WINNISQUAM WATERSHED PLAN PHASE I: GROUNDWORK FOR A WATERSHED PLANNING PROCESS

A Final Report to

The New Hampshire Department of Environmental Services

Submitted by

Lakes Region Planning Commission
103 Main Street
Meredith, NH 03253

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EXECUTIVE SUMMARY

This was a project of limited scope – to build capacity and involvement for watershed planning projects within the five municipalities of the Winnisquam Watershed. The goal was to bring together the people and organizations in the region interested in protecting the health of the Lake Winnisquam Watershed and its water quality. The goal was to lay a foundation upon which a Lake Winnisquam Watershed Management Plan could be developed that would adhere to the nine-element EPA guidelines for Clean Water Act Section 319 grant-funded projects.

The project has produced a cooperative working relationship among the Lakes Region Planning Commission, the Winnisquam Watershed Network, the planning professionals representing the five municipalities that share the Winnisquam shorefront, and other regional entities who share a commitment to pursue funding for a Lake Winnisquam Watershed Management Plan.

The grant period began in August 2017 and ended on December 31, 2018. Federal funds were awarded in the amount of $10,000; in-kind matching funds were provided in the amount of $6,670 by the Meredith Town Planner, the Winnisquam Watershed Network, and the five Winnisquam municipal planners.

The project Objectives were to:

- Provide GIS mapping support to characterize the Winnisquam subwatershed and to assist with planning process goal setting and water quality monitoring plan development.
    - This Objective was met by the Lakes Region Planning Commission through the creation of GIS maps displaying land uses, tributaries, water sampling locations and other pertinent information to support discussions and meetings; and the development of watershed planning

goals by the municipal planners group representing the five Winnisquam municipalities

- Work with the active water quality sampling groups to develop a cohesive water quality monitoring plan
    - This Objective was met by coordinated efforts of the Winnisquam Watershed Network, the UNH Lakes Lay Monitoring Program, the NH DES Volunteer Lake Assessment Program, and the Meredith Town Planner to develop consistent protocols for a three-tiered water quality monitoring plan, which includes sampling nine tributary sites through the NH DES Volunteer Rivers Assessment Program, and developing volunteer monitoring capacity
- Build stakeholder capacity and involvement for watershed planning projects
    - This Objective was met through the convening of collaborative meetings and discussions by the Lakes Region Planning Commission involving the Winnisquam Watershed Network, the five Winnisquam municipalities and others to discuss water quality issues facing Lake Winnisquam and to explore the resources required to complete an EPA compliant nine-element watershed management plan for the Winnisquam Watershed

INTRODUCTION

Lake Winnisquam is New Hampshire's fourth largest lake. It is identified by NH DES as having a high priority for protection and/or restoration, yet a Watershed Management Plan has not been developed to address serious concerns about threats to water quality. Interest in action to protect and improve water quality in Lake Winnisquam is apparent, but efforts have been fragmented. Black Brook is one of the tributaries to Lake Winnisquam. A Black Brook Watershed Management Plan was developed in 2012, but implementing best management practices to reduce phosphorous loading lacked local support without greater evidence of commitment to water quality protection throughout the Lake Winnisqaum watershed.

Greater regional coordination and planning was needed to establish a foundation for successfully developing a community supported nine-element watershed management plan.

It was with this goal in mind – enhancing the capacity to coordinate efforts on a watershed basis – that the Lake Region Planning Commission sought a 319 Watershed Assistance Grant to work with regional partners on laying the groundwork for eventual

development of a watershed management plan for the Lake Winnisqaum watershed. LRPC applied for funding for *Winnisquam Watershed Plan Phase I: Groundwork for a Watershed Planning Process*.

PROJECT AREA

Lake Winnisquam is located in Belknap County in the Lakes Region of central New Hampshire. Winnisquam encompasses 4,264 acres in the municipalities of Laconia, Meredith, Sanbornton, Belmont and Tilton. The majority of water flow into the lake is on its eastern shore where the Winnipesaukee River (**HUC 010700020201**) drains Lake Winnipesaukee, New Hampshire's largest lake, through Paugus Bay and Opechee Bay into Lake Winnisquam. At its northern end, in Meredith, Lake Winnisquam is fed by numerous small streams. The Black Brook flows into Lake Winnisquam on its western shore in Sanbornton. The Winnipesaukee River flows out of Lake Winnisquam at its southern end and joins the Pemisgewasset River in Franklin where it forms the Merrimack River.

NONPOINT POLLUTION CONCERNS

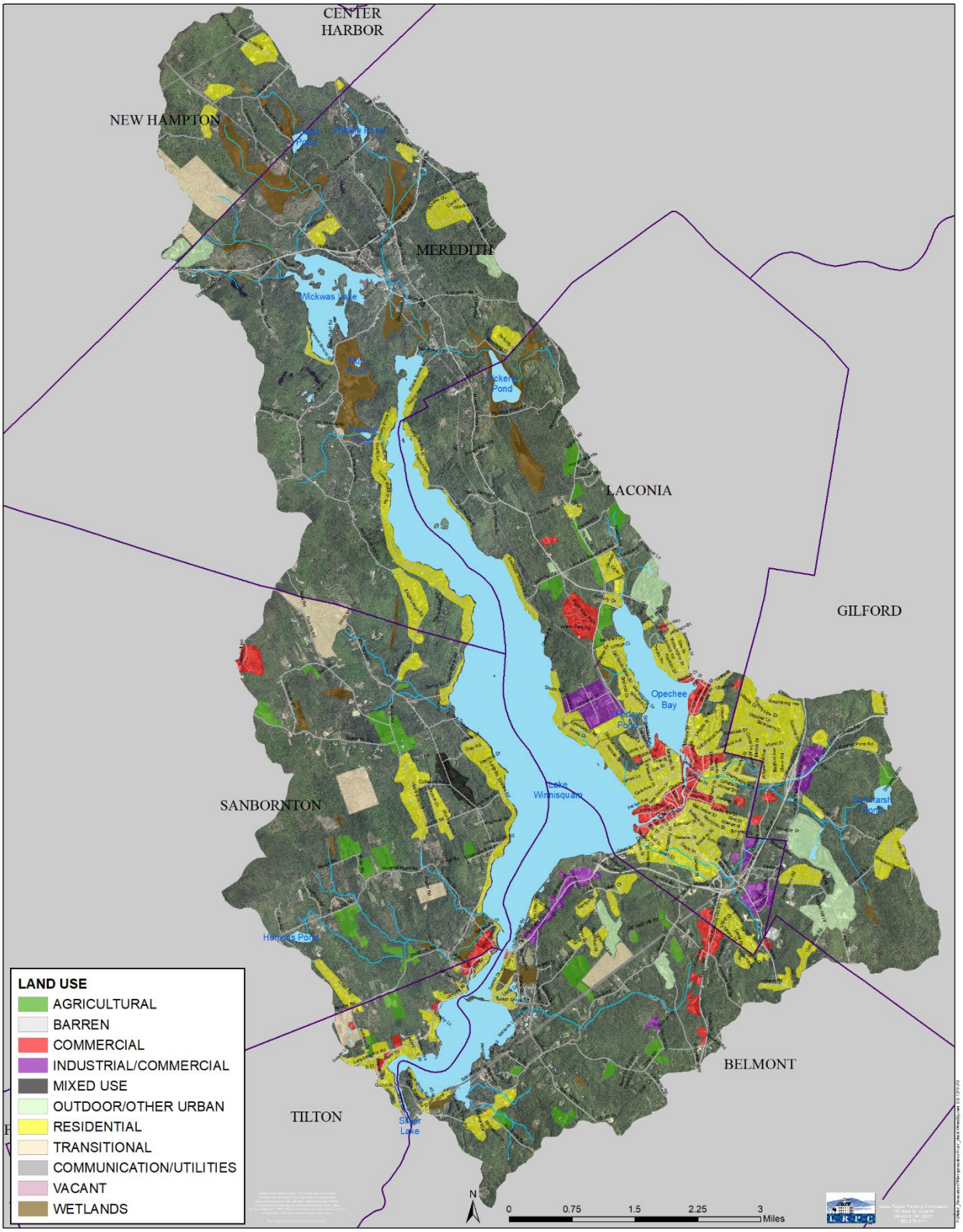
Lake Winnisqaum is classified as oligotrophic. It is included on the NH DES 2016 List of Threatened or Impaired Waters as impaired for aquatic life. Turbidity resulting from highway and development runoff is likely. The 2017 Lake Winnisquam Water Quality Report indicates that conductivity levels are higher than the state median and have worsened over time, perhaps due to road salt usage entering the lake through stormwater runoff. Chloride levels are above the state median but below the state chronic chloride standard.

Although pH levels are good, like most other New Hampshire lakes, Winnisquam has some vulnerability to pH changes from acid rain and other pollutants, according to its acid neutralizing capacity (ANC). Elevated phosphorous levels have been shown in the Mohawk Island area of the lake, downstream from some of the most highly developed areas of the watershed.

A cyanobacteria warning was issued for Lake Winnisquam by NHDES in 2008.

Variable milfoil, an exotic aquatic plant, became established in Lake Winnisquam in 1995 and is evident in several sections of the lake. NH DES developed a Long-Term Variable Milfoil Management and Control Plan for Lake Winnisquam in 2010.

Lake Winnisquam Subwatershed Land Use



Consistent water quality monitoring and tracking of data are necessary for historical trend analysis and determining solutions to nonpoint pollution sources.

PROJECT OBJECTIVES

As its name implies, the overall goal of this project is to lay the groundwork for the development of a Watershed Management Plan for Lake Winnisquam, including developing the capacity of local and regional partners to coordinate their water quality monitoring efforts, engage municipal officials and local land use boards, work with homeowners and lake associations, and involve NHDOT and local highway departments.

Objective 1: Provide GIS mapping support to characterize the Lake Winnisquam subwatershed to assist with goal setting and water monitoring plan development and explanation, and articulate the top three major goals for Winnisquam subwatershed improvement.

LRPC developed GIS maps of the Lake Winnisquam subwatershed to inform discussions and public meetings. Early drafts of the GIS maps were used to inform discussions with the leaders of the recently formed Winnisquam Watershed Network (WWN). The maps also informed a meeting of the professional planning staff from the five municipalities around Lake Winnisquam convened by LRPC to draft water quality improvement goals for review and use by other regional partners. Copies of completed GIS maps and documentation of Goal discussions and conclusions were shared with NHDES. The Winnisquam Water Quality Goals summary is found in **Appendix A.**

Objective 2: Work with the active sampling groups to develop a cohesive water quality monitoring plan and program.

Several groups of volunteers have sampled water at various locations in Lake Winnisquam through the UNH Lakes Lay Monitoring Program (LLMP) and the NH DES Volunteer Lake Assessment Program (VLAP). It was agreed that both programs have value and expertise to assist the Winnisquam Watershed Network and the five towns in monitoring water quality. It was also recommended that monitoring Winnisquam's tributaries be added to the water quality sampling program through the NH DES Volunteer River Assessment Program (VRAP). A Tiered Monitoring Plan was established, which recommends continued sampling at the lake's three deep basins

following VLAP protocols and at the off-shore and cove stations following LLMP protocols. VLAP protocols were recommended at tributary monitoring stations, and a list of nine tributary locations was established. High, medium and low priority areas for monitoring were recommended. Using one analytical laboratory to process samples was also recommended. **See Appendix B**

Objective 3: Build stakeholder capacity and involvement for watershed planning projects

The Winnisquam Watershed Network has solidified itself as an active participant in water quality protection efforts. WWN has posted its 2018 monitoring reports, including results from the sampling of tributaries, which was added to monitoring efforts as a result of the Tiered Monitoring Plan agreement. WWN is also beginning discussions on including septic system assessments for each of the watershed towns in a future Watershed Management Plan. WWN also plans to host summer forums with town representatives so that WWN and municipal governments can share issues related to Lake Winnisquam.

LRPC and WWN have discussed the option of proceeding with an EPA compliant nine-element Watershed Management Plan for the entire watershed, or through phased development of subwatershed plans, and determined to continue planning for a full watershed plan. Plans are also continuing for further discussions between LRPC, WWN and the Lake Winnipesaukee Association to discuss Lake Winnipesaukee water quality issues that affect Lake Winnisquam and how they would impact the development of a Lake Winnisquam Watershed Management Plan.

CONCLUSION

Over the course of this grant project an active watershed advocacy organization – the Winnisqaum Watershed Network – has formed and, combined with LRPC's regional planning outreach to watershed municipalities and other interested partners, there is a solid base of support for undertaking the development of a Lake Winnisquam Watershed Management Plan that complies with EPA guidelines for a 319-funded project. The Lakes Region Planning Commission, the Winnisquam Watershed Network, planners from the five Winnisquam municipalities and others can build on the foundation that has been set by the development of a cohesive water quality monitoring effort for Lake Winnisquam and its tributaries, as well as the planning goals formulated by the municipal planners group in consultation with other partners.

APPENDIX A

Winnisquam Watershed Plan: Phase I

Goals for Watershed Management Planning Process

1. Identify and engage interested participants from Winnisquam Watershed municipalities to develop needed capacity and networks necessary for a Watershed Management Plan that focuses on maintaining and improving surface and groundwater quality.

2. Develop a watershed approach that assesses water quality conditions in Lake Winnisquam's three basins while preserving local decision-making when recommending mitigation strategies and implementation actions.

3. Include public, consumer, and homeowner information and education strategies that focus on non-regulatory approaches to water quality protection.

4. Coordinate water quality monitoring activities in Lake Winnisquam and its tributaries so that monitoring is consistent and reliable for determining long-term water quality trends.

5. Analyze existing water quality monitoring efforts in the Winnisquam Watershed to determine gaps in data and to strategically focus future monitoring efforts.

6. Identify potential causes of Lake Winnisquam's increasing (worsening) conductivity trend to support assessment of mitigating strategies involving road salt usage and stormwater runoff.

7. Identify potential sources of phosphorous to support assessment of nutrient loading and related reduction strategies.

8. Coordinate local responses throughout the watershed for managing, preventing and eradicating invasive species, including variable milfoil, and for preventing human exposure to and protecting public health from high levels of e-coli and cyanobacteria.

9. Work with upstream regional partners, including Lake Winnipesaukee municipalities and the Lake Winnipesaukee Association, to improve water quality entering Lake Winnisquam via the Winnipesaukee River.

10. Focus eventual implementation actions on localized problem areas in each Watershed municipality

APPENDIX B

Lake Winnisquam Tiered Monitoring Plan

Overview of Plan Design and Recommendations

Lake Winnisquam currently has multiple groups monitoring water quality through two volunteer monitoring programs, the UNH Lakes Lay Monitoring Program (LLMP) and the NH DES Volunteer Lake Assessment Program (VLAP). LLMP and VLAP feel both programs have value and expertise to assist the Winnisquam Watershed Network (WWN), Lakes Region Planning Commission (LRPC) and the five towns of Belmont, Laconia, Meredith, Sanbornton, and Tilton in monitoring water quality of Lake Winnisquam and its watershed and recommend joining the NH DES Volunteer River Assessment Program (VRAP) to monitoring tributaries flowing into the lake. LLMP, VLAP and VRAP recommend the following in-lake and tributary monitoring plan as a way to comprehensively assess in-lake water quality, maintain historical data sets tracking water quality trends over time, establish new trend stations, and identify potential pollution sources and loads to the lake.

The comprehensive in-lake and tributary monitoring plans have three tiers identifying high, medium and low priority areas for monitoring and makes recommendations on monitoring frequency, parameters and costs (Tables 1 and 2). We recommend VLAP protocols continue to be followed at the three deep basins while LLMP protocols continue to be followed at off-shore/cove stations and VRAP protocols be followed at tributary monitoring stations.

All three monitoring programs are resource limited and sharing resources across programs is recommended at this time. However, it is recommended that the group utilize one analytical laboratory to process all laboratory samples. For that purpose, costs are broken down by laboratory. We recommend purchasing and/or making a set of in-lake and tributary monitoring equipment as described in Table 3.

Based upon response and participation by the WWN, LRPC and towns, a comprehensive water quality report will be developed to inform all interested parties of the conditions of Lake Winnisquam and make recommendations to protect, maintain and improve the lake.

Table 1. Lake Winnisquam Tiered Monitoring Plan UNH/VLAP

Tier	Site/Station	Pollution Source Potential	Monitoring Period	Monitoring Frequency	Monitoring Parameters	Monitoring Protocol	Monthly Monitoring Cost	Annual Monitoring Cost
I High	Three Island Deep Basin Max. Depth = 22m		May – Sept.	1x/month	pH, ANC, conductivity, chloride, turbidity, total phosphorus, chlorophyll-a, transparency, dissolved oxygen/temperature, apparent color	VLAP	$60-DES	$300-DES
I High	Three Island Deep Basin		July	1x/summer	Phytoplankton	VLAP	$0	$0
I High	Pot Island Deep Basin Max Depth = 53m		May – Sept.	1x/month	pH, ANC, conductivity, chloride, turbidity, total phosphorus, chlorophyll-a, transparency, dissolved oxygen/temperature, apparent color	VLAP	$60-DES	$300-DES
I High	Pot Island Deep Basin		July	1x/summer	Phytoplankton	VLAP	$0	$0
I High	Mohawk Island Deep Basin Max Depth = 18m		May – Sept.	1x/month	pH, ANC, conductivity, chloride, turbidity, total phosphorus, chlorophyll-a, transparency, dissolved oxygen/temperature, apparent color	VLAP	$60-DES	$300-DES
I High	Mohawk Island Deep Basin		July	1x/summer	Phytoplankton	VLAP	$0	$0
I High	10-Waldron Bay Max Depth = 6-10m		May-Sept.	2x/month	Total phosphorus, chlorophyll-a, transparency, color, phycocyanin, temperature, conductivity	LLMP	$40-DES	$200-DES
I High	30-Bartlett Bay Max Depth = 6-10m		May-Sept.	2x/month	Total phosphorus, chlorophyll-a, transparency, color, phycocyanin, temperature, conductivity	LLMP	$40-DES	$200-DES
II Med.	20- Gilson Cove Max Depth = 6-10m		May-Sept.	2x/month	Total phosphorus, transparency, phycocyanin, temperature, conductivity	LLMP	$40-DES	$200-DES
II Med.	Ahern Cove Max Depth = 4-6m	Gov. Park Stream, Ahern SP, Defunct State School	May-Sept.	2x/month	Total phosphorus, transparency, phycocyanin, temperature, conductivity	LLMP	$40-DES	$200-DES
II Med.	Public Dock Cove Max Depth = 4-6m	Winnipesaukee River, Public Docks, Belknap Marine, Bartlett Beach	May-Sept.	2x/month	Total phosphorus, transparency, phycocyanin, temperature, conductivity	LLMP	$40-DES	$200-DES

III Low	Sand Bar Cove Max Depth = 6-10m	Sand Bar, Chapman Brook	May-Sept.	2x/month	Transparency	LLMP/VLAP	$0	$0
III Low	Black Brook Cove Max Depth = 6-10m	Black Bk.	May-Sept.	2x/month	Transparency	LLMP/VLAP	$0	$0
III Low	Mohawk N Cove Max Depth = 6-10m	Marina, sand bar and high traffic boating impacts	May-Sept.	2x/month	Transparency	LLMP/VLAP	$0	$0

Table 2. Lake Winnisquam Tiered Monitoring VRAP

Tier	Site/Station	Monitoring Period	Monitoring Frequency	Monitoring Parameters	Monitoring Protocol	Monthly Monitoring Cost	Annual Monitoring Cost
I High	WINPLACB-Black Brook Inlet	May-October	1-2x/ Month	Dissolved Oxygen, Temperature, Specific Conductance, pH, Turbidity	VRAP	$0	$0
I High	WINPLACCB-Chapman Brook	May-October	1-2x/ Month	Dissolved Oxygen, Temperature, Specific Conductance, pH, Turbidity	VRAP	$0	$0
I High	WINPLACW-Winnipesauke River	May-October	1-2x/ Month	Dissolved Oxygen, Temperature, Specific Conductance, pH, Turbidity	VRAP	$0	$0
I High	WINMBELJMI-Jay's Inlet	May-October	1-2x/ Month	Dissolved Oxygen, Temperature, Specific Conductance, pH, Turbidity	VRAP	$0	$0
II Med.	WINPLACB-Black Brook Inlet	June, July, August	1x/month	Chloride, E.coli, Total Phosphorous	VRAP	$50	$150

II Med.	WINPLACCB-Chapman Brook	June, July, August	1x/month	Chloride, E.coli, Total Phosphorous	VRAP	$50	$150
II Med.	WINPLACW-Winnipesauke River	June, July, August	1x/month	Chloride, E.coli, Total Phosphorous	VRAP	$50	$150
II Med.	WINMBELJMI-Jay's Inlet	June, July, August	1x/month	Chloride, E.coli, Total Phosphorous	VRAP	$50	$150
III Low							

Table 3. Monitoring Equipment Cost Estimated

Equipment Name	Purpose	Estimated Cost	Comments
Kemmerer Bottle	In-lake sampling at discrete monitoring depths.	$400-$500	
Secchi Disk	Transparency monitoring	$50	
Viewscope	Transparency monitoring	$75-$100	
Plankton Net	Deep basin phytoplankton ID and counts	$500	
Calibrated lines	Attach to Secchi disk and plankton net	$25	
Integrated tube	Collect column of water for multiple analyses	$100 to make your own	
Bucket	Empty contents of integrated tube into	$25	
DO/Temp/Conductivity Meter, probes and cable	Determine thermal layers for more precise monitoring, identify DO deficits, measure near-shore conductivity	$3,000-$5,000	May be able to get a re-purposed one for less

Winnisquam Watershed Network

2018 Tributary Monitoring Stations

1 Mill Brook, Meredith - sample from bridge on Meredith Center Rd WICMEREC02

2 Winnipesaukee River, Laconia - sample from launching ramp dock WINPLACW

3 Durkee Brook, Laconia – (sample from bridge on Rte 3) 02-DKB

4 Durgin Brook, Belmont – sample from bridge at Mallards Landing WINMBELI-UP

5 Winnisquam outlet, Tilton – sample from bridge in Lochmere WINMBELO

6 Chapman Brook, Sanbornton – sample at Bay Rd Bridge WINPLACI-UP

7 Black Brook, Sanbornton – sample from private property off Dr. True Rd. WINPLACB

8 Collins Brook sample from bridge at Hitt residence 03-CLNS

9 Jay's Marina inlet (branch of Chapman Brook) – sample from Rt 3 bridge 01-JAY