

WIHAH Conference

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Water Safety Plans (WSPs)

- Objective: Ensure water is safe for consumption *from the source water through the distribution system*
- Promoted by the W.H.O. in the water guidelines of 2001
 - Designed as a risk assessment tool
 - Not strictly regulatory
- Ubiquitous: tailored to local water conditions
 - Community buy-in





WSP Review

- Iceland
 - Well established, all GW
 - Have different plans based on size of system

1.11.2 Risk assessment - checklist

Risk assessment is made for five components of the water supply system. That involves the catchments area, well-zone, storage reservoirs, pump stations and main pipe, distribution system and connections and finally fire hydrants. Only present those factors that scored 4 or higher in the valuation on probability and severity, others are left out. Following is a checklist for features that may be considered as risk factors:

I Water catchments area

Nr.	Risk factor	Likelihood	Severity	Value	Control and control measures
1	Roads, traffic such as oil trucks				
2	Transport of chemicals				
3	The use of fertilizer e.g. in forestry				
4	Industrial activity				
5	Agriculture e.g. sheep and horses				
6	Storage of chemicals				
7	Road fill				
8	Septic tanks				
9	Ablation				
10	Flood				
11	Approaching flights				
12	Vandalism				

Iceland Risk Scoring System

- Likelihood – how likely an event is to occur within your water system

1 – Less than 1/100 years
2 – 1/100 years
3 – 1/1year – 1/10 year
4 – 1/1 week -1/1 year
5 – More than 1/1 week

- Severity – the severity of an event if it did occur within your water system

1 – Very Little
2 – Little
3 – Average
4 – High
5 – Very High



WSP Review

- Alberta
 - Excel File: four sections
 - Same GCDWQ and national regulations

REFORMAT ALL	INS	Risk Description	Risk I.D.	Hazard	Cause of Potential Failure	Comment	Current Monitoring
Disinfection Risks		Failure of disinfection as a result of failure or lack of automatic shutdown following disinfection process failure	DWSP-T-071	Microbiological contamination	Due to WTW failing to shut down when disinfection fails.		
Disinfection Risks		Inadequate treatment as a result of reduced UV efficiency	DWSP-T-072	Microbiological contamination	Due to reduction transmittance of light due to fouling of lamp sheath or to increase in colour or turbidity	If light transmission is reduced UV becomes less effective.	
Disinfection Risks		Inadequate treatment as a result of inability to meet disinfection requirements due to high chlorine	DWSP-T-073	Microbiological contamination	Due to inability to add sufficient chlorine due to high flow or high		

► ... Source Detail Source Schematic Source Risks Treatment Detail Treatment Schematic Treatment Risks Netw ...

Alberta's Risk Scoring System

- Likelihood – how likely an event is to occur within your water system


0 – Not Applicable
1 – Highly Unlikely
2 – Unlikely
4 – Medium
8 – Probable
16 – Almost Certain

- Consequence – the severity of an event if it did occur within your water system

0 – Not Applicable
1 – Insignificant
2 – Minor
4 – Moderate
8 – Severe
16 – Catastrophic



Risk Scoring

- Alberta Risk Score = **Likelihood** x **Consequence**
 - Iceland Risk Score = **Likelihood** + **Severity**
 - Each Risk Score prioritizes an issue
 - Gives a matrix of possible risk scores
 - **High**
 - **Moderate**
 - **Low**
- 

Risk Matrix (Alberta)

		Consequence Descriptor					
		Not Applicable	Insignificant	Minor	Moderate	Severe	Catastrophic
Likelihood Descriptor	Not Applicable	0	1	2	4	8	16
	Most Unlikely	1	1	2	4	8	16
	Unlikely	2	2	4	8	16	32
	Medium	4	4	8	16	32	64
	Probable	8	8	16	32	64	128
	Almost Certain	16	16	32	64	128	256

Case Study

Collins Park Water Treatment Plant



Source

Fletchers Lake

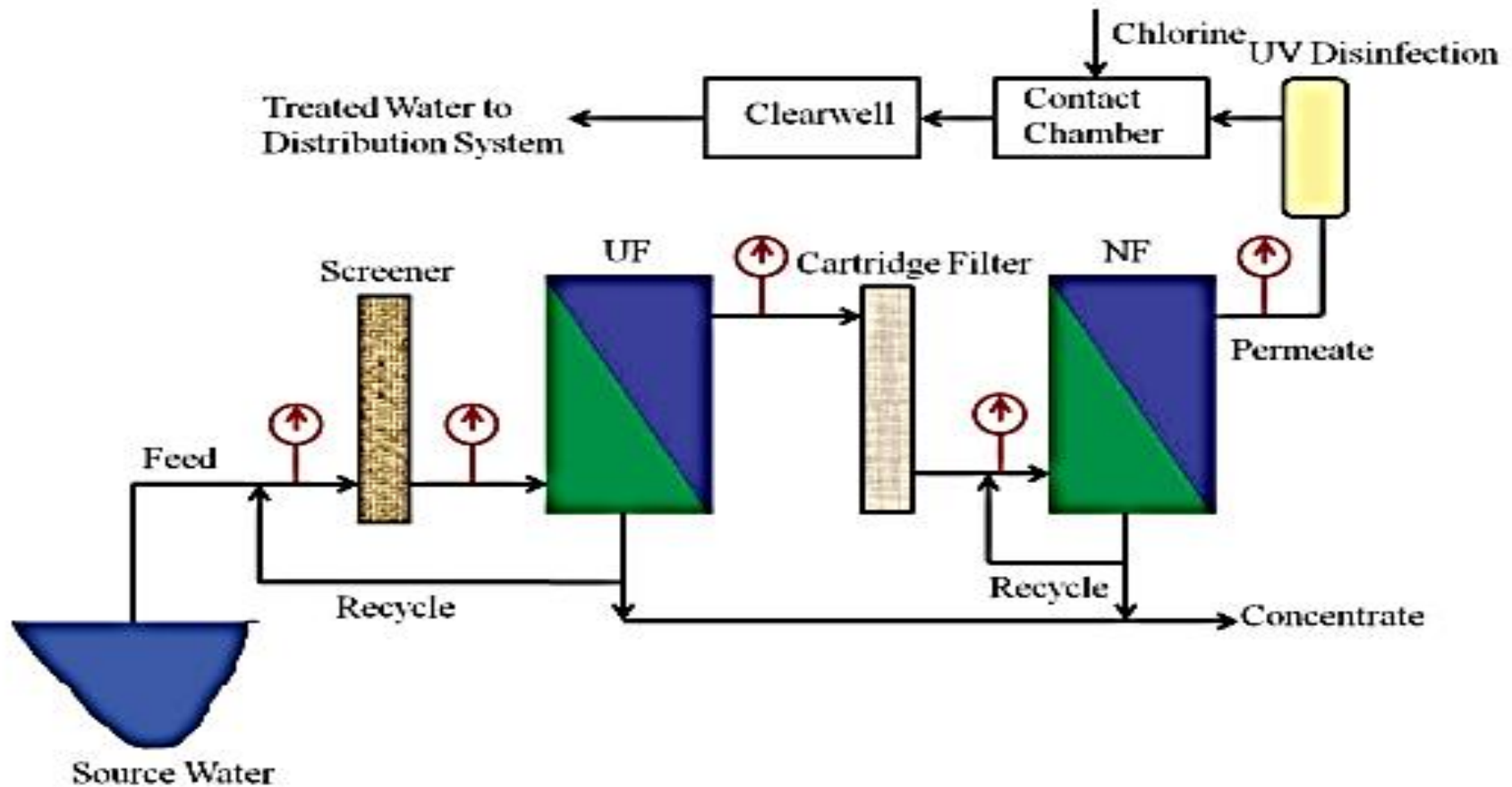
Treatment

Ultrafiltration,
Nanofiltration,
chlorination, UV
disinfection

Serves


313 people

Collin's Park Treatment Schematic





Goals of a WSP at Collin's Park

- Find out whether different scoring systems make a difference in identifying risks
 - *Are the same risks identified?*
 - Assess whether new framework highlights the actual risks that are present within the system
 - Re-evaluate our questions – are we asking the right things
 - *Use operator feedback and input to optimize the way we assess risks*
- 

Example of Question Framework

Likelihood

Do you experience issues with low raw water quantity?

- | | |
|--------|----|
| a) Yes | 16 |
| b) No | 1 |

Consequence

How often do you have leaks in your intake pipes?

- | | |
|-----------------|----|
| a) Frequently | 16 |
| b) Occasionally | 8 |
| c) Rarely | 2 |
| d) Never | 0 |

Example of Question Framework

Likelihood

Do you experience issues with low raw water quantity?

- | | |
|--------|----|
| a) Yes | 16 |
| b) No | 1 |

Consequence

How often do you have leaks in your intake pipes?

- | | |
|-----------------|----|
| a) Frequently | 16 |
| b) Occasionally | 8 |
| c) Rarely | 2 |
| d) Never | 0 |

Issue being identified: Low raw water quantity due to leaks in intake pipes

Likelihood = 16

Consequence = 2

Risk Score = 32

Risk Level= Moderate

Method Under Development

Source Water Quantity

Step 1 of 2: Submit

Has your source water ever provide insufficient water quantity? *

Select an option: ▼

Do you ever exceed water withdrawal permits? *

Select an option: ▼

Do storms or heavy rainfall influence water quantity? *

Select an option: ▼

Have you experienced issues with low influent water pressure? *

Select an option: ▼

Have you ever experienced pump failures? *

Select an option: ▼

Are there ever issues with leaks in raw water mains? *

Select an option: ▼

Online Survey Tool

Easy to use

Users don't see the scores associated with questions

<http://formsmarts.com/form/1qlf?mode=h5>

- Raw data is easier to manipulate
- Changed easily every time you fill out your WSP

30										
31	Source Water Quantity									
32	SWQ L1	SWQ L1.C1	SWQ L1.C2	SWQ L2	SWQ L2.C3	SWQ L2.C4	SWQ L2.C5			
33	No	No - Neve	No - Neve	No	Yes - Rare	No - Neve	No - Never			
34										
35	Source Water Quality									
36	SW L1	SW L1.C1	SW L1.C2	SW L1.C3	SW L1.C4	SW L1.C5	SW L1.C6	SW L1.C7	SW L1.C8	SW L1.C9
37	Yes	Yes	Yes	Medium	Yes - Freq	Yes	No	No	Yes	No
38										

Has your source water ever provide insufficient water quantity? *

Do you ever exceed water withdrawal permits? *

Do storms or heavy rainfall influence water quantity? *

Have you experienced issues with low influent water pressure? *

Have you ever experienced pump failures? *

Are there ever issues with leaks in raw water mains? *

30										
31	Source Water Quantity									
32	SWQ L1	SWQ L1.C1	SWQ L1.C2	SWQ L2	SWQ L2.C3	SWQ L2.C4	SWQ L2.C5			
33	No	No - Neve	No - Neve	No	Yes - Rare	No - Neve	No - Never			
34										
35	Source Water Quality									
36	SW L1	SW L1.C1	SW L1.C2	SW L1.C3	SW L1.C4	SW L1.C5	SW L1.C6	SW L1.C7	SW L1.C8	SW L1.C9
37	Yes	Yes	Yes	Medium	Yes - Freq	Yes				
38							Alberta Scoring System			

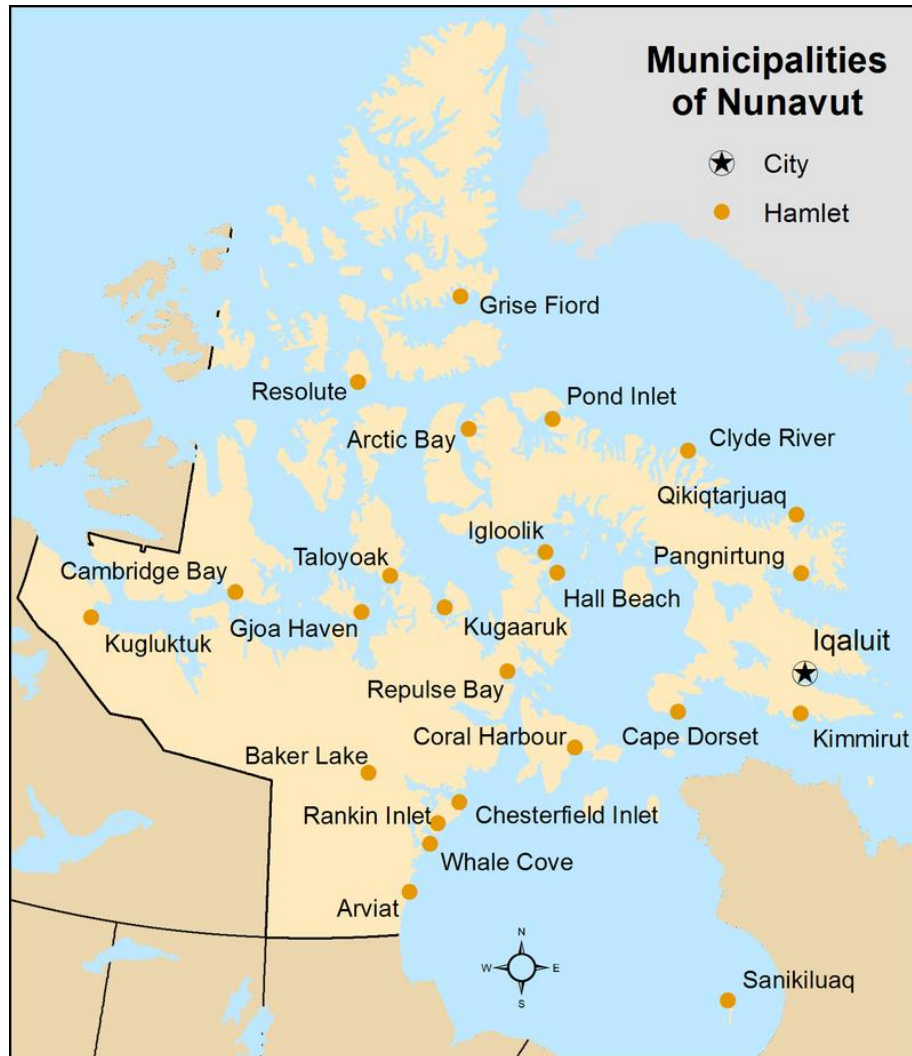
Surface Water Quantity	SWQ L1	Has your source water ever run dry?		No		1			
	SWQ L1.C1		Do you experience high water demand?		No - Never		1	1	Low
	SWQ L1.C2		Do changes in weather influence water quantity?		No - Never		1	1	Low
	SWQ L2	Have you experienced issues with low influent water pressure?		No		1			
	SWQ L2.C3		Have you ever experienced pump failures?		Yes - Rarely		2	0	Low
	SWQ L2.C4		Are there ever issues with leaks in raw water mains?		No - Never		1	0	Low
	SWQ L2.C5		Are there ever damages with intake structures?		No - Never		1	0	Low
	SW L1			Yes					
	SW L1.C1		Are there major highways nearby?		Yes		16	16	Moderate
	SW L1.C2		Are there any septic systems nearby?		Yes		16	16	Moderate
	SW L1.C3		Please rate the security (i.e. from vandalism) of		Medium		8	8	Moderate



Applying a WSP to Nunavut



On-Going Work for WSPs in Nunavut



Very remote
communities

Trucked water

Mix of ground and
surface water



Challenges Unique to Nunavut

- Remoteness
- Highly varied water treatment methods
- Monitoring plans not well defined
- Operator training
- Trucked distribution system



Applying the Alberta DWSP Framework to Nunavut

- Four Sections: Source, Treatment, Network, Customer
- Risks applicable to Nunavut:

Risk Section	Applicable Questions	Total Questions	Percentage Applicable
Source	27	38	71%
Treatment	31	84	37%
Network	20	48	42%
Customer	10	20	50%



Questions Specific to Nunavut

SW L2.1) Is there wastewater infrastructure nearby (i.e. within 30m of a sewer or sewer pipe, within 46m from a septic tank or sewage disposal point, etc.)?

Yes 16

No 0

SW C2.1.1) Have you ever sampled for bacteria?

Yes 1

No 16

SW C2.1.2) Has E.coli ever been found?

Yes 16

No 1

SW C2.1.3) Have you sampled at least once per month for the past five years?

Yes 1

No 16

WSP questions are specific to Nunavut guidelines



Trucked Water Delivery System

- Different from conventional piped distribution system

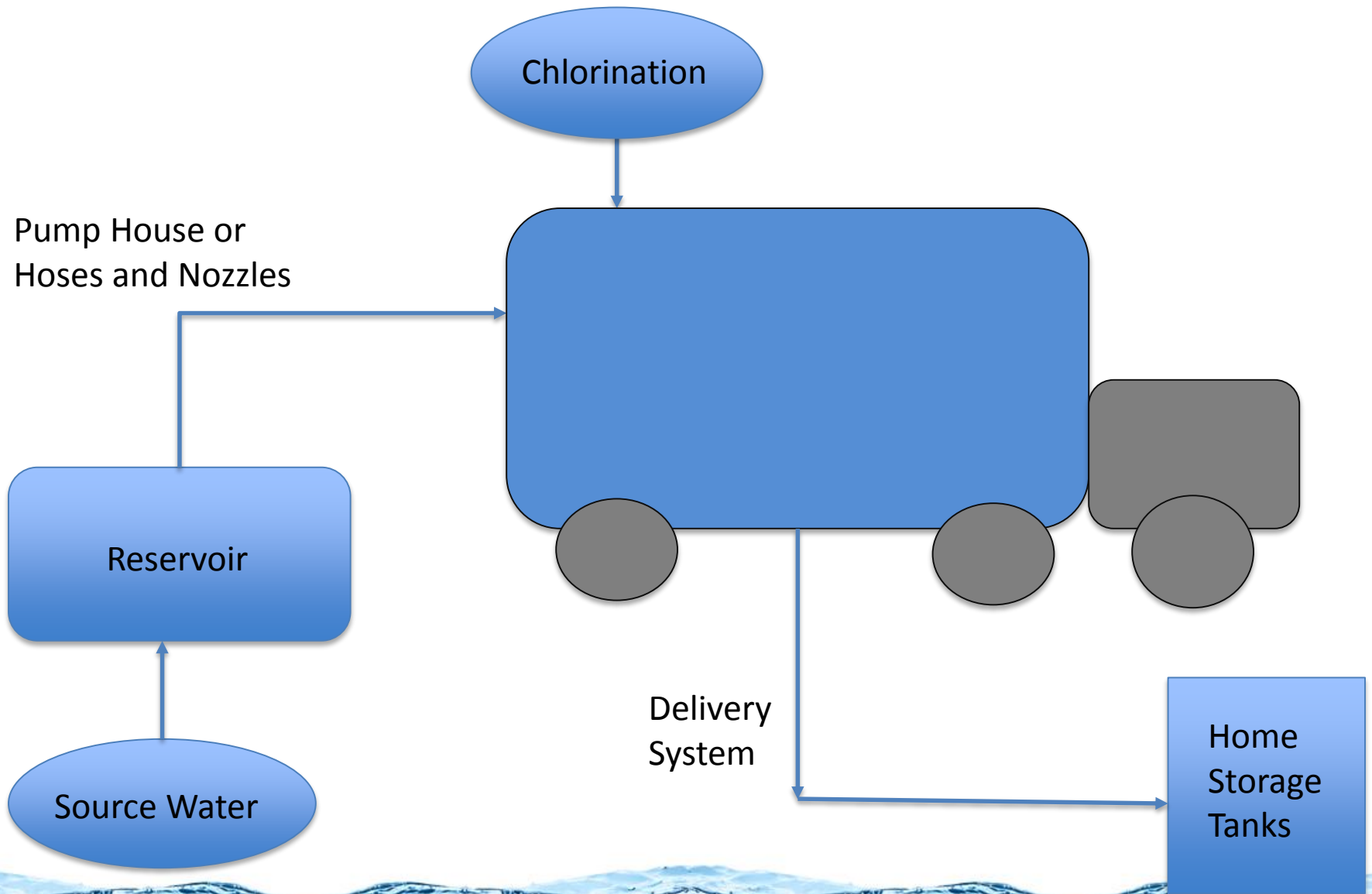


BULK WATER HAULING GUIDELINES

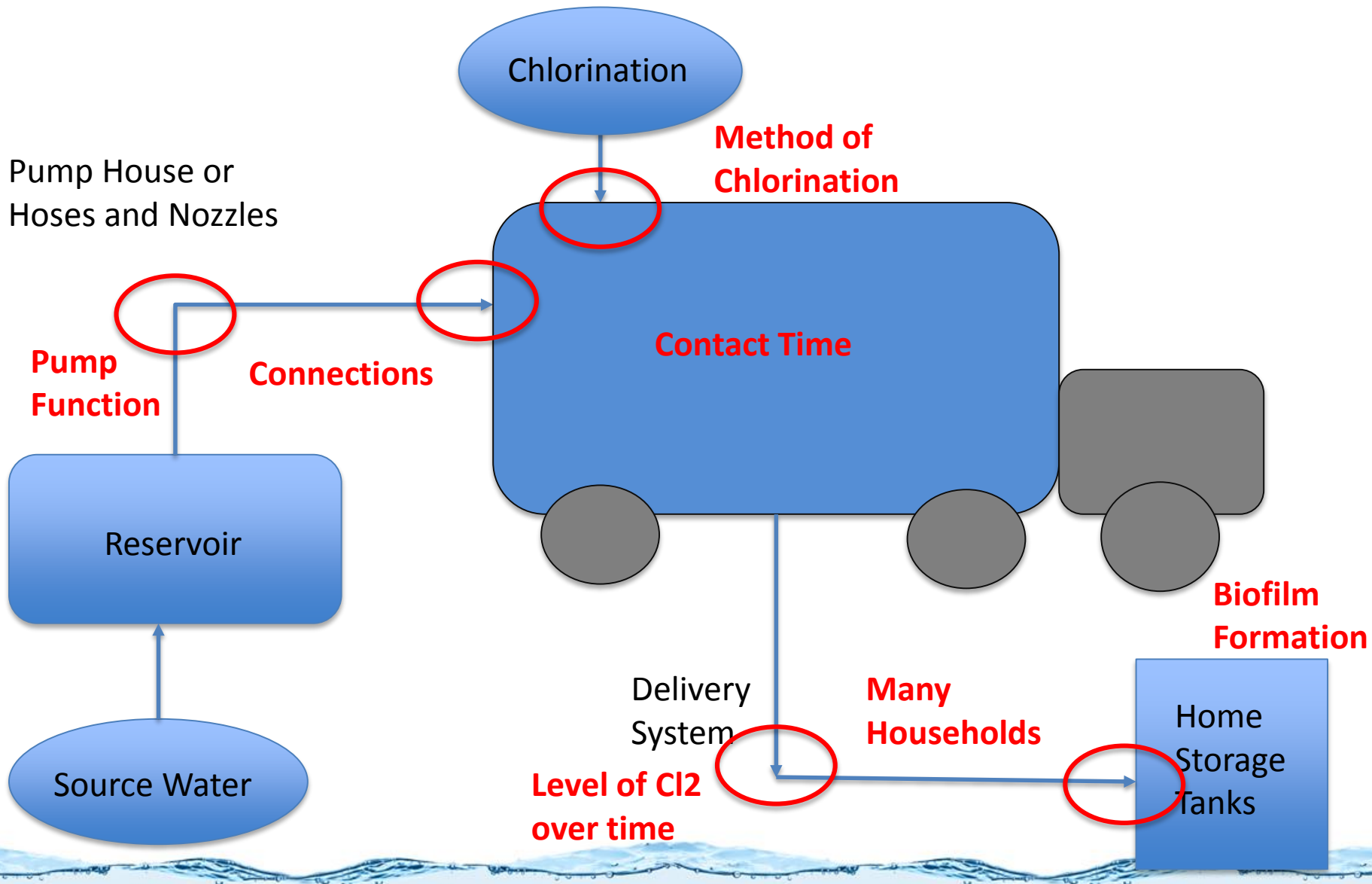
For the purposes of this guideline, “**Bulk Water**” is defined as potable water intended for human consumption that is conveyed and dispensed from an approved transport vehicle (*Water Hauling Truck*).

The water hauling vehicle and associated equipment must be designed, operated and maintained in a sanitary manner to ensure that water does not become contaminated and pose a risk to Public Health.

Trucked Water Delivery System



Trucked Water Delivery System



Trucked Water Survey

- Sections:
 - Connections to truck (pump house and household)
 - Maintenance and Sanitation
 - Chlorination

TWL) Are water delivery trucks used exclusively for treated drinking water?

Yes	1
No	16

TWC) Do water trucks ever carry wastewater (e.g. domestic, industrial, food)?

Yes	16
No	1

Trucked Water Delivery System

Question Code	Likelihood Question	Consequence Question	Likelihood Answer	Consequence Answer	Likelihood Score	Consequence Score	Risk Score	Risk Rating
TW L1	Are water delivery trucks used exclusively for treated (e.g., chlorinated) drinking water?		Yes		1			
TW L1.C1		Is written confirmation from a health officer given prior to using the water delivery truck for substances other than treated drinking water?		No		16	16	Moderate
TW L1.C2		Do water trucks ever carry wastewater (e.g., domestic, industrial, food)?		Yes		16	16	Moderate
TW L1. C3		Do water trucks ever carry untreated freshwater?		No		1	1	Low
TW L2	Are water delivery trucks visually inspected regularly?		No		16			
TW L2.C4		How often are visual inspections of water hauling trucks carried out?		Monthly		4	64	High
TW L2.C5		How often do you find issues (e.g., rust in the tank, leaks) with water hauling trucks?		Rarely		4	64	High



Next Steps

- The developed WSP is in its infancy
 - A first step in preventative drinking water regulations from a **risk management** perspective
- Several additional steps are required to understand how the approach could be best implemented:
 - E.g., pilot-scale application



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waterstudies.

CENTRE FOR WATER RESOURCES STUDIES | DALHOUSIE UNIVERSITY