PERFLUOROCARBON (PFC)-CONTAINING FIREFIGHTING FOAMS AND THEIR USE IN MINNESOTA: SAMPLING at the HIDDEN HARBOR MARINA, BURNSVILLE WETLAND, AND BEMIDJI PRIVATE WELLS

ANTEA GROUP PROJECT NO. 45618DEL03
May 13, 2011

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c-pfc1-16

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1.0 INTRODUCTION

1.1 Purpose

AnteaTM Group (formerly Delta Consultants) has worked under contract with the Minnesota Pollution Control Agency (MPCA) investigating perfluorochemicals in Class B firefighting foams and the use of Class B firefighting foams in Minnesota. Previous information regarding this investigation was presented in the following reports:

- Perfluorocarbon (PFC)-Containing Firefighting Foams and Their Use In Firefighting Training in Minnesota, dated June 30, 2008 (the June 2008 Report);
- Addendum to PFC-Containing Firefighting Foams and Their Use In Firefighting Training in Minnesota, dated October 22, 2008 (the October 2008 Addendum Report);
- Firefighting Training Area Site Reconnaissance, Pine Bend Flint Hills Refinery, Marathon Refinery, Burnsville Fire Training Center, and Site Access for 21 Fire Departments, dated April 3, 2009 (the April 2009 Report);
- Report of Site Reconnaissance and Sampling at Select Firefighting Foam Training Areas in Minnesota, dated June 30, 2009 (the June 2009 Report);
- Report of Investigation Activities at Select Firefighting Foam Training Areas and Foam Discharge Sites in Minnesota, dated February 10, 2010 (the February 2010 Report);
- Perfluorocarbon (PFC)-Containing Firefighting Foams and Their Use in Firefighting Training in Minnesota, dated June 30, 2010 (the June 2010 Report);
- Perfluorocarbon (PFC)-Containing Firefighting Foams and Their Use in Minnesota: Well Receptor Surveys and Follow-Up Sampling at Select Sites, dated November 15, 2010 (the November 2010 Report); and,
- Perfluorocarbon (PFC)-Containing Firefighting Foams and Their Use in Minnesota: Sampling at the Lake Superior College Emergency Response Training Center, Duluth, dated February 25, 2011 (the February 2011 Report).

This report presents additional data and information specific to PFC impacts previously identified in soil and/or groundwater at the following sites: the Marathon Refinery in St. Paul Park; the ABLE Fire Training Center in Burnsville; and, the Bemidji Regional Airport in Bemidji.

1.2 Background

As a part of an overall investigation of PFCs in Minnesota, the MPCA and Minnesota Department of Health (MDH) are investigating firefighting foams as a possible source of PFCs in the environment. The investigation has found that Class B foams, or aqueous film-forming foam (AFFF), are made with PFCs; Class A foam and foams made for training exercises (training foams) are not made with PFCs. PFCs have been identified in soil, sediment, surface

water and/or groundwater samples collected from a number of locations where various brands of Class B firefighting foams have been used repeatedly in training exercises or in large quantity to extinguish fires in Minnesota. PFCs have been identified in the groundwater at concentrations above the State Health Risk Limits (HRLs) for drinking water at the Marathon Refinery in St. Paul Park, the ABLE Fire Training Center in Burnsville, and at the Bemidji Regional Airport.

As presented in the November 2010 Report, groundwater receptor surveys were conducted at several firefighting foam training sites to identify potential receptors around the sites. The receptor surveys identified water wells or other groundwater receptors near several sites, including the following:

- water supply wells at the Hidden Harbor Marina, located approximately 0.3 miles south of the fire training area at the Marathon Refinery;
- a wetland located across Cliff Road from the ABLE Fire Training Center, to where storm water runoff from the ABLE Fire Training Center may flow; and,
- a water supply well at the Kraus Anderson construction shop located approximately one-half mile southeast of the firefighting foam training area at the Bemidji Regional Airport.

Recommendations were made in the November 2010 Report to collect groundwater samples or surface water and sediment samples at the identified potential receptors for analysis of PFCs.

Other domestic water wells were known to exist outside the receptor survey area associated with the Bemidji Regional Airport, located between 3/4 mile and 1 mile east of the fire foam training area at the airport. The MDH expressed some concern that these domestic wells may be downgradient of the airport. Thus, a recommendation was made in the November 2010 Report to conduct a receptor survey in this area and sample a select number of wells identified in the survey.

1.3 Scope of Work

Based on the presence of PFCs at concentrations above the State HRLs and the results of the groundwater receptor surveys conducted in association with Marathon Refinery, the ABLE Fire Training Center, and the Bemidji Regional Airport, the following scope of work was conducted under MPCA Work Order SFDE1113:

1. An access agreement was implemented between the MPCA and the owner of the Hidden Harbor Marina to allow sampling of five water supply wells owned by the Marina for PFC analysis. Water samples were collected from these wells and submitted for laboratory analysis of PFCs.
2. An access agreement was implemented between the MPCA and the City of Burnsville to allow surface water and sediment sampling for PFCs at the wetland located on City property north of the ABLE Fire Training Center. A surface water sample and a sediment sample were collected and submitted for laboratory analysis of PFCs.
3. A well receptor survey was conducted for the neighborhood located approximately 3/4-mile east of the Bemidji Regional Airport.

4. Access agreements were implemented between the MPCA and select well owners in Bemidji for sampling of their water wells for PFCs. Water samples were collected from the select wells and submitted for laboratory analysis of PFCs.
5. This report was prepared summarizing the work performed as part of the scope of work.

Details of the work performed as part of the contracted scope of work are presented in **Sections 2.0 through 4.0**.

2.0 HIDDEN HARBOR MARINA WELL SAMPLING

2.1 Previous Sampling at Marathon Refinery

Sampling of select existing groundwater monitoring wells near the firefighting training area at the Marathon Refinery was conducted in August 2009. Laboratory analysis of five water samples plus one duplicate sample identified PFCs in all of the samples, including perfluorooctane sulfonate (PFOS) concentrations above the PFOS HRL of 300 nanograms per liter (ng/L). The laboratory analytical results are summarized in **Table 1, PFC Analytical Results for Select Firefighting Foam Sites**.

2.2 Sample Collection at Hidden Harbor Marina

The groundwater receptor survey identified five water supply wells at the Hidden Harbor Marina, as follows:

- Unique Well No. 268354 at the marina workshop that is used for non-potable uses such as toilets and cleaning boats (Well A).
- Unique Well No. 559256 at the marina that supplies water to the on-site restaurant and to marina boat customers (Well B).
- A residential well located at the house associated with the marina. This house is currently being used as the shower house for marina customers. The unique well number for this well is unknown (Well C).
- A residential well located at the house at 1001 Oak Street, just south of the marina. The unique well number for this well is unknown (Well D).
- Unique Well No. 429870 at the house at 115 10th Avenue West, just south of the marina (Well E).

A map showing the locations of the wells at the Hidden Harbor Marina is included in **Appendix A**.

An access agreement between the MPCA and the owner of the Hidden Harbor Marina allowed for sampling of the wells at the marina. An Antea Group personnel was accompanied by a marina employee during water well sample collection on March 3, 2011. The well samples were labeled as follows:

- Well A: Unique Well No. 268354 at the marina workshop.
- Well B: Unique Well No. 559256, supplying water to the on-site restaurant and marina boat customers.
- Well C: Residential well located at the house associated with the marina.
- Well D: Residential well located at 1001 Oak Street.
- Well E: Unique Well No. 429870 at the house at 115 10th Avenue West.

Sampling methodologies and a copy of the sampling chain-of-custody are included in **Appendix D**. Water samples were submitted to State-contracted Axys Analytical Services for laboratory analysis of PFCs.

2.3 Sample Results for Hidden Harbor Marina Wells

The laboratory results for the well samples collected at the Hidden Harbor Marina are summarized on **Table 1**. The sampling results table provided by Axys Analytical Services is included in **Appendix A**. Low levels of perfluorinated carboxylic acids were detected in three of the water samples: the water well at the restaurant, and the two houses at 1001 Oak Street and 115 10th Avenue West. All detected PFC concentrations were below the State HRL or other drinking water health-based values defined by the MDH. Sampling results were provided to the owner of the Hidden Harbor Marina.

The PFC compound that was detected above the HRL at the Marathon Refinery (PFOS) was not detected in any of the samples. Based on the type of PFC compounds detected in the wells at the Marathon Refinery and the Hidden Harbor wells, the PFC impacts in groundwater at the Hidden Harbor Marina are unlikely to be from the firefighting training area at the Marathon Refinery.

The City of St. Paul Park is included in an area of Washington County known to have low levels of PFC groundwater impacts associated with landfills where 3M wastes were historically dumped. Assessment and monitoring data associated with the 3M wastes in Washington County are available at the MPCA and MDH websites.

3.0 BURNSVILLE WETLAND SAMPLING

3.1 Previous Sampling at the ABLE Fire Training Center

Groundwater sampling was conducted at the ABLE Fire Training Center in August 2009. A groundwater sample was collected from soil boring B-3. (Attempts to collect groundwater samples from borings B-1 and B-2 were unsuccessful.) Laboratory analysis of the groundwater sample identified several PFCs, including perfluorooctanoic acid (PFOA) and PFOS at concentrations above the HRL of 300 ng/L. The laboratory analytical results are summarized in **Table 1**.

3.2 Sample Collection at the Burnsville Wetland

The groundwater receptor did not identify any water supply wells within the survey area, but a wetland located across Cliff Road from the ABLE Fire Training Center was identified as a potential receptor for storm water runoff. The wetland is on property owned by the City of Burnsville.

An access agreement between the MPCA and the City of Burnsville allowed for sampling of the surface water and sediment from the wetland. Antea Group collected one surface water sample (Burnsville Pond SW-1) and one sediment sample (Burnsville Pond Sed-1) from the wetland on April 20, 2011. A figure showing the sample locations and the sampling chain-of-custody are included in Appendix B. Sampling methodologies are included in

Appendix D. An Antea Group personnel was unaccompanied during the sampling. Water samples were submitted to State-contracted Axys Analytical Services for laboratory analysis of PFCs.

3.3 Sample Results for the Burnsville Wetland Samples

The laboratory results for the surface water sample collected at the Burnsville wetland are summarized on **Table 1**. The sampling results table provided by Axys Analytical Services is included in **Appendix B**. Laboratory results for the sediment sample were not received at the time of this report.

Low levels of perfluorinated carboxylic acids were detected in the surface water sample, at concentrations below the State HRL or other drinking water health-based values defined by the MDH. The State drinking water criteria are not necessarily applicable to surface waters, but are discussed here for comparison purposes only. There are no surface water criteria for PFCs applicable to the sampled wetland in Burnsville.

4.0 BEMIDJI PRIVATE WELL SAMPLING

4.1 Previous Sampling at Bemidji Regional Airport

Soil and groundwater sampling was conducted in November 2009 at the area in front of the fire station at the Bemidji Regional Airport, where the Bemidji Fire Department trains periodically with firefighting foam. Soil and groundwater samples were collected from two soil borings, B-1 and B-2. Laboratory analysis of the groundwater samples identified several PFCs, including PFOS at concentrations above the HRL of 300 ng/L. The laboratory analytical results are summarized in **Table 1**.

4.2 Bemidji Well Surveys

Antea Group conducted a groundwater receptor survey in October 2010 of the area located within one-half mile south and southeast of the training area at the Bemidji Airport. The receptor survey identified one active water supply well within or near the survey area. The well at the Kraus Anderson shop is approximately 20 feet deep and is used for wash water and for toilets. Information regarding the October 2010 receptor survey is presented in the November 2010 Report.

Other domestic water wells were known to exist outside the October 2010 receptor survey area. The MDH expressed some concern that domestic wells located in a neighborhood between 3/4-mile and 1 mile east of the fire foam training area at the airport could potentially be impacted by the PFC groundwater impacts. Thus, a recommendation was made in the November 2010 Report to conduct a receptor survey in this area and sample a select number of wells identified in the survey.

Well survey letters were mailed to the owners of 33 properties in the neighborhood immediately east of the Bemidji Regional Airport. Completed well surveys were returned by 17 well owners; the completed surveys

identified 13 active wells in the neighborhood. A list of all properties surveyed and survey responses received is included in **Appendix C**. A map showing the survey area is also included in **Appendix C**.

Of the thirteen active wells identified during the survey, six of the wells were selected for PFC sampling. The wells were selected so as to sample from varying depths and locations within the survey neighborhood. A seventh well, the well at the Kraus Anderson shop, was also selected for PFC sampling.

4.3 Sample Collection at Private Wells in Bemidji

Access agreements between the MPCA and the well owners allowed for the sampling of their wells. The wells were sampled by Antea Group personnel on March 24, 2011, with the following exception: the well owner at 2120 Anne Street NW was not available on the day of sampling. The locations of the wells sampled are included on the map of the survey area included in **Appendix C**. A laboratory-supplied sample jar, nitrile sampling gloves, and cooler were left at 2120 Anne Street NW by Antea Group personnel on March 24, 2011. The property owner collected a sample from the well on March 29, 2011 and shipped the sample in the cooler provided to Antea Group. The well samples were labeled as follows:

- Bemidji 2021 Anne
- Bemidji 2326 Bardwell
- Bemidji 3481 Laurel
- Bemidji 2316 Bardwell
- Bemidji 2103 Anne
- Bemidji Kraus Anderson
- Bemidji 2120 Anne

Sampling methodologies are included in **Appendix D**. Samples were generally collected from an interior tap that was not run through a water softener or other treatment system, with the following exceptions: the well water for all taps at the house at 2316 Bardwell are run through a water softener, and an attempt to collect a water sample directly from a tap connected outside at the well was unsuccessful; and, all taps in the house at 2103 Anne are run through a water softener, including the kitchen tap from which the water sample was collected.

Water samples were submitted to State-contracted Axys Analytical Services for laboratory analysis of PFCs.

4.4 Sample Results for Private Wells in Bemidji

Laboratory results for the water sample collected from the seven private wells in Bemidji were not received at the time of this report.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Sampling results for the water well samples collected from the five wells at the Hidden Harbor Marina indicate detected concentrations of PFCs are below the State HRL or other drinking water health-based values defined by the MDH. Based on the type of PFC compounds detected in the wells at the Marathon Refinery and the Hidden Harbor wells, the PFC impacts in groundwater at the Hidden Harbor Marina are unlikely to be from the firefighting training area at the Marathon Refinery. Antea Group recommends no further well sampling at the Hidden Harbor Marina in association with the PFC-Containing Firefighting Foam Project at this time.

Sampling of the surface water of the wetland located across Cliff Road from the ABLE Fire Training Center identified low levels of PFCs, which were below State drinking water health-based values. Based on the low PFC levels detected in the surface water, no further sampling is recommended at this time. Laboratory results for the sediment sample collected from the wetland are pending at the time of this report.

Laboratory results for the water well sampling conducted east of the Bemidji Regional Airport are pending at the time of this report.

Upon receipt of pending laboratory results, Antea Group will consult with the MPCA regarding results and conclusions, and recommendations can be discussed at that time.

6.0 REMARKS

The recommendations contained in this report represent Antea Group's professional opinions based upon the currently available information and are arrived at in accordance with currently accepted professional standards. This report is based upon a specific scope of work requested by the client. The contract between Antea Group and its client outlines the scope of work, and only those tasks specifically authorized by that contract or outlined in this report were performed. This report is intended only for the use of Antea Group's client. Antea Group will not and cannot be liable for unauthorized reliance by any other third party. Other than as contained in this paragraph, Antea Group makes no express or implied warranty as to the contents of this report.

Nancy Rodning
Project Geologist

Date: May 13, 2011

Reviewed by:

John Estes
Project Manager

Date: May 13, 2011

TABLES

TABLE 1
PFC Analytical Results for Select Firefighting Foam Training Sites
Delta Project No. 19382DEL0

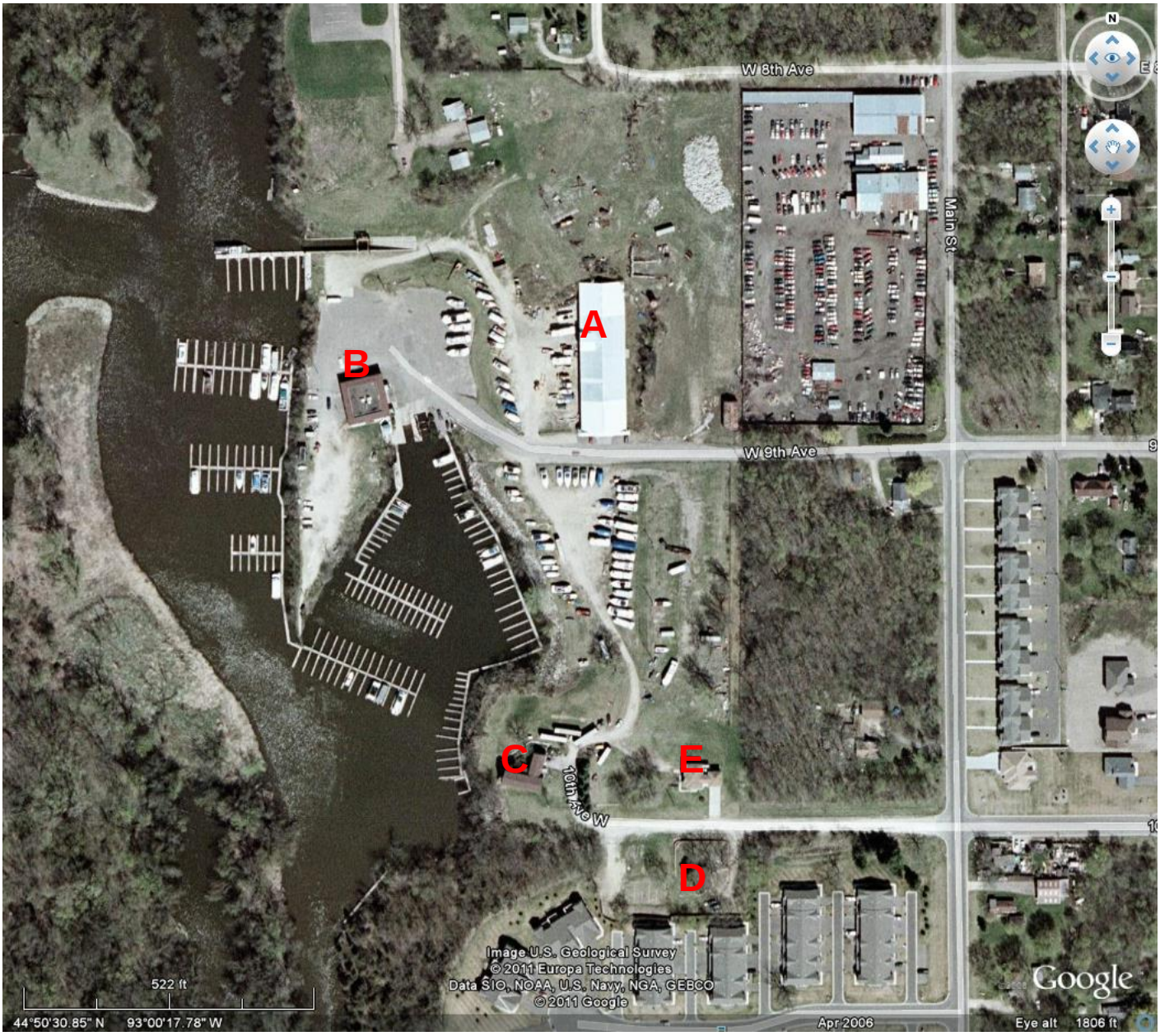
			Perfluorobutanoic acid (PFBA)	Perfluoro-n-pentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnA)	Perfluorododecanoic acid (PFDoA)	Perfluorobutanoic sulfonate (PFBS)	Perfluorohexane sulfonate (PFHxS)	Perflourooctane sulfonate (PFOS)	Perfluorooctane sulfonylamide (PFOSA)
#Perfluorinated Carbon Chains:			**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**4**	**6**	**8**	**8**
Health-Based Limits:			**7000(1)**	**ND**	**ND**	**ND**	**300(2)**	**ND**	**ND**	**ND**	**ND**	**7000(1)**	**RAA(3)**	**300(2)**	**ND**
Sample ID	**Sample Date**	**Laboratory**													
Marathon MW-101	8/20/2009	MPI	**183**	**403**	**150**	**12.4**	**36.7**	<2.5	<2.5	<2.5	<2.5	**479**	**3710**	**93.2**	<2.5
*Marathon MW-912	8/20/2009	MPI	**462**	**298**	**51.5**	**21.8**	**17.5**	<2.5	<2.5	<2.5	<2.5	**37.0**	**1580**	**731**	<2.5
Marathon SP-11	8/20/2009	MPI	**182**	**458**	**171**	**52.2**	**35.6**	**20.7**	<2.5	<2.5	<2.5	**369**	**4910**	**5770**	<2.5
Marathon MW-172	8/20/2009	MPI	**59.8**	**245**	**154**	**25.1**	**15.5**	**11.4**	<2.5	<2.5	<2.5	**49.0**	**1220**	**1330**	<2.5
Marathon MW-156	8/20/2009	MPI	**220**	**1730**	**527**	**200**	**73.1**	**26.9**	<2.5	**2.58**	<2.5	**462**	**10500**	**14900**	<2.5
Marathon MW-156 Dupl.	8/20/2009	MPI	**221**	**1660**	**534**	**184**	**81.4**	**23.7**	<2.5	**2.93**	<2.5	**502**	**8930**	**11700**	**2.62**
Well A - Hidden Harbor	3/3/2011	Axys	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 5.02	< 5.02	< 5.02	< 2.51
Well B - Hidden Harbor	3/3/2011	Axys	**94.3**	**3.11**	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 4.98	< 4.98	< 4.98	< 2.49
Well C - Hidden Harbor	3/3/2011	Axys	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 5.03	< 5.03	< 5.03	< 2.51
Well D - Hidden Harbor	3/3/2011	Axys	**965**	**67.5**	**34.4**	< 11.8	**61.5**	< 11.8	< 11.8	< 11.8	< 11.8	< 23.5	< 23.5	< 23.5	< 11.8
Well E - Hidden Harbor	3/3/2011	Axys	**542**	< 16.5	< 16.5	< 16.5	< 16.5	< 16.5	< 16.5	< 16.5	< 16.5	< 33.1	< 33.1	< 33.1	< 16.5
Burnsville B-3 GW 44.5 ft.	8/27/2009	Axys	**146**	**422**	**281**	**447**	**1260**	**81.7**	**17.8**	< 2.52	< 2.52	**12.8**	**279**	**522**	< 2.52
Burnsville Pond SW-1	4/20/2011	Axys	**10.8**	< 2.55	< 2.55	**2.82**	**4.16**	< 2.55	< 2.55	< 2.55	< 2.55	< 5.10	< 5.10	< 5.10	< 2.55
Bemidji B-1 GW 15 ft.	11/5/2009	Axys	**4.14**	**3.85**	**14.5**	**3.75**	**49**	< 2.50	< 2.50	< 2.50	< 2.50	**19.1**	**227**	**483**	< 2.50
Bemidji B-2 GW 15 ft.	11/5/2009	Axys	**21.1**	**55.5**	**340**	**33.8**	**200**	< 12.2	< 12.2	< 12.2	< 12.2	**129**	**1490**	**789**	< 12.2

Notes:
All results and standards are in nanograms per liter (ng/L), which is equivalent to parts per trillion.
Axys: Axys Analytical Services LTD
MPI: MPI Research
MDH: Minnesota Department of Health Environmental Laboratory.
Bolded type indicates detection above the laboratory method detection limit.
Highlighted concentrations exceed a State health-based limit.
(1) Health-Based Value (HBV) for chronic exposure defined by the Minnesota Department of Health.
(2) Health Risk Limit (HRL) for drinking water defined by the Minnesota Department of Health.
(3) Risk Assessment Advise (RAA) set by the Minnesota Department of Health for PFHxS does not specify numeric values.
ND: No health-based limit defined.
*Sample collected upgradient of fire foam training or discharge area, intended to act as "background" sample.

Antea Group

Appendix A

Hidden Harbor Marina Well Sampling Documentation



Hidden Harbor Marina Water Supply Wells
Sampled for PFCs on March 3, 2011 by Antea Group on behalf of the MPCA

Well A	Located in the marina workshop, used for non-potable uses. Unique Well #268354.
Well B	Located in the parking lot north of the restaurant/bar. Restaurant/bar and marina docks connected to this well. Unique Well #559256
Well C	Located in backyard of marina house. This house is currently being used as the shower house for use by marina customers. Unique Well # unknown.
Well D	Located in the crawl space of the house at 1001 Oak Street. Unique Well # unknown.
Well E	Located in the house basement at 115 10th Avenue West. Unique Well #429870

AXYS | Axys Analytical Services Ltd

CHAIN OF CUSTODY

2045 Mills Road West TEL: (250) 655-5800
Sidney, British Columbia, Canada V8L 5X2 FAX: (250) 655-5811

AXYS CLIENT #: 4095

REPORT TO:
Company: Minn Pollution Control Agency
Address: 520 Lafayette Rd N.
St. Paul, MN 55155
Contact: Nile Fellows
Phone: 651-757-2352
FAX: 651-296-9707
E-mail: nile.fellows@state.mn.us

INVOICE TO:
Company: Same as Report To
Address:
Contact:
Phone:
FAX:
E-mail:

Project Name/Number: 456 18DEL03/WO SFDE1113

Sampler's Name: Nancy Rodning, AnteaGroup
Signature: Nancy Rodning

Client Sample Identification	Matrix	Sampling Date	Sampling Time	Container Type/No.	AXYS Lab Sample ID (Lab use only)	ANALYSIS REQUESTED: PCDFs & PCDDs
Well A - Hidden Harbor	water	3-3-11	9:15	1L HDPE		X
Well B - Hidden Harbor			9:25			X
Well C - Hidden Harbor			9:35			X
Well D - Hidden Harbor			9:50			X
Well F - Hidden Harbor			10:00			X

Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
Nancy Rodning	3-7-11	14:00			
Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time

Courier: Fed Ex
Waybill No.: 8724 3523 9160

Remarks:

Sample Receipt

	Cooler
Temp °C	
Custody Seal #	
Seal Intact Y / N	
Sample Tags Y / N	

CLIENT ID	Well A- Hidden Harbor	Well B- Hidden Harbor	Well C- Hidden Harbor	Well D- Hidden Harbor	Well E- Hidden Harbor	Lab Blank	Spiked Matrix	Well E- Hidden Harbor (MS)	Well E- Hidden Harbor (MSD)	Well E- Hidden Harbor (MSD)	Well E- Hidden Harbor (MS)
AXYS ID	L16203-1	L16203-2	L16203-3	L16203-4	L16203-5 (A)	WG35901-101	WG35901-102	WG35901-103	WG35901-104	WG35901-104	WG35901-103
WORKGROUP	WG35901	WG35901	WG35901	WG35901	WG35901	WG35901	WG35901	WG35901	WG35901	WG35901	WG35901
Sample Size	0.498 L	0.502 L	0.497 L	0.106 L	0.0755 L	0.100 L		0.0735 L	0.0743 L	0.0743 L	0.0735 L
UNITS	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	% Recov	ng/L	ng/L	% Recov	% Recov
PFBA	< 2.51	94.3	< 2.51	965	542	< 12.5	95.7	4040	3810	97	103
PFPeA	< 2.51	3.11	< 2.51	67.5	< 16.5	< 12.5	88.2	3720	3520	105	109
PFHxA	< 2.51	< 2.49	< 2.51	34.4	< 16.5	< 12.5	101	3350	3490	104	98.6
PFHpA	< 2.51	< 2.49	< 2.51	< 11.8	< 16.5	< 12.5	90.6	3730	3570	106	110
PFOA	< 2.51	< 2.49	< 2.51	61.5	< 16.5	< 12.5	115	3430	3490	104	101
PFNA	< 2.51	< 2.49	< 2.51	< 11.8	< 16.5	< 12.5	86.4	4200	3530	105	124
PFDA	< 2.51	< 2.49	< 2.51	< 11.8	< 16.5	< 12.5	99.4	3620	3490	104	106
PFUnA	< 2.51	< 2.49	< 2.51	< 11.8	< 16.5	< 12.5	87.6	3470	3340	99.1	102
PFDoA	< 2.51	< 2.49	< 2.51	< 11.8	< 16.5	< 12.5	103	3650	3370	100	107
PFBS	< 5.02	< 4.98	< 5.03	< 23.5	< 33.1	< 25.0	106	6900	6970	103	101
PFHxS	< 5.02	< 4.98	< 5.03	< 23.5	< 33.1	< 25.0	101	6970	7260	108	102
PFOS	< 5.02	< 4.98	< 5.03	< 23.5	< 33.1	< 25.0	94.1	7880	7890	117	116
PFOSA	< 2.51	< 2.49	< 2.51	< 11.8	< 16.5	< 12.5	93.6	4370	4180	124	129

See below for definitions of possible flags and labels in the database (sheet tab 'GenericEDD')

R	=	peak detected but did not meet quantification criteria number following this flag represents the estimated maximum possible concentration
<	=	less than the detection limit number following this symbol represents the detection limit For homologue totals sums, please see the individual congener data for the detection limit.

There may be additional flags associated with these data; please see individual hard copy reports for a complete list of flags and definitior

Appendix B

Burnsville Wetland Sampling Documentation

Surface Water and Sediment Sample Location
Burnsville Parcel 026420002303
Burnsville, Minnesota

AXYS | Axys Analytical Services Ltd

2045 Mills Road West TEL: (250) 655-5800
Sidney, British Columbia, Canada V8L 5X2 FAX: (250) 655-5811

CHAIN OF CUSTODY

AXYS CLIENT #: 4095

REPORT TO:
Company: Minnesota Pollution Control Agency
Address: 520 Lafayette Rd. St. Paul, MN 55155
Contact: Nile Fellows
Phone: 651-757-2352
FAX:
E-mail: nile.fellows@state.mn.us

INVOICE TO:
Company: Same as 'Report to'
Address:
Contact:
Phone:
FAX:
E-mail:

Project Name/Number: PFC-FireFighting Foam

Sampler's Name: Nancy Rodning
Signature: Nancy Rodning

Client Sample Identification	Matrix	Sampling Date	Sampling Time	Container Type/No.	AXYS Lab Sample ID (Lab use only)	ANALYSIS REQUESTED: PFC 4
Burnsville Pond SW-1	water	4-20-11	13:00	1L HDPE		X
Burnsville Pond Sed-1	soil	4-20-11	13:02	250mL HDPE		X

Relinquished by (Signature): Nancy Rodning/ANTEAGroup — Date: 4-20-11 — Time: 15:00
Relinquished by (Signature): — Date: — Time:

Received by (Signature): — Date: — Time:
Received by (Signature): — Date: — Time:

Remarks:

Courier: Fed Ex
Waybill No.: 8724 3523 9219

Sample Receipt

	Cooler
Temp °C	
Custody Seal #	
Seal Intact Y / N	
Sample Tags Y / N	

CLIENT ID	Burnsville Pond SW-1	Lab Blank	Spiked Matrix	Spiked Matrix (Duplicate)
AXYS ID	L16381-1	WG36395-101	WG36395-102 (A)	WG36395-103 (DUP WG36395-102)
WORKGROUP	WG36395	WG36395	WG36395	WG36395
Sample Size	0.490 L	0.500 L		
UNITS	ng/L	ng/L	% Recov	% Recov
PFBA	10.8	< 2.50	102	99.7
PFPeA	< 2.55	< 2.50	101	95.3
PFHxA	< 2.55	< 2.50	105	98.8
PFHpA	2.82	< 2.50	92.5	88.9
PFOA	4.16	< 2.50	99.2	99.6
PFNA	< 2.55	< 2.50	116	98.3
PFDA	< 2.55	< 2.50	105	103
PFUnA	< 2.55	< 2.50	97.4	95.5
PFDoA	< 2.55	< 2.50	109	107
PFBS	< 5.10	< 5.00	106	111
PFHxS	< 5.10	< 5.00	96.9	104
PFOS	< 5.10	< 5.00	89.3	89.8
PFOSA	< 2.55	< 2.50	91.7	93.6

See below for definitions of possible flags and labels in the database (sheet tab 'GenericEDD')

K	=	peak detected but did not meet quantification criteria number following this flag represents the estimated maximum possible concentration
<	=	less than the detection limit number following this symbol represents the detection limit For homologue totals sums, please see the individual congener data for the detection limit.

There may be additional flags associated with these data; please see individual hard copy reports for a complete list of flags and definitior

Appendix C

Bemidji Receptor Survey and Well Sampling Documentation

WELL RECEPTOR SURVEY RESULTS
BEMIDJI FIRE DEPARTMENT TRAINING AREA - BEMIDJI REGIONAL AIRPORT
March 2011

ADDRESS	WELL? Yes/No	ACTIVE? Yes/No	WELL USE	WELL DEPTH	COMMENTS
2405 Alyce Court NW					No questionnaire returned.
1826 Anne Street NW					No questionnaire returned.
1925 Anne Street NW					No questionnaire returned.
2001 Anne Street NW					No questionnaire returned.
2014 Anne Street NW					No questionnaire returned.
2015 Anne Street NW					No questionnaire returned.
2021 Anne Street NW	yes	yes	drinking, lawn	30 feet	Well installed 1972, basement. Municipal water also being utlilized.
2027 Anne Street NW					No questionnaire returned.
2103 Anne Street NW	yes	yes	all household uses	55 feet	Well installed 1987, front yard. No municipal water being utilized.
2120 Anne Street NW	yes	yes	drinking, lawn	unknown	Well installed ~1995, located between shop and trailer house. No municipal water being utilized.
2220 Anne Street NW					No questionnaire returned.
2127 Bardwell Drive NW	yes	no	NA	unknown	Well installed 1997, abandoned/sealed 2010. Located just north of building. Municipal water being utilized.
2201 Bardwell Drive NW	yes	yes	lawn irrigation	65 feet	Well installed 1995, east side of office portion of building. Municipal water being utilized.
2212 Bardwell Drive NW	no	NA	NA	NA	Reported no well, no municipal water.
2231 Bardwell Drive NW	yes	yes	lawn irrigation	44 feet	Well installed 1995. Accessible via outside faucet. Municipal water also being utilized.
2310 Bardwell Drive NW					No questionnaire returned.
2316 Bardwell Drive NW	yes	yes	all household uses	100+ feet	Well installed 1989. Municipal water not being utilized.
2322 Bardwell Drive NW	yes	yes	bathroom utilities	unknown	Well installed 1997, northeast corner of the property. No municipal water being utilized.
2324 Bardwell Drive NW					No questionnaire returned.
2326 Bardwell Drive NW	yes	yes	all household uses	52 feet	Well installed 1992, front of house. Municipal water also being utilized.
2532 Bardwell Drive NW					No questionnaire returned.
3354 Laurel Drive NW	yes	yes	lawn irrigation	unknown	Located between building and fence.

WELL RECEPTOR SURVEY RESULTS
BEMIDJI FIRE DEPARTMENT TRAINING AREA - BEMIDJI REGIONAL AIRPORT
March 2011

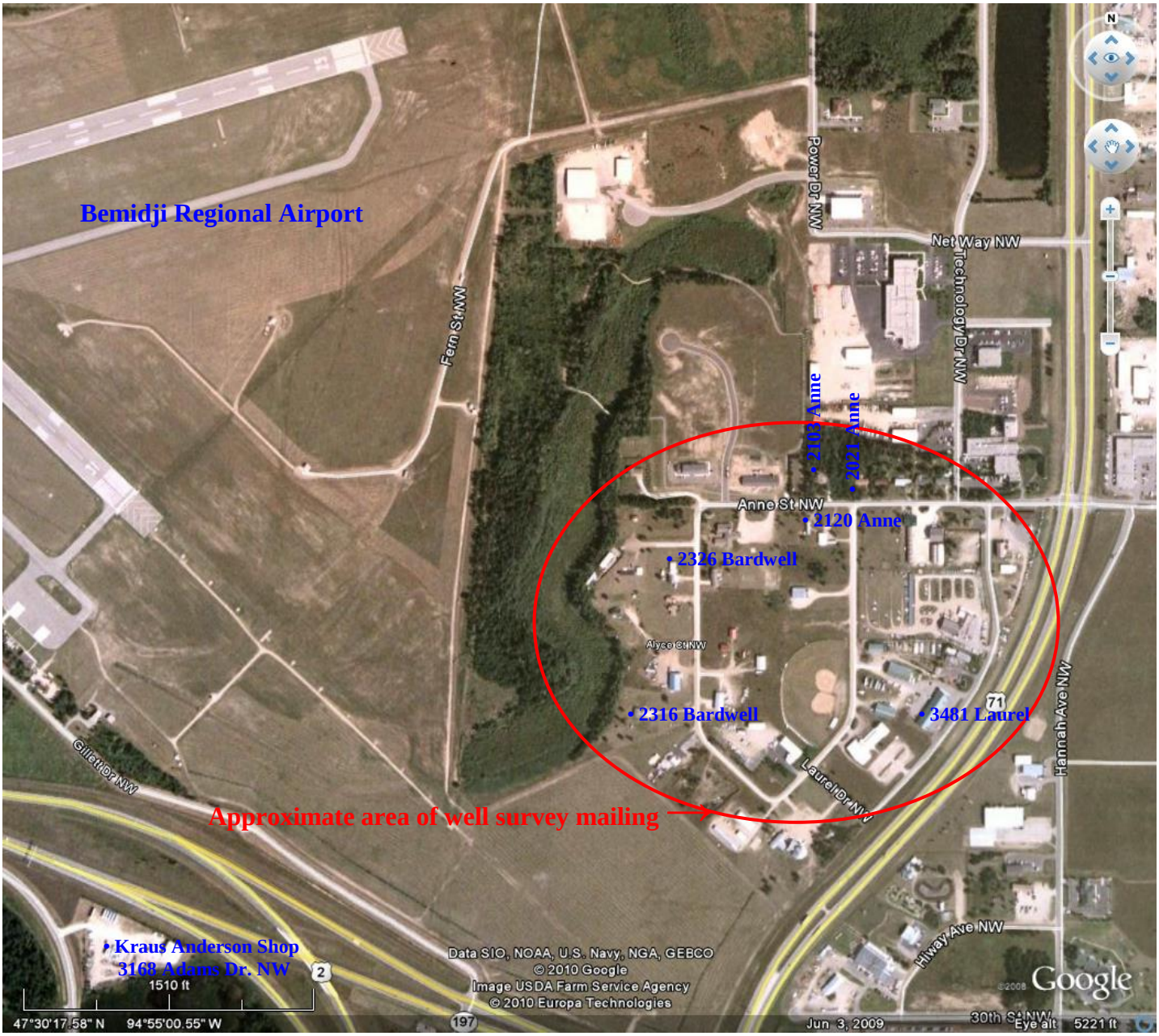
ADDRESS	WELL? Yes/No	ACTIVE? Yes/No	WELL USE	WELL DEPTH	COMMENTS
3455 Laurel Drive NW	yes	no	NA	NA	Well sealed 2010, northwest corner of property.
3481 Laurel Drive NW	yes	yes	drinking	60 feet	No municipal water being utilized.
2134 Bardwell Drive NW	yes	yes	drinking	60 feet	No municipal water being utilized.
3501 Laurel Drive NW	yes	yes	irrigation	100 feet?	Well installed 1987, 10 ft. north of office building. Not used for drinking water. Municipal water also being utilized.
3611 Laurel Drive NW	yes	yes	toilets, washing boats	unknown	Bemidji Marine. Bottled water for drinking. No municipal water being utilized.
3709 Laurel Drive NW	yes	yes	irrigation, pressure wash	unknown	One active and two sealed wells (2010). Well located between the two site buildings. Municipal water also being utilized.
2221 Tod Court NW	no	NA	NA	NA	Reported no well, no municipal water.
2225 Tod Court NW					[1]Survey returned NSN; remailed to property owner tax address.
2402 Tracy Court NW					No questionnaire returned.
2408 Tracy Court NW					[1]Survey returned NSN; remailed to property owner tax address.
3810 Whispering Meadows Court NW					No questionnaire returned.
3813 Whispering Meadows Court NW					No questionnaire returned.
3168 Adams Drive NW	yes	yes	pressure wash, bathrooms	~20 feet	Telephone interview, October 2010, Kraus Anderson Construction Shop

Notes:

(1) mail returned by Post Office, "no such number."

Water sample collected for PFC analysis.

Antea Group



Water Well Sample Locations
Bemidji, Minnesota

AXYS | Axys Analytical Services Ltd

2045 Mills Road West TEL: (250) 655-5800
Sidney, British Columbia, Canada V8L 5X2 FAX: (250) 655-5811

CHAIN OF CUSTODY

AXYS CLIENT #: 4095

REPORT TO:
Company: Minnesota Pollution Control Agency
Address: 520 Lafayette Rd, St. Paul, MN 55155
Contact: Nile Fellows
Phone: 651-757-2352
FAX: 651-296-9707
E-mail: NileFellows@state.mn.us

INVOICE TO:
Company: SAME
Address:
Contact:
Phone:
FAX:
E-mail:

Project Name/Number: Bemidji well Sampling
Sampler's Name: Nancy Rodning
Signature: Nancy Rodning

Client Sample Identification	Matrix	Sampling Date	Sampling Time	Container Type/No.	AXYS Lab Sample ID (Lab use only)	ANALYSIS REQUESTED: PFCs
Bemidji 2021 Anne	water	3-24-11	11:05	1 Liter		X
Bemidji 2326 Bardwell	water	3-24-11	11:30	1 Liter		X
Bemidji Kraus Anderson	water	3-24-11	11:45	1 Liter		X
Bemidji 3481 Laurel	water	3-24-11	12:50	1 Liter		X
Bemidji 2316 Bardwell	water	3-24-11	13:15	1 Liter		X
Bemidji 2103 Anne	water	3-24-11	16:30	1 Liter		X
~~Bemidji~~						

Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
Nancy Rodning	3-25-11	15:00			
Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time

Remarks

Courier: FedEx
Waybill No.: 8724 3523 9208

Sample Receipt

	Cooler
Temp °C	
Custody Seal #	
Seal Intact Y / N	
Sample Tags Y / N	

AXYS | Axys Analytical Services Ltd

2045 Mills Road West TEL: (250) 655-5800
Sidney, British Columbia, Canada V8L 5X2 FAX: (250) 655-5811

CHAIN OF CUSTODY

AXYS CLIENT #: 4095.

REPORT TO:
Company: Minnesota Pollution Control Agency
Address: 520 Lafayette Rd
St. Paul, MN 55155
Contact: Nile Fellows
Phone: 651-757-2352
FAX: 651-296-9707
E-mail: nile.fellows@state.mn.us

INVOICE TO:
Company: same
Address:
Contact:
Phone:
FAX:
E-mail:

Project Name/Number: Bemidji Well Sampling

Sampler's Name: Nancy Radtke
Signature: Nancy Radtke

Client Sample Identification	Matrix	Sampling Date	Sampling Time	Container Type/No.	AXYS Lab Sample ID (Lab use only)	ANALYSIS REQUESTED: PFCs
Bemidji 2120 Anne	water	3-24-11	12:00	1 Liter HDPE		X

Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
Nancy Radtke	3-31-11	12:00			
Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time

Remarks:

Courier: FedEx
Waybill No.: 8724 3523 9193

Sample Receipt

	Cooler
Temp °C	
Custody Seal #	
Seal Intact Y / N	
Sample Tags Y / N	

Appendix D

PFC Sampling Methodologies

SAMPLING METHODOLOGIES AT
FIREFIGHTING FOAM TRAINING AND DISCHARGE AREAS

Special PFC Sampling Consideration

Since PFCs are also found in numerous everyday items, the following special precautions were taken during all sampling activities: no use of Teflon®-containing materials (i.e. Teflon® tubing, bailers, tape, plumbing paste); no Tyvek® clothing was worn; clothes treated with stain- or rain-resistant coatings were avoided or had gone through several washings; no Post-It® Notes were handled or brought on site; no fast food wrappers, disposable cups or microwave popcorn were brought on site during sampling, and hands were washed after handing such items and prior to any sampling activities; and no use of chemical (blue) ice packs was allowed.

Nitrile gloves were worn during all sample collection activities.

Surface Water Sample Collection

Surface water samples were collected near the edge of the water body; the water body was not entered for sample collection. Surface water samples were collected by dipping the (non-preserved) 1-liter High-Density Polyethylene (HDPE) sample jar supplied by the laboratory at the surface of the water and allowing the jar to slowly fill. Intermediary containers were not used. Water samples were labeled and stored in an iced, insulated cooler provided by the laboratory pending shipment to the laboratory.

Surface water samples were collected prior to sediment samples so sediments were not disturbed prior to sample collection.

Sediment Sample Collection

Sediment samples were collected by hand from the upper four inches of sediment, near the edge of the water body; the water body was not entered for sample collection. A shovel was utilized to loosen the sediment at the edge of the wetland; dense vegetation matted the sediment at the bottom of the wetland. Sediment samples were placed directly into non-preserved, 250-millileter HDPE jars supplied by the laboratory, without the use of intermediary containers. Sediment samples were labeled and stored in an iced, insulated cooler provided by the laboratory pending shipment to the laboratory.

Water Supply Well Sample Collection

Water samples were collected from a faucet not connected to a water softener or treatment system, except as reported in the body of the report. The faucet was turned on and water allowed to flow for five minutes before sample collection. Water was collected directly into non-preserved, 1-liter HDPE jars provided by the laboratory. No intermediary containers were used. Water samples were labeled and stored in an iced, insulated cooler provided by the laboratory pending shipment to the laboratory.

Chain of Custody

A chain-of-custody record was prepared for the samples, including client (MPCA) name and address, project name, sample identification, sample matrix, sample date and time, type of analysis, and sampler name and signature. The chain-of-custody was kept with the samples until shipment of the samples to the laboratory

Sample Shipment

Samples for PFC analysis were securely packed in an insulated cooler provided by the laboratory with ice and chain-of-custody record. The cooler was shipped Priority Overnight via FedEx to the following laboratory:

Axys Analytical Services, LTD
2045 Mills Road West
Sidney, British Columbia V8L5X2
Canada

Samples were shipped with required international shipping documents.