Regional District of Bulkley-Nechako

HRVA Electoral Area' D' Committee Backgrounder

ELECTORAL AREA 'D' HAZARD IDENTIFICATION

DECEMBER 2021

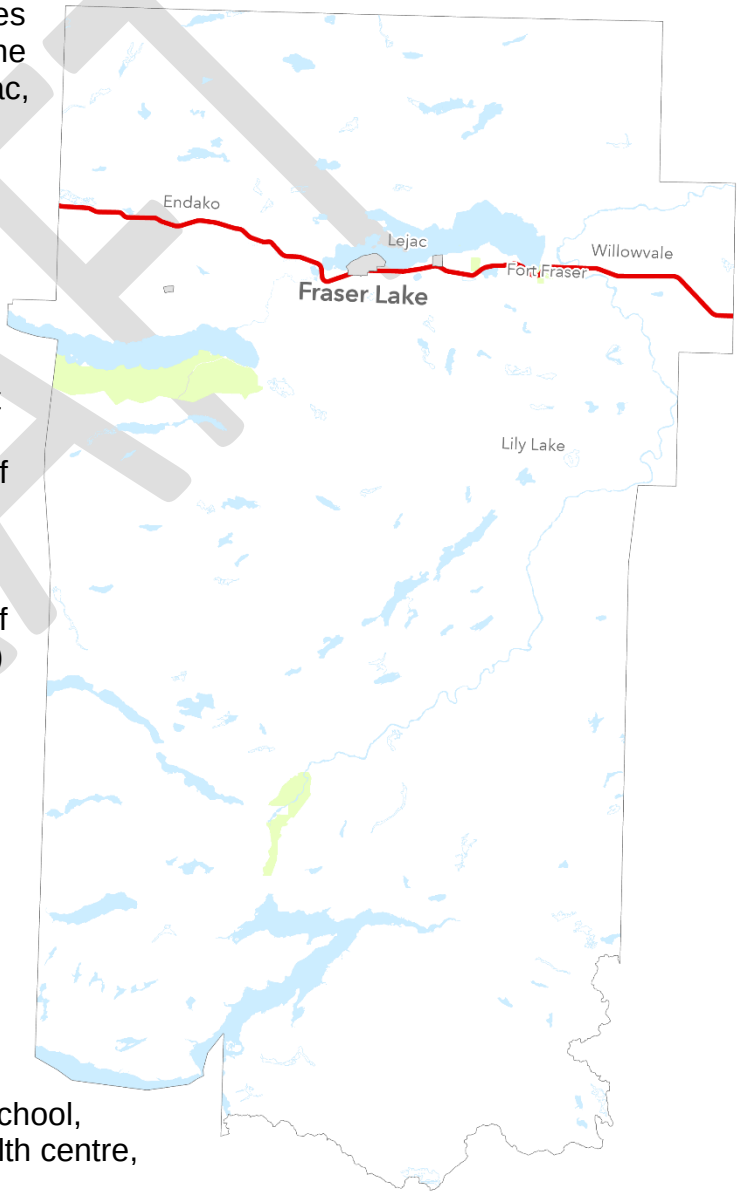
"Know the Risks, Make a Plan, Be Prepared"

CHAPTER 2: ELECTORAL AREA 'D' HAZARD IDENTIFICATION

Electoral Area 'D' Geographic Setting

Electoral Area D (Fraser Lake Rural) is the rural area surrounding the Village of Fraser Lake. The Village of Fraser Lake is an important service centre. The municipal population is less than 1,000 people; however, the population which looks to Fraser Lake as its service centre is considerably higher considering the rural population and local First Nations communities.

The area includes two first nations communities Stellat'en First Nation and Nadleh Whut'en. The unincorporated communities are Endako, Lejac, Fort Fraser, Willowvale, Lily Lake, Glenanan, East Francois Lake and Fort Fraser.



The Stellat'en First Nation has 583 band members on and off-reserve (Canada I. a., First Nations Profiles, 2021). The main community, including the band office, church, community hall, and the Slenyah Gas Bar and Convenience Store, is located at the Stellaquo (Stella) Indian Reserve No. 1 at the west end of Fraser Lake near the mouth of the Stellako River. This reserve has a population of approximately 200 persons and is 830 hectares in size. The Stellat'en has a second much smaller reserve on the shores of Binta Lake. The Stellat'en (people of the stilla) and Nadleh Whut'en are members of the Yinka Dene. The Stellat'en First Nation is a member of the Carrier Sekani Tribal Council. Stellakoquo is located at the confluence between two rivers: the Stellako and Endako. (Nation, 2021)

The Nadleh Whut'en are part of the larger Yinka Dene (Carrier) Nation, accounting for over 5,000 people. The Nadleh Whut'en First Nation has 600 band members living on and off-reserve (Canada I. a., First Nations Profiles, 2021). The community band office, school, church, store, community hall, preschool, health centre, and adult learning centre

are located on the Nautley Indian Reserve No. 1, which is a short distance west of the Village of Fraser Lake at the east end of Fraser Lake. The Nadleh Whut'en have seven reserves with 969 hectares between the community of Fort Fraser and the Village of Fraser Lake. The Nadleh Whut'en Band is a member of the Carrier Sekani Tribal Council.

The Cheslatta Carrier Nation has a registered population of 363 residents living on and off-reserve. The band office and other community buildings are located on a reserve about 1km south of the Southbank ferry landing, south of Francois Lake, and outside the electoral area ‘D.’ The Cheslatta Carrier Nation has five reserves within the electoral area ‘D’ with a total area of 254.9 ha.

Fort Fraser is an active community with a population of approximately 345 persons living in 150 homes. The Fort Fraser Local Commission oversees the operation of the community sewer and water system as a local service provided by the Regional District. (Nechako R. D., 2019)

Endako is a small townsite established near the turn of the century at the time of the Grand Trunk Pacific Railway the community contains approximately 125 persons living in 55 homes. (Nechako R. D., 2019)

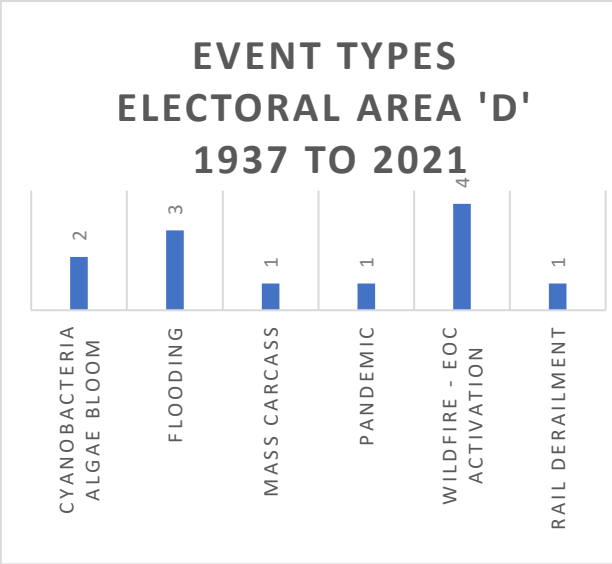
The East Francois Lake or Glenannan area is located around the east end of Francois Lake and has a year-round population estimated to be approximately 230 persons. The area has a large number of seasonal residents that reside in summer cabins along the lake. (Nechako R. D., 2019)

The area boasts 170 lakes within a 100 km radius and is the temporary home to over 1000 Trumpeter Swans during the spring. From its humble beginnings in the early 1900s, Fraser Lake Sawmill (owned and operated by West Fraser Timber Company Ltd.) has evolved into one of the world's most modern sawmills. Located in Electoral Area D, Endako Mine was the second largest Molybdenum Mine in the world.

Electoral Area 'D' Hazard History

Electoral Area 'D' has experienced several events that have impacted residents of the region since recorded in the 1930's. The regularity of the event happening determines the risk factor used in the Hazard, Risk, and Vulnerability Analysis.

Several well-known hazards in Electoral Area 'D' include flooding, wildfires, hazardous materials and explosions, transportation accidents, and interruptions to critical services. Many of these hazards are high risk and priority to all communities within the Regional District of Bulkley Nechako.



The graph below shows the event types experienced in Electoral Area 'D' from 1937 to 2021. The highest recurring event types and severity of impact in this area are:

- Wildfire;
- Flooding;
- Cyanobacteria.

Appendix 1, Historic Hazard Data, provides the details on recorded events in Electoral Area 'D'.

The Regional District HRVA 2003 Hazard, Risk, and Vulnerability Analysis Priority Matrix identify the following hazards:

FREQUENCY	Very Low	Low	High	Very High	
6			Fire – industrial (18)	Fire- interface & Wildfire, Flood (24)	**Frequent or very likely**
5	Avalanche (5)		Dangerous goods spill, Epidemic- human, Explosion transportation accident – Road (15)	Severe Weather (20)	**Moderate or likely**
4		Critical Facility Failure, Infrastructure Failure (8)	Transportation accident – Air, Rail (12)	Earthquake (16)	**Occasional, slight chance**
3		Epidemic – Animal (6)	Landslide, debris flow (9)		**Unlikely, Improbable**
2			Terrorism (6)		**Highly unlikely (rare event)**
1		Dam Failure, Mine Accident (2)		Volcano Eruption (4)	**Very Rare event**
	1	**2**	**3**	**4**	

SEVERITY

Risk index # is the Frequency x Severity.

Village of Fraser Lake Emergency Preparedness Plan 2015 (updated in 2020)

FREQUENCY	Very Low	Low	High	Very High	
6			Dangerous goods spill, transport accident - road (18)		Frequent or very likely
5		Infrastructure Failure, Transportation accident – marine (10)	Fire – industrial, Severe Weather, transportation accident – Rail (15)	Fire- interface & Wildfire (20)	Moderate or likely
4		Epidemic- human, Explosion or Emission, Flood (8)	Critical Facility Failure, Transportation accident – Air (12)		Occasional, slight chance
3		Epidemic – Animal, Landslide, debris flow, Terrorism (6)		Earthquake (12)	Unlikely, Improbable
2			Dam Failure, Volcano Eruption (6)		Highly unlikely (rare event)
1	Riots	Structure Collapse (2)			Very Rare event
	1	2	3	4	
			SEVERITY		

Stellat'en First Nation has a Community Safety Plan in which Goal 6 is to "Implement a coordinated approach to existing Emergency Preparedness Plan (EPP)." The plans under this goal include the need to "ensure forestry agreement, on fire fighting, is current." (Khet, 2017)The Stellat'en First Nation also has a Planning Report that describes key community goals. Goal 8, Environment and Relationship to Land, recognizes the importance of adapting to wildfire risks through safety and security measures. Stellat'en First Nation has an Emergency Plan from 2010 containing a list of hazard probabilities.

Nadleh Whut'en First Nation has an emergency plan from 2013. The Emergency Plan contains a list of hazard probabilities and a historical hazard response matrix, including several hazard response action plans.

After the traumatic events for the community members of the Nadleh-Whuten First Nation during the 2018 Shovel Lake fire, the band released a document titled "Trial by Fire" (Sharp and Krebs, 2018). This document detailed the challenges met by the community during the fires, such as communications and jurisdictional challenges, evacuation challenges, and firefighting challenges. It recommends more training of emergency personnel and improving emergency response and communication networks.

This document also mentions positive outcomes, such as the good working relationship and sharing of resources between the Village of Fraser Lake, Stellat'en, and Nadleh. Following the 2018 wildfires, the Village of Fraser Lake, Stellat'en, and Nadleh worked together on a united wildfire response. The Nadleh-Whut'en website describes in detail a collaborative project to build a Regional Emergency Centre of Excellence.

Defining Hazard Considerations for Electoral Area 'D'

This section provides definitions from the HRVA Hazard Reference Guide 2021 Province of British Columbia and the Village of Fraser Lake emergency management plans. These definitions and related information can help inform the HRVA advisory committee to determine what hazards will be analyzed in this HRVA process.

The hazards are grouped in to three categories: Natural Hazards; Human-Caused Hazards; and Diseases, Pest Infestations & Epidemics. Hazards defined in this section are based on historical events that may have impacted Area 'D' as well as following the Hazard, Risk, and Vulnerability Analysis Priority Matrix's from the Regional District HRVA 2003, Village of Fraser Lake Emergency Preparedness Plan 2015, Nadleh Whut'en Emergency Plan 2013, and Stellat'en First Nation Emergency Plan 2010. This backgrounder has also been updated with input and further research resulting from the Hazard Identification workshop on November 29th, 2021.The top four priority hazards identified by RDBN staff include:

Wildfire

Flooding

Severe Weather

Transportation Accidents Road/ Rail Incidents

Known hazards are also identified on a map of electoral area 'D' and found in Appendix 3 of this chapter. HRVA Electoral Area 'D' Committee Workbook Backgrounder Additional hazard definitions and information can be found in the province's HRVA Companion Guide 2021.

If you have information on known hazards, resources or details on resiliency strategies related to the hazards listed below, please include these as notes and pass them on to the Regional District HRVA Coordinator for inclusion in the analysis.

Indigenous Traditional Knowledge

Long before European explorers and traders arrived in the late 1700s, Indigenous people in B.C. told stories and practiced traditions to share important knowledge about natural hazards. By repeating these stories, Indigenous people passed on valuable information about preparing for and surviving disasters across time and generations. (Prepare BC Emergency Management BC, 2019)

Those holding traditional knowledge can assist in understanding the nature of local hazards, suggest appropriate risk reduction and response mechanisms, and even give options for recovery based on past experiences. Individual community members can also help us recognize and respect First Nations communities' long history and rich traditions on this land. (Munsaka, 2018) The Regional District recognizes the importance of learning from traditional knowledge and is looking to continually strengthen and develop relationships in the hopes that this knowledge can assist and inform future emergency planning and preparedness planning.

Summary of Climate Patterns

The information below has been summarized from the *Climate Patterns, Trends, and Projections for the Omineca, Skeena, and Northeast Natural Resource Regions, British Columbia - Technical Report 097,* 2016. (Foord, 2016)

Baseline climate of the Omineca Natural Resource District

Seasonal/Annual	Precipitation (mm)	Mean Temperature (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)
Vanderhoof District (DVA Stuart Nechako)				
Winter	121.4	-8.9	9.6	-37.1
Spring	79.5	3.9	25.8	-22.4
Summer	144.8	14.0	31.5	-1.0
Fall	130.7	3.8	25.2	-20.4
Annual	475.6	3.2	31.8	-39.5

Electoral Area 'D' is in the Omineca region and Stewart Nechako District.

Omineca Natural Resource Region Trends (1895 – 2008)

The Omineca Natural Resource Region has become warmer and wetter over approximately the last century. Precipitation has increased by approximately 20% in spring, summer, and fall. Precipitation has increased the most in the Vanderhoof District (e.g., approximately 40% in summer). Winters have been getting increasingly drier in the Vanderhoof District. The annual extreme minimum temperature has increased by 2.9−5.7°C across the region, likely because Arctic air movements have become less frequent because the jet stream has been moving northward. Increases in spring extreme minimum temperatures have been large (up to 9.3°C in the Fort St. James District) and seem to follow an east-to-west trend across the Omineca. Summer minimum temperatures have increased by slightly more than one °C in most districts.

Omineca Natural Resource Region Climate Projections

The mean annual temperature in the Omineca Natural Resource Region is projected to increase by 3.5°C, with minimum temperatures increasing more than maximum temperatures. Mean annual precipitation is projected to increase by 7%. Any increases will likely be as rainfall because precipitation as snow is projected to decrease by about 30% (ranging from –10% in Mackenzie District to –40% in the Robson Valley). The number of growing degree-days will increase, and the number of frost-free days will increase. Evaporation and climate moisture deficit will increase despite moderate increases in growing-season precipitation.

Seasonal Climate Projections (Anomalies) Omineca Natural Resource Region

In the Omineca Natural Resource Region, summers are predicted to warm more than other seasons, by 3.8°C, with minimum temperatures increasing the most (Table 11). Seasonal temperatures warm the most in the Robson Valley in the summer and the least in the Robson Valley in the winter. Precipitation is projected to increase the most in the fall (11%) and the least in the summer (Prince George and Robson Valley have slight negative projections). More precipitation will occur as rain than as snow. The greatest increase in the number of frost-free days is projected to occur in the fall.

A Note about Climate Change:

Climate change impacts both the frequency and intensity of many hazards. It may also cause new hazards to emerge. In this HRVA methodology, climate change is not indicated as a separate hazard; however, those hazards identified as being impacted by climate change are indicated with a special symbol. e.g., Drought (BC E. M., 2021)

Natural Hazards

Wildfire

An unplanned fire - including unauthorized human-caused fires - occurring on forest or range lands, burning forest vegetation, grass, brush, scrub, peat lands, or a prescribed fire set under regulation which spreads beyond the area authorized for burning.

The wildland urban interface (WUI) is any area where combustible forest fuel is found adjacent to homes, farm structures or other outbuildings. This may occur at the interface, where development and forest fuel (vegetation) meet at a well-defined boundary, or in the intermix, where development and forest fuel intermingle with no clearly defined boundary. **(Service B. W., 2021)**

- The Village of Fraser Lake has a Community Wildfire Protection Plan developed in 2020. The Plan provides a local wildfire threat and risk assessment summarizing the local threat and risk classification in hectares (section 4.3) (Foresty, 2020). This document further recommends fuel treatments, and other risk mitigation recommendations.
- There are 39 addresses in electoral area 'D' in a high Wildfire Urban Interface risk area.[1] In addition, there are 1597 addresses in electoral area 'D' in a medium Wildfire Urban Interface risk area.
- The Wildland-Urban Interface (WUI) occurs where homes, structures, and critical infrastructure are found adjacent to or intermixed with combustible vegetated lands. Historically in BC, the WUI was created by buffering an area, using geographic information systems, where structure density is greater than 6 structures/km² by 2 km. The 2 km buffered area was originally designed to represent a reasonable distance that embers from a wildfire can travel to ignite a structure.
- In British Columbia, structure density (i.e., the number of buildings located within a given area) is used to define the boundaries of the wildland-urban interface (WUI) for wildfire and risk management planning purposes. The spatial WUI attributes were combined with the Provincial Strategic Threat Analysis (PSTA) wildfire threat layer (for Crown land) to identify at-risk areas at a strategic scale. Maps for this electoral area are included in Appendix 3 (Maps 4-6). The province updated data in June 2021. These threat ratings did not consider local physical attributes that can be used to analyze wildfire threats more thoroughly on a local scale.[2]

[1] This data was collected on October 8, 2021 from the RDBN GIS system

[2] This data was retrieved from the wildland urban interface risk class maps found here: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/vegetation-and-fuel-management/fire-fuel-management/wui-risk-class-maps, Retrieved on Nov 1, 2021.

- After the traumatic events for the community members of the Nadleh Whut'en First Nation during the 2018 Shovel Lake fire, the band released a document titled "Trial by Fire" (Sharp and Krebs, 2018). This document detailed the challenges met by the community during the fires, such as communications and jurisdictional challenges, evacuation challenges, and firefighting challenges. It recommends more training of emergency personnel and improving emergency response and communication networks.
- Nadleh Whut'en has 500 hectares of land threatening the community. 16 hectares of land per year has been receiving fuel mitigation treatment.
- Summer homes dot the shores of Francois Lake South of Hwy 16. The interaction of people and wilderness creates a recipe for wildland urban interface fire.
- Wildfire is the #1 hazard for the Glennanan community, with only one road for access.
- Fort Fraser Fire Department in the spring identifies properties that need fire smart activities implemented.
- The Regional District runs an active Fire Smart program and has been involved in a number of community mitigation projects.
- CGL Gas line creates a fire break on the north side of Fraser Lake.
- The Regional District of Bulkley Nechako operates a FireSmart program that is a federal, provincial, and community-based program that encourages the public to take simple, scientifically proven steps to increase wildfire resiliency. In 2021 the RDBN FireSmart educator conducted 9 home assessments in Electoral Area 'D' to help residents better understand and apply these practices on their properties and homes. These assessments came with funding for mitigation work.

Notable Wildfires in Electoral Area 'D' in 2010 and 2018 with the Shovel Lake Fire. Please see Appendix 1 for details on these notable wildfires.

Notable fires outside Electoral Area 'D'

In the summer of 2018, the RDBN mobilized its emergency management structure for over 72 days in response to 15 major fires, resulting in 64 evacuation orders and alerts with 1,544 dwellings under evacuation order, affecting approximately 3,475 people requiring the relocation of over 3,000 livestock. Eight dwellings and over 45 other structures were lost, and a declaration of a state of local emergency was in place from August 1 to September 20. (Inc., 2019)

Comments and questions for consideration and further research:

- Recognition that joint evacuations, communication and information sharing across local government and first nations is very important.
- Need to identify additional rural areas that need fuel mitigation in the region.
- Public education is a key element in fire protection.

Related Hazards: Air Quality / Extreme Heat / Lightning / Structure Fire / Explosions / Drought / Structure Failure / Electrical Outage / Telecommunications Interruption / Transportation Route Interruption / Water Service Interruption.

Flooding: Lakes, Rivers, and Stream

Flooding is the overflow of natural drainage channels, natural shorelines and/or human-made facsimiles leading to partial or complete inundation from the overflow of inland or tidal waters, and/or the accumulation or runoff of surface waters from any source. **(BC E. M., 2021)**

- Like many northern communities, Fraser Lake rural experiences seasonal snowmelt that results in high levels of water that can sometimes overwhelm drainage infrastructure systems, resulting in flooding. The lake is also prone to flooding, and the 1:200-year floodplain, as defined by the Ministry of Environment, may affect development along the lakeshore. (Lake, 2019)
- Electoral Area 'D' experiences a variety of flooding due to:
  - Heavy Rains or rain-on-snow events in spring, fall, and winter months;
  - Spring freshet flooding from rapid snowmelt;
  - Intense precipitation at any time of year.
- The Stellako and Endako rivers run through Area D.
- The Village of Fraser Lake has municipal water wells adjacent to the lake and a sewage treatment facility located at the western end of the Village, treated effluent is discharged via a 400m long outfall to Fraser Lake.
- The Village of Fraser Lake has established a Floodplain Management Bylaw 685, 2008 for flood-prone lands since 1988. This bylaw was established to reduce or prevent injury or the loss of life and to minimize property damage during flood events.
- The Regional District Floodplain Management Bylaw No. 1878, 2020 was established to reduce or prevent injury or the loss of life and minimize property damage during flood events.
- See Appendix 2 for Ministry of Environment hydrometric data reporting annual maximum daily discharge rates (m3/s) for five monitoring stations and three stations reporting annual maximum daily water level (m).
- During flooding there is concern and risk of contaminations from fertilizers, septic system, and livestock.

Notable floods in Electoral Area 'D' can be found in Appendix 1.

- Flooding in the Downtown core of Fraser Lake 52mm in a short window of time caused flooding and storm water drains to back up.
- Ice jams down the Nechako River and telegraph road in 2020 winter, Horn Road Subdivision.

Comments and questions for consideration and further research:

- Identify organizations that are responsible for mitigation activities.
- What are the potential contaminants: septic systems, mine tailings ponds?
- Land stewardship has started to step up in fencing and education,
- Look up farmland water stewardship initiatives.
- Large systems – Alcan controls materials and resources that have cascading effects on the natural waterways and flood impacts.

Related Hazards: Hurricane/Typhoon/High Wind Event / Landslide/Debris Flow / Storm Water Flooding / Flash Flooding / Dam and Spillways Failure / Dike Failure

Area D Weather Hazards

- In Area D, one Environment Canada station monitors Climate Normal from 1981 – 2010 & 1961-1900 Fraser Lake North Shore and one station that monitored Climate Normal from 1961 – 1990 at Fort Fraser 13S.
- According to Environment Canada Fraser Lake North Shore station, the minimum extreme temperature recorded was -47.57 degrees Celsius and occurred on December 30th, 1984. On average, there are less than 4.9 days in a year where the temperature reaches below -30 degrees Celsius. (Canada E. , 2021)
- Atmospheric River effects can be seen throughout the region. An **atmospheric river, or AR**, is a large, narrow stream of water vapour that travels through the sky. It can stretch to 1,000 miles (1,600 kilometres) long and more than 400 miles (640 km) wide, and on average, carries an amount of water equivalent to 25 Mississippi Rivers. As the rivers cross from the ocean to the land — particularly to mountainous regions like the B.C. coast — the vapour condenses into precipitation, sometimes dumping a month's worth of rain or snow in a matter of days. Less-intense ARs are essential to many continents' water supply by bringing a whole lot of it from the warmer tropical oceans. But the bigger and more intense they get, the more dangerous they can be, triggering landslides and flooding resulting in tens to hundreds of millions of dollars in damage or more. The warmer the air is, the more water vapour an AR can carry. As the atmosphere's average temperature rises, then, an atmospheric river can grow — and when it makes landfall, it can release more rain or snow than in years past. (Linch, 2021)
- Environment and Climate Change Canada is working to create a new warning system that would act as a Canadian version of AR warnings. This system is predicted to be publicly ready in the fall of 2022. (Linch, 2021)
- Anecdotal community stories say that logging truck have earlier shifts than in history – ex. November we would have freeze up but that is not the case in 2021.

Climate Norm's 1981-2010 Fraser Lake[3]	Climate Norm's 1981-2010 Fort Fraser[4]
Annual Rainfall 350.7 mm	Annual Rainfall 330.2 mm
Annual Snowfall 175.1 mm	Annual Snowfall 197.8 mm
Average Temperature, January -9.5 C	
Average Temperature, July 15.4 C	
Frost-free Days 104 days	
Maximum Temperature35 C (Sept 9, 1981)	
Minimum Temperature -47.5 C (Dec 30, 1984)	

Comments and Questions for consideration and further research:

- Are there trend or records of the date freeze up historically happened in industry?
- Can infrastructure withstand atmospheric events?

[3] Station Fraser Lake North Shore (Canada E. , 2021)
[4] Station Fort Fraser 13S

Snowstorms and Blizzards

Meteorological disturbance giving rise to a heavy fall of snow, often accompanied by strong winds. Snowstorm and blizzards impact upon transportation, powerlines and communications infrastructure, and agriculture. **(BC E. M., 2021)**

- Snowfall is a common occurrence in the winter months for the entire Area D. Although it is rarely heavy enough to pose a significant risk, severe snow events cause power failures. This was experienced with the severe snow event of 1996 and Oct 2006.

Notable Storm events in Electoral Area 'D' can be found in Appendix 1.

Related Hazards: Extreme Cold / Freezing Rain or Drizzle / Avalanche / Structure Failure / Electrical Outage / Food Source Interruption / Telecommunications Interruption / Transportation Route Interruption / Fuel Source Interruption / Aircraft Incident / Motor Vehicle Incident.

Extreme Heat

Heat waves can be characterized by temperatures significantly above the mean for an extended period, or by a combination of high temperatures with high humidity and a lack of air motion. Heat waves impact upon the very young, the elderly and those with cardiovascular conditions. Heat waves also impact upon agriculture. **(BC E. M., 2021)**

Notable heatwaves in the Electoral Area 'D' include:

- The last week in June 2021 brought about unprecedented heat in British Columbia and across western Canada. With forecasts stating it was the warmest stretch since records have been kept (In many instances 100+ years) ((MSC), 2021). With CBC reporting 486 sudden deaths over five days from June 25th – 30th, 2021. (News C. , 2021)
- Temperatures reaching 40'C on June 29, 2021. (Online, 2021)

Related Hazards: Lightning / Animal Disease / Human Disease / Plant Disease and Pest Infestation / Public Health Crisis / Structure Fire / Wildfire / Drought / Food Source Interruption / Water Service Interruption.

Lightning

Generally, all the various forms of visible electrical discharge that are produced by thunderstorms; often seen as a bright flash of light in the sky. Lightning impacts air transportation, powerlines and communications infrastructure and causes forest fires. (BC E. M., 2021)

- Lightning occurs virtually year-round in the Pacific coastal region. The average date of the beginning of the lightning season in Western Canada (1999-2018) for British Columbia - Interior – North and high mountain ranges is June 1st. The Average date of the end of the lightning season in Western Canada (1999-2018) is between October 1st and November 1st. (Canada G. o., Lightning Statistics, 2016)
- The Canadian Lightning Detection Network (CLDN) was established in 1998 and consisted of over 80 lightning sensors distributed across Canada. (Canada G. o., Lightning, 2016)

- Some quick facts regarding forest fires from Natural Resources Canada, Forest fires started by lightning represent 45 percent of all fires and 81 percent of the total area burned in Canada, and occur in remote locations and often in multiple clusters. (Canada G. o., Lightning Statistics, 2016)
- There is no total ground to cloud lightning strike data for the Fraser Lake area. (Canada G. o., Lightning Statistics, 2016) Historical Lightning strike data is included in Appendix 3 – Hazard Maps.

Related Hazards: Hail / Wildfire / Storm Water Flooding / Flash Flooding / Electrical Outage / Telecommunications Interruption.

Hurricane / Typhoon / High Wind Event

Hurricanes are tropical cyclones with maximum sustained surface winds of at least 64 knots (118 km/h). Hurricanes are known as typhoons in the western Pacific, very severe cyclonic storms in the North Indian Ocean, and severe tropical cyclones in Australia. There are five classes of hurricane intensity as outlined by the Saffir-Simpson Scale. (BC E. M., 2021)

- Anecdotal stories from regional loggers report increase in logging has caused increase in wind events.
- The ISI Roses (Figure 1) from the HOLY CROSS 2 BCWS weather station near Fraser Lake show that the prevailing winds for this area are from the West, and less so from the SW. (Foresty, 2020)

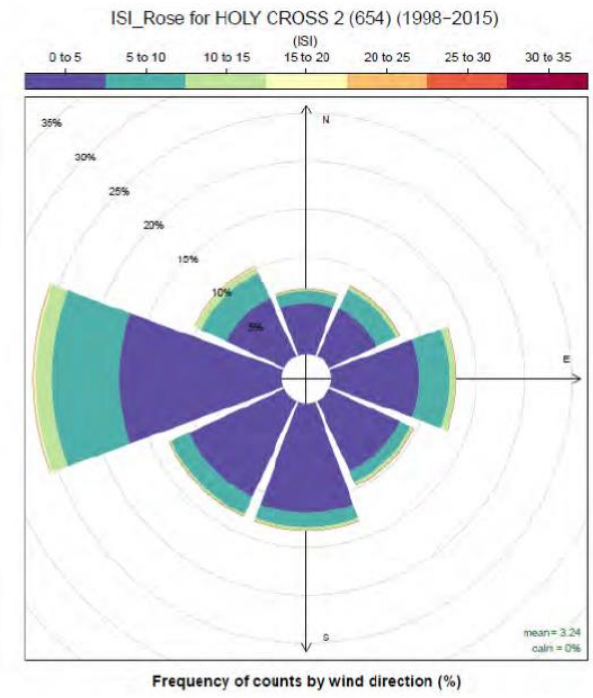


Figure 1: ISI Roses are from wind data collected at the HOLY CROSS 2 weather station between 1998 and 2015 (Gov BC, n.d.).

Comments and Questions for consideration and further research:

- Logger have said more logging, more wind. Are there facts to back this up?

Related Hazards: Hail / Lightning / Snowstorms and Blizzards / Tornado / Landslide/Debris Flow / Explosions / Hazardous Materials Spill / Seiche / Storm Surge / Lake, River, and Stream Flooding / Coastal Flooding / Storm Water Flooding / Flash Flooding / Dam and Spillways Failure / Dike Failure / Structure Failure / Electrical Outage / Food Source Interruption / Telecommunications Interruption / Transportation Route Interruption / Wastewater Interruption / Water Service Interruption / Fuel Source Interruption / Aircraft Incident / Marine Vehicle Incident / Motor Vehicle Incident / Rail Incident

Space Weather

A disturbance or fluctuation in the earth's magnetic field, associated with solar flares. The impact may include disruption of electrical grids, communications systems, navigation equipment, and satellite operations. Resource operations including surveying, drilling, and pipelines may also be negatively affected. (BC E. M., 2021)

- The source of space weather is the Sun. The Sun is a million times larger than Earth and so distant that its light takes eight minutes to reach us. When violent solar phenomena occur, they create space weather effects on Earth, which can pose a hazard for human activities. (Government of Canada, 2021)
- Effects from solar activity include (but are not limited to) geomagnetically induced currents in power systems and pipelines, azimuthal errors in directional drilling, disruptions to HF radio communication and GPS navigation, and failure or mis operation of satellites:
  - Magnetic disturbances induce electric currents in long conductors such as power lines and pipelines causing power system outages or interfere with pipeline corrosion systems.
  - Magnetic disturbances directly affect operations that use the magnetic field, such as magnetic surveys, directional drilling, or compass use.
  - Radio waves used for satellite communications or GPS navigation are affected.
  - Effects on satellites including radiation damage, memory upsets, phantom commands, surface charging and internal charging. (Government of Canada, 2021)

Related Hazards: Cyber Security Threat / Telecommunications Interruption / Electrical Outage / Transportation Route Interruption.

Air Quality

Solids, liquids, or gases which, if discharged into the air, may result in statutory air pollution. (BC E. M., 2021)

- Communities in this region experience air quality episodes due to elevated particulate concentrations at various times throughout the year. Particulate matter is a concern for human health and from an aesthetic point of view. No air quality monitoring station provides an Air Quality Health Index (AQHI)in the electoral area.
- The most significant air pollutant in the Bulkley Valley Lakes District (BVLD – Witset to Endako) is fine particulate matter, $PM_{2.5}$, from open burning, industrial sources, wood-burning appliances, backyard burning, transportation road dust and vehicle emissions. A study conducted by Elliot and Copes (2011) has estimated that between 16 to 74 deaths each year are attributable to fine particulate matter concentrations in Northern and Interior Health Regions alone. (Zirnhelt, June 21, 2021)
- In Canada, wildfires can significantly increase air pollution levels of fine particulate matter ($PM_{2.5}$), posing the greatest human health risk (Canada H. , 2021).
- Elevated $PM_{2.5}$ typically occurs in the autumn and winter months when dispersion is poor, and many different emission sources (industry, space heating, open burning) are active. (Zirnhelt, June 21, 2021)

- The Village of Fraser Lake established an Outdoor Solid Fuel Combustion Appliances Control Bylaw No. 692, 2008 to protect, promote preserve the health of individuals by banning the installation of outdoor solid fuel combustion appliances.
- The Province of B.C. has no active Air Quality Monitoring station located in this region.
- There are no Purple Air Quality Monitoring stations in Electoral Area 'D'.

Related Hazards: Human Disease / Public Health Crisis / Structure Fire / Wildfire / Ash Fall / Explosions / Hazardous Materials Spill / Oil or Gas Pipeline Spill.

Hail

Precipitation in the form of lumps of ice mainly associated with thunderstorms. Hail ranges in size from that of a small pea to the size of cherries, but has been observed as large as grapefruit. Hail in Canada occurs most frequently during the summer when thunderstorm activity is at its peak.. (BC E. M., 2021)

- Hail event around Saik'us that caused $35,000 worth of damage to one property.

Related Hazards: Lightning / Food Source Interruption.

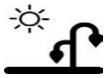
Fog

A cloud based at the earth's surface, consisting of tiny water droplets, or under very cold conditions, ice crystals or ice fog. It is generally found in calm or low wind conditions. Under foggy conditions, visibility is reduced to less than 1 kilometre. (BC E. M., 2021)

- Warmer temperatures are resulting in more fog from Fraser Lake, causing driving concerns.

Related Hazards: Extreme Cold / Freezing Rain or Drizzle / Transportation Route Interruption / Aircraft Incident / Marine Vehicle Incident / Motor Vehicle Incident.

Drought



Drought is a recurrent feature of climate involving a deficiency of precipitation over an extended period, resulting in a water shortage for activities, communities, or aquatic ecosystems. In BC, combinations of insufficient snow accumulation, hot and dry weather, or a delay in rainfall may cause drought. (BC E. M., 2021)

- Drought can lead to reduced water availability for household and business use. Lower stream flows may cause warmer river temperatures, affecting fish and other aquatic life. Low stream flows can also affect the growth of agricultural crops and limit the water available for irrigation. Low flows and extended periods of low precipitation can also have impacts on groundwater levels. Aquifers – particularly those at shallow depths - may develop a lower water table due to drought in any given year and from previous drought seasons, as there may not be enough water to recharge the aquifer. If natural water sources or adequate storage are not available in a community, it may also lead to insufficient supplies for firefighting. (Econics, May 2021)

Notable Incidents involving Drought:

- Due to relatively normal to high snowpacks in the spring, early forecasts did not flag a drought risk for 2018. However, a heatwave in late spring rapidly depleted snowpacks and caused freshet flooding earlier than usual. The lack of precipitation from July to November created extensive dry conditions across lots of the province.
- In 2018, the Northwest, Upper Fraser West, Upper Fraser East, and Nechako regions reached Level 2 to Level 3 drought ratings, meaning these areas were arid. (BC Agriculture & Food Climate Action Initiative, 2019) The Bulkley Lakes (inclusive of Area G) reached level 3 in July and August, very dry. (Columbia P. o., British Columbia Drought Information Portal, 2021)

Related Hazards: Extreme Heat / Lightning / Animal Disease / Human Disease / Plant Disease and Pest Infestation / Public Health Crisis / Wildfire / Food Source Interruption / Water Service Interruption.

Landslide/Debris Flow

Debris avalanches and debris flows.
Debris avalanches are extremely rapid debris flows of mud, rock, brush, trees, and other debris propelled by torrential rains.
Debris flows are a form of rapid mass down-slope movement of a slurry of loose soils, rocks, and organic matter. (BC E. M., 2021)

- A prominent biophysical feature in Fraser Lake is Mouse Mountain. The area has steep and hazardous slopes of over 30 percent and, as such, is largely unsuitable for development. (Lake, 2019)

Related Hazards: Avalanche / Land Subsidence / Submarine Slides / Tsunami / Seiche / Lake, River, and Stream Flooding / Flash Flooding / Structure Failure / Electrical Outage / Telecommunications Interruption / Transportation Route Interruption.

Cyanobacteria Algae Bloom

Cyanobacteria (also known as **blue-green algae**) are naturally occurring microscopic bacteria that are common to freshwater ecosystems across B.C. Cyanobacteria blooms are of particular concern as there are several species capable of producing toxins that can be harmful to humans, domestic animals, and livestock. They can produce potent liver toxins, neurotoxins, as well as skin irritants. However, not all cyanobacteria are toxic, and even toxic species do not always produce toxins. (Environment, 2021)

- Blue-green algae are not true algae but are more properly photosynthetic bacteria and can also be called cyanobacteria. They are commonly found in lakes, ponds, and wetlands. Blooms are unsightly, and blue-green algal blooms may be toxic if ingested by wildlife, livestock, or humans. When conditions are favourable (most often during hot, calm weather), algae increase dramatically, becoming easy to see. This condition is generally called a ***bloom***.
- There are two types of toxins produced by strains of blue-green algae:
  - ***Neurotoxins*** affect the nervous and respiratory systems and can cause muscle tremors, stupor, staggering, rapid paralysis, respiratory failure and — often within 30 minutes — death. Most frequently, animals are found dead close to the lake or pond.
  - ***Hepato-toxins*** affect the liver and cause a slow death, up to 36 hours or longer after drinking water contaminated with toxic strains of blue-green algae. The animals appear ill, may show jaundice (yellowing of the mucous membranes or the white of the eye), photosensitization (swelling and fluid under the skin, which may peel, especially in the unpigmented areas), or severe scouring. (Environment, 2021)

Notable Cyanobacteria events in Electoral Area 'D' can be found in Appendix 1.

Related Hazards: Animal Disease / Human Disease / Plant Disease and Pest Infestation / Public Health Crisis / Water Service Interruption.

Ash Fall

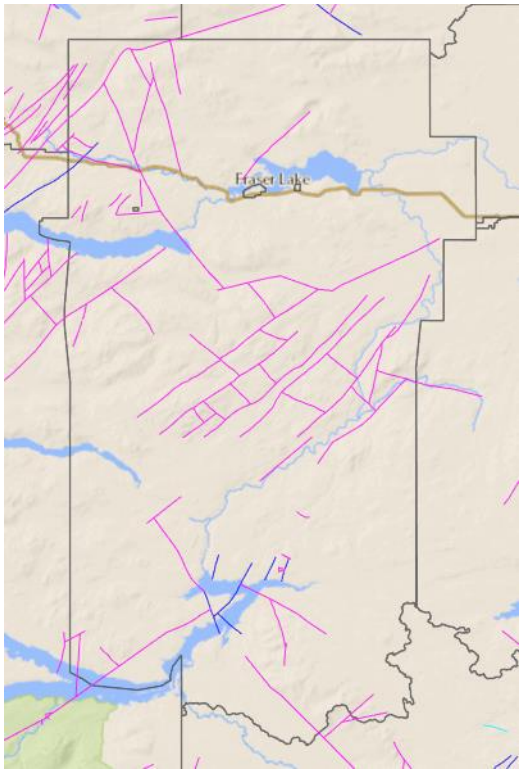
Ash falls occur where fine volcanic ash has been ejected out of a volcanic vent into the atmosphere, possibly transported by upper-level winds, and deposited on the earth. Impacts may include health hazards, damage to crops, harm to wild and domestic animals, reduced visibility, contamination of water supplies, disruption of transportation (with particularly serious consequences for aircraft), damage to power production and distribution systems, damage to many types of machinery, and structural collapse. (BC E. M., 2021)

- Ashfall can come from anywhere depending on the predominant winds.
- This area might be affected by volcanos in the North – Mount Edziza.

Related Hazards: Air Quality / Animal Disease / Human Disease / Plant Disease and Pest Infestation / Public Health Crisis / Pyroclastic Flow, Lava Flow, Lahar, Mudflow / Seiche / Structure Failure / Electrical Outage / Food Source Interruption / Telecommunications Interruption / Transportation Route Interruption / Wastewater Interruption / Water Service Interruption / Aircraft Incident / Marine Vehicle Incident / Motor Vehicle Incident / Rail Incident.

Earthquake

An earthquake is defined as the shaking of the ground due to movement along a fault rupture. When a large magnitude earthquake occurs, energy traveling in seismic waves may cause damage to structures, trigger landslides, liquefaction, or other geologic hazards and, in certain circumstances, generate tsunamis. Impacts from earthquakes can be widespread and severe. (BC E. M., 2021)



- The Regional District's risk for seismic activity is considered medium to low (Canada G. S., 2015).
- In electoral area 'D,' there is a record of one earthquake near Fort Fraser on June 6th, 2011, being 3.3 in magnitude. (Natural Resources Canada, 2021) Local stories of a large earth quake in 1984, where locals remember the tremors felt and the water in the toilets shaking. This earthquake may have been linked to a large earthquake in Alaska.
- Regional District residents would experience minimal physical impact; however, there could be a significant event that could impact the delivery of goods and services, depending on the location of the epicentre and the impact on major transportation routes from the east and the south.
- A map showing faults lines within Electoral Area 'D' reveals that many faults do exist. Most faults in the regional district are of the Strike-Slip (pink) variety, but there are a few Thrust (light blue) type faults in the mountains surrounding Smithers. *See map – source: ImapBC, retrieve Nov 2nd, 2021.*
- The five most significant earthquakes in BC occurred in 1700, 1946, 1949, 1970 and 2012. They ranged in magnitude from 7.3 (1946) to 9.0 (1700).

Comments and questions for consideration and further research:

- What is the impact of an earthquake on the Kenny Dam? Need additional information on the effects.

Related Hazards: Structure Fire / Avalanche / Landslide/Debris Flow / Land Subsidence / Submarine Slides / Liquefaction / Tsunami / Explosions / Hazardous Materials Spill / Mine Incident / Oil or Gas Pipeline Spill / Seiche / Dam and Spillways Failure / Dike Failure / Structure Failure / Electrical Outage / Food Source Interruption / Telecommunications Interruption / Transportation Route Interruption / Wastewater Interruption / Water Service Interruption / Fuel Source Interruption / Marine Vehicle Incident / Motor Vehicle Incident / Rail Incident.

Human Caused Hazards

Dam and Spillways Failure

A breach in the foundations, abutments, or spillways of a dam, which results in a sudden, rapid, and uncontrolled release of the impounded water. (BC E. M., 2021)

Nechako Reservoir

The Nechako River was dammed at its source on the eastern edge of the Kitimat Ranges in the early 1950s to provide power to the Alcan aluminum smelter in Kitimat that Australian company Rio Tinto now owns. The hydroelectric reservoir was formed by constructing the Kenney Dam on the Nechako River and nine smaller dams that inundated a chain of lakes and rivers. The Nechako Reservoir finished filling in 1957 and is 233 km long, with a water surface of 910 km². (Rio Tinto, 2021)

Three emergency scenarios are associated with the Nechako reservoir that could threaten downstream communities, these include:

- **A breach of Kenney Dam** consists of a failure of the dam or its foundations or abutments accompanied by a large or rapidly increasing uncontrolled flow of water from the reservoir. This is the most severe emergency involving the Nechako Reservoir and will result in extensive downstream flooding. (Rio Tinto, November 2020) The Kenney Dam is located in the southern area of Electoral Area D. The Rio Tinto Kenney dams have a dam failure consequence of extreme and a failure probability rating being small. (Staff, 2009)
- **A Saddle Dam breach** consists of a failure of one of the nine saddle dams, the Skins Lake spillway, or their foundations or abutments accompanied by a large or rapidly increasing uncontrolled flow of water from the reservoir. This is the second most serious emergency involving the Nechako Reservoir. A saddle dam breach may result in extensive downstream flooding. (Rio Tinto, November 2020) The Skins Lake spillway is located in Electoral Area E adjacent to Oosta Lake. The Rio Tinto Cut off Creek Saddle #1, #2, and #3 dams have a dams failure consequence of high and a failure probability rating being small. Dam failure probability of small means that the risk level is of no concern and includes regular audit programs to identify any changes to the operation. (Staff, 2009)
- **"An extreme flood release** is defined as a Skins Lake Spillway discharge at or near the Probable Maximum Flood (PMF) of 1653 m3/s. The PMF results from the combination of a severe hydrometeorological event followed – or preceded - by a second extreme event. The PMF flood is estimated to produce a peak daily inflow to the Nechako Reservoir between 3566 m3/s. The Nechako Reservoir is capable of temporarily storing the major portion of these inflows. However, the PMF would require very large releases from Skins Lake Spillway of up to a maximum of approximately 1653 m3/s. These releases would be necessary to prevent excessively high-water levels, which could cause breaching of the dams. The PMF would also be accompanied by a substantial rise in reservoir level, which would cause flooding around the shoreline. It is anticipated that snowpack and/or weather conditions, together with monitoring of reservoir levels, would provide a minimum of several days warning of the need to make very large releases." (Rio Tinto, November 2020)

Rio Tinto provides inundation maps that provide information about possible flood arrival times and water levels for threatened downstream communities. The maps are based on

computer model simulations. The inundation maps concerning Electoral Area D include Skins Lake Spillway map sheet 5 -10 and Fort Fraser map 10.

The Village of Fraser Lake Emergency Preparedness Plan states that "Alcan's emergency plan maps show that in a worst-case scenario, a breach of Kenny Dam would raise Fraser Lake's water level 0.5 m above the bank a full 29 hours after the breach. This would affect all low-lying areas, including the Villages sewage treatment plant. It would also cut off hydro from the west due to the lack of water at Kemano. Other Critical services would be cut off due to massive flooding throughout the Nechako and Fraser River watersheds." (Village of Fraser Lake, 2015 2020)

Rio Tinto makes available inundation maps from 2015. Maps 4 -11 illustrate the extent of flooding of the worst-case scenario of Kenney Dam Breach and Skins Lake Spillway Breach under two scenarios Probable Maximum Flood Breach Scenario and Fair-Weather Breach Scenario. The table below illustrates the inundation levels at Fort Fraser based on the different breach scenarios.

Distance from Skins Lake Spillway: Km 165				
Information *(all water levels are in m)*	**PMF Breach Scenario**		**Fair Breach Scenario**	
	Skins Lake Dam #3	Kenney Dam	Skins Lake Dam #3	Kenney Dam
Initial Water Level (m)	680.9	880.9	677.12	677.12
Maximum Water Level (m)	691.5	719.97	687.8	717.91
Depth above Initial Water Level (m)	10.6	39.06	10.68	4.3
Flood Arrival Time (hr)	14.47	3.67	18.68	4.3
Time for Maximum Elevation (hr)	52.07	30	62.36	30.17
Maximum Discharge (m^3/s)	17746	112161	11076	104026
Maximum Water Velocity (m/s)	1.98	2.74	1.74	2.72

Rio Tinto BC Works inundation maps and Emergency plan found on the Get Involved Nechako website
Maps for the Cheslatta River can be found under the Skins Lake Spillway link – Maps 4 to 9
Maps for Fort Fraser and the Nechako River can be found under the Fort Fraser link – Maps 10 - 12

Tailing Pond Dams in Area 'D'

- The Mines Act and the accompanying Health, Safety and Reclamation Code for Mines in British Columbia (the Code) protect workers and the public through provisions for minimizing the health, safety and environmental risks related to mining activities. This includes regulations on tailings ponds and dams.
- ***Endako*** began operations in 1965 and is located within the municipal boundary of Fraser Lake, on the Yellowhead Highway between Vanderhoof and Burns Lake in the Regional District of Bulkley-Nechako. The mine has been in care and maintenance since December 2015 due to the continued weakness of the molybdenum market. No tailings have been produced or deposited since the end of 2014, and operations resumption is not planned. (Ltd, 2020)
- The Village of Fraser Lake Emergency Preparedness Plan states that "A breach of the tailings dam could cause a rise in Fraser Lake with the potential of localized flooding at White Swan Park and residence in the area. (Village of Fraser Lake, 2015 2020)
- There are three tailings' Ponds, 1, 2, and 3 and seepage collection ponds. The consequence classification of the dam tailings storage facilities are as shown in the table below (Ltd, 2020):

Dam	Population at Risk	Incremental Losses			Dam Classification
		Loss of life	Enviro and Cultural Value	Infra and economics	

Pond 1	Permanent	10 or fewer	Loss of marginal habitat Only/restoration or compensation in kind highly possible	Limited infrastructure or services	High
Pond 2	Permanent	10 or fewer			High
Pond 3	Temporary	10 or fewer			Significant

Source: CDA (Canadian Dam Association). 2013. Dam Safety Guidelines 2007 (Revised 2013).

- The ore body at the Endako Mine contains very low sulphur. Testing carried out by Endako has shown the tailings to be non-acid generating. (Ltd, 2020)

Other Types of Dams

- The Dam Safety Regulation under the Water Sustainability Act, the objective is to mitigate the loss of life and damage to property and the environment from a dam breach by requiring dam owners to inspect their dams, undertake proper maintenance on them, and ensure that these dams meet ongoing engineering standards. The dam administered under this regulation is associated with dams that store or divert freshwater from a stream or aquifer, or both. These dams are inspected annually and assigned a failure consequence and risk rating according to the Dam Safety Regulations of B.C.
- In Area D, there are 18 dams regulated under the Dam Safety Regulations, one of which has a failure consequence of significant and a small failure probability rating. The 18 include 5 Rio Tinto dams mentioned above. Dam failure probability of small means that the risk level is of no concern and includes regular audit programs to identify any changes to the operation. (Staff, 2009)
- There are 106 orphaned flood protection structures throughout BC that were assesses in 2020 by the Fraser Basin Council and reported in the Risk Assessment of BC's Orphan Dikes Summary Report. There are no dikes that were reported within the RDBN.

Related Hazards: Hurricane/Typhoon/High Wind Event / Landslide/Debris Flow / Earthquake / Mine Incident / Storm Water Flooding / Flash Flooding / Dike Failure / Structure Failure / Electrical Outage / Water Service Interruption.

Rail Incident

An incident involving a passenger, cargo or light-rail train that results in damage, bodily injury, or death. (BC E. M., 2021)

- The CN Rail northern main line crosses the area from east to west roughly paralleling the Highway # 16 corridor. The railway serves most of the communities along this northern corridor. This is crucial to the economy and, to a lesser extent, to the social well-being of the area. To have rail service interrupted for any length of time would seriously impact the transport of goods to and from the area.
- A major rail accident in the area could seriously impact residents and the environment, particularly if hazardous materials were involved. Rail traffic will increase substantially over the next few years as the Prince Rupert container port construction continues, and this will further increase the risk of and the effects of a CN Rail transportation route failure.
- There are volumes of hazardous materials transported by C.N. rail along this route to Prince Rupert, including:

Substance PIN # [5] and Recommended Evacuation Radius[6]	
L.P. Gas UN1978	Initial downwind evacuation for at least 800m
Gasoline UN1203	Initial evacuation for 800 meters in all directions
MTBE (Methyl-tert-butylether) UN2398	Initial evacuation for 800 meters in all directions
Methanol UN1230	Initial evacuation for 800 meters in all directions
Fuel Oil Diesel Fuel UN1202	Initial evacuation for 800 meters in all directions
Caustic Soda UN1823	Initial evacuation for 800 meters in all directions
Sulphuric Acid UN1830	Initial evacuation for 800 meters in all directions
Anhydrous Ammonia UN1005	Initial evacuation for 1600 meters in all directions
Hydrogen Peroxide UN2014	Initial evacuation for 800 meters in all directions
Chlorine UN1017	Initial evacuation for 800 meters in all directions
Sulphur Dioxide UN1079	Initial evacuation for 1600 meters in all directions

- A regional example of the rail hazard is the incident in March of 2020, where a C.N. train derailed east of Prince George, BC, forcing a school evacuation. This derailment included seven cars carrying liquefied petroleum gas (LPG), an extremely flammable product. Twenty-eight cars went off the tracks. (Trumpener, 2020)

Notable Rail Incidents in Electoral Area D:

- On February 12th, 2011, there was a derailment of a C.N. unit coal train travelling westward at approximately 45 mph when it derailed 36 of 104 coal cars near Fort Fraser, BC. No reported injuries. (Haggerstone, 2013)

Comments and questions for consideration and further research:

- Can we find out the legislation on how many train cars one train can carry at one time?

Related Hazards: Avalanche / Landslide/Debris Flow / Explosions / Hazardous Materials Spill / Transportation Route Interruption / Fuel Source Interruption.

[5] PIN means product identification number as designated by Transportation Canada for the transportation of dangerous goods.
[6] Distances for evacuation zones can be references in the North American 2016 Emergency Response Guidebook available at https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/ERG2016.pdf

Motor Vehicle Incident

An incident involving a truck, car, bus, farm vehicle, or any other motor- or person-powered vehicle that results in damage, bodily injury, or death. (BC E. M., 2021)

- Hwy 16 runs through the region, transecting the Village of Fraser Lake, Stellako, Fort Fraser, Nadleh and Endako. This route contributes to the risk of motor vehicle crashes in the area, with the majority being reported along Hwy 16. The chance of a hazardous materials spill is also high due to the growing volume of truck traffic.
- According to the Insurance Corporation of British Columbia North Central Crashes 2016 to 2020, there were 37 reported casualty crashes[7] in Fraser Lake, 19 in Fort Fraser, 11 in Endako, 1 in Stellako. (ICBC, 2020)
- Hazardous goods are transported each day along Hwy 16. The winding nature of Hwy 16 through the Villages is of particular concern as it is only a matter of time before an incident causes severe loss of property, injury or even death. While it is relatively unknown as to the materials transported along Hwy 16.

Notable Motor Vehicle Incidents in Electoral Area 'D'

- A major MVI on Hwy 16 westbound Fort Fraser, corner Fraser Mountain Rd where the overpass is, an MVI involving a motorhome with two elderly occupants and a logging truck. This was a head-on accident due to a narrow overpass the motorhome caught fire, and the male of the motorhome escaped with injuries while his elderly wife was trapped in a fully engulfed motorhome and died at the scene. The highway was close for a very long time. The overpass has since been made wider.

Related Hazards: Fog / Freezing Rain or Drizzle / Snowstorms and Blizzards / Explosions / Hazardous Materials Spill / Transportation Route Interruption.

Aircraft Incident

An incident involving one or more aircraft that results in damage, bodily injury, or death. (BC E. M., 2021)

- The Village of Fraser Lake Airport has a 4000-foot-long runway located 5.5 kilometres southeast of the Village boundaries. This airport is owned and supported by the Village. (Lake, 2019)
- Fraser Lake is not dependent on the airport for supplies, but it is very important for medivac (Village of Fraser Lake, 2015 2020).
- Early spring of 2021 a personal aircraft went down into Fraser Lake, re-occurring incident injuring people and spilling fuel into the lake. RCMP advises transportation safety board and this agency contacts other agencies for rescue and remediation.

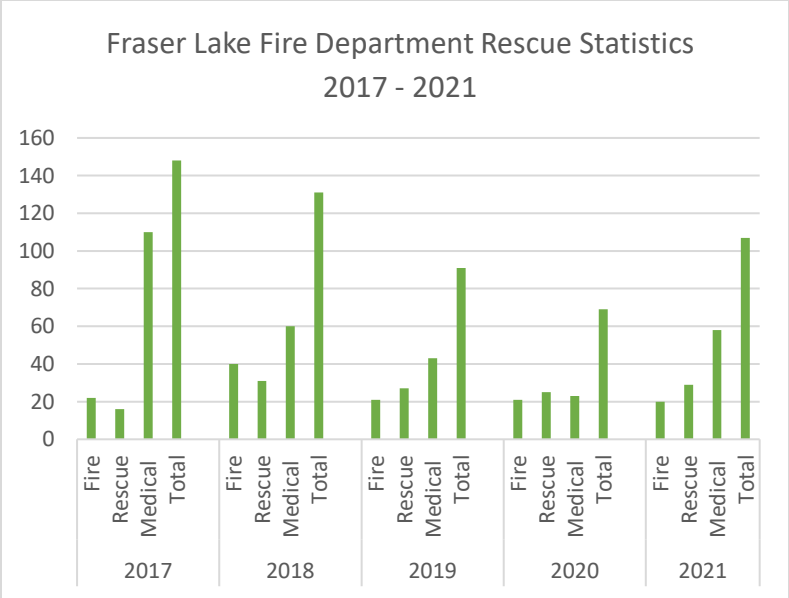
Related Hazards: Fog / Snowstorms and Blizzards / Ash Fall / Explosions / Hazardous Materials Spill / Structure Failure / Transportation Route Interruption.

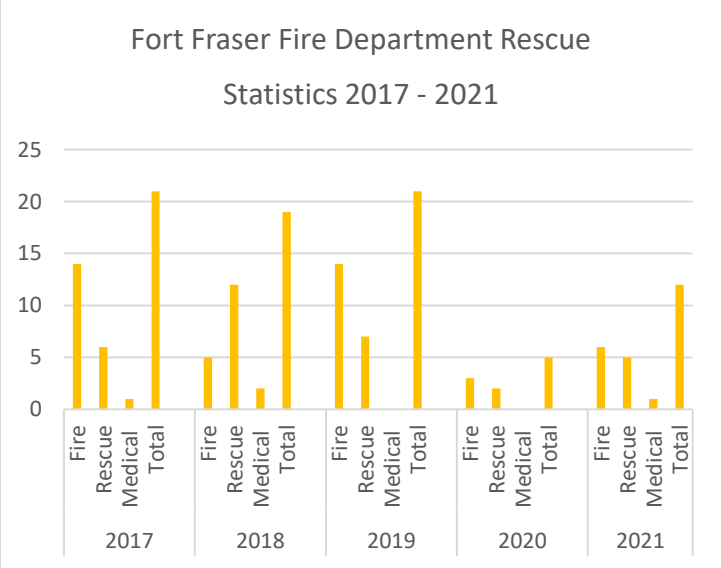
[7] "Casualty Crash" (ICBC collision data) motor vehicle crashes resulting in an injury or fatality.

Structural Fire

Urban fires are fires that occur in a residential, commercial, or industrial community. Rural and urban fires occur on a frequent basis in many parts of the province, and of provincial concern are the fires that cause many deaths and injuries, those that are beyond the ability of the local resources to respond or those that cause severe economic losses. (BC E. M., 2021)

- Mutual Aid Agreements between Fraser Lake, Fort Fraser, Vanderhoof, Burns Lake, and Fort Saint James are a means of ensuring adequate response to a major fire.
- The Mutual Aid Agreement between Fraser Lake and Fort Fraser allows Fort Fraser to send members and equipment but not fire trucks since they have to stay within the fire boundaries.
- There have been no notable structural fires in the community of Fraser Lake since 1966.
- There is a fire hall and fire truck in Fort Babine but no one is trained to drive or operate the fire truck.
- Below is a chart outlining the number of call outs that the Fort Fraser and Fraser Lake Fire departments responded to over the last 5 years:





Related Hazards: Air Quality / Lightning / Wildfire / Explosions / Structure Failure / Electrical Outage / Telecommunications Interruption / Water Service Interruption.

Oil or Gas Pipeline Spill

Pipeline and gas well leaks and explosions occur when natural gas or gasoline pipelines, valves, or components rupture, by accident, by mechanical failure or corrosion. Gas leaks can also be caused by natural hazards such as earthquakes or landslides. (BC E. M., 2021)

- PNG owns and operates natural gas distribution facilities (gas utility), delivering gas from its transmission system to homes and businesses in the various communities served. The PNG Northwest Transmission Pipeline System connects with the Enbridge pipeline system near Summit Lake, British Columbia, and extends 587 km to the west coast at Prince Rupert. The pipeline follows the Hwy 16 corridor. PNG also

owns and operates over 300 km of lateral transmission pipelines, extending into various communities in the Northwest, including Francois Lake residents in Area 'D'.

- Pacific Northern Gas (PNG) Core Emergency Response Plan (ERP) is an operational guide designed to be used by staff to prepare effectively, respond to, and recover from both emergencies and disasters. (Pacific Norther Gas, 2020)
- This Plan identifies the following events that may activate response:
  - Natural disasters;
  - Human-caused: equipment failure and severe damage; environmental incidents security threats and acts of violence; and,
  - Information technology incidents.
- TransCanada Coastal GasLink Project is a pipeline currently under construction in Electoral Area 'D':
  - Approximately 670 kilometres (416 miles), the Coastal GasLink pipeline project will safely deliver natural gas across northern B.C. After Coastal GasLink delivers the natural gas from northeastern B.C. to the LNG Canada facility in Kitimat, B.C., LNG Canada will prepare it for export to global markets by converting the gas to a liquefied state – also known as LNG. (Coastal GasLink, 2021)
  - Section 5 of the Coastal GasLink pipeline runs 82km in length North of Vanderhoof to the south of Burns Lake, along the northern shore of Fraser Lake. This section of the pipeline route is 100% cleared, 88% graded, and 36% installed. Currently, there are 136 workers at Little Rock Lake Lodge near Lejac. (Coastal GasLink, 2021)
  - The proposed pipeline will be underground except at valve sites and compressor stations. The pipeline proposed to be monitored 24 hours a day, 365 days a year. With satellite technology, sensors within the pipeline send data every five seconds to our state-of-the-art control centre. If low gas pressure is detected, the valves on the affected section close automatically and are evaluated by our team of highly trained professionals, assessing the next steps. (Coastal GasLink, 2021)
  - Coastal GasLink has prepared a comprehensive Emergency Response Plan that outlines procedures to protect the public, emergency responders, property, and the environment in the unlikely event of an emergency.

Related Hazards: Animal Disease / Human Disease / Plant Disease and Pest Infestation / Public Health Crisis / Explosions / Hazardous Materials Spill / Fuel Source Interruption.

Electrical Outage

A deficit, interruption or failure of electricity or power systems, services, supplies, or resources. Power outages occur on a regular basis, however, they become a concern when the power outage is for a significant amount of time, when the temperatures are very low, or critical infrastructure, persons, livestock, or businesses are affected. (BC E. M., 2021)

- Power outages occur regularly, however, they become a concern when the power outage is for a significant amount of time when the temperatures are very low, or critical infrastructure, persons, livestock, or businesses are affected.
- Historical electrical outage events in Area 'D' are documented in association with other hazards accounts and found in Appendix 1.

Related Hazards: Space Weather / Lightning / Telecommunications Interruption.

Water Service Interruptions

A deficit, interruption, or failure of water systems, services, supplies, or resources. (BC E. M., 2021)

- Fort Fraser has a Small Waterworks system managed and maintained by the RDBN. The *Drinking Water Protection Act* of British Columbia requires all purveyors of small water systems to have an Emergency Response Plan (ERP).
- In the Water System Emergency Response Plan, there are several events listed requiring emergency response. These include:
  - Pump failure;
  - Power Outage;
  - Contaminated Water;
  - Broken Water Main;
  - Vandalism

Related Hazards: Animal Disease / Human Disease / Plant Disease and Pest Infestation / Public Health Crisis / Structure Fire / Wildfire / Drought / Wastewater Interruption.

Food Source Interruption

Food shortages occur when the population of a community undergoes a severe shortage of food. A severe shortage of food can lead to starvation, illness and, in extreme cases, death. (BC E. M., 2021)

- Statistics Canada provides data on the primary types of locations where BC residents buy their food. If residents in the region are representative of BC, they would be expected to buy 87% of their grocery shopping from supermarkets and other grocery stores. The remaining 13% is purchased from convenience and specialty stores. (Strategies, March 2021) Much of the food in the stores is shipped in through the major highway transportation corridors that are susceptible to external hazards and emergencies that can lead to food source interruptions in this region.
- Agriculture in Electoral Area D is predominantly Beef cattle ranching, hay production and forage country. (Strategies, March 2021). Fraser Lake supports one small farmers' market.
- The cost of locally grown and produced food remains high within the region.
- The average family in the Northern Health region spends $1038 a month on groceries (BC Centre for Disease Control Provincial Health Services Authority, 2018).
- Canada's Food Price Report 2021 forecasts an overall food price increase of between 3% and 5% this year. (Dalhousie University | University of Guelph | University of Saskatchewan | University of British Columbia, 2021)
- The main grocery stores across the region are supplied 50% from the lower mainland and the remainder coming from Edmonton/Alberta. In response to the 2021 November floods in the lower mainland the large chain stores were quick to develop continuity plans to reroute trucking through the US, into Alberta and back over to the North.

Notable Incidents involving food source interruptions:

- COVID-19 Pandemic (Started 2020) exasperated food insecurity for Canadian's who already had food security and affordability issues. Locally, the 2020 COVID-19 Pandemic prompted transportation delays and a crisis in the availability of food at the grocery stores following the March 2020 provincial lockdowns. The grocery stores implemented purchase limits, and store shelves were empty. "Foodbank numbers in the local area increased by 22% at the start of COVID-19 and again increased now that government COVID subsidies have stopped." (Salvation Army Food Bank Coordinator, 2021)
- Big Bar Landslide, BC (2019) caused a decline in salmon fisheries affecting FN food supplies.
- The 2016 ice storms in the Lower Mainland prompted an inevitable crisis — highways were closed, and food trucks couldn't make it up here. Store shelves started emptying.

Related Hazards: Extreme Heat / Extreme Cold / Snowstorms and Blizzards / Animal Disease / Landslide/Debris Flow / Plant Disease and Pest Infestation / Public Health Crisis / Drought.

Transportation Route Interruptions

An interruption or failure of transportation infrastructure or systems. This can include road, rail, or waterway damage, transportation delays due to weather and/or infrastructure failure. Transportation Route Interruptions are probable during disaster events. (BC E. M., 2021)

Related Hazards: Snowstorms and Blizzards / Wildfire / Avalanche / Landslide/Debris Flow / Earthquake / Liquefaction / Tsunami / Lake, River, and Stream Flooding / Aircraft Incident / Marine Vehicle Incident / Motor Vehicle Incident / Rail Incident.

Telecommunications Interruptions

The unavailability of services provided by the communications infrastructure resulting in significant inconvenience or an emergency event caused by human error, equipment malfunction or breakdown. (BC E. M., 2021)

- In the 2020 rain fall and subsequent slides and again in 2021 November floods in the lower mainland the local cell service was disrupted for long periods of time.

Related Hazards: Freezing Rain or Drizzle / Space Weather / Hurricane/Typhoon/High Wind Event / Lightning / Snowstorms and Blizzards / Tornado / Landslide/Debris Flow / Earthquake / Electrical Outage.

Wastewater Interruptions

A deficit, interruption or failure of wastewater or sewer systems, services, supplies, or resources resulting in significant inconvenience or an emergency event. (BC E. M., 2021)

Related Hazards: Hurricane/Typhoon/High Wind Event / Animal Disease / Human Disease / Public Health Crisis / Earthquake / Water Service Interruption.

Fuel Source Interruptions

A deficit, interruption, or failure of fuel systems, services, supplies or resources. This can include pipeline damage, transportation delays due to weather and/or shipping infrastructure damage, or general shortages due to market supply problems, or panic fuel hoarding during emergencies. Fuel Source Interruptions are probable during disaster events. (BC E. M., 2021)

- The majority of fuel is transported from Alberta via Trans Mountain Pipeline and railway. Prince George is the distribution centre, where fuel is then trucked to its destination. There is a refinery in Prince George that refines gasoline, diesel, propane butane and heavy oil.

Related Hazards: Hurricane/Typhoon/High Wind Event / Snowstorms and Blizzards / Wildfire / Landslide/Debris Flow / Earthquake / Oil or Gas Pipeline Spill / Transportation Route Interruption / Rail Incident.

Cyber Security Threat

A circumstance or event with the potential to interrupt or adversely impact organizational operations, assets, or individuals (including mission, functions, image, or reputation). Cyber Threats occur through information systems via unauthorized access, destruction, disclosure, modification of information, and/or denial of service. Also, the potential for a threat-source to successfully exploit a particular information system vulnerability. (BC E. M., 2021)

- Cyber security is a big threat for government and businesses for business continuity.
- Increase in phone, facebook, dating apps, and email scams affecting seniors and vulnerable populations. Limited statistics affecting the local community however recent news reports state that "British Columbians reported $3.5 million in losses to cryptocurrency investment scams in the first eight months of 2021" (Samanski-Langille, 2021).

Related Hazards: Telecommunications Interruption / National Security Threat.

Disease, Pest Infestations & Epidemics

Plant Disease and Pest Infestation

Plant diseases include invasive pests including insects and mites, and plant pathogens including fungi, bacteria and viruses' impact upon crops, forests, and urban environments. New introductions and/or widespread outbreaks could have severe economic and environmental consequences. **(BC E. M., 2021)**

- With climate change, shifts in the distribution, lifecycles, and prevalence of agricultural pests (insects, diseases, weeds, and invasive species) are anticipated. Increasing average annual temperatures (winter minimum temperatures) combined with shifting precipitation patterns is already magnifying pest impacts, pest management complexity, and associated production costs.
- Mountain Pine Beetle outbreaks have significantly impacted the region due to increased winter survival rates. Modelling of changes to biogeoclimatic zones (BGC zones) how the Interior Douglas Fir zone will spread northward and increase in area, while the Sub-Boreal Spruce zone will decrease dramatically. While this modelling was completed with a forestry lens, agricultural pests associated with these ecosystems would be expected to shift along with the BGC zones. (BC Agriculture & Food Climate Action Initiative, 2019)
- Since 2005, the Regional District of Bulkley-Nechako has partnered with the Northwest Invasive Plant Council (NWIPC) to address invasive plant species spread within the region. The NWIPC coordinates the invasive plant response based on priority areas and species and on funding availability through their network of partners. Specifically, funds contributed from the RDBN go toward a number of programs including local education and signage on invasive plants and invasive plant monitoring and treatment at RDBN owned and administered properties. In addition, the NWIPC administers the Private Landowner Rebate program that offers rebates to land owners that use contractors to treat for invasive plants on their property.
- The Northwest Invasive Plant Council (NWIPC) is currently targeting 60 invasive plants for management, as per the NWIPC 2020 Target Plant List. The list of species is reviewed, updated and approved by the membership every spring at the annual general meeting. The Nechako IPMA Plant list for 2020 identified species listed in electoral area D and F.
- Invasive plant species up and down rail lines and highways taking over farm fields – Knapp weed, hock weeds. This results in spraying along Creeks and rivers causing harm to the environment.
- Agriculture producers can also experience challenges due to pests, including grasshoppers, aphids, cutworms and more. Some resources and information are linked below to help with identification, monitoring and management of pests in gardens and crops. Grasshopper Monitoring and Control in BC ; Pesticides and Pest Management - Province of BC

Related Hazards: Animal Disease / Human Disease / Public Health Crisis / Drought / Food Source Interruption.

Human Disease (Including Pandemic and Epidemic)

Diseases that are caused by pathogenic microorganisms and are spread directly, or indirectly, from one person to another. Diseases can impact public health, cause death, have economic implications, and result in mass casualty response. These include epidemics such as meningitis, pandemic flu, hepatitis, E. coli, and other communicable diseases.

A pandemic is the worldwide spread of a new disease. The total number of people who get severely ill can vary. However, the impact or severity tends to be higher in pandemics in part because of the much larger number of people in the population who lack pre-existing immunity to the new virus. (BC E. M., 2021)

Notable Pandemic Incidents in BC:

- COVID-19 Pandemic (2020)
- H1N1 Flu Pandemic (2009)
- SARS Outbreak (2003)
- The lands in BC have been populated by the ancestors of First Nations since time immemorial. Epidemics spread through First Nations communities in advance of explorers. Some researchers have suggested epidemics reached the Northwest Coast as early as the 1500s, believing the well-known epidemics from the Caribbean and Central America may have spread to the Pacific Coast through native trade networks and social contact. Some of the recorded epidemics in the Interior were known to have originated on the prairies during the historical period (the early 1800s). The introduction of infectious diseases from Europe and Asia into the Northwest Coast and adjacent areas, and an increase in the severity of warfare, had devastating effects on the people. Smallpox, influenza, measles, and whooping cough were recorded epidemics, with smallpox particularly recurring with devastating effects in the native population. The 1918-19 influenza pandemic was the last major epidemic to seriously affect First Nations and marked the end of the epidemic cycles that had begun over 150 years previously. In some cases, entire villages were significantly reduced in single disease events, with mortality rates ranging from 50% to 90% of the population. (First Nations Health Council, 2011)
- History of Pandemics: **https://www.visualcapitalist.com/history-of-pandemics-deadliest/**

Related Hazards: Animal Disease / Plant Disease and Pest Infestation / Public Health Crisis.

Public Health Crisis

A localized or regional event that poses or causes a significant threat to the health of human populations. The event may be declared as a Public Health Emergency if the event meets at least two of the following criteria:

- a regional event that could have a serious impact on public health;
- a regional event that is unusual or unexpected;
- there is a significant risk of the spread of an infectious agent or a hazardous agent; and
- there is a significant risk of travel or trade restrictions because of the regional event.

An example of a Public Health Crisis is the contamination of a communities drinking-water supply by a hazardous material. If the event is regional in nature and poses a serious impact to public health, it may be declared a Public Health Emergency. (BC E. M., 2021)

- Overdose B.C.`s Public Health Emergency Progress Update on B.C.`s Response to the Overdose Crisis reported that on April 14, 2016, B.C.'s provincial health officer declared a public health emergency under the Public Health Act. In July 2017, the Ministry of Mental Health and Addictions was established, in part, to work in partnership to develop an immediate response to the overdose emergency. (Columbia B. , 2021)
- Preliminary data in 2021 has found that fentanyl or its analogues have been detected in 85% of all illicit drug toxicity deaths. In 2020, fentanyl or its analogues had been detected in 86% of deaths. (Service C. , 2021) In the Northern Interior,[8] the Illicit drug toxicity deaths between 2011-2021 have increased substantially. It should be noted that this health service delivery area includes Vanderhoof, Fort St James, Prince George and Quesnel, and are reported as follows:

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021[9]
8	12	8	11	15	24	35	63	34	84	36

- By Health Authority (HA), in 2021, the highest rates were in Vancouver Coastal Health (46 deaths per 100,000 individuals) and Northern Health (45 per 100,000). Overall, the rate in BC will be 39 deaths per 100,000 individuals in 2021.
- 2019 Taking the Pulse of the Population an Update on the Health of British Columbians identifies positive Mental Health as a public health challenge and a provincial goal. They were collecting public health statistics as indicators to monitor this complex public health crisis. Under Section 66 of the Public Health Act, the Provincial Health Officer (PHO) has the authority and responsibility to monitor the health of the population in BC and to provide independent advice on public health issues and the need for legislation, policies, and practices respecting those issues.
- Read: https://www2.gov.bc.ca/assets/gov/health/about-bc-s-health-care-system/office-of-the-provincial-health-officer/overdose-response-progress-update-aug-dec-2020.pdf

Related Hazards: Air Quality / Extreme Heat / Extreme Cold / Animal Disease / Human Disease / Plant Disease and Pest Infestation / Explosions / Hazardous Materials Spill /

[8] Fraser Lake, Stellat'en, Fort Fraser, Francios Lake, Nadleh Whut'en are in the North Interior Health Service Delivery Area.
[9] https://www2.gov.bc.ca/assets/gov/birth-adoption-death-marriage-and-divorce/deaths/coroners-service/statistical/illicit-drug.pdf

Structure Failure / Electrical Outage / Food Source Interruption / Telecommunications Interruption / Transportation Route Interruption / Wastewater Interruption / Water Service Interruption / Fuel Source Interruption.

Animal Disease

Precipitation in the form of lumps of ice mainly associated with thunderstorms. Hail ranges in size from that of a small pea to the size of cherries, but has been observed as large as grapefruit. Hail in Canada occurs most frequently during the summer when thunderstorm activity is at its peak.. (BC E. M., 2021)

- Yes, include animal, human and plant disease, pest infestation
- Risk of bovin – economic impacts in ranching community, there is no experience locally but could change any time.
- Moose and fish population hazards – rural communities are reliant on food harvested from the land. Food security is a huge issue the distance to Vanderhoof or FSJ for a family to get groceries could make a family go broke just from gas alone.
- Susceptibility to spread human disease when large families are forced into confined housing or housing that is not suitable. Housing is a challenge in our communities' and creates cascading hazards.
- Increase in grasshopper populations on farmers' fields devastating crops.

Related Hazards: Human Disease / Plant Disease and Pest Infestation / Public Health Crisis / Food Source Interruption.

APPENDIX 1 – ELECTORAL AREA 'D' HISTORIC HAZARD EVENTS

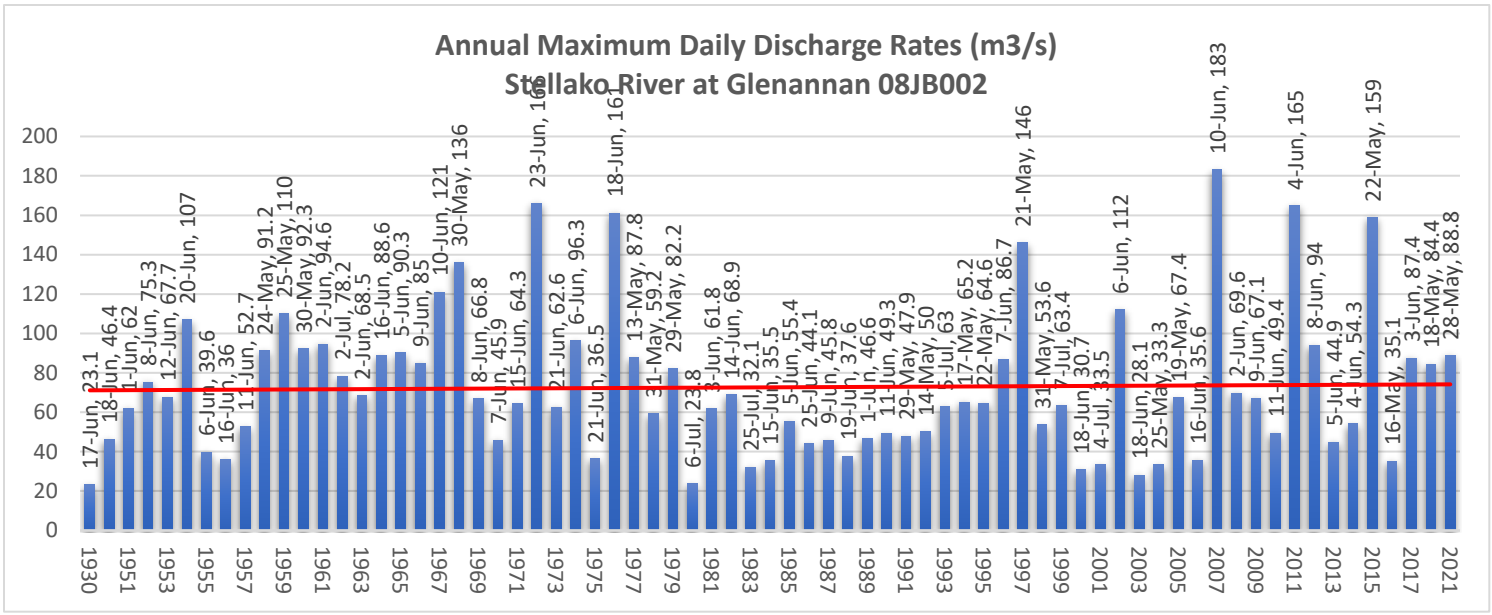
Year	Event Type	Severity	Cause	Impact Effect	Description
1937	Flooding	low	Spring Runoff	Transportation	Warm weather caused rapid snowmelt causing flooding. July The ferryman at Fort Fraser, who had resided there for a quarter of a century, stated the water was within a few inches of "the greatest height he has known." (Septer, 2007)
1947	Flooding	low	Spring Runoff		
1976	Flooding	moderate	Spring Runoff		High water levels caused a washout on the CNR line 12 mi. (19.2 km) east of Endako. After a nine-day disruption, service was restored on May 14.
1996	Rain-on-Snow	Moderate	Snowstorm	Residence	In the Francois Lake-Ootsa Lake area, unusually heavy snow combined with the poor design in some cases caused the roofs of at least seven buildings to collapse. Between January 13-14, five structures (hay barns), one shop and one of undetermined nature came down. Building inspector Wainwright came close to issue a snow advisory, which he did when about 20 roofs collapsed in February and March 1994. On that occasion, however, mild temperatures and heavy rain had swept through the area.
1997	Flooding	High	Spring Runoff	Transportation	On May 19, water levels in the Fraser River at Prince George were slowly dropping, but the Nechako River was rising. The Nechako and Stuart River systems continued to rise, though at a slower rate. Fraser Lake continued to rise to record highs, and Burns Lake also continued to rise. High winds continued to

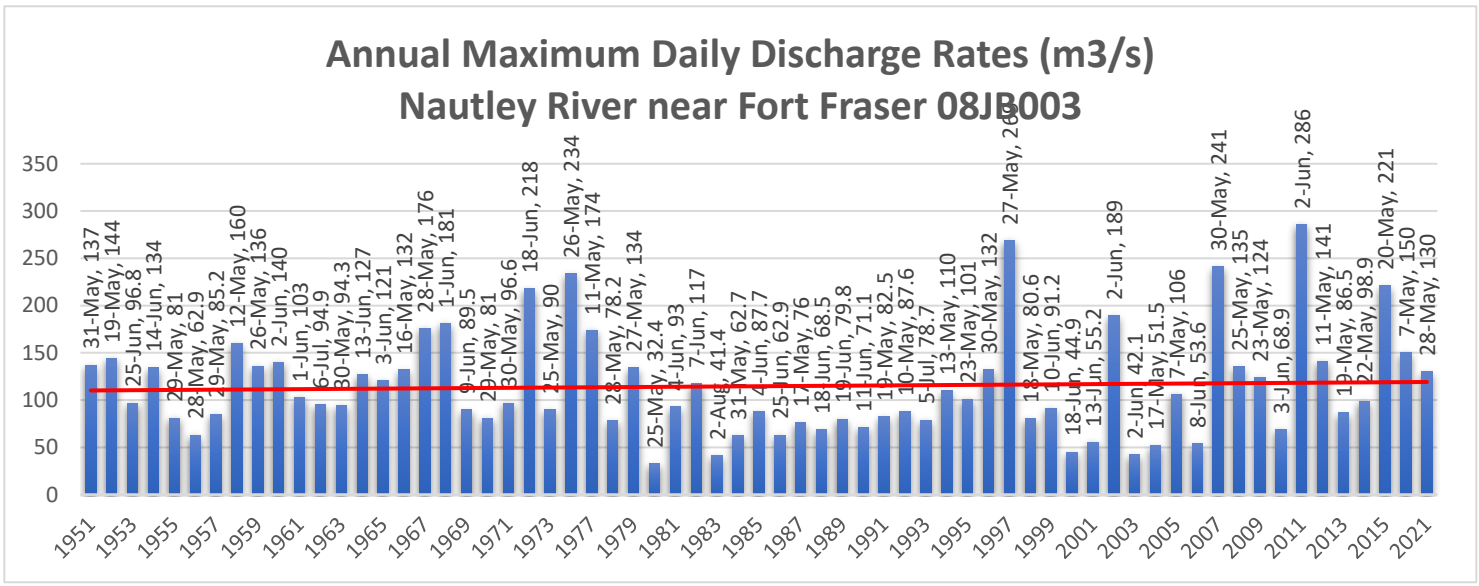
Year	Event Type	Severity	Cause	Impact Effect	Description
					erode Colleymount Road, threatening at least one residence. Francois Lake continued to rise, causing concern about Nadina River to wash out a MoTI road used as an important industrial artery.
2002	Flooding			Flood	May 23, 2002, Fraser Lake is rising along with numerous small creeks.
2006	Electrical Outage – Snowstorm	Low	Severe Weather	Transportation	On October 28, a massive snowstorm that hit northern British Columbia dumped 2.5-3 ft. (75-90 cm) of wet snow in some areas. It was a result of a combination of two weather systems, a warm Pacific and a large cold front, colliding. The Smithers airport set a 24-hour October record of 62 cm of snow. *1) Early on October 28, the 244-km section of Highway 16 between Moricetown-Fraser Lake was temporarily closed, to be reopened the next day. The early season snowstorm left an estimated 15,000 BC Hydro customers in northwestern British Columbia without power. Affected communities included: Mackenzie, Prince George, Vanderhoof, Fort St. James, Fraser Lake, Nadhleh, Stallat'en, Burns Lake, Takla Landing, Houston, Telkwa, Smithers and Hazelton. Three transmission lines were down and due to impassable roads crews in some areas were relying on helicopters to access problem areas. On October 30, an estimated 2,500 customers were still without power.

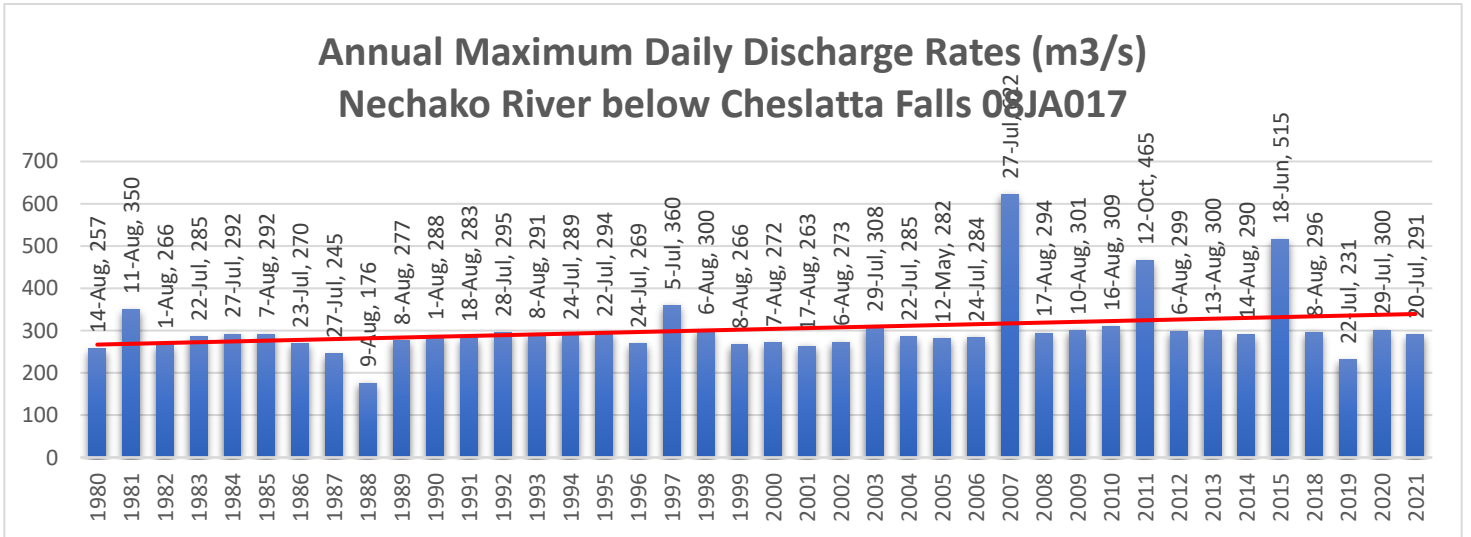
Year	Event Type	Severity	Cause	Impact Effect	Description
					On November 2, six days after the storm, about 200 households in about 10 communities near Burns Lake were still without power. Most of these were unlikely to get service back for several more days. The area most heavily affected was the south shore of Francois Lake, about 25 km south of Burns Lake. Large trees coated with ice hampered repair efforts. BC Hydro representative said, "There was about a metre-and–a-half of wet snow; then it froze."
2007	Flooding	high	Spring Run-Off	Transportation, Residential damage, and evacuation	An evacuation alert was also put in place for residences along Francois Lake and included approximately 350 homes.
2010	Wildfire - EOC Activation	high	Wildfire	Residential evacuation	Binta Lake 40,000 ha Evacuation Order issued Aug 14. Rescinded Aug 25. Evacuation orders, loss of structures, huge biodiversity loss, economic loss of timber supply area
2011	Rail Derailment	low	Mechanical derailment	Transportation	12 February 2011 derailment of a CN unit coal train travelling westward at approximately 45 mph when it derailed 36 of 104 coal cars near Fort Fraser, BC. No reported injuries. A rail car wheel fractured when a crack, which had been growing over some time, reached such a size that the wheel could no longer support normal service loads.
2011	Cyanobacteria Algae Bloom	low		economic	Northern Health and residents Advised - No warnings issued by Northern Health
2012	Mass Carcass	low		economic	20 bred heifers fell through the ice on the Nechako River adjacent to

Year	Event Type	Severity	Cause	Impact Effect	Description
					the producer's farm. All died as a result.
2013	Cyanobacteria Algae Bloom	low		economic	Northern Health and residents Advised - No warnings issued by Northern Health Dry William Lake
2013	Ice Jam	low	Flooding		Ice jam Monitoring on November 20, 2013, at 9:10 am, staff received a report of an ice jam redirecting water towards a residence on Horn Road, south of Fort Fraser off Telegraph Road.
2018	Wildfire - EOC Activation	high	Wildfire	Residential evacuation	Shovel Lake: 92,412 ha; 6.7 km northwest of Endako; discovered July 27; caused by equipment-use logging operations; prompted Evacuation Orders and Alerts Island Lake 12,381 ha caused by lightning – evacuation orders, loss of structures, economic and environmental loss. Foster Creek 328 ha Dog Creek 80ha
2019	Wildfire		Wildfire		The cause of the fire was human – pile burning
2020	Pandemic	moderate	Pandemic	Social-economic	COVID-19 Pandemic, Business shut down and restrictions on gatherings and inter-community travel.
2021	Wildfire - EOC Activation	moderate	Wildfire	Residential Evacuation alert	Cutoff Creek (G41269) - 10,129 hectares as of July 11, 2021, lighting caused. Cut Off Creek – Incident # 210398

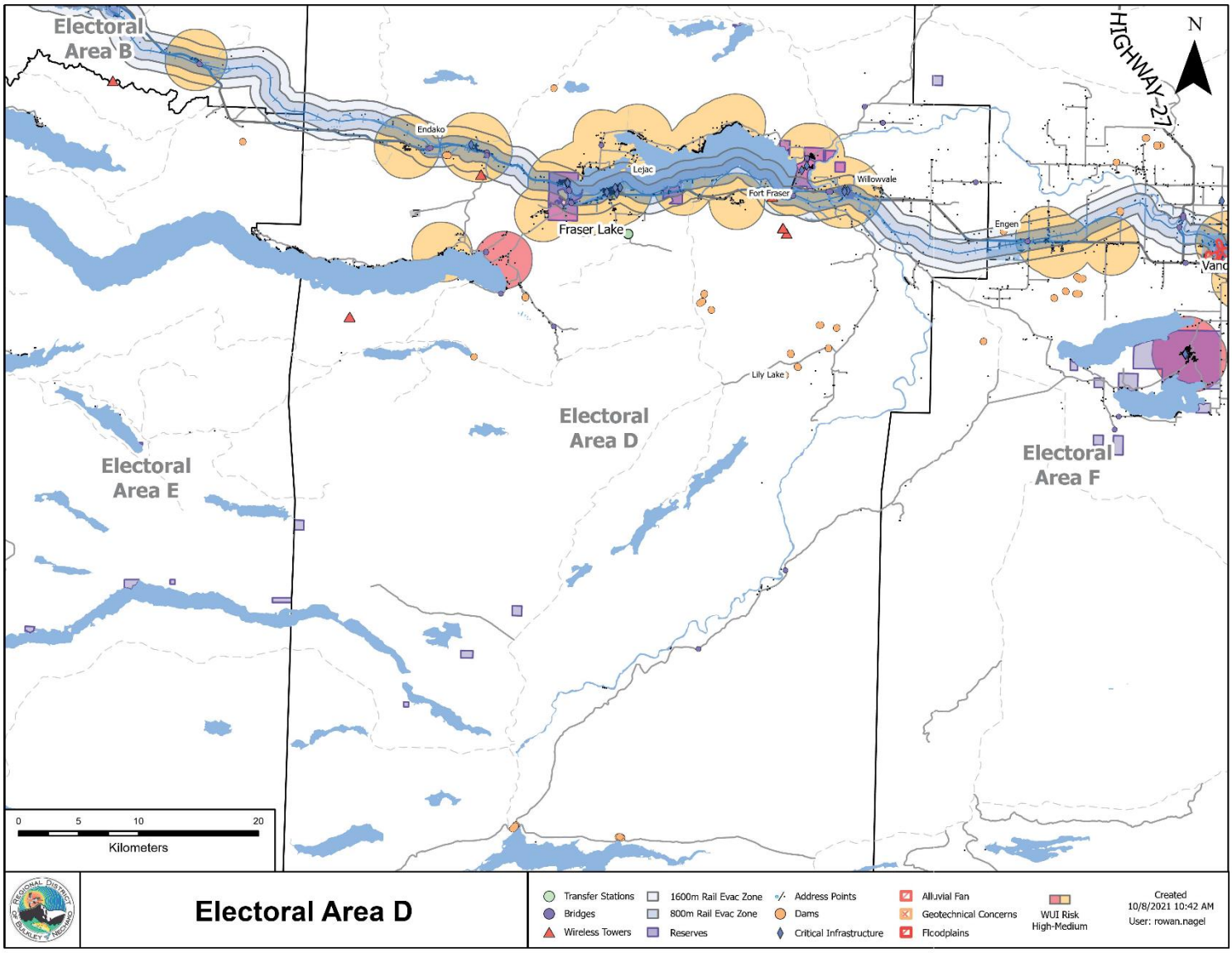
APPENDIX 2 – ELECTORAL AREA 'D' HYDROMETRIC DATA

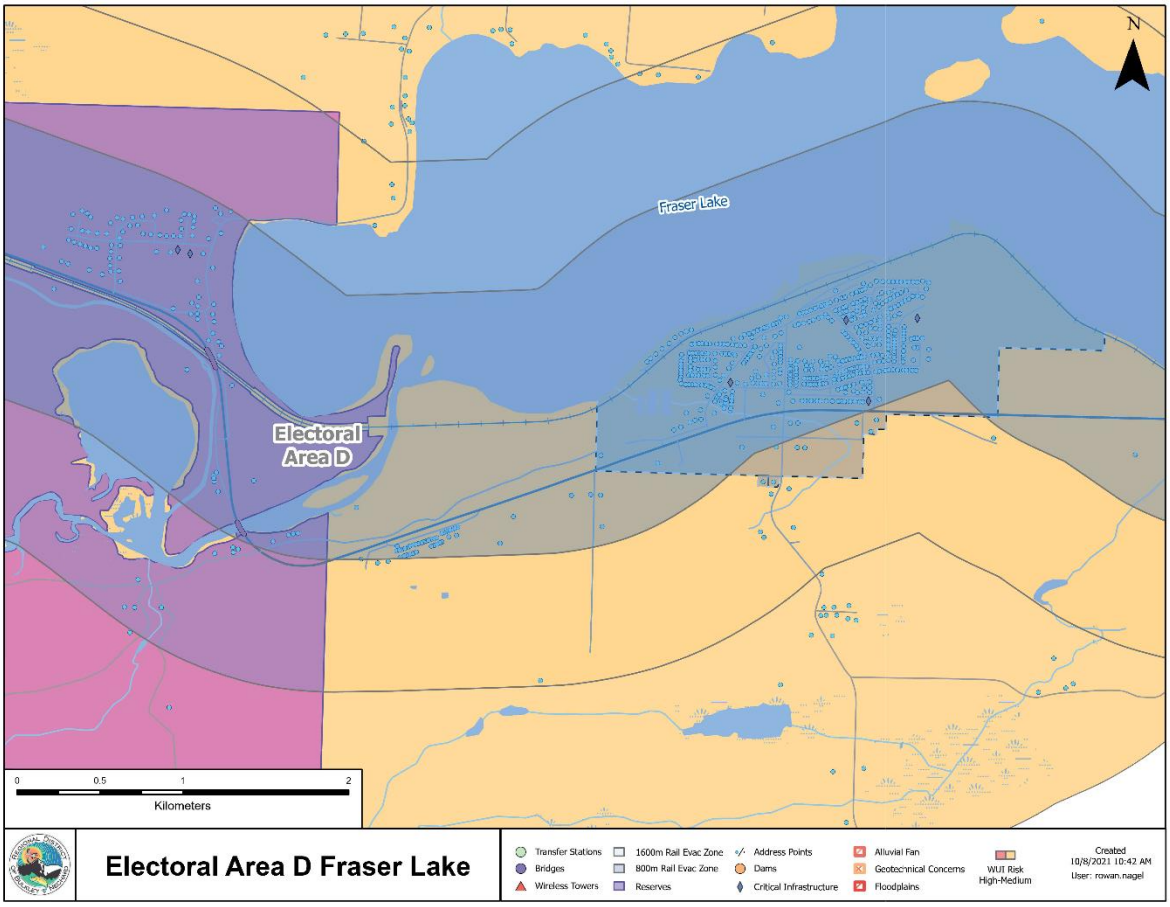






APPENDIX 3 – ELECTORAL AREA 'D' KNOW HAZARDS MAP

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Electoral Area D
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Kilometers
Electoral Area D Fraser Lake
Transfer Stations
Bridges
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1600m Rail Evac Zone
800m Rail Evac Zone
Reserves
Address Points
Dams
Critical Infrastructure
Alluvial Fan
Geotechnical Concerns
Floodplains
WUI Risk
High-Medium
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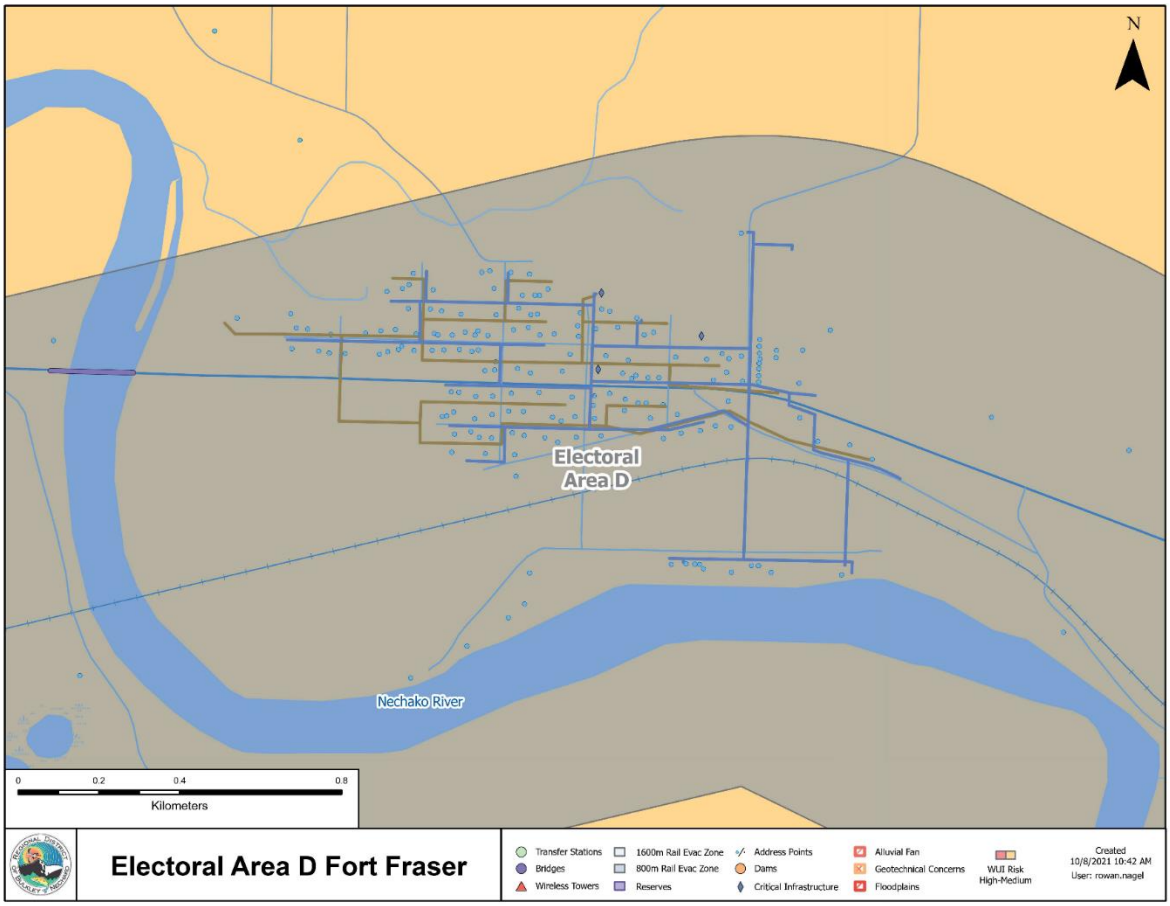
N
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Kilometers
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Transfer Stations
Bridges
Wireless Towers
1600m Rail Evac Zone
800m Rail Evac Zone
Reserves
Address Points
Dams
Critical Infrastructure
Alluvial Fan
Geotechnical Concerns
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WUI Risk
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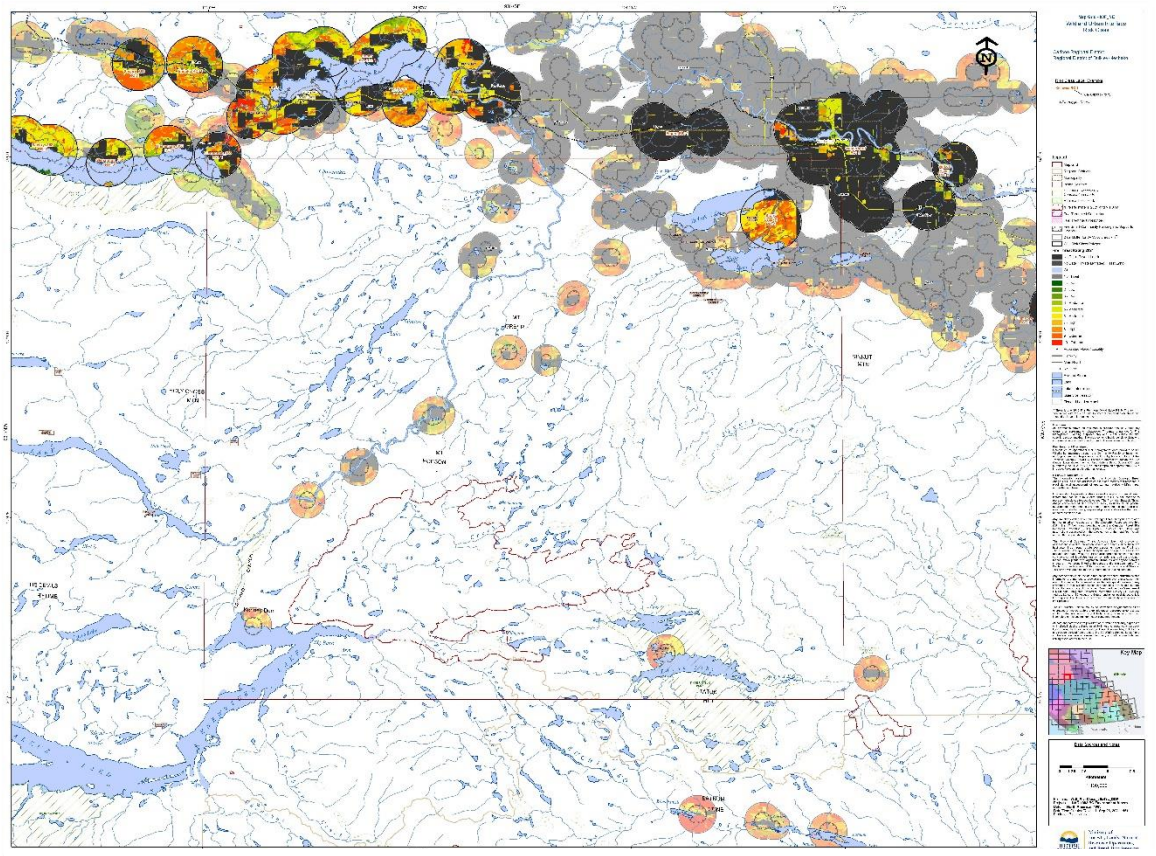
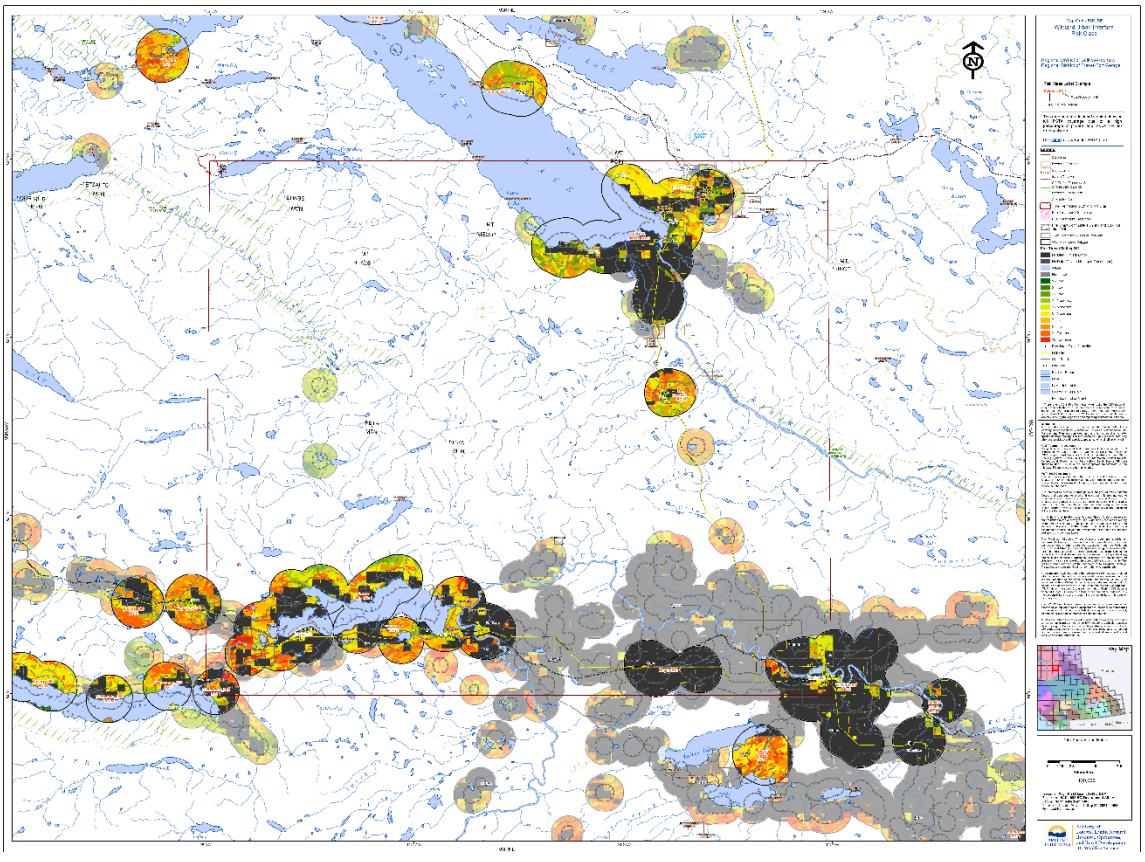
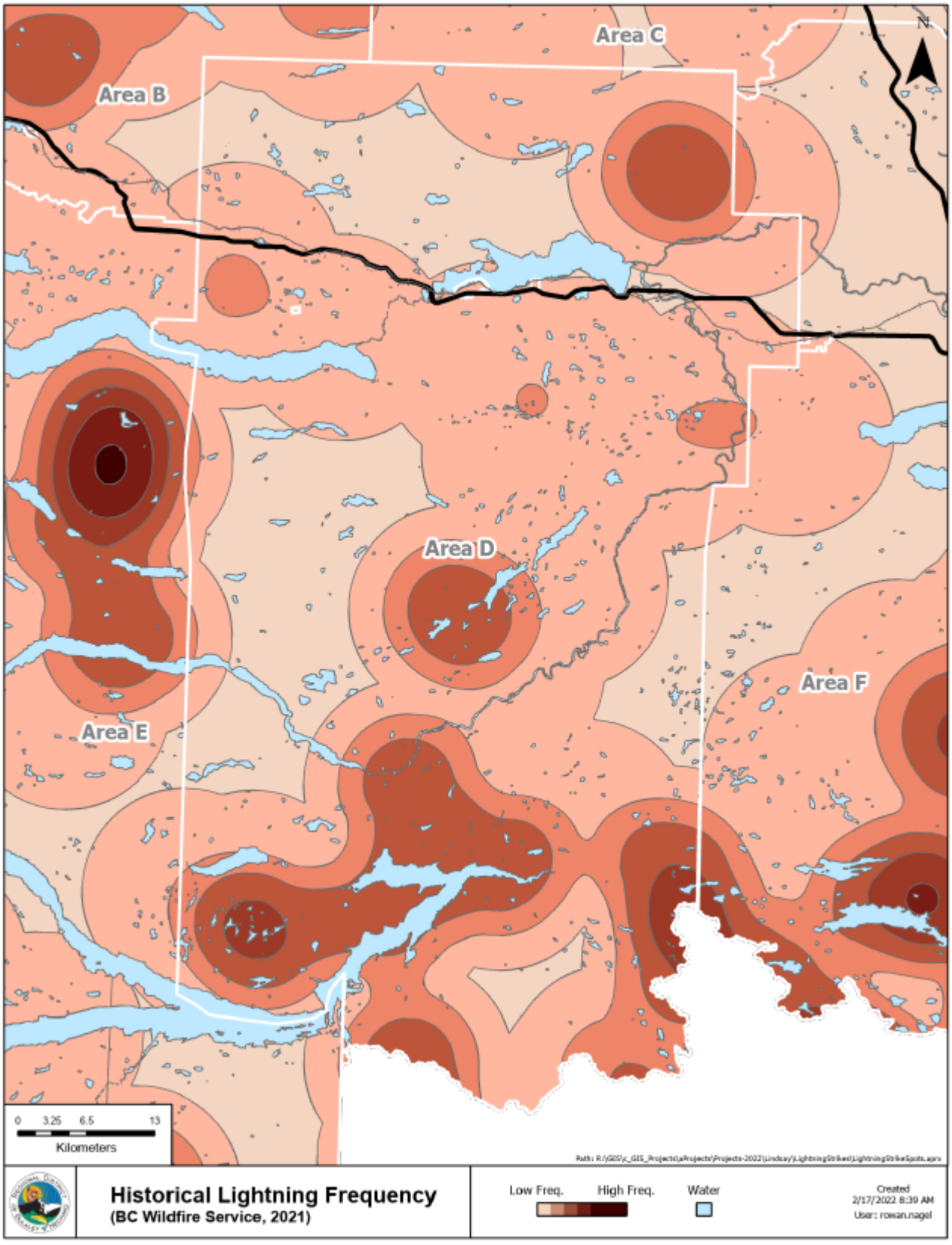
Wildland Urban Interface Risk Class SE & NE






Area C
Area B
N
Area D
Area F
Area E
0 3.25 6.5 13
Kilometers
Historical Lightning Frequency
(BC Wildfire Service, 2021)
Low Freq.
High Freq.
Water
Created
2/17/2022 8:39 AM
User: rowan.nagel

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