



Hazard Resilience Index (HRI)

Geological Hazards (related to soil and earth)

Dust and Sand Storms
Erosion, Deposition and Desertification
Expansive Soils
Landslides and Debris Floods (Gravitational Mass Movements)
Land Subsidence and Sinkholes
Submarine Slides

Geological 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 that only apply to human-caused hazards are in italics.

Dust and Sand Storms

Hazard Resilience Rating				High Resilience <input type="checkbox"/>	Low Resilience <input type="checkbox"/>	Need More Info <input type="checkbox"/>	Not Applicable <input type="checkbox"/>
Yes	No	Need More Info	Not Applicable	FACTORS			This factor is important to my community
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community officials check regularly with weather and air quality monitoring agencies such as Environment Canada to anticipate dust and sand storms generated locally or generated elsewhere that may blow into the community in order to issue appropriate warnings.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community-based dust and sand storm exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises).			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Farmers minimize deep tillage in areas susceptible to dust and sand storms.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	If the dust and sand storms are severe or persist for an extended period, the community has plans to evacuate residents (especially those with respiratory diseases) to a designated shelter with dust-free air.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	In order to prevent dust and sand storms communities have implemented appropriate strategies to reduce erosion, deposition (collection of dirt deposits) and desertification including: re-vegetation of eroded areas with trees, shrubs or grasses that are indigenous to the area; stabilization of dunes and slopes with branches or other materials pushed into the sand in a grid pattern; and establishment of wind breaks to control wind erosion.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	In order to prevent dust and sand storms, communities limit businesses that use significant amounts of water (such as agricultural irrigation and houses with gardens that require large inputs of water) in areas susceptible to drought and desertification; where community gardens are present, use of drought resistant or low water-demand plants is encouraged along with the application of organic materials to maintain soil fertility or other appropriate urban landscaping practices.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	In order to prevent local dust and sand storms, communities have regulations that require farmers to, and limit land uses that, remove or alter vegetation (e.g., over-cultivation of agriculture, livestock over-grazing) or that require planting of vegetation on lands susceptible to wind erosion and desertification.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There is a warning system in place to notify emergency response personnel of potential dust and sand storms.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There is a warning system in place to notify residents of dust and sand storms and to advise them to seek stable shelter for all family members and to shelter domesticated animals/pets; community response plans provide public shelters and make them available during dust/sand storms.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	When dust and sand storms are forecast, the community and power company have a shared plan in place to coordinate the shut off community electrical power to non-essential regions of the grid to avoid electrical fires (electricity to medical facilities, law enforcement and government should be maintained and backup generators in place).			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The community has in place a means to consult with Traditional Knowledge holders or subject matter experts about dust/sand storms and traditional mitigation, response and warning systems.			<input type="checkbox"/>

Erosion, Deposition (collection of dirt deposits) and Desertification

Hazard Resilience Rating				High Resilience <input type="checkbox"/>	Low Resilience <input type="checkbox"/>	Need More Info <input type="checkbox"/>	Not Applicable <input type="checkbox"/>
Yes	No	Need More Info	Not Applicable	FACTORS			This factor is important to my community
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community officials check frequently with weather forecasting agencies such as Environment Canada to anticipate dry weather and wind storms that may cause wind erosion, dust and sand storms in order to issue warnings.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community has completed mapping of areas susceptible to erosion, deposition and desertification and shared the maps with community members.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community-based discussions have taken place in the community-at-large (e.g., table-top or full-scale exercises) regarding erosion, deposition (collection of dirt deposits) and desertification.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communities have policies or regulations in place to prevent local erosion, deposition (collection of dirt deposits) and desertification, and limit land uses that remove or alter vegetation (e.g., over-cultivation of agriculture, livestock over-grazing)			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communities have policies in place that require planting of vegetation on lands susceptible to wind erosion and desertification.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communities have policies or regulations in place to limit activities that use significant amounts of water (such as resource extraction/mining and houses with gardens that require large inputs of water) in areas susceptible to drought and desertification, including community gardens.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communities have established wind breaks to control wind erosion, particularly in mining sites after closure.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communities have policies or regulations in place to provide for the re-vegetation of eroded areas with trees, shrubs or grasses that are Indigenous to the area; stabilization of dunes and slopes with branches or other materials pushed into the sand in a grid pattern.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communities have enacted models to assess soil erosion.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communities have a soil conservation program in place, especially conservation tillage in farming areas.			<input type="checkbox"/>

Expansive Soils

Hazard Resilience Rating				High Resilience <input type="checkbox"/>	Low Resilience <input type="checkbox"/>	Need More Info <input type="checkbox"/>	Not Applicable <input type="checkbox"/>
Yes	No	Need More Info	Not Applicable	FACTORS			This factor is important to my community
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community-based discussions have taken place in the community-at-large regarding the potential for expansive soils, including specific consultation with Traditional Knowledge holders or subject matter experts.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community has completed mapping of areas susceptible to expansive soils and shared the maps with community members.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Most residents living in areas with expansive soils have been educated about these hazards and know that structures built on expansive soils can be better protected if water does not infiltrate soils next to the foundation. This can be prevented by: maintaining soil sloping away from the building; placing gardens, grasses and trees requiring watering away from the building; and ensuring swimming pools and pipes do not leak moisture into soils near the foundation.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The community has geo-technical engineers (experts in soil behavior and earth materials) regularly inspect and monitor areas susceptible to expansive soils.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The community requires new developments to have land checked by geo-technical engineers for expansive soils and if present, the community has regulations that limit construction or require engineering techniques to prevent building foundation damage, such as building foundations beneath the zone of water content fluctuation and adding non expansive materials to the soil; existing structures affected by these expansive soils (e.g., adjacent properties) are updated to meet equal standards.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The community has a means to consult with Traditional Knowledge holders or subject matter experts about the presence of expansive soils within the community to help with community planning.			<input type="checkbox"/>

Landslides and Debris Flows (Gravitational Mass Movements)

Hazard Resilience Rating				High Resilience <input type="checkbox"/>	Low Resilience <input type="checkbox"/>	Need More Info <input type="checkbox"/>	Not Applicable <input type="checkbox"/>
Yes	No	Need More Info	Not Applicable	FACTORS			This factor is important to my community
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communities have regulations that prohibit development, limit land use, or require appropriate hillside development practices for buildings located in landslide hazard areas (which have been identified and mapped), such as grading slopes to reduce steepness, using structural systems to increase slope resistance, or dewatering and redirecting drainage.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community officials check frequently with weather forecasting agencies such as Environment Canada regarding major events that may trigger landslides, such as heavy precipitation or earthquakes.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communities work with utility companies to ensure that underground wiring or culverts do not lead to an increased risk of landslides down slope.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community-based landslide exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises).			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	In developed areas subject to slope instability, communities and landowners have implemented appropriate strategies to reduce landslide hazards by: directing surface and groundwater away from landslide areas; keeping or planting vegetation on slopes to stabilize soils; installing retaining walls to stabilize slopes.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	In developed areas subject to slope instability, communities have used structural measures to redirect, or retain landslides away from roads and developments such as retention basins, deflection structures, or tunnels.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Most residents living in high-risk landslide areas have been educated about landslide hazards and high-risk areas and know to avoid performing activities that can trigger landslide, such as blasting or slope alteration; maintaining soil sloping downhill; placing gardens, grasses and trees requiring watering away from slopes; and ensuring swimming pools and pipes do not leak moisture into slope soils.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There is a warning system in place to notify emergency response personnel of potential landslides.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There is a warning system in place to notify residents of potential landslides, including evacuation route signage in multiple languages and an effective alert system (e.g., horn/siren or social media notification).			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The community has a local Search and Rescue (SAR) team of volunteers in the community or nearby that is trained and involved in emergency response activities.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There is a warning system in place to notify local professional Search and Rescue (SAR) team and volunteers of potential landslides.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There is a means through which Traditional Knowledge holders or subject matter experts engage with decision makers to make plans and develop evacuation routes based on historical knowledge of landslide events.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	For debris flow detection there are sensors available which combine an acoustic, seismic and pressure sensors. These sensors are integrated at an alarm station and allow the detection of a debris flow event.			<input type="checkbox"/>

Land Subsidence and Sinkholes

Hazard Resilience Rating				High Resilience <input type="checkbox"/>	Low Resilience <input type="checkbox"/>	Need More Info <input type="checkbox"/>	Not Applicable <input type="checkbox"/>	
Yes	No	Need More Info	Not Applicable	FACTORS				This factor is important to my community
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communities have regulations that prohibit development, limit land use, or require development buffers in areas susceptible for land subsidence or sinkholes.				<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community members have been educated about subsidence and sinkhole hazards and high-risk areas to encourage voluntary land use restrictions and support for hazard mitigation planning.				<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community monitors check regularly with geologists and monitor areas at risk of land subsidence and sinkholes.				<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community-based land subsidence and sinkhole exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)				<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	In areas subject to subsidence and sinkhole risk, communities require or appropriate strategies to reduce hazards by: limiting rainwater infiltration by directing runoff and/or making ground surfaces impermeable; using flexible pipes; and preventing the decline of the water table.				<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The community has a local Search and Rescue (SAR) team of volunteers in the community or nearby that is trained and involved in emergency response activities.				<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There is a warning system in place to notify Search and Rescue (SAR) volunteers of potential sinkholes or land subsidence events.				<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The community consults Traditional Knowledge holders or subject matter experts about past sinkholes and land subsidence events to aid in community and emergency planning.				<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	In areas subject to subsidence and sinkhole risk, communities require appropriate strategies for erosion and sedimentation control such as using special building foundations; reinforcing road and railway infrastructure; and limiting further development through covenants, easements or land purchase; existing structures affected by these subsidence areas or sinkholes (e.g., adjacent properties) are updated to meet equal standards.				<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Prior to issuing building or road permits, communities require professional engineering/environmental experts conduct an assessment to identify existing and potential subsidence and sinkhole areas.				<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There is a warning system in place to notify emergency response personnel of potential sinkholes or land subsidence.				<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There is a warning system in place to notify residents of potential sinkholes or land subsidence.				<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communities have completed mapping of areas susceptible to sinkholes and land subsidence and shared the maps with community.				<input type="checkbox"/>

Submarine Slides

Hazard Resilience Rating				High Resilience <input type="checkbox"/>	Low Resilience <input type="checkbox"/>	Need More Info <input type="checkbox"/>	Not Applicable <input type="checkbox"/>
Yes	No	Need More Info	Not Applicable	FACTORS			This factor is important to my community
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Communities have completed underwater mapping of areas susceptible to submarine slides and have shared the maps with community, fishers and trappers.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Development regulations in areas susceptible to submarine slides limit land use, prohibit development or require wind and flood resilient building features including elevated buildings and concrete walls.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Community-based coastal surge exercises associated with submarine slides have taken place in the community-at-large (e.g., table-top or full-scale exercises).			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Dredging has taken place to avert potential submarine slides and/or dredging activities are monitored and assessed for their potential to cause submarine slides.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Evacuation routes from coastal surges associated with submarine slide are marked with visible signage in multiple languages (e.g., English/French/Indigenous languages).			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Plans are in place to develop and preserve coastal forests that act as protection against coastal surges associated with submarine slides.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Residents are educated about submarine slides and associated coastal surges and know how and where to evacuate.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There is a warning system in place to notify emergency response personnel of potential submarine slides and areas at risk of surge.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There is a warning system in place to notify residents of potential submarine slides and areas at risk of associated surge.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The community consults Traditional Knowledge holders or subject matter experts about past sinkholes and land subsidence events to aid in community and emergency planning.			<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	In areas at risk of earthquakes, submarine slope regional seismic instability assessments have been conducted and results shared with the community.			<input type="checkbox"/>

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