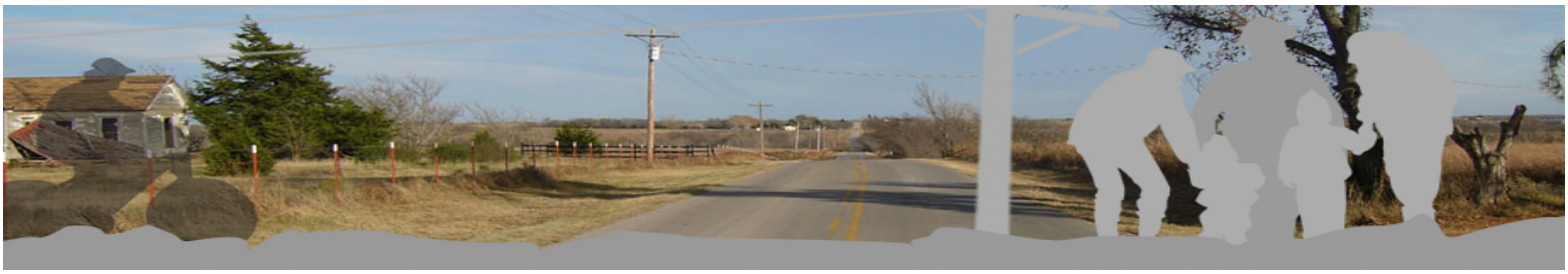

Hazard Resilience Index (HRI)

Hyrdrological Hazards (related to water and snow)

Hydrological Hazards

Please refer to the *Hazard Resilience Index Instructions (HRI)* document for more information on using this document.

In order to avoid repetition, resiliency factors which only apply to human-caused hazards are in italics.

Avalanche – Natural and Human Caused [1 2 3]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Airplanes flying in the vicinity of the airport use “ground proximity warning systems” (systems that notify pilots when their aircraft is at risk of colliding with the ground or an obstacle).	☐
☐	☐	☐	☐	Areas are forested or reforestation is in place in order to retain snow.	☐

☐	☐	☐	☐	Community-based avalanche exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐
☐	☐	☐	☐	Most persons (residents and visitors) using mountains for snow related activities frequently check with avalanche forecasting agencies such as the Canadian Avalanche Centre or hire experts to monitor avalanche risk based on depth of snow, precipitation and temperature.	☐
☐	☐	☐	☐	Plans and personnel are in place to implement appropriate strategies to reduce avalanche hazards by: triggering snow avalanches in a controlled environment; testing and promoting slope stability.	☐
☐	☐	☐	☐	*Plans are in place to identify areas with a high risk of causing an avalanche as of-bound areas for snowmobilers, skiers, and snowmobilers and there are the required personnel to mark and monitor use of this area.*	☐
☐	☐	☐	☐	Regulations prohibit development, limit land use, or require structural reinforcements for buildings that must remain in avalanche hazard areas, such as reinforced walls.	☐
☐	☐	☐	☐	Structures are in place in avalanche runout and catchment zones such as diverters, catching dams or basins, retarding mounds (structures to stop debris), snow fences, snow nets, snow sheds or tunnels which slow, divert or stop avalanche flows.	☐
☐	☐	☐	☐	The community has mapped and posted avalanche evacuation routes in areas of high risk.	☐
☐	☐	☐	☐	The community and mountain resorts have posted visible signs warning residents and visitors of avalanche hazards.	☐
☐	☐	☐	☐	There is a warning system in place to notify community residents and visitors of a potential avalanche and to evacuate the threatened area	☐
☐	☐	☐	☐	There is a warning system in place to notify police, fire and ambulance personnel of a potential avalanche	☐
☐	☐	☐	☐	There is a warning system in place to notify Search and Rescue (SAR) volunteers of a potential or actual avalanche	☐
☐	☐	☐	☐	Wind baffles (deflectors) are in place to direct wind in order to erode snow cover.	☐

Debris Avalanches, debris Flows and Torrents – Natural and Human Caused [4] [5]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Community officials and residents check frequently with weather forecasting agencies such as Environment Canada and have experts monitor conditions and major events that may trigger debris flows, such as frequent rolling stones or the presence of erodible material in the debris-flow source-areas in combination with heavy precipitation.	☐
☐	☐	☐	☐	Community-based debris avalanche, flow and torrent exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐

☐	☐	☐	☐	The community has implemented appropriate strategies to reduce debris hazards by stabilizing slopes to reduce erosion using drainage systems, soil bio-engineering (the use of living plant materials to perform engineering feats), reforestation or installing sills and ramps in stream beds or constructing dams.	☐
☐	☐	☐	☐	The community has implemented appropriate strategies to reduce debris hazards by using structural measures to redirect, slow, or retain debris flows such as debris flow breakers, drop structures (to assist with flow control), debris rakes, retention basins, deflection structures, transport channels, or tunnels.	☐
☐	☐	☐	☐	The community has regulations that prohibit development, limit land use, or require structural reinforcements for buildings that must remain in the debris hazard areas, such as reinforced walls.	☐
☐	☐	☐	☐	The community has prohibited human activity in areas which pose a high risk of debris avalanches, flows and torrents.	☐
☐	☐	☐	☐	There is a warning system in place to notify community residents of a potential debris avalanche, flow and torrent	☐
☐	☐	☐	☐	There is a warning system in place to notify police, fire and ambulance personnel of a potential debris avalanche, flow and torrent	☐

DROUGHT – Natural and Human-Caused [6 7 8]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Community officials check frequently with weather forecasting agencies such as Environment Canada and monitor the area's drought dryness level.	☐
☐	☐	☐	☐	Community-based drought exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐
☐	☐	☐	☐	Farmers are educated about water conservation programs, plant where possible drought-resistant crops and make efficient use of irrigation.	☐
☐	☐	☐	☐	Farmers take advantage of incentives or subsidies for farmers to diversify business activities.	☐
☐	☐	☐	☐	The community actively promotes or requires water conservation practices to reduce the risk and severity of drought, including: having businesses and households install water saving devices; repair leaking fixtures; and collect rain water.	☐
☐	☐	☐	☐	The community has fire restrictions in place during times of drought and has the personnel to enforce these restrictions.	☐
☐	☐	☐	☐	The community has plans to establish a drought crisis centre or hotline, during times of extended drought to educate the public about the health dangers of drought, and provide water to those in need if required. .	☐

☐	☐	☐	☐	The community has policies in place to discourage or prohibit (depending upon the severity of the drought) residents from washing hard surfaces, vehicles, or buildings; filling swimming pools; or watering non-essential gardens.	☐
☐	☐	☐	☐	The community has policies in place to discourage or prohibit (depending upon the severity of the drought) businesses from non-essential commercial water use such as watering golf courses, operating car washes and watering plants in nurseries. .	☐
☐	☐	☐	☐	The community provides education about water conservation to schools and residents.	☐

Flash Floods – Natural [9] [10]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Community officials check frequently with weather forecasting agencies such as Environment Canada and monitor conditions that may lead to flash flooding.	☐
☐	☐	☐	☐	Community-based flash flood exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐
☐	☐	☐	☐	Have a warning system to notify community residents of flash flood risk and to evacuate areas prone to flash flooding (e.g., river beds).	☐
☐	☐	☐	☐	The community has implemented structural measures to reduce the risk of flooding, such as building dams, dykes and floodwalls, creating reservoirs or making channel improvements.	☐
☐	☐	☐	☐	The community has mapped areas subject to flash flooding.	☐
☐	☐	☐	☐	The community has posted signs warning of areas subject to flash flooding (e.g., roads).	☐
☐	☐	☐	☐	The community has regulations that prohibit development, limit land use, or require specific building codes for developments within flood hazard areas, such as elevating structures above maximum flood levels, requiring waterproof materials and anchoring buildings to prevent floatation.	☐
☐	☐	☐	☐	The community has retained or re-established natural ecosystems in floodplains that provide flood control, such as vegetation cover which provides soil stability and absorption, wetlands and estuaries (a partly enclosed coastal body of water with one or more rivers or streams flowing into it and a free connection to the sea) which assist with water retention and absorption, and natural stream flows and riparian areas (areas situated on the bank of a river or other body of water) which slow water runoff velocity, reduce bank erosion and reduce the introduction of sediment and debris in watercourses.	☐
☐	☐	☐	☐	There is a warning system in place to notify community residents of a potential flash flood	☐

☐	☐	☐	☐	There is a warning system in place to notify police, fire and ambulance personnel of a potential flash flood and to prohibit entry into areas subject to flash flooding	☐
☐	☐	☐	☐	There is a warning system in place to notify Search and Rescue (SAR) personnel of a potential flash flood.	☐

Ice Jam Floods – Natural [11 12 13]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Community officials check frequently with weather forecasting agencies such as Environment .Canada and monitor conditions that may lead to ice-jam flooding.	☐
☐	☐	☐	☐	Community-based ice-jam flood exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐
☐	☐	☐	☐	Community volunteers and personnel have received training regarding sand-bagging.	☐
☐	☐	☐	☐	Dredging has taken place to avert potential ice jam floods and/or dredging activities are monitored and assessed for their potential to cause submarine slides.	☐
☐	☐	☐	☐	The community has implemented structural measures to reduce the risk of ice-jam flooding, such as building dams, dykes and floodwalls, creating reservoirs or making channel improvements.	☐
☐	☐	☐	☐	The community has mapped areas subject to ice-jam flooding.	☐
☐	☐	☐	☐	The community has posted signs warning of areas subject to ice jam flooding (e.g., roads, railroad lines).	☐
☐	☐	☐	☐	The community has ready access to stockpiles of sandbags.	☐
☐	☐	☐	☐	The community has regulations that prohibit development, limit land use, or require specific building codes for developments within ice-jam flood hazard areas, such as elevating structures above maximum flood levels, requiring waterproof materials and anchoring buildings to prevent floatation.	☐
☐	☐	☐	☐	The community has retained or re-established natural ecosystems in floodplains that provide flood control, such as vegetation cover which provides soil stability and absorption, wetlands and estuaries (a partly enclosed coastal body of water with one or more rivers or streams flowing into it and a free connection to the sea) which assist with water retention and absorption, and natural stream flows and riparian areas (areas situated on the bank of a river or other body of water) which slow water runoff velocity, reduce bank erosion and reduce the introduction of sediment and debris in watercourses.	☐
☐	☐	☐	☐	There is a warning system in place to notify community residents of a potential ice jam flood and to evacuate areas prone to ice-jam flooding (e.g., river beds, bridges).	☐

☐	☐	☐	☐	There is a warning system in place to notify police, fire and ambulance personnel of a potential ice jam flood and to prohibit entry into areas subject to ice jam flooding	☐
☐	☐	☐	☐	There is a warning system in place to notify Search and Rescue (SAR) personnel of a potential ice jam flood.	☐

Local Floods – Human-Caused [14] [15]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Community officials check frequently with weather forecasting agencies such as Environment Canada and monitor conditions that may lead to local flooding.	☐
☐	☐	☐	☐	Community volunteers and personnel have received training regarding sand-bagging.	☐
☐	☐	☐	☐	Community-based local flood exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐
☐	☐	☐	☐	The community has a warning system to notify community residents and businesses of potential local flooding risk and to evacuate areas prone to local flooding.	☐
☐	☐	☐	☐	The community has implemented measures to reduce the risk of local flooding, such as ensuring that storm sewage drains and systems are well maintained.	☐
☐	☐	☐	☐	The community monitors and maintains pumps and pump stations.	☐
☐	☐	☐	☐	The community has ready access to stockpiles of sandbags.	☐
☐	☐	☐	☐	The community has retained or re-established natural ecosystems in floodplains that provide flood control, such as vegetation cover which provides soil stability and absorption, wetlands and estuaries (a partly enclosed coastal body of water with one or more rivers or streams flowing into it and a free connection to the sea) which assist with water retention and absorption, and natural stream flows and riparian areas (areas situated on the bank of a river or other body of water) which slow water runoff velocity, reduce bank erosion and reduce the introduction of sediment and debris in watercourses.	☐
☐	☐	☐	☐	There is a warning system in place to notify police, fire and ambulance personnel of potential local flooding and to prohibit entry into areas subject to ice jam flooding	☐

Rain Storm Floods – Natural [16] [17]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Community officials check frequently with weather forecasting agencies such as Environment Canada and monitor conditions that may lead to rain storm flooding.	☐
☐	☐	☐	☐	Community volunteers and personnel have received training regarding sand-bagging.	☐
☐	☐	☐	☐	Community-based rain storm flood exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐
☐	☐	☐	☐	Dredging has taken place to avert potential ice jam floods and/or dredging activities are monitored and assessed for their potential to cause submarine slides.	☐
☐	☐	☐	☐	The community has implemented structural measures to reduce the risk of rain storm flooding, such as building dams, dykes and floodwalls, creating reservoirs or making channel improvements.	☐
☐	☐	☐	☐	The community has mapped areas subject to rain storm flooding (e.g., established flood plain areas at the 100 and 200 year level).	☐
☐	☐	☐	☐	The community has posted signs warning of areas subject to rain storm flooding (e.g., roads, railroad lines).	☐
☐	☐	☐	☐	The community has ready access to stockpiles of sandbags.	☐
☐	☐	☐	☐	The community has regulations that prohibit development, limit land use, or require specific building codes for developments within flood plains, such as elevating structures above maximum flood levels (e.g., 100 or 200 year levels), requiring waterproof materials and anchoring buildings to prevent floatation.	☐
☐	☐	☐	☐	The community has retained or re-established natural ecosystems in floodplains that provide flood control, such as vegetation cover which provides soil stability and absorption, wetlands and estuaries (a partly enclosed coastal body of water with one or more rivers or streams flowing into it and a free connection to the sea) which assist with water retention and absorption, and natural stream flows and riparian areas (areas situated on the bank of a river or other body of water) which slow water runoff velocity, reduce bank erosion and reduce the introduction of sediment and debris in watercourses.	☐
☐	☐	☐	☐	There is a warning system in place to notify community residents of a potential rain storm floods and to evacuate areas prone to rain storm flooding (e.g., flood plains).	☐
☐	☐	☐	☐	There is a early warning system in place to notify farmers of a potential rain melt floods and to evacuate livestock from areas prone to snow melt flooding (e.g., flood plains).	☐
☐	☐	☐	☐	There is a warning system in place to notify police, fire and ambulance personnel of a potential rain storm flood and to prohibit entry into areas subject to flooding	☐
☐	☐	☐	☐	There is a warning system in place to notify Search and Rescue (SAR) personnel of a potential rain storm flood.	☐

Snow Melt Floods [18] [19]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Community officials check frequently with weather forecasting agencies such as Environment Canada and monitor snow pack conditions that may lead to snow melt flooding.	☐
☐	☐	☐	☐	Community volunteers and personnel have received training regarding sand-bagging.	☐
☐	☐	☐	☐	Community-based snow melt flood exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐
☐	☐	☐	☐	Dredging has taken place to avert potential ice jam floods and/or dredging activities are monitored and assessed for their potential to cause submarine slides.	☐
☐	☐	☐	☐	The community has implemented structural measures to reduce the risk of snow melt flooding, such as building dams, dykes and floodwalls, creating reservoirs or making channel improvements.	☐
☐	☐	☐	☐	The community has mapped areas subject to snow melt flooding (e.g., established flood plain areas at the 100 and 200 year level).	☐
☐	☐	☐	☐	The community has ready access to stockpiles of sandbags.	☐
☐	☐	☐	☐	The community has regulations that prohibit development, limit land use, or require specific building codes for developments within flood plains, such as elevating structures above maximum flood levels (e.g., 100 or 200 year levels), requiring waterproof materials and anchoring buildings to prevent floatation.	☐
☐	☐	☐	☐	The community has retained or re-established natural ecosystems in floodplains that provide flood control, such as vegetation cover which provides soil stability and absorption, wetlands and estuaries (a partly enclosed coastal body of water with one or more rivers or streams flowing into it and a free connection to the sea) which assist with water retention and absorption, and natural stream flows and riparian areas (areas situated on the bank of a river or other body of water) which slow water runoff velocity, reduce bank erosion and reduce the introduction of sediment and debris in watercourses.	☐
☐	☐	☐	☐	There is an early warning system in place to notify farmers of a potential snow melt floods and to evacuate livestock from areas prone to snow melt flooding (e.g., flood plains).	☐
☐	☐	☐	☐	There is a warning system in place to notify community residents of a potential snow melt floods and to evacuate areas prone to snow melt flooding (e.g., flood plains).	☐
☐	☐	☐	☐	There is a warning system in place to notify police, fire and ambulance personnel of a potential snow melt flood and to prohibit entry into areas subject to flooding	☐
☐	☐	☐	☐	There is a warning system in place to notify Search and Rescue (SAR) personnel of a potential snow melt flood.	☐

Glaciers [20]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Community officials check frequently with weather forecasting agencies such as Environment Canada and monitor glacier conditions that may lead to avalanches associated with glaciers.	☐
☐	☐	☐	☐	Community-based discussions have taken place in the community-at-large regarding glaciers of concern	☐
☐	☐	☐	☐	The community and mountain resorts have posted visible signs warning residents and visitors of avalanches associated with glaciers.	☐
☐	☐	☐	☐	The community has plans in place or has reduced the risk of glacial lakes flooding by constructing a draining tunnel to remove water from the lake.	☐
☐	☐	☐	☐	The community has plans in place to reduce the risk of a glacier avalanche by controlled ice blasting or having snow sheds in place to protect roads and other areas.	☐
☐	☐	☐	☐	The community has plans in place to reduce the risk of portions of glaciers breaking off such as controlled ice blasting.	☐
☐	☐	☐	☐	The community monitors glaciers with annual aerial photos and/or surveillance cameras to see changes and potential risks.	☐
☐	☐	☐	☐	There is a warning system in place to notify community residents and visitors of a potential avalanche associated with glaciers and to evacuate the threatened area	☐
☐	☐	☐	☐	There is a warning system in place to notify police, fire and ambulance personnel of avalanche risks associated with glaciers	☐

Icebergs, Ice Islands and Sea Ice [21]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Community-based marine accidents involving icebergs, ice islands or sea ice exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐
☐	☐	☐	☐	Community officials check frequently with weather forecasting agencies such as Environment Canada and monitor icebergs, ice islands or sea ice conditions that may lead to marine accidents.	☐

Lake Outburst Natural and Human-Caused [22] [23]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Canada and monitor landslide conditions that may lead to lake outbursts.	☐
☐	☐	☐	☐	Community officials check frequently with weather forecasting agencies such as Environment Canada and monitor glacier conditions that may lead to lake outbursts associated with glaciers.	☐
☐	☐	☐	☐	Community-based lake outburst exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐
☐	☐	☐	☐	The community and mountain resorts have posted visible signs warning residents and visitors of the potential for lake outbursts associated with glaciers.	☐
☐	☐	☐	☐	The community has plans in place or has reduced the risk of lake outbursts by removing water from glacial lakes or implementing controlled breaches, overflows, engineered outlet channels or siphoning.	☐
☐	☐	☐	☐	The community has plans in place to reduce the risk of a glacier avalanche by controlled ice blasting or having snow sheds in place to protect roads and other areas.	☐
☐	☐	☐	☐	The community monitors glaciers and glacial lakes with annual aerial photos and/or surveillance cameras to see changes and potential risks.	☐
☐	☐	☐	☐	There is a warning system in place to notify community residents and visitors of a potential lake outburst associated with glaciers and to evacuate the threatened area	☐
☐	☐	☐	☐	There is a warning system in place to notify police, fire and ambulance personnel of potential lake outbursts associated with glaciers	☐

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