseline (1981 – 2010)	Mid-term Projection (2050s)	Long-term Projection (2080s)	Overall Trend
Freeze-Thaw Cycles Average number of freeze-thaw cycles per year	Cycles/Year	82.2	75.3	71.2	↓

Freeze-thaw cycles are expected to decrease as more of the year will be spent at temperatures above 0°C. Water expands when it freezes, so the freezing, thawing and re-freezing of water over time can cause significant damage to roadways (e.g., the formation of potholes), sidewalks and other outdoor infrastructure (Climate Atlas, 2026).

High Wind Gusts

Table C-5: Wind Gust Projections

Climate Variables	Unit	Baseline (1981 – 2010)	Mid-term Projection (2050s)	Long-term Projection (2080s)	Overall Trend
High Winds >= 50 km/h Average number of days per year with wind gusts >= 50 km/h	Days/Year	16.8	n/a	18.4	↑
High Winds >= 70 km/h Average number of days per year with wind gusts >= 70 km/h	Days/Year	2.5	n/a	3.2	↑

How wind will be affected by climate change is not as well understood as variables such as temperature.

Data provided by the reference study shows a slight increase in high wind events. Table C-6 below presents excerpts from the Beaufort Wind Scale which defines the wind speed thresholds and their observed impacts.



Table C-6: Excerpt from Beaufort Wind Scale Table

Wind Speed (km/h)	Descriptive Term	Effects Observed on Land
39 – 49	Strong Breeze	Large branches in motion. Whistling heard in telephone wires. Umbrellas used with difficulty.
50 – 61	Near Gale	Whole trees in motion. Inconvenience felt in walking against wind.
62 – 74	Gale	Breaks twigs off trees. Generally, impedes progress. Walking into the wind is almost impossible.
75 – 88	Strong Gale	Slight structural damage occurs, e.g., roofing shingles may become loose or blow off.
89 – 102	Storm	Trees uprooted. Considerable structural damage occurs.
103 – 117	Violent Storm	Widespread damage. Exceptionally high waves at sea.
118 – 133	Hurricane	Rare. Severe widespread damage to vegetation and significant structural damage possible.

Note: Data are from ECCC (2017).

High Uncertainty – Extreme Weather Events

Many of the costlier and higher profile impacts from climate change are associated with events that are the most difficult to accurately project into the future. These events often are responsible for triggering multiple concurrent impacts, particularly in interconnected systems or services. However, the conditions that cause these extreme values involve complex weather systems that are difficult to model into the distant future. However, the frequency, intensity and duration of these extremes are expected to change with the climate. Most of which can lead to higher frequency and intensity of extreme weather events (Bush et al, 2019).

Nonetheless, it is especially important to view these extreme events through the lens of emergency preparedness planning and consider the appropriate responses as part of DCN's EMP. Data limitations and higher modelling uncertainties prevented us from applying a numerical analysis approach to these events. With the higher degree of uncertainty for extreme events due to limited data, these events were considered using a qualitative approach during the vulnerability assessment and adaptation planning workshop.

Appendix D

Vulnerability Interaction Matrices



Asset Listing	Climate Hazards																											
	High Temperatures Very Hot Days (+30 °C)			Low Temperatures Very Cold Days (-20 °C)			Heavy Precipitation Heavy Precipitation Days (20mm)			Freeze-Thaw Cycles Freeze-Thaw Counts			Freezing Rain Days with Rain or Ice Pellets lasting > 6 hrs			High Wind Gusts High Winds > 70km/hr			Drought Conditions Long Spell of Dry Days									
	Probability Score		3	Probability Score		4	Probability Score		4	Probability Score		4	Probability Score		2	Probability Score		3	Probability Score		2							
Transportation Assets	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R				
Asphalt Roadways and Parking Lots	Premature deterioration of asphalt surfaces (softening) leading to increased maintenance		2	6	Thermal cracking due to contraction; frost heaves damaging base layers		3	12	potential for "scouring" at edges; base saturation		2	8	Rapid formation of potholes; "alligator cracking" and base failure		3	12	0		0	0		0	0		0			
Gravel Roadways and Parking Lots	Increased dust and loss of binding fines; requires more frequent grading		0	0	Frost heaving		1	4	Significant washouts and "washboarding"; loss of surface material		2	8	Severe rutting and loss of stability during thaws; "mushy" surfaces		2	8	0		0	0		0	0		0			
Asphalt and Concrete Sidewalks	Concrete expansion leading to heaving; asphalt softening		1	3	Frost heaving and cracking; salt damage to concrete surfaces		3	12				0	Spalling (surface flaking) and uneven heaving; major trip hazards'		2	8	0		0	0		0	0		0			
Gravel or Natural Pedeterian Trails	Increased dust and loss of binding fines; requires more frequent grading; drying out of surfaces leading to cracks or loose surfaces		0	0	Frost heaving		1	4	Severe erosion and trail rutting; potential for slope failure/slumping		1	4	Significant erosion; surface becomes unstable and unusable in thaw		2	8	0		0	0		0	Surface hardening and cracking; accelerated deterioration		1	2		
Boardwalk (Wooden)			0	0			0	0			0	0			0	0	0		0	0		0			0	0		
Bridges	Expansion joints reaching max capacity; thermal stress on bearings		2	6	Seized expansion joints and bearings; structural steel embrittlement		2	8	Increased "scour" around piers; increased water levels (significant damage or washout); debris accumulation at water level		6	24	Rapid deterioration of concrete decks, steel and timber members; salt-water seepage into rebar; corrosion of steel and timber members from salt water		3	12	Increased load on structure due to ice accumulation on structure		3	6	Structural vibration; closure of long-span bridges to high-profile traffic		6	18	Abutment settling; potential for soil-structure separation		1	2
Water, Wastewater, and Stormwater Assets	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R				Impact		S	R	Impact		S	R	
U/G Sanitary Sewers			0	0	Older or poorly insulated pipes susceptible to cracking. Increased maintenance needs		3	12			0	0	Soil shifting causes pipe misalignment or joint failure in older lines		3	12			0	0			0	0			0	0
U/G Storm Sewers			0	0			0	0	Overflow and localized flooding		2	8			0	0			0	0			0	0			0	0
Maintenance Holes (Maintenance holes, Catchbasins)			0	0			0	0	Overflow and localized flooding		2	8			0	0			0	0			0	0			0	0
Wastewater Treatment Lagoon	Algae bloom, reduced dissolved oxygen, environmental compliance		2	6	Reduced aeration from freezing, biological activity slows		2	8	Risk of overtopping, erosion of berms		3	12	Berm instability		1	4	0		0	Wave action, erosion of berms		3	9	Reduced dilution, concentrated effluent (looking at the outfall, a downstream issues (determine location of outfall) - Check location for centreville		3	6	
Septic Tanks			0	0	Potential freezing stopping flow		2	8	Saturated drain fields leading to slow drainage or environmental damage		2	8	Potential for soil movement to crack the tank or disconnect piping		1	4	0		0			0	0			0	0	
Watermains			0	0	Frost penetration leads to main breaks; significant repair costs		4	16			0	0	High frequency of breaks due to "frost loading" and shifting soil		4	16	0		0			0	0			0	0	
Steel Water Reservoir			0	0	Risk of ice formation within the tank or freezing of inlet/outlet pipes, leading to a total loss of water supply to the community.		5	20	Potential for soil erosion or instability at the tank foundation.		1	4	Structural stress on tank foundations and expansion/contraction of joints and seals, potentially leading to leaks.		2	8	Potential damage to appurtances (ladder, antenna etc)		3	6	Potential damage to appurtances (ladder etc)		3	9			0	0
Private and Public Groundwater Wells	Increased pumping rates; Dropping water tables due to high demand/low recharge; water shortage		5	15	Risk of frozen wellheads or surface piping if not properly housed		4	16	Surface runoff contamination risks; potential for turbidity spikes; If GUDI, turbidity increases		2	8	Risk of frost heave damaging the well casing		0	0	0		0			0	0	Aquifer depletion; pump burnout; complete loss of water source		5	10	
Culverts and Drainage ditches			0	0			0	0	Increased "scour" around culvert; increased water levels (significant damage or washout). Blockages from debris leading to overtopping and road damage		6	24	Ice blockages combined with snowmelt lead to overtopping/washouts		2	8	0		0	Blockage from wind-blown debris/vegetation causing flow issues		2	6			0	0	
Fire Supply/ Water Hydrants	High demand during heatwaves		1	3	Risk of hydrants freezing if not drained		4	16			0	0	Soil heaving can "lift" the hydrant, causing internal leaks		2	8	0		0			0	0			0	0	
Community Structures (separated into building components)	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R				Impact		S	R	Impact		S	R	

Asset Listing	Climate Hazards																				
	High Temperatures Very Hot Days (+30 °C)			Low Temperatures Very Cold Days (-20 °C)			Heavy Precipitation Heavy Precipitation Days (20mm)			Freeze-Thaw Cycles Freeze-Thaw Counts			Freezing Rain Days with Rain or Ice Pellets lasting > 6 hrs			High Wind Gusts High Winds > 70km/hr			Drought Conditions Long Spell of Dry Days		
	Probability Score		3	Probability Score		4	Probability Score		4	Probability Score		4	Probability Score		2	Probability Score		3	Probability Score		2
Foundation/ Structure	Soil shrinkage (especially in clay) causing settlement or cracks	2	6	Cracking of foundations leading to increased maintenance and repair	2	8	Hydrostatic pressure causing seepage or basement flooding	3	12	Frost heave; serious structural cracking and shifting of footings	2	8		0	0		0	0		0	0
Roof (shingles)	Accelerated UV degradation and "blistering"; shortened lifespan	2	6	Brittleness makes them prone to wind damage; ice damming risk	2	8	High-volume runoff overwhelming gutters/downspouts	2	8		0	0		0	0	Blow-offs; loss of shingles leading to immediate water ingress	2	6		0	0
Roof (flat)	High temperatures causing premature cracking and blistering of rubber sealant/ covering	2	6	Membrane shrinkage and cracking	2	8	"Ponding" if drains are clogged	2	8	Severe stress on seams;	2	8	Ice formation in drainage systems causing ponding and potential leaks indoor	4	8	Peeling of membranes	1	3		0	0
Exterior Finishes	Fading, peeling paint, or warping of vinyl siding	1	3	Siding becomes brittle and prone to cracking	1	4		0	0	Mortar deterioration in brickwork; spalling of masonry units	1	4		0	0	Siding panels ripped off; damage from flying debris	2	6		0	0
Mechanical/ Electrical	Heavy HVAC use leading to premature motor failure or outages	3	9	Furnace/Boiler failures due to continuous high-load operation	3	12		0	0		0	0		0	0	Damage to external AC units or rooftop exhaust fans	2	6		0	0
Parks and Recreational Elements	Impact	S	R	Impact	S	R	Impact	S	R	Impact	S	R				Impact	S	R	Impact	S	R
Parks (Soccer Fields, Ball Fields, Tennis Courts, Playgrounds, Gazebos)	Turf browning; increased irrigation costs/water use; service impacted during high temperature days	1	3		0	0	Soil saturation leading to temporary closures to prevent turf damage	1	4		0	0	Damage to park trees; weight causes benches/fences to buckle	2	4	Damage to fences, gazebos, and light poles; loose equipment loss	2	6	Loss of turf; death of expensive landscaping/trees; high irrigation cost	2	4
Pools	Increased demand for service; higher chemical consumption and evaporation rates.	1	3		0	0	Water quality imbalance (pH/chlorine) requiring temporary closure; potential for runoff contamination or flooding of pump rooms.	1	4	Accelerated cracking of concrete pool shells and decking; damage to underground plumbing/recirculation lines.	3	12	Damage to pool covers, equipment or winterizing equipment.	2	4	Debris (branches/leaves) entering pool requiring extensive cleaning; potential damage to pool houses, fencing, or shade structures.	2	6		0	0
Forested and Vegetated Areas		0	0		0	0		0	0		0	0	Freezing rain and high winds causing damage to branches or total uprooting	3	6	Significant blow-down; hazardous hanging branches	2	6	Widespread tree mortality; extreme wildfire fuel loading	4	8
Rivers/Watercourses	Reduced oxygen (invasive species, algae blooms); potential fish kills	3	9	Deep ice cover; potential for "ice jams" leading to bank erosion	1	4	Rapid rise in water levels; bank erosion; loss of habitat	3	12	Bank instability and slumping as frozen soil thaws and loses cohesion	1	4		0	0	Significant wave action causing bank erosion	2	6	Loss of aquatic life; water quality degradation; loss of recreation	4	8
Additional Elements	Impact	S	R	Impact	S	R	Impact	S	R	Impact	S	R				Impact	S	R	Impact	S	R
Farmland	Crop heat stress; reduced yields; increased irrigation demand	4	12		0	0	Soil erosion; nutrient runoff; localized crop drowning/standing water	3	12		0	0		0	0	Soil erosion; damage to standing crops	2	6	Total crop failure; soil erosion; significant revenue losses	5	10
Power/ Utility Cables	Line sagging due to heat; reduced efficiency/transmission capacity; higher A/C loads during high temperatures leading to large scale outages/ brown outs	5	15	Higher heating loads (baseboard heaters) during Cold Temperatures could lead to large scale outages/ brown outs.	5	20		0	0	Increased pole leaning due to ground softening/refreezing	1	4	Line snapping due to heavy wet snow accumulation/ice loading	5	10	Line failure due to fallen trees or pole snapping; widespread outages	5	15		0	0
Communication/ Utility Cables	Line sagging due to heat; reduced efficiency/transmission capacity	2	6	Higher heating loads (baseboard heaters) during Cold Temperatures could lead to large scale outages/ brown outs.	4	16		0	0	Increased pole leaning due to ground softening/refreezing	1	4	Line snapping due to heavy wet snow accumulation/ice loading	4	8	Damage to aerial lines	5	15		0	0
SCADA	Makes voltage drop on lines to equipment, which affects efficiency/power usage. long durations would lead to motor burn outs or device failures. Lag in I/O's not switching quick enough and showing it as a fault for maintainance.	4	12	Higher heating loads during Cold Temperatures could lead to outages.	4	16		0	0	Increased frequency of freeze-thaw cycles drives significant frost heaving and soil expansion/contraction at building entry points. This movement places on rigid conduits, leading to cracking, shearing, or complete breakage of the conduit and the service feeders within.	3	12	Line snapping due to heavy wet snow accumulation/ice loading	4	8	Damage to radio tower or outside equipment.	3	9		0	0
Industrial Facilities	Increased cooling costs; potential for process slowdowns	1	3	Increased heating costs; potential for process slowdowns	1	4		0	0		0	0		0	0	Structural damage to tall stacks, silos, or large warehouse doors	2	6		0	0

Asset Listing		Climate Hazards																							
		High Temperatures Very Hot Days (+30 °C)			Low Temperatures Very Cold Days (-20 °C)			Heavy Precipitation Heavy Precipitation Days (20mm)			Freeze-Thaw Cycles Freeze-Thaw Counts			Freezing Rain Days with Rain or Ice Pellets lasting > 6 hrs			High Wind Gusts High Winds > 70km/hr			Drought Conditions Long Spell of Dry Days					
		Probability Score		3	Probability Score		4	Probability Score		4	Probability Score		4	Probability Score		2	Probability Score		3	Probability Score		2			
Fleet and Equipment		Engine overheating and increased wear on cooling systems during prolonged idling or emergency response.		1	3	Battery failures and cold-start issues; increased response times for emergency vehicles; diesel gelling. (confirm if the trucks / equipment is outside)		2	8	0		0	0		0	0		0	0		0	Increased dust clogging air filters and radiators, requiring more frequent and costly maintenance.		1	2

Asset Listing	Climate Hazards																								
	High Temperatures Very Hot Days (+30 °C)			Low Temperatures Very Cold Days (-20 °C)			Heavy Precipitation Heavy Precipitation Days (20mm)			Freeze-Thaw Cycles Freeze-Thaw Counts			Freezing Rain Days with Rain or Ice Pellets lasting > 6 hrs			High Wind Gusts High Winds > 70km/hr			Drought Conditions Long Spell of Dry Days						
	Probability Score		7	Probability Score		1	Probability Score		5	Probability Score		4	Probability Score		4	Probability Score		4	Probability Score		3				
Transportation Assets	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R					
Asphalt Roadways and Parking Lots	Premature deterioration of asphalt surfaces (softening) leading to increased maintenance		2	14	Thermal cracking due to contraction; frost heaves damaging base layers		3	3	potential for "scouring" at edges; base saturation		2	10	Rapid formation of potholes; "alligator cracking" and base failure		3	12			0	0			0	0	
Gravel Roadways and Parking Lots	Increased dust and loss of binding fines; requires more frequent grading		0	0	Frost heaving		1	1	Significant washouts and "washboarding"; loss of surface material		2	10	Severe rutting and loss of stability during thaws; "mushy" surfaces		2	8			0	0			0	0	
Asphalt and Concrete Sidewalks	Concrete expansion leading to heaving; asphalt softening		1	7	Frost heaving and cracking; salt damage to concrete surfaces		3	3				0	Spalling (surface flaking) and uneven heaving; major trip hazards		2	8			0	0			0	0	
Gravel or Natural Pedeterian Trails	Increased dust and loss of binding fines; requires more frequent grading; drying out of surfaces leading to cracks or loose surfaces		0	0	Frost heaving		1	1	Severe erosion and trail rutting; potential for slope failure/slumping		1	5	Significant erosion; surface becomes unstable and unusable in thaw		2	8			0	0			0	0	
Boardwalk (Wooden)			0	0			0	0			0	0			0	0			0	0			0	0	
Bridges	Expansion joints reaching max capacity; thermal stress on bearings		2	14	Seized expansion joints and bearings; structural steel embrittlement		2	2	Increased "scour" around piers; increased water levels (significant damage or washout); debris accumulation at water level		6	30	Rapid deterioration of concrete decks, steel and timber members; salt-water seepage into rebar; corrosion of steel and timber members from salt water		3	12	Increased load on structure due to ice accumulation on structure		3	12	Structural vibration; closure of long-span bridges to high-profile traffic		6	24	
Water, Wastewater, and Stormwater Assets			Impact		S	R	Impact		S	R	Impact		S	R				Impact		S	R	Impact		S	R
U/G Sanitary Sewers			0	0	Older or poorly insulated pipes susceptible to cracking. Increased maintenance needs		3	3			0	0	Soil shifting causes pipe misalignment or joint failure in older lines		3	12			0	0			0	0	
U/G Storm Sewers			0	0			0	0	Overflow and localized flooding		2	10			0	0			0	0			0	0	
Maintenance Holes (Maintenance holes, Catchbasins)			0	0			0	0	Overflow and localized flooding		2	10			0	0			0	0			0	0	
Wastewater Treatment Lagoon	Algae bloom, reduced dissolved oxygen, environmental compliance		2	14	Reduced aeration from freezing, biological activity slows		2	2	Risk of overtopping, erosion of berms		3	15	Berm instability		1	4			0	0	Wave action, erosion of berms		3	12	
Septic Tanks			0	0	Potential freezing stopping flow		2	2	Saturated drain fields leading to slow drainage or environmental damage		2	10	Potential for soil movement to crack the tank or disconnect piping		1	4			0	0			0	0	
Watermains			0	0	Frost penetration leads to main breaks; significant repair costs		4	4			0	0	High frequency of breaks due to "frost loading" and shifting soil		4	16			0	0			0	0	
Steel Water Reservoir			0	0	Risk of ice formation within the tank or freezing of inlet/outlet pipes, leading to a total loss of water supply to the community.		5	5	Potential for soil erosion or instability at the tank foundation.		1	5	Structural stress on tank foundations and expansion/contraction of joints and seals, potentially leading to leaks.		2	8	Potential damage to appurtances (ladder, antenna etc)		3	12	Potential damage to appurtances (ladder etc)		3	12	
Private and Public Groundwater Wells	Increased pumping rates; Dropping water tables due to high demand/low recharge; water shortage		5	35	Risk of frozen wellheads or surface piping if not properly housed		4	4	Surface runoff contamination risks; potential for turbidity spikes; If GUDI, turbidity increases		2	10	Risk of frost heave damaging the well casing		0	0			0	0			0	0	

Asset Listing	Climate Hazards																				
	High Temperatures Very Hot Days (+30 °C)			Low Temperatures Very Cold Days (-20 °C)			Heavy Precipitation Heavy Precipitation Days (20mm)			Freeze-Thaw Cycles Freeze-Thaw Counts			Freezing Rain Days with Rain or Ice Pellets lasting > 6 hrs			High Wind Gusts High Winds > 70km/hr			Drought Conditions Long Spell of Dry Days		
	Probability Score	7		Probability Score	1		Probability Score	5		Probability Score	4		Probability Score	4		Probability Score	4		Probability Score	3	
Culverts and Drainage ditches		0	0		0	0	Increased "scour" around culvert; increased water levels (significant damage or washout). Blockages from debris leading to overtopping and road damage	6	30		2	8		0	0	Blockage from wind-blown debris/vegetation causing flow issues	2	8		0	0
Fire Supply/ Water Hydrants	High demand during heatwaves	1	7	Risk of hydrants freezing if not drained	4	4		0	0	Soil heaving can "lift" the hydrant, causing internal leaks	2	8		0	0		0	0		0	0
Community Structures (separated into building components)	Impact	S	R	Impact	S	R	Impact	S	R	Impact	S	R				Impact	S	R	Impact	S	R
Foundation/ Structure	Soil shrinkage (especially in clay) causing settlement or cracks	2	14	Cracking of foundations leading to increased maintenance and repair	2	2	Hydrostatic pressure causing seepage or basement flooding	3	15	Frost heave; serious structural cracking and shifting of footings	2	8		0	0		0	0		0	0
Roof (shingles)	Accelerated UV degradation and "blistering"; shortened lifespan	2	14	Brittleness makes them prone to wind damage; ice damming risk	2	2	High-volume runoff overwhelming gutters/downspouts	2	10		0	0		0	0	Blow-offs; loss of shingles leading to immediate water ingress	2	8		0	0
Roof (flat)	High temperatures causing premature cracking and blistering of rubber sealant/covering	2	14	Membrane shrinkage and cracking	2	2	"Ponding" if drains are clogged	2	10	Severe stress on seams;	2	8	Ice formation in drainage systems causing ponding and potential leaks indoor	4	16	Peeling of membranes	1	4		0	0
Exterior Finishes	Fading, peeling paint, or warping of vinyl siding	1	7	Siding becomes brittle and prone to cracking	1	1		0	0	Mortar deterioration in brickwork; spalling of masonry units	1	4		0	0	Siding panels ripped off; damage from flying debris	2	8		0	0
Mechanical/ Electrical	Heavy HVAC use leading to premature motor failure or outages	3	21	Furnace/Boiler failures due to continuous high-load operation	3	3		0	0		0	0		0	0	Damage to external AC units or rooftop exhaust fans	2	8		0	0
Parks and Recreational Elements	Impact	S	R	Impact	S	R	Impact	S	R	Impact	S	R				Impact	S	R	Impact	S	R
Parks (Soccer Fields, Ball Fields, Tennis Courts, Playgrounds, Gazebos)	Turf browning; increased irrigation costs/water use; service impacted during high temperature days	1	7		0	0	Soil saturation leading to temporary closures to prevent turf damage	1	5		0	0	Damage to park trees; weight causes benches/fences to buckle	2	8	Damage to fences, gazebos, and light poles; loose equipment loss	2	8	Loss of turf; death of expensive landscaping/trees; high irrigation cost	2	6
Pools	Increased demand for service; higher chemical consumption and evaporation rates.	1	7		0	0	Water quality imbalance (pH/chlorine) requiring temporary closure; potential for runoff contamination or flooding of pump rooms.	1	5	Accelerated cracking of concrete pool shells and decking; damage to underground plumbing/recirculation lines.	3	12	Damage to pool covers, equipment or winterizing equipment.	2	8	Debris (branches/leaves) entering pool requiring extensive cleaning; potential damage to pool houses, fencing, or shade structures.	2	8		0	0
Forested and Vegetated Areas		0	0		0	0		0	0		0	0	Freezing rain and high winds causing damage to branches or total uprooting	3	12	Significant blow-down; hazardous hanging branches	2	8	Widespread tree mortality; extreme wildfire fuel loading	4	12
Rivers/Watercourses	Reduced oxygen (invasive species, algae blooms); potential fish kills	3	21	Deep ice cover; potential for "ice jams" leading to bank erosion	1	1	Rapid rise in water levels; bank erosion; loss of habitat	3	15	Bank instability and slumping as frozen soil thaws and loses cohesion	1	4		0	0	Significant wave action causing bank erosion	2	8	Loss of aquatic life; water quality degradation; loss of recreation	4	12
Additional Elements	Impact	S	R	Impact	S	R	Impact	S	R	Impact	S	R				Impact	S	R	Impact	S	R
Farmland	Crop heat stress; reduced yields; increased irrigation demand	4	28		0	0	Soil erosion; nutrient runoff; localized crop drowning/standing water	3	15		0	0		0	0	Soil erosion; damage to standing crops	2	8	Total crop failure; soil erosion; significant revenue losses	5	15
Power/ Utility Cables	Line sagging due to heat; reduced efficiency/transmission capacity; higher A/C loads during high temperatures leading to large scale outages/ brown outs	5	35	Higher heating loads (baseboard heaters) during Cold Temperatures could lead to large scale outages/ brown outs.	5	5		0	0	Increased pole leaning due to ground softening/refreezing	1	4	Line snapping due to heavy wet snow accumulation/ice loading	5	20	Line failure due to fallen trees or pole snapping; widespread outages	5	20		0	0

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	High Temperatures Very Hot Days (+30 °C)			Low Temperatures Very Cold Days (-20 °C)			Heavy Precipitation Heavy Precipitation Days (20mm)			Freeze-Thaw Cycles Freeze-Thaw Counts			Freezing Rain Days with Rain or Ice Pellets lasting > 6 hrs			High Wind Gusts High Winds > 70km/hr			Drought Conditions Long Spell of Dry Days		
	Probability Score	7		Probability Score	1		Probability Score	5		Probability Score	4		Probability Score	4		Probability Score	4		Probability Score	3	
Communication/ Utility Cables	Line sagging due to heat; reduced efficiency/transmission capacity	2	14	Higher heating loads (baseboard heaters) during Cold Temperatures could lead to large scale outages/ brown outs.	4	4		0	0	Increased pole leaning due to ground softening/refreezing	1	4	Line snapping due to heavy wet snow accumulation/ice loading	4	16	Damage to aerial lines	5	20		0	0
SCADA	Makes voltage drop on lines to equipment, which affects efficiency/power usage. long durations would lead to motor burn outs or device failures. Lag in I/O's not switching quick enough and showing it as a fault for maintenance.	4	28	Higher heating loads during Cold Temperatures could lead to outages.	4	4		0	0	Increased frequency of freeze-thaw cycles drives significant frost heaving and soil expansion/contraction at building entry points. This movement places on rigid conduits, leading to cracking, shearing, or complete breakage of the conduit and the service feeders within.	3	12	Line snapping due to heavy wet snow accumulation/ice loading	4	16	Damage to radio tower or outside equipment.	3	12		0	0
Industrial Facilities	Increased cooling costs; potential for process slowdowns	1	7	Increased heating costs; potential for process slowdowns	1	1		0	0		0	0		0	0	Structural damage to tall stacks, silos, or large warehouse doors	2	8		0	0
Fleet and Equipment	Engine overheating and increased wear on cooling systems during prolonged idling or emergency response.	1	7	Battery failures and cold-start issues; increased response times for emergency vehicles; diesel gelling. (confirm if the trucks / equipment is outside)	2	2		0	0		0	0		0	0		0	0	Increased dust clogging air filters and radiators, requiring more frequent and costly maintenance.	1	3

[illegible]

Asset Listing	Climate Hazards																											
	High Temperatures Very Hot Days (+30 °C)			Low Temperatures Very Cold Days (-20 °C)			Heavy Precipitation Heavy Precipitation Days (20mm)			Freeze-Thaw Cycles Freeze-Thaw Counts			Freezing Rain Days with Rain or Ice Pellets lasting > 6 hrs			High Wind Gusts High Winds > 70km/hr			Drought Conditions Long Spell of Dry Days									
	Probability Score		3	Probability Score		4	Probability Score		4	Probability Score		4	Probability Score		2	Probability Score		3	Probability Score		2							
Emergency and Public Safety (Fire, Police, etc.)	Increased emergency calls for heat-related illnesses; heat stress for first responders; strain on station cooling systems.		1	3			0	0	Flooded access routes delaying response times; surge in calls for water rescues and flooding assistance.		5	20			0	0	Loss of power to dispatch and communication systems; road blockages from downed trees/lines preventing emergency access.		5	10	Loss of power to dispatch and communication systems; road blockages from downed trees/lines preventing emergency access.		5	15	Reduced water availability/pressure for firefighting; significantly increased risk of wildfires in vegetated or rural areas.		5	10
Healthcare and Wellness (Hospitals, Urgent Care, LTC/Nursing Homes)	Surge in patient admissions for heatstroke and dehydration; critical health risks to elderly residents if HVAC systems fail.		5	15	Increased demand for emergency care due to cold exposure (hypothermia/frostbite) and slips on ice.		1	4	Potential for basement flooding affecting laundry, food service, or mechanical systems; staff shortages due to commute disruptions.		3	12			0	0	Dependence on backup generators for life-saving equipment; potential loss of temperature-controlled medical supplies.		4	8	Dependence on backup generators for life-saving equipment; potential loss of temperature-controlled medical supplies.		4	12			0	0
Educational (Schools, Libraries)	Closure of schools or libraries without modern A/C; cancellation of outdoor youth sports and recreation programs.		2	6			0	0			0	0	Accelerated damage to parking lots and walkways, increasing liability for trips/falls.		2	8			0	0			0	0	Deterioration of community playing fields and green spaces; restricted water use for splash pads or landscaping.		2	4
Recreation (Community Centers)			0	0			0	0			0	0	Accelerated damage to parking lots and walkways, increasing liability for trips/falls.		2	8			0	0			0	0	Deterioration of community playing fields and green spaces; restricted water use for splash pads or landscaping.		2	4
Administrative	Increased demand on social centers to serve as "Cooling Centers" for the public; reduced staff productivity in older buildings.		2	6	Critical surge in demand for warming centers and social support services during extreme cold events.		2	8			0	0			0	0	Interruption of municipal governance and public meetings; loss of online services or public-facing digital communications.		1	2	Interruption of municipal governance and public meetings; loss of online services or public-facing digital communications.		1	3			0	0
Social and Support (Shelters, Food Banks)	Increased demand on social centers to serve as "Cooling Centers" for the public; reduced staff productivity in older buildings.		2	6	Critical surge in demand for warming centers and social support services during extreme cold events.		5	20	Potential for water damage to physical records, archives, or IT equipment stored in basements/lower levels.		2	8			0	0	Loss of power to to provide services to public.		4	8	Loss of power to to provide services to public.		4	12			0	0
Utility and Infrastructure			0	0			0	0	Overloading of combined or storm sewer systems, causing surface flooding and erosion near critical infrastructure sites.		2	8	Repeated frost heaving causing damage to underground pipe connections and building foundations.		3	12	Direct damage to overhead lines and poles leading to widespread, multi-day outages for residents and businesses.		5	10	Direct damage to overhead lines and poles leading to widespread, multi-day outages for residents and businesses.		4	12			0	0
Parks and Recreational Elements	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R
Parks (Soccer Fields, Ball Fields, Tennis Courts, Playgrounds, Gazebos)	Service impacted during high temperature days - potential for heat stroke		1	3	Service impacted during low temperature days - cold exposure		1	4			0	0	There will likely be an increase in costs/labour to maintain the trails in the future due to increased freeze thaw.		2	8	There will likely be an increase in costs/labour to maintain the trails in the future due to increased freezing rain.		2	4			0	0			0	0
Pools	potential for heat-related illness for staff/patrons.		1	3			0	0	Water quality imbalance (pH/chlorine) requiring temporary closure; potential for runoff contamination or flooding of pump rooms.		2	8			0	0			0	0			0	0	Municipal water restrictions may prevent refilling or topping up pool levels, potentially forcing season-long closure.		4	8
Forested and Vegetated Areas			0	0			0	0			0	0			0	0	Ice accretion can lead to uprooted trees or damaged branches - increase in costs/labour to maintain the trees and trails		3	6	High wind can lead to uprooted trees or damaged branches - increase in costs/labour to maintain the trees and trails		4	12			0	0
Rivers/Watercourses			0	0			0	0			0	0			0	0			0	0			0	0	Low water levels, restricting use.		4	8
Additional Elements	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R
Farmland	Changes in temperatures causing changes in growing seasons, could impact hobby farms as residents move towards increasing food security		2	6			0	0	Soil erosion; nutrient runoff; localized crop drowning/standing water; Heavy rainfall causing runoff leading to contamination. Private wells (if GUDI) could be compromised in the area		4	16			0	0			0	0			0	0	Decreased crop yield;		4	8

Asset Listing	Climate Hazards																				
	High Temperatures Very Hot Days (+30 °C)			Low Temperatures Very Cold Days (-20 °C)			Heavy Precipitation Heavy Precipitation Days (20mm)			Freeze-Thaw Cycles Freeze-Thaw Counts			Freezing Rain Days with Rain or Ice Pellets lasting > 6 hrs			High Wind Gusts High Winds > 70km/hr			Drought Conditions Long Spell of Dry Days		
	Probability Score		3	Probability Score		4	Probability Score		4	Probability Score		4	Probability Score		2	Probability Score		3	Probability Score		2
Power/ Utility/ Communication Cables	Higher A/C loads during High Temperatures leading to large scale outages/ brown outs	5	15	Higher heating loads (baseboard heaters) during Cold Temperatures could lead to large scale outages/ brown outs	5	20			0			0	Ice accretion on utility lines causing damage or total failure - loss of service.	6	12	High Winds causing damage or total failure - loss of service	6	18		0	0
SCADA	Makes voltage drop on lines to equipment, which affects efficiency/power usage. Long durations would lead to motor burn outs or device failures and increased maintenance needs. Lag in I/O's not switching quick enough and showing it as a fault for maintainance.	1	3	Higher heating loads during Cold Temperatures could lead to outages and increased maintenance needs.	1	4		0	0	Ground heave shears conduits and service feeders at building entries, causing total power failure. Leads to critical service outages and safety risks; repair requires major capital excavation. (High risk at frost-susceptible entry points).	6	24		0	0		0	0		0	0
Industrial Facilities		0	0		0	0		0	0		0	0		0	0		0	0		0	0
Fleet and Equipment		0	0		0	0	Reduced visibility and hydroplaning risks; fleet unable to access areas with significant road washouts.	4	16		0	0	Extreme safety risk for operators; high probability of accidents or fleet being grounded until roads are treated.	5	10	Risk of tipping for high-profile vehicles (tankers/rescues); road blockages from downed trees preventing deployment.	3	9		0	0

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	High Temperatures Very Hot Days (+30 °C)			Low Temperatures Very Cold Days (-20 °C)			Heavy Precipitation Heavy Precipitation Days (20mm)			Freeze-Thaw Cycles Freeze-Thaw Counts			Freezing Rain Days with Rain or Ice Pellets lasting > 6 hrs			High Wind Gusts High Winds > 70km/hr			Drought Conditions Long Spell of Dry Days											
	Probability Score		7	Probability Score		1	Probability Score		5	Probability Score		4	Probability Score		4	Probability Score		4	Probability Score		3									
Transportation Assets	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R										
Asphalt Roadways and Parking Lots			0	0			0	0	Hydroplaning risks; reduced speeds		1	5	Bumpy uneven driving surface; reduced speeds		1	4	Slippery road conditions - safety issues, and strain on operations and maintenance staff.		4	16			0	0						
Gravel Roadways and Parking Lots	Increased dust from hot and dry weather, leading to service impacts (poor air quality)		1	7			0	0	Washouts and "washboarding" causing bumpy uneven driving surface; reduced speeds		1	5	Freeze-thaw causing heaving of asphalt surfaces leading to deterioration and rutting; reduced speeds		1	4	Slippery road conditions - safety issues, and strain on operations and maintenance staff.		4	16	Increased dust leading to service impacts (poor air quality)		1	4	Extreme dust (visibility hazard/ poor air quality)		1	3		
Asphalt and Concrete Sidewalks			0	0			0	0	Localized ponding; reduced speeds		1	5			0	0	Slippery Conditions - safety issues and strain on operations and maintenance staff. Could lead to increased legal fees due to increased slips/trips/falls claims		5	20			0	0			0	0		
Gravel or Natural Pedeterian Trails	Increased dust from hot and dry weather, leading to service impacts (poor air quality)		1	7			0	0	Washouts and "washboarding" of gravel, localized ponding cause uneven walking surfaces, leading to risk of sprains and strains		1	5	Freeze-thaw causing heaving of asphalt surfaces causing uneven walking surfaces, Could lead to increased legal fees due to increased slips/trips/falls claims		1	4	Slippery Conditions - safety issues and strain on operations and maintenance staff. Could lead to increased legal fees due to increased slips/trips/falls claims		1	4	Increased dust leading to service impacts (poor air quality)		1	4	Extreme dust (visibility hazard/ poor air quality)		1	3		
Boardwalk (Wooden)			0	0			0	0			0	0			0	0	Slippery Conditions - safety issues and strain on operations and maintenance staff. Could lead to increased legal fees due to increased slips/trips/falls claims		1	4			0	0			0	0		
Bridges			0	0			0	0	Localized flooding on bridge leading to service impacts, reduced speeds		1	5			0	0	Slippery road conditions - safety issues, and strain on operations and maintenance staff.		4	16			0	0			0	0		
Water, Wastewater, and Stormwater Assets			Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R				
U/G Sanitary Sewers					0	0			0	0	Inflow and Infiltration (I&I) causing surcharging and backups		3	15			0	0			0	0			0	0			0	0
U/G Storm Sewers					0	0			0	0			0	0			0	0			0	0			0	0			0	0
Maintenance Holes (Maintenance holes, Catchbasins)					0	0			0	0			0	0			0	0			0	0			0	0			0	0
Wastewater Treatment Lagoon					0	0			0	0	Increased odours		1	5			0	0			0	0			0	0			0	0
Septic Tanks					0	0			0	0			0	0			0	0			0	0			0	0			0	0
Watermains					0	0	Potentially leading to break, could lead to boil water advisory.		4	4			0	0	Potentially leading to break, could lead to boil water advisory.		4	16			0	0			0	0			0	0
Steel Water Reservoir			Increased water demand leading to rapid drawdown; potential for water quality issues (e.g., bacterial growth) if tank temperatures rise significantly.		2	14	Maintenance and repairs of tank and inlet/outlet pipes due to ice formations		3	3			0	0			0	0			0	0			0	0			0	0
Groundwater Wells			Increased pumping rates; Dropping water tables due to high demand/low recharge; water shortage		5	35			0	0	Runoff contamination to water supply		5	25			0	0			0	0			0	0	Reduced water supply leading to loss of service		5	15
Culverts and Drainage ditches					0	0			0	0			0	0			0	0			0	0			0	0			0	0
Fire Supply/ Water Hydrants					0	0	Risk of hydrants freezing if not drained, higher difficulty operating nuts on hydrant		3	3			0	0			0	0	Impact serviceability if ice covered		3	12			0	0	Potentially unusable if supply is restricted		5	15

Asset Listing	Climate Hazards																												
	High Temperatures Very Hot Days (+30 °C)			Low Temperatures Very Cold Days (-20 °C)			Heavy Precipitation Heavy Precipitation Days (20mm)			Freeze-Thaw Cycles Freeze-Thaw Counts			Freezing Rain Days with Rain or Ice Pellets lasting > 6 hrs			High Wind Gusts High Winds > 70km/hr			Drought Conditions Long Spell of Dry Days										
	Probability Score		7	Probability Score		1	Probability Score		5	Probability Score		4	Probability Score		4	Probability Score		4	Probability Score		3								
Community Structures (separated into building services)	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R					
Emergency and Public Safety (Fire, Police, etc.)	Increased emergency calls for heat-related illnesses; heat stress for first responders; strain on station cooling systems.		1	7			0	0	Flooded access routes delaying response times; surge in calls for water rescues and flooding assistance.		5	25			0	0	Loss of power to dispatch and communication systems; road blockages from downed trees/lines preventing emergency access.		5	20	Loss of power to dispatch and communication systems; road blockages from downed trees/lines preventing emergency access.		5	20	Reduced water availability/pressure for firefighting; significantly increased risk of wildfires in vegetated or rural areas.		5	15	
Healthcare and Wellness (Hospitals, Urgent Care, LTC/Nursing Homes)	Surge in patient admissions for heatstroke and dehydration; critical health risks to elderly residents if HVAC systems fail.		5	35	Increased demand for emergency care due to cold exposure (hypothermia/frostbite) and slips on ice.		1	1	Potential for basement flooding affecting laundry, food service, or mechanical systems; staff shortages due to commute disruptions.		3	15			0	0	Dependence on backup generators for life-saving equipment; potential loss of temperature-controlled medical supplies.		4	16	Dependence on backup generators for life-saving equipment; potential loss of temperature-controlled medical supplies.		4	16			0	0	
Educational (Schools, Libraries)	Closure of schools or libraries without modern A/C; cancellation of outdoor youth sports and recreation programs.		2	14				0	0			0	0	Accelerated damage to parking lots and walkways, increasing liability for trips/falls.		2	8			0	0			0	0	Deterioration of community playing fields and green spaces; restricted water use for splash pads or landscaping.		2	6
Recreation (Community Centers)			0	0				0	0			0	0	Accelerated damage to parking lots and walkways, increasing liability for trips/falls.		2	8			0	0			0	0	Deterioration of community playing fields and green spaces; restricted water use for splash pads or landscaping.		2	6
Administrative	Increased demand on social centers to serve as "Cooling Centers" for the public; reduced staff productivity in older buildings.		2	14	Critical surge in demand for warming centers and social support services during extreme cold events.		2	2			0	0			0	0	Interruption of municipal governance and public meetings; loss of online services or public-facing digital communications.		1	4	Interruption of municipal governance and public meetings; loss of online services or public-facing digital communications.		1	4			0	0	
Social and Support (Shelters, Food Banks)	Increased demand on social centers to serve as "Cooling Centers" for the public; reduced staff productivity in older buildings.		2	14	Critical surge in demand for warming centers and social support services during extreme cold events.		5	5	Potential for water damage to physical records, archives, or IT equipment stored in basements/lower levels.		2	10			0	0	Loss of power to to provide services to public.		4	16	Loss of power to to provide services to public.		4	16			0	0	
Utility and Infrastructure			0	0				0	0	Overloading of combined or storm sewer systems, causing surface flooding and erosion near critical infrastructure sites.		2	10	Repeated frost heaving causing damage to underground pipe connections and building foundations.		3	12	Direct damage to overhead lines and poles leading to widespread, multi-day outages for residents and businesses.		5	20	Direct damage to overhead lines and poles leading to widespread, multi-day outages for residents and businesses.		4	16			0	0
Parks and Recreational Elements	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	
Parks (Soccer Fields, Ball Fields, Tennis Courts, Playgrounds, Gazebos)	Service impacted during high temperature days - potential for heat stroke		1	7	Service impacted during low temperature days - cold exposure		1	1			0	0	There will likely be an increase in costs/labour to maintain the trails in the future due to increased freeze thaw.		2	8	There will likely be an increase in costs/labour to maintain the trails in the future due to increased freezing rain.		2	8			0	0			0	0	
Pools	potential for heat-related illness for staff/patrons.		1	7				0	0	Water quality imbalance (pH/chlorine) requiring temporary closure; potential for runoff contamination or flooding of pump rooms.		2	10			0	0			0	0			0	0	Municipal water restrictions may prevent refilling or topping up pool levels, potentially forcing season-long closure.		4	12
Forested and Vegetated Areas			0	0				0	0			0	0			0	0	Ice accretion can lead to uprooted trees or damaged branches - increase in costs/labour to maintain the trees and trails		3	12	High wind can lead to uprooted trees or damaged branches - increase in costs/labour to maintain the trees and trails		4	16			0	0
Rivers/Watercourses			0	0				0	0			0	0			0	0			0	0			0	0	Low water levels, restricting use.		4	12

Asset Listing		Climate Hazards																							
		High Temperatures Very Hot Days (+30 °C)			Low Temperatures Very Cold Days (-20 °C)			Heavy Precipitation Heavy Precipitation Days (20mm)			Freeze-Thaw Cycles Freeze-Thaw Counts			Freezing Rain Days with Rain or Ice Pellets lasting > 6 hrs			High Wind Gusts High Winds > 70km/hr			Drought Conditions Long Spell of Dry Days					
		Probability Score		7	Probability Score		1	Probability Score		5	Probability Score		4	Probability Score		4	Probability Score		4	Probability Score		3			
Additional Elements		Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R	Impact		S	R
Farmland		Changes in temperatures causing changes in growing seasons, could impact hobby farms as residents move towards increasing food security		2	14			0	0	Heavy rainfall causing runoff leading to contamination. Private wells (if GUDI) could be compromised in the area		4	20			0	0			0	0	Decreased crop yield		4	12
Power/ Utility/ Communication Cables		Higher A/C loads during High Temperatures leading to large scale outages/ brown outs		5	35	Higher heating loads (baseboard heaters) during Cold Temperatures could lead to large scale outages/ brown outs		5	5				0	Ice accretion on utility lines causing damage or total failure - loss of service.		6	24	High Winds causing damage or total failure - loss of service		6	24			0	0
Communication/ Utility Cables		Higher A/C loads during High Temperatures leading to large scale outages/ brown outs		5	35				0			0	0				0	High Winds causing damage or total failure - loss of service		6	24				0
SCADA		Makes voltage drop on lines to equipment, which affects efficiency/power usage. Long durations would lead to motor burn outs or device failures and increased maintenance needs. Lag in I/O's not switching quick enough and showing it as a fault for maintainance.		1	7	Higher heating loads during Cold Temperatures could lead to outages and increased maintenance needs.		1	1			0	0	Ground heave shears conduits and service feeders at building entries, causing total power failure. Leads to critical service outages and safety risks; repair requires major capital excavation. (High risk at frost-susceptible entry points).		6	24			0	0			0	0
Industrial Facilities				0	0			0	0			0	0			0	0			0	0			0	0
Fleet and Equipment				0	0			0	0	Reduced visibility and hydroplaning risks; fleet unable to access areas with significant road washouts.		4	20			0	0	Extreme safety risk for operators; high probability of accidents or fleet being grounded until roads are treated.		5	20	Risk of tipping for high-profile vehicles (tankers/rescues); road blockages from downed trees preventing deployment.		3	12

Appendix E

“What We Heard” Memorandum



Memo



To: District of Carleton North
From: Dillon Consulting Limited
Date: March 16, 2026
Subject: CCAP Engagement Results
Our File: 25-2522

1.0

Introduction

This report presents the findings from the Community Survey which was posted on February 9 and received a total of 26 participants. Engagement is a cornerstone of the project and the survey provided an opportunity to share the project's objectives, gather valuable local knowledge on climate impacts, and build community support for the adaptation planning process. By introducing climate projections to the public and their associated climate stressors, the project team was able to validate theoretical vulnerabilities with the lived experiences of District of Carleton North residents. The insights captured here will help ensure that the resulting adaptation strategies are grounded in local reality.

2.0

Project Context

The development of the District of Carleton North CCAP relies on a blend of scientific modeling and community wisdom. While previous stages of the project focused on gathering infrastructure data and conducting internal vulnerability workshops, the survey was designed to "ground-truth" those findings. Residents were invited to review projected climate shifts and provide direct feedback on how these changes impact four critical pillars:

- Transportation Networks (Roads, bridges, and culverts)
- Water and Stormwater (Well water, drainage, and flooding)
- Community Assets (Emergency services and public buildings)
- Agriculture and Natural Resources (Local industry and land use)

The goal was to move beyond identifying what is at risk and begin discussing how the community can best respond.

Steering Committee Feedback

While the community survey captured the personal experiences of residents, the following technical details and infrastructure-level priorities were identified by the Steering Committee which consisted of municipal staff to ground the adaptation plan in operational reality.

High Temperatures / Drought

The discussion focused on the physical impacts of extreme heat on infrastructure and the long-term sustainability of community water and agricultural resources.

- **Asphalt and Infrastructure**
Exploration of higher asphalt binder grades to withstand higher temperatures, though it was noted this increases capital costs. While "very high" temperatures are a concern, rutting is currently seen as less of an issue compared to damage from freeze-thaw cycles.
- **Water Supply and Public Wells**
Bristol has already experienced wells going dry. A groundwater study is proposed as part of future subdivision agreements, specifically noting the need for SCADA on Rim Road (14 units).
- **Fire Protection**
Identified the need to invest in dry hydrants. Notable existing water sources include a fill station at McCains and a cistern at Metal Fab, though Glassville and Lakeville lack adequate accessibility.
- **Agriculture and Environment**
Anticipated service impacts for farmers in the future due to changing climate parameters. The Beautification Team is recommended to transition toward drought-resistant species and perennials for community flowers.

Heavy Precipitation

Heavy rainfall was linked to historical flooding events and current deficiencies in drainage and sewer infrastructure.

- **Sanitary Sewer and Stormwater**
Requirement for backflow preventers on all new builds. Implementation of a flushing and camera program (NASSCO standards) and an I&I (Inflow and Infiltration) study is required.
- **Shared Services**
Current street sweeping utilizes Woodstock's infrastructure.
- **Historical Flooding Reference**
Significant flooding was recorded in 2008 at the Bristol Lagoon, Home Hardware, and Main Street. Other flood-prone areas include 105 Flooding, Tapley Road (during spring high water), and Juniper Road.
- **Culverts and Erosion**
A 2017 Culvert Study exists; however, many municipal streets currently lack proper ditching. Bank

erosion is a major concern in Florenceville and Bristol; planting initiatives are suggested in collaboration with the St. John River Watershed Association.

3.3 Freezing Rain / Freeze Thaw / High Wind

Discussion centered on power resilience and the protection of vulnerable populations during ice events.

- **Power and Backup Generation**
Currently, backup power is insufficient across municipal buildings. Recommendations include installing backup generators for the Vesey Centre, Multi-Plex, Town Hall, and the remaining two Fire Halls.
- **Vulnerable Populations**
Priority for backup power should be given to Assisted Living/Senior Homes and the Bath Hospital, which is opening a new Dementia/Alzheimer's facility.
- **Utility Maintenance**
Coordinate with NB Power on tree clearing; a list of priority areas should be developed with input from the general public.

3.4 General Asset Management and Planning

Integrated planning discussions highlighted several systemic issues that span multiple asset classes and impact overall municipal resilience.

- **Condition Assessments**
There are currently no formal condition assessments for municipal buildings; however, all buildings are insured and have fire ratings through fire underwriters.
- **Lift Stations**
The Florenceville Lagoon has experienced issues. While one well has a backup generator, the other does not.
- **Emergency Communications**
Cell service in the region is noted as "very poor," and the Fire Department utilizes TMR (Trunked Mobile Radio).

4.0 Community Feedback

The survey invited residents and stakeholders to share their perspectives on increasing climate stressors and the specific ways these changes affect municipal infrastructure and assets. The following summary details residents' personal experiences with climate shifts and identifies local vulnerabilities to inform the District's adaptation strategies. These insights are based on written participant responses regarding how climate events have impacted their daily lives, properties, and the broader community.

High Temperatures

Projections indicate a significant increase in the number of days exceeding 30°C. Residents were asked to consider both the structural and personal impacts of this trend with residents having expressed a strong link to their personal food security.

Q1: What measures can be done to reduce the impacts of high temperatures on public infrastructure?

- Planting more trees and increasing green spaces near buildings, along sidewalks, and in parks was the most frequent suggestion to provide shade and reduce temperatures.
- Suggestions included using better building materials, lighter colors for buildings and road surfaces, improving insulation/heating/cooling in new municipal buildings, and retrofitting community halls for greater energy efficiency to provide cooling spaces.
- Responses suggested budgeting for on-site renewable energy sources for municipal buildings and switching to solar or wind power for electricity to reduce heat-trapping gases.
- Responses mentioned the need for less pavement/concrete, protecting watersheds, thoughtful drainage planning, and reducing deforestation, especially along rivers and brooks.
- Suggestions included raising awareness of local climate impact, preserving woodlands and wetlands, and consulting scientists for informed solutions.

Q2: How have high temperatures affected you personally?

- High temperatures have led to increased use of air conditioning, resulting in higher electricity/hydro bills for cooling homes and vehicles.
- Respondents are spending less time outside, staying indoors, and facing challenges with working outside for extended periods.
- Difficulties cooling homes due to building standards that don't incorporate passive energy management systems were noted.

Drought

Based on the community feedback collected, the impacts of drought in the District of Carleton North are wide-ranging, affecting everything from basic household needs to the viability of local agriculture. Residents indicated that drought conditions have moved beyond temporary inconveniences and are now fundamentally altering daily household management.

Q1: How have past droughts affected yourself and the community?

- Many in the community, especially those in rural areas, experienced low water levels and water shortages, with concerns about wells going dry, leading some to have to replace their wells.
- Droughts severely affected farmers, resulting in struggling rural farms, shortage of hay for livestock, and difficulties for specific groups like potato growers.
- Gardens and green spaces suffered significantly, causing a huge cutback in the amount of food produced for some.

- Drought conditions led to an employer having to stop harvest, causing layoffs, and high fire indices resulted in some people being unable to work or go into the woods.
- The droughts prompted increased awareness of excess water use and the need for water conservation, leading to changes in habits and a recognition that communities need preparedness plans.

Q2: Have recent droughts changed the way you use water at home, and do you feel these habits are becoming a permanent part of your summer routine?

- A majority of respondents indicated that recent droughts have changed their water usage habits, leading them to consciously use less water.
- Changes include reducing plant/lawn watering, letting grass go brown, washing cars less frequently, and doing less laundry. Many feel these changes, such as less car washing and plant watering, are becoming a permanent part of their summer routine.
- One respondent drew water from the Monquart River to water gardens instead of using tap water, and another is planning on purchasing more rain barrels.
- Some respondents stated they already limited water usage or were extremely conscious of it, so little has changed. A few respondents stated that they have not changed their water usage habits.

4.3

Heavy Precipitation

Precipitation patterns are shifting toward shorter, more violent "flash" rainfall events. As rainfall events become shorter and more intense, residents provided feedback on the capacity of local drainage systems and shared accounts of how shifting precipitation patterns have led to physical isolation and landscape changes.

Q1: Are drainage and culvert systems near you able to handle the projected increase in 'flash' rainfall events?

- Several respondents expressed doubt or concern that existing drainage and culvert systems could handle increased flash rainfall, noting that some are already at or above capacity, or that they have experienced flooding, especially in lower-lying areas.
- A significant number of responses indicated that ditches and drainage systems are old, not properly maintained, or need to be dug out more thoroughly and consistently.
- A number of respondents answered "Yes" or indicated that they have not experienced extreme issues, though one person noted that ditches in lower areas get fuller after heavy rain.
- One person had to replace and repair a culvert multiple times due to upstream clear-cutting at their own expense, and another added a second drainage system due to basement water.
- Concerns were raised about drainage being done to the "cheapest standards" and the need for a comprehensive, mapped-out plan to check, repair, or re-route the old drainage system to utilize overflow water during drought conditions.

Q2: How has an increase in extreme rainfall and flooding affected your community?

- Some respondents reported no issues, stating it hasn't affected their community, or are unaware of any ill effects in their area, with some noting they are rural and located high enough to avoid impact.
- The most significant impacts mentioned were the washout and degradation of roadsides, driveways, and walking paths, as well as the erosion of banks near highways.
- Flooding was reported, which caused destruction of gardens and property, and led to road accidents.
- Other reported issues include increased vegetation greenness, power outages, and the loss of topsoil exacerbated by industrial farming.
- One respondent suggested that more drainage directed to the river might help with flooding in other areas.

4.4

High Winds

Increased "post-tropical" storm transitions are bringing hurricane-force gusts to the region. Residents emphasized a combination of infrastructure hardening and community-led resilience strategies to combat wind-related outages. Residents confirmed a high level of vulnerability across all major utility and communication networks during windstorms.

Q1: When strong winds hit, what changes to local power lines and equipment do you think would best help keep the lights on or get them back on sooner?

- The most frequent suggestion was to place power lines underground to reduce the effects of strong winds. Respondents suggested starting with main lines, moving to secondary lines as budgets permit, and noting the potential cost to taxpayers.
- Aggressive and regular routine maintenance, including cutting back trees further from lines and ensuring lines are cleared of debris, was frequently recommended.
- Suggestions included faster response times from NB Power, recognizing the infrastructure as their responsibility, and noting that past maintenance practices (like keeping lines free of trees) should be reinstated.
- Other ideas included upgrading to stronger wires, investing in rooftop solar and battery systems for homes and public buildings, or using lines furthest away from wooded areas.

Q2: As high winds become more common, have you experienced more frequent power or communication outages?

- A significant number of respondents confirmed experiencing more frequent power or communication outages. Some respondents noted that the outages are of longer duration and are frequent enough that one household installed a generator.
- Some respondents indicated that the outages are related to snow and ice in the winter, in addition to high winds.
- One respondent attributed the outages not to more wind, but to a lack of government planning to update electrical infrastructure.
- A few respondents have not experienced more frequent outages, believe they are becoming less frequent, or noted that outages happen even on calm days.

Low Temperatures

Data indicates a sharp decrease in the number of very cold days and traditional weeks-long "deep freezes" where temperatures remain below -20°C. Residents suggested that rooftop green spaces could serve as a multi-functional adaptation measure for public buildings.

Q1: What measures can be done to reduce the impacts of low temperatures on public infrastructure?

- Focus on preventative and regular maintenance, proper road repairs to minimize damage from freeze/thaw cycles, and implementing better salting and sanding for winter road maintenance. Upgrades to more energy-efficient structures with better insulation were also suggested.
- Utilize low-energy resources for heating and lighting, research insulation in both old and new buildings, and explore more efficient alternatives to current heating systems.
- Restricting truck access in the spring was mentioned as a measure to protect roads.
- Several respondents indicated they did not know or were unsure of meaningful measures within a municipal budget, with some responses noting that low temperatures are inherent to living in Atlantic Canada.

Q2: How has shifting winter patterns and the disappearing 'deep freeze' days changed your daily winter routine or community activities?

- Warmer weather and less freezing temperatures allow for more opportunities to enjoy being outdoors, especially with children.
- Less snow over traditional winter months and a shorter period for cold weather activities means fewer opportunities for activities like snowshoeing, skiing, snowmobiling, and ice fishing.
- More frequent freeze/thaw cycles lead to increased icing on driveways and sidewalks, requiring more salt and discouraging activities like walking.
- Businesses dependent on travel are affected by bad weather, and some feel a reduced desire to attend community events.

Freeze-Thaw Cycles

While overall cycles are decreasing, they remain a destructive force for infrastructure and public safety. Residents expressed significant frustration with how weight restrictions and heavy vehicle traffic impact the local transportation network. Residents identified a direct link between freeze-thaw cycles and a decline in road safety and property accessibility.

Q1: Does the Province's Winter Weight Program and vehicle load-restriction policies affect important transportation routes?

- Several respondents believe the program does affect important transportation routes, with some specifically noting heavy trucks (especially logging trucks) are damaging the roads, causing potholes and cracks, and that weight restrictions should start sooner in the spring.

- Respondents expressed that too many trucks are running overweight, suggesting a need for more enforcement, bigger fines, or extended impound periods to curb the problem, and that there appears to be scant oversight.
- Some stated the program does not affect routes or that they are not personally affected, with one suggesting the weight restrictions need to be more aggressive due to the terrible state of the roads.

Q2: In what ways have freeze-thaw conditions changed how you manage your property and personal safety during the winter months?

- Responses indicate using more salt or sand for icy conditions, spending more time clearing snow to prevent melt re-freezing in driveways, and using ice cleats for personal safety.
- Dealing with more ice buildup and icy situations on the property was reported, with one respondent noting increased injuries from slip and falls. There is a perceived need for more upkeep and maintenance.
- Concerns about dangerous driving conditions were noted, with one respondent staying off the roads and another trying to avoid potholes.
- Minor repairs due to frost heaving a structure and efforts to keep water running to prevent frozen pipes were mentioned.

4.7 Freezing Rain

As winters warm, freezing rain is occurring more frequently in place of traditional snow. Residents highlighted a state of constant vigilance regarding power reliability and road safety during winter weather. Residents also emphasized that infrastructure maintenance must keep pace with the shifting climate and described a significant shift in their winter behavior and vehicle safety requirements due to the increasing frequency of freezing rain.

Q1: Have or do you frequently lose power or communications due to freezing rain?

- The majority of respondents stated they have lost power or communications due to freezing rain, with some adding conditions like increased wind.
- Several responses indicated power loss occurs but not frequently, is rare, or happens only "on occasion" or "once or twice a year."
- A number of respondents reported that they do not frequently lose power or communications due to freezing rain, or that they lose power on calm, sunny days as well, making the cause hard to determine.
- Some responses attributed the issue to poor government planning.

Q2: How have more frequent 'ice days' changed your personal mobility during the winter months?

- A significant number of responses mentioned staying home, not going out, or minimizing travel during freezing rain/ice days, with some having the option to work from home to avoid travel.
- Several people mentioned using four-wheel drive vehicles with good winter tires, ice cleats/picks for boots, or preparing their property with salt/sand.

- Responses noted being more aware of icy conditions, traveling slower on roads, and trying to complete necessary tasks before a storm.
- One respondent noted spending less time outdoors, which affects walking, exercise, and connecting with nature.

4.8 Additional Thoughts

The following summary captures the supplemental feedback and broader concerns shared by residents regarding the District's approach to climate adaptation. These "additional thoughts" reflect a desire for practical, household-level solutions and a focus on long-term environmental stewardship.

- Residents advocate for financial subsidies and rebate programs to support individual property adaptations. Key suggestions include transitioning to solar power with battery storage to reduce grid dependence during outages, improving home insulation, and providing clear communication on existing climate-adaptation grants.
- There is a strong call for localized infrastructure improvements such as repairing culverts, clearing ditches, and burying power lines alongside natural protections. Participants specifically highlighted the need to limit clear-cutting near waterways like the Shiktehawk to protect wildlife habitats and urged the use of native, low-maintenance plants in green spaces.
- Participants expressed a desire for a concrete implementation plan rather than further studies. While many emphasized the importance of high-quality, proactive planning, some respondents voiced skepticism regarding the allocation of tax dollars, noting concerns about policy transparency and the potential impact on the cost of living.

5.0 Next Steps

The insights summarized in this What We Heard report serve as the foundation for the remaining phases of the District of Carleton North Climate Change Adaptation Plan (CCAP). Moving forward, the project team will transition from identifying risks to developing concrete solutions. Our upcoming work will focus on Phase 4 (Adaptation Options and Planning) and Phase 5 (Preparation of Final Reports), which include the following key activities:

5.1 Developing Adaptation Strategies

We will identify and prioritize specific adaptation options to address the vulnerabilities identified during the engagement process. This includes:

- **Strategy Development**
Develop a range of options, including gray (engineered), nature-based, structural, and non-structural solutions, tailored to the District of Carleton North's specific context.
- **Implementation Planning**
A comprehensive implementation plan will be created, detailing a schedule of actions, responsible organizations, and order-of-magnitude costs for the proposed solutions.

- **Validation Workshop**

A virtual Climate Adaptation Workshop will be held with the Steering Committee to review, validate, and refine the draft strategies. During this session, we will also review existing policies and bylaws to recommend improvements that support climate resilience.

5.2 Finalizing and Adopting the Plan

Following the development of strategies, the project will move toward finalization:

- **CCAP Report Compilation**

We will consolidate the background review, vulnerability assessment results, engagement findings, and the implementation plan into a final, comprehensive CCAP report.

- **Review and Refinement**

The draft report will be reviewed by the Steering Committee and the DELG Project Manager to ensure accuracy and alignment with community goals.

- **Council Presentation**

The final CCAP will be presented to the District of Carleton North Council with the goal of achieving formal adoption of the plan.

The final Plan will be completed by March 31, 2026. We thank the residents and stakeholders of the District of Carleton North for their continued participation and commitment to building a resilient community.

Appendix F

District of Carleton North's Adaptation Measures





Adaptation (Physical) and Preventative (Policy) Measures for Moderate Risks

No.	Adaptation Options	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
High Temperatures / Drought Conditions							
1	Pavement Material Upgrades: Potential Asphalt binder upgrade, increasing Asphalt Concrete layer thickness, or using modified asphalt mix are some of the strategies many studies suggest to reduce the risks of pavement structure failure as a result of degradation over time from increased temperature. It is however necessary to further examine the cost-effectiveness of these adaptation measures.	High Temperature Asphalt Roadways/ Parking Lots	Moderate	NBDTI	District of Carleton North, Engineering Consultants	Ongoing	Low
2	Construction QA/QC: Quality Assurance (QA) and Quality Control (QC) protocols during the construction phase to ensure long-term surface integrity.			NBDTI	District of Carleton North, Engineering Consultants	Ongoing	Low
3	Road Inspection & Maintenance Plan: Regularly scheduled inspections and maintenance of transportation assets should be developed to identify changes in road conditions and when repairs or replacement are warranted.			NBDTI	District of Carleton North	Ongoing	Low
4	Bridge Inspection & Maintenance Plan: Regularly scheduled inspections and maintenance of bridge assets should be coordinated with the NBDTI to identify early signs of premature structural deterioration and when repairs or replacement are warranted.	High Temperatures Bridges	Moderate	NBDTI	District of Carleton North, Engineering Consultants	Ongoing	Moderate
5	Bridge Condition Assessment: Conduct formal bridge condition assessments to determine the current condition of the infrastructure and identify necessary upgrades.			NBDTI	District of Carleton North, Engineering Consultants	Ongoing	Moderate
6	Inspection & Maintenance Plan: Regularly scheduled inspections and maintenance of lagoon assets should be developed to monitor liner integrity and aeration efficiency to identify early signs of process failure and when mechanical upgrades or dredging are warranted. Conduct formal effluent sampling to identify necessary upgrades to meet regulatory requirements during peak temperature events.	High Temperature Wastewater Lagoon	Moderate	District of Carleton North	Engineering Consultants	Short-term	Moderate
7	Operational Repairs: Prioritize lagoon repairs to allow for proper level management during extreme weather events.			District of Carleton North	Engineering Consultants	Midterm	High



No.	Adaptation Options	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
8	Groundwater Management: Strategies include conducting comprehensive aquifer assessments and groundwater studies, such as groundwater study requirements for future subdivision agreements, monitoring environmental conditions during dry spells, enforcing temporary water use limitations, and establishing formal communication protocols for the public.	High Temperature / Drought Conditions Groundwater Wells Fire Supply / Water Hydrants	Moderate	DELG/ District of Carleton North	Engineering Consultants, Watershed groups	Short-term	Moderate
9	Update Emergency Action Plan (EAP): Update the municipal EAP that integrates existing fire department protocols and establishes clear roles for Council and staff during declared emergencies. This plan should include specific annexes for Flash Flooding, Wildfire Evacuation, and Power Outage Response.	High Temperature Community Structures (Building Components): Foundation/ Structure Roof (Shingles) Roof (Flat) Mechanical/ Electrical	Moderate	District of Carleton North	EMO, Fire Departments, DELG	Short-term	Low
10	Building Envelope Review: Reviewing building envelopes to optimize energy efficiency during temperature extremes and transitioning to alternative materials like green roofs or UV-protective coatings.		Moderate	District of Carleton North	Engineering Consultants	Midterm	Moderate
11	Building Inspections: Timely inspections can be done to ensure that minor issues are addressed appropriately before they escalate into major problems. This can also assist in identifying potential problems to watch for in the future (e.g., cracking, shrinking, and damage to flashing).			District of Carleton North	Engineering Consultants	Midterm	Moderate
12	Roof Construction Alternatives: Although green roofs are considered as a no-regret adaptation measure that helps address various impacts of climate change, they are still rare in mainstream applications due to potential limitations regarding regulatory compliance, high cost, and maintenance requirements. Other alternatives to consider if green roofs are not feasible is to install shingles in a lighter colour to reduce heat absorption while ensuring there is proper ventilation in attics to allow heat to escape from the roof rather than accumulating and causing damage from the inside.			District of Carleton North	Engineering Consultants	Midterm	High
13	Passive Survivability Retrofits: Evaluate and retrofit critical community hubs (schools, halls) to maintain safe internal temperatures without mechanical systems during extreme heat or power outages, reducing reliance on active cooling.		Moderate	District of Carleton North	Engineering Consultants	Midterm	High



No.	Adaptation Options	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
14	Emergency Preparedness and Backup Power: Planning options include reviewing the electricity and backup power needs of emergency shelters within the EMP and establishing formal cooling and warming center protocols for vulnerable residents.	High Temperature/ Drought Conditions Community Structures (Services): Emergency and Public Safety Education Administration Social and Support Utility and Infrastructure	Moderate	District of Carleton North	Engineering Consultants	Short-term	Moderate
15	Dry Hydrant Installation: Install dry hydrants at strategic locations to allow for water access for fire suppression during drought conditions or when static sources (ponds) are frozen or inaccessible.			District of Carleton North	Fire Departments	Short-term	Moderate
16	Ecological Preservation: Management options consist of monitoring vegetation health closely during peak heat seasons and providing targeted maintenance or irrigation to preserve local flora.	High Temperature/ Drought Conditions Parks Rivers/ Watercourses	Moderate	District of Carleton North	Public Works	Ongoing	Low
17	Agricultural Adaptation: Potential strategies involve supporting a transition toward heat-tolerant or drought-resistant crop varieties to mitigate potential yield losses caused by shifting climate patterns and perennials for community flowers.	High Temperature/ Drought Conditions Farmland	Moderate	Community Members	District of Carleton North	Long-term	High
18	Agricultural Waste Solutions: Develop a policy or support program for agricultural waste collection/disposal to prevent on-farm burning or improper disposal, addressing the gap left by the cessation of municipal farm garbage collection.			District of Carleton North	Engineering Consultants	Long-term	High
19	Emergency Preparedness and Backup Power: Planning options include reviewing the electricity and backup power needs of emergency shelters within the EMP and establishing formal cooling and warming center protocols for vulnerable residents.	High Temperature Power/Utility/ Communication Cables/Substations	Moderate	District of Carleton North	NB Power	Short-term	Moderate
20	Grid Capacity Assessment: Conduct an assessment of electrical infrastructure capacity to handle "Peak Cooling Demand" (air conditioning loads) across all building types, as this is projected to become the critical service risk over heating loads.			NB Power	District of Carleton North	Mid-term	High
21	System Integrity Monitoring: Actions include monitoring effluent concentration levels during high-heat events and modifying treatment processes as necessary to maintain regulatory compliance.	High Temperature SCADA	Moderate	District of Carleton North	Engineering Consultants, Operators	Mid-term	Moderate



No.	Adaptation Options	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
Heavy Precipitation / Flooding							
1	Bridge Inspection & Maintenance Plan: Regularly scheduled inspections and maintenance of bridge assets should be developed to identify early signs of premature structural deterioration and when repairs or replacement are warranted.	Heavy Precipitation Bridges	Moderate	NBDTINBDTI	District of Carleton North, Engineering Consultants	Ongoing	Low
2	Bridge Condition Assessment: Conduct formal bridge condition assessments to determine the current condition of the infrastructure and evaluate the feasibility of raising or reinforcing structures specifically for flood events.			NBDTINBDTI	District of Carleton North, Engineering Consultants	Ongoing	Low
3	Flushing and CCTV Program: Implement a flushing and CCTV program following NASSCO standards to maintain system flow and inspect pipe integrity. This program focuses on identifying structural defects, clearing debris and prioritize future repairs.	Heavy Precipitation U/G Sanitary Sewers U/G Storm Sewers	Moderate	District of Carleton North	Operators	Short-Term	Low
5	Inspection & Maintenance Plan: Conduct formal lagoon berm structural integrity and condition assessments to determine the impact of surrounding vegetation on berm stability and to identify vulnerabilities to erosion or seepage during high-flow events.	Heavy Precipitation Wastewater Lagoon	Moderate	District of Carleton North	Engineering Consultants	Short-term	Moderate
6	Infrastructure Upgrades & Mitigation: Implement physical hardening measures to manage excess volume and protect surrounding property. Ensure backflow preventers are installed and maintained in nearby residential connections. Maintain additional high-capacity pumps on-site to handle water during peak inflow. Construct holding tanks or overflow where necessary to manage surge volumes. Complete detailed design and engineering reviews to raise or strengthen berm heights to prevent overtopping.			District of Carleton North	Engineering Consultants	Midterm	High
7	Flash Flood Response Plan: Develop a comprehensive Flash Flood Response Plan, including real-time level monitoring and established communication protocols utilizing the existing Voyent Alert system for public notification and emergency coordination.			District of Carleton North	Engineering Consultants, EMO, Fire Departments	Short-term	Moderate



No.	Adaptation Options	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
8	Well Integrity Inspection: During heavy rain or flooding, wells can be submerged which puts well water at higher risk of contamination. Inspecting suspectedly contaminated wells can reduce risk of residents contracting a water-borne illness.	Heavy Precipitation Groundwater Wells	Moderate	DELG/ District of Carleton North	Engineering Consultants	Short-term	Moderate
9	Wellhead Upgrades: Potential infrastructure improvements include re-sealing or raising well casings to physically block contaminated surface runoff from entering the potable water supply and area regrading.			DELG/ District of Carleton North	Engineering Consultants	Long-term	High



No.	Adaptation Options	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
10	Stormwater Management Plan: Conduct a stormwater management plan to identify and prioritize drainage needs. This study can be used as a tool to provide recommendations on drainage and road improvements.	Heavy Precipitation Culverts and Ditching	Moderate	NBDTI/ District of Carleton North NBDTI	Engineering Consultant	Short-term	Moderate
11	Green Infrastructure: To increase drainage capacity, the community can consider adopting nature-based solutions where appropriate to capture more rainfall. Green infrastructure encompasses practices, such as vegetated rooftops, roadside planting, absorbent gardens, and other measures that capture and filter stormwater while reducing runoff. Other options such as bioretention ponds and enhanced swales are also typically considered as green solutions. This practice can be effective where overland flooding is a concern. It mitigates the amount of flooding and reduces the polluted runoff that reaches sewers, rivers, and other water bodies.			District of Carleton North	Engineering Consultants	Long-term	Moderate
12	Drainage System Upgrades: Construct properly ditches along all municipal roads and, construct drainage infrastructure where inexistant. Additionally, undersized culverts should be resized to properly updated specifications resulting from a Stormwater Management Study or Drainage Assessment. The upgrade specifications should also include a factor for climate change above the standard design allowances to have the load or adaptive capacity to withstand climate change impacts.			NBDTI, District of Carleton North NBDTI	District of Carleton North	Long-term	High
13	Road Raising: Lifting the level of road surfaces above predicted flood can reduce the risk of overland flooding and its associated impacts. Elevating the road surface above the anticipated flood level can prevent or reduce inundation of the road and maintain access during flood events. This can be one component of a comprehensive flood mitigation strategy which can include other measures, such as improving community drainage systems or creating green spaces to absorb excess water.			NBDTI, District of Carleton North NBDTI	Engineering Consultants, District of Carleton North	Midterm	High
14	Inspection & Maintenance Plan: Regularly scheduled inspections and maintenance of stormwater assets should be developed to identify changes in road conditions and when repairs or replacement are warranted. This includes ditch cleanouts which are focused on sediment and debris removal.			NBDTI/ District of Carleton North NBDTI	Engineering Consultants	Ongoing	Low



No.	Adaptation Options	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
15	Emergency Preparedness and Backup Power: Planning options include reviewing the electricity and backup power needs of emergency shelters within the EMP and establishing formal cooling and warming center protocols for vulnerable and installing decentralized backup power like solar panels/back up generators for critical dispatch systems.	Heavy Precipitation Community Structures (Services): Emergency and Public Safety Healthcare and Wellness	Moderate	District of Carleton North	NB Power, Engineering Consultant, NB EMO	Short-term	Moderate
16	Isolation Route Maintenance: Identify and prioritize the maintenance of secondary back roads that serve as the only egress points when main low-lying routes flood. Confirm these routes are graded and ditched to withstand heavy traffic during emergencies.			NBDTI, District of Carleton North NBDTI	District of Carleton North	Ongoing	Low
17	Wind-Driven Rain Assessment: Assess and upgrade building envelopes (cladding, vents, and flashing) to withstand "Wind-Driven Rain" events, where high winds force water into structures, causing hidden mold and rot.	Heavy Precipitation Community Structures (Building Components)	Moderate	District of Carleton North	Engineering Consultants	Long-term	Moderate
18	Shoreline Erosion Study Plan and Planting Initiatives: Address bank erosion concerns in Florenceville and Bristol through an erosion study and targeted planting initiatives and riparian restoration to stabilize shorelines, enhance biodiversity, and mitigate the long-term impacts of soil loss along the riverbanks.	Heavy Precipitation Rivers / Watercourses	Moderate	District of Carleton North	St. John River Society	Midterm	Moderate
19	Agricultural Best Management: Potential strategies involve promoting vegetative buffer strips to reduce sediment transport and encouraging private well owners to perform bacteriological sampling and verify proper wellhead grading after heavy rainfall.	Heavy Precipitation Farmland	Moderate	District of Carleton North	Community Members, Engineering Consultants	Midterm	Moderate
20	Emergency Preparedness and Backup Power: Actions for consideration include reviewing the specific electricity needs of critical buildings and ensuring that clear operational protocols are in place to manage the impact of a large-scale power failure.	Heavy Precipitation Power / Utility / Communication Cables / Substations	Moderate	District of Carleton North	NB Power	Short-term	Moderate



No.	Adaptation Options	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
1	Pavement Material Upgrades: Potential Asphalt binder upgrade, increasing asphalt concrete layer thickness, or using modified mix are some of the strategies many studies suggest to reduce the risks of pavement structure failure as a result of degradation over time from low temperature. It is however necessary to further examine the cost-effectiveness of these adaptation measures.	Low Temperatures/ Freezing Rain Asphalt Roadways and Parking Lots Gravel Roadways and Parking Lots Sidewalks Pedestrian Trails Fleet and Equipment	Moderate	NBDTINBDTI	District of Carleton North, Engineering Consultant	Ongoing	Moderate
2	Construction QA/QC: Quality Assurance (QA) and Quality Control (QC) protocols during the construction phase to ensure long-term surface integrity and underground infrastructure is installed below the frost depth.			DCN/ NBDTINBDTI	District of Carleton North, Engineering Consultant	Ongoing	Low
3	Road Inspection & Maintenance Plan: Regularly scheduled inspections and maintenance of transportation assets should be developed to identify changes in road conditions and when repairs or replacement are warranted.			NBDTINBDTI	District of Carleton North	Ongoing	Low
4	Winter Maintenance: Reviewing and modifying de-icing procedures to utilize less corrosive agents.			NBDTI/District of Carleton North NBDTI	District of Carleton North, Public Works	Ongoing	Low
5	Bridge Inspection & Maintenance Plan: Regularly scheduled inspections and maintenance of bridge assets should be developed to identify early signs of premature structural deterioration and when repairs or replacement are warranted.	Low Temperatures/ Freezing Rain/ Freeze-Thaw Cycles/ High Wind Gusts Bridges	Moderate	NBDTI/District of Carleton North NBDTI	Engineering Consultants	Midterm	Moderate
6	Bridge Condition Assessment: Conduct formal bridge condition assessments to determine the current condition of the infrastructure and evaluate the feasibility of reinforcing structures specifically for ice events.			NBDTI/District of Carleton North	Engineering Consultants, Watershed Associations	Midterm	Moderate
7	Winter Maintenance: Reviewing and modifying de-icing procedures to utilize less corrosive agents.			District of Carleton North	Public Works	Ongoing	Low
8	Well System Winterization: Infrastructure options include implementing upgrades to protect well heads and surface piping from freezing to ensure continuous water access during extreme cold.	Low Temperature Private and Public Groundwater Wells	Moderate	DELG, District of Carleton North	District of Carleton North, Engineering Consultant	Ongoing	Low
9	Seasonal Building Maintenance: Actions for consideration include cleaning out eavestroughs before the winter season, monitoring for signs of premature deterioration, and exploring the transition to alternative roofing materials such as green roofs.	Freezing Rain Community Structures (Building Components): Roof	Moderate	District of Carleton North	Public Works	Ongoing	Low



No.	Adaptation Options	Interaction	Risk	Implementation Lead	Partners and Resources	Timeline	Level of Effort
10	Emergency Preparedness and Backup Power: Planning options include reviewing the electricity and backup power needs of emergency shelters within the EMP and establishing formal cooling and warming center protocols for vulnerable and installing decentralized backup power like solar panels for critical dispatch systems.	Low Temperatures/Freezing Rain/High Wind Gusts Community Structures (Services): Emergency and Public Safety Healthcare and Wellness Social and Support Utility and Infrastructure	Moderate	District of Carleton North	NB Power, Engineering Consultant, NB EMO	Short-term	Moderate
11	Remote Community Hub Generators: Continue to maintain and test the recently installed backup generator at the Norton Community Centre and backup generator and satellite internet (Starlink) at the Belyea's Cove Community Hall in Wickham. Ensure similar redundancy is planned for other isolated hubs.			District of Carleton North	NB Power, Engineering Consultant	Short-term	Moderate
12	Monitoring: Management options consist of monitoring vegetation health throughout the winter season and providing necessary tending or removal of damaged limbs to prevent secondary hazards.	Low Temperatures/High Wind Gusts Parks Forested Areas	Moderate	District of Carleton North	Public Works	Ongoing	Low
13	Emergency Preparedness and Backup Power: Options include creating and maintaining a robust Power Outage Plan that reviews specific building electricity needs and ensures clear protocols are in place for large-scale disruptions.	Low Temperatures/Freezing Rain/ High Wind Gusts Power/Utility/ Communication Cables	Moderate	District of Carleton North	NB Power, NB EMO	Short-term	Moderate
14	Proactive Vegetation Management: Shift from reactive to proactive tree trimming programs along power lines to prevent outages caused by branch contact during storms. Coordinate with NBDTI and NB Power on priorities areas with input from DCN			District of Carleton North/ NBDTI/NBDTI	Public Works	Ongoing	Low
15	Infrastructure Security: Implement security measures to protect communication lines (copper/fiber) from theft, which is a primary cause of communication failure during outages.			NB Power	District of Carleton North	Mid-term	High
16	Infrastructure Upgrades: Mitigation options involve upgrading to climate-controlled enclosures for sensitive equipment and actively monitoring high-risk frost-susceptible entry points for signs of premature deterioration.	Low Temperatures / Freeze-Thaw Cycles SCADA Systems	Moderate	District of Carleton North	Engineering Consultants	Long-term	High