NORTHEAST CLIMATE CHANGE VULNERABILITY ASSESSMENTS

PHASE 1 COMMUNITY SCOPING REPORT:

POUCE COUPE

submitted by:

SHIFT Collaborative

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TABLE OF CONTENTS

1. INTRODUCTION 4

WHAT DETERMINES RISK AND VULNERABILITY TO CHANGES IN CLIMATE? 6
METHODOLOGY 6

2. OVERVIEW OF CLIMATE CHANGES AND IMPACTS 7

2.1 OVERVIEW OF REGIONAL CLIMATE & PROJECTIONS 7
TEMPERATURE 7
PRECIPITATION 9
COMPOSITE INDICATORS 9
HYDROLOGY 10
2.2 POSSIBLE FUTURE CLIMATE IMPACTS OF CONCERN 11
2.2.1 REGIONAL INITIATIVES ADDRESSING THE IMPACTS OF CLIMATE CHANGE 16
2.3 CURRENT CLIMATE-RELATED IMPACTS OF CONCERN IN POUCE COUPE 17
2.4 LIMITATIONS & GAPS IN CLIMATE DATA 18

3. OVERVIEW OF VULNERABILITIES AND ADAPTIVE CAPACITY 18

3.1 WATER SUPPLY 19
3.1.1 VULNERABILITY TO CLIMATE CHANGE 19
3.1.1.1 ACTIONS THAT REDUCE VULNERABILITY 19
3.1.2 INFORMATION GAPS 20
3.1.3 OPPORTUNITIES FOR A CLIMATE LENS 20
3.2 SEWAGE AND DRAINAGE 20
3.2.1 VULNERABILITY TO CLIMATE CHANGE 21
3.2.1.1 ACTIONS THAT REDUCE VULNERABILITY 21
3.2.2 INFORMATION GAPS 21
3.2.3 OPPORTUNITIES FOR A CLIMATE LENS 22
3.3 TRANSPORTATION (ROADS, BRIDGES, SIDEWALKS) 22
3.3.1 VULNERABILITY TO CLIMATE CHANGE 22
3.3.1.1 ACTIONS THAT REDUCE VULNERABILITY 23
3.3.2 INFORMATION GAPS 23
3.3.3 OPPORTUNITIES FOR A CLIMATE LENS 23
3.4 HAZARD AND EMERGENCY MANAGEMENT 23
3.4.1 VULNERABILITY TO CLIMATE CHANGE 24
3.4.1.1 ACTIONS THAT REDUCE VULNERABILITY 24
3.4.2 INFORMATION GAPS 24

3.4.3 Opportunities for a Climate Lens 25
3.5 Buildings (including public facilities), Planning and Zoning 25
3.5.1 Vulnerability To Climate Change 26
3.5.1.1 Actions that Reduce Vulnerability 26
3.5.2 Information Gaps 26
3.5.3 Opportunities for a Climate Lens 26
3.6 Parks, Green Space, Street Trees 27
3.6.1 Vulnerability To Climate Change 27
3.6.1.1 Actions that Reduce Vulnerability 27
3.6.2 Information Gaps 27
3.6.3 Opportunities for a Climate Lens 27
3.7 Community Development 27
3.7.1 Vulnerability To Climate Change 28
3.7.1.1 Actions that Reduce Vulnerability 28
3.7.2 Information Gaps 28
3.7.3 Opportunities for a Climate Lens 28
3.8 Economic Development 28
3.8.1 Vulnerability To Climate Change 29
3.8.1.1 Actions that Reduce Vulnerability 30
3.8.2 Information Gaps 30
3.8.3 Opportunities for a Climate Lens 30
3.9 Factors Affecting Adaptive Capacity 31
3.9.1 Maturity Scale 31

4. CONCLUSION 32

APPENDIX A: LIST OF DOCUMENTS REVIEWED 33

APPENDIX B: LIST OF INTERVIEWEES 36

APPENDIX C: MATURITY SCALE CHECKLIST 37

APPENDIX D: POSSIBLE FUTURE CLIMATE IMPACTS OF CONCERN 41

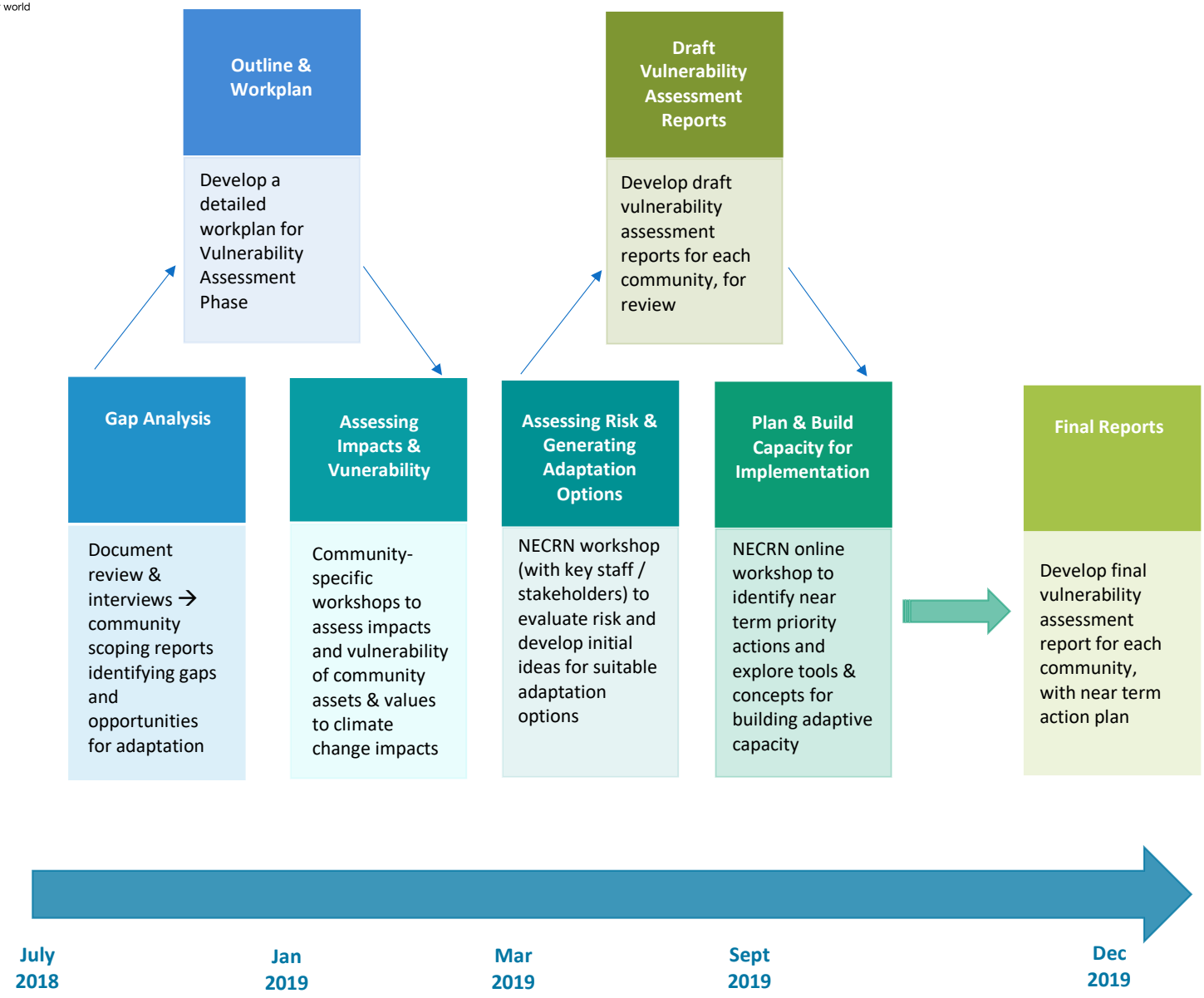
1. INTRODUCTION

The Northeastern region of BC represents 21.8% of the land area of the province (20,494,470 ha), but is the least populated region in BC, with just 1.6% of the population (about 69,068 people). The Northeastern region is expected to undergo significant population and economic growth as a result of rapid expansion in natural gas and oil development. (The population is expected to increase by 30% over the next 25 years, BC Stats, 2014).

Northeastern BC has experienced a significantly more rapid rate of warming over the last 100 years (2.2 °C) than has BC overall (1.2°C). Significant changes in climate are projected for the future. The region is expected to see increases in average temperature and precipitation, the frequency and severity of extreme precipitation, drought and flood events, and other associated impacts.

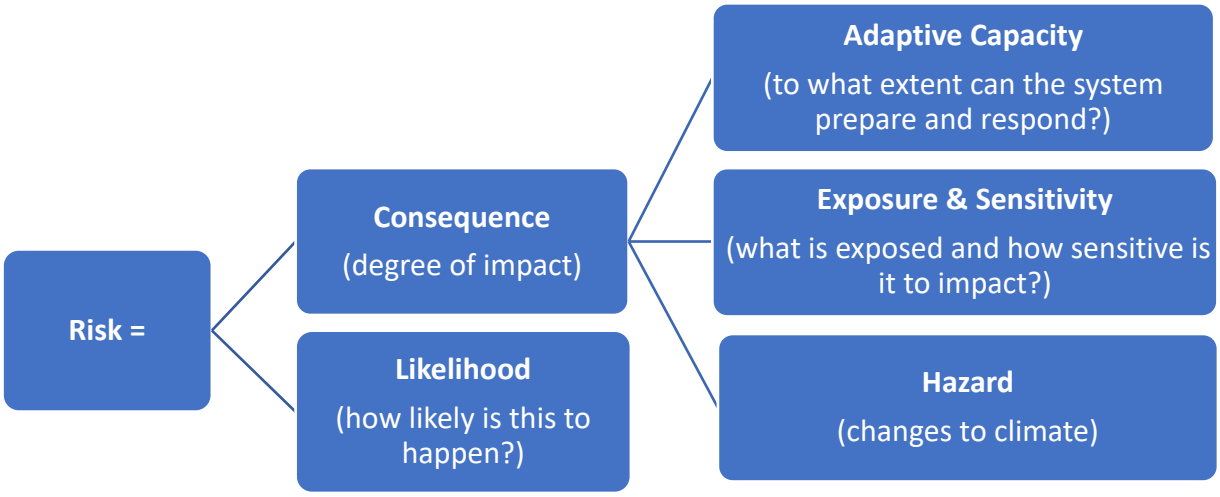
This project is being conducted for the Northeast Climate Risk Network (NECRN). The NECRN includes partners from: the City of Fort St. John, City of Dawson Creek, District of Tumbler Ridge, District of Chetwynd, Village of Pouce Coupe and Northern Rockies Regional Municipality who have come together to better understand and build capacity to address the impacts of climate change. This report is the first step in a Vulnerability Assessment process that will be conducted in 2019. This community scoping report provides a current snapshot or baseline understanding of where the NECRN municipalities are in terms of experiencing and addressing climate change related impacts. The diagram below provides an overview of the steps in the project through 2019.

Northeast Climate Risk Network (NECRN) Climate Vulnerability Assessment Project 2018 - 2019



WHAT DETERMINES RISK AND VULNERABILITY TO CHANGES IN CLIMATE?

There are two broad types of actions relating to climate change: reducing greenhouse gas emissions (climate change mitigation), and preparing for and adjusting to changes in climate that impact human and non-human systems (climate change adaptation). This project focuses mainly on adapting to climate change. A key first step on the way to adapting to climate change, is to consider what the relative risks and vulnerabilities are likely to be, for the various components of the community.



The risks posed by climate change are a combination of the characteristics of the ***hazard*** itself (climate-induced changes, such as the risk of flooding) and how this interacts with human, built and ecological systems. The degree to which these systems are vulnerable, depends in part on whether they are ***exposed*** to the hazard, and how ***sensitive*** they are to its effects. For example, a housing development in a floodplain is exposed to flood risk while a subdivision at higher elevation is not. Similarly, a newer development built with floodproofing features is less sensitive than an older home without any such features.

But vulnerability also depends on the ways in which the affected systems can anticipate, prepare and adapt to better weather the challenge (***adaptive capacity***). For example, communities with a well-developed emergency management system or who have used tools and resources to divert development to areas outside of the floodplain, are more adaptive to an increasing flood hazard.

The degree of impact that occurs as a result (***consequence***), combined with how **likely** this is to happen, provides an indication of the degree of risk due to these changing conditions.

METHODOLOGY

The gap analysis conducted to produce this scoping report, consisted of a combination of document review and interviews. A list of documents reviewed for this report is included in Appendix A. The documents were reviewed to identify:

- Key background and contextual information about the community and systems that may be vulnerable to climate change impacts
- Any policies or actions that directly or indirectly address potential vulnerabilities to climate change
- Any immediate or planned windows of opportunity for incorporating a climate lens
- Any existing information, studies, reports that contribute to understanding of climate change projections or vulnerabilities in this community or the northeast region

Following the initial review of documents, a number of interviews were conducted with local government staff and other agencies, to fill in gaps in information. Interviewees from this community included:

- Christopher Leggett, CAO, Village of Pouce Coupe;
- Blair Deveau, Fire Chief, Village of Pouce Coupe

Due to time and availability, the number of interviews of each community was limited and this limits the range of perspectives that we were able to gather on specific aspects of system vulnerability. Further information and understanding will be incorporated from feedback by the NECRN members, as well as at the first workshop in early 2019. The full list of interviewees for all reports is included in Appendix B. Information from these two key sources was compiled in the report below. Information gaps and opportunities for applying a climate lens are identified for each system area.

2. Overview of Climate Changes and Impacts

2.1 Overview of Regional Climate & Projections

Regional climate projections have been recently developed for the Northeast Region, by the Pacific Climate Impacts Consortium. This section provides a brief summary of key points from the full report, describing how future climate conditions are likely to change in this region. For most variables, projected changes will be noticeable by the 2050s. By the 2080s, projections indicate substantial changes, resulting in a very different lived experience than the Northeast region of today. For further detail, or information on how to interpret these numbers, please see the original report produced by Pacific Climate Impacts Consortium and Pinna Sustainability (2019): "Climate Projections for the BC Northeast Region."

Temperature

Annual and seasonal temperatures are projected to increase across the region. The table below summarizes these projected changes for the region on average:

Table 1. Maximum temperatures by season, for the Northeast Region

	Past (°C)		2020 Change (°C)	2050 Change (°C)	2080 Change (°C)
Spring	6.5	Average Range	+1.4 (0.7 to 2.2)	+2.9 (1.7 to 4.2)	+4.7 (2.7 to 6.8)
Summer	19.2	Average Range	+1.3 (0.4 to 2.1)	+3.1 (1.4 to 5.3)	+5.2 (2.4 to 8.2)
Autumn	3.5	Average Range	+1.5 (0.7 to 2)	+3.2 (2.1 to 4.2)	+5 (3.5 to 6.5)
Winter	-10.9	Average Range	+2.3 (1.2 to 3.7)	+4.1 (2.5 to 5.8)	+6.6 (3.6 to 9)

Table 2. Minimum temperatures by season, for the Northeast Region

	Past (°C)		2020 Change (°C)	2050 Change (°C)	2080 Change (°C)
Spring	-6.1	Average Range	+1.7 (0.9 to 2.5)	+3.5 (2.5 to 4.9)	+5.5 (3.9 to 7.5)
Summer	6.7	Average Range	+1.4 (0.8 to 2.1)	+3.1 (2 to 4.7)	+5.2 (3.5 to 7.2)
Autumn	-5.7	Average Range	+1.7 (1 to 2.2)	+3.6 (2.9 to 4.7)	+5.7 (4.6 to 7.2)
Winter	-6.2	Average Range	+2.7 (2 to 4.2)	+5 (4 to 7.1)	+8.2 (6.2 to 10.5)

By the 2050's, the Northeast region can expect:

- Warmer low temperatures, with ~16% less frost days and ~21% longer growing seasons.
- Triple the number of Days Above 25°C (warm days) in the populated and agricultural areas.
- 8 days per year above 30°C (hot days), on average across the region (in the past, the region experienced an average of 1 day above 30°C annually).
- The average 1-in-20 hottest day (i.e.: an extreme heat event that has a 5% chance of happening in a given year) to increase to 36°C (from 31°C in the past).

By the 2080's the Northeast region can expect:

- Winter daytime and nighttime temperatures to be similar to past fall temperatures[1].
- January temperatures to feel like March temperatures of the past.

[1] Change is relative to baseline of the 1971-2000 average

PRECIPITATION

Overall, precipitation is projected to increase in the region, in all seasons. The table below summarizes the projected changes in total seasonal precipitation in the northeast region on average:

Table 3. Precipitation by season, for the Northeast Region

	Past (mm)		2020 Percent Change	2050 Percent Change	2080 Percent Change
Spring	111	Average Range	+7% (4 to 12)	+19% (10 to 24)	+29% (19 to 38)
Summer	236	Average Range	+4% (-4 to 12)	+7% (-1 to 15)	+5% (-2 to 11)
Autumn	142	Average Range	+6% (0 to 15)	+15% (6 to 24)	+30% (13 to 49)
Winter	105	Average Range	+9% (2 to 19)	+11% (4 to 22)	+20% (15 to 28)

The Northeast Region can expect:

- While there will be more precipitation in all seasons on average, increased variability will also lead to longer dry spells in some years.
- An increased intensity and frequency of extreme rainfall events.
- The volume of precipitation on the wettest day of the year (which in the past averaged 28 mm of precipitation) will increase by 17% by the 2050s, and 22% by the 2080s.
- The volume of precipitation on the wettest 5 days (consecutive) of the year (which in the past averaged 57 mm of precipitation) will increase by 19% to 68 mm by the 2080s.

COMPOSITE INDICATORS

Growing degree days (a derived indicator generally relating to opportunities for agriculture, and challenges for forestry)

- In the past, the region experienced on average 934 growing degree days. In the future, this number can be expected to nearly double to 1790 growing degree days by the 2080s.

Heating & Cooling degree days[2] (a derived indicator relating to energy demand to heat or cool buildings)

[2] Cooling degree days refers to the number of degrees that a day's average temperature is above 18°C. Heating degree days refers to the number of degrees that a day's average temperature is below 18°C. These derived indicators are meant to provide an idea of energy demand for heating or cooling. For more information on the

- Historically, there has been little demand for cooling in this region (12 cooling degree days on average). The region can expect 70 (600%) more cooling degree days by the 2050s, and 171 (1500%) by the 2080s.
- Demand for heating has been much higher than for cooling in this region in the past (6639 heating degree days on average). This will decrease by 18% by the 2050s, and 28% by the 2080s.

Ice days (days when the daytime high temperature is less than 0°C)

- In the past, the region had 119 ice days. The Northeast will experience 19% fewer ice days by the 2050s, and 31% fewer by the 2080s. Depending on annual variability, this can result in additional **freeze-thaw cycles** in any year, leading to **rain-on-snow conditions**.

Extreme weather events

- New thresholds for extreme weather events will include **intensity of precipitation events**, and **may also bring stronger winds and hail events**.

Temperature and precipitation patterns in the summer

- Even though precipitation is increasing gradually over summer months, normal seasonal variability in precipitation can lead to **some drier, hotter summers**, posing **increased risk of wildfire**
- Changes in precipitation patterns, accompanied by higher demand for water during longer, hotter summers as well as during **dry spells** could contribute to water shortages and drought conditions

HYDROLOGY

The forthcoming report "Climate Projections for the BC Northeast Region" will include information on changes to hydrology in the region and some specific watersheds, but this information was not yet available at the time of writing.

As an illustrative example in the meantime, an academic study of the Kiskatinaw River (Saha, 2015) modelled future climate scenarios to assess changes to streamflow, surface runoff and groundwater discharge. This study showed increases in monthly streamflow. In addition to stream flow, simulation results showed that groundwater discharge and surface runoff are also expected to increase in 2020–2040 due to increased precipitation (with surface runoff increasing more than groundwater discharge due to steep topography).

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meaning and use of these indicators, please see the source report: Climate Projections for the BC Northeast Region (2019)

2.2 Possible Future Climate Impacts of Concern

The table below summarizes how climate projections may impact Northeast communities, organized by system or service area. Appendix D provides similar information, showing more directly how particular combinations of climate conditions will translate into impacts, and which service areas are particularly affected by those conditions and impacts. Appendix D will be further refined based on stakeholder input in workshop 1.

System Area	Relevant Climate Projections	Types of Potential Impacts
Water Supply	Increase in average annual precipitation Increase in the intensity and frequency of extreme rainfall → more often and greater volume Changing flow timing and volume Longer dry spells	Changes to maintenance needs Turbidity-related impacts to infrastructure, pumping capacity and water quality Increased surface runoff can lead to increased nutrient concentrations in water and increased sediment and erosion Water shortages (impacts for ecosystems and range of human uses, and competition between uses) Business disruption and economic impacts of low supply for industry
Sewage and Drainage	Fewer ice days, but a change in freeze-thaw cycles Rain-on-snow events Increase in the intensity and frequency of extreme rainfall	Flood risk – ponding, sewer surcharge, back-ups, basement flooding Increasing maintenance requirements and street clearing, decreasing durability of the infrastructure Increasing combined sewer overflows where systems are combined Increasing erosion at sewer outfalls Opportunities to build back better in case of damage
Transportation	Fewer ice days, but a change in freeze-	Changing flood risk

	thaw cycles Rain-on-snow events Increase in the intensity and frequency of extreme rainfall	Damage to roads, bridges, trails, sidewalks Decreased durability of infrastructure meaning increasing maintenance costs and more frequent replacement Changing needs for road clearing, salting and storm clean ups Increased burn-out from public works staff Business disruption and emergency evacuation/response challenges if main transportation routes are blocked by flooding or mass movement Potential for food shortages if transportation routes are disrupted Opportunities to build back better in case of damage
Hazard & Emergency Management	Increase in warm, hot and extreme hot days Increase in the intensity and frequency of extreme rainfall Increase in extreme weather events and associated natural disasters	More frequent / larger scale emergency and disaster events tax municipal resources and capacity for mitigation, planning, preparedness, response and recovery Isolation from health services, critical services during major events Fatigue and burnout due to more frequent deployment of Emergency Operations Centres and response Increase in emergency social services needs and associated volunteers to support evacuations from surrounding region
Buildings, Planning & Zoning	Increase in warm, hot and extreme hot days	Buildings are not designed for the future climate – i.e. aren't comfortable or require temporary cooling during the summer

	Increase in the intensity and frequency of extreme rainfall Potential for wind and hail events	Flood and storm damage to buildings Increased risk of damage to homes, people and infrastructure in flood, mass movement, slope instability and wildfire risk areas. Impacts to health, especially for those most vulnerable, from increases in poor air quality days (outdoor and indoor) due to wildfire smoke in the region. Increased need for sheltering in place Opportunities to build back better in case of damage
Energy Systems, Facilities and Grounds	Rain-on-snow events Increase in the intensity and frequency of extreme rainfall Potential for wind and hail events	Decreased durability of facilities and grounds leading to increased resources required for maintenance and replacement Facilities are not designed for the future climate or community needs (i.e. higher level of air filtration if necessary) Change in energy demand for heating & cooling Increasing risk of power outages and associated cascading impacts
Parks, Green Space, Street Trees	Increase in warm, hot and extreme hot days Increasing growing degree days Overall climatic shifts Dry spells / low flows	Changes to fish and wildlife health and distribution Ecological shifts, changing viability of species Increasing risk of vector-borne diseases and invasive species Increasing replacement of damaged trees and vegetation Increasing wildfire risk in large natural areas

	Extreme weather	Opportunity to use natural assets to buffer impacts – accommodate flood or stormwater, lower stream temperatures, provide shading and cooling, etc.
Community Development	Increase in warm, hot and extreme hot days Increase in summer precipitation Increase in intensity and frequency of extreme events Dry spells / low flows	Range of human health impacts Community and individual well-being (stress and anxiety) Impacts to the community, services and infrastructure due to natural hazard events and/or evacuations from inside and outside the region Patient surge events (hospital) Cultural traditions and practices affected Changes to recreation opportunities Food security (positives and negatives)
Economic Development	Increase in warm, hot and extreme hot days Changing seasonality Increasing growing degree days Dry spells / low flows Increase in extreme weather events and associated natural disasters	Impacts on tourism (positive or negative) Interruptions to business and industrial activities Milder winters and lower climate change impacts may increase in-migration to the region Damages could affect cost of business, insurance, losses Competition and cost for access to water Pests and invasive species will affect forestry, agriculture Declining forest health can exacerbate wildfire risk

		Combination of greater growing opportunities for agriculture, along with increasing risk of crop damage and loss and heat stress to livestock

2.2.1 Regional Initiatives Addressing the Impacts Of Climate Change

There are a number of key documents and initiatives pertaining specifically to the impacts of climate change and strategies for adaptation. The following provides a summary of regional initiatives that may be of relevance to local governments in the Northeast.

Climate Risk Assessment for the Oil and Gas Sector in the Northeast (2015)

In 2015, the Fraser Basin Council undertook a Climate Risk Assessment for the Oil and Gas Sector in the Northeast. The project aimed to increase awareness and understanding of the potential impacts of changing climatic conditions in Northeastern BC and identify potential risks and opportunities in the oil and gas sector. The project also looked at the sector's ability to respond and adapt to impacts in the face of a variable climate regime, and identify gaps in the information and resources available to support the oil and gas sector with possible management options, and adaptation tools and techniques. Report: https://www.retooling.ca/_Library/docs/Climate_Assessment_NEBC_2015_web.pdf

BC Agriculture & Food Climate Action Initiative (2011 - present)

In 2012, the BC Agriculture Food and Climate Action Initiative completed the ***BC Agriculture Climate Change Adaptation Risk & Opportunity Assessment***, evaluating how changes to the climate may impact agricultural production for key commodities in various regions of BC. The assessment generated five regional and commodity-specific reports, including a "Snapshot Report" for grain and oilseed production in the Peace Region. Building on the findings of the assessment, the *Peace Region Adaptation Strategies* plan was completed in 2013, along with a summary. The plan identifies regionally specific collaborative strategies and actions that will enhance agriculture's ability to adapt to projected changes. In 2018, an update to the plan was published. Numerous projects have since been initiated or completed, implementing priorities identified in the plan. A Regional Working Group, with collaboration across sectors, is operating in the region currently.

FLNRO Climate Action Plan for the Northeast Region (2015)

A 2015 Climate Action Plan for FLNRO was developed for the northeast region, and identifies local governments as a key partner. It emphasizes the importance of collaboration with other organizations and the importance of data to inform effective decision-making.

Climate and Health Vulnerability Assessments

Northern Health has pursued support from Health Canada for a three-year initiative (2019-2022) to conduct climate vulnerability and health assessments for communities across the North, including the northeast. These assessments aim to better understand current and projected climate risks and their impact on health and well-being of communities and specifically on vulnerable populations. Northern Health expects to be notified if this project will move ahead by January 2019.

2.3 Current Climate-related Impacts of Concern in Pouce Coupe

Noted changes in the Pouce Coupe climate include a change to spring freshet and runoff levels. Additionally, there has been an increase in severe storms, including one major hail storm which was damaging to property. Recently experienced climate impacts have included:

- Intense rainfall events have contributed to more frequent flood threats from the Pouce Coupe river and Bissett Creek with significant flooding events in 2011 and 2016. More frequent heavy rainfall means that soils remain saturated between storms and streams respond more quickly to additional precipitation.
- Various sources of flooding have impacts to infrastructure, public lands, and habitat. Significant flood events have led to financial impacts – disaster financial assistance and other publicly funded resources help but are inadequate and uncertain in the future. The 2016 flood caused significant damage to Pouce Park, requiring the community to access Disaster Relief.
- Variability of flows (higher highs and lower lows) in the Kiskatinaw River, the water source for Dawson Creek and Pouce Coupe, with extreme low flows in late summer and early fall, and high flows in the spring or early summer (caused by freshet and by heavy rainfall events). An interviewee shared that in early June 2016, the Kiskatinaw had record high flows; by July they were approaching drought conditions.
- More snow has been falling in winter. Changes in the snowpack are impacting the timing and volume of freshet flows, with the freshet occurring around 3 weeks earlier than before (early- to mid-April), and a 14% reduction in peak flows relative to the 1966 – 1991 average.
- Pouce Coupe water supply comes from and is treated in Dawson Creek. A noted impact to the overall system is that there is an increase in periods when water cannot be pumped from Dawson Creek due to high turbidity or minimum flows.
- Culverts have backed up during spring melt
- There has been an increase in extreme weather events including a major hail storm in 2017 which caused damaged to property. It is also speculated that a small tornado may have been part of this storm, which was previously unusual for this area.
- While wildfire is not considered to be an immediate risk to Pouce Coupe, which is surrounded by largely agricultural lands, air quality impacts may affect community health.

2.4 Limitations & Gaps in Climate Data

At this time, the regional report on climate change projections for the northeast region has not yet been completed, so we are missing information on snowpack and hydrology, which will become available early in the new year. This will provide insight into hydrology for a few key rivers and watersheds, but not the entire region. Aside from this, we heard in interviews that, overall, there are gaps in monitoring of the snowpack and so this data could be improved.

PCIC will not be generating specific projections for snowfall, but trends may be extrapolated from other variables (e.g.: winter nighttime low temperatures, and Ice Days) to provide a description of expected trends.

In addition, there are technical challenges with modelling wind and wildfire risk, and so information about these potential changes/impacts are limited to likely trends as opposed to more specific projections.

3. Overview of Vulnerabilities and Adaptive Capacity

Vulnerability to climate change is a function of exposure to climate change related hazards and the sensitivity of the system to the hazard. For example, houses at elevation are less exposed to flood risk than those in low basins, and houses that have been designed with flood proofing elements, are less sensitive to floodwaters than those without these features. The section that follows is organized by system areas that are key to local government responsibilities, and outlines vulnerabilities identified during interviews and gathered through document review. The purpose of this section is not to provide a comprehensive vulnerability assessment but instead to introduce an overview of what information is available so far, and where there may be gaps. This review will inform our initial workshop on impacts and risk assessment in early 2019, and better equip staff and partners with an initial understanding of vulnerabilities their community faces.

The “Actions that Reduce Vulnerability” section refers to actions the municipality is already undertaking or planning to undertake, that reduce vulnerability of these systems to climate change – this includes actions that are informed by climate change projections specifically, and those that did not explicitly consider climate change but nonetheless contribute to reducing vulnerability. “Information Gaps” identifies remaining questions and topics requiring additional information, and the “Opportunities for a Climate Lens” section introduces windows of opportunity identified through the gap analysis, to incorporate a climate change adaptation lens into projects (e.g. a new community centre build), policies, regulations and programs, moving forward.

The adaptive capacity section lists various positive attributes already existing in the community, that will support them in adapting to climate change and where there are challenges that detract from adaptability and resilience.

3.1 WATER SUPPLY

Pouce Coupe owns its own waterworks system but purchases treated water from the neighbouring City of Dawson Creek which comes from the Kiskatinaw watershed, 16 kms west of the city and pumped through a booster pump station, a settling pond, a storage pond and a water treatment plant where it is chlorinated[3]. The existing water system is considered adequate for the current population.

Dawson Creek has been drawing its water from the Kiskatinaw River since the 1940s. Water supply security is a major issue for the municipality, which in turn has implications for Pouce Coupe who also depends on this water source. With demand expected to increase over time (e.g.: 3.2% annually; Saha, 2015), options have been explored in Dawson Creek, with public input (Sure Water 2013). Based on demand and growth projections, in 2015 the current system was estimated to provide an adequate water supply for average daily demands, until 2030 (based on historic precipitation and snowpack data) but to be insufficient under more severe drought conditions. A new water reservoir with a capacity of one million cubic metres is under construction in Dawson Creek, which would add 155 days of storage to the system's existing 73 days.

3.1.1 VULNERABILITY TO CLIMATE CHANGE

Increasing monthly streamflow and surface runoff is projected to occur, which could contribute to increasing erosion, sediment and nutrient loads, and turbidity. The water system pumps in Dawson Creek have to be turned off when the water is too turbid, which limits the number of days that water can be pumped into the reservoirs. As well, at times of low flow, pumps are also shut off. The volume that can be drawn from the river is limited by licensing restrictions and piping capacity. While the newly constructed reservoirs in Dawson Creek will improve water security, multiple low years in a row could pose challenges to water supply.

Large fluctuations in the local population and industrial activity, due to changes in the local economy, add another element of unpredictability to efforts to project and plan for future demand. Limits to supply may create conflict between users.

3.1.1.1 ACTIONS THAT REDUCE VULNERABILITY

Pouce Coupe's Official Community Plan includes specific treatment of climate change mitigation supporting energy and water efficiency in all new and renovated buildings. There is also a

[3] https://en.wikipedia.org/wiki/Pouce_Coupe

municipal policy to promote the use of grey water reuse systems in new construction and rainwater capture in all homes.

The Village has a Water Conservation Bylaw which enables council to activate a water conservation stage if deemed necessary. This is mostly specific to household irrigation and watering of lawns and gardens.

A lot of work has been done in Dawson Creek in relation to the watershed and water supply system, in terms of documentation, studies and planning. There is good baseline data and a recognition of the need to include climate change impacts in the watershed work.

The Kiskatinaw User Group is an informal collaborative group that includes industrial and municipal water users working together with FLNRO and the Oil & Gas Commission to coordinate pumping across users as licenses stipulate one industrial withdrawal at a time. Currently the group relies on an app to communicate when pumping thresholds are met and which user is pumping. To streamline communication, the group is hoping for funding to initiate an online data portal to combine data from existing climate and hydrometric stations and provide more complete watershed information.

3.1.2 Information Gaps

- Are there other climate related impacts we are missing?
- To what extent will the hydrological information from the PCIC regional report support further planning and design? What else might be needed?
- Is there back-up power to the various elements of the system?
- Might other climate related hazards impact viability of the water system and infrastructure (e.g. impacts of flooding, wildfires, etc)?

3.1.3 Opportunities for a Climate Lens

- Planning documents for watershed management and water supply infrastructure
- Pro-active water conservation and water use reduction policies
- Design of current and future water system upgrades and expansion
- Options for addressing turbidity and other system performance issues
- Future water demand and supply projections

3.2 Sewage and Drainage

The Village of Pouce Coupe operates 7 kilometres of sanitary sewers processed through a two-cell lagoon system, with discharge to the Pouce River.

The existing sewer system is considered adequate for the current population, and can handle up to 950 in population, which could be more if water-saving is instituted.

3.2.1 Vulnerability To Climate Change

During intense rainfall events, drainage capacity can be overwhelmed causing street flooding and increased risk for flooding of buildings. It was noted that the soil make up in this region is particularly dense and less permeable, making the Pouce Coupe area more susceptible to flooding. With increased heavy rains, the Village has had to engage the Fire Department to pump water to keep roads clear.

Sewer systems all over BC have been designed and built based on historical rainfall data (Intensity duration frequency curves). They may not be properly sized for projected future rainfall let alone current extremes.

Capacity of water and sewer services may impact future development phasing.

Heavier outfalls of stormwater consistently into natural watercourses may increase erosion depending on where they are situated.

3.2.1.1 Actions that Reduce Vulnerability

The overall costs of sanitary sewer and stormwater infrastructure upgrades, maintenance and testing over time are substantial. If a climate lens can be incorporated during upgrades and renewal, the assets may be effective for a longer lifespan under different future conditions. The incremental cost is likely to be much less than replacement of the asset early after multiple failures.

In 2016 the Village began working with Urban Systems on a detailed and comprehensive asset management inventory and mapping program. Once complete, this program will provide the Village with a complete list of water, sewer and other infrastructure along with map locations of things like shut off valves, hydrants and curb stops. As part of this assessment, the Village is also considering lagoon capacity and freshwater. As infrastructure is aging, this will help the community plan for future investment and infrastructure repairs or upgrades.

In an effort to minimize culvert back ups, the Village has been putting effort into clearing culverts during spring thaw times, and now requires property owners to install larger sized culverts. 2017 saw the replacement of 25 culverts within the Village as well as ditch cleaning in selected areas.

There is a noted practice of now discouraging development outside of municipal boundaries where the Village might have historically serviced water and sewer for these areas. It is not clear what the motivation is behind this practice but it does ensure efficiency of water and sewer systems that in turn ensures infrastructure investment spending is most effectively used.

3.2.2 Information Gaps

- More information is needed on the stormwater and sanitary sewer system.
- What are the current vulnerabilities in the sanitary and stormwater systems that are sensitive to increasing intensity and frequency of rainfall (i.e. Inflow and Infiltration)?

- Are there areas of town that are more susceptible to street flooding?
- Does the asset management inventory include climate change projections?
- Would natural asset management approaches to stormwater and/or sewer management be viable in this location?

3.2.3 Opportunities for a Climate Lens

- Sewer and stormwater system upgrades and maintenance programs
- Additional requirements that could be included in development, zoning and subdivision servicing bylaws
- Public education related to flood risks and clearing private catch basins etc.

3.3 Transportation (Roads, Bridges, Sidewalks)

Highway 2 runs north-south through Pouce Coupe, connecting the town to Dawson Creek and Alberta. Pouce Coupe's internal street network has 14 km of paved and 5 km of unpaved road.[18] The village's commercial activities are centered on the bend in highway. The residential areas are located mostly south of the highway with a gridiron layout. Industry is located north of the highway and agriculture to the west.

Pouce Coupe does not have rail, air, and bus services within its borders but uses those services as they are available in Dawson Creek. The rail lines actually goes through Pouce Coupe, through the north beside by the highway and southwestern corner, but does not stop.. Pouce Coupe is serviced by the Dawson Creek Airport which is located in the southeastern corner of the Dawson Creek municipal borders. Regional bus service, is accessed through Dawson Creek. [4]

3.3.1 Vulnerability To Climate Change

With increased heavy rains, the Village has had to engage the Fire Department to pump water to keep roads clear.

With Highway 2 providing access to and from Pouce Coupe, extreme events affecting this highway could compromise evacuation routes, leaving the community more vulnerable.

An increase in heavy snow events and rain on snow events may increase the difficulty getting around via all modes of transport, increase the costs of street clearing and maintenance and strain the capacity of public works. Sidewalk maintenance may also become more difficult to implement with the increasing number of freeze/thaw events, as well as potential damage to paved surfaces which could require increased maintenance and replacement.

Travel behaviours could change significantly with projected changes – winters will be warmer, with less ice days and summers will be hotter with more extreme heat events. Overall, the

[4] https://en.wikipedia.org/wiki/Pouce_Coupe

climate may be more conducive to active transportation modes than currently. At the same time, extreme heat conditions in the summer may be of growing relevance, affecting travel behaviours as well as needs for bus shelters or cooling centres along active transportation routes. Also, extreme rainfall events or other unpredictable weather may deter active transportation or complicate travel.

Overlap in jurisdictional responsibility for various aspects of the transportation network will require collaboration between agencies and levels of government to effectively adapt the system to changing conditions.

The regional transportation system is vulnerable to disruptions due to extreme weather events and hazards such as floods and landslides. Many communities rely on 'just on time' deliveries for the basic necessities of life. If roads are impacted there is a possibility of food shortages.

3.3.1.1 Actions that Reduce Vulnerability

- None identified

3.3.2 Information Gaps

- Very little information available on transportation infrastructure or existing actions to lower vulnerability of the road network.
- How might transportation / mobility needs for more vulnerable populations (eg: seniors, low income residents) be affected by a changing climate?
- How might demand on Public Works change, given the varying projected changes to weather patterns?
- How might increased flood risk affect Pouce Coupe given limited highway access?

3.3.3 Opportunities for a Climate Lens

- The Village's OCP priorities supporting walkability, building a complete community and direction to develop an integrated trail system throughout the community may be supported by projected changes to climate. Currently, winter weather may be a key barrier to greater uptake of active transportation and transit
- Rationale for greater collaboration across agencies and levels of government relating to the transportation network

3.4 Hazard and Emergency Management

Pouce Coupe's Official Community Plan indicates that the Village maintains an emergency plan which is reviewed and tested annually, and that they work collaboratively with the school district, industry, regional and provincial government to address community health and safety concerns with regards to emergency response

The most likely emergencies named for Pouce Coupe include wildfires, traffic accidents involving dangerous goods, extreme weather events (storms, extremely cold temperatures, droughts), and plane crashes. Flooding was highlighted as a main area of concern in interviews.

Peace River Regional District currently provides 34% of funding to the Pouce Coupe Volunteer Fire Department to serve most of Area D for rural fire protection services, including fire suppression and first responders.

3.4.1 Vulnerability To Climate Change

As the frequency and intensity of extreme events increases, Pouce Coupe may find their emergency response and emergency social services required more frequently, both within the Village and as part of the Fire Department's Rural Fire Protection Agreement with the Peace River Regional District. Cascading impacts to budget and workforce would be anticipated.

While Pouce Coupe has not experienced a direct threat from wildfires, air quality may become more of a concern from wildfires in other locations. This can particularly affect those who are most vulnerable (e.g.: seniors, children, those with respiratory or heart conditions), and outdoor workers.

The Village itself may be less susceptible to severe flooding given its elevation, however, recent flood events have had a significant impact on the environment and recreational lands, and are likely to impact this in the future. Floods may also pose risk for infrastructure, regional economy and residents in flood prone areas. A consideration with climate change is that more frequent and/or intense events will have a cumulative impact over time – both the impacts and effectiveness of different solutions, may look different as the climate changes.

3.4.1.1 Actions that Reduce Vulnerability

- The Village maintains and emergency plan and has been working with local industry on a mass communication system
- There are evacuation protocols in place with local institutions such as the school and other levels of government
- There are strong relationships and informal agreements with neighbouring communities and fire departments to assist with evacuations if needed

3.4.2 Information Gaps

- Are there response plans specific to various hazards (i.e. flood)?
- Is there a resilient community gathering place with back up power in case of an emergency?
- Collection and analysis of snowpack data for predicting freshet timing and volume
- How might wildfire risk change and in what ways is Pouce Coupe vulnerable to direct and indirect impacts?
- How might the changing patterns and nature of climate and extreme weather-related risks, impact the types of challenges faced by various sections of the community? What types of responses may be better suited to these challenges?

- Are the needs of more vulnerable populations being considered and/or addressed?
- To what extent is Public Works or other Village staff integrated with Emergency Management, in preparedness, response and recovery phases?

3.4.3 Opportunities for a Climate Lens

- The Emergency Plan may need to be reviewed with the lens of climate change bringing more frequent events requiring some level of response or more levels of activation.
- Public communications regarding emergency management seems to focus largely on individual households. Is there anything underway to support greater community-wide preparedness for extreme weather events?

3.5 Buildings (including public facilities), Planning and Zoning

Pouce Coupe is a small community with a population of 792 (2016 Census) that self-identifies as a bedroom community to Dawson Creek.

The housing stock overall is aging and there is an identified need for diversification of housing types, and affordable housing. Single-detached dwellings make up the vast majority of Pouce Coupe's housing stock at 92% of total private dwellings. A small portion of total occupied private dwellings are made up of semi-detached houses (3%) and apartments with fewer than 5 stories (1.7%).

The OCP provides guidance to ensure that there is enough residential designated land supply to accommodate a variety of future residential needs. It also promotes the construction of new seniors housing for both independent and dependent elderly residents and supports the development of future housing stock to allow seniors to age-in-place, advising construction within a 400 m walkable distance from the Village centre and amenities.

Future growth in Pouce Coupe is constrained by natural waterways, steep slopes and lands protected by the Agricultural Land Reserve. The Village is part of the South Peace Comprehensive Development Plan (2007), a joint plan with Dawson Creek and the Peace River Regional District to manage growth and development in the region.

Between 2005 and 2007 a collaborative effort between the Village of Pouce Coupe, the Agricultural Land Commission, Peace River Regional District and City of Dawson Creek saw the development of the South Peace Comprehensive Development Plan (CDP) and identified two areas of land to be taken out of the ALR to accommodate future development. At the time, one area was located within the Pouce Coupe municipal boundary and identified for future residential development. The second area was located immediately north of the Village's boundary and identified for future industrial development. This area as well as additional lands have since been incorporated into the Village of Pouce Coupe.

3.5.1 Vulnerability To Climate Change

Buildings are generally built based on historical climate design data. Projected trends include a decrease in heating demand and an increase in cooling demand. Existing buildings may have poor thermal comfort during hotter summers in the future. Heavier rain, higher winds and potentially higher snow loads all have the ability to damage buildings.

Buildings may also require improved emergency systems that support sheltering in place during emergencies, such as ability to continue accessing water and a shared storage of emergency supplies, and emergency evacuation plans. Back-up power supplies to critical buildings may also enhance resilience.

Planning and zoning may encourage development in areas where natural hazard risk, such as flooding or landslide, will increase with climate change. Community planning has the opportunity to improve climate resilience versus increasing impacts.

3.5.1.1 Actions that Reduce Vulnerability

The Village of Pouce Coupe has specific treatment of climate change mitigation such as energy and water efficiency in its OCP, as well as a commitment to implementing the 2010 Energy Plan (energy reductions from municipally owned buildings and vehicles.

The Village has policy in place to “protect the natural environment, life and property by limiting development in areas recognized by Council as environmentally sensitive, and subject to flooding, soil instability, slope instability, or landslides. These areas are entirely in the gullies of Bissette Creek and Pouce Coupe River, on lands owned by the municipality, and are zoned P2. In lieu of creating a development permit area, staff and council will ensure that geotechnical considerations are carefully reviewed in the development process".

3.5.2 Information Gaps

- Is development currently limited due to hazardous areas?
- Are residents reporting impacts to homes from climate-related events?
- Are there areas that are more susceptible to flooding or landslides?
- Which public facilities may require back-up power?

3.5.3 Opportunities for a Climate Lens

- Future climate scenarios could be included in long term planning to ensure infrastructure and services are adapted for future climate with a growing population.
- The OCP could include a stronger section on natural hazards and climate adaptation
- Building guidelines or bulletins

3.6 Parks, Green Space, Street Trees

The Village of Pouce Coupe operates parks within the Village, and the community is bordered to the south by Pouce Coupe Regional Park, operated by the Peace River Regional District. There are several additional Provincial Parks, all to the south of the community.

3.6.1 Vulnerability To Climate Change

Flooding in 2016 saw significant damage to Pouce Park, which raised the ground level by 3 feet and left 7 acres underwater, causing damage to buildings and the local campground. Future flood risk to this area remains high.

Changing climate may shift species zones, introduce new pests, vectors for disease and invasive species. On the positive side, new street trees and vegetation not planted before may be viable.

Increasing intensity and frequency of storms may increase damage to trees and associated public safety hazards. Tree maintenance programs may need to be enhanced. Parks with no refuge from inclement weather (hot or cold) may experience lower use and those in flood prone areas may incur damage and loss of use more frequently.

3.6.1.1 Actions that Reduce Vulnerability

Since the 2016 flood the community has opted not to rebuild campgrounds and regional infrastructure at Pouce Park in recognition of the ongoing flood risk in this area. The park has instead been retained as greenspace as a day use site.

3.6.2 Information Gaps

- Any increases to tree and plant death or maintenance needs?
- Any change to what species of trees and vegetation are being planted?

3.6.3 Opportunities for a Climate Lens

- Tree species and vegetation list suitable for Pouce Coupe may change over time
- If acquiring new parks, consider location, shade provision and drainage.
- Retain green and natural areas where possible to buffer climate change impacts. Consider retaining some tree cover for new developments where possible.
- Objectives / purpose of parks, green spaces and other natural features to include a role as part of a climate change adaptation strategy

3.7 Community Development

Pouce Coupe's OCP names the importance of community development, and affirms its commitment to supporting community-led initiatives, as well as its own Village actions to foster community well-being. The Village overall has an active community with high levels of volunteerism, noting in 2018 each volunteer provided over 150 hours to local activities.

The population of Pouce Coupe is made up of higher than provincial average numbers of youth and seniors.

3.7.1 Vulnerability To Climate Change

Health impacts from climate change include degraded summer air quality due to wildfires burning around the province, new or increased allergens, heat-related illness for those with underlying health conditions and increased stress and anxiety with increased extreme events. In some cases, these risks may be higher for seniors and youth.

There is also an opportunity with climate change and generally milder winters to welcome migrants from other latitudes and countries that are under extreme climate stress in the future.

3.7.1.1 Actions that Reduce Vulnerability

- Interviewers reported high levels of social connectedness and volunteerism.

3.7.2 Information Gaps

- Have health impacts from climate change related events (wildfire smoke) been experienced?
- With increasing movement in and out of the community, how well are neighbours connected? Where do they connect?
- What information exists on different demographic groups and in particular, vulnerable populations (e.g.: low income, seniors, visible minorities, etc)
- Are there community services with important roles in building social connections, servicing low-income populations etc.?
- Do residents generally have a keen sense of preparedness?

3.7.3 Opportunities for a Climate Lens

- Engagement around climate mitigation is a great opportunity to engage around adaptation to build awareness and capacity.
- Partnerships with local health providers on health and climate change messaging.
- Partnerships with social service organizations in education and response to extreme events
- Community engagement with respect to a socially cohesive community and/or emergency preparedness can message the benefits of knowing your neighbours

3.8 Economic Development

The economy of Pouce Coupe is largely based around the region's booming natural gas and reource extraction development. Much of the current economic development is directly connected to oil and gas, occupying the majority of Pouce Coupe's designated industrial areas. The Village is focused on pursuing opportunities for new commercial, Industrial and tourism developments to diversify and grow the Vilage's revenue base, including smaller

commercial, niche market ventures and needed amenities identified by residents. A priority of Economic development initiatives ispreserving of Pouce Coupe's small town charm.

In 2017, the Village undertook the development of an Economic Development Plan (EDP), which was endorsed by Council in early 2018.The main objective of the EDP was to provide the Village with guidance on increasing its economic viability and sustainability. The EDP set forth an economic development purpose, five guiding principles and a number of strategic objectives related to economic development. Tactics designed to increase the economic viability and sustainability included the development of a neighbourhood plan for West Pouce.

Pouce Coupe's core was also identified as a key area for revitalization and growth in the form of infill development and development of under-utilized properties. The core area along Highway 2 contains multiple vacant and underused properties that present opportunities to address the commercial and residential needs of the community through a more efficient use of land. Pouce Coupe is interested in ensuring that it has a sustainable and thriving core that is not dependent on highway traffic for exposure and can successfully draw in bypassing traffic.

A long standing history of food production is an important part of the community's culture and history, and the Village's OCP places priority on supporting local food production.

3.8.1 Vulnerability To Climate Change

The current and future risks and opportunities for agriculture in the region are described in the regional agriculture risk & opportunity assessment and accompanying regional adaptation strategy (BC Agriculture & Food Climate Action Initiative, 2012 & 2013). The four top impact areas identified for the grain and oilseed industry were due to: increasing dry & drought conditions; increasing precipitation & changing precipitation patterns; increased variability & extremes; **i**ncreasing temperatures, Growing Degree Days & growing season length. These contribute to a range of challenges, but also some potential opportunities due to a longer growing season and opportunities for different crops to be grown here. Among the most significant risks to unirrigated agriculture is a severe multi-year drought, a scenario which is predicted to become more likely by the 2050s. At the same time, a study found that irrigation was still not financially feasible up to 2050, even with climate change projections factored in (KWL 2016).

In 2015, the Fraser Basin Council produced a risk and opportunity assessment focusing on the Oil & Gas sector in northeastern BC. Key issues identified, include access to water; damage and disruption to industry and regional transportation infrastructure due to flooding, wildfire, landslides, and more variable weather; health and emergency preparedness impacts due to flooding and wildfires; implications of changing species distributions and habitats. Industry is reportedly not actively considering these types of impacts in their operations.

A 2015 Climate Action Plan for FLNRO was developed for the northeast region, and identifies local governments as a key partner. It emphasizes the importance of collaboration with other organizations and the importance of data to inform effective decision-making.

Other economic vulnerabilities include a shortened construction season. Interviewees mentioned that the season is already shorter and now often rained out. Water heavy industries in the region may start to feel the pressure of drought and competition for the resource. Increasing disruptions to transportation may occur in the shorter term as extreme events increase.

There may be new economic opportunities as the climate changes such as diversified agricultural products and an increase in tourism. Overall, climate change introduces significant uncertainties to a number of key sectors in the region.

3.8.1.1 Actions that Reduce Vulnerability

A number of studies have been conducted in the region, relating to the impacts of climate change on key sectors. The agriculture sector has been working on understanding and adapting to climate change for a number of years now. While the oil & gas sector has had a focus on mitigation, it has reportedly not made this a priority, as climate projections are further in the future than what they are planning for.

Industry in the region is required by legislation to work with First Nations communities, while their relationship with municipalities is case by case. The BCOGC is working in partnership with First Nations in the area, FLNRO and the BC Ministry of Energy, Mines and Petroleum Resources, to produce an environmental assessment on the cumulative effects of development in the northeast region.

Regionally, a working group on adaptation for the agriculture sector exists

3.8.2 Information Gaps

- Is Pouce Coupe represented on various industry-related committees as a stakeholder?
- Where are the greatest supports regionally for economic development?
- Where are there opportunities for collaboration and information sharing (relating to climate change impacts & adaptation) between local governments and other sectors / government agencies, and where are there gaps?

3.8.3 Opportunities for a Climate Lens

- The development of a neighbourhood plan for West Pouce presents an opportunity to include and plan for future climate projections
- Pouce Coupe includes large agricultural areas. With changes in climate, crop diversification may be an option with larger offers to markets.

3.9 FACTORS AFFECTING ADAPTIVE CAPACITY

Pouce Coupe's OCP describes the community as a "resilient, multigenerational community, drawing upon our agricultural heritage and natural resource to provide an affordable lifestyle within the thriving South Peace region."

In Pouce Coupe some factors were identified that contribute positively to the municipality's adaptive capacity, including:

- Because of the significant presence of industrial development in the region , there is a strong culture of safety (many community members have their own equipment which could help in an emergency)
- There is a strong culture of community members helping each other out

3.9.1 MATURITY SCALE

The Adaptation Maturity Scale developed by the Federation of Canadian Municipalities (FCM) is a self-assessment tool intended to help municipalities rapidly identify areas of potential improvement in adaptation planning. It is based on FCM's understanding of the processes needed to incorporate climate change risk into asset management, infrastructure investments and maintenance, and municipal organizational planning. The full checklist is included as Appendix C.

The scale has three competency areas: policy, human resources and governance, and technical and risk management capacity. Each competency area has 5 levels through which a municipality can progress. For the purposes of the Vulnerability Assessment project, an assessment at the beginning and end of the project and several years after implementation will illustrate the impact of the project.

The competencies are:

- **Policy:** Putting in place policies and objectives related to the development of an environment and vision that supports local climate adaptation.
- **Human resources and governance:** Ensuring staff and council are equipped with the mandate, understanding, skills and knowledge needed to support local climate adaptation.
- **Technical and risk management capacity:** Preparing the tools needed to deliver adaptation initiatives and manage operations in a way that minimizes climate risk (e.g. software, hardware, maps, models, etc.).

Based on this initial assessment, the following rating is suggested for Pouce Coupe:

Competency	Level 1	Level 2	Level 3	Level 4	Level 5
Policy	X				
Human Resources and Governance	X				
Technical and Risk Management Capacity	X				

4. CONCLUSION

Pouce Coupe is noted to be a tight-knit, traditionally agricultural community that is evolving to diversify economically, while maintaining a focus on quality of life for its residents in the wake of large scale development in the region. There is a strong community culture of safety, self-reliance, and helping each other out, which presents a strong base for overall adaptive capacity of the community.

The community has already been experiencing impacts associated with climate change, with extreme flooding events in 2011 and 2016. Moving forward, future climate scenarios could be included in long term planning to ensure infrastructure, services, and community/economic development strategies are adapted for future climate with a growing population. The Village's OCP priorities supporting walkability, building a complete community and direction to develop an integrated trail system throughout the community may be supported by projected changes to climate. Issues related to water supply and quality are a significant concern in this area, and there is opportunity to develop or enhance municipal water policy and planning and to collaborate with Dawson Creek on watershed management and water supply strategies.

APPENDIX A: LIST OF DOCUMENTS REVIEWED

REGIONAL DOCUMENTS

Title	Author	Year	Source
Backgrounder: Future Climate in North Eastern British Columbia	Ian Picketts for the Fraser Basin Council and BC Ministry of the Environment	2015	https://www.retooling.ca/_Library/docs/backgrounder_fcnbc_jan_21_2015.pdf
Evaluation of Irrigation Potential in the BC Peace Region	KWL for the BC Grain Producers Association	2016	https://www.bcagclimateaction.ca/wp/wp-content/media/PC05-Evaluation-Irrigation-Potential-Peace-summary.pdf
Adaptation Planning Approaches and State of Climate Science in Dawson Creek	Pembina Institute	2012	Document was emailed to us.
About the Northeast Water Tool (NEWT)	BC Oil and Gas Commission	2015	Document was emailed to us.
Northeastern British Columbia: Climate Risk Assessment for the Oil and Gas Sector	Fraser Basin Council	2015	https://www.retooling.ca/_Library/docs/Climate_Assessment_NEBC_2015_web.pdf
Peace River Regional District Emergency Management Program Directive	Peace River Regional District	2014	https://prrd.bc.ca/wp-content/uploads/2015/03/PRRD-Emergency-Program-Directive-Final-.pdf and https://prrd.bc.ca/services/emergency-services/
Peace River Regional District Regional Emergency Management Feasibility Study	Peace River Regional District	2015	https://prrd.bc.ca/services/emergency-services/projects-emergency-services/

Peace River Regional District Organizational Chart, Committees and Strategic Plan	Peace River Regional District	2018	https://prrd.bc.ca/org-chart/ and https://prrd.bc.ca/agendasminutes/standing-committees/ and https://prrd.bc.ca/who-we-are/strategic-plan/

POUCE COUPE DOCUMENTS

Title	Author	Year	Source
Annual Reports	Village of Pouce Coupe	2014 - 2018	http://www.poucecoupe.ca/content/financial-bylaws-reports
Community Energy Plan	Stantec for the Village of Pouce Coupe	2010	https://prrd.bc.ca/wp-content/uploads/2014/12/PCCEP2010.pdf
Public Works Website	Village of Pouce Coupe	2018	http://www.poucecoupe.ca/content/water-sewer
Water Conservation Bylaw	Village of Pouce Coupe	2009	https://poucecoupe.civicweb.net/document/2024
Sewer Charges and Regulations Bylaw	Village of Pouce Coupe	2011	http://www.poucecoupe.ca/content/water-sewer
Official Community Plan	Village of Pouce Coupe	2016	Emailed to us.

Fire Protection Agreement	Village of Pouce Coupe	2018	http://prrd.bc.ca/board/agendas/2018/2018-18-612852215/pages/documents/09-R-05PouceCoupeRuralFireProtectionAgreement-May2018.pdf
Emergency Services website	Village of Pouce Coupe	2018	http://www.poucecoupe.ca/content/emergency-services
Village Voice Community Newsletter	Village of Pouce Coupe	Monthly	https://poucecoupe.civicweb.net/document/18359

APPENDIX B: LIST OF INTERVIEWEES

Between one and three people were interviewed from each community, along with six interviewees from regional or provincial agencies and sectors. Information in each scoping report was taken from documents and interviews specific to that community, along with regional interviews. The full list of interviewees across communities includes:

- Carol Newsom, CAO, District of Chetwynd;
- Dustin Curry, Director of Protective Service, District of Tumbler Ridge;
- Doug Beale, Director of Operations & Infrastructure, District of Tumbler Ridge;
- Christopher Leggett, CAO, Village of Pouce Coupe;
- Blair Deveau, Fire Chief, Village of Pouce Coupe
- Moira Green, General Manager of Community Services, City of Fort St John
- Victor Shopland, General Manager of Integrated Services, City of Fort St John
- Krista Vandersteen, Community Development Researcher, Northern Rockies Regional Municipality
- Terry Cavaliere, Public Works Administration Manager, Northern Rockies Regional Municipality
- Chelsea Mottishaw, Watershed Coordinator, City of Dawson Creek
- Melanie Turcotte, Sustainability Clerk, City of Dawson Creek
- Peter Nilsen, Energy Manager, City of Dawson Creek
- Alex Wallace, Planning Manager, City of Dawson Creek
- Sandra Allison, Chief Medical Health Officer, Northern Health
- Dirk Nyland, Chief Engineer, BC Ministry of Transportation
- Richard Kabzems and Karen Moss, BC Ministry of Forests, Lands and Natural Resource Operations
- Suzan Lapp, Hydrologist, Resource Development and Stewardship, BC Oil & Gas Commission
- Foster Richardson, Project Manager, Regional Adaptation, BC Agriculture & Food Climate Action Initiative
- Julie Robinson, Principal, Forage Friendly Enterprises (former Regional Agrologist for Peace Region)

APPENDIX C: MATURITY SCALE CHECKLIST

The following pages are the checklist portion of the "Climate Adaptation Maturity Scale" published by the Federation of Canadian Municipalities' "Municipalities for Climate Innovation Program." The full document is available at: https://fcm.ca/home/programs/municipalities-for-climate-innovation-program/climate-adaptation-maturity-scale.htm

Competency: Policy

Putting in place policy and objectives related to the development of an environment and vision that supports local climate adaptation.

	1		2		3		4		5	
	Concept Level		**Preliminary Level**		**Implementation Level**		**Operational Level**		**Continuous Improvement Level**	
	Working on Level 1 ☐	Completed on Level 1 ☐	Working on Level 2 ☐	Completed on Level 2 ☐	Working on Level 3 ☐	Completed on Level 3 ☐	Working on Level 4 ☐	Completed on Level 4 ☐	Working on Level 5 ☐	Completed on Level 5 ☐
Maturity level →	We have set expectations for our work on climate adaptation. We have the support we need to begin preparing a policy.		We have drafted a climate adaptation policy and have prepared strategic guidelines that will inform the development of an adaptation plan and other adaptation initiatives.		We have adopted our climate adaptation policy and are using it to guide our actions, and have drafted an adaptation plan. We have established performance measures to monitor progress.		We have a climate adaptation plan in place and are managing climate risks. We are using performance measures to track the progress and outcomes of our climate adaptation initiatives.		We are continually improving our understanding of climate risks and our approach to managing these risks.	
Outcomes	You have achieved a specific maturity level when you can demonstrate evidence of the outcomes below.									
Policy and objectives	☐ We have looked into policy issues and constraints surrounding climate change adaptation within our community.		☐ We have developed a policy that details our organizational commitment to climate adaptation. ☐ Senior management and council have endorsed the policy.		☐ We are starting to use the policy objectives to guide our broader corporate plans and actions. ☐ We have drafted an adaptation plan detailing specific initiatives and processes.		☐ Senior management and council have endorsed the adaptation plan. ☐ Climate risks are managed in terms of levels of service, operations, and maintenance, in accordance with the policy.		☐ We are validating and refining corporate, service and adaptation objectives based on the evolving needs of our community.	
Strategy and framework	☐ We have defined objectives and committed to taking a concerted approach to managing climate risks.		☐ We have engaged senior leadership in identifying strategic-level climate risk categories across the municipality.		☐ We are beginning to integrate climate risk considerations into our asset management practices.		☐ There are clear links between the climate adaptation plan, asset management practices, and other strategic corporate efforts.		☐ We are continually improving our understanding and management of strategic-level climate risks.	
Measurement and monitoring	☐ We have articulated the expected benefits and outcomes of climate adaptation to council and internal stakeholders.		☐ We have developed guidelines and criteria for local or regional adaptation initiatives.		☐ We have established performance measures to monitor progress on climate adaptation, outcomes, and community benefits.		☐ We monitor progress on the climate adaptation plan and the implementation of adaptation initiatives.		☐ We are monitoring performance and using the feedback to prioritize and make ongoing refinements and improvements.	

Competency: Human resources and governance

Ensuring staff and council are equipped with the mandate, understanding, skills and knowledge needed to support local climate adaptation.

	1		2		3		4		5	
	Concept Level		**Preliminary Level**		**Implementation Level**		**Operational Level**		**Continuous Improvement Level**	
	Working on Level 1 ☐	Completed on Level 1 ☐	Working on Level 2 ☐	Completed on Level 2 ☐	Working on Level 3 ☐	Completed on Level 3 ☐	Working on Level 4 ☐	Completed on Level 4 ☐	Working on Level 5 ☐	Completed on Level 5 ☐
Maturity level →	We have council support[1] to establish a cross-functional climate adaptation team.[2]		We have established a clear mandate for our climate adaptation steering committee.[2] Council has approved use of funding for internal or external awareness raising regarding climate risks and potential adaptation initiatives.		Our climate adaptation steering committee and team[2] have clear responsibility and the support needed for preparing a draft climate adaptation plan.		Our climate adaptation plan is in place. Our climate adaptation team[2] is guiding and supporting climate adaptation on an ongoing basis, and has ongoing council support. Adaptation-related roles and responsibilities are operationalized.		Our staff and council are continually improving our understanding of climate risks and our approach to managing them.	
Outcomes	You have achieved a specific maturity level when you can demonstrate evidence of the outcomes below.									
Cross-functional groups	☐ We have appointed a climate adaptation team to examine current and future climate change risks and to identify potential adaptation opportunities or initiatives.		☐ We have appointed a cross-functional climate adaptation steering committee[2] to oversee planning and deployment of climate adaptation initiatives by the climate adaptation team.		☐ The climate adaptation team, with oversight from the steering committee, is developing and will manage a climate adaptation plan.		☐ Our climate adaptation team has been made permanent to provide ongoing communication, support and guidance on adaptation across the organization.		☐ Our climate adaptation team and steering committee support the continuous improvement of our climate adaptation initiatives.	
Aligned culture	☐ Staff/council have a basic understanding of risks posed by climate change to infrastructure, natural assets and operations.		☐ Our climate adaptation team raises awareness of local climate risks and builds buy-in for potential adaptation initiatives.		☐ Climate-adaptation-related roles and responsibilities are clearly identified and communicated for staff in key departments.		☐ Climate risks are managed in terms of levels of service across our organisation.		☐ Climate change considerations are influencing how we optimise decisions on assets and service delivery.	
Stakeholder engagement	☐ We have identified climate change and adaptation stakeholders within the community.		☐ We have completed some community consultation on our climate change vulnerability assessment and potential adaptation initiatives (see Level 2 of the Technical and Risk Management Capacity competency).		☐ We have completed community consultation on the climate change vulnerability assessment, potential adaptation initiatives, and climate impacts on levels of service.		☐ We communicate regarding climate change adaptation initiatives and progress on climate adaptation plan implementation, internally and externally.		☐ Staff or council members are recognized by peers and external stakeholders as adaptation resources, and engage with them to exchange knowledge. ☐ There are ongoing mechanisms through which the community can be engaged in discussions or activities relating to local climate adaptation.	

[1] Council support is defined as a formal council resolution or adoption of bylaws, studies, master plans or policies that confirm formal support from elected officials.

[2] Members of the climate adaptation team or steering committee may wear many hats within their organization, and may also hold responsibility for other initiatives (e.g. asset management). It is also recognized that in smaller municipalities, members may sit on both the climate adaptation team and climate adaptation steering committee. Some municipalities may choose to engage external stakeholders in their climate adaptation team or climate adaptation steering committee, or in both groups, but it is recommended that there be a strong level of internal representation.

Competency: Technical and risk management capacity

Preparing the tools needed to deliver adaptation initiatives and manage operations in a way that minimizes climate risk (e.g. software, hardware, maps, models, etc.).

	1		2		3		4		5	
	Concept Level		**Preliminary Level**		**Implementation Level**		**Operational Level**		**Continuous Improvement Level**	
	Working on Level 1 ☐	Completed on Level 1 ☐	Working on Level 2 ☐	Completed on Level 2 ☐	Working on Level 3 ☐	Completed on Level 3 ☐	Working on Level 4 ☐	Completed on Level 4 ☐	Working on Level 5 ☐	Completed on Level 5 ☐
Maturity level →	We are exploring our technical needs and data gaps so that we can take steps to better manage our assets and reduce their vulnerability to climate change.		We have defined our technical gaps and are acquiring the necessary data and tools to conduct a vulnerability assessment of our infrastructure-based services.		We understand the priority climate risks to key infrastructure systems and are planning our monitoring and management approach for addressing them.		We understand ongoing climate risks to our assets and levels of service, and are planning adaptation initiatives to address them. We have data collection and analysis processes in place to support risk management and adaptation initiatives.		We continually improve our approach to strategic adaptation planning and reducing climate risk over the longer term.	
Outcomes	You have achieved a specific maturity level when you can demonstrate evidence of the outcomes below.									
Data and performance management	☐ We are compiling available data and identifying gaps related to asset performance, as well as observed and expected local climate change impacts. ☐ We are conducting a needs assessment for an information system to manage and track asset and climate data.		☐ We are filling data gaps related to asset performance and local climate change impacts. ☐ We have established appropriate operational and customer levels of service for priority assets. ☐ We have completed the needs assessment for our information system, and are exploring suitable options.		☐ We have identified our priority assets for risk management, and are establishing processes for ongoing data collection on asset performance and climate change impacts. ☐ We have acquired an information system for managing and tracking data, and are currently implementing it and training relevant staff.		☐ We have implemented our information system, trained relevant staff, and established processes for ongoing data collection related to asset performance. ☐ Our approach to climate change risk management and ensuring levels of service is well-documented.		☐ We continually improve our approach to data collection and management; and practices and tools are in place to manage the quality and consistency of data. ☐ Flexibility is built into the processes and tools to make it easy to adapt them to a changing reality or changing conditions.	
Technical tools	☐ N/A		☐ We are conducting a needs assessment for other technical tools (e.g. models, software, maps, etc.) to support analysis of climate change impacts on established levels of service.		☐ We have acquired or developed other technical tools and have completed a vulnerability assessment of our assets. ☐ We are identifying measures to address climate risks to levels of service, operations and maintenance, and capital projects as needed.		☐ We are using our tools to monitor the effectiveness of our risk management practices and adaptation measures.		☐ We continually improve our tools for analyzing climate impacts on established levels of service and managing climate risk.	

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Economic considerations	☐ We are exploring costs for accessing relevant data sources or acquiring necessary technical tools and systems for conducting a climate risk assessment of our assets.	☐ We have allocated funding for acquiring relevant data, technical tools and systems, and/or training needed to conduct a detailed vulnerability assessment of our assets.	☐ We are assessing costs related to adaptation initiatives that address immediate risks to our assets or levels of service.	☐ We have allocated annual funding to implement priority adaptation initiatives and to manage operations in a way that reduces climate risks to our assets and service levels.	☐ Our climate adaptation initiatives are fully funded and our operations are managed in a way that minimizes climate risk to our assets and service levels over the longer term.

APPENDIX D: POSSIBLE FUTURE CLIMATE IMPACTS OF CONCERN

The following table outlines the potential impacts identified through the gap analysis for communities in the Northeast region. These statements will be reviewed by stakeholders in Workshop 1, in the next step of the Vulnerability Assessment process.

Anticipated Changes	**Impacts**	**Water Supply**	**Sanitary Sewer**	**Storm Drainage**	**Transportation**	**Hazard & Emergency Mgt.**	**Buildings, Planning and Zoning**	**Facilities, Grounds, Energy Systems**	**Parks, Green space, surrounding enviro.**	**Community Development**	**Economic Development**
Increased riverine flood risk due to changing snowpack, snowmelt timing and increased intensity and frequency of precipitation	Increased river flood risk damaging buildings, crops, parkland, infrastructure such as bridges, etc.					✓	✓	✓	✓		
	Increased river flow and flood risk causing increased formation of new channels and bank erosion	✓				✓					
	Increased near term variability in water supply watershed flow volumes and snowmelt timing increases uncertainty around planning and water management	✓				✓					
Warmer Winter	Warmer winter temperatures may allow spruce beetle infestations										✓
	Increasing pest infestations due to warmer weather impacting forestry and agriculture										✓
	Increased localized flooding from culverts backing up during spring melt.			✓	✓						
	Changes in energy demand with decreasing heating requirements and possibly increasing cooling needs						✓			✓	

Anticipated Changes	Impacts	Water Supply	Sanitary Sewer	Storm Drainage	Transportation	Hazard & Emergency Mgt.	Buildings, Planning and Zoning	Facilities, Grounds, Energy Systems	Parks, Green space, surrounding enviro.	Community Development	Economic Development
	Increasing freeze/thaw cycles decreases the durability of infrastructure, specifically surfaces and triggers more maintenance				✓			✓	✓		
	Increased potential of rain on snow events increases the risk of street flooding, street closures, mobility issues and potential damage to nearby buildings			✓	✓		✓	✓			
Increased intensity and frequency of precipitation	Decreasing number of days that pumping from the river to the reservoir is possible due to increased turbidity or low flows	✓									✓
	Increasing sewer back-ups damaging buildings as heavy rainfall increases		✓								
	Decreased safety and ease of travel, especially for mobility challenged individuals, during winter				✓						
	Increasing surface run-off during the rainy season and decreased during the longer dry spells will impact groundwater	✓								✓	
	Increased intensity of rainfall causes localized flooding and sewer surcharge		✓	✓			✓				
	Increased intensity of rainfall makes crop harvest more difficult for farmers										✓

Anticipated Changes	Impacts	Water Supply	Sanitary Sewer	Storm Drainage	Transportation	Hazard & Emergency Mgt.	Buildings, Planning and Zoning	Facilities, Grounds, Energy Systems	Parks, Green space, surrounding enviro.	Community Development	Economic Development
	Increased impacts to water quality due to increasing run-off carrying more salt in the winter and other contaminants								✓		
	Increased surface runoff can lead to increased nutrient concentrations in the water and increased sediment load thereby impacting operation of water supply infrastructure	✓									
	Increasing erosion at sewer outfalls								✓		
Increase in extreme events	Increasing extreme events cause more frequent power outages in turn affecting household power and power to critical infrastructure					✓		✓			
	Increased intensity of snowfall, increasing ice events and rain on snow events is taxing the capacity of public works to respond				✓						
	Increased extreme events (wind, rain, snow, ice) causes more damage to temporary and permanent public facilities							✓	✓		
	Increased extreme events (wind, rain, snow, ice) causes more damage to paved trails and recreation grounds							✓			
	Evacuation routes and transportation in and out of the community are more readily impacted by wildfire and landslides				✓					✓	✓

Anticipated Changes	Impacts	Water Supply	Sanitary Sewer	Storm Drainage	Transportation	Hazard & Emergency Mgt.	Buildings, Planning and Zoning	Facilities, Grounds, Energy Systems	Parks, Green space, surrounding enviro.	Community Development	Economic Development
	Unusual weather events such as hail and tornados may increase with damaging effect					✓					
	Increased pressure on community volunteers including ESS and volunteer fire fighters					✓					
	Decreasing durability of infrastructure generally as extreme events increase meaning earlier replacement and increased maintenance needs	✓	✓	✓	✓			✓			✓
	Increased costs for storm and flood clean-ups					✓					
	More frequent / larger scale emergency and disaster events tax municipal resources and capacity for mitigation, planning, preparedness, response and recovery					✓					
	Isolation from health services or critical services during major events due to limited transportation routes									✓	
Hotter, drier summers and longer growing season	Increasing stress on the community's emergency response and emergency social services as regional forest fire evacuees increase in number and frequency					✓				✓	
	Increasing temperatures and longer growing seasons impact the ability to grow certain crops while improving the opportunity to grow others										✓

Anticipated Changes	Impacts	Water Supply	Sanitary Sewer	Storm Drainage	Transportation	Hazard & Emergency Mgt.	Buildings, Planning and Zoning	Facilities, Grounds, Energy Systems	Parks, Green space, surrounding enviro.	Community Development	Economic Development
	Change in seasonality and temperature mean a change to invasive species							✓	✓		
	Potential of decreased water supply in late summer following drought	✓									✓
	Increasing impacts to health of the community from poor air quality days due to wildfire smoke									✓	
	Changes in energy demand with decreasing heating requirements and possibly increasing cooling needs							✓		✓	
	Increasing wildfire risk in large natural areas.					✓					