

Protocol C1
Water Assessment Manual for Category 1
Facilities



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May 10, 2022

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1.0 Introduction

This manual was prepared by Baird AE on behalf of CropLife Canada to assist greenhouse growers in validating the integrity of closed loop chemigation systems. This water assessment protocol shall be used in conjunction with the Protected Agriculture Stewardship - National Auditable Standards (PAS) to mitigate risks associated with pesticide application in protected agriculture environments. This protocol is intended to be used by operators of closed-loop systems within Canada.

The Protected Agriculture Stewardship National Auditable Standards version 1.0 was released in February 2022. As of January 1, 2024, all category 1 (closed-loop) greenhouses or protected agricultural operations, as defined in the National Auditable Standard, who wish to purchase greenhouse labelled crop protection products will need to be certified under the standard.

By undertaking the water assessment to validate the integrity of chemigation system(s), growers shall:

- ensure the system is functioning properly;
- ensure that there are no intentional or unintentional cross-connections between the system and the stormwater management system in both the outgoing and return pipe networks;
- prevent loss of product into the environment.

2.0 Definitions

The following terms will be used throughout this manual:

Auditor is defined as the person completing the Protected Agriculture Stewardship – National Auditable Standards.

Chemigation system is defined as all components of the water irrigation system used to apply chemicals to the growing medium of a crop including feedwater and transfer piping, mixing and holding tanks, injectors/pumps, mixing, anti-siphon and backflow devices. Also referred to as fertigation systems.

Closed Chemigation System is defined as a water irrigation system designed to not allow transfer of treated irrigation water outside of the operation as discharges to the environment or stormwater management system. Systems include benches, troughs, flood floors, capture and return lines, catchment tanks, floor drains and waste water lines. Also referred to as a nutrient feedwater collection system or recirculation systems.

Grower is defined as the owner/ operator/ owner's representative of a protected agriculture facility utilizing closed chemigation systems for the duration of the assessment.

Qualified Person (QP) is defined as person with a combination of technical training and experience in greenhouse infrastructure, who is a third party to the farm ownership and arm's length from any levy-based grower organization. If required, the PAS Steering Committee will approve the credentials of any proposed Qualified Person.

Further, a Qualified person may include a plumber with Red Seal certification or Master Plumber Licence (or equivalent), a Professional Engineer and a Certified Engineering Technologist.

Testing Methods are defined as physical testing protocols developed to determine the integrity of the closed-loop system. Physical methods provide the most conclusive results. All testing methods are described in Appendices C through E of this manual. If Growers are unable to complete one of physical testing methods in this guide, they will need to submit a rationale as to why physical methods cannot be used and provide an alternative testing methodology that meets the intent of testing methods included in this guide. Further details can be found in 4.0 Testing Methods.

Protocol C1 is defined as follows:

- a) Operation has undertaken an approved water-management assessment by a third party every six (6) years that demonstrates its chemigation system is closed – this may include a dye test or alternatives.

IF a renovation or reconfiguration of the chemigation system occurs, a water management assessment must be undertaken and passed upon the modifications being completed.

Protocol C1 – Water Assessment Manual (The Manual) is defined as the document describing testing methods to satisfy Protocol C1 prepared by Baird AE.

3.0 Water Assessment Phases

The water assessment has been divided into three (3) phases: prior to the site visit, during the site visit and after the site visit. Each phase is generally described below. Further detailed information is provided in the appendices specific to each testing method.

Prior to Site Visit by QP

- a) Grower representative shall arrange a site visit with the QP. A grower with knowledge of the greenhouses' chemigation and stormwater systems shall attend this site visit;
- b) QP shall provide the Greenhouse Information Summary for completion by grower;
- c) QP shall review aerial images (i.e. Google maps images or equivalent) of the subject property;
- d) Grower, in consultation with QP, shall select desired testing method.

During Site Visit

- a) QP shall review as-built and utility drawings to identify the various chemigation systems and stormwater management systems related to the greenhouse being tested;
- b) QP shall complete Infrastructure Summary and Visual Inspection and Floor Drain Log. Any deficiency that could lead to loss of product to the environment shall be recorded and identified in the report as requiring corrective action;
- c) QP and grower shall complete physical test;
- d) QP shall record results of test;
- e) QP shall provide deficiency list to grower.

After Site Visit

- a) QP shall complete a report per Section 5.0 of this manual and provide to grower;
- b) The QP shall provide written confirmation that the repairs have been completed to the grower. Written confirmation to be attached to report.

4.0 Testing Methods

This document includes physical testing methods. Physical testing is the preferred method for determining the integrity of the closed-loop system. If Growers are unable to complete one of physical testing methods in this guide, they should submit a rationale to Agrichemical Warehousing Standards Association (AWSA) via email at manager@awsa.ca as to why physical methods cannot be used and provide an alternative testing methodology that meets the intent of testing methods included in this guide. AWSA, with guidance from the PAS Technical Working Group, will make a determination as to the rigour of the approach. The QP should work with the Grower to ensure that the proposed alternative approach(es) satisfy Protocol C1. AWSA can provide further guidance on what should be included in an alternative testing method and examples. AWSA will respond to the initial request within five (5) business days.

Although chemigation systems used at each facility vary, it is anticipated that at least one of the following methods shall be suitable.

The physical testing methods presented below are the preferred protocols that will provide the most conclusive results.

Testing methods are described in the following appendices:

Testing Method	Appendix
Dye Testing	C
Fog Testing	D
Pressure Testing	E

5.0 Test Report

In order to satisfy Protocol C1, a report prepared by the Qualified Person documenting the testing method and results is required. This report shall be retained by the grower and provided to the auditor(s) as part of the PAS audit. The report should contain, at a minimum, the following:

1. A statement confirming that testing or verification was required and completed including description of method;
2. The completed Greenhouse Information Summary, Infrastructure Summary and Visual Inspection Log;
3. A complete Testing or Analysis Log and Floor Drain Log for each system tested;
4. A description of deficiencies, timeline for repair(s) and additional tests, if any, required to satisfy C1;
5. The report shall be signed by the Qualified Person who oversaw the testing protocol;

6. Drawing of all chemigation systems tested. Include a separate drawing for each system. Tested fixtures and drains should be labelled on the plan and correspond to those reported in the appropriate testing log and Floor Drain Log. Sample testing logs and floor drain logs are included in Appendix F;
7. Written confirmation of completed repairs, if required. A separate letter may be attached to the report, if required.

6.0 Satisfying Protocol C-1 as part of the PAS – National Auditable Standard

As per the PAS Standards (Full Manual), all protocols must be satisfied for certification to be granted. The PAS audit shall be conducted every two (2) years and the Water Assessment shall be conducted every six (6) years.

The water assessment (Protocol C1) may be completed prior to the PAS audit, after or in parallel. The PAS audit cannot be finalized until the water audit has been completed and a report prepared.

The PAS auditor shall request the water assessment report prepared by the QP. The auditor shall review the document to confirm use of approved testing method, required corrective actions and completion of same.

The auditor shall assign a Yes/ No to Compliance of Protocol C1: Water Management Assessment in Section C: Water Assessment and Equipment Management of the National Auditable Standard auditing document. The auditor shall only assign a passing score once all concerns noted in the report have been addressed and rectified.

APPENDIX A
GROWER INFORMATION SUMMARY

GROWER INFORMATION SUMMARY

Greenhouse Owner Information		
Owner Name	Phone	Email
Address		
Greenhouse Operation Information		
Greenhouse Operating Name		
Physical Address		
Primary Contact	Phone	Email
Municipality		
Types of crops grown/ product description		

APPENDIX B
INFRASTRUCTURE SUMMARY AND VISUAL INSPECTION LOG
FLOOR DRAIN LOG

INFRASTRUCTURE AND VISUAL INSPECTION SUMMARY

Item	Description			Details and Notes
Interior Inspection				
1	Describe incoming water source. Describe treatment steps, if any.			
2	Describe the chemigation system, record type(s) of irrigation system(s) used, irrigation system layout, area covered by each and recirculation system. Obtain as-built and utility drawings for each greenhouse to be tested. Locate the chemigation system drain furthest from the main collection point to ensure entire network is being tested.			
Example	a)	Flood Floors	Area: ha	
	b)			
	c)			
	d)			
	e)			
	f)			
3	Describe additives to irrigation system (i.e. Water, nutrients, pesticides, etc.			

GROWER INFORMATION SUMMARY

Item	Description	Details and Notes
4	Is feedwater used indefinitely? Is storage adequate to contain the excess chemigation water collected or is disposal required? Describe disposal methods.	
5	Describe pesticide application methods, i.e. foliar, if different from irrigation system.	
6	Describe subsurface drainage, if any.	
7	Describe production cycle(s) (i.e. year-round) and when zones may be empty.	

GROWER INFORMATION SUMMARY

Item	Description	Details and Notes
8	<p>Examine each area and room of each greenhouse, particularly those areas where pesticides are stored and mixed including sprayer wash areas and irrigation rooms. Look for drains, pipes, holes in the floor, cracks or gaps in floor, overall maintenance level and care of irrigation system. Determine drain discharge location, if able. Note location (or evidence) of spills. Be aware of skids or objects covering floor drains. Document presence of floor drains in Floor Drain Log. Utilize same Floor Drain Log during physical testing. A site map as required in A1 and E1 of the PAS National Auditable Standards may aid in this process.</p>	
9	<p>Describe any major repairs to the chemigation supply and return system made since the last water assessment.</p>	

GROWER INFORMATION SUMMARY

Item	Description	Details and Notes
Exterior Examination		
1	Describe key exterior features such ditches, ponds, wells. If water level is high, return to inspect when water level is lower. Refer to the aerial images.	
2	Describe visible pipes and identify origin, if able.	
3	Describe evidence of erosion at pipe outlet, if any.	
4	Describe location and volume of septic beds and septic tank.	

GROWER INFORMATION SUMMARY

Item	Description	Details and Notes
5	Review stormwater management plan as-built drawings. Identify all manholes and catchbasins that receive stormwater from the subject greenhouse.	
6	Determine if the stormwater collection system(s) discharge to a stormwater management pond or directly to a receiving watercourse.	
7	Based on above information, is the subject system a closed-loop system?	Y/ N

FLOOR DRAIN LOG

DATE: _____ **FARM NAME AND TEST LOCATION:** _____

AREA DESCRIPTION	FLOOR DRAIN (Y/N)	PHOTO (Y/N)	DRAIN TESTED (Y/N)	TEST RESULTS (IF APPLICABLE)	NOTES
GROWING AREA					
IRRIGATION ROOM					
PESTICIDE STORAGE AREA					
PESTICIDE MIXING AREA					
SPRAYER STORAGE AREA					
SPRAYER WASHING AREA					
OVERFLOW IN SUMP					
ANY OTHER OVERFLOWS					

TEST PERFORMED BY: _____
PRINT NAME

SIGNATURE

**APPENDIX C: PHYSICAL TESTING
DYE TESTING
DYE TESTING LOG**

DYE TESTING

The dye testing method has been described in a document, prepared by Heide Mikkelsen, P.Eng. for the Ontario Greenhouse Vegetable Growers, entitled "Dye Testing for Greenhouse Nutrient Feedwater Facilities: Operation Manual" and dated August 26, 2019. Though written for use in Ontario, minor adaptations allow for use throughout Canada.

Growers in Ontario that have previously used the Dye Testing method presented in the Mikkelsen manual may continue to do so.

In the following method, the term nutrient feedwater collection system is used in place of chemigation system.

Dye Testing Preparation

1. Request and review as-built and utility drawings for nutrient feedwater system(s) and stormwater management system.
2. Examine the nutrient feedwater system(s) and the stormwater collection system(s) for the greenhouse to be tested.
3. Complete Infrastructure and Visual Inspection Summary and Floor Drain Log.
4. Select a day for testing when the water in the pond or watercourse is clear with very low turbidity.
5. Prepare the following materials prior to testing:

a) Tracer Dye

All dyes utilized for testing must be non-toxic, biodegradable and National Sanitation Foundation Certified (N.S.F.). Multiple colours are recommended for complex sites. Dyes that are ultraviolet sensitive, that have not been tested for their effect on produce, should only be used in situations where the collection systems can be completely flushed out and there is no risk of contamination.

- b) Communication devices (radio or cellphone);
- c) Staff to observe the various testing points;
- d) Tools to open manholes, floor drains/covers, sump lids, etc.;
- e) Hose(s) to extend from the water supply to the top end(s) of the nutrient feedwater collection system;
- f) Rubber test ball plug(s) with a diameter matching that of the nutrient feedwater collection system outlet pipe into the sump;
- g) Compressor to inflate test ball to desired pressure;
- h) Flashlight;
- i) Camera;
- j) Blacklight (if using ultraviolet sensitive dye);
- k) Dye Test Log.

Dye Testing Notification and Personnel

1. It is the responsibility of the parties delivering the water assessment to ensure the appropriate agencies and authorities have been notified of testing that may impact local water bodies. Notification shall be provided at least two (2) days prior to commencing the planned testing. This will allow the governing agencies to better handle any public inquiries about unidentified substances in the watercourse.
2. Additional personnel will be required to administer the testing protocol and document the results. Typical roles will include:

- a) Assisting in completion of the Infrastructure and Visual Inspection Summary and Floor Drain Log;
- b) Recording the location and time that dye is introduced into the nutrient feedwater collection system;
- c) Monitoring the nutrient feedwater collection points to observe and document the outcome of the dye testing;
- d) Monitoring and documenting the outcome of the dye testing at the receiving stormwater drains, manholes, catchbasins, pond, etc.

Dye Testing Procedure

1. Mark the location of each fixture where dye is to be introduced on the record drawing. (Note: Drains/fixtures to be tested shall be left to the discretion of the staff present on site. All drains/fixtures within the greenhouse shall be tested unless staff can visually confirm that all the nutrient feedwater pipes drain to the same location.).
2. Ensure that the main nutrient feedwater collection point being tested has been drained (pumped) down prior to any testing commencing.
3. Plug the outlet pipe using the rubber test ball plug at the identified manhole, sump, cleanout, outfall or other appropriate locations needed to fill the nutrient feedwater collection system. Note any sharp protrusions (i.e. Screws) into the pipe as they may puncture the test balls. Ensure the plug is inflated to 25 psi or the maximum pressure stated on the supplier label for the plug.
4. Mix approximately 30mL (2 tbsp) of dye powder (or as directed by the manufacturer's recommendations) with approximately 8L of water and add the mixture to the furthest (highest) collection point in the nutrient feedwater collection system being tested. Repeat the mixing and adding procedure up to 5 times for systems with large nutrient feedwater pipes or systems which travel a long distance to reach the outlet pipe. Make sure to record the time the dye was added on the Dye Testing Log.
5. Begin to fill the nutrient feedwater collection system with a hose at the same collection point that the tracer dye was added. Note the slope of the ground and low points to determine points to check to ensure the system does not overflow and cause a false positive result.
6. Station personnel at the outlet pipe to ensure the rubber test ball plug does not leak or become removed as the water pressure in the system increases.
7. Inspect multiple points along the collection system to ensure dyed water is flowing along the path outlined in the as-built drawings. If water is observed to be flowing without colour from the dye, more dye may need to be added at the highest collection point. The system does not need to be drained to do so, simply add more dye at the same concentration outlined in step 4 and then continue to fill the system.
8. Continue filling the system with water until the lowest collection point in the nutrient feedwater collection system is full. Record the time the system was full on the Dye Testing Log.
9. At this time, the entire stormwater management system must be inspected for any traces of dye. This inspection should be done before the rubber test ball plugs are removed. Record observations on the Dye Testing Log.
10. Once step 9 is complete, remove the plug and ensure that the water draining from the system contains tracer dye (it may take a few minutes for the dyed water to appear as there may have

been some standing water in the system before the test began). Record the time the system was drained on the Dye Testing Log.

11. The entire stormwater management system must then be re-inspected for any traces of dye. Note that at this time traces of dye may be observed from any overflows in the sumps or pumping system. Record observations in the Dye Testing Log.
12. If multiple collection systems feed back to the same main nutrient feedwater collection point, repeat steps 2 through 11 with an alternate colour dye.
12. Review previously completed Floor Drain Log for drain and overflow locations. Record locations on as-built drawings.
13. If floor drains and/or overflows are observed to be in the areas specified, tracer dye must be run through the system at the same concentration as outlined in step 4. Run water through the system following the dye and perform an inspection of the entire stormwater management system. Record observations on the Floor Drain Log.
14. Document all observations and submit report to maintenance staff to fix any deficiencies within the system observed.
15. Once the Dye Testing protocol has been completed, the tested nutrient feedwater collection system must be flushed thoroughly with water until no signs of the tracer dye are visible.

Dye Testing Tips

a) Examples of common dye tracers include:

1. **Coloured Tracer Dye (Powder)**
Name: Blue Tracer Dye (10165)
Red Tracer Dye (11249)

Available from: Plant Products Inc.
1520 Sandhill Dr
Ancaster, ON L9G 4v5
800 387-2449

2. **Fluorescent Tracer Dye**
Name: C.I. Acid Yellow (CAS#528-47-8)

By: Cole Parmer Instrument Company
625 East Bunker Court
Vernon Hills, Illinois 60061
1-800-363-5900

By: Cole Parmer Canada
210-5101 Buchan Street
Montreal QC H4P 2R9
(514) 355-6100

b) Test each drain individually by adding dye to the drain and waiting to observe in manhole or sump before proceeding to the next drain.

c) When multiple colours of dye are utilized, alternate the colours of dye so observers know what coloured water is seen coming from the current drain being tested.

- d) Fluorescent dye tracer will glow in ultra violet light. For those in Ontario, O.G.V.G. has an ultra violet light that can be signed out upon request.
- e) Continue to monitor the Storm Drainage System for hours or even days afterwards to ensure that no leaks or bypasses are detected.
- f) The dye can be neutralized from the solution by adding chlorine. Check manufacturer documentation for ratio of dye to chlorine. Keeping track of the amount of dye used in each case will allow for accurate dosing of chlorine.
- g) Ensure dye is observed at the final nutrient feedwater outfall of the site.
- h) Ensure that dyed water that needs to be removed from the system is properly disposed of and not introduced into the storm drainage system.

Interpreting Testing Results

If dye is observed in the nutrient feedwater sump, cleanout or manhole and no dye is observed in the stormwater management system (i.e. Cleanout, manhole, catch basins or pond), then the test was a success. Ensure that the storm outfall or pond is continued to be monitored on a daily basis until the next rainfall event, in case the storm system was slow to respond. Record the results and submit a report as noted below.

If any dye is observed in the stormwater management system, immediately notify the grower and proceed with the following steps (unless directed otherwise):

- a) Narrow the search by retesting about half of the nutrient feedwater access points.
- b) Keep retesting until it is determined which fixture(s) or drain(s) is cross-connected with the stormwater management system.
- c) Advise the grower to immediately remedy the cross-connected fixture(s) or drain(s) to ensure proper disconnection from the stormwater management system. If this is not possible, the grower should implement mitigation measures to ensure no chemigation water reaches the environment.

DYE TESTING LOG

DATE: _____

FARM NAME AND
TEST LOCATION:

LOC #	LOCATION NAME OR DESCR	COLOUR	AMOUNT OF DYE	TIME DYE IN	TIME FULL SYSTEM	TIME DYE OUT	DYE IN STORM SEWER (Y/N)	DYE IN POND (Y/N)	NOTES
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

TEST PERFORMED BY: _____

PRINT NAME

SIGNATURE

**APPENDIX D: PHYSICAL TESTING
FOG TESTING
FOG TESTING LOG**

FOG TESTING

Fog testing consists of blowing a harmless coloured vapour into the closed loop system and observing where the fog exits from the system.

The fog has no odour, is non-staining, is not harmful to health and will dissipate after a few minutes.

Fog Testing Preparation

1. Request and review as-built and utility drawings for chemigation system(s) and stormwater management system.
2. Examine the chemigation system(s) and the stormwater collection system(s) for the greenhouse to be tested.
3. Complete Infrastructure and Visual Inspection Summary and Floor Drain Log.
4. Prepare the following materials prior to testing:
 - a) Fog testing may be completed by a licenced plumber or technician familiar with this activity. Materials required may include manhole ventilator and fog generator. Organic farms shall confirm with their certifier that incidental contact of fog within the system is allowable.
 - b) Communication devices (radio or cellphone);
 - c) Staff to observe the various testing points;
 - d) Tools to open manholes, floor drains/covers, sump lids, etc.;
 - e) Hose(s) to extend from the water supply to the top end(s) of the system for rinsing after test completion;
 - f) Rubber test ball plug(s) with a diameter matching that of the chemigation pipes and outlet pipe into the sump;
 - g) Compressor to inflate test plug(s) to desired pressure;
 - h) Flashlight;
 - i) Camera;
 - j) Fog Testing Log.

Fog Testing Notification and Personnel

1. Notification shall be provided to appropriate authorities depending on local and provincial requirements. Notification shall be provided at least two (2) business days prior to any planned testing. This will allow the governing agencies to better handle any public inquiries about unidentified substances in or near the watercourse.
2. Additional personnel will be required to administer the testing protocol and document the results. Typical roles will include:
 - a) Establishing test sections, if required;
 - b) Assisting in completion of the Infrastructure and Visual Inspection Summary and Floor Drain Log;
 - c) Recording the location and time that fog is introduced into the collection system;
 - d) Observing the test plug(s) to ensure they do not dislodge during testing;
 - e) Monitoring the collection points to observe and document the outcome of the testing;
 - f) Monitoring and documenting the stormwater management system for signs of fog.

Fog Testing Procedure

1. Using utility drawings, indicate location of each fog entry point. Depending on the size of the system, it may be divided into smaller sections for testing purposes. Use rubber test plug(s) to establish sections.
2. Pump down or drain the section being tested. Standing water in the lines may impede the movement of the fog within the section.
3. Commence testing at the highest point in the section.
4. Insert rubber test plug at the any manhole, sump, cleanout or other location needed to fill the collection system. Ensure that no object will pierce the rubber plug. Inflate per manufacturer's instructions.
5. Introduce fog into system using a manhole ventilator and fog generator. Record time on the Fog Testing Log.
6. Place observers at the downstream end of the section being tested to ensure the rubber test plug does not become dislodged during the test.
7. Observe multiple points along the section being tested to ensure fog is moving through the system. If no fog is observed, continue adding fog to the system or create smaller sections using additional test plugs.
8. Continue filling the system with fog until the lowest collection point in the section or system is full. Record the time the system was full on the Fog Testing Log.
9. Place observers inside and outside the facility. Inspect the stormwater management system. Fog visible from a catchbasin or any part of the stormwater management system indicates a cross-connection with the chemigation system. Fog visible elsewhere may indicate a leak.
10. Upon completion of step 9, remove the plug and allow fog to dissipate. Fog should dissipate quickly.
11. Should multiple collection systems utilize the same collection point, repeat steps 2 to 10 for each section. Allow all fog to dissipate prior to commencing another test.
12. Reference previously completed Floor Drain Log for floor drain and overflow locations. Record locations on as-built drawings.
13. Drains and overflows found in areas listed in step 12, must be tested, unless otherwise determined by the QP or a visual inspection confirms that all chemigation pipes drain to the same location. Introduce fog into these systems and inspect stormwater management system as described in steps 2 to 10. Record observations on Floor Drain Log.
14. Flush system with water thoroughly after testing.
15. Document all observations and list deficiencies. Provide to grower.

Interpreting Testing Results

If fog is observed in the chemigation system and no fog is observed in the stormwater management system or at the pond inlet, the test was a success. Use recorded results to prepare a report as described in Section 5.0 of the manual.

If fog was observed in the stormwater management system or at the pond inlet, immediately notify the grower and repeat the test as follows (unless otherwise directed):

- a) Retest one half of the system or create smaller sections using test plugs. Continue testing until cross-connection is isolated.
- b) Advise the grower to immediately remedy the cross-connected fixture(s) or drain(s) to ensure proper disconnection from the stormwater management system. If this is not possible, the grower should implement mitigation measures to ensure no chemigation water reaches the environment.

FOG TESTING LOG

DATE: _____

**FARM NAME AND
TEST LOCATION:** _____

LOCATION #	LOCATION NAME OR DESCRIPTION	TIME FOG IN	TIME NETWORK FULL	TIME FOG OUT	FOG IN STORM SEWER (Y/N)	FOG IN POND (Y/N)	NOTES
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

TEST PERFORMED BY: _____

PRINT NAME

SIGNATURE

**APPENDIX E: PHYSICAL TESTING
PRESSURE TESTING
PRESSURE TESTING LOG**

PRESSURE TESTING

Pressure testing shall be completed by a licensed plumber or technician familiar with this testing method. Confirm allowable testing pressure with pipe manufacturer and technician prior to commencing test.

Use caution when employing this method.

Pressure Testing Preparation

1. Request and review as-built and utility drawings for chemigation system(s) and stormwater management system.
2. Examine the chemigation system(s) and the stormwater collection system(s) for the greenhouse to be tested.
3. Complete Infrastructure and Visual Inspection Summary and Floor Drain Log.
4. Confirm pipe type and pressure rating prior to commencing test. Confirm desired testing pressure with technician.
5. Prepare the following material prior to testing:
 - a) Compressor with necessary fittings, valves and gauge to fill system with pressure. Coordinate with technician performing the test to ensure all required materials are available and ready for use;
 - b) Staff to observe the various testing points;
 - c) Communication devices (radio or cellphone);
 - d) Tools to open manholes, floor drains/covers, sump lids, etc.;
 - e) Rubber test ball plug(s) with a diameter matching that of the chemigation pipes and the outlet pipe into the sump;
 - f) Compressor to inflate test plug(s);
 - g) Flashlight;
 - h) Camera;
 - i) Pressure Testing Log.

Pressure Testing Notification and Personnel

1. Notification of appropriate authorities is not required for pressure testing.
2. Additional personnel will be required to administer the testing protocol and document the results. Typical roles will include:
 - a) Establishing test sections, if required;
 - b) Assisting with completion of Infrastructure and Visual Inspection Summary and Floor Drain Log
 - c) Recording the location and time of system pressurization;
 - d) Observing test plug(s) to ensure they do not dislodge during pressurization of the system;
 - e) Observing and documenting test outcomes.

Pressure Testing Procedure

1. Using utility drawings, indicate location of point where compressed air will be added to system. Depending on the size of the system, the system may have to be divided into sections for testing purposes. Use rubber test plugs to establish sections.
2. Pump down or drain the section being tested.

3. Insert rubber test plug at the any manhole, sump, cleanout or other location needed to establish and fill the section. Ensure that no object will pierce the rubber plug. Inflate per manufacturer's instructions.
4. Attach pressure gauge, air compressor hose and fittings to a cleanout or similar. Using an air compressor, fill section with air until attached pressure gauge reads the desired test pressure (ex. 5 to 7 psi). If a large section of the system is being tested, it may take hours to fill the section with compressed air.
5. Position observers at the outlet pipe or section end to ensure the rubber test plug does dislodge as the air pressure in the system increases.
6. When desired pressure is achieved, stop adding compressed air to system, remove hose, and record pressure reading and time on the Pressure Testing Log.
7. Set a timer for 15 minutes. The system must hold the desired pressure for 15 minutes. Observers may hear air escaping form the system if there is a leak.
8. After 15 minutes, record pressure gauge reading in the Pressure Testing Log.
9. Open valve to release pressure from system. When gauge reads zero (0), carefully remove plug(s). There may be pressure remaining in the system.
10. Should multiple collection systems utilize the same collection point, repeat steps 2 to 9 for each section.
11. Reference previously completed Floor Drain Log for floor drain and overflow locations. Record locations on as-built drawings.
12. Drains and overflows found in areas listed in step 11 must be tested unless otherwise determined by the QP or a visual inspection confirms that all chemigation pipes drain to the same location. Repeat steps 2 to 9 for each drain and record observations in Floor Drain Log.
13. Document all observations and list deficiencies. Provide to grower.

Interpreting Testing Results

If the test pressure was maintained for the entire 15 minutes in the section being tested, the test was a success. Use recorded results to prepare a report as described in Section 5.0 of the manual.

If the test pressure was not maintained for the duration of the test, immediately notify the grower and repeat the test as follows (unless otherwise directed):

- a) Retest one half of the system or create sections using test plugs. Continue testing until cross-connection or leak is isolated.
- b) Advise the grower to immediately remedy the cross-connected fixture(s) or drain(s) to ensure proper disconnection from the stormwater management system. If this is not possible, the grower should implement mitigation measures to ensure no chemigation water reaches the environment.

PRESSURE TESTING LOG

DATE: _____

FARM NAME AND
TEST LOCATION: _____

LOCATION #	LOCATION NAME OR DESCRIPTION	TEST PRESSURE (psi)	TIME TEST PRESSURE ACHEIVED	PRESSURE AFTER 15 MIN. (psi)	DROP IN PRESSURE (Y/N)	NOTES
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

TEST PERFORMED BY: _____

PRINT NAME

SIGNATURE

APPENDIX F
SAMPLE TESTING LOGS
SAMPLE FLOOR DRAIN LOG

DYE TESTING LOG

DATE: 2022-01-18

FARM NAME AND TEST LOCATION: Ontario Farms - GH1

LOC #	LOCATION NAME OR DESCR	COLOUR	AMOUNT OF DYE	TIME DYE IN	TIME FULL SYSTEM	TIME DYE OUT	DYE IN STORM SEWER (Y/N)	DYE IN POND (Y/N)	NOTES
1	INLET A	BLUE	30mL	9:00am	9:30am	9:45am	N	N	
2	INLET B	RED	60mL	10:00am	10:45am	11:00am	N	N	
3	INLET C	BLUE	30mL	11:15am	11:45am	12:15pm	Y	Y	BLUE DYE AT POND INLET
4	INLET D	RED	90mL	12:30pm	1:30pm	1:45pm	N	N	
5	INLET E	BLUE	120mL	2:00pm	3:15pm	3:30pm	Y	Y	DYE FOUND AFTER DYE OUT
6									
7									
8									
9									
10									
11									
12									

TEST PERFORMED BY: _____

PRINT NAME

SIGNATURE

FLOOR DRAIN LOG - DYE TESTING

DATE: 2022-01-18

FARM NAME AND TEST LOCATION: Ontario Farms - GH1

AREA DESCRIPTION	FLOOR DRAIN (Y/N)	PHOTO (Y/N)	DRAIN TESTED (Y/N)	TEST RESULTS (IF APPLICABLE)	NOTES
GROWING AREA	N	N/A	N/A		
IRRIGATION ROOM	Y	Y	Y	DYE FOUND IN CB	OUTLET LEADS TO CB NE CORNER IRRIGATION ROOM
PESTICIDE STORAGE AREA	N	Y	N/A		VENTILATION & CATCHMENT BIN PRESENT
PESTICIDE MIXING AREA	Y	Y	Y	NO DYE IN SWM	DRAIN PUMPED TO TANK IN IRRIGATION ROOM
SPRAYER STORAGE AREA	N	Y	N/A		IN GROWING AREA
SPRAYER WASHING AREA	N	Y	N/A		IN GROWING AREA
OVERFLOW IN SUMP	Y	Y	Y	DYE AT POND INLET	OVERFLOW DIRECTLY CONNECTED TO POND
ANY OTHER OVERFLOWS	N	N/A	N/A		

TEST PERFORMED BY:

PRINT NAME

SIGNATURE

FOG TESTING LOG

DATE: 2022-01-18

FARM NAME AND TEST LOCATION: Ontario Farms - GH 1

LOCATION #	LOCATION NAME OR DESCRIPTION	TIME FOG IN	TIME NETWORK FULL	TIME FOG OUT	FOG IN STORM SEWER (Y/N)	FOG IN POND (Y/N)	NOTES
1	INLET B TO INLET C	9:00am	9:30am	9:45am	N	N	
2	INLET A TO SUMP	11:30	12:25pm	12:40pm	Y	Y	FOG AT POND INLET
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

TEST PERFORMED BY:

PRINT NAME

SIGNATURE

FLOOR DRAIN LOG - FOG TESTING

DATE: 2022-01-18

FARM NAME AND TEST LOCATION: Ontario Farms - GH1

AREA DESCRIPTION	FLOOR DRAIN (Y/N)	PHOTO (Y/N)	DRAIN TESTED (Y/N)	TEST RESULTS (IF APPLICABLE)	NOTES
GROWING AREA	N	N/A	N/A		
IRRIGATION ROOM	Y	Y	Y	FOG IN CB	OUTLET LEADS TO CB NE CORNER IRRIGATION ROOM
PESTICIDE STORAGE AREA	N	Y	N/A		VENTILATION & CATCHMENT BIN PRESENT
PESTICIDE MIXING AREA	Y	Y	Y	NOFOG IN SWM	DRAIN PUMPED TO TANK IN IRRIGATION ROOM
SPRAYER STORAGE AREA	N	Y	N/A		IN GROWING AREA
SPRAYER WASHING AREA	N	Y	N/A		IN GROWING AREA
OVERFLOW IN SUMP	Y	Y	Y	FOG AT POND INLET	OVERFLOW DIRECTLY CONNECTED TO POND
ANY OTHER OVERFLOWS	N	N/A	N/A		

TEST PERFORMED BY:

_____ **PRINT NAME**

_____ **SIGNATURE**

PRESSURE TESTING LOG

DATE: 2022-01-18

FARM NAME AND TEST LOCATION: Ontario Farms - GH1

LOCATION #	LOCATION NAME OR DESCRIPTION	TEST PRESSURE (psi)	TIME TEST PRESSURE ACHEIVED	PRESSURE AFTER 15 MIN. (psi)	DROP IN PRESSURE (Y/N)	NOTES
1	INLET A TO SUMP	6	9:45AM	6	N	
2	INLET C TO SUMP	6	2:00PM	4	Y	LEAK DETECTED
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

TEST PERFORMED BY: _____
PRINT NAME

SIGNATURE

FLOOR DRAIN LOG - PRESSURE TESTING

DATE: 2022-01-18

FARM NAME AND TEST LOCATION: Ontario Farms - GH1

AREA DESCRIPTION	FLOOR DRAIN (Y/N)	PHOTO (Y/N)	DRAIN TESTED (Y/N)	TEST RESULTS (IF APPLICABLE)	NOTES
GROWING AREA	N	N/A	N/A		
IRRIGATION ROOM	Y	Y	Y	PRESSURE LOSS	OUTLET LEADS TO CB NE CORNER IRRIGATION ROOM
PESTICIDE STORAGE AREA	N	Y	N/A		VENTILATION & CATCHMENT BIN PRESENT
PESTICIDE MIXING AREA	Y	Y	Y	PRESSURE MAINTAINED	DRAIN PUMPED TO TANK IN IRRIGATION ROOM
SPRAYER STORAGE AREA	N	Y	N/A		IN GROWING AREA
SPRAYER WASHING AREA	N	Y	N/A		IN GROWING AREA
OVERFLOW IN SUMP	Y	Y	Y	PRESSURE LOSS	OVERFLOW DIRECTLY CONNECTED TO POND
ANY OTHER OVERFLOWS	N	N/A	N/A		

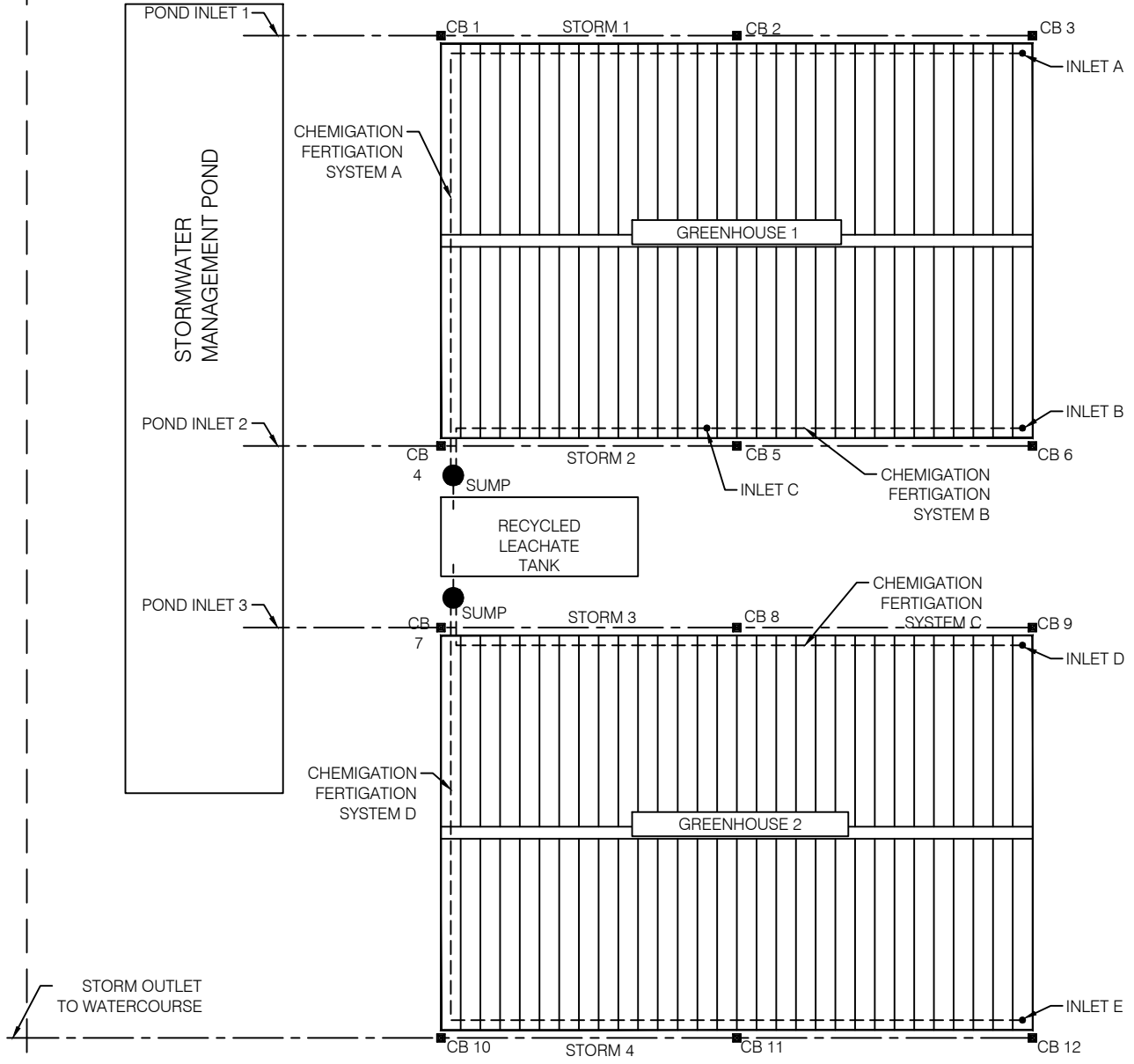
TEST PERFORMED BY:

PRINT NAME

SIGNATURE

**APPENDIX G
SAMPLE DRAWING**

WATERCOURSE



**APPENDIX H
REFERENCES**

REFERENCES

FCO/ OGVG. (2021). *Abatement Plan Worksheet*. Version 8.

Mikkelsen, P.Eng., Heide. (2019). *Dye Testing for Greenhouse Nutrient Feedwater Facilities*. N.J. Peralta Engineering Ltd.

Protected Agriculture Stewardship – National Auditable Standards. (2022). *DRAFT V.11.11.2021*.