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4	Raw water (Source)	External chemical spill (water supply shortfall)	Chemical - Contamination	Monitor & sample Well head protection	1	5	4	20	No	Monitor & sample		EOP 04 - Spills Contingency Plan SOP 17 - Switch to Alternate Well SOP 27 - Consultant Assistance	Install signage indicating no overnight parking	18/11/2019
5	Raw water (Source)	Naturally occurring - (Sudden changes to raw water characteristics)	Biological - Contamination of the aquifer	Monitor & sample Well head protection	1	5	4	20	No	Monitor & sample		SOP 02 - External Water Supplies SOP 17 - Switch to Alternate Well SOP 27 - Consultant Assistance		10/12/2018
6	Raw water (Source)	Naturally occurring - (Sudden changes to raw water characteristics with turbity and pH)	Biological	Monitor & sample Well head protection	1	5	4	20	Yes	Monitor and sample	D3, D4 & D5- Turbidity analyzer - 0.9 NTU alarms out and 1.0 NTU well shutdown, pH must be > 6.5 < 8.5	SOP 17 - Switch to alternate well		10/12/2018
7	Raw water (Source)	Naturally occurring - (Sudden changes to raw water characteristics)	Chemical	Monitor & sample Well head protection	5	3	3	45	Yes	Monitor and sample	Sodium and Flouride	Use Public Health directives and communicate to users		23/11/2020
8	Well	Casing failure (water supply shortfall & sudden changes to raw water characteristics)	Physical - Loss of raw water supply	Alternate well	2	2	2	8	Yes	Monitor & sample	D3, D4 & D5 - Turbidity analyzer - 0.9 NTU alarms out and 1.0 NTU well shutdown	SOP 17 - Switch to Alternate Well		10/12/2018
9	Well 3	Casing failure (water supply shortfall)	Contamination from surface water	Alternate well	2	3	3	18	No	Monitor & sample	D3 - Turbidity analyzer - 0.9 NTU alarms out and 1.0 NTU well shutdown	SOP 17 - Switch to alternate well		10/12/2018
10	Well 4	Casing failure (water supply shortfall)	Contamination from surface water	Alternate well	2	3	3	18	No	Monitor & sample	D4 - Turbidity analyzer - 0.9 NTU alarms out and 1.0 NTU well shutdown	SOP 17 - Switch to alternate well		18/11/2019
11	Well 4 monitoring well	Casing failure	Contamination from surface water		1	1	3	3	No	Monitor		SOP 25 - Well Inspections		18/11/2019
12	Well 5	Casing failure (water supply shortfall)	Contamination from surface water	Alernate well	1	3	3	9	No	Monitor & sample	D5 - Turbidity analyzer - 0.9 NTU alarms out and 1.0 NTU well shutdown	SOP 17 - Switch to alternate well		18/11/2019
13	Well	Pump failure	Physical - Loss of raw water supply	Alternate well	1	1	1	1	No	Maintenance & Inspection		SOP 17 - Switch to Alternate Well SRP 07 - Well Pumps		10/12/2018
14	Well	Pumping system failure	Physical - Loss of raw water supply	Alternate well	1	1	3	3	No	Maintenance & Inspection		SOP 17 - Switch to Alternate Well SRP 07 - Well Pumps		10/12/2018

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15	D4 monitoring well	Security	Physical - Tampering with well head	Security fence, locked cap, weekly security check	1	5	3	15	No	Sample & inspection		SOP 25 - Well Inspections SOP 21 - Water Sampling and Testing SOP 17 - Switch to Alternate Well SOP 03 - Forensic Inspection	Install camera security system	10/12/2018
16	Well	Hydro electric outage	Physical - Generator not operational	D3 Gense -D4 Genset or D5 Genset or Fire system genset (D3)	2	1	1	2	No	Maintenance and testing		SOP 02 - External Water Supplies SOP 23 - Well D3 Generator Testing and Maintenance SOP 24 - Well D4 Generator Testing and Maintenance	Invest in Water Tower	10/12/2018
17	Well	Pre-distribution piping and valves (water supply shortfall)	Physical - Loss of water supply	Alternate well	1	2	3	6	No	Monitoring processes or daily Inspection		SOP 17 - Switch to Alternate Well		10/12/2018
18	Well	Low Well level (Water Supply Shortfall)	Physical - Loss of water supply	Alternate well	1	5	1	5	Yes	SCADA Eramosa	D3 - 2.0 meters D4 - 5.0 meters	SOP 17 - Switch to Alternate Well	To create a procedure regarding drought conditions and water conservation-by-law	10/12/2018
19	Well 3	High Turbidity (water supply shortfall)	Biological and Physical - Loss of water supply	Alternate well	1	2	1	2	Yes		D3 - Turbidity analyzer - 0.9 NTU alarms out and 1.0 NTU well shutdown	SOP 06 - Isolate and Flush		18/11/2019
20	Well 4	High Turbidity (water supply shortfall)	Biological and Physical - Loss of water supply	Alernate well	1	1	1	1	Yes	SCADA	D4 - Turbidity analyzer - 0.9 NTU alarms out and 1.0 NTU well shutdown	SOP 06 - Isolate and Flush		10/12/2018
21	Well 5	High Turbidity (water supply shortfall)	Biological and Physical - Loss of water supply	Alernate well	1	1	1	1	Yes	SCADA	D5 - Turbidity analyzer - 0.9 NTU alarms out and 1.0 NTU well shutdown	SOP 06 - Isolate and Flush		18/11/2019
22	Well D3, D4 & D5	Diesel fuel tank spill (chemical spill impacting source water)	Contanimation of aquafer	Spill contingency plans, double walled tank	1	4	3	12	No	Monitor & sample		EOP 04 - Spills Contingency Plan SOP 17 - Switch to Alternate Well SOP 27 - Consultant Assistance SOP 21 - Water sampling and testing	Secondary containment - risk management plans	10/12/2018
23	Well 3 Ultra-Violet	Failure of redundant units 1 and 2 (water supply shortfall)	Physical - Loss of well water supply	Switch to alternate well	1	1	1	1	Yes	UV PLC and SCADA	<40 mj/cm^3	SOP 34 - Trojan Swift UV Maintenance SOP 35 - Trojan Optiview Maintenance		18/11/2019

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24	Ultra-Violet Optiview	Failure	Physical - UV will go to default settings	Fix optiview	1	1	3	3	Yes	UV PLC	<70% UV transmittancy - shut down <90% UV transmittancy - minor alarm	SOP 17 - Switch to Alternate Well SRP 07 - Well Pumps	Build in redundancy of optiview	10/12/2018
25	Chlorination	Internal chemical major (>10 Litres) spill	Physical - Staff safety	personal protective equipment, secondary containment and spill kit	1	1	3	3	No	Monitoring processes or daily inspection		SOP 05 - Internal spills		10/12/2018
26	Chlorination	Failure of primary system	Physical - Raw well shutdown	Backup equipment	1	1	1	1	Yes	SCADA	D3, D4 & D5 - chlorine pump leak detector - shutdown D4 - <= 0.50 or >= 3.00 mg/l - shutdown D3 & D5 - <= 0.50 or >= 5.00 mg/L - shut down	SOP 18 - Switch to Backup Chlorinator SRP 02 - Chlorination Pumps		18/11/2019
27	Chlorination	Failure of secondary system	Physical - Loss of water supply	Alternate well, weekly testing	1	2	1	2	Yes	SCADA	D3, D4 & D5 - chlorine pump leak detector - shutdown D3 - <= 0.35 or >= 1.90 mg/l - call-out D3 - <= .025 or >= 1.90 mg/l - shutdown D4 - < =0.35 or >= 1.90 mg/l - call-out D4 - <= 0.25 or >= 1.90 mg/l - shutdown D5 - <=0.35 or >= 1.90 mg/L - call out D5 - <= 0.25 or >= 1.90	SOP 17 - Switch to Alternate Well SRP 02 - Chlorination Pumps	To switch to alternate well if low chlorine occurs (Eramosa)	18/11/2019
28	Reservoir - General	Contamination (water supply shortfall)	Physical	Security inspections	1	5	3	15	No			SOP 17 - Switch to Alternate Well SOP 16 - Super Chlorinate and Flush SOP 21 - Water Sampling and Testing		10/12/2018

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29	Reservoir - General	Contamination (water supply shortfall)	Biological	Alternate well	3	5	3	45	No			SOP 17 - Switch to Alternate Well SOP 16 - Super Chlorinate and Flush SOP 21 - Water Sampling and Testing		23/11/2020
30	Reservoir - General	Contamination (water supply shortfall)	Chemical	Alternate well	1	5	3	15	No			SOP 17 - Switch to Alternate Well SOP 16 - Super Chlorinate and Flush SOP 21 - Water Sampling and Testing SOP - 12 Reservior Cleaning		10/12/2018
31	Reservoir - General	Reservoir piping failure	Physical - loss of reservoir, loss of fire protection		3	3	3	27	No		Low reservoir alarm, D3 - 5 meters, D4 -	Notify the Insurance Company, Fire Department. SOP 44 - Water Main Repair Installation		23/11/2020
32	Monitoring equipment - Well 3	Turbidity analyzer failure	Physical - Raw well shutdown	Alternate well	1	1	1	1	Yes	SCADA	D3 - 0.90 NTU - call-out D3 - 1.00 NTU - shutdown	SOP 17 - Switch to Alternate Well SRP 05 - Turbidity Meters		18/11/2019
33	Monitoring equipment - Well 4	Turbidity analyzer failure	Physical - Raw well shutdown	Alternate well	2	1	1	2	Yes	SCADA	D4 - 0.90 NTU - call-out D4 - 1.00 NTU - shutdown	SOP 17 - Switch to Alternate Well SRP 05 - Turbidity Meters		18/11/2019
34	Monitoring equipment - Well 5	Turbidity analyzer failure	Physical - Raw well shutdown	Alternate well	1	1	1	1	Yes	SCADA	D5 - 0.90 NTU - call-out D5 - 1.00 NTU - shutdown	SOP 17 - Switch to Alternate Well SRP 05 - Turbidity Meters		18/11/2019
35	Monitoring equipment	PLC Failure (water supply shortfall, failure of primary and secondary disinfection)	Physical - Loss of water supply	Alternate well	2	1	1	2	No	Monitoring process or daily inspection		SOP 17- Switch to Alternate Well SOP 27 - Consultant Assistance		10/12/2018
36	Monitoring equipment	Pump house Communications Failure	Operational effeciency	manual override operation of wells	3	1	1	3	No	Monitoring process or daily inspection		SOP 09 - Manual Operations	Water tower will have communication availability	10/12/2018

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37	Monitoring equipment	SCADA failure	Physical - Loss of system monitoring and/or data loss	Manual override operation of wells	2	1	1	2	No	Monitoring process or daily inspection		SOP 15 - SCADA, SOP 27 - Consultance Assistance, SOP 09 - Manual Operations		10/12/2018
38	Monitoring equipment	Alarm system failure (auto dialer & telephone line)	Physical - Loss of call-out to operators	Alternate well	2	3	4	24	No	SCADA		SOP 17 - Switch to Alternate Well SRP 01 - Alarm Systems	Add in phone check to weekly security checklist	18/11/2019
39	Distribution	High lift pump failure	Physical - Maintaining fire flow pressure	Alternate pump fire pump system - D3, alternate well	1	2	1	2	Yes	SCADA	D3 - <= 40 or >= 90 psi - call-out D4 - <= 30 or >= 90 psi - call-out, D5 - <= 30 or >= 90 psi - call-out	SOP 17 - Switch to Alternate Well SRP 04 - High Lift Pumps SOP 22 - Fire System Maintenance		10/12/2018
40	Distribution	Water main break (water supply shortfall)	Physical and biological - Loss of service Potential contamination	Throttle water to isolated zone	3	3	3	27	No	SCADA		SRP 06 - Water Main Breaks	We are using the watermain disinfection procedure	10/12/2018
41	Distribution	Low pressure	Biological - Loss of service Potential contamination	Troubleshoot problem, backflow preventers	3	4	1	12	Yes	SCADA	D3 - <= 40 or >= 90 psi - call-out D4 - <= 30 or >= 90 psi - call-out, D5 - <= 30 or >= 90 psi - call-out Distribution - water meter backflow detection	SOP 08 - Low Pressure SRP 06 - Water Main Breaks or SOP 04 - Hydrants	Distribution pressure monitoring	10/12/2018
42	Distribution	No pressure (sustained pressure loss)	Biological - Loss of service Contamination	Troubleshoot problem Determine distribution problem	2	5	1	10	Yes	SCADA	D3, D4 & D5 - < 20 psi - Best Management Practice	EOP 01 - Adverse Water (Loss of Pressure) SRP 04 - High Lift Pumps	Distribution pressure monitor	10/12/2018
43	Distribution	Adverse residual - low	Biological - Adverse water	Daily residual testing	1	4	3	12	Yes	Daily residual testing	< 0.05 mg/l adverse report, rrechloreine pump engages as 0.35 mg/l and shut down at 0.25 mg/l	EOP 01 - Adverse Water (Low Residual) SOP 21 - Water Sampling and Testing		18/11/2019
44	Distribution	Adverse residual - high	Chemical - Adverse water	Daily residual testing	1	4	3	12	Yes	Daily residual testing	> 4.00 mg/l adverse report, well monitoring shuts down at 2.0 mg/l chlorination into distribution	EOP 01 - Adverse Water (High Residual) SOP 21 - Water Sampling and Testing (High Residual)		18/11/2019
45	Distribution	High Turbidity	Biological	Daily inspection Public complaint Weekly Testing	1	4	4	16	No	Visual inspection and testing	adverse conditions > 1.0 NTU leaving pump house, adverse conditions > 5.0 NTU in the distribution system	EOP 01 - Adverse Water (High Turbidity) SOP 21 - Water Sampling and Testing		10/12/2018

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46	Distribution	Cross connections	Biological and Chemical - Contamination	Public education, Back Flow	3	4	4	48	No	Cross connection inspection - 2003, 2004, 2009 & 2010 Water meters with back flow detection, ICI Back Flow preventers installed 2010	Flag of reverse flow from water meter data collection	SOP 21 - Water Sampling and Testing EOP 01 - Adverse Water (Operator initiated) SOP 27 - Consultant Assistance SOP 06 - Isolate & Flush SOP 02 - External Water Supplies SOP 03 - Forensic Inspection		18/11/2019
47	Distribution	Backflow prevention device failure (Standard 2.0)	Biological & Chemical - Contamination	Annual inspection of device, Public education	3	4	4	48	No	Lab testing	Flag of reverse flow from water meter data collection	SOP 21 - Water Sampling and Testing EOP 01 - Adverse Water (Operator Initiated) SOP 27 - Consultant Assistance SOP 06 - Isolate & Flush SOP 02 - External Water Supplies SOP 03 - Forensic Inspection	Trained operator for municipal facilities	10/12/2018
48	Distribution Security	Hydrant access (Standard 2.0)	Physical, Chemical and Biological - Contamination	Lab testing SCADA	3	4	5	60	No			SOP 21 - Water Sampling and Testing EOP 01 - Adverse Water (Operator Initiated) SOP 27 - Consultant Assistance SOP 06 - Isolate & Flush SOP 02 - External Water Supplies SOP 03 - Forensic Inspection	If we suspect an area we can install hydrant locks, also look into bulk water station installation	18/11/2019
49	Distribution	Biofilm	Biological - Concern	Lab testing	1	3	4	12	No	Lab testing		SOP 06 - Isolate and Flush SOP 16 - Super Chlorinate and Flush SOP 27 - Consultant Assistance		10/12/2018
50	General	Failure to receive critical vendor supply	Physical	Alternate suppliers	2	5	3	30	No	Inventory control		SOP 02 - External Water Supplies, EOP 01 - Adverse Water		10/12/2018
51	General	Ability to get samples to Lab	Physical - Regulation compliance	Alternate transportation	3	1	3	9	No	Staff		SOP 21 - Water Sampling and Testing	Ensure that visual check is done next day to verify samples shipped	18/11/2019
52	General	Lab unable to test	Physical - Regulation compliance	Alternate lab	3	1	3	9	No	Lab		SOP 21 - Water Sampling and Testing	Find alternate - remove	10/12/2018

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53	General	Fire flow events	Biological contamination, backflow and low pressure	Operate wells and fire pumps	3	4	4	48	No	Staff		SOP 09 - Manual Operations	Water tower will help with water supply	18/11/2019
54	General	All wells fail (water supply shortfall)	Physical and Biological - Limited or loss of distribution supply	Alternate supplier	1	5	1	5	No	Staff		EOP 03 - Public Communications - Emergency Activate Township Emergency Procedure SOP 02 - External Water Supplies	Water Tower - New Well	10/12/2018
55	Security	Vandalism - distribution system (Standard 2.0)	Physical - Property damage or theft	Building security Security fencing Neighbourhood Watch	2	4	4	32	No	Daily inspections		SOP 03 - Forensic Inspection		10/12/2018
56	Security	Vandalism - pump house (Standard 2.0)	Physical - Property damage or theft	Building security Security fencing Neighbourhood Watch	1	5	3	15	No	Daily inspections		SOP 03 - Forensic Inspection	Install security camera	18/11/2019
57	Security	Terrorism (Standard 2.0)	Physical radiological, chemical and biological - Contamination - pump house - hydrants - reservoirs - private property	Building security Security fencing Neighbourhood Watch	1	5	3	15	No	Inspections & testing		SOP 21 - Water Sampling and Testing EOP 01 - Adverse Water (Operator Initiated) SOP 27 - Consultant Assistance SOP 06 - Isolate & Flush SOP 02 - External Water Supplies SOP 03 - Forensic Inspection		10/12/2018
58	Severe Weather	Severe Weather - Extreme weather events including ice storm	Loss of Water Supply	D3 Genset D4 Genset or D5 Genset or Fire system genset (D3)	3	2	3	18	No			EOP 03 - Public Communications - Emergency EOP 05 - On WARN Activation		10/12/2018
59	Severe Weather	Severe Weather - Extreme weather events including tornado	Loss of Water Supply	D3 Genset D4 Genset or D5 Genset or Fire system genset (D3)	2	5	3	30	No			EOP 03 - Public Communications - Emergency EOP 05 - On WARN Activation		10/12/2018
60	General	Long Term Impacts of Climate Change	Climate Change - flooding		2	2	3	12	No			EOP 01 - Adverse Water EOP 03 - Public Communications - Emergency EOP 04 - Spill Contingency Plan EOP 05 - On WARN Activation		10/12/2018

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61	General	Long Term Impacts of Climate Change	Climate Change - drought	Communication to residents to conserve water	1	5	1	5	No			SOP 11 - Water Conservation EOP 03 - Public Communications - Emergency	To create a procedure regarding drought conditions and water conservation-by-law	10/12/2018
62	General	Sustained extreme temperatures heat wave	Power outage, increased water usage, fires	Communication to residents to conserve water	1	1	3	3	No			SOP 11 -Water Conservation		10/12/2018
63	General	Sustained extreme temperatures deep freeze	Water main breaks, frozen water services	Form 51 - Dundalk Frozen Water Notice	2	3	4	24	No			EOP 03 - Public Communications SOP 37 - Frozen Water Services Frozen Water Policy		10/12/2018
64	Well 5 source water protection	135 Rowes Lane septic system in whpa	Biological		1	2	3	6	No				Connect to sanitary sewer in 2020	18/11/2019
65	Well 5 source water protection	Flato Block 75 sanitary sewer piping (apartment) project	Biological		1	2	3	6	No				Installation of sanitary sewer in 2020	18/11/2019
66	General	Pandemic	Biological - Impact Staff	Social Distancing, PPE	3	4	3	36	No	Monitor for symptoms, complete pre-screening forms		COVID-19 Protocol - engage OCWA (Ontario Clean Water Agency) if needed		23/11/2020