Application for use of **Pesticides**
under an **Aquatic Nuisance Control Permit**
Per 10 V.S.A. Chapter 50, § 1455

For Aquatic Nuisance Control Permit Program Use Only
Application Number: 2016-C14

VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WATERSHED MANAGEMENT DIVISION
LAKES & PONDS PROGRAM

Submission of this application constitutes notice that the entities listed below intend to use pesticides in waters of the State to control aquatic nuisance plants, insects, or other aquatic life; and that the entities below have demonstrated that (1) there is no reasonable nonchemical alternative available; (2) there is acceptable risk to the nontarget environment; (3) there is negligible risk to public health; (4) a long-range management plan has been developed which incorporates a schedule of pesticide minimization; and (5) there is a public benefit to be achieved from the application of a pesticide or, in the case of a pond located entirely on a landowner's property, no undue adverse effect upon the public good. Submit an application fee of $75 for a private pond or $500 for all other waterbodies, made payable to the State of Vermont. All information required on this form must be provided, and the requisite fees must be submitted to be deemed complete.

A. Applicant Information

1. Entity's Name: Bradley Young, United States Fish and Wildlife Service

2a. Mailing Address: 11 Lincoln St.

2b. Municipality: Essex Junction	2c. State: VT	2d. Zip: 05452

3. Phone: 802-872-0629	4. Email: bradley_young@fws.gov

B. Pesticide Applicator Information (Check box if same as above in Section A: ☒)

1. Entity's Name:

2a. Mailing Address:

2b. Municipality:	2c. State:	2d. Zip:

3. Phone:	4. Email:

C. Application Preparer Information (Check box if same as above: Section A ☒ and/or B ☐)

1. Preparer's Name:

2a. Mailing Address:

2b. Municipality:	2c. State:	2d. Zip:

3. Phone:	4. Email:

D. Waterbody Information

1. Name of waterbody: LaPlatte River 2. Shelburne, Hinesburg

3. Are there wetlands associated with the waterbody? ☐ Yes ☒ No
Contact the Vermont Wetland Program: (802) 828-1535 for additional information.

4. Are there rare, threatened or endangered species associated with the waterbody? ☒ Yes ☐ No
Contact the Vermont Fish & Wildlife Natural Heritage Inventory: (802) 241-3700 for additional information.

5a. Is this waterbody a private pond (per 10 V.S.A. 5210)? ☐ Yes ☒ No If No, skip to Question D6.

5b. Is this private pond totally contained on landowner's property? ☐ Yes ☐ No

5c. Does the private pond have an outlet? ☐ Yes ☐ No
If yes, what is the name of the receiving water from this outlet?

5d. Is the flow from this outlet controlled? ☐ Yes ☐ No
If yes, how and for how long?

6. List the uses of the waterbody – check all that apply:
☒ Water supply ☒ Irrigation ☒ Boating ☐ Swimming ☒ Fishing ☐ Other:

E. Treatment Information

1a. Proposed start date: 10/11/16

1b. Proposed end date (if known): 11/30/16

2. Aquatic nuisance(s) to be controlled:
Plant/Algae/Animal: Sea Lamprey
Submit additional information as needed.

3. Pesticide(s) to be used[1]: 3-Trifluoromethyl, 4-Nitro
Trade Name: TFM-HP and TFM-BAR
EPA Registration #: 6704-45 and 6704-15
Submit a copy of the Product Label & Material Safety Data Sheet.

4. Provide a map of control activity area.
Provide location of (each) treatment area in waterbody.

5. Application rate (ppm): see attachment 1
Explain the above application rate & provide calculations.

6. Attach a narrative description of the proposed project to include the following items:
 a) Reason(s) to control the aquatic nuisance;
 b) Brief history of the aquatic nuisance in the waterbody;
 c) Reason why no reasonable nonchemical alternatives are available; and,
 d) Description of the proposed control activity.

7. If you answered "no" to D5b above, then a Long-range Management Plan[2] (LMP) is required:
 a) Describe how control of the nuisance species will be conducted for the duration of the permit (must be at least a 5 year time span and incorporate a schedule of pesticide minimization); and,
 b) Explain how the LMP will be financed; include a budget and funding sources for each year.

F. Applicant/Applicator Certification

As APPLICANT, I hereby certify that the statements presented on this application are true and accurate; guarantee to hold the State of Vermont harmless from all suits, claims, or causes of action that arise from the permitted activity; and recognize that by signing this application, I agree to complete all aspects of the project as authorized. I understand that failure to comply with the foregoing may result in violation of the 10 VSA Chapter 50, § 1455, and the Vermont Agency of Natural Resources may bring an enforcement action for violations of the Act pursuant to 10 V.S.A. chapter 201.

Applicant/Applicator Signature: ______________________ Date: 5/12/2016

G. Application Preparer Certification (if applicable)

As APPLICATION PREPARER, I hereby certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Application Preparer Signature: ______________________ Date: 5/12/2016

H. Application Fees

Print Form

Submit this form and the $75 or $500 fee to:

Vermont Department of Environmental Conservation
Watershed Management Division
Aquatic Nuisance Control Permit Program
1 National Life Drive, Main 2
Montpelier, VT 05620-3522

Direct all correspondence or questions to the Aquatic Nuisance Control Permit Program at:
ANR.Shoreland@vermont.gov
For additional information visit: www.watershedmanagement.vt.gov

[1] The application fee for the aquatic pesticide Aquashade® and copper compounds used as algaecides is **$50** per application.
[2] Any landowner applying to use a pesticide for aquatic nuisance control on a pond located *entirely* on the landowner's property is exempt from the Long-range Management Plan requirement, as per 10 VSA §1455(e)

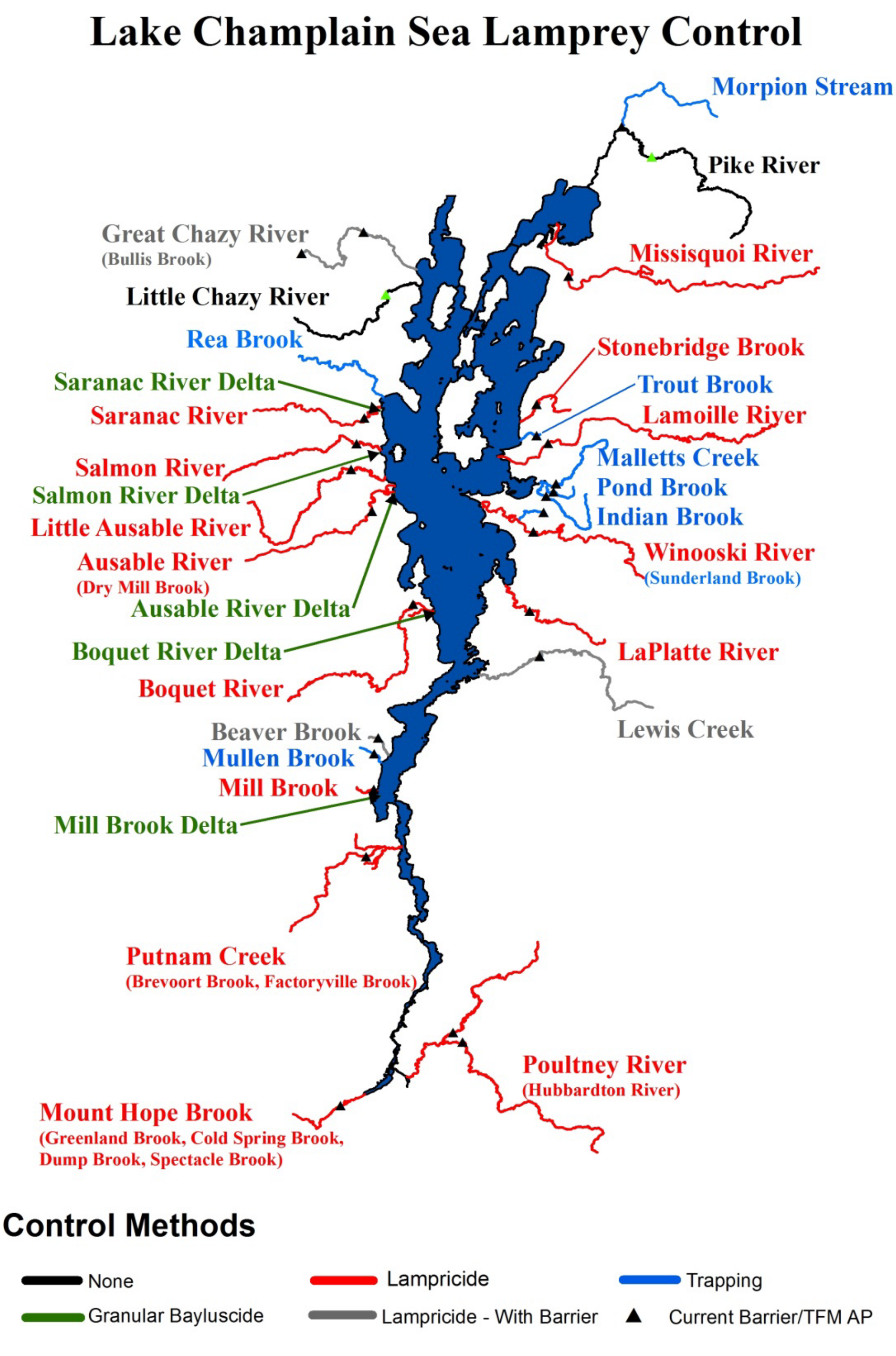
Attachment 1

Proposed Lampricide Treatment of the LaPlatte River in 2016 and 2020

Detailed Project Description
and
Information Supporting the Five Criteria for Aquatic Nuisance Control Permit Issuance

April 13th, 2016

Background and Rationale



The Lake Champlain Fish and Wildlife Management Cooperative (LCFWMC), made up of the Vermont Fish and Wildlife Department (VTFWD), New York State Department of Environmental Conservation (NYSDEC), and U. S. Fish and Wildlife Service (USFWS), initiated the long-term sea lamprey *(Petromyzon marinus)* control program in 2002. The Final Supplemental Environmental Impact Statement (FSEIS), *A long-term program of sea lamprey control in Lake Champlain*, details the program (purpose and need: pp. 3-10; history of the problem: pp. 27-31; summary of lampricide treatment methodologies: pp. 34-36). The long-term program was developed in response to significant improvements in salmonid survival, fishing quality, and economic impact resulting from the 1990-1997 experimental sea lamprey control program (Fisheries Technical Committee 1999). There are currently 20 tributary systems included in the long-term program, with eight in Vermont, ten in New York, the Poultney/Hubbardton River system on the New York-Vermont border and the Pike River/Morpion Stream system in Quebec (Figure 1).

Figure 1. Lake Champlain tributaries included in the sea lamprey control program.

Wounding Rates and Socio-economic Impacts

From the conclusion of the experimental program in 1997 to the initiation of the long-term program in 2002, the parasitic-phase sea lamprey population rebounded and lamprey wounding approached and exceeded pre-control levels. Current wounding rates (27) on Lake Champlain lake trout (*Salvelinus namaycush*) and landlocked Atlantic salmon (*Salmo salar*) (19) continue to remain just above targets established for the program (Table 1). The program's objectives, stated in the FSEIS, are a maximum of 15 and 25 wounds per 100 fish for salmon and lake trout respectively. The walleye (*Sander vitreum*) wounding rate monitoring program includes surveys that alternate by river and year in order to collect data that represent the wounding rate throughout the basin (Table 2). Consistent maintenance of a long-term program of sea lamprey treatments at regular intervals is necessary to achieve and sustain target wounding rates for salmon, lake trout, walleye, and other species affected by sea lamprey parasitism.

Poor fishing in the past led many anglers to seek fishing opportunities elsewhere and adversely affected the Lake Champlain charter fishing industry. In 1997, 13 Lake Champlain fishing charter businesses (based in Vermont and New York) participated in an economic study of fishing-related businesses (Gilbert 1998). This number is estimated to be less than half of the fishing charter businesses that operated at that time. Through the 2000's, about four to six fishing charter businesses remained with significant levels of operation on Lake Champlain. It has been estimated that $29.4 million (dollars in 1990 value) in annual economic benefits to businesses and residents of the Lake Champlain Basin may have been lost due to the impacts of the uncontrolled sea lamprey population (Gilbert 1999).

Substantial public benefits of sea lamprey control in Lake Champlain were demonstrated during the 8-year experimental program (Fisheries Technical Committee 1999). At the end of the experimental program, fishery benefits and angler satisfaction increased. Responses from surveyed anglers showed that they planned to spend an estimated additional 1.2 million angler days annually fishing Lake Champlain. This additional effort was estimated to generate an additional $42.2 million in fishing-related expenditures if sea lamprey control was fully implemented and its resulting benefits were to accrue and continue. This value increases to an estimated $59.2 million when all water-based recreational activity is considered (Gilbert 1999; Marsden et al. 2003).

While wounding rates are reaching all-time lows since the inception of the program, continued suppression of sea lamprey in Lake Champlain is necessary to sustain and enhance economic and environmental benefits. These benefits include improved fishing quality and related positive economic impacts, as well as enhancing restoration of native lake trout, landlocked Atlantic salmon, lake sturgeon (*Acipenser fulvescens*), and walleye populations in Lake Champlain. Reaching the LCFWMC goal of comprehensive control of all sea lamprey-producing sources in Lake Champlain will achieve and sustain these benefits in the long term (Fisheries Technical Committee 2009).

Table 1. Sea lamprey wounding rates (wounds per 100 fish) on lake trout and landlocked salmon through time. ML= Main Lake basin; IS-MB= Inland Sea-Malletts Bay. Sample sizes are in parentheses.

Species	**Lake Trout[a]**	**Landlocked Salmon[b]**		
Basin	**ML**	**Lakewide**	**ML**	**IS-MB**
Objective	**25**	**15**	**15**	**15**
Pre-control[c]	55 (1,854)	32 (646)	34 (115)	32 (531)
Experimental control[d]	38 (3,290)	31 (1,594)	27 (1,013)	39 (581)
1999	55 (318)	38 (106)	33 (76)	50 (30)
2000	61 (288)	26 (459)	25 (417)	40 (42)
2001	60 (166)	53 (209)	54 (163)	50 (46)
2002	72 (182)	56 (101)	38 (47)	72 (54)
2003	77 (203)	93 (134)	79 (66)	106 (68)
2004	62 (117)	53 (206)	47 (74)	57 (132)
2005	94 (64)	69 (159)	59 (118)	98 (41)
2006	99 (137)	70 (230)	71 (159)	69 (71)
2007	46 (26)	74 (205)	71 (180)	92 (25)
2008	31 (75)	38 (182)	35 (150)	50 (32)
2009	55 (88)	32 (513)	31 (414)	38 (99)
2010	40 (218)	15 (292)	15 (269)	22 (23)
2011	30 (168)	19 (621)	19 (543)	14 (78)
2012	40 (197)	21 (207)	21 (187)	26 (19)
2013	54 (332)	19 (331)	15 (259)	33 (72)
2014	30 (398)	15 (568)	13 (481)	29 (87)
2015	**27 (388)**	**19 (1,017)**	**18 (886)**	**25 (131)**

[a] Lake trout in the 533-633 mm (21-25 inches) length interval.
[b] Salmon in the 432-533 mm (17-21 inches) length interval.
[c] Pre-control included 1982-92 for lake trout and 1985-92 for salmon.
[d] Experimental control included 1993-98

Table 2. Sea lamprey wounding rates on Lake Champlain walleye through time. Sample sizes are in parentheses ("ns" indicates not sampled).

Number of sea lamprey wounds per 100 walleyes [a]																	
Basin	**Objective**	**Pre-control**	**Experimental control**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Poultney & South Bay (South/Main Lake)	2	13 (831)	4 (451)	3 (122)	3 (80)	ns	0 (58)	ns	3.8 (52)	4 (50)	ns	Ns	0 (489)	ns	ns	0 (326)	ns
Winooski (Main Lake)	2	ns	3 (664)	2 (110)	7 (174)	4 (265)	ns	11 (389)	6.4 (94)	ns	4.6 (173)	Ns	ns	3.9 (362)	ns	ns	5.2 (346)
Lamoille (Mallet's Bay)	2	ns	4 (975)	16 (69)	Ns	ns	9 (68)	ns	5.5 (105)	ns	ns	Ns	5.0 (139)	ns	ns	2.7 (221)	ns
Missisquoi (Inland Sea)	2	ns	1 (877)	4 (789)	1 (140)	0 (78)	1 (267)	ns	3.8 (130)	3.3 (120)	ns	3.9 (208)	ns	ns	1.5 (133)	ns	ns

[a] Walleyes in the 534-634 mm (21.0-24.9 inches) length interval, collected in spring spawning population surveys. For walleye, pre-control included 1988-92, while eight-year control includes 1993-97. There are no pre-control data for the Winooski, Lamoille, and Missisquoi rivers.

Sea Lamprey Population and Treatment History

The LaPlatte River has never been treated with lampricide. It is however listed in the FSEIS as a candidate river for control. Until 2006, a few surveys of the river indicated it was either free of lamprey or contained so few that it was not considered a priority for adding to the program. Surveys completed since 2006 indicate that the population has increased greatly in number and warrants control as part of the comprehensive control approach in the Lake Champlain Basin.

Sea lamprey larval population assessments conducted by the USFWS Lake Champlain Fish and Wildlife Resources Office are used to select streams that warrant treatments. In 2009, the first signs of a growing population were seen when the river wide population estimate which had been less than 200 in past surveys, jumped to almost 8,000. That finding and resulting Quantitative Assessment Survey (QAS) population estimate led to the investigation of a barrier in 2010. Once the barrier was deemed infeasible, the decision to wait to include the LaPlatte in the new basin-wide geographic-realignment strategy was made which placed its first proposed treatment in 2016. In 2015, a more extensive survey, not QAS, was performed to estimate the density and distribution of larval sea lamprey in the LaPlatte River. The data from that survey are shown in Table 3. While this was not done strictly by previous QAS methods, similar techniques were used that could be used to produce a population estimate seen in Table 3. That estimate is simply a reference to compare to previous surveys. Future non-QAS surveys will be comparable to the 2015 larval density table and abundance distribution maps (Figures 2 and 3).

Table 3. The number of LaPlatte River sea lamprey larvae collected in 2015 from 11 sample plots in Reach 1 and 12 sample plots in Reach 2. Population estimate is given simply as a reference to bridge the gap during transitioning from QAS methodolgy to non-QAS methodolgy.

Reach	N	m^2	Density	Population Estimate
1	122	201	0.607	8,725
2	58	267	0.217	4,952
	180	468	0.3846	13,677

Figure 2. The eleven transects of LaPlatte River, Reach 1 (Route 7 to Shelburne Falls) where lamprey were electrofished in 2015 and the number of larvae collected at each site. The overall catch per unit effort (density) for sea lamprey was 0.607 lamprey/m^2 for the entire area of habitat sampled in Reach 1.

Figure 3. The twelve transects of the LaPlatte River, Reach 2 (Shelburne Falls to Leavensworth Road) where lamprey were electrofished in 2015 and the number of larvae collected at each site. The overall catch per unit effort (density) for sea lamprey was 0.217 lamprey/m^2 for the entire area of habitat sampled in Reach 2.

Five Statutory Criteria [10 V.S.A. § 1455 (d)] to be met for the issuance of a VT Aquatic Nuisance Control Permit

(1) There is no reasonable non-chemical alternative available. The USFWS uses an integrated pest management approach to determine appropriate long-term control strategies on a stream-specific basis (FSEIS pp. 41-47). A body of research has been developed on non-chemical sea lamprey control methods in the Great Lakes (Wagner et al. 2006, Sorensen and Hoye 2007, McLaughlin et al 2007, Bergstedt and Twohey 2007) and Lake Champlain (Alternatives Workgroup 2006). An entire issue of the Journal of Great Lakes Research was dedicated to current lamprey control and alternatives research (Jones et al. 2003) and a current list of research funded by the Great Lakes Fisheries Commission on non-chemical alternative control methods can be found at this website: http://www.glfc.org/research/scr.php#ac. Interest in the use of pheromone attractants as a potential non-chemical alternative has received considerable attention; however, pheromones related control methodologies have not yet progressed beyond the point of limited experimental usage (Johnson et al. 2015).

The *Status Report for the Lake Champlain Sea Lamprey Alternatives Workgroup* (USFWS 2006) summarizes nine studies conducted from 2002 through 2006 which assess potential alternatives to lampricide. Since then, projects such as Pheromone-assisted trapping, Microelemental natal stream statolith signatures, and identifying cross-sectional flow patterns in streams to target the trapping of out-migrating transformers have been undertaken. To date, these efforts have not resulted in development of additional, feasible alternative control methods. In addition, recent studies conducted in Lake Champlain and the Great Lakes, focusing on the use of pheromones as attractants to manipulate spawning runs, have not progressed to the point of an applicable management technique.

The FSEIS states that we must first evaluate trapping as a preferred control technique on the LaPlatte River. If trapping is found to not be feasible, then lampricide usage is recommended. In 2010, the USFWS partnered with the United States Army Corps of Engineers (USACE) and the Vermont Department of Wildlife and Fisheries to evaluate constructing a barrier on the LaPlatte River that would block sea lamprey before they were able to find suitable spawning habitat. This was happening concurrently with an ongoing project to build a sea lamprey barrier of this type in Quebec. The USACE formed a project management plan for us to address constructing a lamprey barrier in the LaPlatte River. This plan included no specific design details, but did assess typical costs for all the phases of the project to be completed as part of the USACE's "Continuing Authorities Program" (Attachment 2). The cost share stipulation of this USACE program would have split the cost 60% for the Cooperative and 40% for the USACE with VT Fish and Wildlife providing $190K in state capital funds. The USACE delivered their project management plan with a cost estimate of over $2 million to complete this project. Even at 60%, that $1.2+ million were an enormous cost, funds that we don't have, and approximately 100 times the cost of a lampricide treatment. After consideration with the Cooperative partners and comparing it to the cost of the Quebec barrier, it was quickly agreed that a barrier was infeasible due to lack of funds and that it would be a gross misuse of public funds when a much less expensive alternative (lampricide) is available and has been shown over the course of 25 years to have very few impacts on non-target species. For these reasons, the barrier/trapping option was determined infeasible by the Cooperative and plans for a proposed lampricide treatment were begun.

(2) There is acceptable risk to the non-target environment. The evidence presented in the FSEIS (pp. 104-170; 188-197; and 307-311) and the results of our previous treatments, demonstrate the low impact that controlled applications of lampricides have on non-target species.

Two State-listed endangered fish species (Stonecats and Channel Darters) are present in the LaPlatte River and are addressed in detail in the VT Endangered and Threatened Species Takings permit application. That application for this proposed treatment is currently under review by the Agency of Natural Resources and therefore, it will not be readdressed in this permit application. One non-listed species of concern (silver lamprey) in the LaPlatte River will be potentially adversely affected by the proposed treatment. Silver lamprey are effectively equal to sea lamprey in their susceptibility to the treatment. There are no other species of special concern or species known to be especially sensitive to TFM known to be present in the LaPlatte River. All known species in the LaPlatte River have been subjected to lampricide treatments in other Vermont rivers in the past and their populations have persisted.

Silver Lamprey

Impacts of TFM on silver lamprey are discussed in pp. 136-140 of the FSEIS. Lampreys of the genus *Ichthyomyzon* (including silver lamprey *I. unicuspis* and northern brook lamprey *I. fossor*) are known to be slightly more resistant to TFM than is the sea lamprey, but substantial losses of silver lamprey larvae are unavoidable in TFM treatments. It has been suggested that reductions in larval sea lamprey abundance may benefit silver lamprey, since invading sea lamprey are highly adaptable and have a competitive advantage (Schuldt and Goold 1980). While not part of a study, USFWS survey data suggest that silver lamprey have proportionally increased in relative abundance to sea lamprey in the Poultney River following successive TFM treatments. Silver lamprey exist at an extremely low density in the LaPlatte River which is not surprising because there is very little available preferred spawning habitat (large gravel) for silver lamprey, but abundant small-large cobble (preferred by sea lamprey). Table 4 presents the results of the most recent population survey for larval lampreys where only 3 silvers were collected. No silver lamprey were collected upstream of Shelburne Falls.

Table 4. LaPlatte River silver lamprey collected during the 2015 pre-treatment larval survey.

Year	River	Population Estimate	# (N)	M^2	Density
2015	LaPlatte	303	3	201	0.01

(3) There is negligible risk to public health. The risk of human exposure to TFM is discussed on pp. 101-104 in the FSEIS. The U. S. Environmental Protection Agency (EPA) stated in its 1999 *Reregistration Eligibility Decision* that "Human risks from exposures of TFM and niclosamide do not exceed levels of concern for the currently registered uses" (FSEIS Appendix C). In 2004, EPA issued risk assessment guidance that stated, "The estimate of 300 parts per billion considers the most sensitive sub-population, infants, and includes a safety factor of 1000x in accordance with agency policy." (Lindsay 2004). The USFWS considers the guidance from the EPA to be adequate, however, the USFWS recognizes and abides by Vermont's state action threshold of 35 parts per billion.

The USFWS is requesting a window for application of lampricide to run from the day after Labor Day until the 1st of December. Historically, the earliest lampricide treatment occurred in Vermont on September 16th, but delta treatments have occurred as early as September 3rd in New York and stream treatments as early as September 8th. This range of dates has been chosen to balance the concerns of different stakeholders while still allowing for a reasonable opportunity to perform lampricide treatments. As the fall season progresses, defoliation of deciduous trees and changing weather cause stream levels to rise, which limits our opportunities to perform treatments because of technical concerns and permit conditions. This becomes a particular concern when multiple treatments are scheduled in Vermont and New York each year.

We avoid spring and summer because of an increased risk of exposure for swimmers and the potential presence of susceptible life stages of lake sturgeon in some rivers which become more tolerant of lampricide as they grow larger. By not applying lampricides until after Labor Day the USFWS avoids major public recreation periods at public access points. The USFWS is committed to informing the public of the risk of exposure to lampricide at the advisory levels mentioned above. A brief description of the plan to notify the public is provided below.

In addition to product label use restrictions, the USFWS will follow the mitigation procedures that further limit human exposure to TFM described in the FSEIS (pp. 178-188) and detailed in, Vermont prior notification, and water supply plan for lampricide applications (Smith 2016a), and Contingency plan for accidental spillage of lampricides during Lake Champlain sea lamprey control operations (Smith 2015). Water use advisories dictated by these procedures advise the public of the risk of exposure from household, agricultural, and recreational swimming uses, and recommend against water use or exposure until TFM levels fall below 35 ppb. All other recreational uses have an advisory level of 100 ppb. A water user survey will be sent to all landowners and leaseholders within the treatment advisory area whose properties are located along the shoreline of the affected area during the summer prior to treatment.

The affected area will encompass the length of the LaPlatte River from Leavensworth Road to its mouth at Lake Champlain. Plume modeling suggests that sampling about 0.75 miles north of the LaPlatte River mouth in Shelburne Bay, extending northward to an east-west arc from Allen Hill Point to the mouth of Monroe Brook (Figure 4), will be more than adequate to monitor the chemical concentration in the lake as it drops below the VDOH advisory thresholds. The Champlain Water District intake and finished water will be sampled as a precaution during this first-time treatment to monitor measurable concentrations there (if any). The public water use survey will identify surface water uses and potential water needs during the treatment (Smith 2016b). The USFWS will post public access points with a sign approved by Vermont DEC and provide a voluntary press release for local broadcast media to notify the public.

A detailed plume modeling study was contracted by the USFWS and completed by Roger Binkerd P.E., which shows the predicted progression and concentration of the chemical plume as it enters the southernmost edge of Shelburne Bay (Attachment 3). Hundreds of simulations were run and evaluated allowing us to present the worst case scenario based on chemical volume applied, river discharge, bay temperature, wind speed and direction, and other considerations. Our chief concern is of course the exposure that may be potentially received by the Champlain Water District (CWD). The model showed that under worst case scenario conditions and without any consideration of photolytic breakdown (2-4 day half-life in sunlight), the highest concentration ever expected to reach the either intake of the CWD is less than 2 ppb. With the VDOH setting its advisory threshold at 35ppb, we believe this treatment does not pose any danger or causes for concern for CWD water users. We will be sampling the intake and finished water at CWD following the treatment, as we have done at Burlington, to confirm this expectation.

(4) Long-range Management Plan. The entire FSEIS constitutes a long-range management plan for sea lamprey control. A commitment to pesticide minimization over time through an integrated pest management approach is detailed in the FSEIS. Lampricide is applied at levels necessary to effectively kill the target organism (sea lamprey), but great care is given to use no more than is necessary thereby limiting the impacts on the non-target environment to the greatest extent possible. Our proposed long-term control strategies include non-chemical control methods in 4 of the 13 Vermont streams inhabited by sea lamprey. We will continue to support and participate in research and investigations into new technologies and methodologies that seek to develop ways to reduce the amount of lampricide needed to effectively control sea lamprey.

(5) Public Benefits. Substantial public benefits of sea lamprey control in Lake Champlain were demonstrated in the 8-year experimental program (Fisheries Technical Committee 1999). At the end of the experimental program, fishery benefits and angler satisfaction increased so dramatically that anglers planned to spend an estimated additional 1.2 million angler days annually fishing Lake Champlain, which generate an estimated additional $42.2 million in fishing related expenditures, if sea lamprey control was fully implemented, and its resulting benefits were to accrue and continue. This value increases to an estimated $59.2 million when all water-based recreational activity is considered (Gilbert, 1999; Marsden et al. 2003). Further details of public benefits can be found on pp. 198-202 of the FSEIS.

While more recent empiric data are not available, the results of the large, lake-wide fishing derbies, the numbers of participants, increased fishing in Lake Champlain, angler satisfaction, and wide-spread public support of the lamprey control program point to many increased public benefits for the citizens of Vermont.

Treatment Strategy and Methodology

Proposed Treatment Strategy

The issue which drove our choice of 1.2 x MLC as the target treatment concentration was the presence of stonecats in the LaPlatte River. We would have proposed 1.3 x MLC if Channel Darters were the only listed species (as in Poultney and Winooski). Our previously permitted and successful experience in treating over stonecats in Vermont (Missisquoi River 2012) at 1.2 x MLC led to our decision to limit the application to that concentration. That concentration is extremely challenging from a technical standpoint (smaller rivers are harder to treat than larger ones due to higher temporal variability), but we believe the strategy outlined below will provide a successful treatment when executed

1. *The primary lampricide application point (AP) is located at the Leavensworth Road crossing (river mile 12.3). There may be multiple maintenance (Boost) AP's; at the Dorset Street crossing (river mile 10.3), the Spear Street crossing (7.0), and at the Falls in Shelburne (3.5). Because this is a first-time treatment, we have no experience on which to judge the location, number, and need for boosts. For this reason, we have listed a maximum number of potential boost sites. Treating at a relatively low concentration of 1.2 x MLC requires more boosts to maintain the lethal concentration and makes the need for boosts more likely, but there is truly no way to know until we do the treatment whether we will need to boost at any or all of those listed points.*

2. *Application rate: TFM will be applied for 12 to 14 consecutive hours to achieve a target in-stream treatment concentration of no greater than 1.2 x MLC.*

3. *MLC will be determined by the results of an on-site flow-through toxicity test and diurnal stream pH and alkalinity. Adjustments will be made to target concentrations and application rates to compensate for unexpected variations in pH and/or alkalinity during treatment. The toxicity test will be conducted as near as feasible to the proposed primary application point, using water drawn from the LaPlatte River at this location.*

4. *TFM (liquid or bar formulation) may be applied at supplemental application points (SAP) on up to two small tributaries near their confluences with the LaPlatte River (at river miles 6.6 and 7.8) concurrent with passage of the mainstem lampricide block at those points to block lamprey escapement into untreated water from these streams.*

The proposed treatment strategy is designed to provide an effective sea lamprey control treatment while providing a margin of safety for listed species in the LaPlatte River.

Treatment Methodology

Treatment planning and execution will be similar to that of treatments in other Lake Champlain tributaries. All applications of lampricides will be made in accordance with Endangered and Threatened Species Takings permit, companion to this one. Two TFM (lampricide) products, TFM-HP and TFM Bar are proposed for use (Safety Data Sheet = TFM-HP and TFM-Bar). Both lampricides will be applied according to the Standard Operating Procedures (TFM-HP TFM-Bar). The MLC will be determined by the results of an on-site toxicity test prior to treatment. The MLC may change during treatment in response to shifts in pH or alkalinity that differ from pre-treatment conditions, target concentration will be adjusted accordingly.

Lampricide will be applied at concentrations equivalent to a factor of up to 1.2 x MLC for a period of 12 to 14 hours. Amount of chemical applied and application rate is based on measured stream conditions at the time of treatment (i.e. discharge, pH, and alkalinity). The toxicity of lampricides varies depending on stream water pH and total alkalinity levels. The USFWS estimates that between 35 to 200 gallons of TFM-HP formulation (approx. 110 to 630 lbs. active ingredient) may be applied to the LaPlatte River over a 12 to 14-hour period based on a range of anticipated river discharge rates of between about 10 and 45 cubic feet per second. We estimate from experience on previous Lewis Creek treatments (similar river discharge and watershed) that we should have an effective treatment within this range of flows. Up to 20 TFM Bars may be used in up to 2 supplemental application points (SAP's 1 and 2) to prevent the diluting effects of a tributary to the mainstem being treated (Figure 4).

Pre-treatment and Treatment Water Chemistry Monitoring

Monitoring the daily fluctuations in stream pH and total alkalinity is necessary to determine corresponding changes in lampricide toxicity. Diurnal pH fluctuations will be monitored for at least 24 hours prior to treatment, and usually for a longer period. Total alkalinity will also be measured periodically over the same time frame as for pH monitoring. The pH and alkalinity data will be considered with the results of the pre-treatment toxicity test to determine the stream MLC (SMLC) which is the instantaneous concentration (mg/L) of TFM needed to achieve 1.0 x MLC for lamprey at any given time or place in the river. This value fluctuates over time and space due to many factors. Lampricides may be applied at less than the maximum proposed treatment concentrations (but not lower than 1.0 x MLC) if conditions forewarn that the SMLC may drop, downstream of the application.

Water samples collected at the most upstream sampling station below each AP to control the application rate will also undergo water chemistry analysis. Water chemistry will be monitored at least once every 2 hours at downstream stations during the periods that the lampricide block passes through each point, as well as immediately below each supplemental application point, if used. Adjustments will be made to the application rate and target concentration to compensate for unexpected changes in pH and/or total alkalinity at the most upstream sampling station (or at downstream stations if applicable) during the treatment. Water chemistry will be monitored at stations with pH/temperature data recorders, supplemented by periodic hand sampling for lab measurements; total alkalinity will be measured at least at the times of deployment and retrieval of the data recorders at these stations.

Lampricide Monitoring

Lampricide concentrations will be monitored during the treatment to precisely measure the efficacy of the application throughout the treated reach and to regulate the application rate in response. TFM concentrations are measured with accuracy to within 0.1 mg/L (0.1 ppm). Locations of application points and analysis stations are shown in Figure 4. Water samples will be collected for analysis at intervals of 30 minutes at the most upstream sampling station below each AP, as well as below supplemental application points where TFM-HP is applied. Lampricide concentrations will be monitored at least once every 2 hours at all other downstream sampling stations, by hand or by deployment of automatic water samplers, to assess concentrations and duration of the lampricide block passing each point. Water sampling below supplemental application points using TFM bars is less frequent since the bars release the active ingredient at a constant rate. Once the target concentration is achieved with a TFM Bar application, at least two additional water samples will be collected over the duration of the dissolution period. Water samples may also be collected at other points on the stream to track progress of the block.

a. Station 1: Downstream of Leavensworth Road AP
b. Station 2: Downstream of the Dorset Street Boost AP (IF USED)
   Station 2: Dorset Street (IF BOOST NOT USED)
c. Station 3: Carpenter Road
d. Station 4: Downstream of Spear Street Boost AP (IF USED)
   Station 4: Spear Street (IF BOOST NOT USED)
e. Station 5: Downstream of Shelburne Falls Boost AP (IF USED)
   Station 5: Shelburne Falls (IF BOOST NOT USED)
f. Station 6: Route 7
g. Station 7: Upstream side of Bay Road at River Mouth

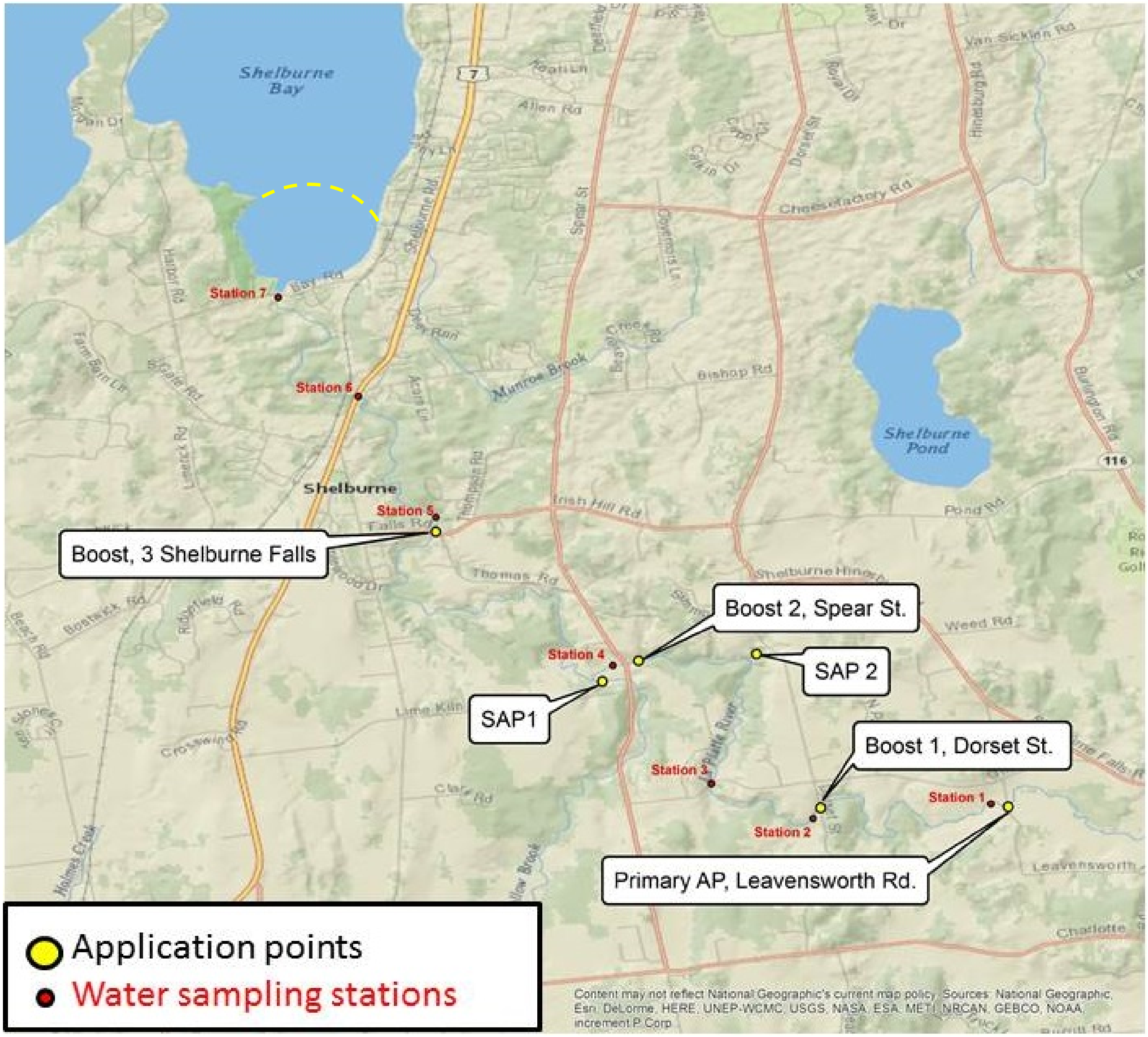


Figure 4. Map of LaPlatte River showing locations of the proposed lampricide application points (AP), potential supplemental application points (SAP), and water analysis stations. Water samples will also be analyzed periodically, immediately below each SAP, if used. Yellow-dotted line indicates the northern extent of our proposed low-level sampling in Shelburne Bay.

<u>Target/Non-target Species Mortality Monitoring</u>

Post-treatment mortality assessment crews will walk systematically, pre-defined sections of each treated stream reach within 36 hours of the lampricide block passage. All visible river-bottom in each section will be inspected and observations of non-target organism mortalities, except lampreys, will be recorded. Non-target assessment sections comprise about 20% of the treated reaches and are defined based on the locations of USFWS sea lamprey QAS transects as follows: Five sample zones, equal in length to 1/23 the length of the associated river reach, will be surveyed between equidistantly-spaced transects. In Reach 1, these zones are found between transects 3-4, 8-9, 13-14, 18-19, and 23-24. In Reach 2, these zones are found between transects 3-4, 8-9, 13-14, 18-19, and 23-Leavensworth Road AP (Figure 5).

Figure 5: The LaPlatte River non-target, post-treatment, survey zones (10), highlighted in yellow. Leavensworth Road is at the end of the yellow highlight in the bottom right corner. Shelburne Falls, the split between Reach 1 and Reach 2, is between LP1-T24 and LP2-T01. The base of Shelburne Bay and the river mouth is located at LP1-T01.

All dead fish (excluding lamprey), amphibians, mussels and other large invertebrates encountered will be identified and enumerated, if possible. Organisms not identified in the field will be collected, if possible, and retained for identification. As noted above, dead lamprey larvae will not be counted during the post treatment mortality survey, but the first 30 encountered in each zone will be retained and identified. Assessment of treatment effects on lamprey populations will instead be accomplished by means of a larval survey within one year of treatment. Larval surveys following treatments provide a more direct and statistically sound means of comparison with pre-treatment survey data.

Results of non-target mortality surveys will be submitted to the VT DEC by May 1 of the year following the treatment. The post-treatment larval survey results will be submitted by December 31 of the year following the year of treatment.

Conclusion

Considering the five Vermont statutory criteria discussed above, the USFWS has the opinion that a controlled application of TFM at a concentration of up to 1.2 X MLC will acceptably meet and fulfil the requirements necessary for obtaining an Aquatic Nuisance Control Permit for the proposed sea lamprey treatment of the LaPlatte River. Proposed permit conditions are presented in Attachment 4.

Permit cycle

At a meeting in Montpelier on February 24th, 2015 with Secretary Markowitz, Commissioner Porter, and other key individuals, the duration of the permits and the idea of lumping them was discussed. As a result, it was decided that the T&E permits should be made consistent in duration with the DEC's Aquatic Nuisance Control Permit which last 5 years. Therefore, we are asking for this ANC permit to become effective in the fall of 2016 and remain effective through the fall of 2021. This would allow the LaPlatte River to be treated twice on this one permit (2016 and 2020). If issues arise or need to be addressed, the permit can be reopened. This does not guarantee 2 treatments; instead it will allow a second treatment in 2020 assuming that nothing significant has changed during that time that would affect permit conditions. The applicant will notify the Agency of Natural Resources at least 6 months prior to a planned second treatment to allow time for any questions or concerns to be raised and addressed.

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US Army Corps
of Engineers
New York District

CONTINUING AUTHORITIES PROGRAM

PROJECT MANAGEMENT PLAN

LaPlatte River Sea Lamprey Barrier
Shelburne, Vermont

Section 1135 – Aquatic Ecosystem Restoration

CONTINUING AUTHORITIES PROGRAM
PROJECT MANAGEMENT PLAN

LaPlatte River Sea Lamprey Barrier
Shelburne, Vermont

Section 1135 – Aquatic Ecosystem Restoration

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   A. Document Purpose
   B. Authority
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   E. Problem Description
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CONTINUING AUTHORITIES PROGRAM
PROJECT MANAGEMENT PLAN

LaPlatte River Sea Lamprey Barrier
Shelburne, Vermont

Section 1135 – Aquatic Ecosystem Restoration

I. PROJECT DESCRIPTION AND SCOPE

A. Document Purpose– This Project Management Plan (PMP) details the scope, schedule, and budget for study tasks through the feasibility phase.

B. Authority: Section 1135 of the Water Resources Development. Act of 1986, as amended.

C. Congressional District: Sen. Patrick Leahy, VT; Sen. Bernard Sanders, VT; Rep. Peter Welch, VT- At Large

D. Project Location: The project area is located on the LaPlatte River in the Town of Shelburne, Chittenden County, Vermont. The LaPlatte River drainage area is 138 km2 at the mouth, draining into Shelburne Bay.


Falls
Rt 7 Bridge
Railroad bridge
LaPlatte River
Shelburne, VT
Approximate distance from Rt 7 Bridge to Falls- 2.4 rkm
Approximate distance form river mouth to Rt 7 Bridge- 2.85 rkm
0
250
500
1,000
1,500
2,000
Meters

E. Problem Description: Sea lamprey, an eel-like parasitic fish, is an aquatic nuisance species in Lake Champlain and the Great Lakes that has hindered restoration of favorite sport-fish populations such as lake trout and landlocked Atlantic salmon.

The LaPlatte River is the largest tributary to Shelburne Bay in Lake Champlain. Because the population of the parasitic sea lamprey in the La Platte River is currently uncontrolled, and appears to be increasing in numbers, control is necessary. Implementing lamprey control on the river would help to achieve long-term and comprehensive sea lamprey control, thus reducing or even eliminating the need for recurring pesticide treatments on this river.

Lake Champlain International in partnership with the Vermont Department of Fish and Wildlife and Vermont Department of Environmental Conservation request assistance from the U.S. Army Corps of Engineers under to do feasibility analysis, study, and report for a sea lamprey barrier on the LaPlatte River.

G. Status of Local Cooperation: Lake Champlain International will serve as the non-Federal cost-sharing partner.

H. Pertinent Data:

BENEFIT-COST RATIO	NA
TOTAL PROJECT COST (000s)	TBD
TOTAL ANNUAL COSTS (000s)	TBD
TOTAL ANNUAL BENEFITS (000s)	NA
NET ANNUAL BENEFITS (000s)	NA
PROJECT LIFE (years)	TBD
INTEREST RATE	TBD
PRICE LEVEL	TBD

II. PROJECT DELIVERY TEAM IDENTIFICATION

Roles	Point of Contact	Branch	Independent Technical Reviewer
Project Manager	Ronald Pinzon	PPMD	
Planning Division			
Plan Formulation Section Chief	Jodi McDonald	PL-F	
Plan Formulation	Olivia Cackler	PL-F	Karen Ashton
Socio-Economics	TBD	PL-F	Carrie McCabe
Environmental Section Chief	Jenine Gallo / Peter Weppler	PL-E	
Environmental	Bonnie Hulkower	PL-E	Melissa Alvarez
Cultural Resources	TBD	PL-E	
HTRW	Richard Dabal	PL-E	
Engineering Division	Elena Manno	EN	David Yang
H & H	Michael Morgan	EN	
Real Estate Division	Bob Hass	RE	
Office of Counsel	Ellen Simon	OC	
Non-Federal Sponsor	Marit Larson	NYC, DPR Natural Resources Group	
	Vicky Ruzicka	NYC, DPR Natural Resources Group	

PROJECT TEAM

Programs & Project Management Division		
Project Manager	Ronald Pinzon	PP-C
Planning Division		
Plan Formulation		
Environmental Resources	Jodi McDonald	PL-F PL-E
Environmental Resources	Jenine Gallo	PL-E
Cultural Resources	TBD	PL-E
Socio-Economics	TBD	PL-F
HTRW	Richard Dabal	PL-E
Engineering Division	Milton Ricks	EN
H & H	Michael Morgan	EN
Geotech	Kristen Vanhorn	EN
Cost	John Chew	EN
Real Estate Division	Robert Hass	RE
Local Sponsor	Marit Larson NYC, Dept. of Parks and Recreation Natural Resources Group	

III. PROJECT FUNDING

PROJECT FUNDING

TOTAL FUNDS REQUIRED (Federal Funds Only) (000's)

	ERR	P&S	CONST
Project Cost	934.0	0.0	0.0
Allocated to Date	765.0	0.0	0.0
Required to Complete	169.0	0.0	0.0

FUNDS AVAILABLE CURRENT FISCAL YEAR (000's)

	FED	NON-FED	TOTAL
FY 05 Carry-Over	18.0	0.0	18.0
FY 06 Budgeted	*400*.0	0.0	400.0
TOTAL	*418*.0	0.0	418.0

FUNDING HISTORY (Federal Funds Only) (000s)

	Prior FY 05	FY 06
PRP	10.0	0.0
ERR	270.0	*400*.0
P&S	0.0	0.0
Constr	0.0	0.0
TOTAL	280.0	*400*.0

IV. PROJECT SCHEDULE

A. Overall Schedule

PROJECT SCHEDULE		DATES			
NO.	**Milestones**	**Scheduled**	**Forecast**	**Actual**	**Notes**
C-1B	Initiate Study (PRP)	Sep 00		Sep 00	
C-2	PRP	Feb 01		Feb 01	
C-3	EA/ERR Study Initiated	Jul 03		Sep 03	
	March 04 funding constraints, study delayed				
C-4A	Draft EA/ERR Report (draft FONSI)	June 06	Dec 06		
4B	Division Approves Draft EA/ERR	July 06	Feb 07		
C-5	Final EA/ERR	Dec 06	June 07		
C-6	Receipt of P&S Funding	Jan 07	July 07		
C-7	P&S Certification	May 07	Nov 07		
C-8	Project Approval	June 07	Dec 07		
C-9	HQ Construction Funding	Aug 07	Feb 08		
C-10	PCA Execution	Dec 07	Jun 08		
C-11	**Initial Work Allowance (CMR)**	Apr 08	July 08		
C-12	Notice of Physical Completion		Dec 08		
C-13	Final Completion Report		Oct 09		

B. CURRENT FISCAL YEAR

NO.	Milestones	Scheduled	Forecast	Actual	Notes
	PROJECT SCHEDULE	**DATES**			
C-2	PRP	Feb 01		Feb 01	
C-3	ERR Study Initiated	Jul 03		Sep 03	
	Contaminant Screening I	Jan 04		Jan 04	
	Contaminant Screening II	Mar 04	N/A		
	Geotechnical Work	Mar 04	May 05	Aug 05	
	Cultural Work IA	Jan 04	June 05	Sept 05	
	Topographic/Bathymetric Surveys	Jan 04	May 05	Oct 05	
	Survey Tide Gauges	Mar 04	May 05	Nov 05	
	Vegetation Survey	Sep 03	June 05	Sept 05	
	Wetland Delineations	Sep 03	May 05		
	Bio-Benchmarking	Sep 03	May 05	Oct 05	
	Spot Elevations	Sep 03	Jan 06		
	Evaluation of Planned Wetlands	Jan 04	Jan 06		
	Tide Gauge Data	Jan 04	Jan 06		
	Cultural Work IB	Apr 04	June 05	N/A	
	Biological Baseline	Oct 04	Feb 06		
	Preliminary Alternative Development	Jan 04	Feb 06		
	Preliminary Planting Design	Jan 04	Mar 06		
	Preliminary Quantity Estimates	Mar 04	Mar 06		
	Cultural Appendix	Jul 04	Sept 05	Jan 06	
	Coastal Processes	Apr 04	Apr 06		
	Hydrodynamic Analysis	Apr 04	Apr 06		
	Preliminary Cost Estimates	Mar 04	Apr 06		

	Incremental Cost Analysis	Apr 04	June 06		
	Final Design Development	May 04	Aug 06		
	DFWCAR	Jun 04	Sept 06		
	Final Plan Layout	Jun 04	Sept 06		
	PED Estimate	Jun 04	Oct 06		
	MCACES	Jun 04	Oct 06		
	RE Appendix	Jul 04	Nov 06		
	Engineering Appendix	Jun 04	Nov 06		
	FFWCAR	Jun 04	Nov 06		
	EA draft FONSI	Jul 04	Dec 06		
	Draft ERR	Jul 04	Dec 06		
	Division review - EA draft FONSI/draft ERR	Aug 04	Feb 07		
	Public/agency review and public meeting	Oct 04	Apr 07		
	Colonel signs FONSI	Sep 04	June 07		
	Draft PCA	Sep 04	July 07		
C-5	Division review – EA/signed FONSI and ERR	Dec 04	July 07		

V. WORK BREAKDOWN STRUCTURE

Feasibility Phase

Account Number	Account	Resp. Office	Work Task	Cost
JI	Public Involvement	PL-F/E	Coordination Presentation Material Meeting Attendance	$23,500
JBB	Social Studies	PL-F	Establish financial capability of local sponsor	$5,000
JG	Cultural Resource Studies	PL-E	Cultural Resources, Section 106 Compliance	$50,000
JD	Environmental Studies/Report	PL-E	Wetland Delineation EFH	$4,800 $15,000
			Vegetation Survey Air Quality	$7,200 $10,000
		PL-F PL-E	Incremental Cost Analysis Benthic, fish, and bird surveys	$15ba,000 $35,000
			Evaluation of Planned Wetlands	$15,000
			Design Development	$18,000
			Planting Design	$12,000
			NEPA Process and Coordination ERR Coordination	$30,000 $20,000
			Environmental Assessment	$15,000
			Regulatory Review (DEC)	$10,000
			GIS Support	$7,800
			Coastal Zone Management Determination	$3,000
JE	Fish and Wildlife Studies	PL-E	Fish and Wildlife Coordination Report	$15,000
JB	Economic Studies	PL-F	Review of ICA	$3,000
JC	Real Estate Studies	RE	Real Estate Supplement (RES)	$25,000
JAB	Hydrology and Hydraulic Studies	EN		$113,650
JAC	Geotechnical Studies	EN		$21,050
JF	HTRW Studies	PL-E	Database Query	$80,000
JN	All Other Studies	PL-F	QA/QC Review	$10,500
JAA	Surveying and Mapping	EN	Site Survey	$28,000

JA	Engineering Management Branch	EN	Total – Plans and Layouts	$50,000
JH	Cost Estimating	EN	Preparation of Cost Estimates	$22,100
JP	Study Management	PL-F	Coordination and Oversight	$50,000
JJ	Plan Formulation and Evaluation	PL-F	Formulation of Alternatives	$50,000
JK	Report Preparation	PL-F	Draft Ecosystem Restoration Report	$27,500
			Final Ecosystem Restoration Report	$16,000
	Office of Counsel	OC		$5,000
	Programs Management	PP		$7,000
JQ	Draft PCA	PL-F	Preparation of a draft PCA	$7,000
	Feasibility Study Sub-Total			$833,100
	Contingency		12%	$99,972
Total Study Cost				$933,072

Design and Implementation Phase

Account Number	Account	Resp. Office	Work Task	Cost
JI	Public Involvement	PL-F/E	Coordination Presentation Material Meeting Attendance	$23,500
JBB	Social Studies	PL-F	Establish financial capability of local sponsor	$5,000
JG	Cultural Resource Studies	PL-E	Cultural Resources, Section 106 Compliance	$50,000
JD	Environmental Studies/Report	PL-E	Wetland Delineation EFH	$4,800 $15,000
			Vegetation Survey Air Quality	$7,200 $10,000
		PL-F PL-E	Incremental Cost Analysis Benthic, fish, and bird surveys	$15ba,000 $35,000
			Evaluation of Planned Wetlands	$15,000
			Design Development	$18,000
			Planting Design	$12,000
			NEPA Process and Coordination ERR Coordination	$30,000 $20,000
			Environmental Assessment	$15,000
			Regulatory Review (DEC)	$10,000
			GIS Support	$7,800
			Coastal Zone Management Determination	$3,000
JE	Fish and Wildlife Studies	PL-E	Fish and Wildlife Coordination Report	$15,000
JB	Economic Studies	PL-F	Review of ICA	$3,000
JC	Real Estate Studies	RE	Real Estate Supplement (RES)	$25,000
JAB	Hydrology and Hydraulic Studies	EN		$113,650
JAC	Geotechnical Studies	EN		$21,050
JF	HTRW Studies	PL-E	Database Query	$80,000
JN	All Other Studies	PL-F	QA/QC Review	$10,500
JAA	Surveying and Mapping	EN	Site Survey	$28,000
JA	Engineering Management Branch	EN	Total – Plans and Layouts	$50,000

JH	Cost Estimating	EN	Preparation of Cost Estimates	$22,100
JP	Study Management	PL-F	Coordination and Oversight	$50,000
JJ	Plan Formulation and Evaluation	PL-F	Formulation of Alternatives	$50,000
JK	Report Preparation	PL-F	Draft Ecosystem Restoration Report	$27,500
			Final Ecosystem Restoration Report	$16,000
	Office of Counsel	OC		$5,000
	Programs Management	PP		$7,000
JQ	Draft PCA	PL-F	Preparation of a draft PCA	$7,000
	Feasibility Study Sub-Total			$833,100
	Contingency		12%	$99,972
Total Study Cost				$933,072

STUDY TASK DESCRIPTIONS AND COSTS

The feasibility and the design and implementation phases work plan has many detailed tasks. For ease of review, those tasks have been grouped under general task descriptions according to the relevant code of accounts. Following is a listing of the general task descriptions and costs that will be required to conduct the feasibility study as well as the design and implementation phase.

Feasibility

JA– Engineering Management Branch: $ 50,000

This task includes the cost to manage Tasks JAA, JAB, and JAC for the District's Engineering Branch.

JAA – Surveying and Mapping: $ 28,000

Topographic design surveys will be conducted at sufficient detail to produce an accurate cost estimate (1 ft. contours). Tidal gauges and bio-benchmarked flags placed during environmental studies will also be surveyed. A bathymetric survey will also be conducted and a map of the bay bottom will be submitted.

JAB – Hydrology and Hydraulic Studies: $113,650

The existing condition hydrology will be analyzed to obtain the project's drainage area, and the mean and annual fluvial flows and storm water runoff to and in the sited will be determined. It is assumed that the improved conditions will not alter the upland hydrology significantly. The existing hydraulics will be estimated by installing and analyzing several tide gauges, and by examining the topographic/bathymetric survey. A nearby desired reference wetland site will be identified, and the hydraulic/hydrodynamic characteristics of the reference site will be analyzed. Wave forces from small watercrafts will be estimated, so that the sediment transport for the suggested alternatives can be approximated. Cut and fill estimates will be determined for the 3 suggested regarding schemes.

JAC – Geotechnical Studies: $21, 050

Geotechnical investigations will include evaluation of grain size distributions, sedimentation rates, material classification, and estimated volume of material at selected sites. Design guidance will be provided for the various alternatives to be investigated for terrestrial restoration using available subsurface information and existing site conditions.

JB – Economic Studies: $ 3,000

Work conducted as part of the study effort will include a cost effectiveness and incremental cost analysis (CE/ICA) of ecosystem restoration features to support decision making on implementation of the ecosystem restoration alternatives identified in the plan formulation process. The CE/ICA will follow the procedures specified in EC 1105-2-210, Ecosystem Restoration in the Civil Works Program 1 June 1995.

The objective of this task is to provide information to assist in determining the most cost effective level of ecosystem restoration. The level of ecological benefits associated with each restoration alternative will be developed by team ecologists. The cost of each restoration alternative will be developed by team cost estimators. The CE/ICA combines this information to develop and evaluate a range of alternatives and determine the plans which provide the greatest level of ecological benefit at the lowest cost.

JBB – Social Studies: $ 5,000

This task includes studies required to determine and assess the economic and social impact of alternative plans under consideration.

JC – Real Estate Studies: $ 25,000

These studies will include the involvement and coordination with the NYD Real Estate Division (CENAN-RE). Integral to this work effort, as outlined in Chapter 12 of ER 405-1-12, is the preparation of a Baseline Cost Estimate for Real Estate in MCACES format and a Real Estate Plan or Appendix (REP). These items are required for inclusion in the final report. This will involve a detailed accounting of property ownership and acquisition activities of impacted project lands (both staging and restoration sites), preparation of a Gross Appraisal, assessment of

LERRD Requirements, and related issues.

JD – Environmental Studies/Report: $ 223,800

Environmental Studies will include raw data collection and data analysis to evaluate and characterize the study area. Baseline biological data (benthics, fish, birds, vegetation) that can be used in the evaluation of the restoration project will also be collected under this task. This information will then be used to develop the overall project goals, prepare the preliminary planting design, conduct an Evaluation of Planned Wetlands, and prepare an Environmental Assessment (EA) and draft FONSI. The EA and final (signed) FONSI will incorporate comments and recommendations received during the review process.

JE – Fish and Wildlife Studies: $ 15,000

USFWS activities include 1) informal endangered species coordination, under Section 7 of the ESA, and 2) preparation of a Fish and Wildlife Coordination Act (FWCA) Report. The USFWS will provide input for NYD compliance with the Endangered Species Act. A USFWS 2(b) Coordination Act (FWCA) Report formally cites USFWS recommendations on project alternatives, impacts and beneficial uses, which will be prepared for the EA. Final recommendations will be fully coordinated prior to report submittal.

JF – Hazardous & Toxic and Radioactive Waste (HTRW) Studies: $ 80,000

HTRW studies will comprise of two phases; Phase One is a file search that will determine what, if any past site activities impacted the soil and groundwater. Sources of information used during a Phase One are city, county, state and federal agency records. Another source is conducting interviews with personnel associated with the site. Additional sources are commercial firms that conduct research through the use of aerial photographs. Verification of records will be conducted by a field check. The Phase One report will guide the objectives of the Phase Two Site Characterization. A Phase Two project will collect soil and groundwater samples to ascertain the level of impact from past activities. The sampling pattern, number of and type of laboratory analyses of the Phase Two project will be determined by what is found during the Phase One Assessment. Results of the Phase Two Site Characterization will guide the planning of and construction of any activity on that particular site.

JG – Cultural Resources Studies: $ 50,000

Cultural resources activities include tasks required for compliance with Section 106 of the National Historic Preservation Act of 1966, as amended through 1992 and the Advisory Council on Historic Preservation Guidelines for the Protection of Cultural and Historic Properties (36 CFR Part 800). A Phase 1A Documentary Archaeological Study shall be conducted and recommendations offered. Based on the information gathered during this investigation, and with input from the geomorphologic study, Phase 1B field-testing may be required. Based on these investigations, the eligibility of a site, or sites, for inclusion on the National Register of Historic Places will be determined. Recommendations will be made with regard to a mitigating situation if sites cannot be avoided.

JH – Cost Estimating: $ 22,100

Cost estimates for selected alternatives and the recommended plan will be provided using MCACES and Code of Accounts or an acceptable alternative cost estimating procedure.

JI - Public Involvement: $ 23,500

Public involvement will consist of notifying concerned parties (newspapers, police, property owners, etc.), as appropriate actions related to the proposed projects, primarily focusing on the completed ERR. This task includes coordination and the attendance at meetings with presentation material.

JJ – Plan Formulation and Evaluation: $ 50,000

Plan formulation refers to the formulation and evaluation of alternative solutions to the problems. Ecosystem restoration is the purpose of this project. An optimization analysis will be performed for all alternatives by comparing the habitat provided and the costs of each, to identify the selected plan. This plan will be coordinated with the sponsor to confirm the suitability of the selected plan, and their willingness to participate.

JK – Report Preparation: $ 43,500

This sub-account includes assembling, writing, editing, typing, drafting, reviewing, reproducing and distributing the draft and final study Ecosystem Restoration Report (ERR), which is anticipated to be an integrated feasibility report and environmental assessment.

The contents of the ERR are summarized as follows:

(1) Main report summarizing the technical findings, conclusions and recommendations, with an integrated Environmental Assessment (EA)

(2) Technical Appendices presenting the detailed backup and results to individual work tasks

JN– All Other Studies/Investigations: $ 10,500

This task includes a Quality Assurance/Quality Control Review by the District.

JP – Study Management: $ 50,000

Study management involves coordinating all aspects related to the management of the study including scheduling, coordination, correspondence, etc., from the point of initiation through the review process and completion. This includes coordination and implementation of study team meetings, executive committee meetings, communication with North Atlantic Division (CENAD) and the non-Federal sponsor. The in-kind services and cash contributions will be coordinated into the overall study budget and in-house efforts. The study manager will develop a detailed study plan and monitor funds and work progress to ensure tasks are completed on time and within budget.

JQ – Draft PCA: $ 7,000

This task includes funding to negotiate a draft Project Cooperation Agreement (PCA) with the local sponsor.

Design and Implementation

WA - Plans and Specifications (P&S)

WAB – Plans and Specifications

New York District Engineering Division will prepare the technical aspects of the project for the 60%, 90% and final design submittals including a Design Analysis and Plans and Specifications.

WABA – Hydrology and Hydraulics – $53,000

WABB – Civil Engineering - $32,000

The civil engineering design will include the plans and specifications of the excavation of the 3 acres salt marsh, placing some of excavated material on project site(some goes to off site), re grading and covering with clean fill. Design will also include the relocation of the bicycle path and grade, fill and grade the scenic over look, cut and fill and cross section drawings. In addition a site visit, meetings and PMP input will be incorporated into the project.

WABC – Geotechnical - $15,000

The geotechnical design will include the design analysis, plans and specifications required to support the project. Geotechnical evaluation of the fill area and dredging slopes will be included in the design analysis. Plan sheets will be developed for subsurface exploration logs and locations in addition to the geotechnical details to the cross sections. PMP input and meetings will be incorporated into the project.

WABD – Preparing Specifications - $5,000

The solicitation package, including technical specifications, price schedule, and special contract requirements, will be prepared in coordination with designers and technical manager.

WABE – District Quality Control Reviews - $42,400

The District Quality Control is an internal review of the engineering work products focused on fulfilling the project quality requirements defined in the Project Management Plan. Internal review of the engineering work products will be performed by individuals not involved in the day-to-day production of the project/product. Basic quality control tools include a Quality

Management Plan providing for seamless review, quality checks and reviews, supervisory reviews and PDT reviews.

WABF – Agency Technical Review - $25,000

Reviews of the plans and specifications will be performed by a qualified USACE team from outside of the New York District that is not involved in the day-to-day production of the project/product throughout each submittal. The Agency Technical Review will ensure that all USACE regulations and criteria are met and that the products prepared are of high quality. Comments will be incorporated into computations and products.

WABG – OMRR&R Manual Cost – Approximately $27,500

This activity includes all deliverables related to the preparation of the OMRR&R manual.

WABH – Engineering Management Documentation – $20,000

This task includes engineering management, coordination of the design between the engineering disciplines, project schedule and status, meetings, coordination with other divisions, construction contracting actions, assembly of internal, agency review documentation, QA/QC reviews and assembly of correspondences for dissemination of information to other divisions.

WAD – Biddability, Constructability, and Operability Review - $11,200

The plans and specifications will undergo Biddability, Constructability, and Operability (BCO) review to ensure that all USACE regulations and criteria are met and that the products prepared are of high quality. The New York District Construction Division and Safety and Occupational Health Office will perform this task. After back-checking the construction contract package for compliance with the BCO review comments, Construction Division will provide the BCO certification.

TOTAL COST OF WA – Plans and Specifications - $231,100.00

<u>WC – Real Estate Analyses/Documents</u>

WCB – Real Estate Acquisition Documents - $1,000

The Project land is owned in fee by the Project Sponsor, the City of New York (NYC DPR); the Sponsor will provide the District with copies of its deeds, or, a Title Report, for the entire Park.

WCE - Real Estate Appraisal Documents - $0

No further Appraisals will be required. The Sponsor will not be required to acquire any real property, or interests in real property, for this Project, nor will it be necessary to appraise the LERRD provided by the Sponsor for Crediting purposes, since the value of the land to be provided by the Sponsor will be NOT be diminished by the Project, but will instead be increased, or remain the same.

WCF - Real Estate PL-91-646 Assistance Documents - $0

No persons, farms or businesses will be displaced by the Project, so NO PL-91-646 Relocation Assistance will be required.

WCG - Real Estate Rights-of-Entry/Temporary Permits - $2,000

If requested to do so by the non-Federal Sponsor, RE Div will obtain a temporary Right-of-Entry for Construction (or equivalent) from the State of New York (DEC) allowing the Project to traverse certain State-owned land in the Project vicinity, for access to the Project area.

WCH - Real Estate Audit Report - $500

RE Div must review the Sponsor's deeds, or its Title Report, prior to RE Certification.

WCL - Real Estate Project Related Administration Documents - $1,000

Anticipated cost of preparing Project Real Property Certification memo

TOTAL ESTIMATED COST OF WE – Real Estate - $4,500 (rounded to: $5,000)

WD – Environmental Studies Documents - $200,000

Environmental Studies will include supplemental biological baseline and soils data collection and data analysis to evaluate and characterize the project area. This information will then be inputted into design parameters used to prepare the preliminary and final planting designs, prepare the planting schedule and incorporate the planting design and all requirements into the plans and specifications package. Additional work conducted as part of the project effort will include review of the designs for functionality and relevance for coordination with NYSDEC for the necessary Water Quality Certification, as well as actual Water Quality Certificate acquisition. This effort also includes input into the Operations and Maintenance manual.

During construction tasks include: attendance at site field meetings; the review of submittals associated with soils and plantings; input and field construction oversight assistance during re-grading and planting operations; the preparation of project completion reports for the NYSDEC; and oversight support for adaptive management tasks.

Post-construction monitoring includes: the conduct site visits for storm or other damage; annual marsh monitoring in compliance with WQC conditions; the preparation of annual marsh monitoring reports; the development of herbicide application and wrack and debris removal SOWs, as well as additional marsh maintenance Scopes of Work as needed; the negotiation of associated contract costs; and field oversight for marsh maintenance tasks.

These tasks will be performed by the New York District's Environmental Analysis Branch (or its Contractor).

The cost for marsh maintenance, including herbicide and wrack and debris removal for a five year period, at an $11,000 annual cost, would cost $55,000.

WDL - All Other Environmental Documents (GIS Data Management) - $15,000

Update, in coordination with the PDT members, the existing geospatial data collection and management plan in support of the project. Obtain data, complete with metadata, and catalog it into a enterprise geo-database for maximum future access, decision support and distribution. The geographer and applicable PDT members shall insure that the data is labeled and used appropriately with regard to any licensing or security issues, such as: Proprietary Data, For General Use, Sensitive, Confidential, Official Use Only, etc.

Prepare GIS maps for PDT members to perform field work and project support; perform geospatial analysis in support of needs by the project biologist, cultural resources team member and others as needed. This work will be completed by the New York District Environmental Analysis Branch.

WE - HTRW Studies/Report

WEA&WEB – Local Sponsor and USACE HTRW Study/Report - $66,000

This tasks will include: coordination with the NYS DEC, New York City Parks Department, and other agencies regarding the removal, re-use and/or disposal of material, attendance at PDT, interagency, public and other meetings; conducting additional sampling efforts (development of a sampling plan, sampling oversight, review and analysis, coordination of results); review of plans and specifications and construction oversight. A report will be prepared describing the results of the additional testing, which will be used to determine the potential to re-use material on-site or disposal off-site.

This task will be performed by the New York District's Environmental Analysis Branch (or its Contractor).

WF - Cultural Resources Studies Documents - $10,000

The studies and related tasks listed below are required to fulfill the following regulations: The *National Historic Preservation Act of 1966*, as amended through 1992, particularly Section 106 (which requires a Federal Agency to take into account the effect of any undertaking on any district, site, building, structure or object that is included in or eligible for inclusion in the National Register of Historic Places), and *36 CFR Part 800: Protection of Historic Properties*, the regulations governing the Section 106 Review Process, including the coordination among a Federal Agency, the appropriate State Historic Preservation Office, and the Advisory Council, when necessary. An evaluation of the affect of project plans on historic properties as been made in consultation with the State Historic Preservation Officer (SHPO). A Cultural Resource Phase

1A Documentary Study of the Area of Potential Effect (APE) and the immediate surrounding area of Soundview Park, The Bronx, (Bronx County) New York, was undertaken in 2005 (Smyth 2005). This study consisted of documentary research, a review of the previous cultural resource studies of the area and a site visit/field inspection. The report made recommendations based on the conclusions presented with regard to the cultural resources within the project area. While the general geographic area of the south Bronx has been known to contain both prehistoric and historic sites, the APE within Soundview Park area has been heavily modified during the twentieth century with the importation of earthen material (soils) from various areas around the City of New York to create the current landscape that comprises Soundview Park today. The restoration of Sound View Park, as proposed, is therefore not expected impact significant cultural resources. The report was reviewed by the New York State Office of Parks, Recreation and Historic Preservation Office (NY SHPO) in the fall of 2005 and its recommendations were accepted by that office.

If any alternative plans are considered, cultural resource studies will be required at additional cost. If an unanticipated discovery is made during construction cultural resources surveys and data collection shall be required at additional cost.

This effort associated with this task includes attendance at PDT, interagency and public meetings, PDT coordination and the review of Corps and other relevant project documents including plans and specs to ensure project elements did not change to affect cultural resources. The New York District's Environmental Analysis Branch will perform this task.

WG – Cost Estimate - $50,000

This activity includes all deliverables required to prepare construction cost estimates needed to support the various phases of the (60%, 90%, & 100%) plans & specifications. Cost estimates will be developed in accordance with the guidance contained in ER 1110-2-1302, *Civil Works Cost Engineering*, & ETL 1110-2-573 Construction Cost Estimating Guide for Civil Works, using the MCACES cost estimating system. Cost estimates will be presented in the Civil Works Breakdown Structure (CWBS) format.

WI – Contract Award Documents - $20,000

Work under this sub product includes preparation of an Independent Government Estimate, advertisement of the contract, reproduction (Electronic Bid Sets) of the plans and specifications, coordination with bidders and preparation of amendments as required, and award of the contract. The New York District Engineering Division and Contracting Division will perform this work.

WJ – Engineering and Design during Construction - $23,000

New York District Engineering Division will provide Engineering and Design support as required during construction. This could include resolving technical questions, responding to requests for information, clarifying the plans and specifications, and visiting the project site as needed to resolve issues.

X – Value Engineering Study - $30,000

A Value Engineering (VE) Study shall be performed on the Environmental Restoration Report. The Corps of Engineers' VE Policy is to provide VE studies on Construction General Projects, with estimated costs of $2 million and greater. It is anticipated that the estimated project cost will exceed $2 million.

VI. ACQUISITION STRATEGY

The PDT will acquire development support from contractors presently supplying ecosystem restoration services. Consultant services will be procured as necessary to provide unique and specialized assistance. Acquisition of additional contract support will be obtained, if needed. The distribution of task responsibilities is listed in the following tables.

Account Number	Account	Work Task	Lead Office	Implementation
JI	Public Involvement	Coordination	PL-F	PL-F
		Presentation Material	PL-F	PL-F
		Meeting Attendance	NYD	NYD
JBB	Social Studies	Establish financial capability of local sponsor	PL-F	PL-F
JG	Cultural Resource Studies	Cultural Resources, Section 106 Compliance	PL-E	PL-E
JD	Environmental Studies/Report	Wetland Delineation	PL-E	PL-E
		Vegetation Survey	PL-E	PL-E
		Incremental Cost Analysis	PL-F	PL-F
		Evaluation of Planned Wetlands	PL-E	PL-E
		Design Development	PL-E	PL-E
		Planting Design	PL-E	PL-E
		NEPA Process and Coordination	PL-E	PL-E
		Environmental Assessment	PL-E	PL-E
		Regulatory Review (DEC)	PL-E	PL-E
		GIS Support	PL-E	PL-E
		Coastal Zone Management Determination	PL-E	PL-E
JE	Fish and Wildlife Studies	Fish and Wildlife Coordination Report	PL-E	FWS
JB	Economic Studies		PL-F	PL-F
JC	Real Estate Studies	Real Estate Supplement (RES)	RE	RE
JAB	Hydrology and Hydraulic Studies		EN	EN
JAC	Geotechnical Studies		EN	AE
JF	HTRW Studies		PL-E	PL-E
JN	All Other Studies	QA/QC Review	PL-F	NYD
JAA	Surveying and Mapping	Site Survey	EN	PL-E
JA	Engineering Management Branch	Total – Plans and Layouts	EN	EN
JH	Cost Estimating	Preparation of Cost Estimates	EN	EN
JP	Study Management	Coordination and Oversight	PL-F	PL-F
JJ	Plan Formulation and Evaluation	Formulation of Alternatives	PL-F	PL-f
JK	Report Preparation	Draft Ecosystem Restoration Report	PL-F	PL-F
		Final Ecosystem Restoration Report	PL-F	PL-F
JQ	Draft PCA	Preparation of a draft PCA	PL-F	PL-F

Account Number	Account	Work Task	Lead Office	Implementation
WAB	Plans and Specifications	60% Design Submittal	EN	EN
		90% Design Submittal	EN	EN
		Final Design Submittal	EN	EN
WABA	Hydrology and Hydraulics		EN	EN
WABB	Civil Engineering	Site Visit	EN	EN
		Meeting Attendance	EN	EN
		PMP Input	EN	EN
WABC	Geotechnical	Geotechnical evaluation	EN	EN
		Meeting Attendance	EN	EN
		PMP input	EN	EN
WABD	Preparing Specifications	Prepare specifications in coordination with designers and technical managers	EN	EN
WABE	District QC Reviews	Review QMP	EN	NAD
		Quality Checks and Reviews		
		Supervisory Reviews		
		PDT Reviews		
WABF	Agency Technical Review	Ensure all USACE regulations and criteria have been met and of high quality	Outside of NAD	Outside of NAD
WABG	OMRR&R Manual Cost	All deliverables related to the preparation of the OMRR&R manual	EN	EN
WABH	Engineering Management Documentation	Engineering Management	EN	EN
		Coordination of Design		
		Project Schedule and Status		
		Coordination with other divisions		
		Construction Contracting Actions		
WAD	BCO Review	BCO review to ensure that all USACE regulations and criteria have been met and of high quality	CO/ Safety and Occupational Health Office	CO
WCB	Real Estate Acquisition Documents	Provide copies of deeds/Title report for park	RE	NYC DPR
WCG	Real Estate Rights of Entry/Temp Permits	Obtain Rights of Entry or Temporary Permits	RE	NYC DPR
WCH	Real Estate Audit Report	Review Deed/Title Report	RE	RE

WCL	Real Estate Project Related Administration Documents	Prepare Project Real Property Certification Memo	RE	RE
WD	Environmental Studies	Biological Baseline and Soils Collection and Data Analysis	PL-E	PL-E
		Prepare Preliminary and Final Planting Designs	PL-E	PL-E
		Prepare Planting Schedule	PL-E	PL-E
		Incorporate Planting Designs into P&S package	PL-E	PL-E
		Water Quality Certificate Acquisition	PL-E	PL-E
		OMRR&R manual input	PL-E	PL-E
		Site Visits	PL-E	PL-E
		Review Submittals	PL-E	PL-E
		Prepare Project Completion Reports	PL-E	PL-E
		Annual Marsh Monitoring	PL-E	PL-E
		Preparing SOW’s	PL-E	PL-E
WDL	All Other Environmental Documents	GIS Data Management	PL-E	PL-E
WE	HTRW Studies	Local Sponsor HTRW Studies	PL-E	PL-E
		USACE HTRW Studies	PL-E	PL-E
WF	Cultural Resources Studies Documents	Meeting Attendance	PL-E	PL-E
		PDT Coordination	PL-E	PL-E
WG	Cost Estimate	Prepare construction Cost Estimates to support the various phases of the P&S.	EN-C	EN-C
WI	Contract Award Documents	Prepare IGE	CO/EN	CO/EN
		Advertisement of contract	CO/EN	CO/EN
		Reproduction of P&S	CO/EN	CO/EN
		Coordination with Bidders	CO/EN	CO/EN
		Preparation of Amendments	CO/EN	CO/EN
WJ	Engineering and Design during Construction	Resolve Technical Questions	NAD	NAD
		Respond to RFI’s	NAD	NAD
		Visiting Project Site	NAD	NAD
X	Value Engineering	Perform VE study on the ERR		

VII. RISK ANALYSIS

Risk will be minimized through the use of the schedules, metrics, and assignment of specific responsibilities to the PDT. Monthly status review sessions will identify issues and problems that cause risk for the program and identify alternative resolutions.

Potential areas of risk include delays associated with the PMT review and approval process, priority conflicts resulting in extended review times and consequent schedule delays, and a limit in the capability of existing contractors. Monthly reviews will assess problems of this nature and establish workarounds including:

- Reallocation of resources to problem areas;
- Use of consultants for specialized topic areas; and
- Acquisition of additional contract support.

Limits to the team's ability to perform include:

- Funding and
- PMT approval process.

The estimated schedule, reflected in the WBS, has no contingency built in. Contingencies to manage financial risk have been incorporated into the cost estimates.

VIII. SAFTEY AND OCCUPATIONAL HEALTH HAZARD ANALYSIS/MONITORING

All work performed as part of the Soundview Park CAP Section 206 Aquatic Restoration Study will be conducted in accordance with the U.S. Army Corps of Engineers policies, including those listed in EM 385-1-1 *Safety and Health Requirements Manual* dated 3 September 1996.

IX. CHANGE MANAGEMENT PLAN

The PM, in coordination with other members of the PDT, can initiate and approve program and schedule changes that do not affect other initiatives or the overall completion schedule for the project. Changes that affect the overall project schedule/scope will be coordinated through the PM for approval. On-going analysis throughout the life of the project will evaluate impacts to quality, cost, scheduling and scope. The process for managing change resulting from one of those factors is as follows. Changes will be documented by the PM and will be submitted to the PDT for approval. A record of all changes will be maintained in Appendix 1 to the PMP.

1. A change proposal is presented to the PM.

2. The PM gathers sufficient information to analyze the proposal and potential solutions.

3. Analysis is distributed to the appropriate decision maker(s), if other than the PM.

4. A decision is made.

5. The decision and its impacts and/or actions are communicated to appropriate parties.

6. Change is recorded in this document, held by the PM.

X. CLOSEOUT PLAN

The work of the PDT will terminate with delivery of the Final Feasibility Report and NEPA Document. The PDT shall prepare an After Action Report to detail issues, concerns and recommendations for future efforts. Additional support will be provided by PDT members on a continuing, ad hoc basis to aid follow-through on PE&D and construction.

XI. APPROVALS

Project Team Endorsements:

PROJECT TEAM ENDORSEMENTS

Project Manager:________________________________

PROJECT TEAM

Planning Division Team Members

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Engineering Division Team Members

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____

____

Real Estate Division Team Members

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____ ___________

Project Manager Date

____ ___________

Local Sponsor Date

ATTACHMENT A – QUALITY CONTROL PLAN

US Army Corps
of Engineers®
New York District

QUALITY CONTROL PLAN

for

Soundview Park, Bronx, New York

Section 206 – Aquatic Ecosystem Restoration

QUALITY CONTROL PLAN

TABLE OF CONTENTS

I. INTRODUCTION

The New York District Planning Division has adopted this Quality Control Plan (QCP) for the Soundview Park Section 206-Aquatic Ecosystem Restoration Study. This QCP has been tailored to meet the needs of this study effort and is commensurate with the level of risk, cost, complexity and uniqueness of the effort being undertaken.

This plan summarizes the Quality Control Review Process to be employed during the conduct of the review procedures have been developed in accordance with the New York District Standard Operating Procedures.

II. PURPOSE OF PRELIMINARY DESIGN AND ANALYSIS (PDA) PHASE

The study and design phase consists of all the planning and design activities required to demonstrate, that Federal participation in a project is warranted and completes all activities required to award the construction contract

III. STUDY AUTHORITY

The Section 206 of the 1996 Water Resources Development Act as amended authorizes the study under the Continuing Authorities Program (CAP). A Preliminary Restoration Report (PRP) was approved in August 2001, indicating Federal interest.

IV. DESCRIPTION OF STUDY AREA

The project area is located along the east bank of the Bronx River as it empties into East River – bordered by Lafayette, Metcalf, and Bronx River Avenues.

V. QUALITY CONTROL PROCESS

Quality Control (QC) is the process used to ensure that each project/product is in compliance with Corps of Engineers technical and policy requirements and meets the customer's needs and requirements. This two-part process consists of product review and an independent review. Together, the two reviews assure a degree of completeness, correctness and consistency.

A. Product Review.
Each division will conduct their own internal review through its respective chain of command, and is responsible for producing quality products/sub-products. Study team members, Technical Managers, Project Managers and Functional Chiefs still retain responsibility for the quality and timely execution of study tasks in accordance with

milestones, costs and commitments.

B. Independent Review.
An independent review will be conducted (1) within the district, (2) by another district, (3) in centers of expertise, (4) by teams or individuals throughout USACE, or (5) by a contract team or consultant. The review provides additional quality control, not replacement of existing responsibility for accurate, high quality work products.

*All review team members will review the ERR for the **Soundview Park Section 206-Aquatic Ecosystem Restoration Study.** The review of Draft and Final products, when available, will identify and resolve problems, if any, prior to report submission. The Study Team will incorporate all appropriate changes. These records will be kept in the project files. Unusual issues/conflicts that cannot be resolved may be addressed to an appropriate resource in the North Atlantic Division for guidance.*

The Division/Office Chief's signature will ensure that the product and reviews were satisfactorily accomplished in accordance with procedures established with each Division/Office. The Division/Office Chiefs will submit certification of review at the conclusion of the study.

VI. REVIEW SCHEDULE

As major interim products/decision points, as defined by project execution measures, are reached, the review team provides an intermediate review. The following schedule provides specific interim points requiring review:

Review of ERR	Dec 2006

V. ACQUISITION STRATEGY

The PDT will acquire development support from contractors presently supplying ecosystem restoration services. Consultant services will be procured as necessary to provide unique and specialized assistance. Acquisition of additional contract support will be obtained, if needed.

VII: CERTIFICATION OF REVIEW

A review of the Soundview Park Section 206-Aquatic Ecosystem Restoration has been performed and all concerns, if any, have been addressed.

____ _______________

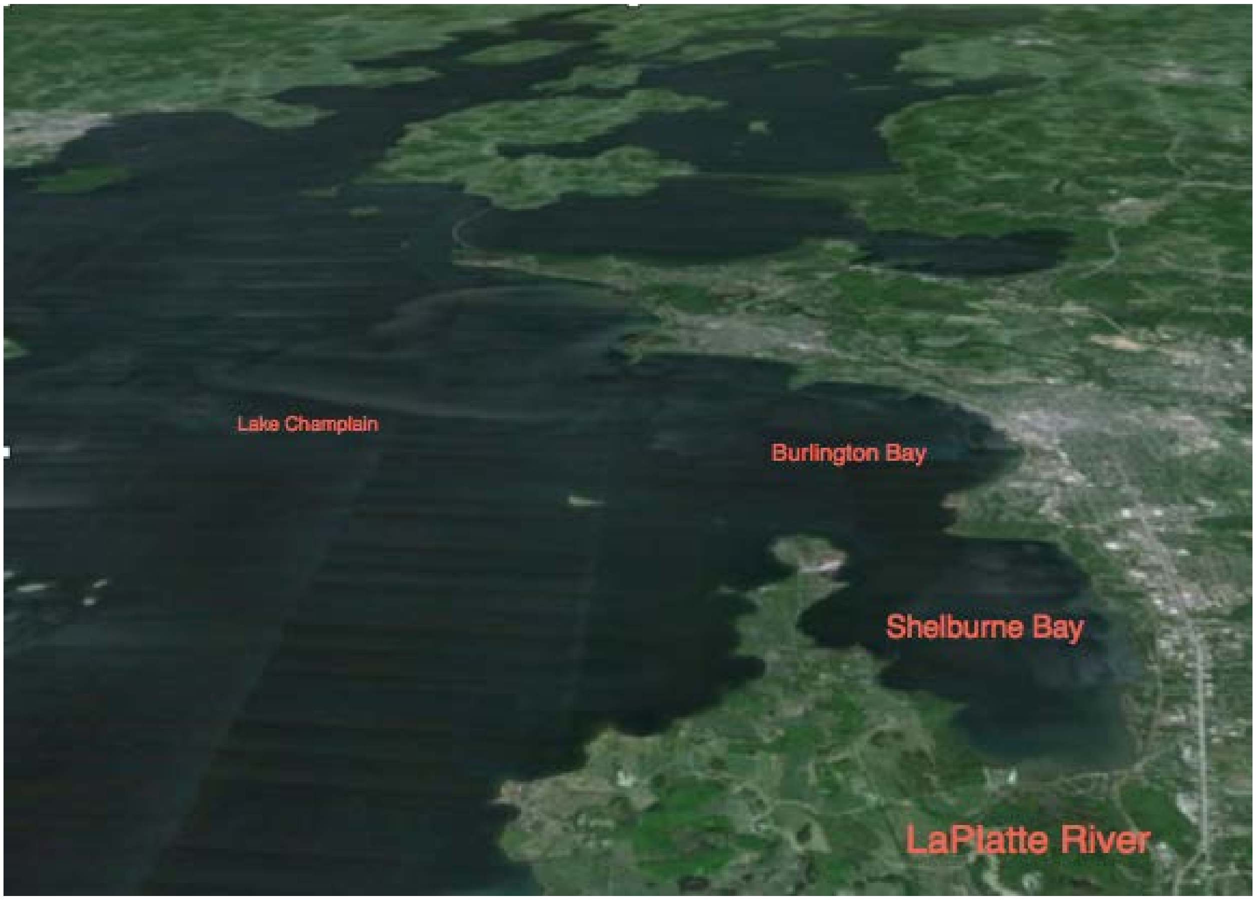
Chief, Planning Division Date

____ _______________

Chief, Engineering Division Date

____ _______________

Chief, Real Estate Division Date



Hydrodynamic Model Study: Lampricide Plumes in Shelburne Bay Near the LaPlatte River

Prepared For

Lake Champlain Fish and Wildlife Conservation Office
United States Fish and Wildlife Service
Essex Junction, VT 05452

Prepared By

BINKERD ENVIRONMENTAL

Charlotte, VT May 2016

Contents

Abstract

The Lake Champlain Fish & Wildlife Conservation Office, United States Fish and Wildlife Service (USFWS) has proposed a lampricide treatment in the LaPlatte River to control sea lamprey larvae. As required by the State of Vermont permit process the USFWS needs to provide information regarding potential lampricide exposure to Lake Champlain water users. To provide this information the fate of lampricide as it enters, mixes and disperses in Lake Champlain is required. The USFWS will use this information to delineate zones in Lake Champlain where the public would be advised not to use lake water until concentrations dilute and degrade to below a threshold concentration. The USFWS contracted with *BINKERD ENVIRONMENTAL* to provide predictions, using mathematical modeling, of lampricide distribution and concentration in Lake Champlain.

Using Delft3D as an analysis tool, the objective is achieved by modeling TFM distributions for uniform and steady winds from two directions (south and north-north-west), for two wind speeds (8 and 20 miles per hour, mph), for three river discharges [5, 25 and 50 cubic feet per second (cfs)], and for two lampricide concentrations [5,000 and 7,000 parts per billion (ppb)]. In addition, two fresh water intakes, three wastewater treatment plants, and three tributaries are included in all simulations.

The 35 ppb contour never exceeded a distance of 1,200 feet from the mouth of the LaPlatte River; less than 10% of the north/south length of Shelburne Bay. The maximum concentration observed near the Champlain Water District intakes, near the north end of Shelburne Bay, approached 1.8 ppb when originating from an initial concentration of 7000 ppb, winds from either the South or North North-West, and a river discharge of 50 cfs.

Two conservative choices formulated in this model are: (1) No decay [photolytic breakdown which is documented to occur (Hubert 2003)] of lampricide (TFM) and (2) selection of the downstream-most application site 0.9 miles from the mouth of the river, not at Shelburne Falls where the last application of TFM will be made (longitudinal attenuation between the falls and the 0.9-mile site will necessarily produce a lower concentration than what is being modeled). These conservative choices result in predictions of lampricide concentrations that will be higher than what is expected during the actual treatment.

List of Illustrations

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1.0 Introduction

The Lake Champlain Fish & Wildlife Management Conservation Office, United States Fish and Wildlife Service (USFWS) has proposed a lampricide treatment to control sea lamprey larvae in the LaPlatte River, a tributary to Shelburne Bay (Lake Champlain). As required by the State of Vermont permit process, the USFWS needs to provide information regarding potential lampricide (3-trifluoromethyl-4-nitrophenol, TFM) exposure to users of Lake Champlain water. The fate of lampricide as it mixes and disperses in Lake Champlain is required to provide this information. The USFWS contracted with *BINKERD ENVIRONMENTAL* to provide predictions using mathematical modeling of lampricide distributions and concentrations in Lake Champlain resulting from the proposed application of lampricide in the LaPlatte River.

1.1 Objective

An application of lampricide to the LaPlatte River to kill lamprey larvae is proposed by the United States Fish and Wildlife Service (USFWS). Lampricide would enter Shelburne Bay and mix with waters in the bay, creating a lampricide plume. The objective of this study is to predict the maximum likely distribution and magnitude (expressed by concentration) of lampricide TFM (3-trifluoromethyl-4-nitrophenol) originating from proposed application of lampricide in the LaPlatte River. A maximum of 35ppb of lampricide has been used in the model as the level at which the Vermont Department of Environmental Conservation requires specific actions to-be-noted in their permit.

1.2 Overview on Selection of Parameters and Environmental Variables

Several environmental factors and other parameters need to be considered and selected for modeling of lampricide plumes in Shelburne Bay resulting from the application of lampricide in the LaPlatte River. The guiding principle in making a selection for each parameter and environmental factor is to make selections that result in larger modeled distributions at higher concentrations than would be expected during the actual lampricide treatment.

To ensure the results of this modeling effort do not under-predict actual concentrations, the effects of each selected environmental factor are sequentially analyzed by comparing model results only to changes made to the factor under consideration. In all cases selections of factors are made that are "conservative." "Conservative," in this report, means predicted plume distributions are more wide spread and magnitudes of concentrations are at higher concentrations compared with likely conditions that may be encountered during the actual lampricide treatment.

2.0 Methods

The analysis method selected simulates the distribution and concentration of lampricide utilizing a hydrodynamic mathematical model: Delft3D-Flow, developed by Deltares, 2016. A description of Delft3D-Flow is found at http://www.deltares.nl. Delft3D-FLOW is a general mathematical representation of multi-dimensional hydrodynamic flow and transport phenomena and is applied at a location using site-specific data. Primary site data required by the Delft3D-Flow simulation are lake bathymetry, lake water elevation, tributary discharge, and wind speed and direction. Also, facilities that withdraw lake water, such as water intakes (public water intakes), and those that discharge water to the lake, such as waste-water treatment plants, are included this model using site-specific data.

Hydrodynamic models written by Deltares (formally developed by Delft Hydraulics Laboratories) have been successfully applied to Lake Champlain for analyses of water quality (Binkerd, 2004) and wave field and shore erosion (Binkerd, 2009) related to the proposed removal of a causeway near Carry Bay in North Hero. Also, Delft3D-Flow has been used to simulate and predict lampricide plumes in Malletts Bay for a proposed lampricide treatment of the Lamoille River (Binkerd, 2009).

Using Delft3D-Flow as an analysis tool, the objective is achieved by modeling TFM distributions for uniform and steady winds for two directions (south and north-north-west), for two wind speeds (8 and 20 miles per hour, mph), for three river discharges (5, 25 and 50 cfs), and for two lampricide mixed concentrations (5,000 and 7,000 ppb). Two freshwater intakes, three wastewater discharges, and four tributaries are included in the model application.

The results of interest and presented in this report are (1) the maximum extent of the 35 ppb TFM concentration in Shelburne Bay, and (2) modeled lampricide TFM concentration near the simulated freshwater intakes (one in Shelburne Bay and one in Burlington Bay).

2.1 Model Domain

The region of Lake Champlain included in the mathematical model is called the model "domain." It is necessary to choose a "domain" that is large enough to fully contain the area where mixing and dispersion takes place to achieve dilution of discharge to acceptable levels. Also, in situations where boundary conditions cannot be described with mathematical precision, it is necessary to locate boundaries such that they have minimal impacts on plume mixing and dispersion. With these factors in mind, and with experience gained from field and model studies the initial model domain is selected. Based on preliminary model results the domain may be modified especially if assumed boundary conditions impact areas of concern.

The model domain selected for this investigation includes Burlington Bay, Shelburne Bay, and a section of the LaPlatte River. These three regions are included in the domain based on their impact and contribution to the mixing and transport process of lampricide plumes. A section of the LaPlatte River was selected to represent and describe the impact of river dispersion on lampricide concentrations before discharging to Shelburne Bay. All of Shelburne Bay was selected, in part, because a major water supply for many surrounding communities is located at the northern end of Shelburne Bay. Burlington Bay was selected because it provides a gateway to the much larger region of Lake Champlain. It is assumed that once lampricide reaches the boundary between Burlington Bay and the main lake it will not only be at very low concentrations, but after leaving Burlington Bay it will be very unlikely to have the capacity to return in sufficient amounts to have any impact on plumes in Shelburne Bay for time scales modeled in this study.

The following photograph and the cover photograph show three regions included in the model domain: lower LaPlatte River, Shelburne Bay and Burlington Bay.

Figure 1. Shelburne Bay, Burlington Bay and the lower LaPlatte River.

Each section of the domain was investigated to discover features that may impact lake hydrodynamics and possibly plume mixing and dispersion. The first section to be investigated is the lower section of the LaPlatte River. This section extends from the mouth of the LaPlatte River, i.e., where the LaPlatte River discharges to Shelburne Bay, upstream 0.9 miles to a Beaver Dam. The following picture illustrates this described section of the LaPlatte River. McCabe Brook is identified in this picture. McCabe Brook, originating south of Charlotte, VT discharges to the LaPlatte River as shown in this picture. McCabe Brook receives discharge from Shelburne No. 1 Wastewater Treatment Plant (WWTP) that is located on Turtle Lane near a bridge that crosses the McCabe Brook on Harbor Road.

The total drainage area of the LaPlatte River is about 53 square miles. The USGS LaPlatte River Station has a drainage area of 44.6 square miles. The discharge of McCabe Brook is downstream of the USGS LaPlatte River Station and is not included in those discharge measurements.

Figure 2. LaPlatte River from Route 7 Bridge to Shelburne Bay

Based on a ratio of drainage areas (6.2/53), discharge to the LaPlatte River from McCabe Brook is about 12 percent of the total LaPlatte River discharge.

Moving north, a map of the southern section of Shelburne Bay is shown below. This section depicts features from the mouth of the LaPlatte River to about half-way to Red Rock Point; a quasi-boundary between Shelburne Bay and Burlington Bay. Features in this section that are included in the model are Munroe Brook, a discharge location for WWTP Shelburne No. 2., and the South BTV WWTP discharge.

Figure 3. Southern Portion of Shelburne Bay - USGS Nautical Chart

The upper-half of Shelburne Bay is shown in the following display. Features relevant to the present investigation include the discharge from South Burlington's WWTP which was studied by Binkerd, 1996. Potash Brook and Champlain Water District (CWD) water intakes are two other features in this section that are included in the model. Potash Brook has a drainage area of 7.1 square miles which is about 13 percent of the drainage area of the LaPlatte River. Champlain Water District's water intake has a maximum design capacity of 15 mgd. CWD maintains two intake pipes at this location.

Figure 4. Northern Portion of Shelburne Bay - USGS Nautical Chart

A section of Burlington Bay is depicted below. Notable features included in the model are the discharge of Burlington Main WWTP just west of the southern end of the breakwater and Burlington's water intake about 4000 feet off-shore. The yellow "dots" mark the location of two historic sunken boats: the "*General Butler*" (near the WWTP discharge) and the "*O. J. Walker*" (near the water intake). A *PWI* (public water intake) further off-shore and a "*sewer*" discharge further off-shore are shown on two charts, NOAA Nautical Chart 14785 *Burlington Harbor* and NOAA Nautical Chart 14782 *Cumberland Head to Four Brothers Islands;* however, neither of these structures were built. The "*boat wreck*" northwest of the BTV Water Intake is the "*Horse Ferry*" and the two unmarked structures to the west of the "*Horse Ferry*" are abandoned Burlington PWI's. Englesby Brook (not shown) discharges to Burlington Bay at a location about 4,500 feet south of the south end of the breakwater

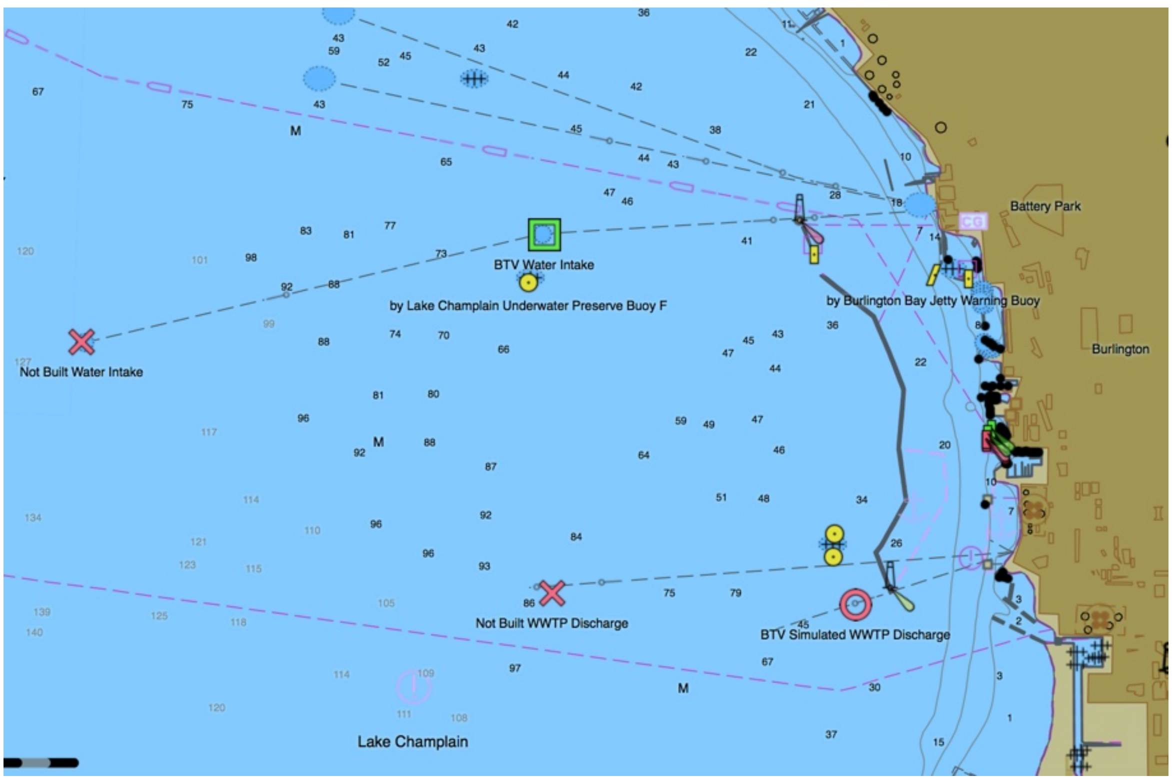

Figure 5. Portion of Burlington Bay - USGS Nautical Chart

2.2 Model Grids and Land Boundary

The coordinate system used throughout this report is Universal Transverse Mercator system (UTM 18), in meters. The east/west coordinates and the north/south coordinates are obtained from Google Maps.

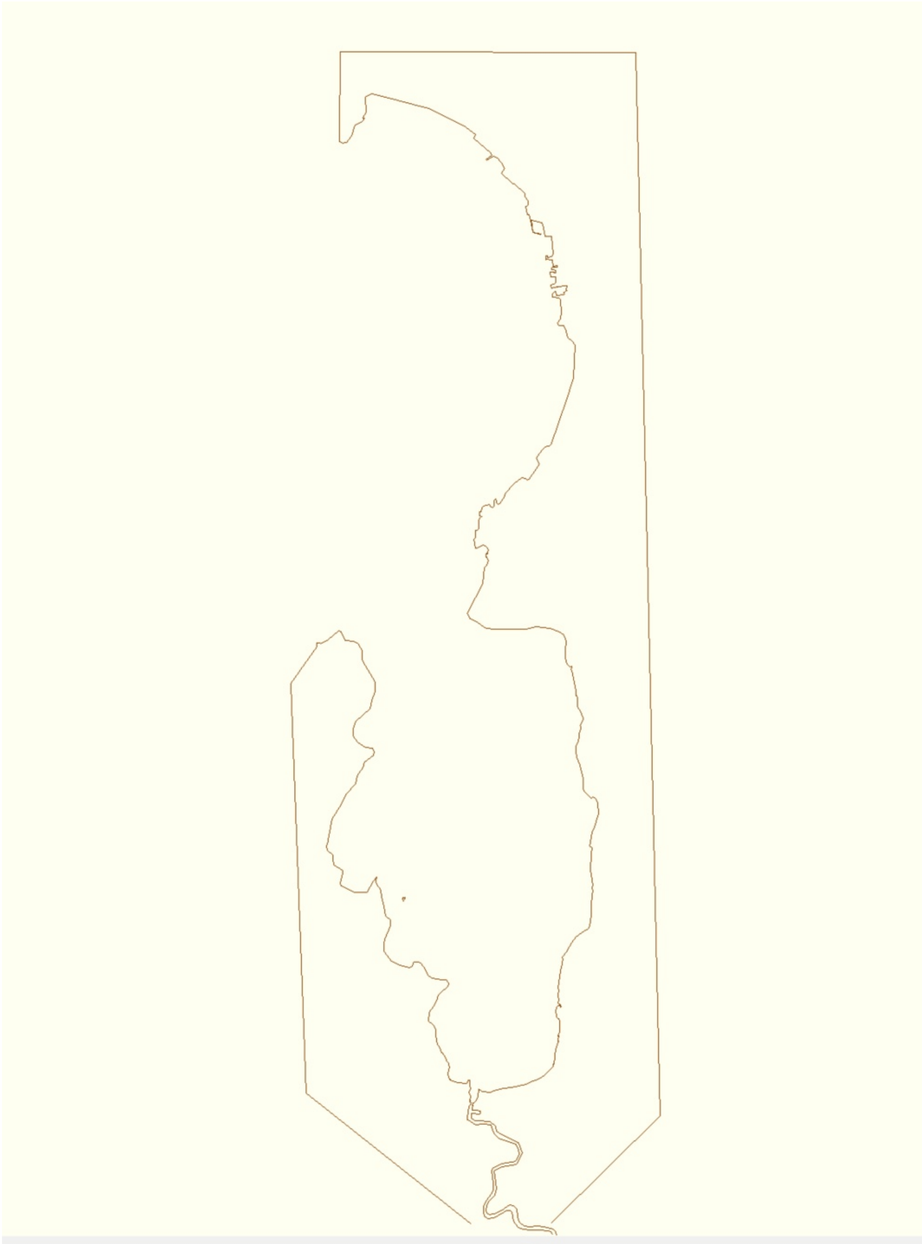

Figure 6. Model Domain Land Boundary

Within the land boundary, lake water depths are plotted. Depth data are obtained from NOAA Nautical Charts and adjusted to a lake water level of 97 feet MSL. The depth scale is in meters.

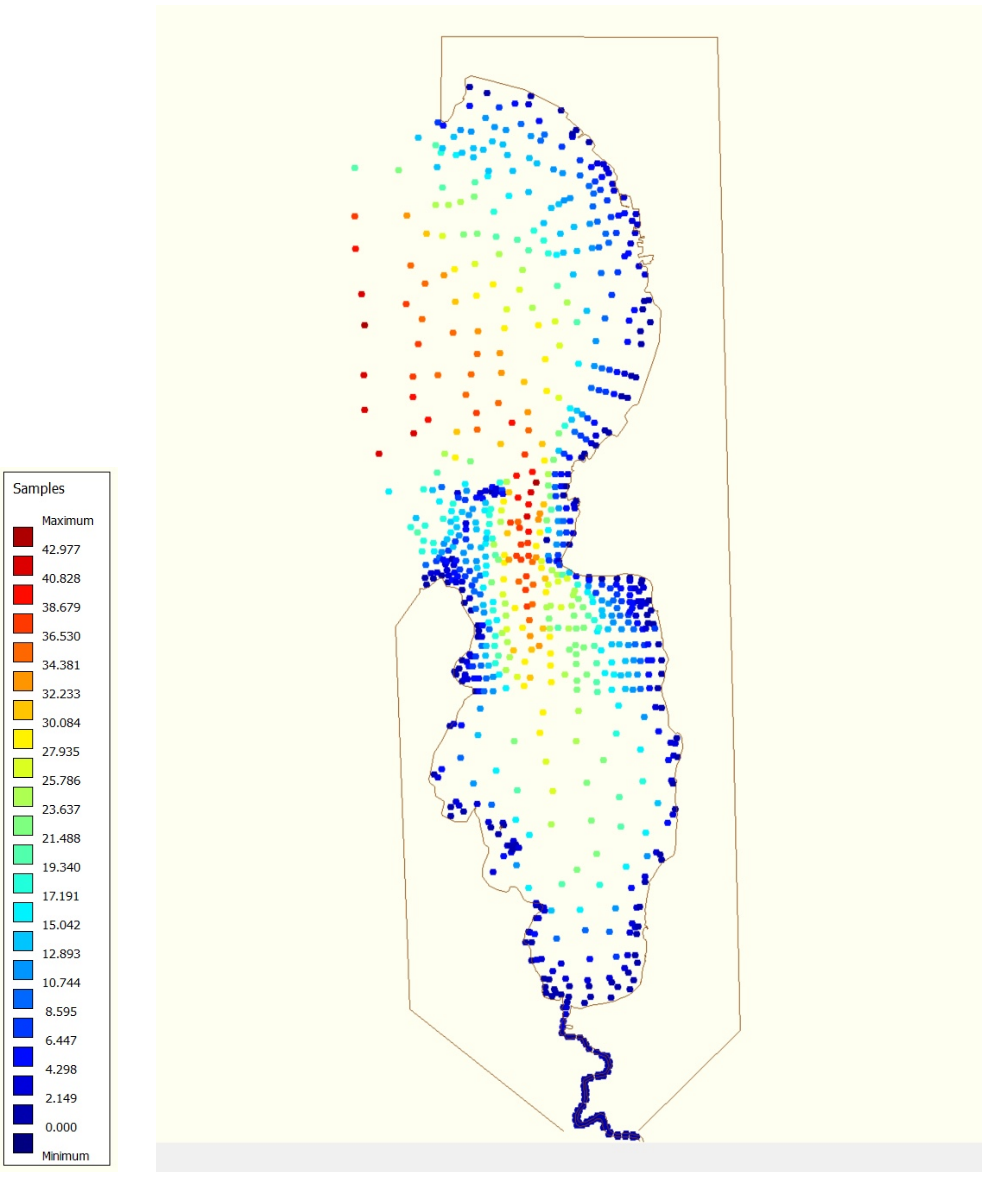

Figure 7. Water Depths from NOAA Charts.

The domain is divided into "computational grid cells." Each cell is described by quadrangles. The grid for the entire domain is shown below. Each cell can be modeled as a single layer or multiple layers. Simulations of both single layer and multiple layers (up to ten layers) are included in this study.

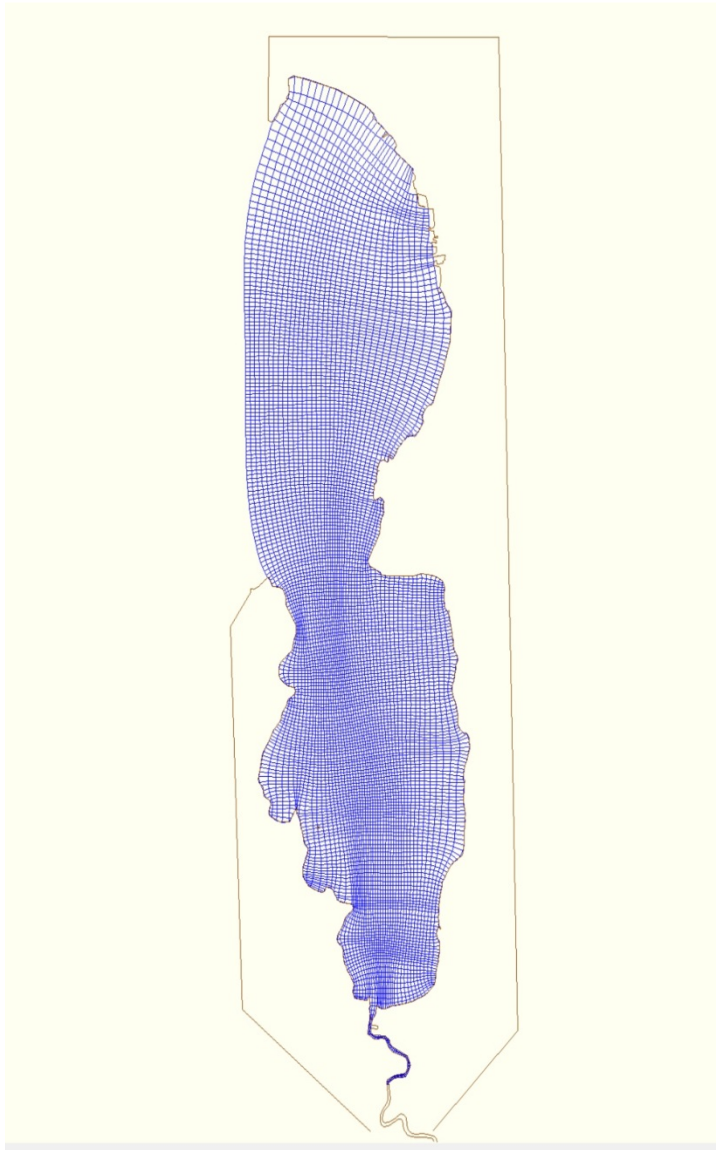

Figure 8. Model Grid

2.3 Model Depths

"Model depths," i.e., depths below 97 feet MSL at the corners of each cell, are computed for each grid cell by triangulation routines using adjusted NOAA lake chart data. From the "model depths", bottom contours are obtained as shown in the following display. The depth scale is in meters.

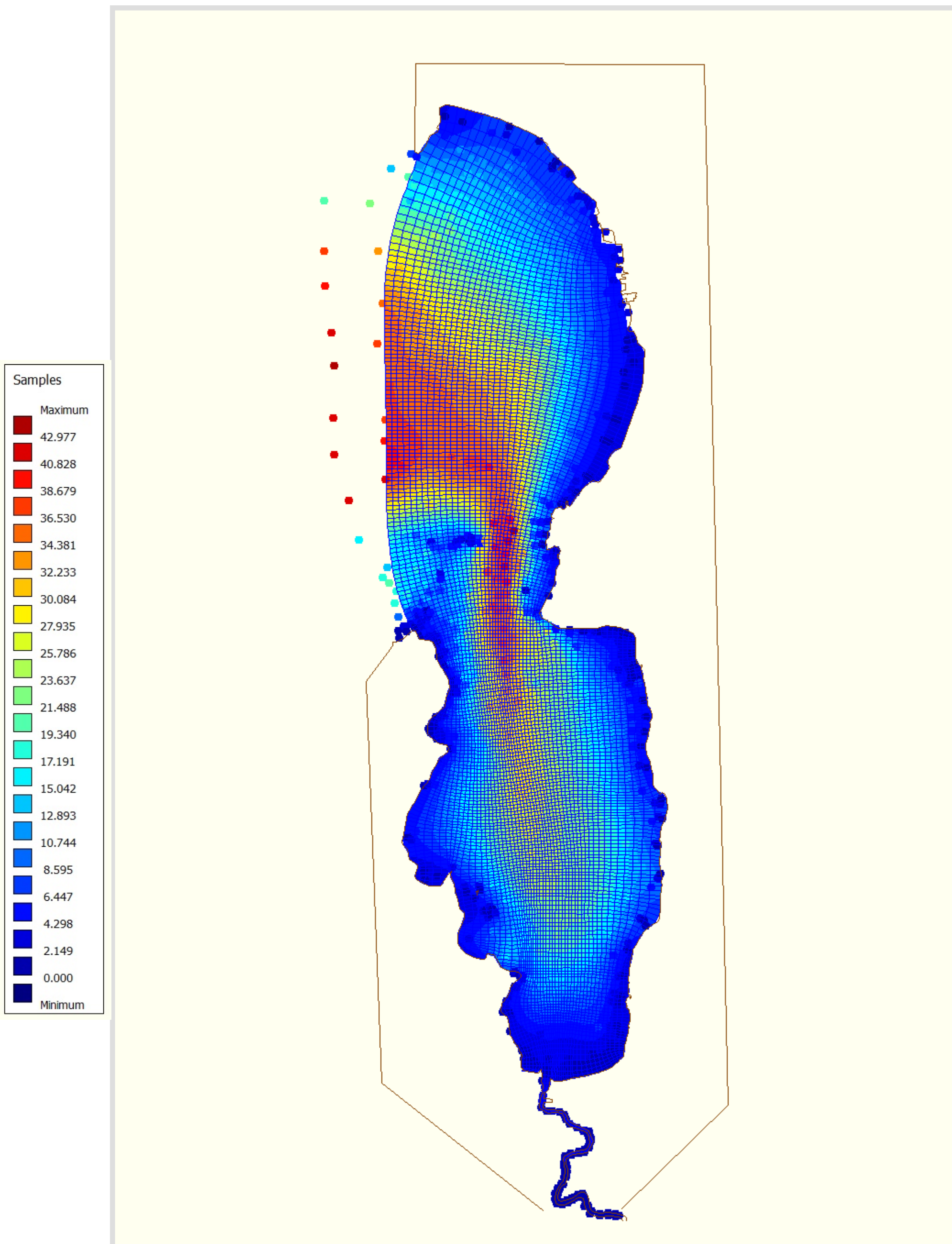

Figure 9. Water depth contours and grids.

The following shows shaded bottom contours without the grid.

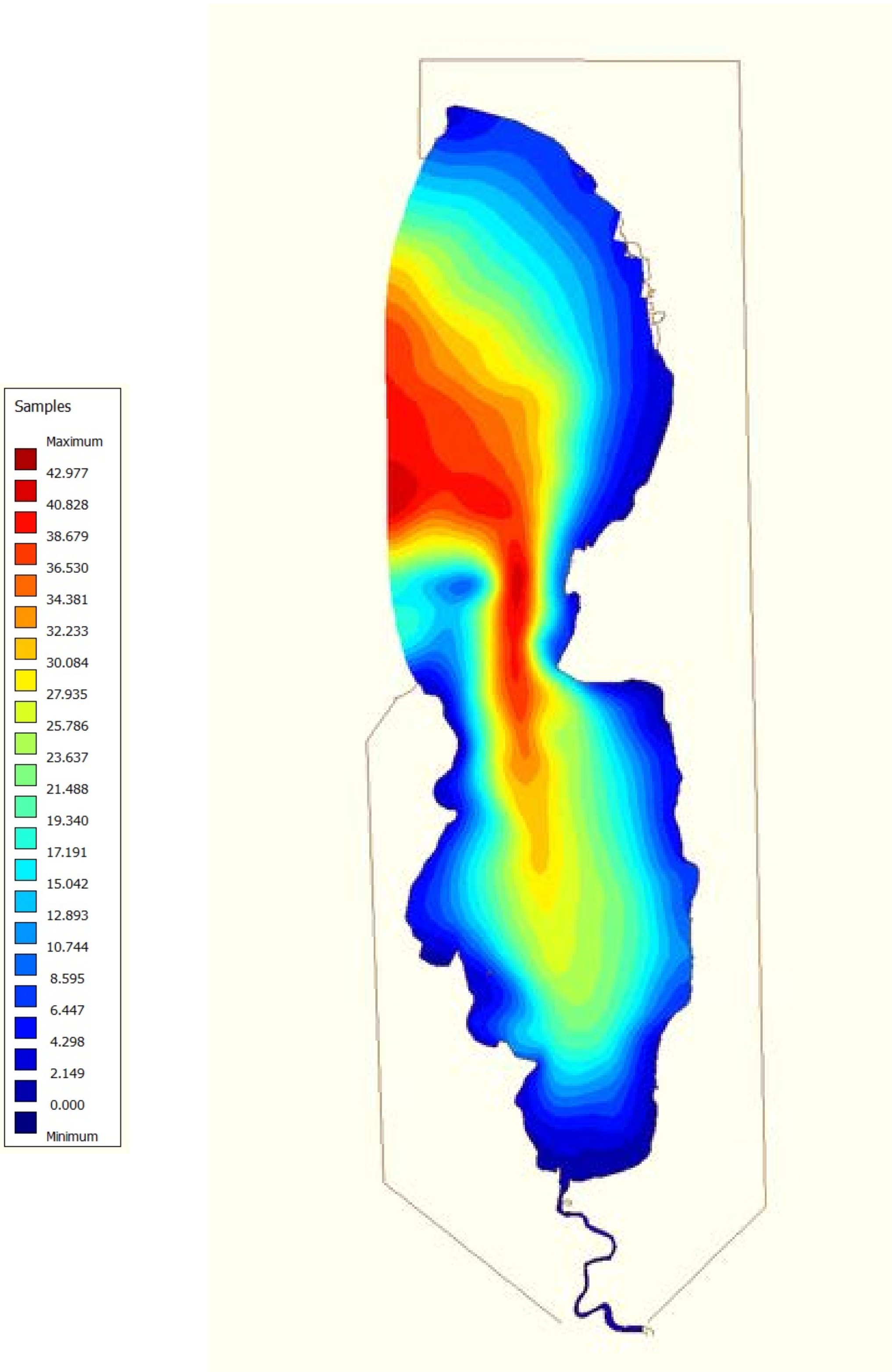

Figure 10. Model Water Depths, in meters.

Lake bathymetry is shown in 3D below. The LaPlatte River is seen in the distance, above the bay. Notice the relatively deep regions protruding into Shelburne Bay. Champlain Water District's water intakes are located within this relatively deep area. Be aware that this is a highly distorted view of the topography of the domain. Depths, even in the deepest areas of Shelburne Bay, are about 100 feet deep while the width of the bay approaches 9,000 feet and the length exceeds 16,000 feet. If a 3D plot of Shelburne Bay is plotted with horizontal (x and y) and vertical directions (z) at the same scale, say, 1 inch equal to 1,000 feet, then one tenth of an inch (0.1 inch) would represent depths of 100 feet, 9 inches would represent maximum widths and 16 inches would represent the length. Ploted to scale, Shelburne Bay would be similar to the shape of a thin magazine lying flat, not the distorted view shown below.

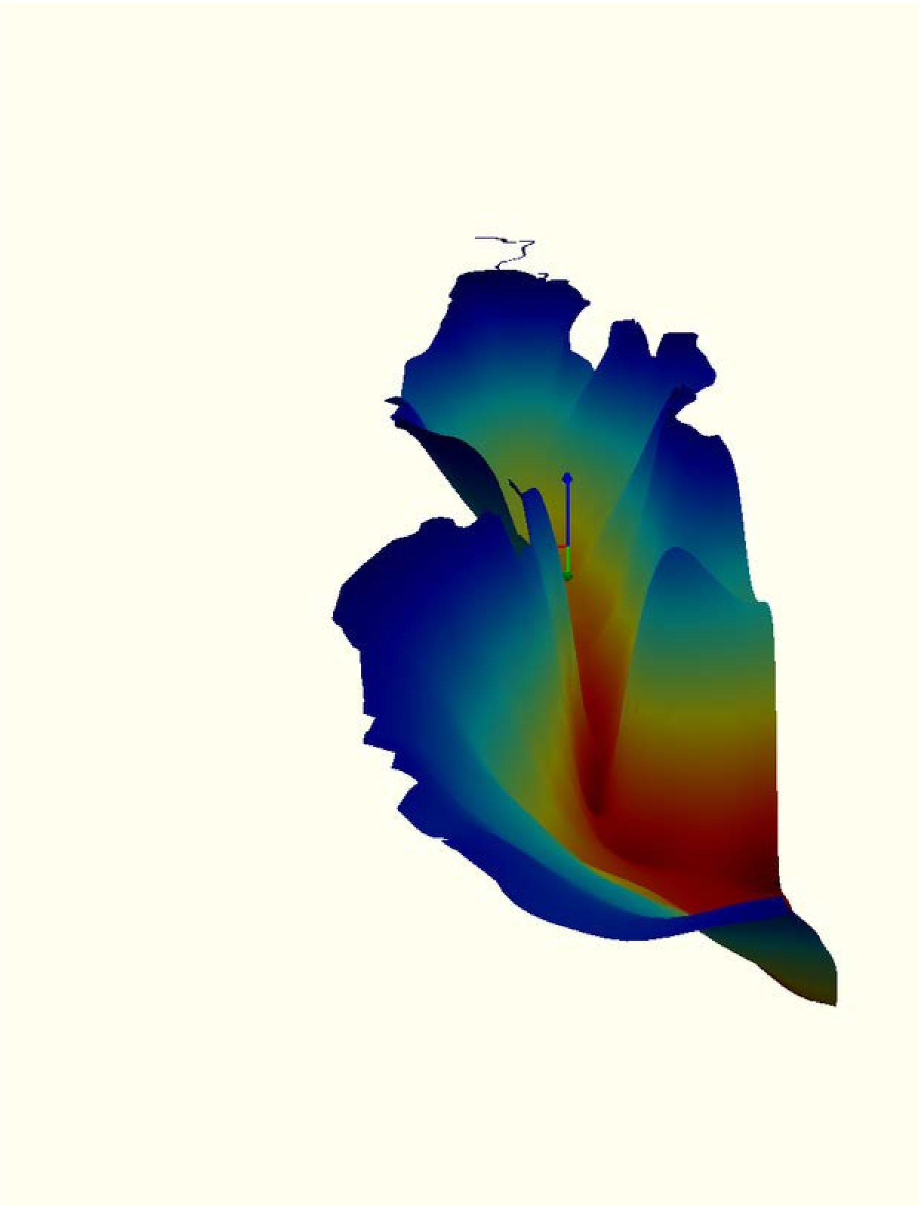

Figure 11. 3D - Model Water Depths, in meters.

2.4 Model Boundaries

2.4.1 Definitions and Locations

At all boundaries, physical conditions specified replicate outside influences on the model domain. In this application, the model domain has four types of boundaries conditions: (1) boundaries at the shoreline, islands, structures and the lake bottom defined by no transport of mass or volume perpendicular to the boundary; (2) boundaries at tributaries, such as, the LaPlatte River, McCabe Brook, Munroe Brook, Potash Brook and Englesby Brook, defined by water volume flow rate; (3) water intakes and wastewater discharges defined by volume flow rates withdrawn or discharged; and, (4) the boundary between Burlington Bay and the adjacent open and extensive region of Lake Champlain which is defined by constant lake level. The constant water elevation boundary condition treats the non-domain region as an infinite source and/or sink of volume transport. All river and lake boundary locations are shown below. Only the lower section of the LaPlatte River is included in the domain, i.e., from a large beaver dam, a semi-permanent feature on the LaPlatte River, to Shelburne Bay.

The first three boundary conditions described above (solid boundaries, tributaries and man-made water sinks & sources) are known with some certainty, but the boundary conditions at the interface of the model domain and main portion of Lake Champlain are not well known and are assumed. The locations of this boundary is selected to minimize impact on the region of interest in the model, Shelburne Bay, due to its distant location from the region of interest.

Also shown in the display below are observation points which are locations where a time history of a selected parameter, e.g., a time history of lampricide, is available after a scenario has been simulated. A “scenario” is a complete set of parameters: boundary conditions, wind speed and direction, bottom roughness, physical constants, tributary discharge rates, sinks (water intakes), sources (wastewater discharges), concentration, and duration and location of lampricide application.

The LaPlatte river discharge rate is known with some certainty because it is gaged by the U.S. Geological Survey. Discharge at all other tributaries are calculated by a ratio of their drainage area divided by the drainage area of the LaPlatte River upstream of its gage, multiplied by the selected discharge rate of the LaPlatte River. Completely mixed river lampricide concentrations multiplied by the river discharge rates and the duration of application equals the mass of lampricide applied.

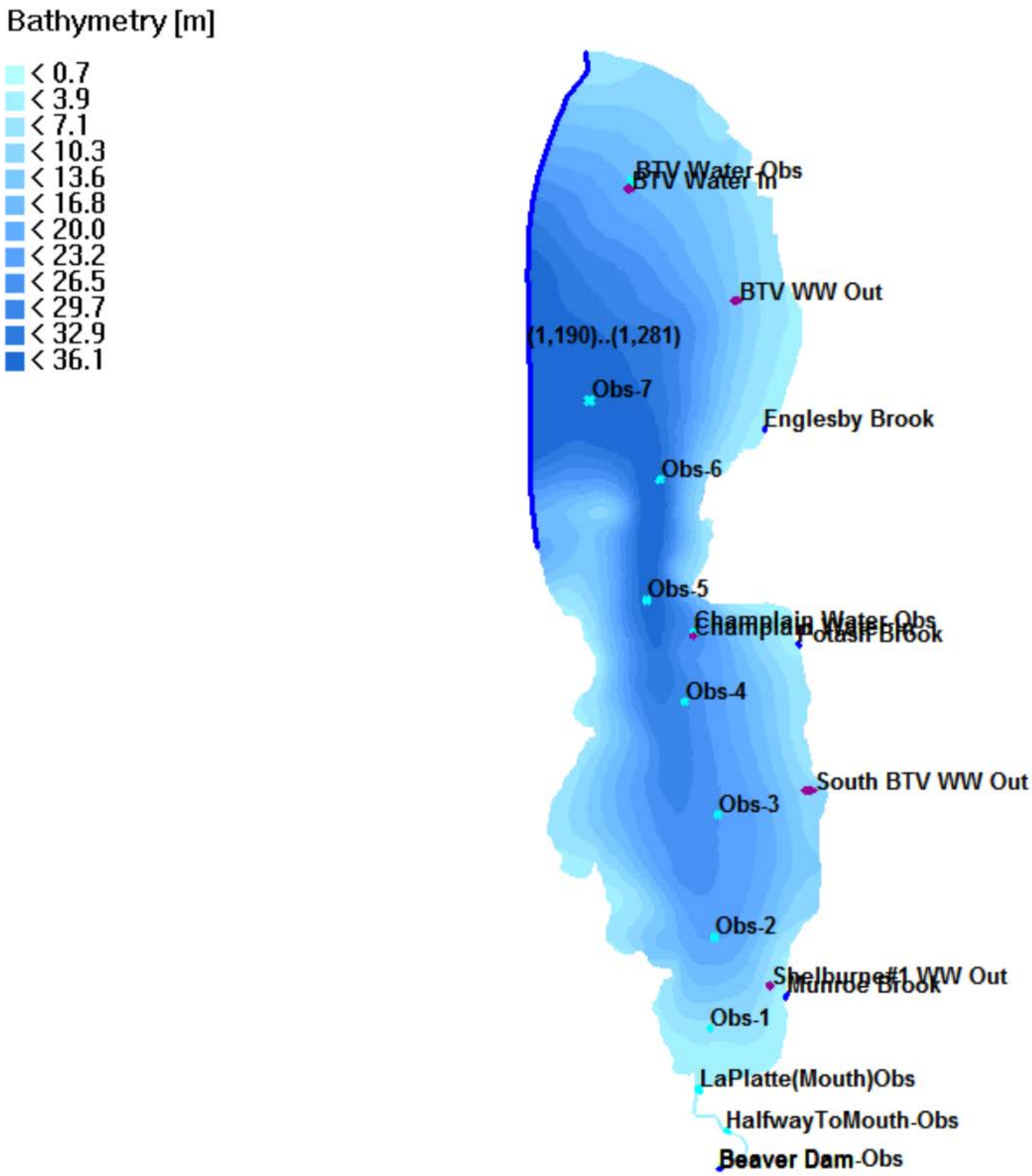

Figure 12. Observation Locations, Tributaries, Water Intakes and Wastewater Discharges.

2.4.2 Modeled Flow Rates: Tributaries, Water Intakes, and Wastewater Discharge
The USGS (U.S. Geological Survey) maintains and operates a monitoring station on the LaPlatte River in cooperation with Champlain Water District; USGS 04282795 LaPlatte River at Shelburne Falls. This station is located a short distance upstream of Shelburne Falls. The blue line in the graphs below, Figures 13 & 14, depicts the LaPlatte River calculated discharge at this location in October 2015. The red star on the blue line represents a measured discharge of four cubic feet per second.

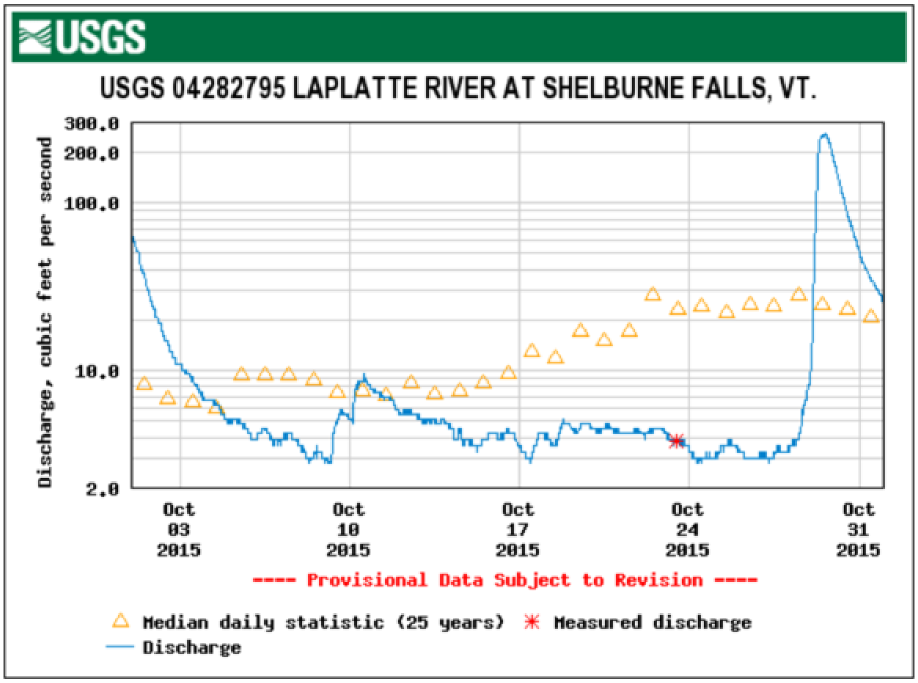

Figure 13. USGS October Discharge Data, LaPlatte River.

The "yellow" triangles depict the 25-year median daily flow rate observed on that date in October calculated using a twenty-five-year history. It appears that during the first half of October, the 25-year average daily discharge is usually less than 10 cfs. After mid-October the 25-year average increases and plateaus between 20 and 30 cfs and then continues at this level into November.

From these data, the LaPlatte River model discharge was selected at three rates: 5, 25 and 50 cfs. The discharge of all other tributaries are scaled to these values based on size of their drainage areas compared to the size of the drainage area of the LaPlatte River upstream of the USGS station.

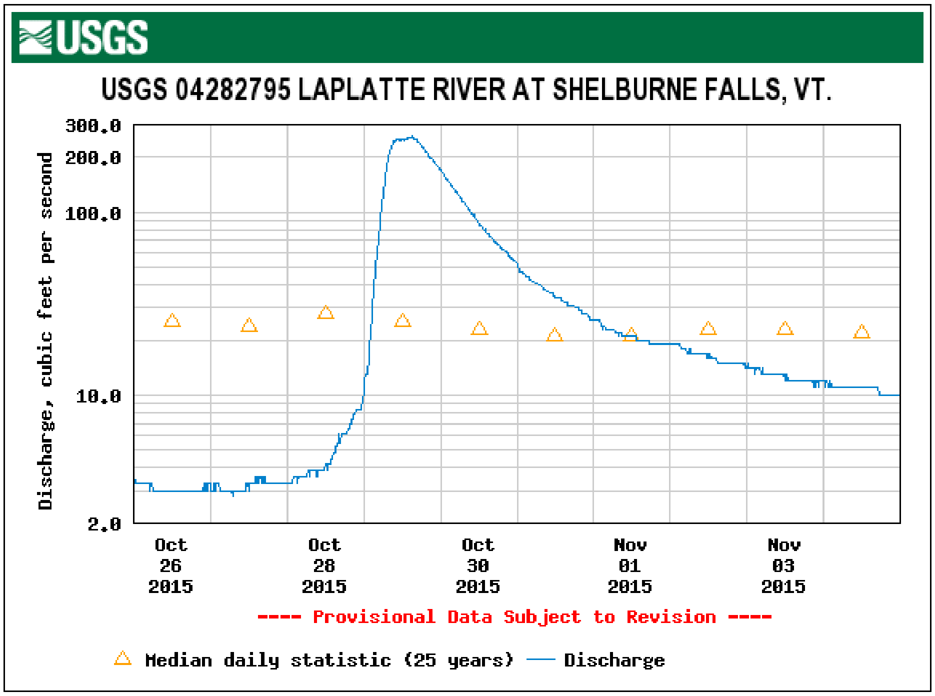

Figure 14. USGS October 26 to November 3, 2015 Discharge Data, LaPlatte River.

The total drainage area of Shelburne Bay is about 71.6 square miles. The LaPlatte River drains 53 square miles or nearly 75% of the total Shelburne Bay drainage. The "USGS LaPlatte River at Shelburne Falls, VT" station has a drainage area of 44.6 square miles. McCabe Brook has a drainage area of 6.2 square miles and discharges to the LaPlatte River close to Shelburne Bay. Munroe Brook and Potash Brook have drainage areas of 5.5 and 7.1 square miles, respectively, and discharge directly to Shelburne Bay. Englesby Brook, with a drainage area of 0.9 square miles, is the only direct tributary to Burlington Bay. Discharge from McCabe Brook is not included in the model even though it provides water that would dilute lampricide before discharge to Shelburne Bay. The effect of this additional dilution is modeled and results indicate that only and a small decrease in near-field plume concentrations are affected as the mass of lampricide applied did not change and the effect of river dispersion is minimal because McCabe Brook discharge is close to the mouth of the LaPlatte River.

The Champlain District Water intake is modeled at 15 million gallons per day (mgd), which is its maximum withdrawal rate. The Burlington Water Intake is modeled at 8.5 mgd based on an estimate of population served in Burlington compared with the population served by CWD.

The wastewater treatment plant discharges are modeled at permit limits. These are 5.3 mgd for Burlington Main, 0.44 mgd for Shelburne No. 1 WWTP on Crown Road, and 1.25 mgd for South Burlington WWTP on Barlett Bay Road. Shelburne No. 2 WWTP on Turtle Road is permitted to discharge 0.66 mgd to the McCabe Brook, but this is not included in the model as its discharge is to McCabe Brook and McCabe Brook is not included in the model.

2.5 Model Wind Speed & Direction

Wind speed and direction is based on the following wind rose for Burlington Vermont for the month of October. As indicated, winds most often come from either the N, NNW, NW or WNW (40 percent time). Winds come from the S and SSW (30% of the time). Winds are recorded from other directions some of the time and this obviously occurs as wind changes from northerly to southerly and back, but sustained winds from directions other than *WNW to N* and from *S to SSW* are rare.

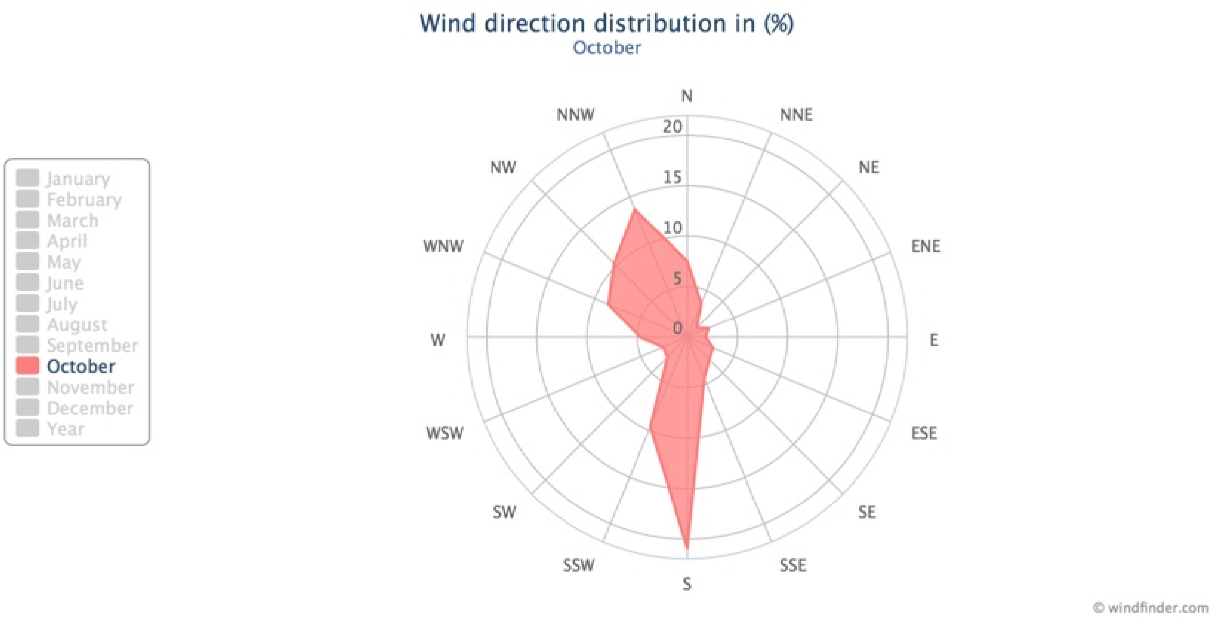

Figure 15. October Wind Rose: Burlington, Vermont.

2.6 Model TFM Chemical & Physical Properties

TFM (3-trifluoromethyl-4-nitrophenol) is a complex chemical compound that has received extensive research, especially with regard to its effect on lamprey and non-target species. It is known to decay and transform with exposure to environmental variables, primarily by photo-degradation. TFM half-life estimates under a variety of laboratory and field conditions ranged from about 4 hours to 5 days (Hubert 2003). In this study, zero decay is used to predict plume distributions, i.e., TFM is considered to be an absolutely conservative substance, even though it is known to degrade. The selection of zero decay for modeling the chemical properties of TFM is an example of a conservative parameter selection made in the formulation of this model.

2.7 Model Time Duration and Time-Step

The model time duration is thirty days for all simulations and the "time-step" is five minutes. The "time-step" is the interval in "model time" between calculations. Thirty day simulations computed with a five-minute time-step took about twenty minutes in "real time" on the computer used in this study. The selection of 30 days is based on initial test runs and examination of results of simulated lampricide concentrations near Champlain Water District's two water intakes. In a time period of thirty days, concentrations near CWD intakes are well past maximum concentrations. Thirty days also included a four-day initial start-up phase before lampricide application is introduced in the model. From examination of modeled results for various conditions of wind speed, wind direction, and river discharge, four days is more than sufficient to allow a steady and/or a repetitive condition to be established with a model originating from initial conditions of *no flow* and *zero water elevation differential*. The convention use for writing time is year/month/day hr:min:sec. An example of "midnight" between Oct 4th and Oct 5th is written 2016/10/05 00:00:00.

2.8 Model Output Parameters

For this study, the important output parameter is lampricide (TFM) concentration. Lampricide concentrations are shown in plan view maps for concentration distributions. At "observation points" results are available as a time history, i.e., lampricide concentration versus time. During model set-up and testing, multiple layers and single layer simulations are run and examined to investigate vertical distributions of modeled lampricide concentration. No difference is noted for single layer or multi-layer simulation. This is expected since lake water temperatures are nearly uniform in October and no buoyancy forces entered into the model. Consequently, final runs are simulated as one layer and even then, using the same scenario and only modifying the number of layers, additions simulations are run to provide continual check on the validity of one layer results compared with multi-layered results.

3.0 Analysis & Results

3.1 General Approach

3.1.1 Overview

A "mathematical model" consists of mathematical representations of the domain, boundary conditions, initial conditions, and other factors as presented above. With a model properly applied to a specific site the influence of each variable on plume distribution can be examined and many "what if this…or…. what if that" questions can be posed and examined for relatively little effort. The five variables explored here are (1) location of lampricide application, (2) initial mixed lampricide concentration, (3) river discharge, (4) wind speed, and (5) wind direction.

Impact of changes in each of these five variables are based on two statistics obtained from model results: (1) distance to the maximum extent of the 35 ppb concentration and (2) the maximum simulated lampricide concentration near Champlain Water District's water intake.

An initial set of values for the five variables constitute a "base" run. Then, one variable is selected, its value is changed, a simulation is run, and finally the results of the modified run are compared to the "base" run. The modified values for each variable used in successive analyses are selected based on their capacity to produce estimates of a *longer distance* to the edge of the 35 ppb contour and/or a *higher concentration* near CWD's water intake. The value or the location for the variable examined continues on in future simulations until each of the five variables are examined. Using this procedure, a combination of values is ultimately selected that would most likely result in plumes with the longest distance from the mouth of the river to the edge of the 35 ppb concentration and the highest concentration near CWD's water intake.

Specifically, the impact on river dispersion is examined by selection of two locations for lampricide application: the Route 7 bridge (1.8 miles from Shelburne Bay), and near the location of a Beaver Dam (0.9 miles from Shelburne Bay). The simulation that resulted in the largest and longest plumes and highest concentration near the CWD intake is retained in the next examination of the impact of initial concentration on plumes. Mixed initial concentration of lampricide is examined by increasing the value used in the base run from 5,000 ppb (base run) to 7,000 ppb. Next, river discharge of 25 cfs is used in the base run and compared with 50 cubic feet per second. Then, wind speeds are increased from 8 mph (base run) to 20 mph. Finally, South winds (base run) and North-Northwest NNW winds are compared.

For documentation purposes, twenty-four additional simulations were run and results are available, if needed. These additional simulations are for uniform and steady winds from two directions (South and North-Northwest), for two wind speeds (8 and 20 miles per hour, mph), three river discharges (5, 25, and 50 cfs), and two mixed initial concentrations of lampricide (5,000 ppb and 7,000 ppb). The duration of application is twelve hours and the application location used for these twenty-four additional simulations is at Beaver Dam (Figure 2).

3.1.2 Discussion of the Phenomena of Dispersion

What is river dispersion and why is it important in this study? River dispersion can be observed indirectly by observations of a "tracer" discharged to the river, such as lampricide, or by observation of a "natural tracer" such as turbidity. What is observed is the spreading out and mixing of a tracer across the width of the river, from surface to bottom, and along the length of the river. Spreading and mixing in all directions and at different rates is related to individual water parcels, even on a molecular level, moving in a multitude of directions and speeds. The leading edge (some parcels travel faster) and the trailing edge (some move slower) of the tagged section mixes with untagged water on both ends resulting in a reduction in concentration and an increase in overall length of a "tagged" section.

Dispersion is not limited to just the LaPlatte River portion of the domain. Dispersion is one continuous phenomena starting, in this situation, at the point of application, and continuing throughout its passage along the LaPlatte River, Shelburne Bay, Burlington Bay, main Lake Champlain, and well beyond.

The location of the application point is important because the further upstream in the LaPlatte River lampricide is applied, the more time and distance the effect of dispersion has to spread out and reduce peak concentrations prior to discharge to Shelburne Bay. Dispersion for a substance that does not decay, settle to the bottom, or exchange with the atmosphere has no impact on the "mass" of the substance that remains in the water.

Note that lampricide is not a "conserved" model variable. During the actual "physical" lampricide application, additional quantities of lampricide (boosts) will be added downstream of the application point to maintain a lethal dose for lamprey larva due to dispersion and decay of TFM in the eight miles of LaPlatte River upstream of Shelburne Falls. Below Shelburne Falls lampricide will not be added. The distance from the initial lampricide application point is over eight miles to Shelburne Falls. From Shelburne Falls to Shelburne there is an additional distance of 3.6 miles. These distance estimates are approximations to the physical centerline distance of the river; the actual path of an individual parcel of water and associated lampricide molecule could be, and most likely is, much further. The known dispersion and decay phenomena, accounted for by the USFWS's treatment strategy above Shelburne Falls, is not considered in the simulations for the length of river between Shelburne Falls and the Beaver Dam where the same processes will affect concentration. Dispersion and decay (attenuation) will occur between the downstream-most permitted lampricide application point (Shelburne Falls) and the site chosen (Beaver Dam) to simulate full strength lampricide application, but it will not be reflected in the model output. The concentrations simulated at the Beaver Dam as a full-strength lampricide application point will assuredly not be full strength after traveling from Shelburne Falls to the Beaver Dam during the actual treatment. This adds another layer of conservative estimation when calculating the length of plume and the concentration reaching the CWD intake.

3.2 Analysis - "This or That"

Below is an example of a plume plotted on a map of the entire domain. All other displays in this section are of an enlargement of the region near the mouth of the LaPlatte River. Also, the peak concentrations and arrival times near CWD's intake discussed in this section are read from graphs similar to the one below. Start time for application is always at simulated time 2016/10/05 00:00:00 (midnight on Oct 4th). The duration of application is always twelve hours. In Figure 16, the time 2016/10/05 17:00:00 highlighted in *blue* is seventeen hours after the start time of lampricide application at 2016/10/05 00:00:00.

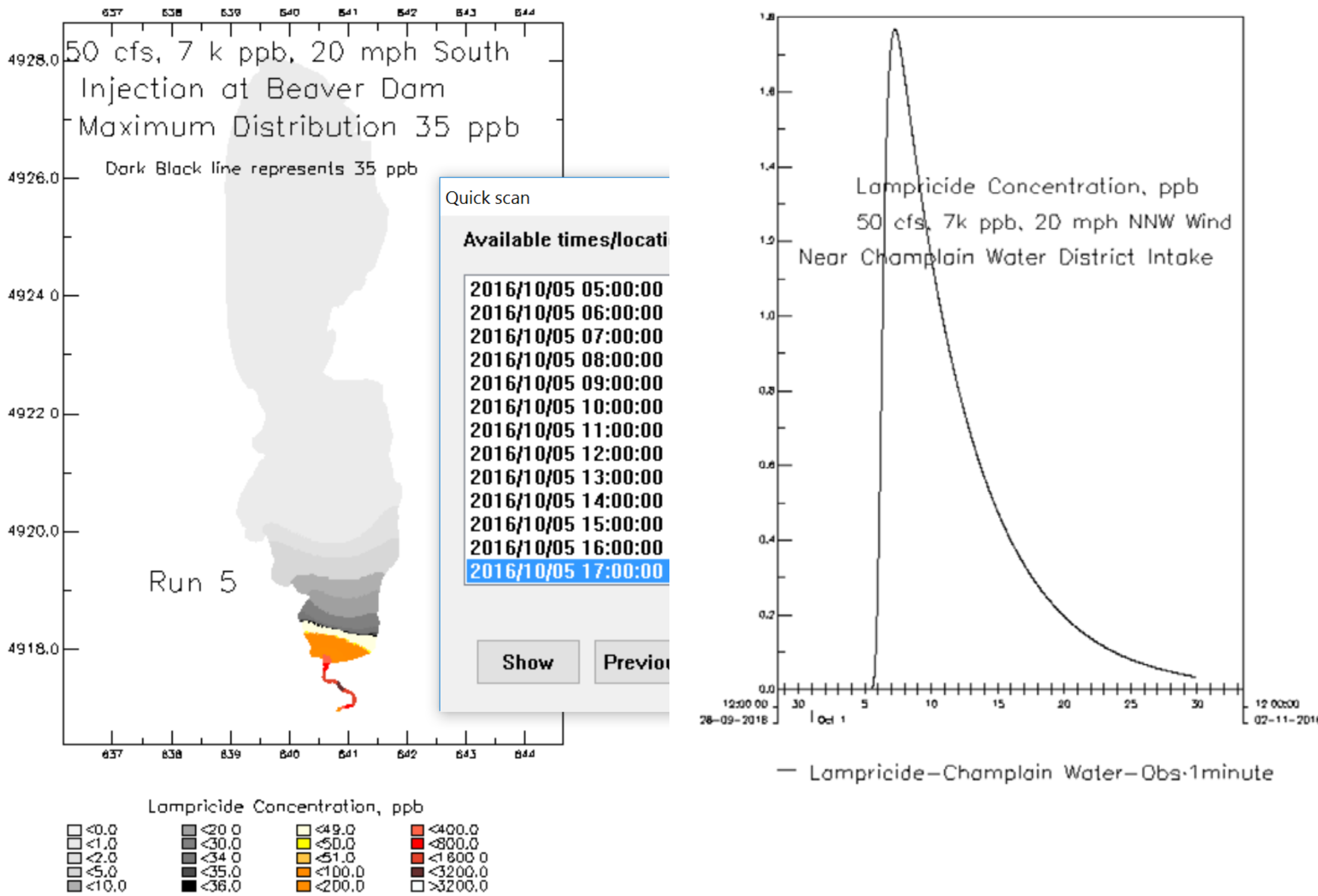

Figure 16. Example of a lampricide plume plotted on a map of the entire domain and lampricide versus time simulated near Champlain Water District intakes.

Table 1. Run **descriptions** and **results** of seven runs.

Run #	Application at	Discharge, cfs	Concentration, ppb	Wind Direction and Speed, mph
1	Route 7 Bridge	25	5000	South 8
2	Beaver Dam	25	5000	South 8
3	Beaver Dam	25	7000	South 8
4	Beaver Dam	50	7000	South 8
5	Beaver Dam	50	7000	South 20
6	Beaver Dam	50	7000	North Northwest 20
7	Beaver Dam	50	7000	North Northwest 8

Run #	Distance in feet to Maximum Extent of 35 ppb Concentration	Maximum Concentration Near Simulated CWD Intake, ppb	Maximum Concentration Near Simulated CWD Intake Arrived in Days: Hours
1	285	0.54	4 days 12 hours
2	370	0.62	4 days 2 hours
3	490	0.87	4 days 2 hours
4	735	1.32	4 days 0 hours
5	680	1.74	2 days 15 hours
6	1200	1.78	2 days 11 hours
7	610	1.42	4 days 12 hours

This location versus that location for application - Run #1 vs. Run #2**:** The location for simulated application of the base run, Run #1, is at the Route 7 bridge, north of Shelburne center. This bridge is about 1.8 miles from Shelburne Bay. The only change in the Run #2 is the location for application to near a Beaver Dam about 0.9 miles from Shelburne Bay. From Table 1, notice that aplication simulated at the Beaver Dam had both longer distance to the maximum extent of 35 ppb concentration and higher maximum concentration near the simulated Champlain Water District's water intake; therefore, Beaver Dam is selected for additional simulations. The increase in both statistics selected for comparisons is due to less dispersion before discharge to Shelburne Bay.

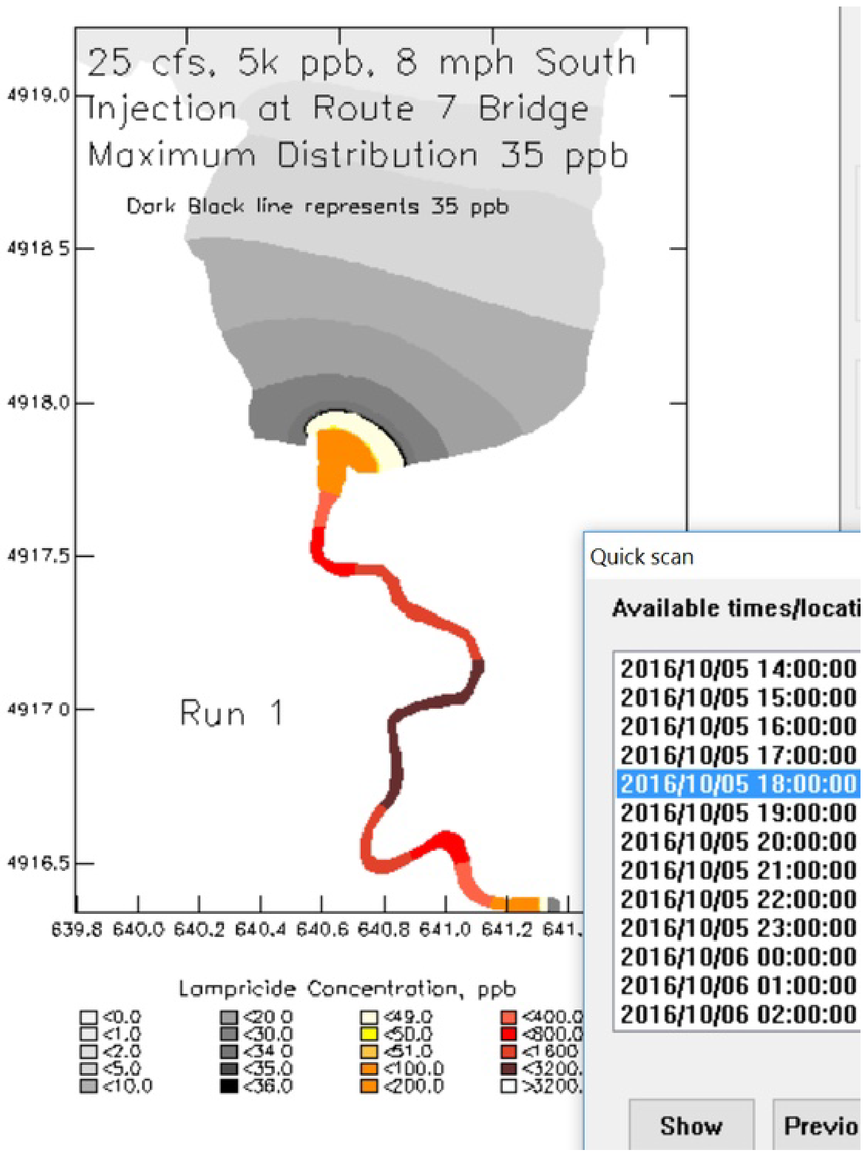

Figure 17. Plume at maximum extent of the 35 ppb concentration for Run #1.

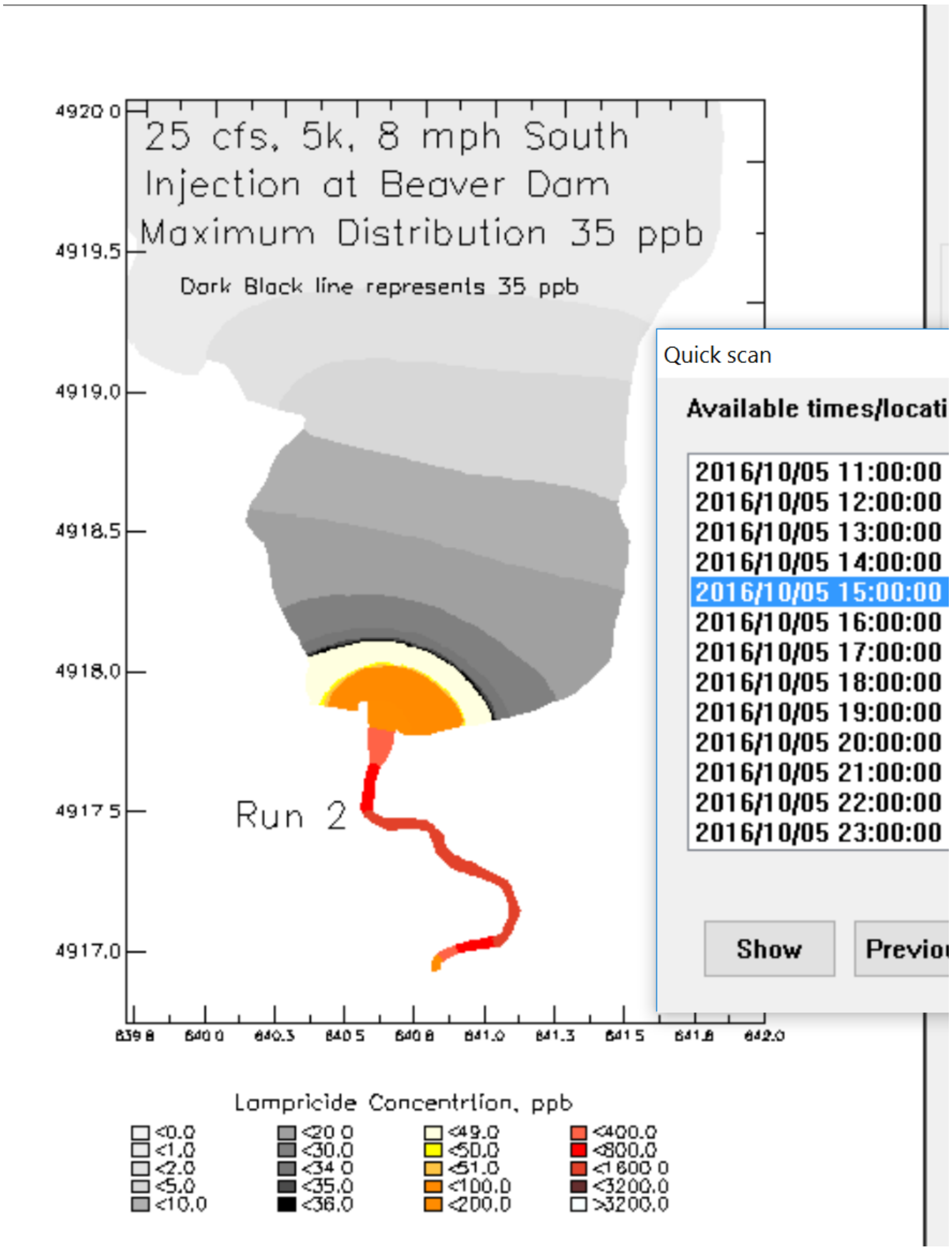

Figure 18. Plume at maximum extent of the 35 ppb concentration for Run #2.

This initial concentration versus that initial concentration - Run #2 vs. Run #3: *N*otice that the concentration near the intake in Run #3, 0.87 ppb, compared with the concentration in Run #2, 0.62 ppb, is higher by 7/5 or the ratio of initial concentrations (7000ppb/5000ppb). In fact, all concentrations are proportional to the ratio of initial mixed concentrations provide that that is the only change. The maximum extent of 490 feet is slightly less than 7/5 times of 370 feet (518 feet); however, this may be a result of the subjective approach to estimating distance.

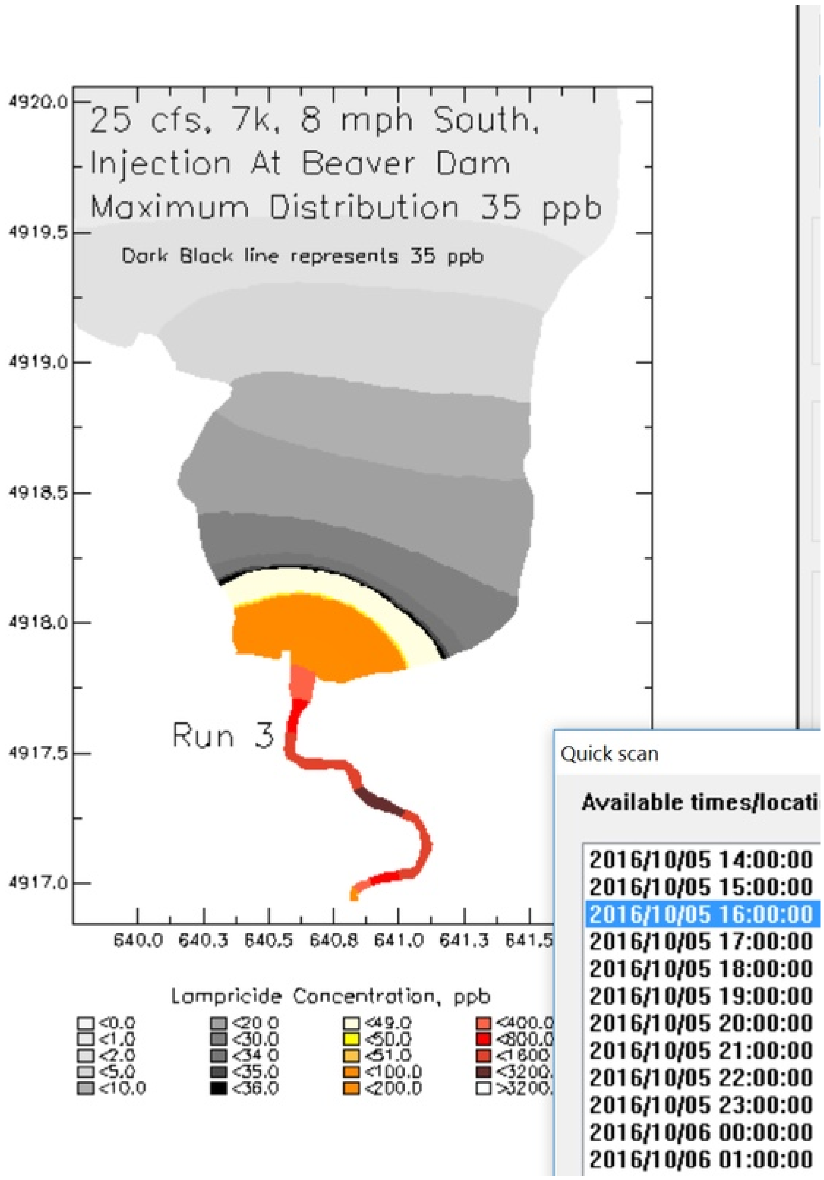

Figure 19. Plume at maximum extent of the 35 ppb concentration for Run #3.

This river discharge versus that river discharge- Run #3 vs. Run #4: River discharge is doubled in Run #4 to 50 cfs for comparison with Run #3, 25 cfs. This change doubles the mass of lampricide applied in the same amount of time. Notice that the concentration at CWD intakes did not double (1.32 ppb is not twice as high as 0.87 ppb) with a doubling of river discharge while holding the initial mixed concentration the same. This may indicate that the relationship due to river discharge alone may not be linear.

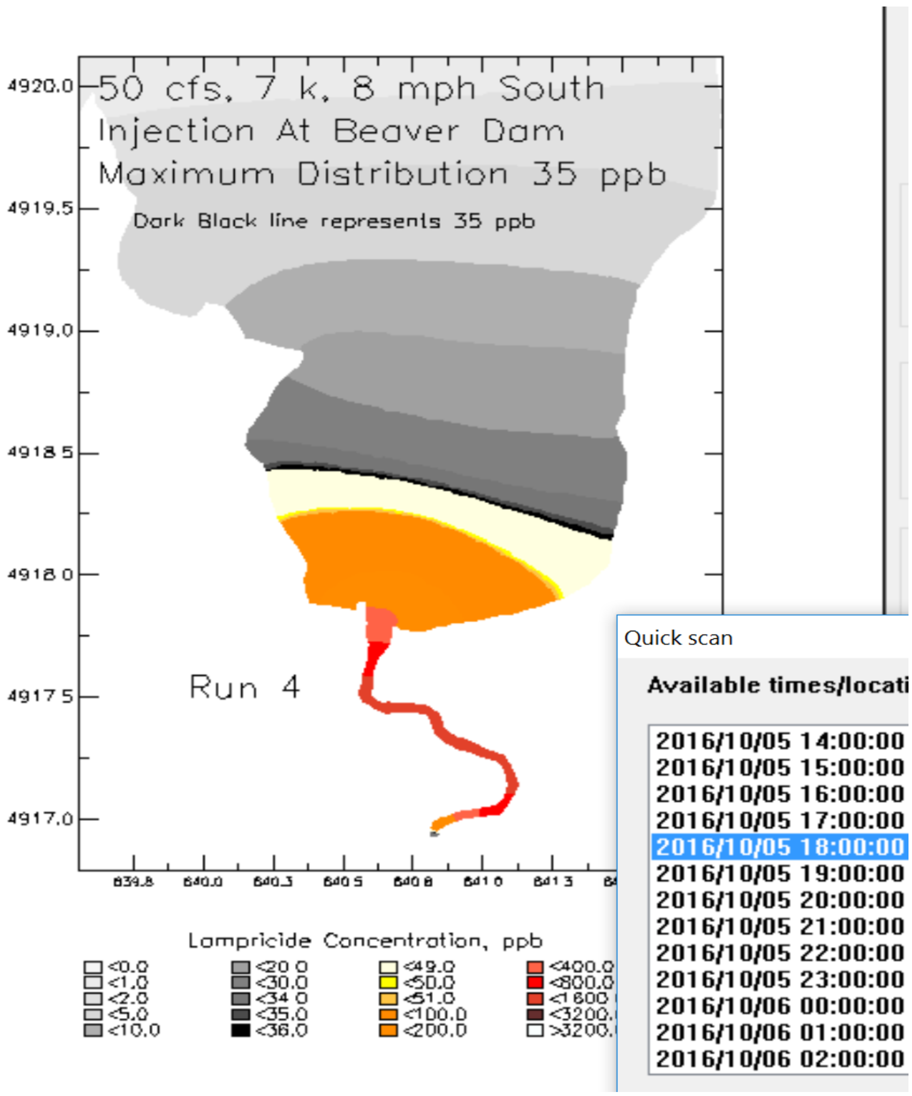

Figure 20. Plume at maximum extent of the 35 ppb concentration for Run #4.

This wind speed versus that wind speed - Run #4 vs. Run #5: Wind speed, from 8 mph to 20 mph, is the only change from Run #4 to Run #5. The result is a change in travel time to CWD's water intake from just over four days to 2 days and 15 hours. The higher wind speed resulted in an increase in simulated concentration near the CWD's water intake, perhaps due to less time for dispersion.

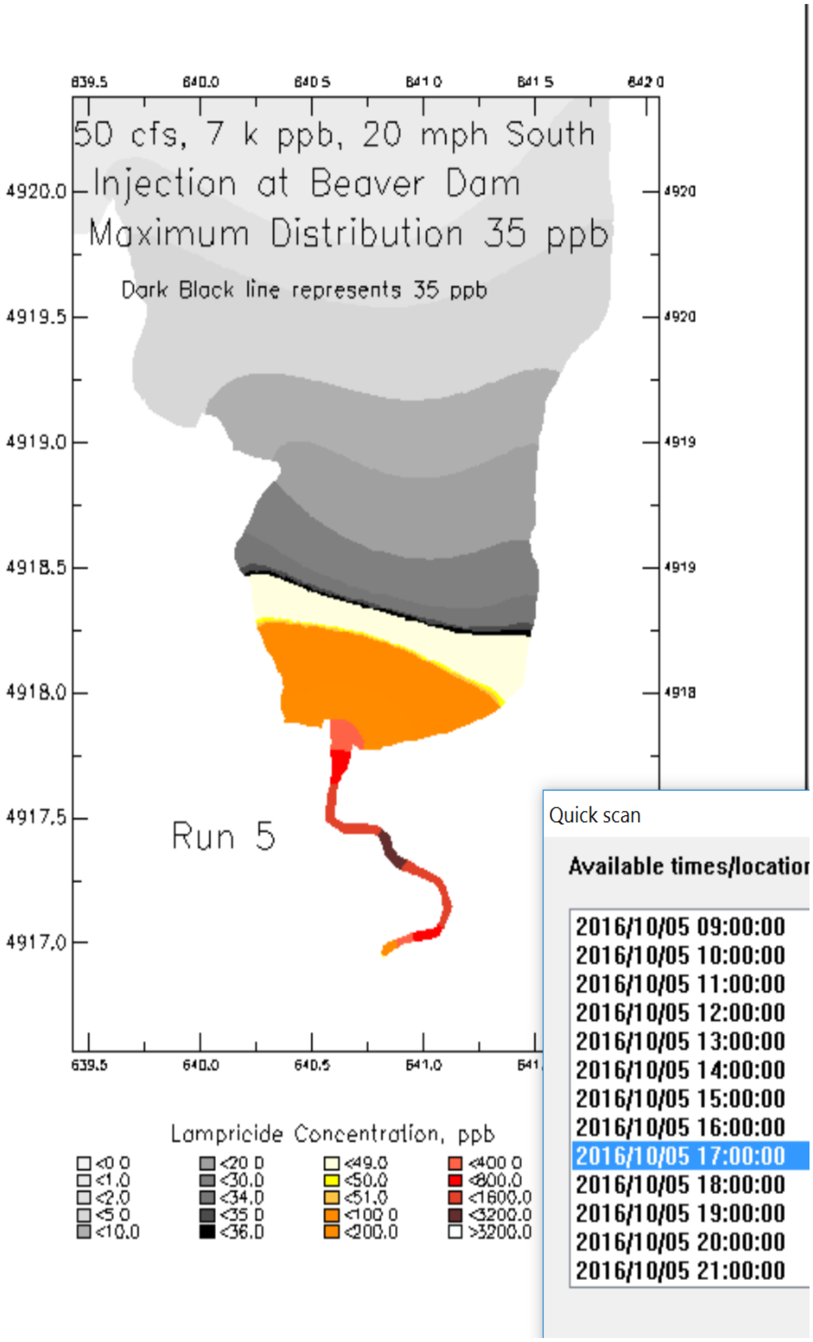

Figure 21. Plume at maximum extent of the 35 ppb concentration for Run #5.

This wind direction versus that wind direction - Run #5 vs. Run #6: High winds from the NNW resulted in the maximum extent and the maximum concentrations observed near CWD's intake. These results are somewhat unexpected and counter-intuitive. So, why did this occur? Why did NNW winds cause both slightly larger plumes and slightly higher concentrations at CWD intakes than South winds of the same magnitude?

First, the longer distance from the mouth of the river to the maximum extent of the 35 ppb concentration is partially due to the NNW wind plume being skewed, i.e., longer along the east shore and shorter along the west shore. But also, the answer may be due to the dynamics of two forces responsible for transport: wind and inflow from tributaries.

When wind is from the South, there is a net transport of surface water to the north. Water elevations in the southern end are slightly lower than water elevations toward the north. In this situation, the force due to the wind on the surface of the water is in balance with the horizontal pressure gradients due to water elevation differences (also called "head" or "head differential"). Net surface transport exceeding tributary inflow is balanced by transport south from Burlington Bay by lateral differences in currents (east to west) or vertical differences in currents. Water entering from the LaPlatte River reduces surface elevations created by the South wind.

When the wind is from the North (or from NNW as in the present situation) both the wind and the inflow from the LaPlatte River increase water elevations in the southern end of Shelburne Bay. However, in this situation, there is no escape for water transported toward the south compared with water transported north and toward the open expanse of Lake Champlain. With NNW winds water elevations increase in the southern end of Shelburne Bay until forces due to horizontal pressure gradients overcome opposing forces due to wind. At this point, increased northern transport of water occurs until a balance of opposing forces is re-established and this cycle is repeated.

As with lampricide concentrations water elevations and currents are available for each time-step, i.e., each minute. Observations of the distribution of water surface elevations at sequential times illustrate these patterns. Simply stated, steady south winds produce stable current patterns and water elevations, while current patterns and water elevations observed for north winds are repetitive, but not stable.

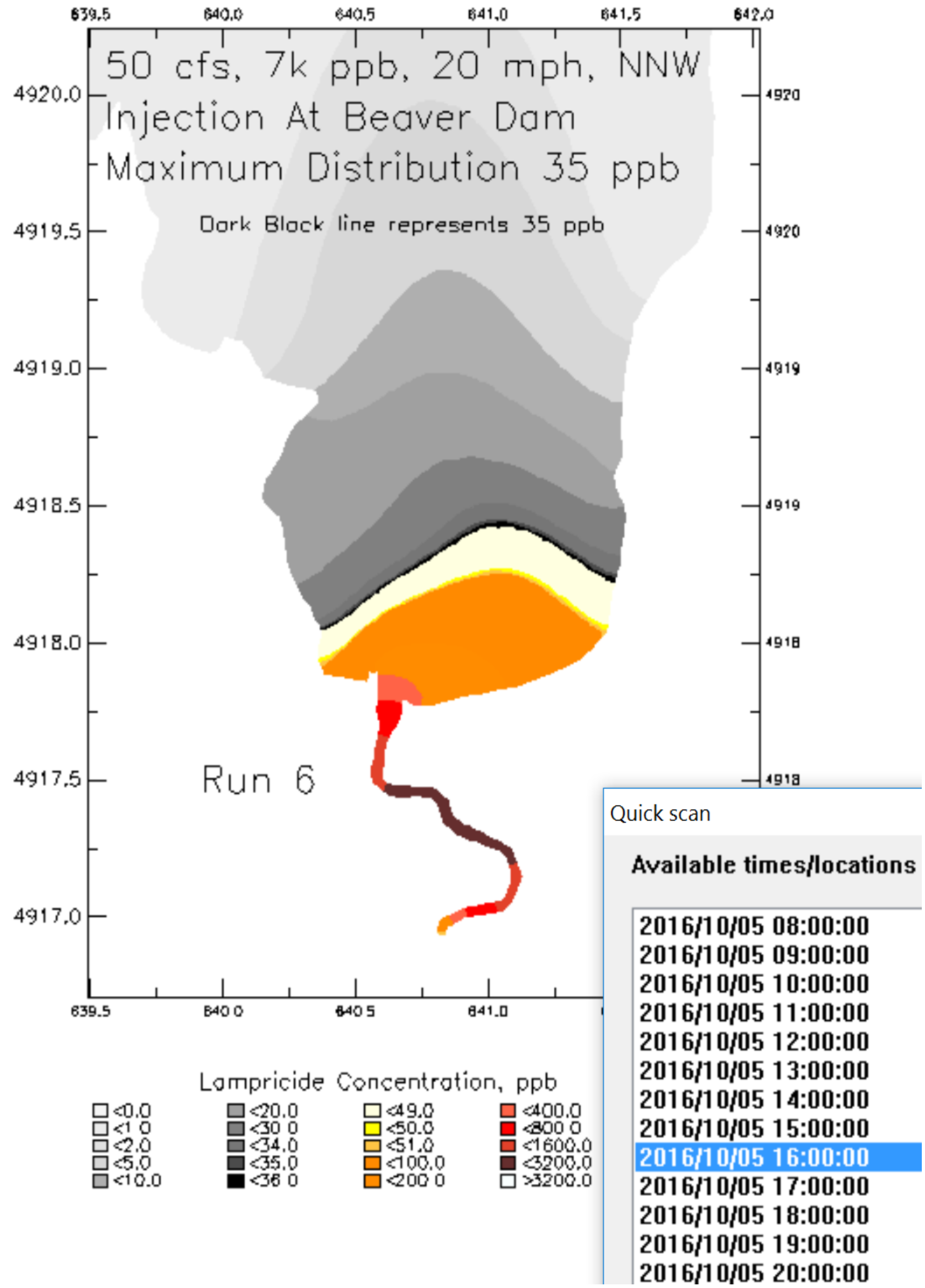

Figure 22. Plume at maximum extent of the 35 ppb concentration for Run #6.

This N-NW wind at 8 mph versus that South wind at 8 mph - Run #4 vs. Run #7: Again, somewhat of a surprise result, but consistent with the previous comparison as plume size and maximum concentration observed near CWD's water intake are similar in magnitude for South and NNW winds of the same magnitude. Also, the arrival times near the water intake are nearly the same.

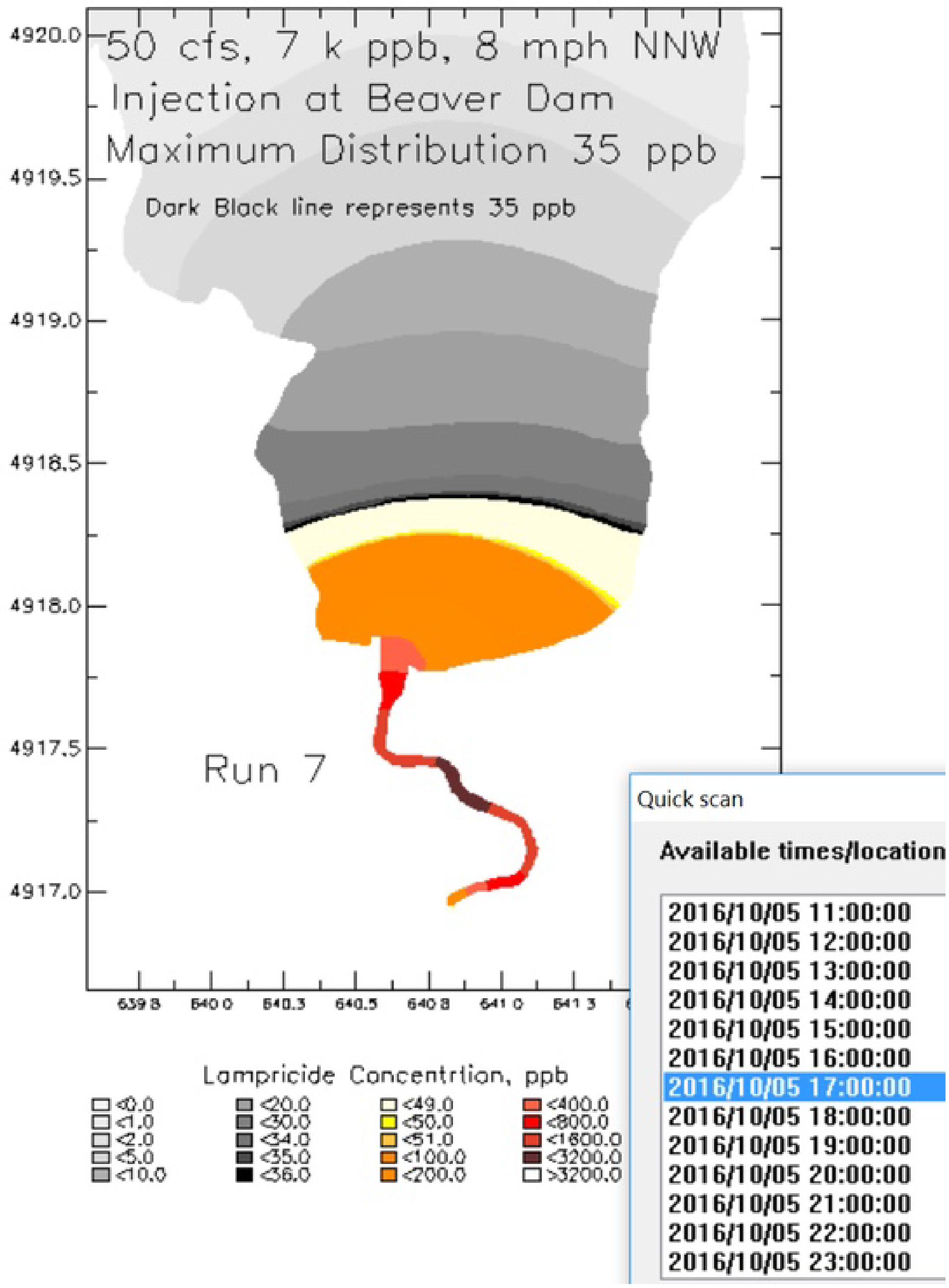

Figure 23. Plume at maximum extent of the 35 ppb concentration for Run #7.

4.0 Discussion of Results

The following two questions will be explored in this section: Are these model results reasonable? And, what impact do conservative selections formulated into the model have on model results?

With regard to first question, a mass balance will be presented. The mass of lampricide discharged to Shelburne Bay can be calculated by the product of river flow rate, mixed concentration, and duration of application. This calculated mass of lampricide discharged is assumed to be completely mixed with the volume of water in Shelburne Bay and the well-mixed Shelburne Bay average concentration is compared with the value of the maximum observed lampricide concentration predicted near CWD water intakes. Results of the model indicate the lampricide is dispersed unevenly throughout the bay and varies in time so an exact match is not anticipated, but it seems “reasonable” that the maximum concentrations calculated in the model near the north end of Shelburne Bay should be diluted, at least, to the same “order of magnitude” as the well-mixed concentration calculated using this mass balance approach.

In the display below, a polygon has been drawn to represent the region of the entire domain that is considered to be Shelburne Bay for this calculation. The northern boundary is selected at the narrows between Shelburne Point and Red Rocks. The volume within the polygon at a lake level off 97 feet above mean sea level is estimated at 1.40645E+08 cubic meters (almost 37 billion gallons of water). In CWD’s *2014 Water Quality Report* it states that “*Shelburne Bay holds 33 billion gallons of water*”, but the boundaries of the bay are not defined and the reference elevation is not stated. In any case, these two estimates are in “reasonable agreement”.

The mass of lampricide discharged is represented by the river volume discharged in twelve hours at a rate of 50 cfs, and at a concentration of 7,000 ppb; or 428 ppb -million cubic meters. Dividing this quantity by the 140 million cubic meters (the estimated volume in Shelburne Bay) yields a mixed concentration of 3.0 ppb (parts per billion). Model results indicated that for the same mass loading (Runs 4, 5, 6, & 7) maximum concentrations near the CWD’s water intakes are 1.43 ppb to 1.78 ppb. These results compared with the well-mixed estimated concentration of 3.0 ppb appear to be a sensible and reasonable check on model results.

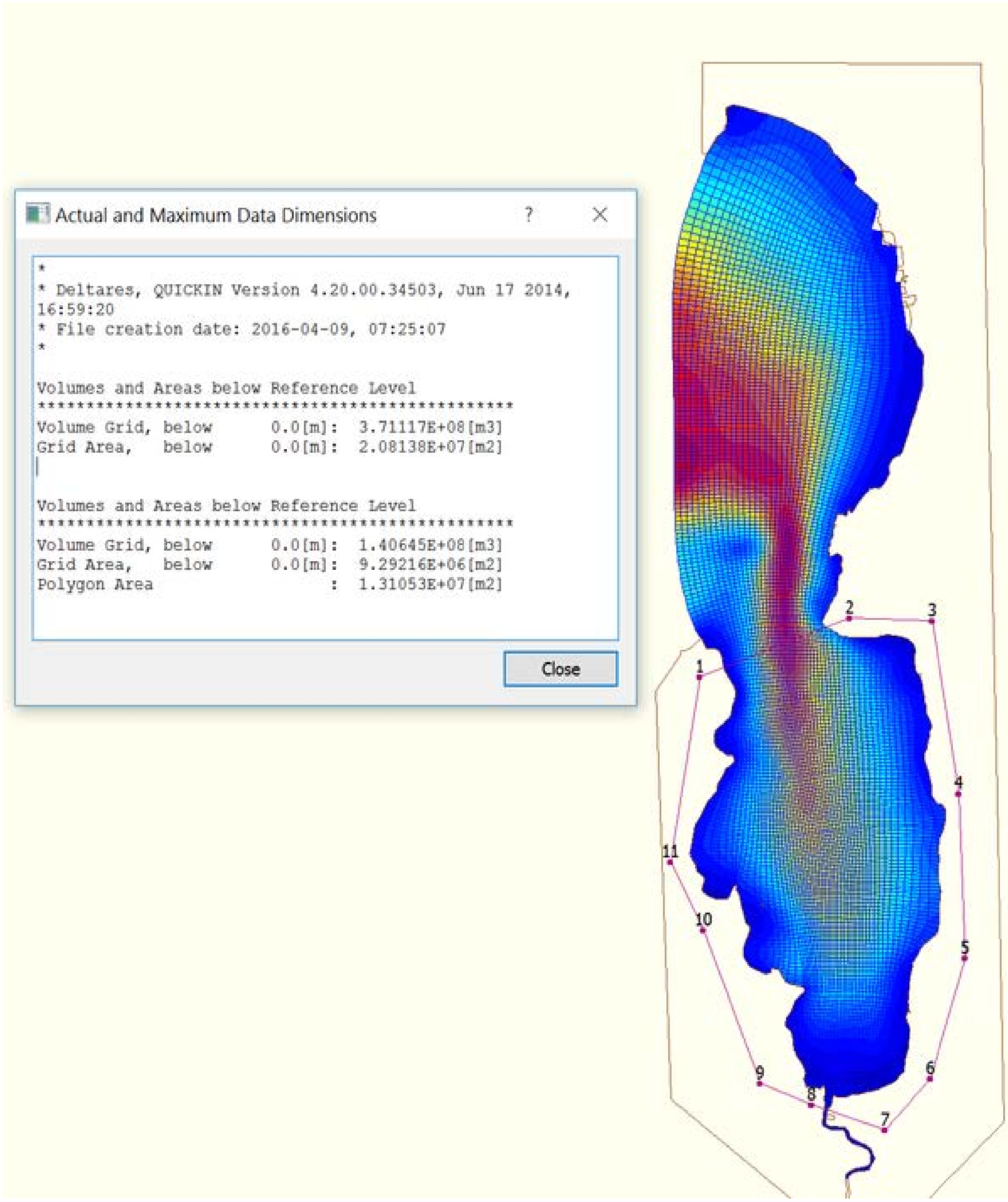

Figure 24. Boundary of Shelburne Bay Selected for Volume Calculation (complete domain and polygon enclosure).

The second question is now discussed - “What impact do the conservative selections formulated into the model have on model results?” There are two main conservative selections: (1) zero decay of TFM, and (2) application location of lampricide simulated near the Beaver Dam instead of near Shelburne Falls.

Zero Decay: First, the selection of zero decay means that TFM is treated as a completely conserved chemical in direct conflict with known chemical properties of lampricide. Half-life of TFM is discussed in section 2.7 and half-lives of 4 hours to 5 days are referenced. A half-life of five days means that in five days 50% of the initial concentration remains, ½ of **C,** or **C**/2; In an additional five days 50% of what remained after the first five days remains, ½ of **C**/2, or **C**/4. In five more days only 1/8th of the original mass of lampricide would remain, and so on.

Travel times from the mouth of the LaPlatte River to near CWD’s water intake ranged from 2 days & 11 hours with NNW winds of 20 mph winds, to 4 days & 12 hours with NNW winds of 8 mph winds. For a half-life of five days, which is the slowest reported decay rate, and the fastest travel time from the river to the intake area, the concentration of TFM is reduced to 54% of initial concentration; for the slower travel time of 4 ½ days, the initial concentration is reduced to 70% of initial concentration indicating that predictions could be high by a factor of two or more due to even the slowest rate of decay.

Application Location: The impact of the distance upstream selected for application has been examined in this report by comparing model results for a simulated application near the Beaver Dam compared with an application near at the Route 7 bridge in Shelburne. With all variables held the same except for the location of application, the site closest to Shelburne Bay (Beaver Dam) had plumes with larger surface areas within the same concentrations. Near the northern end of Shelburne Bay, maximum observed concentrations are about 10% higher for an application point located near the Beaver Dam than was observed for the application point being located at the Route 7 bridge. Based on this result, the Beaver Dam was selected for the modeled application site because plumes are larger and maximum concentrations are higher.

5.0 References

Binkerd R. 1996. "*Mixing Zone Study and Diffuser Design, Bartlett Bay Waste Water Treatment Plant, South Burlington, Vermont*," for Webster-Martin, Inc. South Burlington.

Binkerd R. 1997a. "*Phase II, Diffuser Design and Mixing Zone Study*," Bartlett Bay Waste Water Treatment Plant, South Burlington, Vermont," for Hoyle, Tanner & Associates, Inc. Burlington, Vermont.

Binkerd, R. 1997b. "*Expected Dilutions from Burlington's Main Outfall using Field Dye Study and Commix Model*," for City of Burlington, Public Works Department, Burlington, Vermont.

Binkerd, R., 2004. "*Carry Bay Causeway, A Field Study and Hydrodynamic Model*," for Vermont Department of Environmental Conservation**.**

Binkerd, R. 2009a. "*Carry Bay Causeway, A Wave Modeling and Beach Stability Study*," for Vermont Department of Fish & Wildlife.

Binkerd, R. 2009b. "*Hydrodynamic Model Study: Lampricide Plumes in Lake Champlain Near the Lamoille River*," for Lake Champlain Fish & Wildlife Management Cooperative and Vermont Department of Fish & Wildlife.

Hubert, T. D. 2003. "*Environmental Fate and Effects of the Lampricide TFM: A Review*," Journal of Great Lakes Research 29 (Supplement 1):456-474.

Deltares, 2016. Delft, The Netherlands. 2016. www.deltares.nl/en/.

6.0 Acknowledgement

Roger Criswell Binkerd, Principal at *Binkerd Environmental,* would like to thank Mr. Bradley A. Young, Supervisory Fish Biologist, Sea Lamprey Control, U.S. Fish and Wildlife Service, for his administration of the project and technical assistance and for his patience and understanding during these past few months.

Attachment 4

Proposed Aquatic Nuisance Control Species Permit Specific Conditions for the 2016 and 2020 LaPlatte River TFM Treatments

Part II. Pesticide Application Conditions

A. Pesticide Use Conditions

1. The Permittee is authorized to use TFM-HP Sea Lamprey Larvicide (EPA Reg. No. 6704-45), and TFM Bar (EPA Reg. No. 6704-86)

2. All TFM-HP, and TFM-Bar (lampricide) products shall be registered with the U.S. Environmental Protection Agency and the Vermont Agency of Agriculture, Food and Markets for use in Vermont at the time of the treatment, and shall be handled, applied, and disposed of in full conformance with all label requirements as well as all state and federal regulations in effect at the time of the treatment.

3. All Operators (pesticide applicators) shall be certified by the Vermont Agency of Agriculture, Food and Markets in Category Five – Aquatics.

B. Date, Location and Environmental Conditions

1. The Permittee is authorized two applications of lampricide under this permit; one between September 14 and December 1 of 2016 and one between Labor Day and December 1 of 2020. If the 2016 treatment must be postponed until 2017 or the 2020 treatment postponed until 2021, that rescheduled treatment must occur during the same date range. In the case of a postponement, the next treatment shall remain on its original schedule, not pushed back one year, so the basin alignment strategy for conducting lampricide treatments can be maintained.

2. The Permittee shall apply TFM only in the authorized areas of the LaPlatte River as shown on Attachment 1, identified as follows:

a. The primary lampricide application point (AP) located at the Leavensworth Road crossing (river mile 12.3).
b. A potential boost at the Dorset Street crossing (river mile 10.3)
c. A potential boost at the Spear Street crossing (river mile 7.0)
d. A potential boost at the Falls in Shelburne (river mile 3.5)
e. A SAP at the confluence of Mud Hollow Brook and the LaPlatte River (river mile 6.6)
f. A SAP at the confluence of an unnamed tributary and the LaPlatte River (river mile 7.8)

3. The Permittee shall ensure the water temperature at the primary application points (prior to application) during the day of scheduled treatment is at or above 2° C.

4. Treatment shall only occur in the LaPlatte River when the measured flow rate on the day of treatment is between 5 cfs and 50 cfs according to USGS LaPlatte River gauging station at Shelburne Falls.

5. The Permittee shall monitor stream flow during Lampricide application.

6. No treatment shall occur unless the surface elevation of Lake Champlain is at or below 98.0 feet National Geodetic Vertical Datum (NGVD) as measured at the permanent USGS gauging station located at Burlington, Vermont.

C. Pesticide Application Conditions

1. The Permittee shall apply the lampricide in accordance with the following:
a. *Standard Operating Procedures for Application of Lampricides in the Great Lakes Fishery Commission Integrated Management of Sea Lamprey (Petromyzon marinus) Control Program*, Marquette Michigan. Control Report 04-001.6 (Adair and Sullivan 2014); and,
b. *Contingency Plan for Accidental Spillage of Lampricides during Lake Champlain Sea Lamprey Control Operations* (Smith 2015).

3. As determined by an on-site toxicity test conducted on or after September 1 of the year of the treatment the Permittee shall apply lampricide to maintain a 9-hr lethal concentration (1.0 x MLC or greater) in all downstream areas from the primary application point.

4. Lampricide will be applied at both the Primary Application Point and at up to 3 boost application points at a rate that shall not exceed 1.2 x MLC to sea lamprey measured at Stations 1, 2, 4, and 5, as identified in Attachment 1.

5. The Permittee shall monitor and adjust application concentrations for changes in pH and alkalinity in order to maintain the authorized TFM concentration.

6. The Permittee shall not apply TFM into the LaPlatte River at a single location for longer than 14 consecutive hours.

D. General Conditions

1. The Permittee shall notify the Aquatic Nuisance Control Program Coordinator, Misha Cetner, by phone 802-490-6199 or via email at mischa.cetner@vermont.gov, at least five days in advance of the scheduled lampricide application taking place. In the event that any necessary treatment schedule changes are made within this 5-day period, the Permittee shall notify the Aquatic Nuisance Control Program as soon as possible to inform it of the schedule change and reasons for such change.

2. This permit may be modified or amended upon request by the Permittee or by the Department. Any modification under this condition shall be performed in accordance with the public notice requirements of the *Public Review and Comment Procedures for Aquatic Nuisance Control Permit Applications and General Permits*, dated January 30, 2003.

3. Prior to any treatment occurring with equipment (e.g. boat, trailer, vehicle, gear) that has been in or on any other waterbody, the Permittee shall comply with 10 V.S.A. §1454. All equipment shall be decontaminated in compliance with the *Draft Voluntary Guidelines to Prevent the Spread of Aquatic Invasive Species through Recreational Activities*, Aquatic Nuisance Species Task Force, November 2012. All Operators shall adhere to these guidelines.

4. Cause for permit suspension or revocation includes, but not limited to, the following:
   a. violation of any of the terms or conditions by the Permittee;
   b. failure to disclose relevant facts, new research, findings, or other information not previously made available by the Permittee;
   c. any misrepresentation of fact or the provision of false information by the Permittee;
   d. a determination that the risk to the non-target environment resulting from the activities authorized under this permit is unacceptable;

e. a determination that the risk to public health resulting from the activities authorized under this permit is more than negligible; and/or
f. a determination that there is an undue adverse effect upon the public good resulting from the activities authorized under this permit.

5. The Permittee shall obtain and conduct the treatment in accordance with an Endangered and Threatened Species Takings Permit from the Vermont Department of Fish and Wildlife.

Part III. Monitoring, Surveying & Reporting

A. Monitoring

1. The Permittee shall collect and analyze (for pH and Lampricide concentration) water samples every ½ hour from the following sample stations (as indicated in Attachment 1) during treatment by hand or pH logger. Samples shall be analyzed for alkalinity at least every 2 hours at:
a. Station 1: Downstream of Leavensworth Road AP
b. Station 2: Downstream of the Dorset Street Boost AP (IF USED)
c. Station 4: Downstream of Spear Street Boost AP (IF USED)
d. Station 5: Downstream of Shelburne Falls Boost AP (IF USED)

2. The Permittee shall collect and analyze (for pH and Lampricide concentration) water samples every hour from the following stations (as indicated in Attachment 1) during treatment by hand or pH logger:
a. Station 2: Dorset Street (IF BOOST NOT USED)
b. Station 3: Carpenter Road
c. Station 4: Spear Street (IF BOOST NOT USED)
d. Station 5: Shelburne Falls (IF BOOST NOT USED)
e. Station 6: Route 7
f. Station 7: Upstream side of Bay Road at River Mouth

4. Except for samples collected for water use advisory purposes, the Permittee shall determine TFM concentrations with analytical instruments accurate to within 0.1 parts per million (ppm).

5. The Permittee shall take samples from Station 1 (and at stations 2, 4, and 5 if any of those boosts are used) at three locations along a transect at the one-quarter, one-half, and three-quarters points between the river banks.
a. If TFM concentration measurements along this transect are within 0.1 MLC of each other and at or below the 1.2 MLC target, then sampling may be reduced to the midstream (one-half) location only.
b. If TFM concentration measurements along this transect are NOT within 0.1 MLC of each other and at or below the 1.2 MLC target, then sampling shall continue at all three locations in until subsequent measurements along this transect are within 0.1 MLC and at or below the 1.2 MLC target.

6. The Permittee shall conduct all monitoring, surveys and reporting of the water use advisory zone in accordance with the *Water Use Advisory Zone Monitoring Plan for Lampricide Treatments in Lake Champlain* (Smith 2016)

B. Surveying

1. The Permittee shall conduct a post-treatment survey to estimate the relative abundance of sea lamprey and other lamprey species in the LaPlatte River using the standard Larval Assessment Sampling Protocol (Adair and Sullivan 2011) within one year after treatment. The results of this

survey shall be submitted to the Aquatic Nuisance Control Program within 6 months after completion of the survey.

2. The Permittee shall conduct post-treatment non-target mortality surveys in the 10 zones between the following survey transects in Reach 1: [3-4, 8-9, 13-14, 18-19, and 23-24] and Reach 2 [3-4, 8-9, 13-14, 18-19, and 23-Leavensworth Road] in the LaPlatte River as identified in Attachment 1. This survey shall be conducted in accordance with and shall include the following information:

a. Each post-treatment non-target mortality surveys shall be conducted within 24 hours of the lampricide clearing each zone;
b. All visible bottom sections will be inspected and observations of non-target organism mortalities, except lampreys, shall be recorded;
c. At each survey Zone the first 30 lampreys (all species) encountered will be collected and brought back to the lab for identification.
d. Preliminary results shall be made available to the Aquatic Nuisance Control Program within 24 hours of completion;
e. If preliminary results, per subsection 2d above, indicate a significant level of impact on non-target organisms, then a full reach survey may be requested at any time by the Aquatic Nuisance Control Program.

C. Reporting

1. The Permittee shall submit a final report on the LaPlatte River TFM treatment to the Aquatic Nuisance Control Program by May 1st of the following year.
2. The final report shall include at a minimum:
a. the batch numbers and the quantity used of TFM-HP and TFM Bar;
b. the results from the on-site toxicity test and MLC determination;
c. the treatment duration;
d. summary of water chemistry monitoring data;
e. summary of stream flow data;
f. a summary of treatment activities; and
g. all non-target, non-lamprey post-treatment mortality survey data and the proportional representation of each lamprey species in post treatment collections (section III. B. 2.).

3. All required surveys and reports shall be submitted to:

Misha Cetner, Aquatic Nuisance Control Program Department of Environmental Conservation Watershed Management Division One National Life Drive, 2 Main Montpelier, VT 05620-3522

Or, preferably via email to Misha Cetner, at **misha.cetner@vermont.gov**.

Part IV. Public Use Advisories & Restriction Notifications

A. Use Advisories

1. The Permittee shall conduct all public use advisories in accordance with the approved *Lake Champlain prior notification and water supply plan for lampricide applications* (Smith, 2016).

2. All laboratory analyses for TFM regarding public use advisories and notifications shall be conducted with a minimum detection limit of 5 parts per billion (ppb) or less.

B. Restriction Notifications

1. The Permittee shall inform the public all surface water downstream of the primary application location should not be used for drinking, cooking, washing or other household purposes such as bathing, showering, and dish and clothes washing, as well as for swimming, irrigation or livestock watering until analytical results confirm that TFM residues are less than 35 ppb.

2. The Permittee shall inform the public that water within the use advisory area should not be used for fishing, hunting or and other water-based recreation activities until analytical results confirm that TFM residues are less than 100 parts ppb.

Part V. Compliance; Enforcement

The Permittee shall comply with all terms and conditions of this permit. Any permit noncompliance constitutes a violation of 10 V.S.A. Chapter 50, and is grounds for enforcement action; permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

Cyanotoxin Response Protocol

This flow chart will be used for the monitoring and detection of TFM pertaining to Water Treatment Facility Monitoring.