BC Good Agricultural Practices Guidelines:
Risk Assessment for Natural Flood Disaster Events

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Photo Credit: Mike Boot

BRITISH COLUMBIA
Ministry of Agriculture, Food and Fisheries

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Introduction

The 2021 flooding affected large portions of BC agricultural production and now requires producers to look at how this affected agricultural operations, and how to respond to ensure the safety of food coming from these affected production areas. This means carrying out a detailed Risk Assessment to determine the extent of how the natural disaster affected the entire operation, including stored crops, unharvested crops, and land/fields/water sources for future crop production.

All Good Agricultural Practices (GAPs) Standards and Risk Assessments are based on food safety principles; and all food safety programs require growers to address major deviations when they disrupt the normal operations of food production. The 2021 flood event can be considered a major deviation where certification audits will require documentation showing how identified hazards were addressed and what corrective actions taken to reduce or prevent the contamination from causing food contamination.

This Risk Assessment (RA) is written to help guide growers through such an event. To understand the purpose of working through an RA consider the following:

- Risk Assessments identify **contamination sources** and categorize the types of hazards they present as either
    - Biological (B) hazards are microorganisms, some of which are disease-causing such as bacteria (e.g. *Escherichia coli*, *Salmonella, Listeria*), viruses, parasites, fungi, and moulds. Common sources of biological hazards are manure, human sewage, and animal mortalities. Most biological hazards are broken down through exposure to microorganisms or UV light, over time. Healthy soil will accelerate the decomposition process.
    - Chemical (C) hazards are poisonous or toxic substances. Common sources of chemical hazards are pesticides, fuels, paints, and industrial chemicals. Some chemical hazards are broken down by microorganisms or exposure to UV light such as some fuel-based chemicals and most pesticides. Other chemical hazards such as heavy metals can not be broken down and levels will only decrease after a prolonged period of time (many years), an example is chromated copper arsenic (CCA) used for preservation of timber. The extent that those substances are available for uptake by crops varies widely depending on various soil properties. Healthy soils may help to immobilize some chemical hazards.
    - Physical (P) hazards are foreign objects or unwanted materials such as glass, wood, metal, plastics, rocks, which under this type of flooding are often contaminated with biological or chemical hazards.
- Risk Assessments use **science-based evidence** and learnings from past events;
- Risk Assessments guide decisions on **what to test and how to monitor** the identified hazards;
- Risk Assessments lead to guidance on effective **GAPs corrective actions** to implement to ensure safe food production;
- Risk Assessments are a **prevention tool** to reduce or control hazards and thereby reduce the possibility of a recall.

Both certified and non-certified growers are encouraged to complete the risk assessments forms. This review will help growers to address and mitigate the potential hazards created by the flood conditions and thereby ensure the safety of food production.

Growers with organic certification should consult their certifier as there may be additional requirements made by their organic certification.

Guidance on how to complete this Risk Assessment

This risk assessment will help you identify the food safety risks to your operation from some of the potential hazards or contamination sources. It is recommended that you work through these forms in the following order of Farmyard, Well Water and Irrigation Water, Building & Equipment,

Field Conditions, and Fruit and Vegetable Crops. All producers are encouraged to complete the Farmyard section, regardless of whether buildings are present on the property. Mark other sections that do not apply as Not Applicable (N/A).

Step 1: Start by filling out details of your farm on Form #1 and use the template for flood record keeping (Form #3) to record any special dates, times, what photos were taken, etc. to refer to when you are completing the risk assessment forms.

Step 2: Start with the left hand column (#1) and read the Identified hazards and think about what happened to your field, well, yard, buildings or crops. If you have photos or recorded information like dates, mark that down.

Step 3: As you read the individual hazards, mark in Column #2 a Yes – that did happen, or a NO – that did not apply to your situation. If a NO was selected, continue reading down the list of other hazards. If a YES was selected, then continue to Column 3.

Step 4: Column #3 tells you what category of hazard that your observations fall under as it will be either a biological or chemical or physical or a combination of these hazard categories.

Step 5: Column #4 provides the rationale as to why and how this hazard will cause contamination and if the level of risk requires further action. Reading this rationale will help you understand how research has determined the best way to monitor or test to determine the level of risk, or if the research determines that the risk presented is at a low level for your operation.

Step 6: Understanding the rationale is key to ensuring that the appropriate corrective action is taken for your specific situation. Make the best choices for the level of deviation that occurred. This may mean some or all of the corrective actions need to be implemented.

Step 7: Column #6 enables you to set a date by which you need to complete the corrective actions to ensure that the next crop will be harvested under the safest conditions following a major deviation from your usual operational practices. Keep records of what the deviation looked like (if possible), and what you did to correct or clean up the contamination brought by this disaster. This risk assessment is part of your documentation for your next certification audit.

Declaration of Risk Assessment Review

Documents, including this guidance, do not establish legally enforceable responsibilities. Instead, the guidance refers to current research and academic knowledge publicly available on a topic and should be viewed only as recommendations, unless specific regulatory or statutory requirements are cited. The use of the word ‘should’ in this guidance means that something is suggested or recommended, but not required. This risk assessment highlights some of the known hazards, however it is the responsibility of the producer to identify any and all hazards that may pose a risk to food safety on their farm.

BC Good Agricultural Practices Guidelines: Risk Assessment Forms

Form #1: Farm Operational Details

Name of Operation:	
Operator/Owner:	
Location/Address:	

Event Details:	
Type of Event:	Environmental Atmospheric River Rainfall causing excessive water flooding and damage in a short time period
Flood	
Fire	
Other	
Start Date of Event:	
End Date of Event:	

Risk Assessment Date:

Assessor:

Risk Assessment Information: *(indicates which sections of the RA will be assessed)*

Farmyard:	
Manure Storage	
Livestock: *<list type & number>*	
On-site Septic *<location and size>*	
Chemical Storage:	
Fuel Storage	

Ag Chemicals		
Well Water: Location:		
Irrigation Source:		
Buildings:		*<Type and number, usage e.g. raw produce in bins, livestock,>*
	1.	
	2.	
	3.	
	4.	
Equipment*:*		<Farm vehicle list> <Processing equipment if any on-site>
	1.	
	2.	
	3.	
	4.	
Field Info:		*<list of crops, in-field plants/bushes, stored on farm, future crops>*
Field ID & Size:	1.	
	2.	
	3.	
	4.	
Fruit & Veg Crops: **Plants/Crops:** <include field size>		
Crops: **In-field** *(not harvested)*		
Stored crop(s): *<harvested>*		

Future crops: *<planning on growing>*	
Other items affecting Risk Assessment: *<list>*	

Notes:

a) All of the above items/practise areas are covered in ALL Certification Standard requirements (e.g. CanadaGAP, Global G.A.P., SQF, Primus, etc.); however, this risk assessment covers them under the category as a **major deviation having occurred and where corrective actions need to be implemented when indicated**.

b) Biological hazards (disease causing are called pathogenic organisms) can NOT be seen with our eyes, so clues and monitoring provide the information to determine, on specific sites, the level of risk that may be present due to this major deviation. Whenever possible keep notes of visual observations with photos, recorded time periods, or testing results (Template Forms #3) as confirmation to determine if the risk requires further corrective actions. When any of these hazard categories are identified then a decision on how to deal with this risk should be determined and implemented. The level of risk can be reduced and supported by the implementation of recommended corrective actions along with documentation and record keeping of all important flood details.

Form #2A: Farmyard Assessment

Name of Operation:	
Operator / Owner:	
Location / Address:	
Property to North	
Property to South	
Property to East	
Property to West	

Farmyard Assessment: provides details as to size, neighbouring N-E-S-W activities as these provide clues as to what may have landed on your yard as contamination/hazard sources. It covers the primary contamination sources of biological (B) hazards from livestock and animal mortalities and on-site septic systems, chemical (C) hazards from agricultural chemicals/pesticides, and fuel/oil, and physical (P) hazards which carry or transmit B or C hazards to workers who can then transfer them to food products.

#1: Hazard Identification: Observations < *if YES, provide observations and note if photos are available* **>**	**#2: YES / NO**	**#3: Hazard Type: P / C / B**	**#4: Rationale for type of Hazard Identified /** *Research & documented monitoring methods &/or acceptable parameters of acceptance*	**#5: Corrective Action Plan** <check all that will be implemented>	**#6: Date Completed**
Manure Storage:					
○ Are there livestock operations on your farm? ○ Are there livestock operations on the land bordering your growing operation? ○ Were there manure stockpiles in your yard prior to the flood event? ○ Did flood waters cover the manure piles while the water was flowing into area?	YES NO YES NO YES NO YES NO	B	• This can be a biological hazard. • The directional flow of the water will determine if any of the manure contaminated downstream flood waters. • The distance from livestock operations/manure sto ckpiles, flow of water and extent of damage will determine if manure was dislodged from your yard or brought to your yard.	☐ If observations suggest manure came onto your property from a neighbouring operation, contact your neighbours to get more details. ☐ See Buildings & Equipment Assessment and Field Conditions Assessment for corrective actions.	

○ Are there manure stockpiles on your yard that were flood impacted that you intend to use in crop production?	YES NO	B	• Manure stockpiles that are not completely composted present a biological hazard. • All GAP programs address the use of manure and manure compost tea as natural plant fertilizers. • Note: Canada has regulations regarding chemical medications given to livestock. Chemical hazards are considered a non-existent to low risk from manure. (Ref 1.1)	☐ If planning to use your manure as a crop amendment, review GAPs on Composting (Ref 1.2). ☐ Record the period of time that the manure piles were submerged. ☐ Monitor the temperature of the manure piles, turn manure piles, and record monitoring dates. ☐ See planting options in the Field Conditions RA and Fruit & Veg Crop RA. ☐ Growers using CanadaGAP review Section 4 on manure and manure Compost tea application times, and time period between application and harvest date. (Ref 1.3)	
○ What direction was the water flowing? Did it flow towards neighbouring fields?	YES NO	B	• Depending on which fields are downstream of your manure storage, and your storage practices will determine the scale of spread of contaminated water.	☐ Good neighbour policy is to contact your neighbours regarding your manure pile storage methods.	
On-site Septic System:					
○ Is the septic field flooded? ○ How long were flood waters on septic field? ○ Did the sewage back-up into the house? ○ Is the septic system connected to the packing/storage buildings?	YES NO YES NO YES NO YES NO	B & P	• This can represent a biological hazard and, if sewage backed up, a physical hazard. Depending on water movement it can have contaminated flood waters. This is a low risk, as sewage effluent waters are located beneath the soil, not on top of the soil, and will not have mixed with above soil water. • Flood water pressure could also have damaged parts of the septic system making it inoperable. • Primary source of contamination will occur inside of buildings due to backup as the field becomes too overloaded. • Over time, the field biological hazard will break down, however	☐ Contact your local septic contractor to empty the septic reservoir and determine if the system is in working order. ☐ Use GAP sanitation practices when cleaning inside buildings where backup has occurred. ☐ If your system is working, do not damage it by pouring cleaning waters with high levels of sanitizer into it. ☐ Neutralize the sanitizing water first with thiosulphate and use septic bio-enzymes to encourage good microbe growth.	

			the tank will require maintenance to help the field recover if not damaged. (Refs 1.4)		
Agricultural Chemical/Pesticide Storage:					
○ Was your chemical shed compromised during the flooding event? If so, list details of damage (e.g. broken window, containers damaged, etc.):	YES NO	C & P	• This can represent a chemical hazard from spilled chemicals and possibly a physical hazard depending on extent of water damage to the shed. • If a chemical shed was located on the field or on a neighbouring field, and the event caused it to be taken off of its moorings, or openings like windows dislodged: 1) chemical containers could have been opened due to pressure, 2) or if the containers had already been opened, water could have gotten in and caused leakages. • Depending on water movement chemicals can have contaminated on-site gardens, yard play areas, rest areas for farm workers. • Agricultural chemicals used on fields will breakdown over time. (Ref 1.5)	☐ Record dates of events ☐ Take photos to document extent of damage ☐ Mark out area where you suspect contamination occurred so that it does not cause cross-contamination to other areas until proper time periods have passed to break down the chemicals. ☐ If you know what chemicals were in the shed and which chemicals spilled, search for information on the PMRA Pesticide ☐ Label Data website to find how to handle spills for your specific chemicals (Ref 1.6) ☐ Repair the chemical shed to meet pesticide storage facility requirements. ☐ Use GAPs (Workplace Safety) hand cleaning and glove use when cleaning up area (Ref 1.7). ☐ Awareness training should be used to ensure cross-contamination does not result for people who have contact with the area (e.g. children, visitors, workers). ☐ Contaminated fields should be evaluated prior to planting (see Field Conditions and Fruit & Veg RA).	
Fuel Storage Tanks:					
○ Were on-site fuel tanks compromised? ○ If so, did they lose fuel during the time that water was flowing? ○ Do surrounding soils or water have a 'shiny' look?	YES NO YES NO YES NO	C & P	• This can represent a chemical hazard and possibly a physical hazard if the tank stability was compromised. • Depending on water movement it can have contaminated gardens, yard play areas, and rest areas for farm workers. • Research indicates fuel-based chemicals (petroleum	☐ Do maintenance to repair fuel tanks to avoid further contamination from occurring. ☐ Keep records of all activities. ☐ Mark out the areas where chemical spills were observed or suspected. ☐ Monitor plant growth close to the fuel spills, as poor plant growth may be an indicator of fuel present in the soil.	

			hydrocarbons) are considered at low risk to food safety through plant uptake from contaminated soil, rather they have an effect on plant growth which affects volume and quality of food production. • Fuel-based chemicals are broken down by soil organisms and time will remediate the contaminated soil (Ref 1.8 1.9, 1.10)	☐ Contaminated fields should be evaluated prior to planting (see Field Conditions and Fruit & Veg RA).	
○ Is there other debris that flood waters brought to your yard? If so, list the items	YES NO	B & P	• Miscellaneous items that flowing water may have deposited on your yard, can harbour biological and chemical hazards. • Care should be taken when handling during clean-up due to risk of picking up or being injured (Ref 1.11)	☐ Review Ref 1.11 HealthLink BC for Clean-up precautions ☐ Awareness training should be used to ensure cross-contamination does not occur from cleaning up contaminated items when handling clean food crops which were not affected by flood waters. ☐ Use hand washing and separation of dirty gloves and clean gloves when cleaning up.	
○ Were other chemicals released on your property (eg. chromate copper arsenic treated wood, paints, etc)?	YES NO	C	• These are chemical hazards. • The level of contamination will depend on the volume stored/spilled.	☐ Mark out the areas where chemical spills were observed or suspected. ☐ Awareness training should be used to ensure cross-contamination does not result for people who have contact with the area (e.g. children, visitors, workers). ☐ Contaminated fields should be evaluated prior to planting (see Fruit & Veg RA).	

Form #2B: Well Water and Irrigation Water Assessment

Name of Operation:	
Operator / Owner:	
Location / Address:	
Well Location:	

Well Water and Irrigation Water Assessment: provides details for well depth, neighbouring N-E-S-W activities as these provide clues as to what may impact the recharge waters as contamination or identify hazard sources, water is a carrier for all hazard categories, but the biological hazards carry the highest risk levels.

#1: Hazard Identification: Observations < *if YES, provide observations and note if photos are available*>	**#2: Yes / NO**	**#3: Hazard Type: P / C / B**	**#4: Rationale for type of Hazard Identified** */ Research & documented monitoring methods &/or acceptable parameters of acceptance*	**#5: Corrective Action Plan** <check all that will be implemented>	**#6: Date Completed**
Well Water:					
○ Was the well head submerged under flood waters? To what depth? ○ How long was the well head and recharge area under flood waters? ○ Water use: Is this well water used as a 'potable' water source for drinking and handwashing? ○ Do you have a well soil strata log? ○ Does your well lack a clay layer? ○ Do you know the depth of your well? Is your well shallow?	YES NO YES NO YES NO YES NO YES NO YES NO	B (For C Hazards see Question below)	• This can present biological hazards from on-site sewage systems, and any stored livestock manure on-site, and can impact the well water with potential pathogens. • If the well head is not properly protected, flood waters can run down the outside of the main well standpipe and contaminate the water pump and well water (Ref 2.1). • Depending on the depth of flood waters and time for waters to recede, will have an impact on the level of contamination of the recharge area. As this contamination can take time to reach the well pump. • If your well has a clay layer, this is beneficial to keeping your well water safe. Clay is extremely dense and when wetted will not allow movement of water to lower waters. (Ref 2.2; 2.6) • If your well is shallow, it will be influenced by the surface (above ground) recharge waters like rain and snow and contamination events like flooding. These may cause contaminants to enter into your well source waters. (Ref 2.2, 2.6) • If used as a potable source, tests based on BC Safe Drinking Water Regulation require <1 (zero) *Fecal* coliforms and <1 *E.coli* coliforms per 100 ml of water. (Ref 2.4)	☐ If used as a potable source, test the water for biological indicators (*E.coli* and *Fecal* coliforms) as per B.C. Drinking Water Protection Regulation. (See Ref 2.4). ☐ Do NOT drink the water until confirmed safe to drink. ☐ If the lab confirms it falls out of required Health drinking safety levels for biological hazards, follow the well shock treatment as soon as possible. ☐ Follow CanadaGAP Appendix A or contact your local Public Health Office for directions (Ref 2.3; 2.8). ☐ CanadaGAP Standards require testing water "prior to use and once during the season" (Ref 2.8) ☐ Keep retesting the water on a frequent basis (minimum monthly) to document that the water is safe, especially if receding waters took time. Keep a record of this time period. ☐ If this water is required for hand washing (but not for drinking) and does not meet the potable safety requirements, then a 2-step hand cleaning must be followed: 1. Wash with soap and rinse; followed by 2. Use of hand sanitizer and air dry. (Ref 2.6).	

			• For chemical contamination see question below.		
○ Is there an adjacent source of manure or fertilizers that could have impacted the flood waters, which are now draining into the recharge zone?	YES NO	C	• Nitrates and nitrites are a chemical hazard which should be tested for depending on RA of livestock manure or fertilizer in the area. • Health effects are Methaemoglobinaemia (blue baby syndrome) and effects on thyroid gland function in bottle-fed infants. • Review the BC Safe Drinking Water Regulation and the Canadian Drinking Water Standards are (Ref 2.4; 2.7)	☐ Chemical nitrates are difficult to remove and should be tested for to determine level of contamination. (Ref2.7) ☐ If above recommended levels of 45 mg/L as nitrate; 10 as nitrate-nitrogen, then babies should not be given this water. ☐ Continue yearly testing to see if the levels are going higher. If levels are rising, then a further investigation of the source and reduction practices should be addressed. ☐ Keep records of the testing results.	
Irrigation Source waters:					
○ Source: Is there a ditch or stream next to your field which you use for irrigation? ○ Time exposure: Was it under water during the flood period?	YES NO YES NO	B	• B.C research shows that surface waters used for irrigation can be contaminated and can be a higher risk level for ready-to-eat (raw) food crops. This water should be tested prior to using for irrigation and at a frequency of 2 or 3 times in a growing season depending on length of growing season. B.C Min of Environment Irrigation Guidance recommends a test limit of ≤77 *E.coli* per 100 ml of irrigation water. (Ref 2.9; 2.10)	☐ Test your irrigation water prior to use. ☐ Follow the BC Ministry of Agriculture brochure on Irrigation Water Sampling on best practices for when and how to take irrigation water samples. ☐ Lab results should read ≤77 *E.coli* per 100 ml of water (Ref 2.10)	
		C	• Chemical contaminates in irrigation water are normally not tested for unless there is an identified source of contamination. • Research indicates that agricultural chemicals and fuel-based chemicals (hydrocarbons) are considered at low risk to food safety through irrigation waters, unless there is a known large commercial spill. Both types of chemicals are broken down by soil	☐ Monitor growth and development of plants (crop and weeds/native plants as poor plant growth may indicate soil contamination or poor soil health. ☐ Take photos of plants over time as a record of how contamination levels are changing over time.	

			organisms and time will remediate the contaminated soil (Ref 1.7; 1.8; 1.9) • Time is a key factor in the breakdown of these chemicals. • Plants will react to high levels of chemical contamination in the soil.		

Form #2C: Building and Equipment Assessment

Name of Operation:	
Operator / Owner:	
Location / Address:	

Building and Equipment Assessment: *provide details as to size, neighbouring N-E-S-W activities as these provide clues as to what may have brought contamination or hazard sources*.

#1: Hazard Identification: Observations *<if YES, provide observations and note if photos are available>*	**#2: Yes / NO**	**#3: Hazard Type: P / C / B**	**#4: Rationale for type of Hazard Identified /** *Research & documented monitoring methods &/or acceptable parameters of* ***acceptance***	**#5: Corrective Action Plan** <check all that will be implemented>	**#6: Date Completed**
Packing or processing buildings:					
○ Were packing or processing buildings impacted by the flooding event? If so, list the buildings: ○ Were these buildings connected to a septic system which backed up?	YES NO YES NO	B & C	• Research shows that biological hazards find their way into all areas, especially cracks and crevices. A thorough cleaning and sanitation should be carried out prior to any fresh product brought into these areas, particularly if sewage effluent backup was identified. (Ref 3.1; 3.2). • If waters contained chemical hazards, special cleaning products (degreasers) may have to be used to get rid of these hazards (e.g. fuel, PHCs, spilled paint, etc.).	☐ Follow your GAP cleaning and maintenance SSOPs to ensure that contamination hazards are properly removed. Maintenance may require some renovations of the building structure. ☐ Consider implementing an environmental monitoring plan to validate and verify that your SSOP is working as intended. (Ref 3.3)	

Storage / Dry:					
○ Were storage areas impacted by the flooding event? ○ Did flood waters enter these areas? ○ Were single use packaging containers impacted? ○ Pests – are there signs of rodents harbouring? **Note**: see stored food crops in Fruit & Vegetable Section	YES NO YES NO YES NO YES NO	B & C	• Flood waters which contained biological or chemical hazards can have damaged clean packaging, or dry stored products. If contact with flood waters these cannot be cleaned off, so need to be destroyed. • Flood waters will make rodents move up within a building, watch for rodents in dry areas and accessing anything that they can chew (e.g. packaging)	☐ Destroy all single-use packaging that had contact with contaminated waters. ☐ Follow your SSOP for cleaning and sanitizing the area. ☐ Consider implementing an environmental monitoring plan to validate and verify that your SSOP is working as intended. (Ref 3.3) ☐ Follow your GAP for pest control, making sure you look at high level areas (e.g. beams, walls)	
○ Were bins (harvest & storage bins) impacted?	YES NO	B & C	• Most bins have crevices where biological and chemical hazards can harbour. Proper cleaning needs to be carried out to remove these hazard sources. (Ref 3.2)	☐ Follow your SSOP on cleaning and sanitizing all bins. (Ref 2.9 BC GAP Guidelines)	
Storage with Temperature control:					
○ Were coolers impacted by flood waters? ○ Were coolers impacted by busted cooling pipes? ○ Were coolers impacted in other ways? If so, list:	YES NO YES NO YES NO	B & C	• Flood waters and localized internal flooding can carry both biological and chemical hazards. In temperature-controlled units, biological hazards like *Listeria* can grow and multiply even under cool conditions, so special care should be taken in making sure cleaning and sanitizing gets into all cracks and crevices. (Ref 3.1) • Chemical contamination from damaged equipment (cooling units) will require special cleaning and maintenance.	☐ Follow your SSOP on deep cleaning and sanitizing. Pay special attention to fans and floor drains as those are harbourage sites for biological hazards. (Ref 3.3) ☐ For cooler chemical clean-up contact your equipment supplier on clean-up and maintenance. ☐ Ensure proper sanitizing chemicals are used and measured as instructed by the company making these chemicals. ☐ Use appropriate safety gear (goggles, gloves) when doing the clean-up. ☐ Do not use high pressure washers to do this cleaning as it will spread the contamination to clean areas.	
○ Did storages lose temperature control? If so, for how long?	YES NO	**B**	• Lack of optimum temperatures and storage conditions often lead to rapid food product deterioration and lack of quality. This lack of quality and food deterioration can very quickly present a biological hazard. • A biological hazard like *Listeria* grows rapidly when in moist and cool	☐ Consult a food safety specialist to help evaluate the risks and determine if food sample tests are appropriate and for further corrective actions. ☐ Ensure proper SSOP is carried out in coolers on a consistent basis to control hazards like *Listeria*. (Ref 2.9 BC GAP Guidelines)	

			temperatures and is extremely difficult to remove once it is part of the microbial flora in a production operation. Moist environments encourage coliform and mould growth creating conditions like biofilms to flourish. (Ref 3.3)		
Equipment:					
○ Was other production equipment impacted by the flooding event (eg. sorting and packaging equipment)? If so, list:	YES NO	B & C	• If flood waters had contact with food sorting and packaging equipment, an evaluation of how much damage the equipment received should be made by a representative of the equipment supplier if possible. If submerged in water then B and C hazards can be harbouring in cracks, crevices and joints which require specialized cleaning and maintenance. (Ref 3.1)	☐ Contact a supplier of your equipment to determine the extent of damage the equipment may have received, as they will know if there are some key items in the equipment that will need to be replaced (e.g. O-rings) before cleaning the equipment. ☐ Carry out your SSOP on cleaning all equipment and keep records of cleaning and maintenance. ☐ Consider implementing an environmental monitoring plan to validate and verify that your SSOP is working as intended. (Ref 3.3)	
○ Was other field equipment impacted by the flooding event (eg. harvesters, trailers, tractors, trucks)? If so, list: ○ - Were any of these vehicles submerged in flood waters?	YES NO YES NO	B & C	• Vehicles submerged in water for any time period are subject to losing wet fluids, which are classified as hazardous wastes. If these were picked up by flood waters or leaked inside buildings, then special care should be taken when cleaning up as residues could have been in the flood waters. (Ref 3.6) • Research supports biosecurity measures which include cleaning or not allowing vehicles to transport biological, chemical and physical hazards from one infected area to a clean area. (Ref 3.4). GAPs can reduce this source of transmission of pathogens or cross-contamination from a contaminated area.	☐ After Field Conditions and Farmyard Assessments have been completed to determine the level of contamination in a flooded field, a sanitation and cleaning plan should be carried out if equipment was used in contaminated fields. ☐ Use SSOPs of vehicle tires and floor mats to help with this prevention-based corrective action. This SSOP should be implemented to ensure that vehicles are cleaned after leaving a contaminated area. (Ref 3.5) ☐ Worker awareness training of cross-contact with contaminated footwear and vehicle floor mats will reduce transmission from contaminated fields to clean fields and areas.	

Form #2D: Field Condition Assessment

Name of Operation:	
Operator / Owner:	
Location / Address:	

Field Condition Assessment: provides field details as to size, neighbouring N-E-S-W activities as these provide clues as to what may have landed on the field as contamination or hazard sources. Corrective Actions are limited; however, time, sun UV rays, and maintaining healthy soil practices will help bring sustainable and healthy safe crops in the future.

#1: Hazard Identification: Observations < *if YES, provide observations and note if photos are available*>	**#2: Yes / NO**	**#3: Hazard Type: P / C / B**	**#4: Rationale for type of Hazard Identified /** *Research & documented monitoring methods &/or acceptable parameters of acceptance*	**#5: Corrective Action Plan** <check all that will be implemented>	**#6: Date Completed**
Field Conditions:					
○ Are flood waters still on the field? ○ Is there still unharvested crop in the field? ○ Did these flood waters come from other sources (e.g. overflow of drainage ditches, dike breaches, etc.)? **Note:** Pooled water from rain that is not from excessive overflows, should not be excessively contaminated and not considered in this Field Assessment. Fields are constantly exposed to rainfall and therefore considered a normal risk level. Flooding due to rainfall and causing overflows to flood buildings is covered under	YES NO YES NO YES NO	B *For chemical hazard see Fuel Spills and Ag Chemical hazards*	• This represents a biological and chemical (see Fuel and Agricultural Chemical Spills under Farmyard Assessment) hazards. • All unharvested food products in contact with flood waters should be considered contaminated as this level of contamination cannot be washed off. Primary contamination is the silt (suspended in the water) where the microbes attach to will deposit on the plants during the time water is receding into the ground. (Ref 4.1) • Fields that were flooded just from rainfall, will not have contaminants from other areas. This type of isolated flooding does not constitute a food safety risk. The risk is increased when product is harvested under wet conditions due to cross-contamination with soil staying on products. (Ref 4.4)	☐ All unharvested food product in contact with flood waters should **be identified and destroyed.**	

the Buildings & Equipment Assessment.					
○ Are there visible signs of livestock manure on the field? ○ Are there manure stockpiles in any of the surrounding areas (N-E-S-W)? ○ Is there a home with a septic system adjacent to the field? ○ Was there a portable toilet on the field? ○ Is the portable toilet still on the field? ○ When was the portable toilet last emptied prior to the flooding event?	YES NO YES NO YES NO YES NO YES NO	B	• Depending on what the flood waters were exposed to prior to flooding your field, they could have been exposed to both livestock manure (green/not composted) or from human septic systems. If these are upstream from the direction of where the water came, then this contamination could have settled on your field supplying an extra load of pathogens onto the field. • Research shows that healthy soils, sun UV, and a period of time (120 days) are the best methods to reduce an extra load of pathogens. (Ref 4.5, 4.6) ○ **Note**: Canada has restrictions on livestock medications, and therefore no chemical Hazard is presently associated with livestock manure.	☐ Take photos of crop in flood waters. ☐ Monitor the time period of when last water recedes to when next crop is ready for harvest. ☐ Ensure that 120 days passes prior to a new crop is harvested. (Ref 4.5) ☐ Use farming practices that improve soil health (eg. cover crops, crop rotation, etc.) ☐ Use GAPs cleaning and safety precautions when dealing with the port-a-potty. ☐ Mark area if the reservoir was tipped and emptied during the flood period. ☐ Contact a rental company for proper method of cleaning and disposal of spilled human sewage.	
○ Were there animal carcasses from drowned rodents, wild animals, domestic livestock on the field?	YES NO	B & P	• This is a biological hazard and dead carcasses can be a physical hazard to future workers on the field. • Cattle carcasses can harbour Bovine Spongiform Encephalopathy (BSE) or Mad Cow Disease and must be handled and disposed of as "Specified risk material" as regulated by the CFIA (Ref 4.12) • Other animal carcasses require removal to a proper composting site. GAPs should be used to prevent cross-contamination to worker removing the carcasses.	☐ Awareness of cross-contamination when handling dead carcasses. ☐ Use gloves and follow proper hand washing for personal safety. ☐ Refer to CFIA Guidance on specified risk material for disposal of cattle carcasses. ☐ Follow waste management protocols for dead carcass removal or bury dead rodents to speed decomposition.	
○ Is there debris on the field that the water brought along from adjacent properties (eg. wood, metal, or plastic)? If so, list the debris:	YES NO	P & B	• This is both a physical hazard, and a biological hazard. • Due to contact with contaminated water, debris should all be considered contaminated (Ref 1.7). • Follow GAPs during cleanup to prevent cross-contamination to workers (Ref 1.8).	☐ Cleaning fields of physical debris and harvesting clean products requires that all workers are retrained on basic Cross-contamination awareness. ☐ GAPs in use of dirty and clean gloves should be followed. This will also help workers from becoming ill from	

				handling contaminated debris. (Ref 1.12)	
○ Is there indication of fuel contamination in the waters or on the field? ○ Does the water or soil have a 'shiny' look to it? ○ Did you observe fuel tanks/containers within the field or surrounding areas? ○ Were any vehicles abandoned next to the field?	YES NO YES NO YES NO YES NO	C & P	• This represents a chemical hazard. • If unharvested fall crops are still in the field, these food products should be considered contaminated as this contamination cannot be removed from food product (Ref 4.7)). • Research indicates fuel-based chemicals (PHCs) are considered at low risk unless there is a known large commercial spill. These chemicals are broken down by soil organisms and time will remediate the contaminated soil (Ref 4.7; 4.8; 4.9; 4.10)	☐ Destroy any unharvested crop if chemical contamination occurred. ☐ Clearly mark the field or sections where chemical contamination is observed or suspected. ☐ Take photos of any fuel tanks/containers in the field ☐ If chemical contamination is observed or reasonably suspected based on a spill of fuel-based chemicals, consider: ☐ delaying pruning, ☐ delay planting, or ☐ testing the soil. ☐ If test results show elevated levels that exceed guidelines, do not plant but conduct further soil testing again later in the summer ☐ Review the Fruit & Vegetable Crop RA in regard to Future crops.	
○ Did you observe plastic containers from chemicals or pesticides in the field? ○ Was there a chemical storage on the field, what condition is it in now? ○ Was there a chemical shed on the property next to your field?	YES NO YES NO YES NO	C & P & B	• This can present both chemical and physical hazards. • If the flooding caused a nearby chemical shed to be taken off of its moorings, or openings like windows dislodged: 1) chemical containers could have been opened due to pressure, 2) or if the containers had already been opened water could have gotten in and caused leakages. • Many of these chemicals are put on fields prior to harvesting and do break down over time (Ref 1.10).	☐ Mark out the field areas where chemical spills were observed or suspected. ☐ When determined if and what type of chemicals entered the field, keep a log from the date of occurrence to first date of next harvest to show that correct pre-harvest intervals were met. ☐ Use GAPs proper glove use for cleanup of any physical agricultural containers as they will be contaminated with biological hazards. (Ref 1.12)	

			• Ensuring healthy soil organisms are present will help degrade agricultural chemicals.		
○ Does a major asphalted highway or road run along any side of the field? ○ Is there a busy intersection adjacent to your land? ○ Other identified sources?	YES NO YES NO YES NO	C	• Research shows that during a heavy rain storm or flooding event, heavy metals, asbestos, and other fuel-based chemicals (PHC)s can be picked up by moving waters and then deposited in other areas. It is documented that these contaminants can be carried up to half a mile/500 to 800 meters from a source like a major highway or commercial source. Asbestos is a natural substance found in certain parts of the natural earth formations and used in vehicle brakes. It is a known carcinogen and can contaminate soil. At present the research is limited but does not indicate a direct food safety hazard to food production through plants and can be considered a low risk due to the high allowances for asbestos in the soil. (Refs. 4.7 – 4.11)	☐ There is no corrective action for this. ☐ Monitor growth and development of plants (crop and weeds/native plants) on edge of field closest to the major asphalted road as poor plant growth may indicate soil contamination or poor soil health.	

Form #2E: Fruit and Vegetable Crops Assessment

Name of Operation:	
Operator / Owner:	
Location / Address:	

Fruit and Vegetable Crops Assessment: *provides details as to what type of crops were not harvested / Stored crops / Berry Plants in field / and Future crops*.

#1: Hazard Identification: Observations < *if YES, provide observations and note if photos are available>*	**#2: YES / NO**	**#3: Hazard Type: P / C / B**	**#4: Rationale for type of Hazard Identified /** *Research & documented monitoring methods &/or acceptable parameters of acceptance*	**#5: Corrective Action Plan** <check all that will be implemented>	**#6: Date Completed**
Unharvested and planted crops present at time of flooding:					
○ Were plants submerged in flood waters? ○ How high was the water?	YES NO	B	• This represents biological hazards and all unharvested food products in contact with flood waters would be considered contaminated as this level of contamination cannot be washed off (Ref 5.1, 5.2, 5.3.5.4).	☐ All unharvested food product in contact with flood waters should be identified and destroyed.	
Fall Planted root crops (e.g. garlic) – see Future Crops below					
Stored crops harvested before flooding:					
○ Were stored food products in contact with flood waters?	YES NO	B & C	• This represents a biological and /or chemical hazard. • All harvested food products in contact with flood waters would be considered contaminated as this level of contamination cannot be washed off (Ref 5.2, 5.6, 5.7).	☐ All stored food product in contact with flood waters should be identified and destroyed.	
○ Were there flood waters in storage area, but stored food product not in contact with flood waters?	YES NO	B & C	• Identify all unaffected products for removal. • If GAPs (hand cleaning, use of gloves, etc.) during removal are not used the products can become cross-contaminated causing both B and C	☐ Train workers on GAPs for prevention of cross-contamination. ☐ Ensure proper glove use, hand cleaning, ☐ Use clean bins, separation barriers are used when moving products.	

			hazards due to the surrounding environment. Be prepared that buyers may ask for photos to show lack of contact with flood waters, and possibly food product testing for Indicator Organisms (E.coli up to 10 cfu per gram of food product) (Ref 5.2;5.6).	☐ If buyer requests verification of food safety, be prepared to send samples for E.coli testing to be done by a certified lab. (E.coli up to 10 cfu per gram of food product) (Ref 5.6) ☐ Ensure traceability records of these products are documented. (Ref 5.7)	
Existing planting: perennial crops:					
○ Were perennial plants submerged in flood waters ○ Are these plants going to produce a crop next season?	YES NO YES NO	B & C	• The biological hazards from the 2021 flood waters should have a low risk impact on 2022 harvest products as long as enough sun UV rays, and time has elapsed. chemical hazards will be based on the • Field Conditions RA and if chemical contamination occurred. However, most pesticides and fuel hydrocarbons break down over time. Research indicates when specific chemicals are of concern there are ways to improve soil health. (Ref 5.8)	☐ Monitor the time period of when last water recedes to when next crop is ready for harvest. ☐ Monitor plant growth close to suspected fuel spills, as poor plant growth may be an indicator of fuel present in the soil.	
○ Are pruning activities planned for the months following flooding? (e.g. blueberry, raspberry, blackberry)	YES NO	B & C	• This can represent a biological and chemical hazard to people pruning and handling contaminated plant material. • If plants were submerged, they should be considered contaminated and extra care should be taken when handling this plant material and any tools and gloves used during this pruning. • The 2021 flood waters biological hazards should be a low risk impact for 2022 harvest products as enough sun UV rays, time, and use of GAPs during pruning should have reduced potential biological hazards. • If chemical contamination occurred based on the Field Conditions RA, then	☐ Delay pruning as long as possible to allow as much sun UV to break down biological and chemical hazards as possible. ☐ Train workers in cross-contamination awareness and personal hygiene habits to prevent worker from getting ill (e.g. touching the face, eating without proper hand cleaning, etc.). ☐ Have staff report any illnesses. ☐ During pruning, ensure workers are frequently: ☐ cleaning pruning tools, ☐ changing dirty gloves, and ☐ hand washing	

			research supports that the prunings from affected plants should be removed from the field (not chipped/mulched) so as not to add chemicals to the soil for later uptake by the plants or contamination of waterways. (Ref 5.1)	☐ Review Field Condition Assessment RA, if chemical contamination is suspected, ensure pruned plant material is properly removed from the field.	
Existing planting: fall-planted root crops:					
○ Were fields planted with root crops prior to the flooding? ○ Fall planted for next spring e.g. garlic, seeded brassicas?	YES NO YES NO	B	• Soil testing and food testing can be used to determine if this is a potentially HIGH risk. Consider the volume of food units when considering testing food, as this can be expensive based on the volume of units to test to ensure the level of confidence is achieved. (Ref 5.2, 5.5, 5.6) • If manure is a potential hazard (Field RA), the plant health is NOT an indicator of the non-presence of pathogens. The quality of plant growth can be a deceiving factor as to the safety of the food product.	☐ Corrective actions will be determined by amount of contamination in the Field Conditions RA. ☐ The quality of the plants (fruiting or bulb structures) should be monitored during growth and development. ☐ Send representative samples for food testing prior to harvesting. Tests should include E.coli, Listeria, and Salmonella (if indicated) in Field Condition RA. ☐ Ensure safe GAP harvesting practices by workers in regard to: ☐ proper hand washing before and after handling products, ☐ use and cleaning of harvest tools. ☐ Ensure traceability records are kept on all products harvested.	
Future planting:	**Note: The 2021 flood waters biological hazards should have a low impact on 2022 non-ground level harvest products as enough sun UV rays and time should have reduced any potential surface biological hazards. However cross-contamination can result from heavily contaminated soils and especially to products that can be eaten raw in close proximity to the soil. GAPs should be used to prevent these types of potential hazards causing food contamination. Consideration of these risks should be part of the planting decisions for these flooded fields, thereby giving them a chance to recover and encourage healthy soil practices.**				
○ Working in contaminated fields following a major deviation like flooding?	YES NO	B & C	• Soil can still have higher than normal contaminant levels during pruning, seeding, and planting time, as organisms do not die in cold	☐ Follow GAPs for training on cross-contamination awareness for both biological and chemical hazards,	

			temperatures (they only hibernate), so care should be taken when working in these types of fields. (Ref 5.8, 5.9, 5.10)	☐ Follow GAPs for on-field hand washing to be available for workers ☐ Follow GAP for worker hygiene awareness, as it is easy for workers to pick up biological hazards while working in contaminated soil conditions (e.g. gloves, boots, poor hygiene habits). ☐ Tools, vehicle tires to be cleaned after leaving a contaminated field. ☐ Mark off portions of the field where Chemical hazards were identified.	
○ Are you planning on planting products that can be eaten raw (no cooking)? Like salad greens, radishes, green onions, etc.	YES NO	B & C	• These food crops present a high risk with high potential for recalls. (Ref 5.1). If the Field Condition RA indicates a high load of contamination of either biological or chemical hazards, research recommends a rest period with a non-edible cover crop be grown. • Many buyers are now expecting growers to sample products for indicator organisms before shipping, especially to export markets. (Ref 5.1, 5.12).	☐ Base your planting decisions on the level of risk determined by the Field Conditions RA. ☐ Products that can be eaten raw are strongly discouraged if there are risks identified in the Field Conditions RA. ☐ Consider growing a quick growing cover crop to allow more time for degradation of contaminants. ☐ If a biological hazard is indicated in the Field Conditions RA, consider growing a crop that requires peeling of the outer shell and a cooking step prior to consuming the product (e.g. hard shelled squashes).	
○ Are you planning to plant root crops in the coming months?	YES NO	B & C	• From your Field Condition RA determine the risk of chemical hazards to field site.	☐ Ensure you apply the 120 day separation from the time of flooding to harvesting to provide a time period for breakdown of identified hazard organisms and sun UV light to breakdown surface organisms. ☐ Be aware of cross-contamination when using irrigation sources which may still have high loads of pathogens.	

				☐ If chemical hazards are identified in the Field RA, consider doing the following: ☐ delay planting, ☐ plant a cover crop, ☐ plant a lower risk crop instead (e.g. a non-food crop or a crop that consumers do not eat (e.g. non-edible flowers, hops, hemp, etc.). ☐ test crop before harvest ☐ Test irrigation waters to ensure you do not add extra biological hazards to the crop. ☐ During harvest follow your regular GAP and Traceability programs to ensure safe products.	
○ Are you planning to plant perennial berry crops in the coming months?	YES NO	B & C	• Soil can still have higher than normal levels of contaminants during planting time, as organisms do not die in cold temperatures (they only hibernate), so care should be taken when working in these types of fields. • New blueberry and raspberry plants typically are not harvested in the first year of planting, so product food safety is not a concern. • Refer to the chemical contaminants identified in your Field Conditions RA.	☐ Follow your regular GAP program for safe practices when planting or seeding new crops. ☐ Ensure workers moving from new fields to clean existing fields are aware of how cross-contamination and transmission happens. For example, gloves used in a contaminated field should not be used in a clean field. ☐ Vehicle tires and footwear to be cleaned after having been in a contaminated field and before entering a clean field.	

Form #3: Template for Flood Record Keeping

Name of Operation:	
Operator / Owner:	
Location / Address:	

Template for Flood Record Keeping: Documentation is important part of food safety. To help keep flood information all in one spot, here is an example of all the primary pieces of information you should have on hand, particularly if you get audited for a Food Safety Certification program. This information supports the risk assessment forms and what corrective actions you chose to implement.

Date	**# of Acres / Storage Unit/ Well / Equipment**	**Crop / Field plants**	**Flood Date & Source of Flood Water**	**Duration of Flood** (time)	**Testing Results** (either your own or copy from other source)	**Current Status / Comments/ Photos taken**

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