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QUALITY MANAGEMENT SYSTEM (QMS)

PETERSBURG

DRINKING WATER SUPPLY SYSTEM

OPERATIONAL PLAN

Prepared by:

The Regional Municipality of Waterloo, Water and Wastewater Services - Water Operations and Maintenance

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COMMON DWQMS ELEMENTS

This site specific operational plan is to be read in conjunction with the "Regional Operational Plan", DOCS #447981.

The "Regional Operational Plan" is the main document containing links that reference all common elements and procedures pertaining to the QMS for all Regional drinking water systems. Site specific Operational Plans consist of information pertaining to the specified system.

Table of Common Elements:

1	Quality Management System	12	Communication
2	QMS Policy	13	Essential Supplies & Services
3	Commitment & Endorsement	14	Review & Provision of Infrastructure
4	QMS Representative	15	Infrastructure Maintenance, Rehabilitation & Renewal
5	Document & Records Control	17	Monitoring & Recording Equipment Calibration & Maintenance
7	Risk Assessment	18	Emergency Management
9	Organizational, Roles & Responsibilities	19	Internal Audit
10	Competencies	20	Management Review
11	Personnel Coverage	21	Continual Improvement

Site specific operational plans consist of information pertaining to a specified system. Only elements with site specific information are included in this operational plan.

Table of Site Specific Elements:

6	Drinking Water System
8	Risk Assessment Outcome
16	Sampling, Testing & Monitoring

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6.0 DRINKING WATER SYSTEM

6.1 PURPOSE

Describe RMOW owned and operated drinking water systems, relevant processes/components, raw water source characterization, and critical upstream/downstream processes required for producing safe drinking water.

6.2 BACKGROUND

A healthy public drinking water supply is achieved by the use of the multiple barrier approach. The multiple barrier approach is an integrated system of procedures, processes and tools that collectively prevent or minimize the contamination of drinking water from source to consumer in order to reduce risks to public health.

6.3 GENERAL

The following information is included in the operational plan to ensure that Element 6 requirements are met:

- Drinking water description (including applicable treatment processes and distribution system components)
- Name of the Owner and Operating Authority
- Process flow chart
- Description of source water (including characteristics, common event-driven fluctuations, any operating challenges and/or threats)
- Critical upstream and downstream processes required to ensure safe drinking water
- A summary description of the municipal residential drinking water system is part of
- A summary description of systems connected to one or more drinking water systems owned by different owners indicating:
    - Whether the system obtains water from or supplies water to those systems, and
    - Names of the Owner and Operating Authorities of those systems.

The drinking water system description is updated, as required, and/or when a drinking water system process or component is added or altered.

Note:

Whenever a change is made to the drinking water system infrastructure (added, altered, replaced or removed) the corresponding changes must be communicated by relevant O&M personnel to the QMS Representative to ensure that drinking water infrastructure is accurately reflected in the corresponding operational drinking water description.

6.4 TERMS AND DEFINITIONS

See Regional Operational Plan (DOCS# 447981)

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6.5 PETERSBURG DRINKING WATER SYSTEM

The Region of Waterloo is the owner and operating authority of the Petersburg drinking water system. For subsystem classification and waterworks information please see DOCS# 209965.

Township of Wilmot is the owner and operating authority of the Petersburg distribution system.

6.5.1 Process Description

Ground water source well, PE1, supplies the drinking water treatment system. Sodium hypochlorite solution is added to the source water upstream of the reservoir. The sodium hypochlorite system is designed to effectively deliver chlorine dosages required to achieve primary disinfection within the reservoir and maintain secondary disinfection throughout the distribution system in accordance with the "Procedure for Disinfection of Drinking Water in Ontario".

Table 6-1 Process Component and Description

Process Component		Description
Raw Water Well Supply	• Well PE1	Good ground water source.
Disinfection System	• 2 metering pumps • 1 sodium hypochlorite tank	Metering pumps operate simultaneously. Each metering pump has a sufficient capacity to dose at a rate to establish free chlorine residual that is required to achieve primary disinfection and maintenance of secondary chlorine residual into the distribution system in accordance with the "Procedure for Disinfection of Drinking Water in Ontario."
Reservoir/Storage	• in-ground treated water reservoir	The baffled in-ground concrete reservoir has a total usable volume of 114 m^3 required for disinfection contact time and storage.
High Lift Booster Pumps	• 2 vertical split case centrifugal high lift pumps	The pumps operate in a Duty/Standby configuration to supply water into the distribution system and to pressurize the distribution system. Both pumps rated at 11 L/s @ 48.5 m TDH

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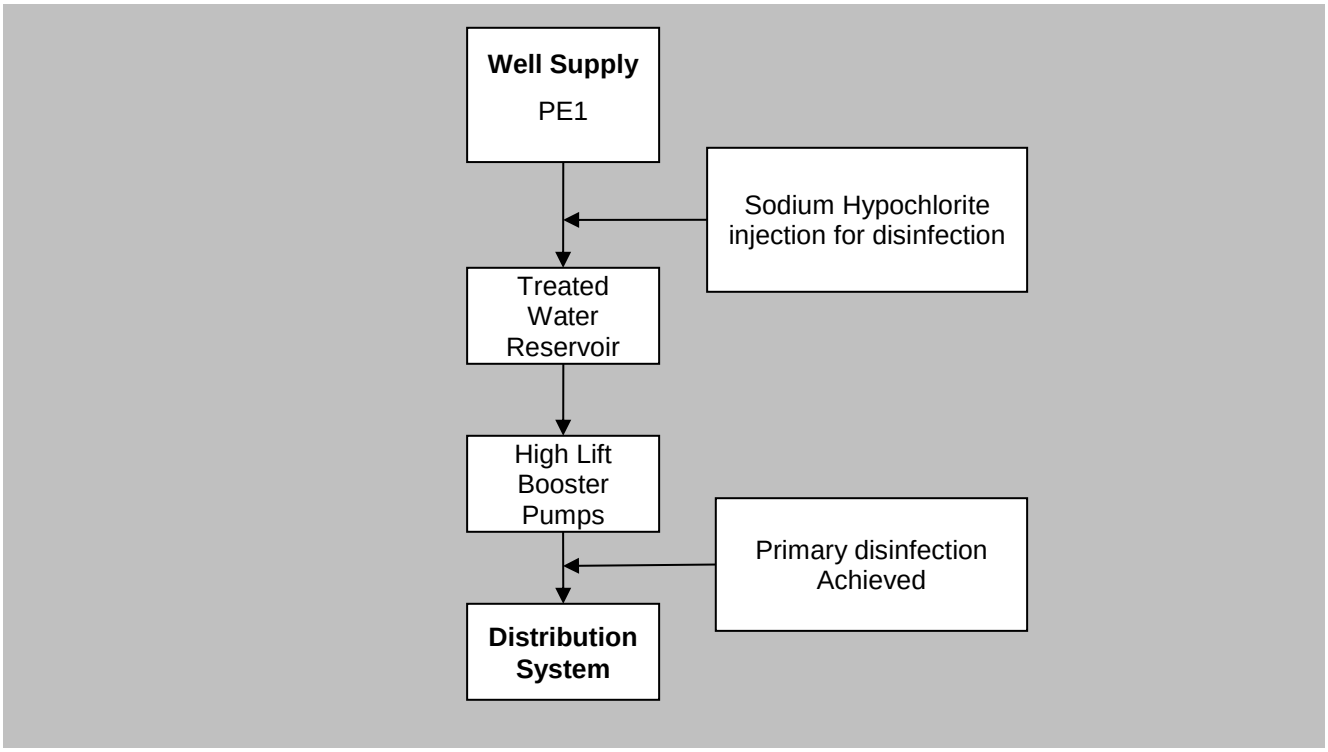

Figure 6-1 Petersburg drinking water system process flow diagram

6.5.2 Raw Water Supply and Characterization

Overall ground water quality is consistent. Ground water testing demonstrates the presence of iron from the well above the aesthetic objective as defined in the Ontario Drinking Water Quality Standard. Raw water characterization is shown in the following table. Drinking water analysis results for raw water microbiological characterization can be found in the Region of Waterloo Annual Water Quality Reports. Refer to “Related Documents” for access to these reports.

Table 6-2 Raw Water Characteristics

Petersburg Raw Water			
Well	**PE1**		
2024	Min	Max	Average
Alkalinity	210	228	216
Iron	0.623	0.666	0.645
Manganese	0.0181	0.0185	0.0183
Sodium	10.2	10.7	10.5

Table 6-3 Petersburg System Well Information

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Raw Water Source Information					Pump Information	
Production Well	**Type** **P=** primary **S=** secondary	**Dia.** (mm)	**Depth** (m)	**Casing Depth** (m)	**S=** submersible **VT=** vertical turbine	**Capacity** @ **TDH** (m)
PE1	**P**	254	71.4	??	**S**	5.7 L/s @ 58.7m

6.5.3 Common Event-driven Fluctuations

Petersburg well supply is a consistent and stable ground water source with little to no fluctuations and does not appear to be affected by weather or seasonal patterns.

6.5.4 Operational Challenges

Operational challenges include maintaining distribution system pressure and continual supply of treated water during power failure and equipment failure.

6.5.5 Monitoring

Continuous analyzers monitor the levels of chlorine prior to the water being discharged. Analyzer data is continuously collected and transmitted to Mannheim Water Treatment Plant SCADA system which is monitored by an operator 24 hours per day.

6.5.6 Distribution System

The Petersburg Drinking Water system provides water to the Petersburg distribution system, owned and operated by Township of Wilmot. Contact the Township of Wilmot for distribution operational plan.

For the population serviced by this Distribution system please refer to the annual Water and Wastewater Monitoring Report. This is a direct pressure system with no elevated storage structures.

8.0 RISK ASSESSMENT OUTCOMES

Requirement for this element is covered by the Regional Operational Plan.
See “QMS Element 8 Procedure – Risk Assessment Outcomes”

- DOCS #500123, in electronic format or

see “Procedural Element” section in QMS Manual for procedure

Table 8-1 and Table 8-2 below provide the risk assessment and risk assessment outcomes for the Petersburg drinking water system

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Risk Assessment Table 8-1 Petersburg Drinking Water System (well PE1)						
Activity/Process & Hazardous Event/Hazard	**Control Measures**	**RV**= LXC **CCP=** R V ≥ 12				**Comment**
		L	**C**	**RV**	**CPP**	
Source Water Quality Changes: • Chemical • Microbiological • Physical • Regulation Changes	• Sampling & testing • Source water protection program • Spill in a Wellhead Protection Area SOP, DOCS #788003 • EELS provides email notification and flags final reports for ½ MAC results. • Standard Practices for Construction within 200m of a Municipal well DOCS# 2071070	3	3	9	No	• May impact on treatment process • Good quality ground water • Only water source, single well with no redundancy • Research and Innovation Committee, working groups discuss potential regulatory impacts
Source water Production Changes: • Well integrity failure Reduced water production	• Continuous monitoring pressure and flow • Inspection • Well rehabilitation program in place • New well connection and replacement protocol in place	3	1	3	No	• Ability to provide alternate supply (tanker truck) • Only water source, single well with no redundancy
Primary Disinfection Chlorination system failure: • Loss of primary disinfection-ineffective pathogen removal	• Continuous monitoring & alarms • Scheduled instrumentation maintenance and verification/calibration • Auto well shut off on disinfection system failure or low chlorine residual • Continuous CT calculator to monitor primary disinfection effectiveness	4	2	8	Yes	• Mandatory CCP • Low chlorine residual • Disinfection system failure

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Risk Assessment Table 8-1 Petersburg Drinking Water System (well PE1)						
Activity/Process & Hazardous Event/Hazard	**Control Measures**	**RV**= LXC **CCP=** R V ≥ 12				**Comment**
		L	**C**	**RV**	**CPP**	
	• Redundant sodium hypochlorite pumps					
Secondary Disinfection Residuals (low) Chlorination system failure: • Loss of secondary disinfection (<0.05mg/L free chlorine residual)-potential bacterial re-growth	• Continuous monitoring & alarms • Scheduled instrumentation maintenance and verification/calibration • EELS provides notification for low residuals obtained when collecting microbiological samples	4	2	8	Yes	• Mandatory CCP • Low chlorine residual
Secondary Disinfection Residuals (high) High distribution chlorine residual: • Taste and Odour/ Customer concerns	• Continuous monitoring & alarms • Customer service SOP-DOCS#460326 • Scheduled instrumentation maintenance and verification/calibration • EELS provides notification for high residuals obtained when collecting microbiological samples	4	2	8	Yes	• CCL = 3.0 mg/L • System-wide controller upgrade program includes high chlorine residual shutdowns

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Risk Assessment Table 8-1 Petersburg Drinking Water System (well PE1)						
Activity/Process & Hazardous Event/Hazard	**Control Measures**	**RV**= LXC **CCP=** R V ≥ 12				**Comment**
		L	**C**	**RV**	**CPP**	
Mechanical, Instrumentation and Electrical Equipment Failure • Reduced water production • Contractor Activity/Human Error	• Continuous monitoring & alarms • Emergency repair readiness • Redundancy • Customer service SOP-DOCS#460326 • Tender Document • ON1Call • Training/awareness	3	2	6	No	• Well pump/motor failure (investigate shelf spares due to only one well) • Leaks from appurtenances
Water Quality Monitoring Communication/RPU/SCADA Failure • Loss of remote continuous monitoring and alarming	• Continuous monitoring & alarms • Automatic control • Loss of SCADA Communication with a Water Supply Facility SOP, DOCS #449257 • Redundancy (Dataloggers)	4	1	4	No	• Manual sampling and testing • Manual operation option • Data Logger • No redundant comms only Bell comms
Utility Power Power Failure Loss of pressure and/or flow: • Potential compromised water quality	• Option to hook up tanker truck to supply the system	4	1	4	No	• Option for tanker truck to supply
Distribution System Watermain break-Loss of pressure and/or flow: • Potential compromised water quality	• Continuous monitoring & alarms • Emergency repair readiness • Ability to isolate and control • Low Pressure Alarm Event SOP, DOCS #449781 • Watermain Repair SOP, DOCS# 477203	2	4	4	No	• Area Municipality responsible for repairs

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Risk Assessment Table 8-1 Petersburg Drinking Water System (well PE1)						
Activity/Process & Hazardous Event/Hazard	**Control Measures**	**RV**= LXC **CCP=** R V ≥ 12				**Comment**
		L	**C**	**RV**	**CPP**	
Distribution Backflow/Water Quality Potential Cross-Connection	• Bylaws • Area Municipality responsible for distribution system	2	2	4	No	• Old homes / private wells • Area Municipality responsible for distribution system
Distribution Water Quality Lead connections/services Flushing/Swabbing Potential compromised water quality	• Sampling and Monitoring • Monitoring pH/Alkalinity	2	2	4	No	• Lead technical bulletin (PIBs #7423e) • Older system
Reservoir Compromised structural integrity • Potential compromised water quality	• Regular inspection program • Suspicious Observation SOP, DOCS#519574	3	2	6	No	• Possible reservoir infiltration/contamination
Security Vandalism/terrorist threat • Potential compromised water quality	• Locked hatches & doors • Suspicious Observation SOP, DOCS #519574 • Routine patrols made by Security provider as requested	2	2	4	No	• Future plans for fences/security system

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Risk Assessment Table 8-1 Petersburg Drinking Water System (well PE1)						
Activity/Process & Hazardous Event/Hazard	**Control Measures**	**RV**= LXC **CCP=** R V ≥ 12				**Comment**
		L	**C**	**RV**	**CPP**	
Security Cybersecurity • Network/cyber attacks • Loss of process visibility • Interruption of data logging • Inability to control systems • Loss of automatic control schemes	• Firewalls, anti-virus, passwords, regular updates, and other protections provided by IT • Backups of PLC files (weekly/monthly) • Backup of SCADA (iFix) and other servers (daily/monthly) • Manually retrieve data from PLC dataloggers	3	2	6	No	Future plans: adding backup servers at a different location, Ignition Edge HMI for local control when comms are down, investigate additional control measures and develop operating procedures for Tenable. Cybersecurity maturity assessment report received. Review recommendations.
Climate Change • Extreme Weather (tornados, ice storms etc.) • Extreme Temperature (freezing/heat wave) • Drought/Flooding	• Source water monitoring • Extreme weather SOP • GRCA flooding alert • GRCA low water response • Conservation By-law	3	1	3	No	

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Risk Assessment Outcomes Table 8-2 Petersburg Drinking Water System (well PE1)			
CCP(s)	**Critical Control Limit(s)**	**Monitoring and Response Processes**	**Response Procedure(s)**
Primary Disinfection • Chlorination • CT (chlorine concentration X time)	SCADA Lo Alarm limit is based on current SCADA alarm setpoints for CT	• Continuous on-line monitoring • Alarm activated when Lo SCADA alarm values are exceeded • Low chlorine well shutdown	• Critical Control Response Protocol DOCS #1127653 • AWQI Response Protocol DOCs #459404 • Primary Disinfection Guideline (CT Spreadsheet)DOC #483459 • Refer to MDWLs DOCS Public Folder # 2138795 for specific disinfection requirements • SCADA Alarm Setpoints DOCS#1567508
Secondary Disinfection Residuals (low/high) • Chlorination • Free Chlorine Residual (FCR)	CCL for low secondary disinfection is 0.3 mg/L and the high CCL is 3.0 mg/L.		

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16.0 SAMPLING, TESTING AND MONITORING

Requirement for this element is covered by the Regional Operational Plan.

See “QMS Element 16 Procedure – Sampling, Testing and Monitoring”

- DOCS #500161, in electronic format or
- See “Procedural Elements” section of QMS Manual

Sampling, testing and monitoring is done according to a “Master Drinking Water Sampling Schedule” updated each year, in accordance with the Safe Drinking Water Act O. Reg. 170/03.

Contact a Water Quality Specialist for the “Master Drinking Water Sampling Schedule”, DOCS #556848.

Any additional or special sampling, testing and monitoring required for this drinking water system can be found in the Master Drinking Water Sampling Schedule.

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RELATED DOCUMENTS

Document	Location, Source or URL
Regional Operational Plan	• DOCS #447981
"Drinking Water Quality Management Standard Guidance Document" – Implementing Quality Management, a Guide for Ontario's Drinking Water Systems.	http://www.ontario.ca/drinkingwater/160420.pdf
Safe Drinking Water Act	http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_02s32_e.htm
O.Reg.170/03	http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_030170_e.htm
O.Reg.169/03	http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_030169_e.htm
Procedure for Disinfection of Drinking Water in Ontario	http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079706.pdf
Water and Wastewater Monitoring Report	https://www.regionofwaterloo.ca/en/regional-government/water-and-wastewater.aspx#Water-and-wastewater-monitoring-reports
DWQMS Procedures	• DOCS Public Subfolder# 878670
Emergency Procedures	• DOCS Public Subfolder# 878588
QMS Related Procedures	• DOCS Public Subfolder# 118350
Information (CT)	• DOCS Public Subfolder# 1331916
QMS Documents Public Folder (all documents and records)	• DOCS Public Folder # 878106
Municipal Drinking Water License (MDWL) and Drinking Water Works Permits (DWWP)	• DOCS Public Folder# 987301
Annual Water Quality Reports	• DOCS Public folder# 964369
Township of Woolwich Operational Plan	• Contact Township of Woolwich

SCHEDULE "C" (SUBJECT SYSTEM DESCRIPTION FORM)

DOCS Public Folder# 3408181

Revise when MDWL is issued.

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REVISION HISTORY

Date	Revision #	Reason
December 20, 2024	4735223v1	• New