Chapter 9 – Key Findings

9.1 Key Findings in this Assessment Report

This *Assessment Report* represents the culmination of five years of research about sources of *drinking water* in the Cataraqui Source Protection Area (CSPA). The following are some of the key findings by Cataraqui Region Conservation Authority (CRCA) staff and consultants.

9.1.1 Water Quality

- The quality of *surface water* in the CSPA varies between the 12 major *watersheds*. As discussed in Chapter 2, some standards have been exceeded due to natural causes, while the presence of excess *nutrients* is mainly due to human *activities* on the landscape. There are limited data by which to assess groundwater quality. However, the available data suggest problems with bacteriological *contamination* from the surface. As discussed in Chapter 7, climate change may further degrade the quality of our water resources.
- The raw (source) water quality for the 12 municipal residential *drinking water systems* is generally good and only a limited number of *drinking water issues* were identified in Chapters 5 and 6.

9.1.2 Water Quantity

- As reported in Chapter 3, the Tier 1 Water Budget for the CSPA found that some *subwatershed*s may not always have enough available water for all users during the summer months. This information will be helpful for both government and non-government organizations that care for local *subwatershed*s.
- The Tier 2 Water Budget work at the municipal wells at Lansdowne found that while the water level in the wells appears to be falling, the pumps are not in danger of being exposed in the near future, and therefore the stress is low. Additional work in the future to consider the falling water levels is recommended (such as *monitoring* water levels), but the work will not continue on to Tier 3 at this time.
- The Tier 2 exercise for the upper Millhaven Creek *subwatershed* at Sydenham found that the existing and future demand could put significant stress on the water supply; however, it should be noted that the prescribed methods at Tier 2 did not allow consideration for the presence of Sydenham Lake (see Section 3.4.1 for more information).

  As the Tier 2 exercise resulted in a significant stress, it moved to a Tier 3 consideration. The Tier 3 work was able to consider the presence of Sydenham Lake and the whether the withdrawal amount could be met in regular as well as drought conditions. The Tier 3 findings assign a low *risk* level as all simulated scenarios of water use and loss for Sydenham Lake never fell below the critical level. Sufficient water supply is expected for the Sydenham area.
- As discussed in Chapter 7, climate change may reduce the quantity of water that is available to all users.

9.1.3 Groundwater Sources

- The Cataraqui area and adjacent parts of eastern Ontario are characterized by shallow soils and fractured *bedrock*. The movement of groundwater through this *geology* is unpredictable and is governed by the number, size and orientation of the fractures in the rock. Unlike other parts of the province, it is difficult to identify distinct *aquifers* that are separate from their surroundings.
- Due to the *geology* noted above, a majority of the entire CSPA is considered as a *highly vulnerable aquifer* (see Chapter 5). Site specific investigations may confirm the presence of soil and *bedrock* conditions that reduce the vulnerability of the groundwater. Once groundwater is *contaminated*, it can be very difficult and expensive to clean up, and sometimes it can no longer be used as a source of potable water. For these reasons, the vulnerability of the groundwater in eastern Ontario is an important challenge that requires careful attention. We need to ensure that our groundwater resources can be used in the future.
- *Significant groundwater recharge areas* (SGRA) have been identified in Chapter 5 based on the relatively high rate of *infiltration* of *surface water* into the ground in those areas, per Technical Rule # 44(1). *Recharge* occurs in all parts of the Cataraqui area, through the fractures in the *bedrock* noted above. Further research will be required to confirm the extent of the significant areas.
- *Wellhead protection areas* (WHPA) have been identified around the three groundwater-based municipal residential *drinking water systems* in the CSPA, with an acceptable level of certainty (see Chapter 5). Further research (such as tests on *monitoring* wells) has been recommended to improve our understanding of the groundwater that supplies the Cana well supply, the community of Lansdowne and the Miller Manor Apartments. Further work on the Lansdowne wells to identify the source of *contamination*, and to improve the pumping wells to meet Reg. 903 is also recommended.
- Technical work in the adjacent Mississippi-Rideau Source Protection Area found that a small portion of the WHPA ‘D’ for the Westport Water Treatment Plant (WTP) extends into the CSPA.

9.1.4 Surface Water

- The movement of water in the eastern end of Lake Ontario and the upper part of the St. Lawrence River is affected both by the prevailing current towards the Atlantic Ocean and by wind conditions. This means that pollution in the lake and *river* could flow towards the west under some wind conditions. There is the potential for pollution to move through the water across the entire area within a few days.
- Research in the Quinte Source Protection Region found that *intake protection zone* 3 for the Picton WTP extends into the CSPA. Owing to its sheltered location on the Bay of Quinte, this intake is not classified as a Great Lake intake. The IPZ 3 was therefore defined by the Quinte Source Protection Committee based on the total area that directly contributes water to the intake.

9.1.5 Other Key Findings

- Application of the three prescribed methods for defining a *drinking water threat* (see Chapter 4) resulted in relatively few existing *activities* being identified (**Table 9-1**). A total of 114 parcels with significant *drinking water threats* were identified in the ten *intake protection zones* and four WHPAs. A review of the provincial Tables of Drinking Water Threats (MOE, 2009) found that other *drinking water threats* could emerge in the future. Some of these *activities* may be permitted by the current municipal official plans and zoning by-laws.

Table 9-2a (significant *threats*) and **Table 9-2b** (significant, moderate and low *threats*) provide an expanded list of the type and occurrence of *threat activities* that are occurring in each vulnerable area within the CSPA. *Threat activities* present in the tables reflect significant, moderate and low parcels enumerated from **Appendix 'H'**.

Table 9-1: Parcels with Drinking Water Threats Identified within the CSPA

System	Significant	Moderate	Low	Total Parcels	Total Threats
Cana	23	44	9	76	95
Lansdowne	64	106	41	211	256
Miller Manor Apartments	20	22	79	121	185
Brockville	3	293	8	304	356
James W. King (Gananoque)	1	166	12	179	229
Kingston Central	0	1	101	102	113
Point Pleasant (Kingston West)	0	0	10	10	14
Fairfield (Amherstview)	0	7	173	180	223
Bath	0	34	82	116	309
A.L. Dafoe (Napanee)	0	6	21	27	66
Sandhurst Shores	0	7	179	186	344
Sydenham	3	168	5	176	348
TOTAL	**114**	**854**	**720**	**1,688**	**2,538**

Please refer to Chapter 5 and 6 for Westport and Picton threat activities

Table 9-2a Type and Occurrence of Significant Threat* Activities

DWT No.	Drinking Water Threat	Cana	Lansdowne	Miller Manor	Brockville	James W. King (Gananoque)	Kingston Central	Point Pleasant	Fairfield	Bath	A.L. Dafoe (Napanee)	Sandhurst Shores	Sydenham	TOTAL
1	Waste management	-	-	-	-	-	-	-	-	-	-	-	-	**0**
2	Septic system, holding tank	3	3	17	-	-	-	-	-	-	-	-	-	**23**
	Stormwater management	-	-	-	-	-	-	-	-	-	-	-	-	**0**
	Wastewater collection facility (including sewer mainlines; does not include storage tanks)	1	1	-	-	-	-	-	-	-	-	-	-	**2**
	Wastewater treatment (e.g. lagoons)	1	-	-	-	-	-	-	-	-	-	-	-	**1**
3	Application of agricultural source material to land	-	4	-	2	1	-	-	-	-	-	-	3	**10**
4	Storage of agricultural source material	-	2	-	2	1	-	-	-	-	-	-	3	**8**
6	Application of non-agricultural source material to land	-	-	-	-	-	-	-	-	-	-	-	-	**0**
7	Handling and storage of non-agricultural source material	-	-	-	-	-	-	-	-	-	-	-	-	**0**
8	Application of commercial fertilizer to land	-	4	-	-	-	-	-	-	-	-	-	-	**4**
9	Handling and storage of commercial fertilizer	-	-	-	-	-	-	-	-	-	-	-	-	**0**
10	Application of pesticide to land	-	4	-	3	1	-	-	-	-	-	-	3	**11**
11	Handling and storage of pesticide	-	-	-	-	-	-	-	-	-	-	-	-	**0**
12	Application of road salt	-	-	-	-	-	-	-	-	-	-	-	-	**0**
13	Handling and storage of road salt	-	-	-	-	-	-	-	-	-	-	-	-	**0**
15	Handling and storage of fuel	12	49	5	-	-	-	-	-	-	-	-	-	**66**
16	Handling and storage of DNAPLS	2	2	-	-	-	-	-	-	-	-	-	-	**4**
17	Handling and storage of solvents	2	-	-	-	-	-	-	-	-	-	-	-	**2**
21	Livestock pasturing land, outdoor confinement, farm-animal yard	-	2	1	2	1	-	-	-	-	-	-	3	**9**
Corridor Related Threats														
12	Application of road salt on roads	-	-	-	-	-	-	-	-	-	-	-	-	**0**
local	Transportation of fuel	-	-	-	-	-	-	-	-	-	-	-	-	**0**
local	Transportation of pesticides	2	2	1	-	-	-	-	-	-	-	-	-	**5**
local	Transportation of DNAPLs	5	2	1	-	-	-	-	-	-	-	-	-	**8**
local	Transportation of organic solvents	2	2	1	-	-	-	-	-	-	-	-	-	**5**
	TOTAL	**30**	**77**	**26**	**9**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	
	OVERALL TOTAL	**158**												

* Multiple significant threats can occur in a land parcel (there are 114 land parcels with significant threats in the CSPA representing 158 significant threats within these parcels).

Table 9-2b Type and Occurrence of Significant, Moderate and Low Threat* Activities

DWT No.	Drinking Water Threat	Cana	Lansdowne	Miller Manor	Brockville	James W. King (Gananoque)	Kingston Central	Point Pleasant	Fairfield	Bath	A.L. Dafoe (Napanee)	Sandhurst Shores	Sydenham	TOTAL
1	Waste management	-	-	-	-	-	-	-	-	1	1	-	-	**2**
2	Septic system, holding tank	14	5	102	166	45	-	-	62	27	11	141	139	**712**
	Stormwater management	-	-	-	1	-	-	-	3	6	-	-	-	**10**
	Wastewater collection facility (including sewer mainlines; does not include storage tanks)	1	1	-	2	5	1**	1	1	3	-	-	1	**16**
	Wastewater treatment (e.g. lagoons)	1	1	-	-	-	-	-	-	-	1	-	-	**3**
3	Application of agricultural source material to land	-	12	2	2	1	-	-	2	29	3	25	3	**79**
4	Storage of agricultural source material	-	2	1	2	1	-	-	2	14	3	9	3	**37**
6	Application of non-agricultural source material to land	-	-	-	-	-	-	-	-	3	1	1	-	**5**
7	Handling and storage of non-agricultural source material	-	1	-	-	-	-	-	-	-	-	-	-	**1**
8	Application of commercial fertilizer to land	-	12	2	4	1	-	-	1	33	3	25	3	**84**
9	Handling and storage of commercial fertilizer	-	1	-	5	2	-	-	1	14	2	6	2	**33**
10	Application of pesticide to land	-	12	2	4	1	-	-	1	33	3	25	5	**86**
11	Handling and storage of pesticide	-	-	-	2	1	-	-	1	1	1	-	1	**7**
12	Application of road salt	2	-	-	-	-	-	-	11	6	1	-	5	**25**
13	Handling and storage of road salt	-	1	1	3	2	-	-	1	1	1	-	3	**13**
15	Handling and storage of fuel	35	160	56	11	24	3	2	21	34	12	70	141	**569**
16	Handling and storage of DNAPLS	3	2	-	7	11	18	2	1	3	1	-	-	**48**
17	Handling and storage of solvents	3	2	1	9	14	8	2	5	18	4	5	1	**72**
21	Livestock pasturing land, outdoor confinement, farm-animal yard	-	4	1	2	1	-	-	2	13	3	9	3	**38**
Corridor Related Threats														
12	Application of road salt on roads	10	16	7	63	52	50	3	46	29	2	12	14	**304**
local	Transportation of fuel	11	18	7	64	53	7	4	47	29	4	13	15	**272**
local	Transportation of pesticides	5	2	1	3	5	-	-	5	4	3	1	3	**32**
local	Transportation of DNAPLs	5	2	1	3	5	13	-	5	4	3	1	3	**45**
local	Transportation of organic solvents	5	2	1	3	5	13	-	5	4	3	1	3	**45**
	TOTAL	**95**	**256**	**185**	**356**	**229**	**113**	**14**	**223**	**309**	**66**	**344**	**348**	
	OVERALL TOTAL	**2,538**												

*Multiple threats can occur in a land parcel. ** A combined sewer network exists for the Kingston Central IPZ

- The evaluation of available *source water* quality information identified naturally occurring *drinking water issues* such as *hardness* at all *drinking water systems*, but very few *issues* potentially related to human *activities* (**Table 9-3**).

Table 9-3: Drinking Water Issues related to Human Activities

System	Drinking Water Issues with Possible Link to Human Activities
Cana	Chloride, sodium
Lansdowne	Total coliform, *Escherichia coli*
Miller Manor Apartments	Chloride, sodium, nitrate, total coliform, *Escherichia coli*
Brockville	*Escherichia coli*
James W. King (Gananoque)	--
Kingston Central	--
Point Pleasant (Kingston West)	--
Fairfield (Amherstview)	Total coliform
Bath	Organic nitrogen, *Escherichia coli*
A.L. Dafoe (Napanee)	--
Sandhurst Shores	--
Sydenham	Dissolved organic carbon

Research for this *Assessment Report* was constrained by *data gaps* described in detail in **Appendix 'K-1'**. *Data gaps* exist where it was not possible to fulfil a requirement of the Technical Rules: Assessment Report (MOE, 2009a) in this edition of the report. The primary solution for filling these gaps is additional field *monitoring*, both on a short-term project basis and on a longer-term program (network) basis. As outlined in **Appendix 'K-2',** there are also opportunities for the broader improvement of the document through additional information gathering and analyses.