AUSABLE BAYFIELD MAITLAND VALLEY SOURCE PROTECTION REGION

SOURCE PROTECTION TECHNICAL STUDY: DRINKING WATER QUALITY THREATS ASSESSMENT

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October 20, 2009

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File No. 06083

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1.0 INTRODUCTION

1.1 Purpose of the Report

Section 1.1 of Ontario Regulation 287/07 to the *Clean Water Act, 2006* prescribes a series of land use activities which represent risks to the quality of drinking water sources. The Act also mandates that as a component of the Drinking Water Source Protection (SP) program, SP Authorities must conduct an evaluation of potential threats to drinking water within designated vulnerable areas (e.g., well head protection areas, water intake protection zones).

This report describes the threats assessment process carried out for the Source Protection Technical Study (Technical Study); a SP initiative conducted by Waterloo Numerical Modelling Corporation, B. M. Ross and Associates Limited and International Water Consultants Limited on behalf of the Ausable Bayfield Maitland Valley (ABMV) SP Region. The Technical Study has been undertaken (1) to delineate and characterize the Well Head Protection Areas (WHPAs) for most municipal well supplies in the ABMV SP Region and (2) to assess the potential drinking water threats within these specific vulnerable areas. The aforementioned activities form 'Part 1' and 'Part 2' of the Technical Study, respectively.

The threats assessment report addresses Part 2 of the study methodology and incorporates the following major components:

- An overview of the process to inventory land use activities within WHPAs.
- A summary of the process carried out to identify and categorize threats to source water.
- A description of the major assumptions for assigning threats to land use activities.
- An outline of results from the threats assessment process.
- A synopsis of key study findings and related observations.
- A review of considerations for future risk assessments.

It is anticipated that the findings of this assessment program will provide the ABMV SP Committee with a basis for evaluating significant water quality threats within the designated WHPAs. In this regard, the ABMV SP Committee will be responsible for coordinating additional investigations to confirm the nature and significance of those potential risks to source water inventoried in the Technical Study.

1.2 Assessment Framework

In 2006, the Ministry of the Environment (MOE) introduced draft modules to provide SP Authorities with guidance for the delineation of WHPAs and the assessment of risks to source water within these designated areas. The methodology employed for the threats assessment process detailed in this report built upon the framework and protocols defined in Draft Guidance Module 5 and Draft Guidance Module 6. Module 5 described the process to compile an inventory of potential drinking water threats within these vulnerable areas. Module 6 detailed the process to evaluate the significance of these threats and to ultimately determine potential risks to source water. Collectively, the requirements of these modules formed the general methodology of the threats assessment program employed for the Technical Study. However, the specific assessment program conducted for the threats evaluation was completed in accordance with the MOE Technical Rules for SP Region Assessment Reports. These protocols, issued in December 2008, supersede the draft modules.

The assessment program established for this project incorporated six general phases:

1. Inventory land uses and pathways (e.g., private wells, watercourses).
2. Identify and prioritize threats associated with land uses.
3. Associate contaminants (chemical, pathogen) with each identified threat.
4. Assess the risk for each threat based upon contaminant threat.
5. Assign risks for individual properties (i.e., conduct risk assessment at a parcel scale).
6. Categorize threats and identify prioritizes for further assessment and evaluation.

The following section of the report outlines the various components of the study methodology.

2.0 THREATS INVENTORY

2.1 Delineated WHPAs

The first component of the risk assessment process involved assembling an inventory of all land use activities occurring within those municipal WHPAs included in the Technical Study (i.e., the 'study area'). As specified by the MOE, the inventorying process required the compilation of relevant, property-level data for all parcels of land situated within individual WHPAs. A total of 28 WHPAs were incorporated into the study area; encompassing the capture zones of 44 municipal wells (as presented in Appendix A). The associated vulnerable areas extend over approximately 185 km^2 and include lands in Huron, Perth, Bruce and Wellington Counties. It is important to note that there are relatively few municipal wells in operation within the southern portion of the ABMV SP Region, as most municipal water systems in this area are supplied via the Lake Huron Primary Water Supply System. Figure 2.1 illustrates the general location of those WHPAs incorporated into the Technical Study.

N

Lake Huron

Bruce County

Grey County

Wellington County

Huron County

Perth County

Huron Sands

Wingham

Clifford

Harriston

Dungannon

Palmerston

Belgrave

Molesworth

Gowanstown

Auburn

Century Heights

Benmiller

Blyth

Brussels-Well#2

Listowel-Well#5

Listowel-Well#4

Brussels-Well#1

Listowel-Well#6

Atwood

McClinchey

Kelly

Clinton

Van de Wetering

S.A.M.

Carriage Lane

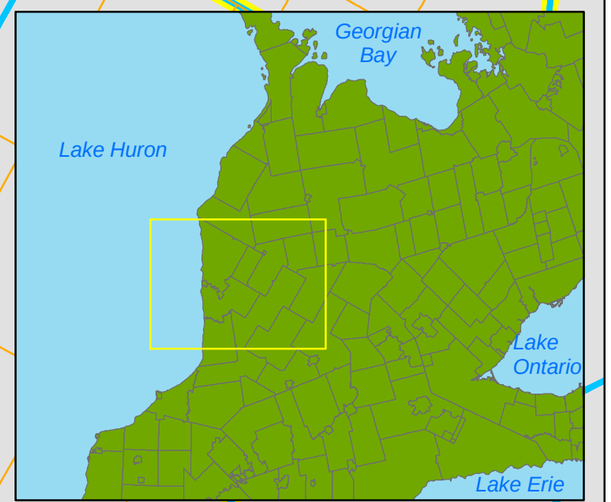
Harbour Lights

Brucefield

Zurich

Legend

- County Road
- Provincial Highway
- WHPA
- Lower Tier Boundary
- Upper Tier Boundary



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ABMV Source Protection Technical Study

General Location Plan: Wellhead Protection Areas

DATE	PROJECT No.
May 8, 2009	06083
SCALE 1:275 000	FIGURE No. 1

Approximately 7,500 properties are situated within the delineated well head capture zones, as well as a multitude of transportation corridors and watercourses. A wide variety of land uses are evident on these lands and, in many cases, multiple activities occur on individual properties. In summary, the vulnerable areas incorporated into this assessment are composed of these broad land use types:

- 909 Agricultural Activities. Total Area: 11,531 ha (65.4% of total landbase).
- 5,506 Residential Activities. Total Area: 816 ha (4.6%).
- 885 Commercial/ Industrial/ Institutional Activities. Total Area: 438 ha (2.5%).
- 983 Open Space/ Recreation Activities: Total Area: 4,146 ha (23.5%).
- 36 Transportation Activities: Total Area: 699 ha (4.0%).

2.2 Data Assembly

a) Desktop Review

At the outset of the inventory phase of the data assembly process, a 'desktop' review was carried out to compile all relevant technical information available for the study area. Several sources of spatial data were ultimately assembled into a geographic information system (GIS) platform, most notably:

- Municipal Property Assessment Corporation (MPAC) parcel information.
- WHPA mapping delineated during earlier phases of the Technical Study.
- MOE Contaminant Source Inventory (CSI) data (containing information on fuel storage, landfills, records of contaminant spills).
- Municipal and private well records (MOE/ ABCA/ MVCA).
- Natural heritage (woodlots/ wetlands) and watercourse mapping (ABCA/ MVCA).
- Land Use Planning Data (Official Plan/ Zoning Information).
- Digital Aerial Photography (2006).
- Universal Transverse Mercator (UTM) coordinates.

Base plans were subsequently developed to provide a visual representation of potential drinking water threats within each WHPA. These plans were used for reference purposes during field research.

b) Windshield Surveys

The data compiled within the GIS platform required field verification and refinement at a parcel scale. Field surveys were therefore carried out to confirm land use activities, to augment basic property descriptions and to identify possible contaminant sources. As on-site investigations were not permitted under the terms of the guidance modules and were not incorporated into the scope of the Technical Study, 'windshield' surveys were employed to assess land use activities in the designated areas.

The windshield survey program was carried out for all lands within the designated WHPAs, on an intermittent basis, between June 2007 and September 2009. Survey work was conducted by a compliment of two staff members. The second staff member was provided to simplify the recording process and to provide support for field verification (e.g., confirmation of land use activities, identification of possible sources of contamination). Several activities were carried out during the course of the windshield survey work, most notably:

- Verification of basic site details (e.g., existing land use activities, UTM coordinates).
- Identification of potential contaminants on-site and on adjacent lands, including the approximate location of contaminant sources.
- Photologging of land use activities, natural features and unique features (e.g. wells, adjacent storm sewers).

All data and photographs gathered from the field assessment process were incorporated into the GIS platform to augment data assembled through the desktop analysis.

2.3 Threats Evaluation

a) Land Use Categories

Following assembly of the WHPA parcel inventory, a process was conducted to categorize the type, or types, of land use occurring on each of the identified properties relative to the defined WHPA capture zones (e.g., WHPA-A, WHPA-B). Three activities were carried out in this respect:

1. Land Use Fragmentation. Larger parcels (e.g., agricultural parcels) were fragmented into distinct activities based upon aerial photograph interpretation. In most instances, the fragmentation involved separation of main buildings (e.g., farm dwellings, barns) from the larger land base (e.g., farm fields). Each resultant parcel fragment was encoded with a unique parcel identification in order to differentiate specific activities on the same parcel.

2. WHPA Fragmentation. Additional parcel fragments were established in situations where the lot boundaries of parcels extend across multiple capture zones. This fragmentation procedure is required in order to assign different threat levels for land use activities based upon the applicable WHPA zone (discussed in section 3.1 of this report). All resultant fragments were assigned unique parcel identifications.

3. Land Use Classification. Land uses classes for all parcel fragments were established following a review of North American Industry Classification System (NAICS) codes, as provided to SP Regions by the MOE. In most situations, the identified land uses directly corresponded to specific NAICS codes. Approximately 140 NAICS codes were assigned to land uses within the delineated WHPAs. An additional 16 supplementary codes were established (1) to address circumstances where NAICS codes were not directly applicable or (2) to better reflect the types of land uses evident in the study area (e.g., farmstead, cropland, railroad corridor).

As an outcome of this process, all parcel fragments in the WHPAs were assigned a specific activity code relating to the particular land use and/or the specific location of this fragment relative to the defined WHPA zone. Approximately 13,800 parcel fragments were inventoried within these vulnerable areas.

b) Assessment of Threats

As discussed, Section 1.1 of Ontario Regulation 287/07 prescribes 19 activities which are classified as threats to drinking water quality. The significance of these threats is defined in chemical and pathogen threats tables developed by the MOE and posted as Regulation. Within these tables, a multitude of descriptive 'circumstances' are provided for each prescribed threat. Individual circumstances incorporate threat values based upon the location of the subject lands relative to the WHPA zones and vulnerability scores established during earlier phases of SP planning. Threats are classified by the MOE as 'Significant', 'Moderate' or 'Low'.

As a guideline, the MOE has provided tables which define a specific set of prescribed threats for each particular NAICS code. These lists of applicable threats were utilized as the framework for assessing the potential drinking water risks attributable to individual land use types. In certain situations, threats were either added or removed from a general land use type depending upon the local context. No site-specific modifications were made to the threats list. It is anticipated that through the course of future investigations by the ABMV project team, the set of applicable threats will ultimately be refined for particular land use types and/or individual parcels.

A review was subsequently carried out to identify the most appropriate circumstance for each threat related to a particular land use code. Given the limited availability of site-specific information, a 'worst-case' scenario model was employed to select an applicable circumstance for each prescribed threat. Background assessments and professional judgement were also utilized to identify likely circumstances for each identified threat. More detailed assessments of on-site activities are needed, however, to validate the appropriateness of these selections. In this respect, there is a high level of uncertainty associated with the nature and scope of this evaluation technique. Accordingly, site-specific investigations by the ABMV project team should substantially reduce the overall uncertainty of the threats assessment process.

c) Major Assumptions

Several major assumptions were made to facilitate the development of this threats assessment methodology. They are as follows:

- Land use activities are considered to be 'static' following evaluation through the desktop and windshield survey exercises. It is anticipated that policies will be established to ensure that source water protection is considered as part of the development review process for proposals made under the *Planning Act, Ontario Building Code* or other applicable legislation.

- Drinking water threats can be combined for small properties with multiple land use activities. In situations where these activities have similar threats, the more detrimental (impactful) circumstances were selected for inclusion within the risk analysis. For large properties with multiple land uses, parcel fragments were delineated to differentiate activities. Most commonly, farm parcels were separated into three activities: farmsteads (barns, sheds, dwellings), pasture lands and field crops. Naturalized areas were also separated from the main land uses.

- Most common farming operations (e.g., hog farms, chicken farms) can be categorized under the general terms of farmstead and/or crop farming. In this respect, most agricultural activities have similar chemical and pathogen threats according to the MOE guidance tables.

- All developed properties are assumed to be serviced by either municipal sanitary sewage systems or private septic systems. Service areas for the sanitary sewer systems were approximated, given available information on urban boundaries and local knowledge. Minor adjustments to these service areas may be necessary to accurately reflect existing conditions.

- The MOE guidance tables specify that most developed, non-residential properties accept hazardous wastes. It is assumed that the MOE anticipates that these land uses employ a multitude of chemical contaminants which, collectively, are of sufficient quantity to represent significant drinking water risks.

- In accordance with the MOE guidance tables, a large proportion of commercial and industrial operations are assumed to employ the handling and storage of dense non-aqueous phase liquids (DNAPLs).

- Most developed properties are assumed to include fuel tanks of between 250 L and 2,500 L for the containment of home heating oil.

- Road transportation corridors are not considered to have any associated drinking water threats.

2.4 Data Verification

A data verification process was implemented to confirm, as practical, the specific land uses activities established for inventoried properties. Several methods were incorporated into this review process, including comparisons of site descriptions with aerial photography and site photographs, discussions with individuals possessing local knowledge, website inquiries and secondary site visits. As noted, for this phase of the risk assessment process, property owners were not contacted to verify land use activities. ABMV project staff will be responsible for conducting landowner consultation.

3.0 RISK ASSESSMENT

3.1 Threat Scoring

An exercise was carried out to establish the significance of each identified threat to source water, given the location of the land use activity relative to the delineated WHPA zones. Tables provided to SP Regions by the MOE were referenced to calculate the threat score posed by land uses occurring on each inventoried parcel fragment. The assigned threat value was predicated on three factors: (1) the defined circumstance for the applicable threat, (2) the location of the parcel fragment relative to the WHPA zone and (3) the defined vulnerability score for that site. As an outcome of this process, the significance of all potential chemical and pathogen threats related to a particular fragment was calculated. Values of Significant, Moderate, Low and 'No Defined Threat' were established for each activity on a given parcel fragment.

3.2 Assessment Results

Table 3.1 provides a breakdown of the highest threat level (chemical or pathogen) calculated for each parcel fragment in the designated WHPAs. As presented in this table, approximately 37% of the property fragments in these vulnerable areas exhibit either significant or moderate threats to source water. The balance of the parcel fragments exhibit either low or no defined threats under the terms of the MOE guidance tables. Appendix B includes tables which summarize the highest assessed threat (chemical or pathogen) calculated for each parcel fragment in the designated WHPAs, by general land use activity.

Table 3.1
WHPA Parcel Fragments: Highest Assessed Threat (Chemical or Pathogen)

WHPA	Significant	Moderate	Low	No Threat[1]	Total
Atwood	26	8	195	37	266
Auburn	16	0	97	19	132
Bayfield (CL)[2]	6	0	35	9	50
Bayfield (HL)[3]	20	1	121	14	156
Belgrave	54	8	238	54	354
Benmiller	25	0	231	9	265
Blyth	54	34	289	62	439
Brucefield	34	30	145	31	240
Brussels (Well 1)	122	104	173	81	480
Brussels (Well 2)	35	7	67	30	139
Century Heights[4]	587	240	654	15	1,496
Clifford	132	153	255	65	605
Clinton	677	32	1,254	91	2,054
Dungannon	17	0	118	12	147
Gowanstown	13	1	146	21	181
Harriston	110	709	413	85	1,317
Huron Sands	11	0	169	7	187
Kelly	4	0	52	13	69

Table 3.1 Continued:

WHPA	Significant	Moderate	Low	No Threat[1]	Total
Listowel (Well 4)	46	45	139	39	269
Listowel (Well 5)	390	146	308	46	890
Listowel (Well 6)	30	9	176	21	236
McClinchey	1	0	33	11	45
Molesworth	9	0	96	19	124
Palmerston	550	149	687	94	1,480
S.A.M.	2	0	37	6	45
Van de Wetering	4	0	31	19	54
Wingham	302	10	1,071	67	1,450
Zurich	159	14	396	67	636
Total	3,436	1,700	7,626	1,044	13,806
% of Total	***24.9%***	***12.3%***	***55.2%***	***7.6%***	***100%***

Notes:
1. No defined threats as per MOE guidance tables.
2. Bayfield (Carriage Lane) WHPA.
3. Bayfield (Harbour Lights) WHPA.
4. Incorporates WHPA-E.

In accordance with the requirements set out in the *Technical Rules: Assessment Report* document prepared for the *Clean Water Act* implementation program, the MOE requires a listing of all significant drinking water threats identified in each designated WHPA. Tables 3.2 and 3.3 compile the significant chemical and pathogen threats within the study area at a parcel scale, respectively. Appendix C includes tables which itemize the significant chemical and pathogen threats for individual WHPAs at a parcel scale.

TABLE 3.2
SUMMARY OF SIGNIFICANT DRINKING WATER THREATS (CHEMICAL)
ABMV SP REGION: SOURCE PROTECTION TECHNICAL STUDY

Tabulation of Significant Drinking Water Threats (Chemical)[1]:
Designated Well Head Protection Areas[2]

Prescribed Threat[3]	Description of Prescribed Threat	Atwood	Auburn	Bayfield (Carriage Lane)	Bayfield (Harbour Lights)	Belgrave	Benmiller	Blyth	Brucefield	Brussels (Well 1)	Brussels (Well 2)	Century Heights[4]	Clifford	Clinton	Dungannon	Gowanstown	Harriston	Huron Sands	Kelly	Listowel (Well 4)	Listowel (Well 5)	Listowel (Well 6)	McClinchey	Molesworth	Palmerston	S.A.M.	Van de Wetering	Wingham	Zurich	TOTAL
1	Establishment/ Operation of a Waste Disposal Site *(Total)*	10	5	1	0	1	2	11	8	2	7	1	18	22	4	0	4	1	2	10	5	5	1	5	5	1	1	15	21	**168**
	i. Generic[5]	*10*	*5*			*1*	*2*	*10*	*8*	*2*	*7*	*1*	*18*	*22*	*4*		*4*	*1*	*2*	*10*	*5*	*5*	*1*	*5*	*5*	*1*	*1*	*14*	*21*	***165***
	ii. Hazardous Waste (Storage)							*1*																				*1*		***2***
	iii. Hazardous Waste (PCB Storage)																													***0***
2	Establishment/ Operation of a Sewage Collection/ Treatment Facility																													
3	Application of Agricultural Source Material to Land	4						4							3			1	1				1	2	1			1	1	**19**
4	Handling/ Storage of Agricultural Source Material	4						5					1		3			1	1				1	2	1			1	1	**21**
5	Management of Agricultural Source Material																													
6	Application of Non-Agricultural Source Material to Land	4						4							3			1	1				1	2	1			1	1	**19**
7	Handling/ Storage of Non-Agricultural Source Material	4						8			2		6		3			1	1				1	4	1			3	2	**36**
8	Application of Commercial Fertilizer to Land	4						5					1		3			1	1				1	2	1			1	1	**21**
9	Handling/ Storage of Commercial Fertilizer	2						1					1															1	1	**6**
10	Application of Pesticide to Land							1						1	2			1					1							**6**
11	Handling/ Storage of Pesticide	5						5					1	1	3			1	1				1	2	1			2	1	**24**
12	Application of Road Salt																													
13	Handling/ Storage of Road Salt																													
14	Snow Storage																													
15	Handling/ Storage of Fuel	19	15	9	14	53	9	35	23	73	11	14	53	32	8	19	41	6	12	15	20	5	10	17	46	6	19	15	49	**648**
16	Handling/ Storage of a DNAPL	4	3					4	7		12	1	9	40	1		24			7	18	9		1	23			33	19	**215**
17	Handling/ Storage of an Organic Solvent	1	1					3			1		1															2		**9**
18	Management of Runoff Containing Aircraft De-Icing Materials																													
19	Livestock Grazing or Pasturing	4						5					1		3			1	1				1	2	1			1	1	**21**
	TOTAL	**65**	**24**	**10**	**14**	**54**	**11**	**91**	**38**	**75**	**33**	**16**	**92**	**96**	**36**	**19**	**69**	**15**	**21**	**32**	**43**	**19**	**19**	**39**	**81**	**7**	**20**	**76**	**98**	**1213**

Notes:
1. Threats assessed at a parcel scale.
2. WHPAs are combined in situations where capture zone boundaries intersect.
3. Threats prescribed by section 1.1 of the *Clean Water Act*, 2006.
4. Incorporates WHPA-E.
5. Sites accepting wastes defined as 'General - Waste Management' under Regulation 347 of the *Environmental Protection Act*, 1990

TABLE 3.3
SUMMARY OF SIGNIFICANT DRINKING WATER THREATS (PATHOGEN)
ABMV SP REGION: SOURCE PROTECTION TECHNICAL STUDY

Tabulation of Significant Drinking Water Threats (Pathogen)[1]:
Designated Well Head Protection Areas[2]

Prescribed Threat[3]	Description of Prescribed Threat	Atwood	Auburn	Bayfield (Carriage Lane)	Bayfield (Harbour Lights)	Belgrave	Benmiller	Blyth	Brucefield	Brussels (Well 1)	Brussels (Well 2)	Century Heights[4]	Clifford	Clinton	Dungannon	Gowanstown	Harriston	Huron Sands	Kelly	Listowel (Well 4)	Listowel (Well 5)	Listowel (Well 6)	McClinchey	Molesworth	Palmerston	S.A.M.	Van de Wetering	Wingham	Zurich	TOTAL
1	Establishment/ Operation of a Waste Disposal Site	4						4							3			1	1				1	2	1			1	1	**19**
2	Establishment/ Operation of a Sewage Collection/ Treatment Facility	19	15	9	14	53	9	35	23	73	12	14	53	33	8	19	41	6	12	17	21	5	10	17	46	6	19	17	50	**656**
	i. Septic System	*19*	*15*	*9*	*14*	*53*	*9*		*23*	*3*		*14*	*53*		*8*	*19*	*23*	*6*	*12*				*10*	*17*	*2*	*6*	*19*	*7*	*1*	***289***
	i. Sanitary Collection System							*35*		*70*	*12*		*53*	*33*			*18*			*17*	*21*	*5*			*44*			*10*	*49*	***367***
3	Application of Agricultural Source Material to Land	4						4							3			1	1				1	2	1			1	1	**19**
4	Handling/ Storage of Agricultural Source Material	4						5					1		3			1	1				1	2	1			1	1	**21**
5	Management of Agricultural Source Material																													
6	Application of Non-Agricultural Source Material to Land	4						4							3			1	1				1	2	1			1	1	**19**
7	Handling/ Storage of Non-Agricultural Source Material	4						5					1		3			1	1				1	2	1			2	1	**22**
8	Application of Commercial Fertilizer to Land																													
9	Handling/ Storage of Commercial Fertilizer																													
10	Application of Pesticide to Land																													
11	Handling/ Storage of Pesticide																													
12	Application of Road Salt																													
13	Handling/ Storage of Road Salt																													
14	Snow Storage																													
15	Handling/ Storage of Fuel																													
16	Handling/ Storage of a DNAPL																													
17	Handling/ Storage of an Organic Solvent																													
18	Management of Runoff Containing Aircraft De-Icing Materials																													
19	Livestock Grazing or Pasturing	4						5					1		3			1	1				1	2	1			1	1	**21**
	TOTAL	**43**	**15**	**9**	**14**	**53**	**9**	**62**	**23**	**73**	**12**	**14**	**56**	**33**	**26**	**19**	**41**	**12**	**18**	**17**	**21**	**5**	**16**	**29**	**52**	**6**	**19**	**24**	**56**	**777**

Notes:
1. Threats assessed at a parcel scale.
2. WHPAs are combined in situations where capture zone boundaries intersect.
3. Threats prescribed by section 1.1 of the *Clean Water Act*, 2006.
4. Incorporates WHPA-E.

4.0 OBSERVATIONS AND CONCLUSIONS

4.1 Observations

The threats scoring exercise detailed in section 3.0 of this report provides an understanding of the potential risks to drinking water quality within designated municipal WHPAs. In review, there are a limited number of activities which pose a significant risk to drinking water relative to the number of parcel fragments in these specific vulnerable areas. Significant threats represent the principal concerns for source protection planning and require further investigation and assessment.

There are several circumstances which have effectively increased the total number of significant drinking water threats within the study area. Each is outlined below:

- The handling and storage of DNAPLs is classified as a significant threat within WHPA-A, WHPA-B and WHPA-C. Given that most commercial and industrial operations are assumed to employ DNAPLs, there are a considerable number of significant chemical threats evident within the defined WHPAs. It is anticipated that many of these operations do not utilize DNAPLs in any appreciable quantity, which should mitigate the potential threat posed by these chemical contaminants. Best management practices for the containment and disposal of these contaminants may also be in place, which could further mitigate the potential risks related to DNAPL handing and storage.

- The circumstance selected for the handling and storage of fuel represents a significant chemical threat for parcel fragments situated within highly vulnerable areas (e.g., WHPA-A). It is anticipated that most of the affected properties are heated via natural gas or propane and will not contain large fuel tanks. Tank inspection programs, if employed, would also limit the potential threat to source water.

- Agricultural properties are assumed to incorporate a multitude of chemical and pathogen contaminants. The nature and quantity of these contaminants may vary considerably among farming operations; a factor which could reduce the risks to drinking water quality posed by these activities. Furthermore, a large percentage of the affected properties are likely incorporated into farm management plans designed to ensure farm practices are carried out in accordance with best practices principles (i.e., practices developed to minimize off-site environmental impacts).

- Individual and communal septic systems represent significant pathogen threats within highly vulnerable areas. Several of the affected systems have been inspected, upgraded or replaced as part of an ABMV SP Committee initiative. In this respect, improvements to the local network of private septic systems should decrease the potential for pathogen contaminants reaching municipal well supplies.

- Agricultural-industrial operations, such as fertilizer plants, are assumed to store substantial quantities of chemical contaminants (i.e., significant threats). The quantities selected for threat circumstances may overstate the actual quantities evident at these locations. It is also expected that industrial safety protocols and risk management plans are in place to mitigate the potential for off-site impacts (e.g., provision of runoff containment facilities).

Collectively, there are several sources of mitigation which need to be thoroughly considered in the planning process in order to provide a more accurate assessment of potential drinking water threats within WHPAs. It is acknowledged that many of the future investigations described in this section of the report are outside of the prescribed scope of the ABMV SP Assessment Report being prepared in accordance with MOE protocols. However, the ABMV project team may have an opportunity to pursue these matters as part of a broader risk management initiative.

4.2 Conclusions

Given the foregoing, it is apparent that additional investigations should be carried out to inventory the specific land use activities of parcels considered risks to source water. It is anticipated that following confirmation on on-site activities and practices, several threat scores would be refined in a manner that reduces the total number of significant drinking water threats. Moreover, a site-specific review of safety protocols and best management practices would provide a better understanding of the actual and immediate risks posed by certain land use activities.

The ABMV SP Region will be responsible for coordinating detailed investigations of significant drinking water threats during the next phase of the risk assessment procedure. As part of this initiative, surveys of affected property owners will be carried out to determine what measures are in place to mitigate potential risks within WHPAs. It is anticipated that risk management programs may also need to be implemented for certain land use activities to effectively protect the integrity of municipal drinking water sources.

5.0 SUMMARY

This report documents the drinking water threats assessment process conducted as Part 2 of the Source Protection Technical Study being carried out for most municipal Well Head Protection Areas within the Ausable Bayfield Maitland Valley Source Protection Region. This study was carried out in accordance with program guidelines provided by the Ministry of the Environment. As an outcome of this assessment, several land use activities were identified which could pose a significant threat to source water. Additional site-specific investigations are required to fully evaluate the nature and scale of these potential drinking water risks. Risk management initiatives may also be required to effectively mitigate any significant risks established through more detailed site evaluations.

All of which is respectfully submitted.

B. M. ROSS AND ASSOCIATES LIMITED

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:hv

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APPENDIX A

WELL HEAD PROTECTION AREAS AND ASSOCIATED PROPERTIES

ABMV SOURCE PROTECTION TECHNICAL STUDY:
WELL HEAD PROTECTION AREAS AND ASSOCIATED WELLS

Well Head Protection Area	Associated Well Supplies
Atwood	Well No. 1 Well No. 2
Auburn	Well No. 1
Bayfield (Carriage Lane)	Well No. 1
Bayfield (Harbour Lights)	Well No. 1
Belgrave	Jane Street Well McCrae Street Well
Benmiller	Benmiller Estates Well No. 1
Blyth	Well No. 1 Well No. 2
Brucefield	Well No. 1
Brussels (Well 1)	Well No. 1
Brussels (Well 2)	Well No. 2
Century Heights	Well No. 1 Well No. 2 WHPA-E[1]
Clifford	Well No. 1 Well No. 3 Well No. 4
Clinton	Well No. 1 Well No. 2 Well No. 3
Dungannon	Well No. 1 Well No. 2
Gowanstown	Well No. 1
Harriston	Well No. 1 Well No. 2 Well No. 3
Huron Sands	Well No. 1
Kelly	Well No. 1
Listowel (Well 4)	Well No. 4
Listowel (Well 5)	Well No. 5
Listowel (Well 6)	Well No. 6
McClinchey	Well No. 1
Molesworth	Well No. 1
Palmerston	Well No. 1 Well No. 2 Well No. 3
S.A.M.	Well No. 1
Van de Wetering	Well No. 1
Wingham	Well No. 3 Well No. 4
Zurich	Well No. 1 Well No. 3

[1] Well supply potentially under the influence of surface water (Maitland River watershed).

APPENDIX B

HIGHEST ASSESSED THREAT:
DESIGNATED WELL HEAD PROTECTION AREAS
(PARCEL FRAGMENTS)

WHPA	Land Use	No Defined Threat	Low	Moderate	Significant
Atwood					
	Agricultural	55	8	4	4
	Commercial	13	2	1	9
	Industrial				6
	Public	6	4	2	1
	Recreation	32			
	Residential	56	9		14
	Transportation	33	3	1	3
	Totals	195	26	8	37
Auburn					
	Agricultural	47	7		
	Commercial	2			7
	Industrial				1
	Public		1		
	Recreation	25			1
	Residential	14	8		10
	Transportation	9			
	Totals	97	16		19
Bayfield (Carriage Lane)					
	Agricultural	5			
	Industrial				1
	Recreation	22			
	Residential	6	6		8
	Transportation	2			
	Totals	35	6		9

WHPA	Land Use	No Defined Threat	Low	Moderate	Significant
Bayfield (Harbour Lights)					
	Agricultural	11	4		
	Public	1	2		
	Recreation	19		1	
	Residential	77	14		14
	Transportation	13			
	Totals	121	20	1	14
Belgrave					
	Agricultural	87	22	3	
	Industrial		1		1
	Recreation	94			
	Residential	42	31	5	53
	Transportation	15			
	Totals	238	54	8	54
Benmiller					
	Agricultural	86	18		
	Industrial				1
	Public	4			
	Recreation	113	1		1
	Residential	6	6		7
	Transportation	22			
	Totals	231	25		9
Blyth					
	Agricultural	40	9	10	7
	Commercial	28	2	1	9
	Industrial	2	2	1	5
	Public	13	2	2	2
	Recreation	72			
	Residential	113	39	20	39
	Transportation	21			
	Totals	289	54	34	62

WHPA	Land Use	No Defined Threat	Low	Moderate	Significant
Brucefield					
	Agricultural	77	19	11	
	Commercial				7
	Industrial	1			7
	Public		3	6	2
	Recreation	46			
	Residential	5	12	13	15
	Transportation	16			
	Totals	145	34	30	31
Brussels-Well#1					
	Agricultural	44	18	10	
	Commercial	2	5	2	1
	Industrial	3			1
	Public		5	2	
	Recreation	86			
	Residential	24	94	90	79
	Transportation	14			
	Totals	173	122	104	81
Brussels-Well#2					
	Agricultural	27	15	3	
	Commercial		5	1	8
	Industrial	2	7		13
	Public		1		3
	Recreation	19			
	Residential	5	5	2	5
	Transportation	14	2	1	1
	Totals	67	35	7	30

WHPA	Land Use	No Defined Threat	Low	Moderate	Significant
Century Heights					
	Agricultural	127	18	143	
	Commercial		27	45	
	Industrial	3	5	18	2
	Public		2	8	
	Recreation	415	13	10	
	Residential	58	522	16	13
	Transportation	51			
	Totals	654	587	240	15
Clifford					
	Agricultural	60	11	16	1
	Commercial	1	3	6	13
	Industrial			1	7
	Public	1		1	2
	Recreation	58	5	4	2
	Residential	108	108	121	38
	Transportation	27	5	4	2
	Totals	255	132	153	65
Clinton					
	Agricultural	326	96	26	
	Commercial	24	58	1	29
	Industrial	8	5	1	10
	Public	28	50	1	39
	Recreation	322	16		3
	Residential	489	452	3	10
	Transportation	57			
	Totals	1254	677	32	91

WHPA	Land Use	No Defined Threat	Low	Moderate	Significant
Dungannon					
	Agricultural	50	15		3
	Commercial		1		2
	Industrial				1
	Recreation	60			
	Residential		1		6
	Transportation	8			
	Totals	118	17		12
Gowanstown					
	Agricultural	79	7		
	Commercial	1	1		
	Recreation	40		1	
	Residential	13	5		21
	Transportation	13			
	Totals	146	13	1	21
Harriston					
	Agricultural	143	35	12	
	Commercial	9	5	39	24
	Industrial	3	1	4	6
	Public	7	4	32	11
	Recreation	145	3	13	3
	Residential	71	59	608	41
	Transportation	35	3	1	
	Totals	413	110	709	85
Huron Sands					
	Agricultural	102	11		1
	Recreation	51			
	Residential	4			6
	Transportation	12			
	Totals	169	11		7

WHPA	Land Use	No Defined Threat	Low	Moderate	Significant
Kelly					
	Agricultural	6	1		1
	Industrial				1
	Recreation	20			
	Residential	17	3		11
	Transportation	9			
	Totals	52	4		13
Listowel-Well#4					
	Agricultural	70	10		
	Commercial		2	2	4
	Industrial				2
	Public		1	2	27
	Recreation	54		1	
	Residential	1	33	40	6
	Transportation	14			
	Totals	139	46	45	39
Listowel-Well#5					
	Agricultural	104	13		
	Commercial	5	8	2	12
	Industrial				10
	Public	16	14	3	7
	Recreation	43	6	4	
	Residential	112	349	137	16
	Transportation	28			1
	Totals	308	390	146	46

WHPA	Land Use	No Defined Threat	Low	Moderate	Significant
Listowel-Well#6					
	Agricultural	94	18	1	
	Commercial	5	7	4	3
	Industrial	6	1		15
	Public	1		2	3
	Recreation	32			
	Residential	14	4	2	
	Transportation	24			
	Totals	176	30	9	21
McClinchey					
	Agricultural	15	1		1
	Recreation	13			
	Residential	1			10
	Transportation	4			
	Totals	33	1		11
Molesworth					
	Agricultural	49	5		2
	Commercial				2
	Industrial				1
	Recreation	34			
	Residential	5	4		14
	Transportation	8			
	Totals	96	9		19

WHPA	Land Use	No Defined Threat	Low	Moderate	Significant
Palmerston					
	Agricultural	140	27	15	1
	Commercial	3	23	2	21
	Industrial	11	1	1	10
	Public	17	16	5	15
	Recreation	62	8	4	
	Residential	398	468	122	45
	Transportation	56	7		2
	Totals	687	550	149	94
S.A.M.					
	Industrial				1
	Recreation	19			
	Residential	11	2		5
	Transportation	7			
	Totals	37	2		6
VandeWetering					
	Agricultural	7	3		
	Recreation	17			1
	Residential		1		18
	Transportation	7			
	Totals	31	4		19
Wingham					
	Agricultural	116	46	2	1
	Commercial	32	16	1	22
	Industrial	8	6		36
	Public	25	11	2	6
	Recreation	212	14	3	
	Residential	627	209	2	2
	Transportation	51			
	Totals	1071	302	10	67

WHPA	Land Use	No Defined Threat	Low	Moderate	Significant
Zurich					
	Agricultural	56	35	10	3
	Commercial	12	16		24
	Industrial	4	9	4	6
	Public	5	5		6
	Recreation	104	12		
	Residential	185	82		28
	Transportation	30			
	Totals	396	159	14	67
		7626	3436	1700	1044

APPENDIX C

SIGNIFICANT THREATS SUMMARIES: DESIGNATED WELL HEAD PROTECTION AREAS (PARCEL BASED)

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Atwood			Total	108
	Chemical		Sub-Total	61
		Application of Agricultural Source Material		4
		Application of Commercial Fertilizer		4
		Application of Non-Agricultural Source Material		4
		Grazing/Pasturing of Livestock		4
		Handling/ Storage of Agricultural Source Material		4
		Handling/ Storage of an Organic Solvent		1
		Handling/ Storage of Commercial Fertilizer		2
		Handling/ Storage of Fuel		19
		Handling/ Storage of Non-Agricultural Source Material (Temporary)		4
		Handling/ Storage of Pesticide		5
		Waste Disposal Site -Generic		10
	DNAPL		Sub-Total	4
		Handling/ Storage of a DNAPL		4
	Pathogen		Sub-Total	43
		Application of Agricultural Source Material		4
		Application of Non-Agricultural Source Material		4
		Grazing/Pasturing of Livestock		4
		Handling/ Storage of Agricultural Source Material		4
		Handling/ Storage of Non-Agricultural Source Material		4
		Operation of Sewage Works - Septic System		19
		Waste Disposal Site - Operation		4

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Auburn			Total	39
	Chemical		Sub-Total	21
		Handling/ Storage of an Organic Solvent		1
		Handling/ Storage of Fuel		15
		Waste Disposal Site -Generic		5
	DNAPL		Sub-Total	3
		Handling/ Storage of a DNAPL		3
	Pathogen		Sub-Total	15
		Operation of Sewage Works - Septic System		15
Bayfield (Carriage Lane)			Total	19
	Chemical		Sub-Total	10
		Handling/ Storage of Fuel		9
		Waste Disposal Site -Generic		1
	Pathogen		Sub-Total	9
		Operation of Sewage Works - Septic System		9
Bayfield (Harbour Lights)			Total	28
	Chemical		Sub-Total	14
		Handling/ Storage of Fuel		14
	Pathogen		Sub-Total	14
		Operation of Sewage Works - Septic System		14
Belgrave			Total	107
	Chemical		Sub-Total	54
		Handling/ Storage of Fuel		53
		Waste Disposal Site -Generic		1
	Pathogen		Sub-Total	53
		Operation of Sewage Works - Septic System		53

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Benmiller			Total	20
	Chemical		Sub-Total	11
		Handling/ Storage of Fuel		9
		Waste Disposal Site -Generic		2
	Pathogen		Sub-Total	9
		Operation of Sewage Works - Septic System		9

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Blyth			Total	153
	Chemical		Sub-Total	87
		Application of Agricultural Source Material		4
		Application of Commercial Fertilizer		5
		Application of Non-Agricultural Source Material		4
		Application of Pesticide		1
		Grazing/Pasturing of Livestock		5
		Handling/ Storage of Agricultural Source Material		5
		Handling/ Storage of an Organic Solvent		3
		Handling/ Storage of Commercial Fertilizer		1
		Handling/ Storage of Fuel		35
		Handling/ Storage of Non-Agricultural Source Material (Permanent)		2
		Handling/ Storage of Non-Agricultural Source Material (Temporary)		6
		Handling/ Storage of Pesticide		5
		Waste Disposal Site - Hazardous Waste (Storage)		1
		Waste Disposal Site -Generic		10
	DNAPL		Sub-Total	4
		Handling/ Storage of a DNAPL		4

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
	Pathogen		Sub-Total	62
		Application of Agricultural Source Material		4
		Application of Non-Agricultural Source Material		4
		Grazing/Pasturing of Livestock		5
		Handling/ Storage of Agricultural Source Material		5
		Handling/ Storage of Non-Agricultural Source Material		5
		Operation of Sewage Works - Sanitary Sewers		35
		Waste Disposal Site - Operation		4
Brucefield			Total	61
	Chemical		Sub-Total	31
		Handling/ Storage of Fuel		23
		Waste Disposal Site -Generic		8
	DNAPL		Sub-Total	7
		Handling/ Storage of a DNAPL		7
	Pathogen		Sub-Total	23
		Operation of Sewage Works - Septic System		23
Brussels-Well#1			Total	148
	Chemical		Sub-Total	75
		Handling/ Storage of Fuel		73
		Waste Disposal Site -Generic		2
	Pathogen		Sub-Total	73
		Operation of Sewage Works - Sanitary Sewers		70
		Operation of Sewage Works - Septic System		3

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Brussels-Well#2			Total	45
	Chemical		Sub-Total	21
		Handling/ Storage of an Organic Solvent		1
		Handling/ Storage of Fuel		11
		Handling/ Storage of Non-Agricultural Source Material (Permanent)		1
		Handling/ Storage of Non-Agricultural Source Material (Temporary)		1
		Waste Disposal Site -Generic		7
	DNAPL		Sub-Total	12
		Handling/ Storage of a DNAPL		12
	Pathogen		Sub-Total	12
		Operation of Sewage Works - Sanitary Sewers		12
Century Heights			Total	30
	Chemical		Sub-Total	15
		Handling/ Storage of Fuel		14
		Waste Disposal Site -Generic		1
	DNAPL		Sub-Total	1
		Handling/ Storage of a DNAPL		1
	Pathogen		Sub-Total	14
		Operation of Sewage Works - Septic System		14

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Clifford			Total	148
	Chemical		Sub-Total	83
		Application of Commercial Fertilizer		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of an Organic Solvent		1
		Handling/ Storage of Commercial Fertilizer		1
		Handling/ Storage of Fuel		53
		Handling/ Storage of Non-Agricultural Source Material (Permanent)		3
		Handling/ Storage of Non-Agricultural Source Material (Temporary)		3
		Handling/ Storage of Pesticide		1
		Waste Disposal Site -Generic		18
	DNAPL		Sub-Total	9
		Handling/ Storage of a DNAPL		9
	Pathogen		Sub-Total	56
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of Non-Agricultural Source Material		1
		Operation of Sewage Works - Sanitary Sewers		53

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Clinton			Total	129
	Chemical		Sub-Total	56
		Application of Pesticide		1
		Handling/ Storage of Fuel		32
		Handling/ Storage of Pesticide		1
		Waste Disposal Site -Generic		22
	DNAPL		Sub-Total	40
		Handling/ Storage of a DNAPL		40
	Pathogen		Sub-Total	33
		Operation of Sewage Works - Sanitary Sewers		33

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Dungannon			Total	62
	Chemical		Sub-Total	35
		Application of Agricultural Source Material		3
		Application of Commercial Fertilizer		3
		Application of Non-Agricultural Source Material		3
		Application of Pesticide		2
		Grazing/Pasturing of Livestock		3
		Handling/ Storage of Agricultural Source Material		3
		Handling/ Storage of Fuel		8
		Handling/ Storage of Non-Agricultural Source Material (Temporary)		3
		Handling/ Storage of Pesticide		3
		Waste Disposal Site -Generic		4
	DNAPL		Sub-Total	1
		Handling/ Storage of a DNAPL		1
	Pathogen		Sub-Total	26
		Application of Agricultural Source Material		3
		Application of Non-Agricultural Source Material		3
		Grazing/Pasturing of Livestock		3
		Handling/ Storage of Agricultural Source Material		3
		Handling/ Storage of Non-Agricultural Source Material		3
		Operation of Sewage Works - Septic System		8
		Waste Disposal Site - Operation		3
Gowanstown			Total	38
	Chemical		Sub-Total	19
		Handling/ Storage of Fuel		19
	Pathogen		Sub-Total	19
		Operation of Sewage Works - Septic System		19

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Harriston			Total	110
	Chemical		Sub-Total	45
		Handling/ Storage of Fuel		41
		Waste Disposal Site -Generic		4
	DNAPL		Sub-Total	24
		Handling/ Storage of a DNAPL		24
	Pathogen		Sub-Total	41
		Operation of Sewage Works - Sanitary Sewers		18
		Operation of Sewage Works - Septic System		23

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Huron Sands			Total	27
	Chemical		Sub-Total	15
		Application of Agricultural Source Material		1
		Application of Commercial Fertilizer		1
		Application of Non-Agricultural Source Material		1
		Application of Pesticide		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of Fuel		6
		Handling/ Storage of Non-Agricultural Source Material (Temporary)		1
		Handling/ Storage of Pesticide		1
		Waste Disposal Site -Generic		1
	Pathogen		Sub-Total	12
		Application of Agricultural Source Material		1
		Application of Non-Agricultural Source Material		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of Non-Agricultural Source Material		1
		Operation of Sewage Works - Septic System		6
		Waste Disposal Site - Operation		1

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Kelly			Total	39
	Chemical		Sub-Total	21
		Application of Agricultural Source Material		1
		Application of Commercial Fertilizer		1
		Application of Non-Agricultural Source Material		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of Fuel		12
		Handling/ Storage of Non-Agricultural Source Material (Temporary)		1
		Handling/ Storage of Pesticide		1
		Waste Disposal Site -Generic		2
	Pathogen		Sub-Total	18
		Application of Agricultural Source Material		1
		Application of Non-Agricultural Source Material		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of Non-Agricultural Source Material		1
		Operation of Sewage Works - Septic System		12
		Waste Disposal Site - Operation		1
Listowel-Well#4			Total	49
	Chemical		Sub-Total	25
		Handling/ Storage of Fuel		15
		Waste Disposal Site -Generic		10
	DNAPL		Sub-Total	7
		Handling/ Storage of a DNAPL		7
	Pathogen		Sub-Total	17
		Operation of Sewage Works - Sanitary Sewers		17

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Listowel-Well#5			Total	64
	Chemical		Sub-Total	25
		Handling/ Storage of Fuel		20
		Waste Disposal Site -Generic		5
	DNAPL		Sub-Total	18
		Handling/ Storage of a DNAPL		18
	Pathogen		Sub-Total	21
		Operation of Sewage Works - Sanitary Sewers		21
Listowel-Well#6			Total	24
	Chemical		Sub-Total	10
		Handling/ Storage of Fuel		5
		Waste Disposal Site -Generic		5
	DNAPL		Sub-Total	9
		Handling/ Storage of a DNAPL		9
	Pathogen		Sub-Total	5
		Operation of Sewage Works - Sanitary Sewers		5

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
McClinchey			Total	35
	Chemical		Sub-Total	19
		Application of Agricultural Source Material		1
		Application of Commercial Fertilizer		1
		Application of Non-Agricultural Source Material		1
		Application of Pesticide		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of Fuel		10
		Handling/ Storage of Non-Agricultural Source Material (Temporary)		1
		Handling/ Storage of Pesticide		1
		Waste Disposal Site -Generic		1
	Pathogen		Sub-Total	16
		Application of Agricultural Source Material		1
		Application of Non-Agricultural Source Material		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of Non-Agricultural Source Material		1
		Operation of Sewage Works - Septic System		10
		Waste Disposal Site - Operation		1

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Molesworth			Total	68
	Chemical		Sub-Total	38
		Application of Agricultural Source Material		2
		Application of Commercial Fertilizer		2
		Application of Non-Agricultural Source Material		2
		Grazing/Pasturing of Livestock		2
		Handling/ Storage of Agricultural Source Material		2
		Handling/ Storage of Fuel		17
		Handling/ Storage of Non-Agricultural Source Material (Permanent)		1
		Handling/ Storage of Non-Agricultural Source Material (Temporary)		3
		Handling/ Storage of Pesticide		2
		Waste Disposal Site -Generic		5
	DNAPL		Sub-Total	1
		Handling/ Storage of a DNAPL		1
	Pathogen		Sub-Total	29
		Application of Agricultural Source Material		2
		Application of Non-Agricultural Source Material		2
		Grazing/Pasturing of Livestock		2
		Handling/ Storage of Agricultural Source Material		2
		Handling/ Storage of Non-Agricultural Source Material		2
		Operation of Sewage Works - Septic System		17
		Waste Disposal Site - Operation		2

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Palmerston			Total	133
	Chemical		Sub-Total	58
		Application of Agricultural Source Material		1
		Application of Commercial Fertilizer		1
		Application of Non-Agricultural Source Material		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of Fuel		46
		Handling/ Storage of Non-Agricultural Source Material (Temporary)		1
		Handling/ Storage of Pesticide		1
		Waste Disposal Site -Generic		5
	DNAPL		Sub-Total	23
		Handling/ Storage of a DNAPL		23
	Pathogen		Sub-Total	52
		Application of Agricultural Source Material		1
		Application of Non-Agricultural Source Material		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of Non-Agricultural Source Material		1
		Operation of Sewage Works - Sanitary Sewers		44
		Operation of Sewage Works - Septic System		2
		Waste Disposal Site - Operation		1

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
S.A.M.			Total	13
	Chemical		Sub-Total	7
		Handling/ Storage of Fuel		6
		Waste Disposal Site -Generic		1
	Pathogen		Sub-Total	6
		Operation of Sewage Works - Septic System		6
VandeWetering			Total	39
	Chemical		Sub-Total	20
		Handling/ Storage of Fuel		19
		Waste Disposal Site -Generic		1
	Pathogen		Sub-Total	19
		Operation of Sewage Works - Septic System		19

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Wingham			Total	100
	Chemical		Sub-Total	43
		Application of Agricultural Source Material		1
		Application of Commercial Fertilizer		1
		Application of Non-Agricultural Source Material		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of an Organic Solvent		2
		Handling/ Storage of Commercial Fertilizer		1
		Handling/ Storage of Fuel		15
		Handling/ Storage of Non-Agricultural Source Material (Permanent)		1
		Handling/ Storage of Non-Agricultural Source Material (Temporary)		2
		Handling/ Storage of Pesticide		2
		Waste Disposal Site - Hazardous Waste (Storage)		1
		Waste Disposal Site -Generic		14
	DNAPL		Sub-Total	33
		Handling/ Storage of a DNAPL		33

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
	Pathogen		Sub-Total	24
		Application of Agricultural Source Material		1
		Application of Non-Agricultural Source Material		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of Non-Agricultural Source Material		2
		Operation of Sewage Works - Sanitary Sewers		10
		Operation of Sewage Works - Septic System		7
		Waste Disposal Site - Operation		1

Wellhead	Type of Threat	Threat (Parcel Based)	Significant Threats	
Zurich			Total	154
	Chemical		Sub-Total	79
		Application of Agricultural Source Material		1
		Application of Commercial Fertilizer		1
		Application of Non-Agricultural Source Material		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of Commercial Fertilizer		1
		Handling/ Storage of Fuel		49
		Handling/ Storage of Non-Agricultural Source Material (Permanent)		1
		Handling/ Storage of Non-Agricultural Source Material (Temporary)		1
		Handling/ Storage of Pesticide		1
		Waste Disposal Site -Generic		21
	DNAPL		Sub-Total	19
		Handling/ Storage of a DNAPL		19
	Pathogen		Sub-Total	56
		Application of Agricultural Source Material		1
		Application of Non-Agricultural Source Material		1
		Grazing/Pasturing of Livestock		1
		Handling/ Storage of Agricultural Source Material		1
		Handling/ Storage of Non-Agricultural Source Material		1
		Operation of Sewage Works - Sanitary Sewers		49
		Operation of Sewage Works - Septic System		1
		Waste Disposal Site - Operation		1
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