Hazard Response Plan:

Drought Toolkit

Updated September 2025

Response

Confirm nature, scope, and severity of the incident. **SAFETY FIRST!**

- Approach cautiously from upwind, uphill and/or upstream and identify the hazard, stay clear of fire/smoke, vapors, spills, pooling or rushing waters and collapsed buildings.

ASSESS THE SITUATION:
- Is there a power outage, water contamination, deceased animals?
- Who/what is at risk: people, property or the environment?
- What actions should be taken – evacuation, shelter-in-place?
- What resources (human and equipment) are required?
- What are the weather conditions? (i.e. Air Quality Risk, Extreme Heat)

CALL 911, if required

OBTAIN HELP:
Advise your Chief and Council and **call EMCR at 1-800-663-3456 to obtain a Task Number**

Have the fire department or police been notified?
It is recommended you call the **non-emergency** numbers for both Police and Fire in your jurisdiction. You can record their numbers here:
Non-emergency Police:
Non-emergency Fire:

Connect with the appropriate agencies to advise of the situation.

RESPOND:
- Do you need to activate your emergency response plan? Does your EOC need to be activated?
- Document all changes and actions taken. Damages, repairs, unforeseen costs, water shortage (when and where), changes to streams, equipment used, overall drought conditions as they changed over the drought period, and anything else that comes to mind.
- Monitor water source usage and quality. If conditions worsen, intervene with your emergency drinking water supply plan.
- Encourage voluntary water conservation actions for Drought Levels 1-2.
- Enforce mandatory water conservation actions for Drought Levels 3-5.
- Monitor wildfire conditions and outlooks. If likely or ongoing, anticipate potential impacts on local water supply.

Pre-Drought Season Preparedness

Drought Community Preparedness:

- Actively monitor local and regional drought conditions.
- Actively monitor surface water levels and groundwater well levels.
- Identify priority water users (Critical Demand Water List). Obtain their contact information, map their locations and develop a plan to restore those users first, in case of water service disruptions.
- Potential priority users: medical services and community members with specific medical conditions (like dialysis), first responders, transportation services.
- Monitor water supply and calculate how long water could be provided if the drought persists.
- Evaluate Community Risk.
- Develop an emergency drinking water supply plan.
    - Contact potential response partners, like FNHA for emergency medical support and Blue Triton or a local water bottling service for emergency supply, to prepare in advance.
    - You can coordinate with neighbouring communities and Nations to create a water sharing/use plan if feasible.

- Create and emergency water supply if drought seems likely when monitoring.
- Designate dark cool space(s) for water storage
- Develop a water conservation plan. Define voluntary vs mandatory water conservation and when these actions should be put in place by community.
- Create a communications plan to share critical drought information with community
- If fish salvages seem likely, gather the necessary equipment, understand the permit process, and contact Land Guardians or a fish biologist for further guidance.
    - Identify where fish will be translocated or held beforehand.

- **For people with pets/animals:** Create a Pet First Aid Kit which should have a 72-hour food and water supply, leash, pet carrier, medication, medical records, veterinarian contact information, id tags, a blanket, and a toy.

Questions to ask:

- Do you have water procured for __ number of people? Does this include vulnerable community members?
- Do you know where to get fish salvage permits and when?
- Do you have a reliable avenue of providing information to the community?
    - Are community members aware of water conservation plans and guidelines?

DROUGHT PREPAREDNESS CHECKLIST

- [ ] Actively **monitor** local and regional **drought conditions.**
- [ ] Actively **monitor** surface **water levels and groundwater** well levels.
- [ ] **Identify priority water users** and **create a Critical Demand Water List.**
- [ ] **Monitor water supply** and calculate how long water could be provided if the drought persists.
- [ ] Develop an **emergency drinking water supply plan**.
- [ ] **Contact potential response partners**,
- [ ] **Coordinate with neighbouring communities and Nations** to create a water sharing/use plan if possible.
- [ ] Create and e**mergency water supply** if drought seems likely when monitoring.
- [ ] Designate **dark cool space(**s) for **water storage**
- [ ] Develop a **water conservation** plan. **Define voluntary vs mandatory water conservation.**
- [ ] Create a **communications plan** to share **critical drought information** with community
- [ ] Gather **the necessary equipment, permits,** and **people for fish salvages.**
- [ ] **For people with pets/ animals:** Create a Pet First Aid Kit which should have a **72-hour food and water supply.**

Additional Resources/Contacts for Support

- NGOs:
  - EPS - 778-795-0724
  - LFFA - (778) 666-2910
  - FNFC - 778-379-6470
- FNHA
  - General 604-693-6500
  - Toll-free: 1-866-913-0033
  - Specific.
- EMCR Southwest Region - 604-586-4390
  - EMCR Task Number - 1-800-663-3456
- Water Conservation Officer Service - 1-877-952-7277

BC Drought Classification:

Level	Impacts	General Response Measures
0	There is sufficient water to meet socioeconomic, and ecosystem needs	Preparedness actions
1	Adverse impacts to socio-economic or ecosystem values are rare	Stewardship and (Voluntary) Conservation actions
2	Adverse impacts to socio-economic or ecosystem values are unlikely	Conservation actions including local water restrictions where appropriate
3	Adverse impacts to socio-economic or ecosystem values are possible	Conservation actions including local water restrictions where appropriate
4	Adverse impacts to socio-economic or ecosystem values are likely	Conservation actions including local water restrictions and regulatory action where appropriate
5	Adverse impacts to socio-economic or ecosystem values are almost certain	Conservation actions including local water restrictions, regulatory action and emergency response measures where appropriate

E.g. of Contacts Table

Contact Name	Organization/Utility name	Phone Number/Email
….	….	….
….	….	….

Recovery

- Create a lessons learned document or memo summarizing all or any success, challenges, and unforeseen issues during drought response and preparedness.
- Lift water restrictions
- Monitor water sources and rate of recovery (are water sources replenish after drought and how quickly).
- Invest in long term mitigation:
    - Update infrastructure
    - Install water meters
    - Install tap aerators
    - Grey Water Reuse
- Collect rainwater
- Plant drought tolerant vegetation
- Rehabilitate Streams/Creeks
    - Remove invasive species
    - Introduce dense riparian vegetation.
- Identify opportunities for groundwater recharge using stormwater and reclaimed water

Immediate Drought Readiness + Response

Emergency Planning Secretariat

Updated: September 2025

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Definitions

Drought: Recurrent deficiency in precipitation over an extended period of time, resulting in low water storage for activities, communities or ecosystems. It is temporary.

Freshet: The flood of a river from heavy rain or melted snow.

Low Streamflow: Low water in streams and waterways below seasonal averages.

Potable Water: Water that has been treated and tested to ensure a low percentage of microbes, viruses and bacteria, for drinking.

Water Scarcity: Low summer streamflow due to an imbalance between natural water available and demand for water.

Drought Classification:
The province, through the River Forecast Centre uses a 5-level system for monitoring drought. To find the current drought level, visit the Provincial Drought Portal: https://droughtportal.gov.bc.ca/pages/drought-map

Level	Impacts	General Response Measures
0	There is sufficient water to meet socioeconomic and ecosystem needs	Preparedness actions
1	Adverse impacts to socio-economic or ecosystem values are rare	Stewardship and (Voluntary) Conservation actions
2	Adverse impacts to socio-economic or ecosystem values are unlikely	Conservation actions including local water restrictions where appropriate
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5	Adverse impacts to socio-economic or ecosystem values are almost certain	Conservation actions including local water restrictions, regulatory action and emergency response measures where appropriate

For those on municipal or regional district water supply, please connect with the jurisdictional authority for current information on water restrictions, drought hazard classification, and appropriate action items. Resources in the appendix can support First Nations staff with community messaging, environmental response and independent recovery costs regardless of their water supply ownership.

Preparedness (3-6 months prior to Drought)

Drought hazard is difficult to predict because it is determined by multiple environmental factors and fast changing weather patterns. Monitoring key signs and symptoms can help staff prepare early for potential drought episodes over the summer months.

Drought Indicators

Major Indicators:

- Lack of **precipitation**
- **Snowpack** below normal levels
- Reduced or low **streamflow**
- Lower **groundwater** levels and dry wells

Supporting Signs:

- Early **Spring Freshet** and/or low water level rise.
- Scorched, wilted, defoliated, and stressed **vegetation**
- Abnormally dry and hard **soils**

Indicator Timeline

The table shows the ideal time of the year to begin monitoring different drought indicators. Lighter shades of orange are used to show when you can start monitoring, while the darkest shade of orange indicates when it is absolutely necessary to observe each metric to prepare for drought effectively.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Snowpack												
Precipitation												
Streamflow												
Groundwater												
Soil												
Plants												

Identify Thresholds

There is no set threshold to exceed or fall below that will directly indicate drought. These signs should be assessed in comparison to what is considered “normal” for that time of year in the region or community. For example, water levels in streams are lower in the summer months, if you are noticing that water flow or levels are below summer thresholds then this observation may raise concern for drought.

If you are observing changes in **3 out of the 4** major indicators from section 3.1, especially between the months of **January and April**, you should anticipate and prepare for drought conditions over the summer.

Monitoring

Streamflow conditions, precipitation, groundwater levels, and snowpack conditions can be observed online on the Provincial Drought Monitor Website. If data for or near your community is unavailable on the BC Drought Portal, communities can self-log and monitor drought indicators:

Streamflow	Precipitation	Groundwater
Estimate streamflow by taking consistent measurements of stream depth to represent changes in flow and discharge. If it is unsafe to enter or access a stream, then a representative photo with recorded observations can substitute formal measurements. Instructions for water depth measurements and additional methods can be found on **pg. 12**	General observations can be made for precipitation (i.e. what days it rained, for how long, and how hard). For greater accuracy, measure with a rain gauge placed in an open area outside away from structures/objects. Average precipitation levels can then be calculated for each month or year.	Measure well depth with a water level meter & record results to compare over time. When it is not possible to measure well depth, monitor the water quality. If you are noticing discolouration or cloudiness, it could be a sign that the well is going dry either from drought or other underlying issues.

Preparedness Action Items

Community Education & Awareness

Share relevant drought information and preparedness tips with your community to raise awareness before the summer. Use a variety of methods based on how members prefer to receive updates. See additional resources for examples of community messaging in **Appendix 1** on pg. 14**.**

Examples of Methods

- Infographics
- Community Bulletins
- Website/Social Media Updates
- Phone Alerts
- Newsletter(s)
- Workshops (Virtual & In-person)

Based on finances/funding opportunities, community supports and programming can be put in place such as:

- Workshops for rainwater collection, drought resistant gardening, and/or any other preparation tips
- Youth education and tools through after school activities
- Involving community in decision-making processes, such as setting and defining water restrictions
- Directory for available drought resources
- Financial assistance for water conservation home upgrades (installing water meters, rain barrels, or tap aerators)

Water Scarcity Resources and Inventory Assessment

Keep a record of the potable and non-potable water sources in your community. It is important to assess and identify the water sources available to community for consistent monitoring and emergency preparedness. Templates for water inventory and documentation can be found in **Appendix 1.**

Water capacity in litres can be estimated by measuring the length, width, and depth of a water source. Multiply the length, width, and depth (L x W x D) to get an estimate answer in cubic metres which can then be converted

to litres. 1 cubic metre is equal to 1000 litres. If it is not possible to measure the water source, the water capacity metric can be supplemented or replaced with a description, picture, and/or single depth measurement for reference.

Water Compliance and Enforcement

Unauthorized water use and illegal pulling threaten water supply. Before drought worsens in the summer months, leadership or the relevant department(s) should document current water licenses (either from private industry or from internal business operations) as well as what that license allows. If someone is seen pulling water and is reported, they can be cross referenced with the information above to see whether it is authorized.

Reports can be made to areas responsible for enforcement within Treaty First Nations or to local jurisdictional authorities such as the **Conservation Officer Service online or by phone at 1-877-952-7277**. Increased signage near critical water sources and aquatic habitats can also be used to deter unauthorized pulling.

Acquire Fish Salvage Permits

If your community anticipates worsening stream conditions and/or has conducted fish salvages in the past, consider applying for any necessary collection permits before conditions worsen. These permits can be valid for 3-4 months:

- For freshwater fish collection in non-tidal waters, apply for a Scientific Fish Collection Permit with the Province of BC
- For saltwater fish and salmon in freshwater, permits are issued by the Department of Fisheries and Oceans. Application forms must be filled out and sent by email to the applicable DFO regional office.

Water Procurement

If drought seems likely when monitoring earlier in the year, begin encouraging community members to build a water supply, at least 2 litres/day per person, that can last for approximately for 2 weeks. A separate supply should be established to support those unable to secure sufficient water for storage.

Pets

Community members may want to procure and store water beforehand if you anticipate drought conditions worsening. Consider creating a Pet First Aid Kit which should have a 72-hour food and water supply, leash, pet carrier, medication, medical records, veterinarian contact information, id tags, a blanket, and a toy. These kits will also be helpful if there is an emergency evacuation, though unlikely. If anyone is unsure of what to do in an emergency or must leave you pet(s) behind contact organizations like the Canadian Disaster Animal Response Team (CDART) for support.

Human Response (During Drought Hazard)

Water scarcity from drought may lead to active emergency situations where an **Emergency Management and Climate Readiness (EMCR) task number** can be obtained by contacting the appropriate regional emergency coordination centre for documentation and reimbursement purposes. Reimbursements may be claimed with a task number through Resource Requests (RR) and/or Expenditure Authorization Forms (EAF), sent to the Provincial Regional Emergency Operations Centre.

Active emergencies can be drought induced boil-water advisories, water contamination incidents, and/or water shortages. Additional hazards may occur simultaneously to drought hazards, such as power outages, fire risk, and extreme heat events, please prepare for the cumulative effects of these hazards.

Start and **maintain a record of drought related expenses.** Take specific inventory of what is being used and what equipment is needed, making special note of unforeseen expenditure or actions that were not taken due to lack of resources.

Response Action Items:

Water Scarcity and Management

Voluntary Water Conservation can be used as a first-step response to drought hazard. The following table can be shared with community members. Additional resources can be found in the **Appendix 2 (Page 15).**

Voluntary Water Conservation: Recommended for Drought Level 1-2

Limit Outdoor Water Use	Limit Indoor Water Use

• Water lawn and plants minimally
• Water early in the morning or in the evening to avoid evaporation during peak heat in the afternoon.
• Avoid power washing or using a hose to clean driveways, try sweeping with a broom instead
• Avoid washing cars when possible
	• Take shorter showers and choose a shower over a bath
	• Check plumbing for leaky toilets, sinks, and taps
	• Only run a full load of dishes in the dishwasher
	  ○ Or fill the sink with hot, soapy water and wash dishes in batches either rinsing them once at the end or having a second container of clean water to rinse dishes before drying.
	• Use or create a low flow toilet
	• Only run full loads of laundry
	• Turn off the tap, don't leave the faucet running
	  ○ Place a jug of water in the fridge to drink from instead of running the tap until the water gets cold.
	• Install a tap aerator

Mandatory Water Restrictions: Recommended for Drought Level 3-5

Restrictions can consist of formally enforcing some or all the above-mentioned voluntary actions. Examples of Water restrictions are but not limited to:

- Restricting Driveway Hosing and Power Washing
- Prohibiting Filling Pools and/or Water Play
- Limiting Lawn Watering
- Setting Lawn Watering Timeframes
- Limiting Car Washing
- Limiting Indoor Water Use
- Restricting Fishing Activities

Under severe water restrictions only use water for:

- Drinking water
- Mixing Baby Formula
- Brushing teeth
- Washing/Basic Hygiene

Drought Level 5 indicates a worst-case scenario with exceptionally dry conditions, all and any efforts must be taken to conserve water and protect critical stream flows. Water use beyond food needs and basic hygiene maintenance should be restricted. Please follow your community's compliance protocol for how to enact and enforce water restrictions during Drought Hazards.

Drinking Water Supply and Procurement:

As drought conditions change, risk of water shortage and contamination can increase. Water can be stored in containers at a cool location for approximately six months. Below are examples of possible water procurement methods during emergency:

Packaged Water:

Procuring packaged water from a local water bottling service/company is a short-term solution to aid water supply in community. Bottled water can also be procured from Blue Triton and/or FNHA in an emergency. Steps and considerations for packaged water procurement can be found in **Appendix 3** (p.17).

Bulk Water:

Bulk water can be acquired from a neighbouring community/municipality or a provincial/national water source. Under the Water Sustainability Act, water license holders can divert, use or store the water specified in the license. These rights can be temporarily extended to another party outside of the "appurtenancy" or boundary of the original license holder, however, it is only possible if allowed by a comptroller that determines there is no other reasonable water supply for the party requesting the temporary extension of the license.

Alternatively, water hauling services and large water shipments through water trucks which can then be stored in community. Further steps and instructions can be found in **Appendix 3 (pg. 17).** Consider filling out the Critical Demand List for water supply, also in **Appendix 3 (pg. 19),** to better inform water procurement plans.

Social and Cultural Support

Knowledge keepers, elders, and spiritual supports can greatly aid in the planning, response, and recovery process as well as support community members during this time. Local groups and organizations, like First Nations Health Authority, can also provide beneficial psychosocial supports.

Interim or regular wellness checks as needed for vulnerable community members can ensure they have enough water and can stay cool. Check-in on community members, especially vulnerable populations like elders, persons with disabilities, and youth, to determine impacts of drought stress (financial, social, psychological). In the event of concurrent emergencies, i.e simultaneous drought & extreme heat hazards, messaging for available emergency services, clinics and hospitals in the area should be shared with those most at risk.

Pets

Many community members with pets will need additional information and messaging on how to look after their animals. This section provides some guidance and resources to distribute to community members.
Water restrictions usually do not prohibit water usage for animal consumption and hygiene, however in extreme cases community members can consider alternating between bathing furry pets with water and no-rinse shampoos. In situations where no water is available for consumption (e.g.: the aquifer has dried up) people will have to rely on outside resources like packaged and bottled water. Pets can also stay hydrated by switching over to wet foods and supplementing meals with no-sodium store bought broths (vegetable/chicken/beef) diluted with water (when possible).

Stream Level Response

Drought conditions considerably worsen streams and aquatic habitats as water levels lower, water temperatures increase, and levels of dissolved oxygen decrease. Fish salvaging may be needed to reduce overall fish mortality from temperature changes and dry streams. It is recommended that you contact EMCR for a task number but please note that they some expenses for fish salvage may be ineligible for cost recovery.

Fish Salvaging:

If fish mortality is likely or has previously been an issue in local streams, prepare in advance:

- Acquire the necessary equipment for a fish salvage like dip nets, seines, waders, boots, thermometers, coolers, and buckets
- Apply for fish collection permits in advance. While monitoring fish habitat, stream temperature, and overall conditions begin the permit application process if conditions show signs of worsening.
    - For freshwater fish collection in non-tidal waters, apply for a Scientific Fish Collection Permit with the Province of BC
    - For saltwater fish and salmon in freshwater, permits are issued by the Department of Fisheries and Oceans. Application forms must be filled out and sent by email to the applicable DFO regional office.
- If fish collection and relocation is out of scope for community, notify the appropriate government body about worsening conditions and/or fish mortality.

This process will require supports from a fisheries biologist who must conduct a stream assessment. While assessments from Lands Guardians are not required by permits, their knowledge and expertise will provide invaluable insight that can help community determine next steps and processes as well as alternatives to fish salvages. Organizations such as the Lower Fraser Fisheries Alliance (LFFA) and First Nations Fisheries Council (FNFC) may provide valuable supports or technical advice as well.

Recovery

Recovery will look different depending on the local and regional impacts of drought. For drought conditions to 'officially' be over precipitation must exceed normal precipitation levels enough to accommodate for previous water scarcity. For those on municipal water supply, please follow guidance from the jurisdictional authority. The following actions should also be taken to support drought recovery:

Recovery Action Items:

Document Plans and Processes:

Record the different drought related actions taken over the drought period if not done already. This log will serve as a useful tool to prepare for future drought seasons. Reflect on what measures were taken, the position(s) responsible, and department(s) in charge alongside community feedback of what did or did not work in terms of preparedness and response.

Additionally, examine impacted habitats and document changes to critical habitat and species. Long term monitoring beyond the drought period will be needed to fully assess the effectiveness of preparedness and response measures as animal, plant, and soil recovery can only be assessed after the fact. Changes to water sources should also be logged, for example keeping photos of well water levels over time, to understand what systems may be burdened and will need support under future drought conditions.

Overall, updating plans through this process may reveal gaps in resource access, education, and awareness.

Lift Water Restrictions:

As water levels recover, create a timeline to lift water restrictions previously put in place. Monitor environmental conditions and consider ideal times to either lift restrictions all at once after a considerable amount of rainfall or gradually as greater precipitation is forecasted. Restrictions can be lifted in the reverse order that they were placed into effect.

Identify who will decide if or when to lift restrictions (often Chief and Council). Ensure community members are notified in a timely and accessible manner. This may mean having more than one information source or outlet, like sending out phone notifications alongside emails and preparing a community bulletin.

- Restrictions may be over, however sustainable and low barrier water conservation efforts such as installing water meters or tap aerators can still be encourage and supported.

Anticipate Economic Impacts

It will be useful to take note of indirect financial burdens faced in community and how these costs were dealt with over the drought period. Water scarcity conditions may impact packaged water and food prices. Community members or businesses reliant on water, like agriculture and food services, will likely be adversely affected by restrictions long-term. These changes can lead to increased financial burdens and vulnerability in off-seasons, which while difficult to prevent, may require research into strategic funding options or targeted support from local non-profit organizations.

Information and Resources

Monitoring	Manuals and Guides	Beneficial Training and Skills
General: • BC Drought Portal • BC Water Scarcity and Drought Response Plan • Canada Drought Monitor Streamflow: • BC Water Tool • 7-Day Streamflow Averages • 30-Day Lowflow Stream Forecast Precipitation and Snowpack: • Precipitation Conditions • Snow Basin Indices • Snow Conditions and Water Supply Bulletin Groundwater: • Groundwater Conditions Map • Provincial Groundwater Observation Well Network • Provincial Aquifer Data Compliance: • Water Rights License Map • Water License Query Tool	Preparedness: • Drought Incident Action Checklist (US EPA) • User's Guide to Streamflow Measurement • Low Flow Toilet Guide Response: • First Nations and Local Authority Emergency Management Plan for Water Scarcity Template • Pacific Salmon Foundation Drought Affecting Salmon Reporting Tool	Community: • Psychological First Aid • Standard First Aid and CPR Emergency Management: • Incident Command System 100 • UN-DPHI Integrated Drought Management Course • Indigenous Climate Change Adaptation Planning Toolkit • IDMP Drought Pillars Environment: • Salmon Habitat Restoration Course

Governance Information:

Regulations and Legislation	Decision Making Authorities
Drinking Water Protection Act (2001) WLRS (through the water sustainability Act) DFO (through the Fisheries Act) Ministry of Environment (through the Environmental Management Act) Local Governments and Regional Districts (through the Local Government Act) EMCR (through Emergency and Disaster Management Act) Critical Infrastructure Operators (BC Hydro)	Engineers, Water Managers and Comptroller of Water Rights • Can restrict water use Water Bailiffs • Act on behalf of Province to manage conflicts in stream before or during a drought Regional Technical Drought Working Group • Convene by regional provincial government staff to provide coordinated response to regional drought Drought Advisory Tables

Stream Flow Measurements Methodology

Only measure streamflow when deemed safe to do so, avoid days with heavy rainfall, strong winds, and especially turbulent waters. More advanced measurement methods and additional information for streamflow considerations can be found in "A User's Guide to Measuring Streamflow" which is linked in the above table: Information & resources.

Observation Method:
A representative photo of the stream, at the same location where the streamflow measurement is being conducted, must be taken each time. The photo should incorporate the full width of the stream (i.e., bank to bank) and note the streams condition such as any beaver activity or debris that may impact the streamflow. The photo must also include a date and time stamp. If it is unsafe to physically measure the streamflow, as per Section 3, then a photo must be taken to represent the streamflow conditions.

Water Depth Measurement:
Stream depth and changes to depth can represent streamflow if it is not possible to measure streamflow across the stream. The location must be marked to ensure consistency, either with a stake or something visible. The measurement location should also be accessible from the stream's edge, where the water is flowing uniformly, free from plants or branches and along a straight stretch of the channel.

Avoid measuring the stream depth in a pools or slow water where the sediment can accumulate. The measuring device (a waterproof metre stick, wading rod, or a suspended weight in deeper water for example) should rest on the stream bottom and not sunk into soft substrate and read as close to the water level as practicable.

Be sure to take a picture of the stream where the depth is measured and include a photo showing the stream depth as measured. If there is a bridge or stream crossing a ruler or measuring device can be attached to permanently, this may be a better place to measure the stream depth.

Culvert (Timed) Flow Measurement:
Used to estimate the flow from streams where the flow goes over a fall, making it useful for testing where the flow can be captured in a container. In addition to a container to capture water, you will need a stopwatch for timing.

Mark the level of the bucket indicating the volume of water which will be captured (use a container of known volume to do this). A "5-gallon" bucket may work well for low flow rates.
Take the average of three readings.

1. At the water discharge point (e.g., through a culvert or pipe or over a stream fall), move the bucket under the flow and at the same time start the stopwatch.
2. Stop the watch when the water reaches the marked level on the bucket and note the time.
3. Repeat two more times and average the readings of time to fill the container.
4. Convert the readings into a flow rate (discharge): Flow rate = volume / time.
    a. If you are using a 5-gallon bucket, the flow rate would be in gallons/second.
    b. To convert gallons/second to m3/s divide the value by 264.2.

E.g.: If it took 2 seconds to fill a 5-gallon bucket the discharge or flow rate would be:

- Gallons/sec = 5 gallons / 2 sec
- Flow rate or discharge = 2.5 gallons/sec
- Flow rate or discharge = 2.5 gallons/sec / 264.2
- Flow rate or discharge = 0.009 m3/s

Appendix 1: Streamflow Recording Sheet:

Adapted from "A User's Guide to Measuring Streamflow" Prepared for Province of British Columbia by Climaterra Consulting (2023). This sheet can be adjusted for precipitation and groundwater measurements.

The following information should be recorded when collecting a streamflow measurement using the Depth or Timed Volume:

Information to Record	Description
Date	
Water License Number	
Latitude and Longitude	
Streamflow Value for the Week	
Time of Day	
Who Took the Measurements	
Description Of the Site (e.g., rocky, vegetation, beaver activity, debris, straight stretch, etc.): Weather (sunny/windy/rainy/etc.)	
Method Used to Estimate Streamflow (Circle One)	Depth / Time Volume / Other (explain below)
If Streamflow Is Unmeasurable Due To Conditions, Please Indicate. A Photo Is Still Required	Flow too low to measure/ Flow too high to measure / Other (explain below)
Estimated Depth (meters) or Streamflow (m3/s)	
Photos (ensure date is included on the photo) *Attach/staple photos to this sheet for physical copies.*	

Appendix 2: Infographics for Community Education:

E.g.: Water Use and Restrictions (City of Kamloops, n.d.)

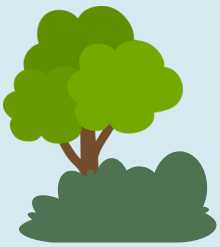
Water Use Restrictions Plan

Based off of Provincial Drought Level Guidlines

Outdoor Water Use Activity		Levels 0–2 Normal	Level 3–4 Heightened	Level 5 Severe
Lawns	**Sprinkler Use** (automated or manual)	3 days/ week	1 day/ week	Not Allowed
	Hand Watering (spring-loadednozzleorwatering can)			
	New Lawns (sod or seed) Permission required for additional watering	If permission/ permit is granted	If permission/ permit is granted	
Trees, Shrubs, Plants, Flowers	**Sprinkler Use** (automated or manual)	3 days/ week	1 day/ week	
	Drip Irrigation (automated or manual)		3 days/ week	1 day/ week
	Hand Watering (spring-loaded nozzle or watering can)	✓	✓	✓
	New Trees or Shrubs Permission required for additional watering	If permission/ permit is granted	If permission/ permit is granted	
Food-Producing Plants and Crops	**Sprinkler Use** (automated or manual)	3 days/ week	1 day/ week	
	Drip Irrigation (automated or manual)		3 days/ week	1 day/ week
	Hand Watering (spring-loaded nozzle or watering can)	✓	✓	✓
Other	**Washing Vehicles or Boats** (spring-loaded nozzle or pressure washer only)	Allowed	Allowed	Permitted only to wash boats for control of invasive species
	Commercial Car Washes			✓
	Washing Hard Surfaces (spring-loaded nozzle or pressure washer only) ***examples: sidewalks, driveways, patios, building exteriors***		Pressure wash only	For safety purposes only
	Filling Swimming Pools, Hot Tubs, Ponds, Fountains		✓	Not Allowed

Water Use Restrictions Plan

Based off of Provincial Drought Level Guidlines

Outdoor Water Use Activity		Levels 0–2 Normal	Level 3-4 Heightened	Level 5 Severe
 **Lawns**	**Sprinkler Use** (automated or manual)	**3 days/ week**	**1 day/ week**	**Not Allowed**
	Hand Watering (spring-loadednozzleorwatering can)			
	New Lawns(sod or seed) Permission required for additional watering	If permission/ permit is granted	If permission/ permit is granted	
 **Trees, Shrubs, Plants, Flowers**	**Sprinkler Use** (automated or manual)	**3 days/ week**	**1 day/ week**	
	Drip Irrigation (automated or manual)		**3 days/ week**	**1 day/ week**
	Hand Watering (spring-loaded nozzle or watering can)	✓	✓	✓
	New Trees or Shrubs Permission required for additional watering	If permission/ permit is granted	If permission/ permit is granted	
 **Food-Producing Plants and Crops**	**Sprinkler Use** (automated or manual)	**3 days/ week**	**1 day/ week**	
	Drip Irrigation (automated or manual)		**3 days/ week**	**1 day/ week**
	Hand Watering (spring-loaded nozzle or watering can)	✓	✓	✓
 **Other**	**Washing Vehicles or Boats** (spring-loaded nozzle or pressure washer only)	**Allowed**	**Allowed**	**Permitted only to wash boats for control of invasive species**
	Commercial Car Washes			✓
	Washing Hard Surfaces (spring-loaded nozzle or pressure washer only) ***examples: sidewalks, driveways, patios, building exteriors***		Pressure wash only	**For safety purposes only**
	Filling Swimming Pools, Hot Tubs, Ponds, Fountains		✓	✗

Appendix 3: Water Inventory Assessment (Preparedness)

Below templates adapted from "First Nations and Local Authority Emergency Management Plan for Water Scarcity Template", Ministry of Emergency Management and Climate Readiness, July 2023

Potable Water Sources:

- Using a table like the one below, describe the potable water sources accessible and identify the water flow rate if applicable. See **pg. 13** for Streamflow measurement guidance. Determine if the water sources are subject to water licensing. Some areas may be subject to a water license priority system, first in time First in right (FITFIR), which can be added to the table below if necessary.
- Additional information could be factors like storage limitations or run-off exposure.

Water Source	Primary/ Secondary Source	Capacity	Water Flow Rate (L/s)	Water License	Additional Information
[E.g., Reservoir 1]	[Primary]	[1,000,000 L]	[100 L/s]	[WSA]	…
[Well 1]	[Secondary]		-		

Table #: Water sources that supply the community's water system. (EMCR, 2023)

Non-Potable Water Sources:

- Optionally, you may want to include a table with non-potable water sources based on community needs. A description of potential usage can be added as well.

Water Source	Access Point	Capacity	Additional Information
[E.g., Stream 1]	[123 Road]	[100,000 L]	

Table #: Non-potable and alternate Water sources. (EMCR, 2023)

Water Procurement

Packaged Water:

- You can use a table, like the one shown below, or another form of recording information to identify the position or department within community responsible for each step in this process. Additionally, document the process to maintain an accurate record and to refer back to as the situation changes.
- Each objective can be changed to better reflect community context and goals, similarly the process and key information sections can and should be adapted based on the community's approach.

Objective /Step	Process	Key Information	Position Responsible
Ongoing: Manage internal and external communications/logistics related to packaged water.	• …	• …	*[Position Responsible]*
Step 1: Procurement processes related to packaged water logistics.	E.g.: • Determine storage and distribution location(s) and approaches. • Determine quantity and when the water is needed. • Contact Vendors	E.g.: • Local/Primary Vendors: Blue Triton • Key Information to Provide to Vendor: [*quantity required, size format of packaged water, delivery location and operating hours, delivery timeframe.]*	*[Position Responsible]*
Step 2: Transportation of packaged water to the community.			
Step 3: Storage – Coordinate storage for packaged water.			
Step 4: Distribution – Distribution of water to community.			
Step 5: Tracking packaged water distribution			
Step 6: Demobilization of packaged water logistics efforts.			

Table #: Packaged Water Outline and Key Responsibilities. (EMCR, 2023)

Bulk Water:

- You can use a table, like the one shown below, or another form of recording information to identify the position or department within community responsible for each step in this process. Additionally, document the process to maintain an accurate record and to refer back to as the situation changes.

Process Step / Objective	Process	Key Information	Position Responsible
Ongoing: Coordinate internal and external communications related to bulk water logistics.	• …	• …	*[Position Responsible]*
Step 1: Procurement – Coordinate procurement and financial processes related to bulk water logistics.	E.g.: • Contact source(s) / vendor(s). • Provide key information to source(s) / vendor(s). • Confirm plan with regional health authorities (FNHA) • **Required: Obtain *Water Sustainability Act* authorization granting an extension of rights to supply bulk water.** • Seek approval(s) and formalize contract(s). Document delivery information.	E.g.: • *[Vendor name, location, contact information, capacity, and other relevant details]*	*[Position Responsible]*
Step 2: Bulk Water Transportation –			
Step 3: Water Testing			
Step 4: Water Storage			
Step 5: Distribution to Community			
Step 6: Tracking bulk water and logistics resources.			
Step 7: Demobilization of bulk water logistics efforts.			

Table #: Bulk Water Outline and Key Responsibilities. (EMCR, 2023)

Critical Water Demand User List

Consider completing a comprehensive assessment of critical water demand. This information can be tailored for your local community.

Potable Water

Category	Sub-Category	Delivery Location and Address	Demand (L/s)	Special Requirements	Primary Contact Name	Primary Phone/Email
Education	*School*	*[ABC Elementary School; XX 1st Street, City].*	*[L/s]*	*[Delivery in 5-gal jugs]*	*[John Doe]*	*[Cell: 555-555-5555]*
Neighboring Communities	*First Nation*					
Neighboring Communities	*Local Authority*					
Agriculture	*Crops / Irrigation*					
First Responders	*Ambulance*					
First Responders	*Fire/Wildfire response*					
Health Sector	*Primary Care*					
Health Sector	*Paramedical Services*					
Veterinary	*Veterinary Clinic / Animal Hospitals*					
Senior Care	*Assisted Living Facilities*					
Social Services	*Mental Health Centres*					
Social Services	*Family Services*					
Social Services	*Housing Assistance / Transition / Safe Houses*					
Transportation	*Public Transit*					

Non-Potable Water

Category	Sub-Category	Delivery Location and Address	Demand (L/s)	Special Requirements	Primary Contact Name	Primary Phone/ Email
First Responders	*Fire Suppression*					
Waste Management	*Landfills / Recycling*					

Drought Resilience Planning

Emergency Planning Secretariat

Updated September 2025

Table of Contents

Definitions

Drought: Recurrent deficiency in precipitation over an extended period, resulting in low water storage for activities, communities or ecosystems.

Dieback: Progressive death of twigs, shoots, and branches from the tip downward.

Compacted Soil: Soil particles that have been pressed together, reducing pore space between them and allowing less water to infiltrate.

Community Asset Mapping: A process of identifying, documenting, and analyzing the strengths and resources within a community.

Evapotranspiration: All processes by which water moves from the land surface to the atmosphere via evaporation and transpiration.

First in Time, First in Right (FITFIR): Legal principle where water rights in BC may be exercised based on priority according to their respective dates (this principle is upheld by the BC Water Sustainability Act).

Flash Drought: Flash drought is the rapid onset of drought, set in motion by below average precipitation as well as abnormally high temperatures and/or winds.

Freshet: The flood of a river from heavy rain or melted snow.

Hydrophobic Soil: Soils that repel water, often occurring after drought and/or forest fires.

Low Streamflow: Low water in streams and waterways below seasonal averages.

Permeable Surfaces: Surfaces that allow water to enter the soil to filter out pollutants and recharge groundwater.

Potable Water: Water that has been treated and tested to ensure a low percentage of microbes, viruses and bacteria, for drinking.

Water Scarcity: Low summer streamflow due to an imbalance between natural water availablity and demand for water.

Greywater: Water waste from laundry, sinks, and showers. Greywater is water with some pathogens but without any fecal content which can allows it to be redirected for non-potable use (irrigation, cooling devices and potentially toilet water).

Vulnerability: Refers to the conditions (physical, social, environmental, and/or economic) that increase the exposure of communities, community members, and/or systems to hazard impacts

Intention

This toolkit is meant to be a summary of best practices for long-term adaptation and risk reduction and is meant to be updated regularly. Recognizing one of the challenges with disaster risk reduction is that hazards are not limited by jurisdiction or borders this toolkit acts as guidance for communities posed with the challenge of planning for and preparing their own community, while responding to landscape or even global level drivers of risk. We intend for this advice to support communities in their own planning, and/or in the influencing of regional planning.

Understanding Risk

Drought is described as a drier-than-normal period caused by lack of precipitation and can last for days, months, or years. Drought conditions progress gradually, which means the slow onset and indefinite length of hazard conditions have lasting impacts on health, agriculture, and the environment.

The provincial government categorizes drought through a 6-level scale and drought level is determined solely based on environmental factors such as precipitation, 7-day streamflow, and groundwater changes. This scale is helpful for determining drought severity on the land; however, it is not an assessment of vulnerability or risk related to drought.

BC Drought Classification:

Level	Impacts	General Response Measures
0	There is sufficient water to meet socioeconomic and ecosystem needs	Preparedness actions
1	Adverse impacts to socio-economic or ecosystem values are rare	Stewardship and (Voluntary) Conservation actions
2	Adverse impacts to socio-economic or ecosystem values are unlikely	Conservation actions including local water restrictions where appropriate
3	Adverse impacts to socio-economic or ecosystem values are possible	Conservation actions including local water restrictions where appropriate
4	Adverse impacts to socio-economic or ecosystem values are likely	Conservation actions including local water restrictions and regulatory action where appropriate
5	Adverse impacts to socio-economic or ecosystem values are almost certain	Conservation actions including local water restrictions, regulatory action and emergency response measures where appropriate

Despite receiving a significant amount of precipitation across the province annually, drought conditions continue to persist each year. These conditions are partly due to historical regional weather patterns in which there is a large amount of rainfall from autumn to spring and a substantial dip in precipitation during the summer months. Usually, water is naturally stored through snowpack accumulation and released during spring freshet which prevents streamflow drought in the summer.

However, rising temperatures from climate change impacts have disrupted this seasonal pattern. With warmer weather, more winter precipitation falls as rain rather than snow and summers become hotter, considerably increasing evapotranspiration and exacerbating water scarcity. Below-normal snowpack and streamflow translate to **snow drought** in the winter and **streamflow drought** in the summer. These factors are why BC's southwest region has experienced varying drought conditions since 2015 and multi-year drought since 2021.

Extreme heat conditions can rapidly increase drought likelihood even when precipitation rates improve. For example, record high temperatures leading to the heat dome conditions in 2021 resulted in fast developing

drought despite decreased water usage as well as moderate snowpack and precipitation in 2020. This situation is referred to as flash drought and may become more likely in the coming years. Due to drought being a relatively recent phenomena, there is a significant lack of drought modelling and research in this region, making informed predictions challenging.

What Exacerbates Drought Impacts Beyond Climate Change?

Water consumption and conservation can be significant drivers of change during drought. Per capita demand for water and water use has gone down in recent years, however the rate of change in consumption overall has remained steady due to population increase. Conservation, awareness, and updating old infrastructure are all needed to curb unnecessary water use.

Provincial water management and governance models also pose barriers to equitable and effective water distribution. The Provincial drought classification system relies heavily on voluntary actions until severe drought conditions (level 4 or 5) require regulatory action. This response system fails to mitigate preventable impacts on communities and the environment by remaining reactive rather than proactive. Currently, the First in Time, First in Right (FITFIR) water license system prioritizes the date of water rights over considerations for inherent rights, and First Nations Title. For more information, please refer to BC's Water Sustainability Act.

Impacts of Drought

Water scarcity

Drought reduces precipitation and snowpack, often leading to water shortages and scarcity. Surface waters like streams and lakes experience low flows, while groundwater may temporarily support them but can be quickly depleted. Since both rely on precipitation and snowmelt for recharge, recovery during drought is slow. Lower water flow also raises the risk of contamination. As wells dry, harmful contaminants concentrate, and warmer water promotes bacterial growth and algae blooms, which reduce oxygen levels and can devastate aquatic ecosystems.

Habitat Degradation

Reduced snowpack and precipitation can lead to dry streams and warmer water, increasing fish mortality and fragmenting aquatic habitats—especially in critical spawning areas. Loss of riparian vegetation further raises stream temperatures, creating unlivable conditions for fish, even when some flow remains. On land, water loss and hardened soils, limiting plant growth, increasing dieback and mortality. Sometimes, these conditions support aggressive invasive species growth as heat and drought tolerant species outcompete native plants even more so than usual due to their changing habitat. For example, reed canary grass, a persistent invasive species commonly found across the lower mainland, is particularly heat tolerant.

Drought also contributes to plant-eating insect outbreaks by stressing ecosystems, making certain plants/ ecosystems more susceptible to outbreak. Species like the mountain pine beetle and hemlock looper moth thrive in drought conditions. Drought stress and nutrient shortages weaken tree populations, while the insects benefit from the drought-conditions.

Disaster Intensification

Drought dries out soils and plants, increasing combustible materials and increasing the risk of fire, both in frequency and velocity. While controlled burns help mitigate risks, prolonged droughts extend fire seasons, requiring longer monitoring. Post-drought floods can worsen as drought-hardened, water-resistant soils struggle to absorb rainfall. Streams that have been dry or low-flow for long periods may build up sediment, reducing their capacity to handle heavy rain and increasing flash flood risk. Forest fires, with or without drought, also create water-resistant soils, which in turn increase drought likelihood and worsen flooding in the following year, creating a harmful drought-fire feedback loop.

Evaluating Community Risk

Below tables are adapted from the Ministry of Emergency Management and Climate Readiness, Hazard Risk and Vulnerability Analysis Document Library, n.d and "Hazard Risk Vulnerability Analysis", Emergency Oceanside September 2019.

Vulnerability

Vulnerability refers to conditions (e.g. physical, social, environmental, or economic) that increase the exposure of communities, community members, and/or systems to hazard. Age, income, and housing are all factors influencing vulnerability. Examples of at-risk demographics could be elders, children, single-parents, lower income groups, and unhoused peoples.

Species and traditional knowledge systems are also vulnerable as environments and weather patterns become unpredictable. Communities reliant on hunting or foraging face greater food insecurity during drought. Other vulnerabilities include infrastructure—such as power, transportation, community spaces, and healthcare systems—and essential services that may be more exposed to water shortages.

Risk Evaluation

Drought impacts vary by community, depending on local conditions, infrastructure, environment, and community needs. This guide helps identify potential drought impacts, assess how likely they are, and understand their possible consequences. Working closely with Chief and Council to review these impacts and risks ensures priorities reflect what matters most to the community. While preparation is important, emergencies can still happen—having clear risks and priorities laid out in advance helps your community respond quickly and minimize further damage when drought strikes.

Step 1: Impact Identification

To understand your drought risk, you need to identify community impacts, the likelihood each impact will happen, and the consequence of each impact. Start by listing potential drought-related problems in your community. Some examples include:

- Water Scarcity and Shortage
- Dried-up Well(s)
- Stream Drought
- Invasive Species Spread
- Fish Mortality
- Vegetation Dieback
- Dry Soils
- Poor Water Quality
- Illness
- Mental Stress

Step 2: Likelihood Evaluation

Your identified impacts should then be assessed by how likely they are to occur. Refer to the Likelihood Ranking Table below as an example. Likelihood can be a scale from **Rare – Almost Certain.** If it is not useful to predict how likely something is, you can leave the "likelihood" column out of your table. Ranking the likelihood of each impact will assist with the prioritization of which risks to address first.

Likelihood Scale

Rare	Unlikely	Possible	Likely	Almost Certain

Likelihood Ranking *Example*

Hazard #	Impact	Historic	Current	Future Likelihood
1	Stream Drought	Possible	Likely	Almost Certain
2	Drinking Water Shortage	Unlikely	Likely	Likely
3	Mental Distress of Community Members	Likely	Almost Certain	Almost Certain
…	…	…	…	…

Step 3: Consequence Identification:
Determine the consequence(s) of each drought-related impact you identified in Step 1. Drought could adversely impact **First Nations Rights and Title** related to **hunting, fishing, trapping, gathering, navigation,** and **archaeological/heritage** resources or sites due to the environmental stress on land and water systems. These changes should be documented alongside potential consequence categories, as seen below:

Social:
- Fatalities
- Displacement
- Psychosocial
- Support System
- Environmental
- Cultural Resources

Physical:
- Self-Sufficiency
- Property Damage
- Critical Infrastructure
- Environmental
- Economic

Step 4: Consequence Evaluation:
It is important to identify how damaging each consequence could be. For example: Could a drying aquifer lead to serious harm / fatality, mental stress, or people having to leave their homes? Each consequence should be scored from none-extreme based on the *Consequence Scale* below. Your responses can be filled out in a table in the *Consequence Table* below.

Consequence Scale

None	Low	Medium	High	Extreme

Consequence Table *Example*

Drought Impact	Fatality	Injury/ Illness	Displacement	Psycho social	Cultural Impact	Critical Infrastructure	Environ-mental	Economic	Average
Stream Drought	None	None	None	Med	High	Medium	High	Low	Medium-High
Drinking Water Shortage	Medium	high	medium	high	Med	high	low	high	High
Mental Distress	*Med*	*Med*	*Med*	*High*	*Med*	*Low*	*Low*	*Low*	*Medium*
…	…	…	…	…	…	…	…	…	…

Step 5: Create your Risk Profile
Use the information from Steps 1-4 to build a **risk profile**—a simple summary of the main drought risks in your community and their priority rating. Please note, outside factors like wildfires or changes to water sources can exacerbate conditions, and these plans will need to remain flexible and updated based on current conditions.

First, you will determine your risk level, using the *Risk Level Score* below. Risk is a combination of likelihood and consequence. For example, if water shortage is both highly likely and highly dangerous for community health, it would be a high risk. Secondly, you can rank each drought impact from highest to lowest priority. The highest priority will be the drought impact with the highest risk level. Refer to the Risk Profile below as an example of a completed Risk Profile.

Risk Level Score:

Sometimes, the likelihood and consequence of a drought impact won't fit neatly into the example scale. For instance, something might be **low likelihood** but **high consequence**. In that case, you might rate it as a **medium risk**. When things don't clearly fit the scale, it's important to talk it through with staff and Chief and Council to decide what makes the most sense for your community's risks and values.

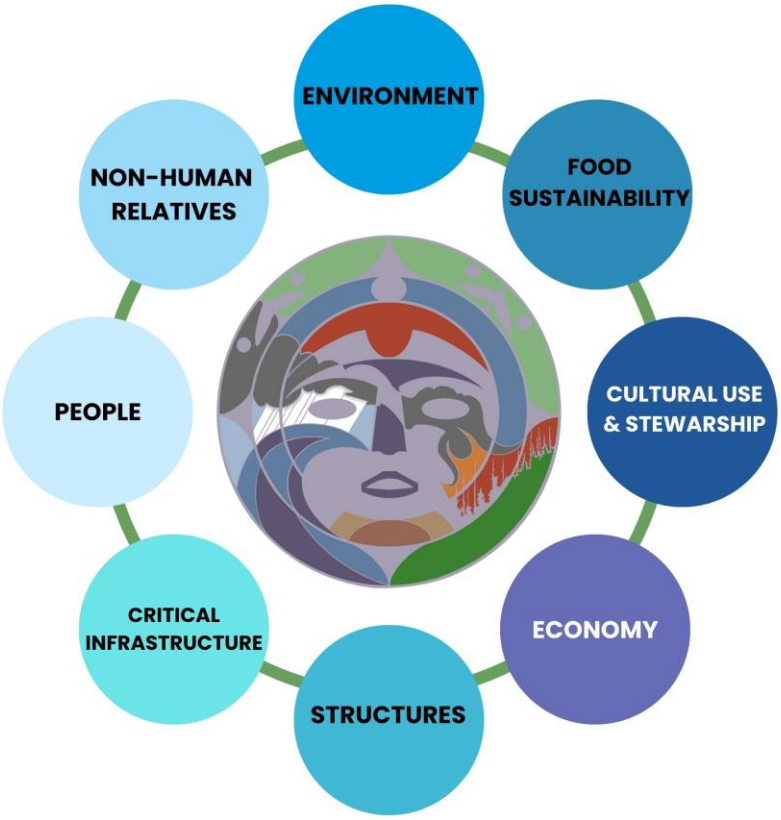
Low Likelihood / Low Consequence	Low Likelihood / Med. Consequence	Med. Likelihood / Med. Consequence	High Likelihood / Med. Consequence	High Likelihood / High Consequence

Risk Profile:

Priority	Drought Impact	Likelihood	Consequence	Risk Level
1	Drink Water Shortage	Likely	High	High Likelihood / High Consequence
2	Stream Drought	Almost Certain	Medium-High	High Likelihood / Med. Consequence
3	Mental Distress	Almost Certain	Medium	High Likelihood / Med. Consequence

**This table is an example, actual values should reflect community specific risk.*

For a helpful reference for factors at risk to consider, please reference the receptors of risk diagram in Hílekw Sq'eq'ó . More resources on creating a risk analysis and fillable PDF templates can be found in the **Information and Resources** table on **pg. 21**.



Preparedness

Early Preparedness

With multiple environmental factors to consider and fast changing weather patterns, drought hazard can be difficult to be predict well in advance. Key signs and symptoms during winter and spring can help us prepare early for potential drought episodes over the summer months and monitoring these signs can help shape how communities allocate resources.

Major Indicators:

- Lack of **precipitation**
- **Snowpack** below normal levels
- Reduced or low **streamflow**
- Lower **groundwater** levels and dry wells

Supporting Signs:

- Early **Spring Freshet** and/or low water level rise.
- Scorched, wilted, defoliated, and stressed **vegetation**
- Abnormally dry and hard **soils**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Snowpack												
Precipitation												
Streamflow												
Groundwater												
Soil												
Plants												

Update and incorporate drought as a hazard into existing emergency response plans as well. Water scarcity response and forest fire management are both impacted by dry conditions and reduced water supply, including drought as a hazard exacerbating these issues can enhance preparedness overall.
See the Short-term Response Plan for more details on monitoring and preparedness.

Efficient Water Management

Water supply in community can come from groundwater, surface water systems like reservoirs, or from neighbouring municipalities. Recycling and storing water during drought can help reduce the strain on these systems. Below are actions that can aid water conservation:

Greywater Reuse

Greywater is the water waste from laundry, sinks, and showers. Greywater reuse systems take water without any fecal content and redirect them for non-potable use (irrigation, cooling devices and potentially toilet water). This water does have pathogens, but they are much easier to filter and clean than the ones in blackwater (water with fecal matter).

Provincial laws consider greywater as sewage, which means formal septic or filtration systems are needed before any kind of reuse. Setting up these systems, for homes or community/administrative buildings, can help save water but are costly and will require a contractor or professional able to install a septic system.

Reducing Run-Off

A large amount of water from precipitation is lost as surface or stormwater runoff. Having more permeable surfaces, trees, and vegetation overall allows for more water to be absorbed back into the ground, slowly replenishing groundwater sources and retaining soil moisture

Rain Gardens are specifically designed to absorb runoff and retain more water. The sides of the garden bed are higher while the centre of the garden is depressed. When creating a rain garden, it is often divided into three planting zones. The bottom zone (most depressed) plants should tolerate wetter conditions, the second zone outside of the bottom should tolerate wet or dry conditions, and the edges of the garden should have drought tolerant plants that can survive with less water. To find more information on setting up a rain garden, look at the **Information and Resources** table on **pg. 21**.

Bioswales are shallow depressions in the land covered in vegetation designed to absorb and concentrate stormwater. They are designed to infiltrate water quickly into the soil and can serve as recharge zones for aquifers.

Voluntary Water Conservation Measures

Limit Outdoor Water Use	Limit Indoor Water Use

• Water lawn & plants minimally
• Water early morning or in the evening to avoid evaporation during peak heat in the afternoon.
• Avoid power washing or using a hose to clean driveways, try sweeping with a broom instead
• Avoid washing cars when possible
	• Take shorter showers and choose a shower over a bath
	• Check plumbing for leaky toilets, sinks, and taps
	• Only run a full load of dishes in the dishwasher
	  • Or fill the sink with hot, soapy water and wash dishes in batches either rinsing them once at the end or having a second container of clean water to rinse dishes before drying.
	• Use or create a low flow toilet
	• Only run full loads of laundry
	• Turn off the tap, don't leave the faucet running
	  • Place a jug of water in the fridge to drink from instead of running the tap until the water gets cold.
	• Install a tap aerator

Installing Water Meters

Water meters measure how much water is being used in your home. Measuring how much water is being used can make conservation easier and help identify potential leaks or other issues in the water system.

Collecting Rainwater (for non-potable use)

Harvest rainwater by setting up a rain barrel. These can be found at your local home hardware retailer or by refurbishing an old garbage bin. The barrel should be placed on a raised surface (wooden slats or bricks) under the downspout of a roof gutter; the gutter may need to be shortened to the height of the barrel.

Check the barrel regularly as high rainfall events can cause the barrel to overflow, constant overflows may lead to water damage near your home. Advanced roof runoff or collection systems with underground filtration require significant home upgrades. If desired and financially feasible, reach out to a contractor for information and installation options.

Rainwater should be stored in a way that prevents stagnation and mosquito breeding; mosquito dunks can be periodically dropped in to the barrel to kill larvae, the water can be manually moved regularly to avoid stagnation or drops of eco-friendly soap/oil can be placed on top to disrupt the surface tension. Strictly use this water for non-potable activities, like watering a lawn or garden.

3.3 Drought Resilient Habitats

As our non-human kin face adverse drought impacts, supporting drought resilient habitats is crucial. Before acting, it is important to understand what the baseline environmental conditions are within your territory. It is

understood that not every action in this toolkit will be available to every community and thus stronger governance and advocacy support towards regional protections may be the only way to progress some of this much needed revitalization and restoration work on traditional territory and Title lands, especially as it pertains to watershed management. Many communities may have either service agreements, bilateral, and or multilateral agreements as to industrial and environmental activities that take place both on and in the surrounding area of their Title lands. This toolkit acts as a reference guide for resilience planning for those able to conduct this work on their territory, as well as a reference guide for those looking to build partnerships with surrounding jurisdictions and organizations who further this work.

Through engagement and discussion with elders and knowledge keepers it will be useful to develop a comprehensive understanding of Baselines through Traditional Knowledge. Key characteristics to pay close attention to include historical weather patterns (such as snow droughts), temperature changes, key watersheds, and streamflow variations. These areas of interest will vary from community to community. Western scientific methods may also be used to understand habitat conditions. These baseline conditions will help determine what areas require more attention and/or which habitats are seeing more adverse changes.

Provincial drought classification solely relies on environmental data like hydrological reports and river forecasting for each region in British Columbia, however Nations are best equipped to understand their unique territories and the potential imbalances in their local microclimates. Communities will also notice that on the ground conditions are worse than provincial drought levels which is why relying on not only gauges but also people are crucial to make sure we are learning from the land on the land.
The below guidelines are useful for both households/gardening practices as well as efforts to support ongoing restoration projects in the territory.

Soils

Soil moisture and water retention are important factors in ensuring plants have an increased chance at survival. Measure with a soil moisture meter or manually by inserting a wooden stick into the soil, leaving it for approximately one minute and then removing it see how damp it is when removed. Distinct soil types based on how much gravel, sand, silt, or clay they have will react slightly differently to this test.

Deep Watering

For agricultural production and household use (if permitted). Watering plants deeply when the top 5-10 cm (2-4 inches) are dry directly supplies roots with water supply while reducing overall water evaporation.

Ensure water penetrates 15-20 cm (6-8 inches) into the soil by slowly watering over a longer period (approximately fifteen minutes) and check to see with a wooden stick or soil moisture test if water penetrated to the root level of the plants (15-20cm). Low flow watering systems, like drip irrigation and soaker hoses are ideal for this method. Water stakes or deep watering pipes may also be used.

- *Drip Irrigation:* A drip irrigation system involves placing a network of pipes and emitters that release water through small outlets (drippers) at slow controlled rate, usually 2-20 litres per hour. These pipes are directly connected to a water source. Consider this method in place of a sprinkler system.
- *Soaker Hose:* Place the hose(s) near your plants, make sure they are not touching the stems. Once the hose(s) are placed, connect them directly to a water source. Hoses may need to be secured so they do not shift too close to plants over time. This system may result in uneven watering, test and check the system before fully securing pipes to see where the water is going.

Both these methods require sketching/planning out a layout of hoses or pipes in the landscape beforehand. Deepwater infrequently and only when the top layer of soil is dry. Watering before dawn or after dusk will reduce water evaporation. Use rainwater through a barrel or roof run-off systems, when possible.

Mulching

Placing a layer of mulch over your trees, garden beds, or agriculture (if appropriate) can help retain moisture because it will supress weeds and reduce evaporation.

Non-organic mulches, like tarps and rocks **should be avoided** as they absorb heat and dry out soils. Organic mulches, like leaf litter, wood chips, and pine needles, retain soil moisture but are extremely flammable and pose a risk as they can feed growing forest fires. These mulches should not be placed near homes/buildings (at least 1.5m or 5 ft away) and are **not recommended if there is a high fire risk.**

Mulches made from composted material are the **best option.** Compost can provide nutrients while protecting soil and root systems. Ensure that compost used is mature and fully decomposed (it should look similar to soil with no large debris/organic bits) to avoid fire risk. Space and resources need to be dedicated outdoors for a compost pile/bin. Be particularly mindful of potential rodents.

Hard Soils

Breaking up hard soils by tilling or with a rake can be situationally useful to allow for water infiltration. This process introduces air into the soil which can dry it out and bury crop residue, proceed with caution and till as minimally as possible. Place an emphasis on soil preparation with organic matter such as compost or well-rotted manure to increase the soils' ability to retain water over time and prevent soil erosion.

Vegetation

Measures to **increase soil moisture** are one form of mitigation that is useful when trying to **save already established plants** that are not particularly drought tolerant and/or to reduce water demand during the drought season. **Introducing drought tolerant plants** to survive in dryer soils is another form of adaption and useful when trying to **increase ground cover and adapt long term.**

Combining methods may not be compatible in the same area. Some plants are tolerant of short drought periods but still thrive in moist in conditions while others are adapted to dry soils. For instance, planting a drought tolerant species, like yarrow, used to low moisture conditions and then mulching, irrigating, or adding substantial organic matter to the topsoil will drown the plant(s) and they will be unable to establish themselves.

Alternatively, there are scenarios where plants are only drought tolerant once established, like saskatoon berry; here it would be appropriate to mulch and water frequently for the first few months until established. Discretion and case-by-case assessments are needed based on the plants, habitat, and soils in the area. Please refer to the **Resource Guide on pg. 21** for more information**.**

General Planting Tips

When possible, planting vegetation at different stand levels and/or height will help create shade cover. Shade cover will reduce the rate of water evaporation from the soil. Plants at the lowest level should be shade tolerant while those at the highest stand must do well with fuller sun coverage.

Planting closer together is also useful as it will shrink the gaps between each plant, protecting the soil and in turn reducing the need for mulches, shade cover, and weed killer. Both these tactics will keep soil moist and reduce the amount of mulch needed.

Drought-Tolerant Plants for Parks and Gardens
Grow plants that require less water and will have a higher chance of survival during and after drought. To replace your lawns, consider planting native grasses like **fescue** and plants like **yarrow, sage, lavender, and mountain juniper**. Avoid clover lawns as they are invasive.

Groundcover can also replace your lawn or accompany garden beds to retain soil moisture. Widespread moss cover can survive drought by becoming dormant and protect soils. Moss does require shade to grow, so only consider planting if the surrounding areas provides enough shade (e.g.: large trees, plants with various heights, and/or shrubs). **Creeping thyme, creeping juniper, creeping phlox, and Kinnikinnick** are great alternatives and work in dryer soils. Keep in mind that groundcover plants cannot tolerate frequent foot traffic which may not be ideal if you have pets. Other drought tolerant shrubs and plants include **salal, nodding onion, snowberry,** and **sword fern**. See the **Waterwise Gardening Manual** in the **Information and Resources table** on **pg. 21** for more details.

x̱pá:yelhp / x̱ápaw̓ay / Western Red Cedar
This language was gifted to us by www.firstvoices.com/halqemeylem & museumofvancouver.ca/indigenous-plant-guide-in-squamish-language

Red cedars are not drought tolerant and are extremely at risk as drought and extreme heat events increase. A key sign of drought stress on cedar trees is if the tree crown (top) begins thinning as well as subsequent branch dieback. Improving soil moisture is one of the keyways to support cedars, they are tolerant of wet conditions and poorly drained soils, therefore mulching and adding larger amounts of organic matter to surrounding topsoil will be beneficial without risking major damage to root systems. Moisture increasing measures should surround trees but not reach up to the trunk and bark to reduce the risk of disease spread and damage.

If looking to plant new cedar saplings, assess potential habitats and look for moist microclimates within your territory. Reducing competition for water sources, for new growth and old growth, can increase cedar survival. Specifically, removing invasive species where possible and for new saplings avoiding areas with habitat competition, especially from Western hemlock and well-established old growth. Any and all actions to increase cedar access to moisture should be taken when possible. Certain trees may also be prioritized over others for protection, like old growth and culturally modified trees (CMT), for their cultural significance and survivability as old growth is proven to be more drought tolerant.

While protection is possible, it will be difficult to save every cedar. Adapting and planning for long term species range shift and range shrinkage for cedars is needed. Cross-community and Nation-to-Nation collaboration will be necessary as the natural occurring range of cedars changes with climate change to ensure the protection of and access to cedar. Long term adaptation may be achieved by translocating cedar trees and seeds from drier areas in regionally to wetter microclimates. For example, cedar trees from Interior BC have likely adapted to drier conditions, using seedlings from these trees in wetter, coastal areas could result in resilient trees better equipped to handle moderate drought conditions. This methodology is experimental and will require further research to fully test how effective cedar seed stock exchange will be.

Streams

Low flows conditions that cause stream drought are becoming commonplace every year, which may mean preparing well in advance to conduct Fish Collections and Salvages with the guidance of Lands Guardians and stream biologists. Digging designated pools for these salvages could also be needed as conditions worsen. During these times, cross-community partnerships will be key when temporarily translocating fish populations if there is no longer suitable habitat within community.

Habitat Restoration
Habitat restoration is a crucial tool to reduce drought impacts and provide streams the best chance at long term recovery and adaptation.

Dense Riparian Vegetation:
Dense vegetation surrounding creeks and stream systems will reduce stream temperatures by providing shade cover, preventing surface evaporation and keeping the streams cooler for fish and aquatic life. Maintaining healthy riparian zones also ensures the functioning of their essential ecosystem services and the regulation of hydrological processes. These areas are particularly important to recharge groundwater systems during floods and rainstorms which can then ensure a base flow during dry seasons. Rehabilitation in these areas will require identifying what areas are lacking vegetation and planning a planting strategy based on what is native to the region and the three main zones by a stream. Plants at the stream bank, riparian area, and streamside buffer zone will have to be different. For more guidance, refer to Riparian Vegetation Recommendations in the **Information and Resources** on p. 21.

Invasive Species:
Assessing the habitat and conducting a site study is needed before beginning any invasive species removal efforts to understand the issues with stream flow. Identify the invasive species in the area of concern and if there is more than one, assess and prioritize removal for those most adversely impacting the habitat.

- Manual removals can be done throughout the year and during drought. Special attention must be taken to ensure that species removal at certain times of the year does not contribute to the spread of invasive species.
- Cultural Control refers to cultivating native plant species that can increase local biodiversity and shade out invasive species, reducing the capacity for invasives to thrive. Dense native vegetation can be planted to provide shade and cool down stream temperatures.

For both methods, ensure you have the necessary equipment, such as gloves, garbage bags, buckets, wading boots, hand pruners, shovels/hoes, weed wrench or an extractigator, and rakes. It is equally important to have a disposal plan before beginning as these plants cannot be composted or left to decompose. Options can include hiring a waste collection service or delivering plant remains (in bags) to a nearby landfill.

Debris
Side channels and connecting streams can be blocked by lodged debris, from human actions (trash, pollution) or an accumulation of organic material. Identifying what is blocking stream flow and creating a plan to remove accordingly is needed. Large woody debris (LWD) is often placed to enhance stream habitats during restorations; however, these also need to be monitored regularly to ensure they do not excessively block water ways.

3.4 Food Security

First Nations self-sufficiency is particularly at risk as drought conditions impact plant and animal species that have been foraged and hunted since time immemorial.

To prepare for future droughts, it is important to first identify which key species are susceptible to drought conditions. Most freshwater fishes, like **salmon, sturgeon,** and **eulachon**, will be at a greater risk due to higher rates of fish mortality. Plants and roots native to moist and/or marsh like conditions like **eelgrass**, **spring bank clover,** and different **edible camas** may struggle more as droughts worsen while species like **nodding onion, desert parsley,** and **bitterroot** remain in better condition.

Marking these species through community asset mapping will help document what plants are being foraged most in community as well as which areas need rehabilitation or time to recover. If space and resources allow, setting up areas for community gardening can improve food security. These gardens provide spaces for cultivating crops and vegetables as well as additional space to cultivate the roots and greens that experience greater drought stress on the land.

Creating low barrier resources or workshops by engaging with knowledge keepers, like elders and community hunters, to understand food security and traditional food sources could be valuable for community as well.

Local grocery stores, agriculture, and off-reserve food sources will similarly take a hit during drought conditions as severe water scarcity could restrict crop yields and growing time frames. Many agricultural water users work with the province to ensure crop yields and secure crop insurance, so impacts could be felt as increases in prices for fresh produce rather than an overall scarcity of food at stores. Potential for increased costs in the future will specifically affect those experiencing economic insecurity and they may require additional supports from community.

3.5 Community Wellbeing

Living with Drought

Climate change, water consumption, and population change are all factors influencing drought severity and occurrence. With the likelihood of drought and its cascading effects rising in the region, it is important to accept that drought may become our 'new normal'. Social supports and community connections are crucial to establish a strong foundation for resilience through collective action and advocacy. Beyond these support systems, we must also plan for the reality that both our communities and non-human kin may not recover from certain drought impacts. Drying streams and lands will have irreversible effects on our environment, grieving these potential losses while adapting our actions to protect as much as possible can help us adjust to drought changes.

Social Supports

Knowledge keepers, elders, and spiritual supports can greatly aid in the planning, response, and recovery process as well as support community members during this time. Local groups and organizations, like First Nations Health Authority, can also provide beneficial psychosocial supports. Interim or regular wellness checks as needed for vulnerable community members can ensure they have enough water and can stay cool. Check-in on community members, especially vulnerable populations like elders, persons with disabilities, and youth, to determine impacts of drought stress (financial, social, psychological).

4. Recovery

*Immediate **recovery** actions, such as financial reimbursement and water restrictions actions, can be found in the **Short-Term Drought Response Plan.***

While drought is technically "over" when precipitation exceeds normal levels enough to accommodate for previous water scarcity, land and water systems may need decades to recover to pre-drought conditions. Long term recovery actions may be:

- Creating a Community Water Procurement Plan
- Habitat Restoration
- Conducting a Hazard Risk Vulnerability Assessment
- Creating Community Food Gardens
- Updating Infrastructure for Water Efficiency e.g.:
    - Nature-Based Stormwater Management
    - Rainwater Collection Systems
    - Grey Water Re-Use Systems

These are all examples and suggestions. Community specific action items should be determined through engagement with community members to understand unique concerns, and with guidance from administration and leadership.

4.1 Water Sources

Specific attention should be paid to water recovery systems. Changes to water source conditions and changes should be logged, for example keeping photos of well water levels over time, to understand what systems may be burdened and will need support under future drought conditions.

Identify the water source(s) most severely impacted by drought conditions. For instance, fully dried streams, depleted aquifers, and/or depleted reservoirs. Then examine what will be needed to replenish and rehabilitate these sources as well as if these are actions that communities can currently take on.

Streams and Surface Water:
Stream rehabilitation projects will potentially be long-term plans to restore the habitat by removing invasive species, diverting flows, planting dense native vegetation for shading, or altering the stream bed to increase water retention.

Aquifers/Groundwater:
It is important to note that groundwater systems lag behind surface water systems in recovery. Aquifers are replenished through groundwater recharge where surface water percolates down in recharge zones. This process will be affected by soil type as well as the amount and frequency of precipitation. During drought these sources take longer to replenish than reservoirs, and groundwater use during drought can worsen surface water conditions if streams or lakes are dependent on the aquifer during dry spells. These circumstances mean that heavy precipitation can alleviate drought on the land, however it will take longer for groundwater sources to recharge and therefore should be used carefully directly post-drought.

Reservoirs:
Water reservoir levels are often managed regionally and are heavily dependent on snowpack, rainfall, and water usage. Communities can monitor reservoir levels and curtail unnecessary water use if needed, however not much else can be done until the water reservoirs fill from precipitation.

4.2 Monitoring

Monitoring and evaluation of drought conditions, alongside the broader impacts of climate change, will be necessary to prepare and adapt to drought long-term. As drought becomes commonplace year after year, long term goals that align with community and cultural values will better support community success. These can be indicators of wellbeing for land, water and human systems range from data collection and analysis to holistic lands management plans. Monitoring efforts could be:

- Community Drought Knowledge Check-ins
- Water Storage and Capacity Documentation
- Streamflow Measurements and Data Collection
- Invasive Species Removal Progress Checks

A monitoring framework can simply be a process that tracks the progress for the recovery and adaptation actions being taken. It can be a useful tool to share updates with community and remain on track with the goals set. Below is cyclical framework that can help guide monitoring efforts, if question 5 remains unanswered then it is queue that monitoring should continue and if it is answered then communities can adjust or set new goals that builds on work already done. Questions 1-4 are great guides to help set up the planning or monitoring goals themselves.

Source: Red Rock Indian Band, n.d.

1. Where have we been?
2. Where are we now?
3. Where do we want to go?
4. How will we get there?
5. Have we arrived?

Tracking Long-Term Goals

When creating monitoring and recovery goals it is equally important to understand what success looks like in these projects. Indicators of success can be determined by identifying a baseline and outlining a new target to be achieved. If documentation and records are needed/preferred the below table can serve as a template to help track overall goals:

Expected Result (Outcomes and Outputs	Indicators (Baseline and Target)	Data Collection Method	Timeline/Check-in Frequency	Responsibility	Resources	Risks
e.g. Goal: Improve Stream Flow in [XXXX] Creek e.g. Action: Removal of Invasive Species blocking Stream Flow (Reed Canary Grass)	Baseline Removal: 0% Target Removal: 100%	e.g. Site Visits. Conducted by [XXXX] Nation staff and/or community members	e.g. Year-long, monthly visits	e.g. Lands Department, Volunteers	e.g. [XXXX] Nation Historical Record, Land Guardians, Knowledge Keepers.	TBD, Based on resources and site
Action/Goal 2: ….	….	….	….	….	….	….
Action/Goal 3: ….	….	….	….	….	….	….

United Nations Development Programme. (2009). Handbook on Planning, Monitoring, and Evaluating for Development Results, from https://mandeguidelines.iom.int/sites/g/files/tmzbdl2306/files/2023-03/pme-handbook.pdf

6. Information and Resources

Monitoring	Manuals and Guides	Beneficial Training and Skills	Equipment Needed
General: • BC Drought Portal • BC Water Scarcity and Drought Response Plan • Canada Drought Monitor Streamflow: • BC Water Tool • 7-Day Streamflow Averages • 30-Day Lowflow Stream Forecast Precipitation and Snowpack: • Precipitation Conditions • Snow Basin Indices • Snow Conditions and Water Supply Bulletin Groundwater: • Groundwater Conditions Map • Provincial Groundwater Observation Well Network • Provincial Aquifer Data Compliance: • Water Rights License Map • Water License Query Tool	Preparedness: • User's Guide to Streamflow Measurement • Low Flow Toilet Guide Risk and Vulnerability • Hazard Risk Assessment • Kanaka Bar Vulnerability Assessment • BC Hazard, risk and vulnerability analysis document library • Hazard Likelihood Fillable PDF • Hazard Consequence Fillable PDF • Risk Profile Fillable PDF • BC HRVA Online Tool* Water Scarcity: • Pacific Salmon Foundation Drought Affecting Salmon Reporting Tool • First Nations and Local Authority Emergency Management Plan for Water Scarcity Template • Build a Rain Garden Plants and Soils: • Drip Irrigation Guide • Drip Irrigation Video • Composting At Home • Grow Me Instead (Invasive Species) • FireSmart Plants • Agricultural Cover Crops • Alternate Forage Crops • Water Wise Gardening • First Nations Food Guide FNHA • Riparian Vegetation Recommendations Rainwater Harvesting: • Rain Barrel Installation • Collecting and Using Rainwater at Home CMHC	Community: • Psychological First Aid • Standard First Aid and CPR Emergency Management: • Incident Command System 100 • UN-DPHI Integrated Drought Managment Course • Indigenous Climate Change Adaptation Planning Toolkit • IDMP Drought Pillars Environment: • Salmon Habitat Restoration Course	Preparedness: • Water Level Meter • Rain Gauge • Rain Barrel Watering: • Soil Moisture Meter • Drip irrigation System • Soaker Hose Fish Salvage • Dip Nets • Seines • Waders • Boots • Thermometers • Coolers • Buckets Invasive Species Removal • Gloves • Garbage Bags Buckets • Wading Boots • Hand Pruners • Shovels/Hoes • Weed Wrench Or • Extractigator • Rakes

** Available to First Nations Communities and Local Authority representatives who have a Business BCeID account.*