CORPORATION OF THE COUNTY OF PRINCE EDWARD

PICTON WATER TREATMENT PLANT INTAKE REPLACEMENT PROJECT

PHASE 1 & 2 CLASS ENVIRONMENTAL ASSESSMENT REPORT

PREFERRED INTAKE LOCATION AT THE

PICTON WATER TREATMENT PLANT

Prepared for:

County of Prince Edward

R.V. Anderson Associates Limited
engineering · environment · infrastructure

2001 Sheppard Avenue East Suite 400
Toronto Ontario M2J 4Z8 Canada
Tel 416 497 8600 Fax 416 497 0342
www.rvanderson.com

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

The County of Prince Edward is responsible for the supply and treatment of drinking water for the Town of Picton and Village of Bloomfield via the Picton Water Treatment Plant (WTP).

Through the Quinte Source Water Protection Program, the 2009 Intake Protection Zone Delineation and Vulnerability Assessment[1] identified that the existing two intakes at the Picton Water Treatment Plant are vulnerable to certain risks, contaminants and fluctuations in water quality and increasing maintenance costs. Local residents have also issued complaints about taste and odour and water quality issues in general. As such, the County of Prince Edward is interested in replacing their existing two intakes with a new intake in a different location.

In April 2011, the County retained R.V. Anderson Associates Limited to conduct a Municipal Class Environmental Assessment (Class EA) and to prepare the design for an intake replacement.

This report summarizes the Class EA undertaken to address the need for an intake replacement at the Picton WTP. This report also summarizes the design considerations, alternative solutions to address the water quality issue, assessment of the preferred intake location and the optimal routing to get to the preferred intake location. Each section includes evaluations based on a variety of qualitative, quantitative and cost factors.

1.1. Background

The Picton WTP is located on a small peninsula in Picton Bay. The existing facility has two intakes to draw raw water from Lake Ontario:

- The primary intake is the 400mm diameter “South” intake that is approximately 91m from the WTP in 3.3m deep water in Picton Bay. This intake is equipped with a wooden crib, screened inlet, zebra mussel control, and a sampling line.
- The secondary intake is the 400mm diameter “North” intake that is approximately 305m from the WTP in 3.3m deep water. This intake consists only of the intake pipe with a metal cage over the inlet. It does not have an intake crib or zebra mussel control.

The Picton WTP employs conventional filtration and chlorine disinfection for water treatment. The Picton WTP consists of four (4) spiral flocculation tanks, two (2) sedimentation tanks, four (4) gravity filters, a clear well/low level reservoir. Chlorine is injected into the filtered water prior to entry into the clear well to achieve primary disinfection.

The original construction of the Picton WTP, including the primary “South” intake, was completed in 1928. Various additions followed over the years. An emergency “North” intake was added during an expansion in 1958. A major upgrade was done in 1994 that increased capacity by adding two new filter cells, chemical storage and a high lift pumping system for the Bloomfield water distribution system. Due to the aging infrastructure and new Ministry of Environment regulations on residue management, the County of Prince Edward retained R. V. Anderson Associates Limited (RVA) in 2008, to design additional upgrades for the WTP,

[1] XCG Consultants Limited, “Technical Memorandum #1, Quinte Source Protection Region, Intake Protection Zone Delineation and Vulnerability Assessment for Picton Water Treatment System,” October 2009.<http://quintesourcewater.ca/site/images/stories/DVD%20Appendix/Appendix%20F/Appendix%20F-3%20Picton/XCG%202009a%20Picton%20IPZ%20Delineation%20&%20Vulnerabilty.pdf>

including a retrofitted clearwell, a new transfer building, new process equipment and electrical works, as well as a new residue management system.

Table 1.1 below shows the current rated capacity of the Picton WTP and its average and maximum daily demands.

Table 1.1: Current Picton WTP Capacity (based on 2010-2013 data)

Capacity & Demand	Flow Rate (Total)
Capacity of "South" intake (at minimum Lake level of 73.6m)	11,450 m^3/day
Rated WTP Capacity	10,400m^3/day (120 L/s)
Maximum daily demand	4,600 m^3/day
Average daily demand	3,206 m^3/day
Minimum daily demand	1,819 m^3/day

1.2. Existing Condition of Intakes

Out of the two existing Picton WTP intakes, only one is used at a time to supply raw water from Picton Bay, Lake Ontario, to the raw water well.

The primary intake is the "South" intake and was constructed with the original WTP in 1928. Despite the age of the existing south intake, the wooden crib floor is still in relatively good condition, and the intake pipe shows only minor to moderate signs of deterioration.

The secondary or "North" intake was constructed in 1952 as part of an expansion to the WTP. The existing "North" intake also shows minor to moderate signs of deterioration.

The intakes require annual cleaning of zebra mussels by water blasting. Nearby weeds/vegetation are also removed in order to keep the intakes in working condition.

The approximate location of the two existing intakes, the Picton WTP, and the existing Intake Protection Zones (IPZs) are as shown in Figure 1.1. The IPZ is defined as "the area that is related to a surface water intake and within which it is desirable to regulate or monitor drinking water threats." (Clean Water Act 2006 O.Reg. 287/07). There are three levels of IPZs and they are defined as follows:

- IPZ-1: Primary protection area around the intake.
- IPZ-2: Secondary protection area around the intake.
- IPZ-3: All surface watercourses upstream of the intake and that may contribute water to that intake.

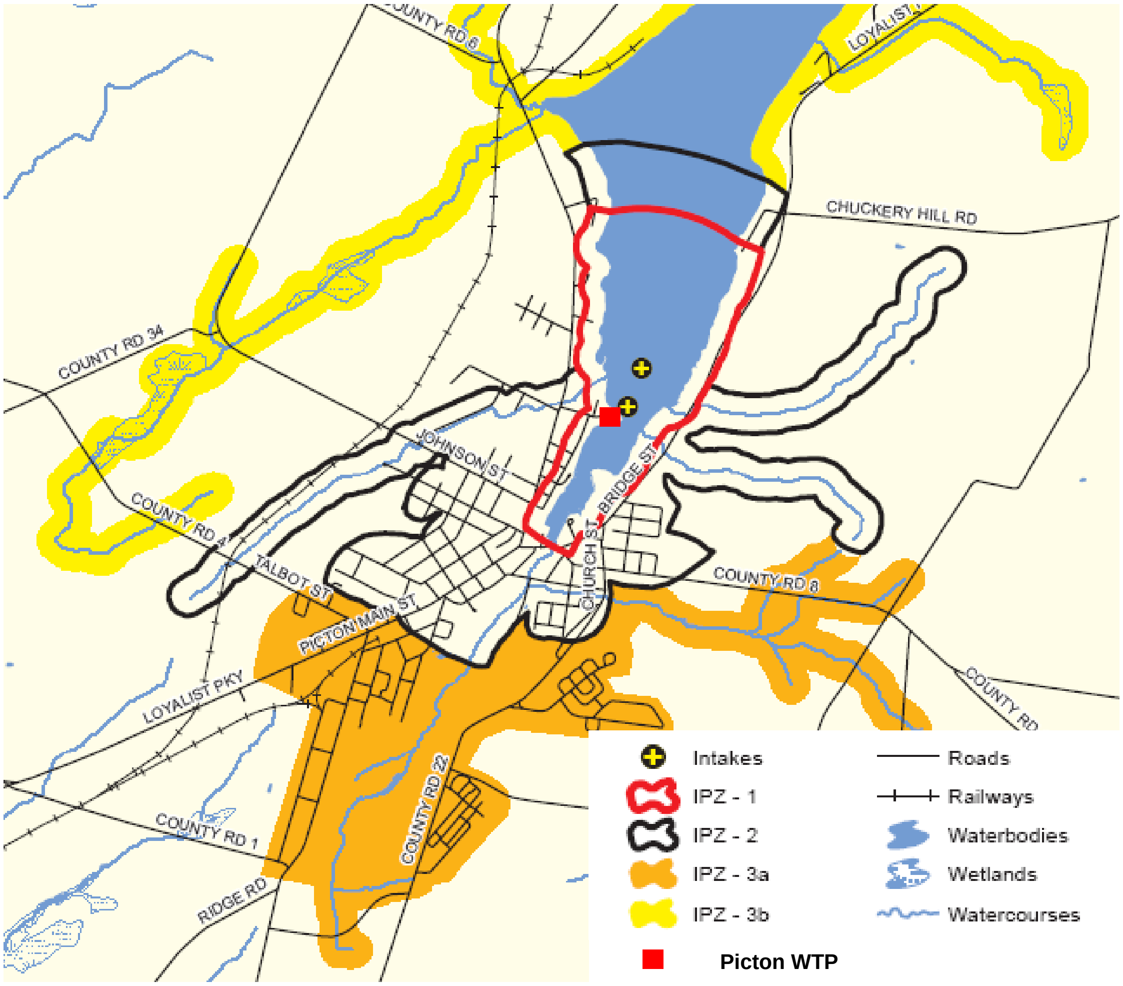


Figure 1.1: Existing Picton WTP Intakes and the IPZ Mapping
(*Reference: Intake Protection Zone Delineation and Vulnerability Assessment Technical Memorandum #1. Oct 2009)*

Figure 1.1 was taken from the XCG October 2009 Technical Memorandum on the Intake Protection Zone Delineation and Vulnerability Assessment for Picton Water Treatment Plant System prepared for Quinte Conservation.

1.3. Concerns with Existing Intakes

The County has reported various concerns regarding the existing intakes, namely, the age of the intakes and the fluctuating raw water quality due to the intakes' location. Studies driven by the Source Water Protection Program have also noted high vulnerability to sources of contaminants in the existing intakes IPZs.

Residents have reported seasonal taste and odour issues during summer and autumn. Taste and odour concerns are typically related to the algae blooms during the summer to fall season. These algae blooms produce chemicals such as Geosmin or 2-Methylisoborneol (MIB), which give the water an earthy or musty odour.

Operators of the Picton WTP have reported that the treatment plant experiences wide fluctuations in turbidity. Operators have noted that past turbidity have ranged from 0.100 NTU to 100 NTU in the raw water. Various factors are suspected to contribute to the high turbidity, such as seasonal run-offs from the neighboring Mosquito Creek or when winds from the North and Northwest stir up the shallow portion of Picton Bay. High turbidity causes clogging of filters and reduced filter runs, i.e. the Operators must backwash the filters more frequently. This results in increased operation difficulties, wasting of treated water, downtime for the filters, and possible concerns in keeping up to the water demand.

Operators have also raised concerns regarding the frequent boat traffic around the intakes. The reason for their concern is that boat traffic may contribute to turbidity issues and an unsuspecting boater may lower their anchor on the intake structure/pipe, causing damage.

There are several storm outfalls/drainage ditches discharging into Picton Harbour and the surrounding shorelines that feed into Picton Bay, all within close proximity to the existing two intakes. The Picton Wastewater Treatment Plant also discharges its effluent into Picton Harbour via Marsh Creek.

The XCG 2009 Technical Memorandum on the Intake Protection Zone Delineation and Vulnerability Assessment for Picton Water Treatment Plant System was completed as part of the Source Water Protection initiative sponsored by Quinte Conservation. The study examined and quantified how vulnerable the IPZs of the existing intakes were to sources of contaminants. The results in Table 1.2 showed that the vulnerability scores were very high, where 10 was the maximum and 1 was the minimum.

Table 1.2: Vulnerability Factors for Picton Intakes' IPZs

Picton Intakes' IPZ	IPZ-1	IPZ-2	IPZ-3a	IPZ-3b
Area Vulnerability Factor (10 = max; 1 = min)	10	9	8	6

(*Reference: Intake Protection Zone Delineation and Vulnerability Assessment Technical Memorandum #1. Oct 2009)*

The high scores were due to the shallow depth of the intakes, their close distance to shore, and turbidity events as a result of nearby creeks, run-offs and boat traffic.

The Picton WTP was upgraded in 2009 to extend the facility's life for another 20 years. It is uncertain if the existing intakes will be in functional condition to match the plant's extended lifespan.

In response to all of the issues and concerns presented, it was recommended that a new intake be considered to replace the existing intake(s) of the Picton WTP. The new intake can either be located in the deeper waters of Picton Bay and further from Picton Harbour or located in another water source (i.e. Lake Ontario via Wellington WTP).

The Class Environmental Assessment (Class EA) process undertaken to investigate and evaluate the alternatives for a new intake and the selection of the preferred alternative have been outlined in the following sections.

2.0 MUNICIPAL CLASS EA PROCESS

2.1. General

A Municipal Class Environmental Assessment (Class EA) is an approved planning procedure that proponents can follow in order to meet the requirements of the Ontario Environmental Assessment Act. The Class EA approach provides for the evaluation of alternative solutions to a problem or opportunity. The Class EA process is illustrated in Figure 2.1 at the end of this section.

The Class EA approach includes mandatory requirements for public and regulatory agency input. The Class EA identifies three different categories or "schedules" of projects as follows:

- **Schedule A** projects are limited in scale and have minimal adverse effects. These projects are approved and may proceed directly to implementation without following the Class EA process.
- **Schedule B** projects have the potential for some adverse environmental effects and must be subjected to a screening process, involving consultation with the directly affected public and relevant government agencies to ensure that any concerns are addressed. If there are no outstanding concerns, then the proponent may proceed to implementation.
- **Schedule C** projects have the potential for significant environmental effects and must proceed under the full planning and documentation procedures specified in the Class EA document.

The Municipal Class EA[2] identifies "replacement of water intake pipe for a surface water source" to be a "Schedule B" project.

The procedure for a Schedule 'B' undertaking is indicated below.

Phase 1	Identify the problem or opportunity.
Phase 2	Identify and evaluate alternative solutions to the problem by taking into account the existing environment and establishing the preferred solution taking into account public and agency review input. Document the process in a Project File Report.
Notice of Completion	Upon completion of the Project File Report, a Notice of Completion is advertised and issued to the public and agencies expressing interest in the project, for a 30 day review period. If a concern is not resolved through discussions with the proponent, the person raising the concern may request the proponent to voluntarily elevate the Schedule B project to a Schedule C project or to an individual environmental assessment. If the proponent declines to elevate the project, and the person with the concern wishes to pursue the matter, they may write to the Minister of the Environment (MOE) and request a Part II Order (i.e. a "bump-up request"). In this case, the Environmental Assessment and Approvals Branch at the MOE will review the information and prepare a recommendation for the Minister's consideration.

[2] Municipal Engineers Association. "Municipal Class Environmental Assessment". October 2000, amended 2011.

The Minister will then make a decision whether the "bump-up request" will be denied or upheld or if the matter will be referred to a mediator.

Implementation Provided that no Part II Order requests are made to the Minister of the Environment within the 30-day review period, the project is approved and may proceed to detailed design, construction, operation and monitoring, if specified, for adherence to environmental provisions and commitments.

2.2. Problem & Opportunity Statement

An Intake Protection Zone Delineation and Vulnerability Assessment was completed in 2009 as part of the Quinte Source Water Protection Program. The assessment identified that the existing intakes at the Picton Water Treatment Plant (WTP) are vulnerable to several risks, such as contaminants, fluctuations in water quality and increasing maintenance costs. At the same time, the County could benefit from a new intake to match the plant's potentially extended lifespan and to accommodate the future water supply needs of the community.

In order to reduce the identified vulnerability and to plan for the future, the County is undertaking a review of alternatives, design and construction of a new replacement intake and structure for the Picton WTP, complete with a new raw water well to connect to the existing WTP.

The preferred solution for these works would be constructible, environmentally friendly, affordable, reliable, and easy to maintain and operate and would meet both the short and long term needs of the County. The solution must be achievable with minimal interruption to the operation of the existing water treatment plant.

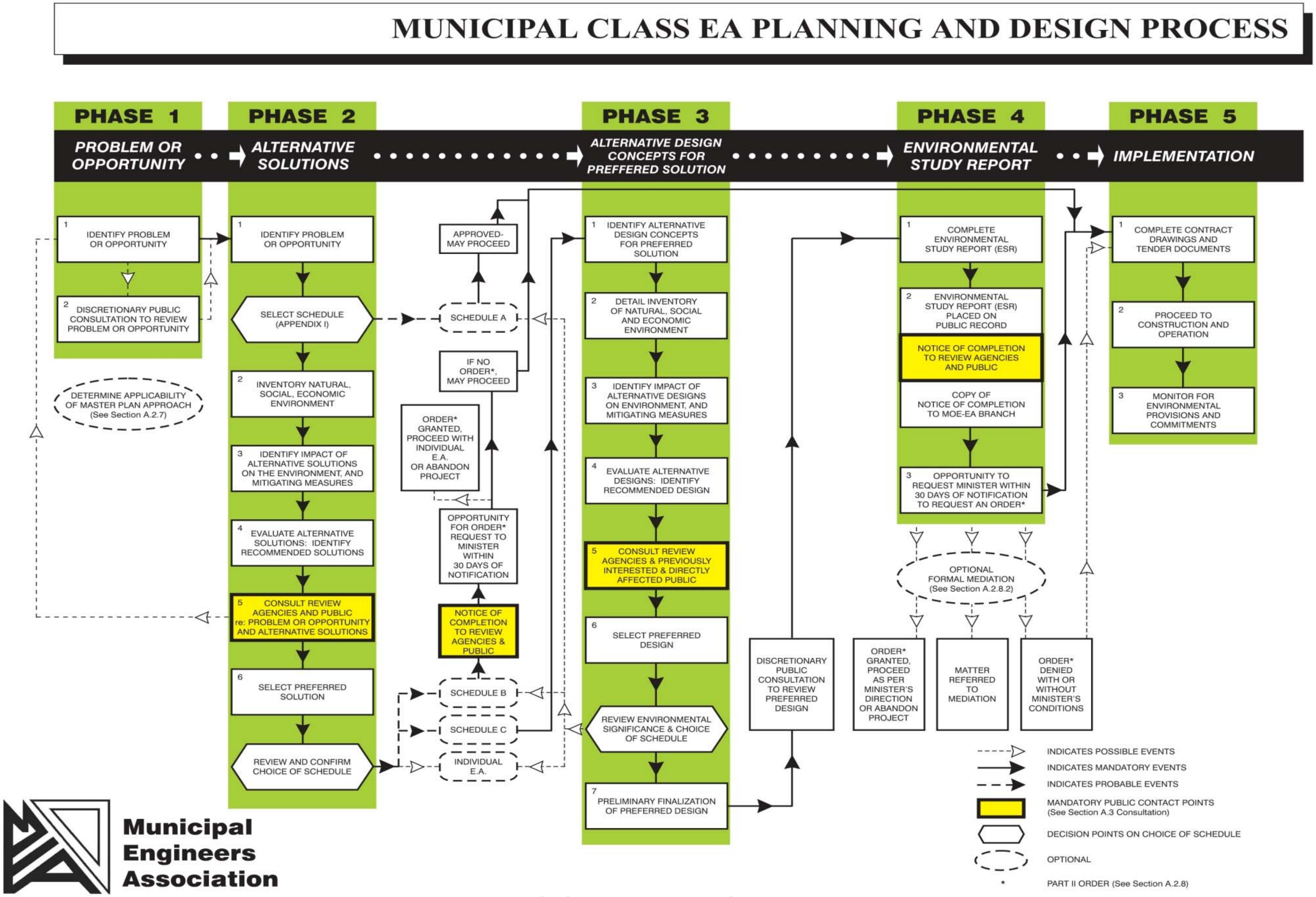


Figure 2.1: Municipal Class Environmental Assessment Process

(Reference: Municipal Engineers Association. "Municipal Class Environmental Assessment". October 2000, amended 2011.)

3.0 CONSULTATION WITH REVIEW AGENCIES & PUBLIC

One of the essential components of the EA process is public and agency participation. This project involved public input from members of the public at large, as well as agencies. Due to the potential for environmental impacts of the various alternative solutions, meetings with agencies such as Quinte Conservation Authority, Ministry of the Environment, Ministry of Natural Resources, and Transport Canada were undertaken throughout the Class EA process.

3.1. Notice of Commencement

The Notice of Commencement was sent out to the stakeholders on June 7, 2011 and published in the “County Weekly News” and the “Picton Gazette” on June 7, 2011, and posted on the County of Prince Edward website.

The notice advised that the Class EA for this project was commencing, that a Public Information Centre (PIC) will be held shortly and that questions and comments on this project should be submitted to R.V. Anderson Associates Limited or the County.

Copies of the notice, mailing list, as well as the responses that were received, are provided in Appendix A.

3.2. Notice of Public Information Centre

On April 27, 2012, the Notice of a Public Information Centre (PIC) was sent to the stakeholders inviting them to attend the PIC to be held on May 10, 2012 at the Crystal Palace on located 375 Main Street, Picton.

The notice was also published in Picton Gazette and County Weekly News on May 1, 2012 and posted on the County of Prince Edward website. A copy of the notice and the mailing list is provided in Appendix B.

3.3. Public Information Centre

A PIC was held on Thursday, May 10, 2012 to present the alternative solutions and the preferred alternative to the interested public. County staff and members of the consulting team were available to answer questions. Seven (7) citizens attended the PIC and one (1) comment sheet/correspondence was submitted. All comments received from the public or other stakeholders prior to December 4, 2012 are addressed in this report.

Copies of the display materials, sign in sheet, comment sheets generated at the PIC and associated responses are provided in Appendix C.

Comments and correspondences were also received from the MOE throughout the Class EA process. All correspondences from the MOE and the responses are provided in Appendix C and J.

3.4. Technical Advisory Meetings

Technical advisory meetings were held with various agencies, the County and the consulting teams on June 23, 2011 and April 24, 2012 to discuss the project and receive comments. Agencies such as the Ministry of the

Environment, Quinte Conservation Authority, Ministry of Natural Resources and Transport Canada were invited to attend the meetings.

Additional discussions and correspondences between the Ministry of the Environment, Quinte Conservation, the County and the Consulting Team were held in 2013-2014.

The discussions and comments received throughout the Class EA process, as well as the responses provided to the various reviewers are documented in Appendix D and J.

3.5. Notice of Completion

A Notice of Completion was published in the Picton Gazette on October 2 and 9, 2014 and sent to the stakeholders with the requirement to submit comments to the County within 30 calendar days. If there are no issues identified and unresolved during this 30-day review period, the County can assume that the selected preferred alternative is acceptable to the stakeholders and proceed with the detailed design of the preferred solution and application for approvals from the various agencies.

Copies of the Notice of Completion and the mailing list are included in Appendix E.

4.0 CURRENT AND FORECASTED POPULATION AND WATER DEMANDS

In order to properly size the new intake to account for future growth, it is necessary to determine the design flow rate for the intake. The following sections summarize the current and future population in the Picton area and the forecasted water demand.

4.1. Current and Forecasted Population

Using data from the 2006 Canada wide census, County of Prince Edward's (PEC's) Official Plan and the Ontario Ministry of Finance, the current permanent population for the Town of Picton and the Village of Bloomfield is estimated between 4280 and 4530 permanent residents. It is estimated that there would be 511 new residents in the Picton area by 2021. And although PEC's Official Plan did not provide a specific growth forecast for the Picton area to or beyond 2031, an assumed linear growth in population results in an estimate of 1022 and 2555 new residents by 2031 and 2061, respectively.

Further information regarding the current and forecasted population and water demands are available in the "Technical Memorandum for the Preferred Intake Location at the Picton Water Treatment Plant" located in Appendix F.

4.2. Current and Forecasted Water Demand

Using the conservative population growth data from PEC's Official Plan and the current water demand data from the Picton Water Treatment Plant, the forecasted 2031 design flows are summarized in Table 4.1.

Table 4.1: Current and Forecasted Future 2031 Average and Maximum Day Demands

	Current Flow Rate (Total)	**Future Predicted (2031) Flow Rate (Total)**	**Future Predicted (2061) Flow Rate (Total)**
Maximum daily demand	4,600 m^3/day	5,800 m^3/day	8,000 m^3/day
Average daily demand	3,206 m^3/day	4,100 m^3/day	5,600 m^3/day

The forecasted 2031 maximum day demand of 5,800 m^3/day is within the current Picton WTP's rated capacity of 10,400m^3/day. Therefore a capacity increase at the plant is unlikely in 2031, however certain parts of the plant may be at the end of their useful life.

The Ministry of Environment design guidelines for a new intake recommend that intake pipes be sized to accommodate a design period in excess of 20 years as the cost of material is small compared to the labour and effort of installing a new intake. Following the above population growth and water demand assumptions, the predicted average day and maximum day demand by 2031 would be 4,100 m^3/day and 5,800 m^3/day, respectively. The predicted average day and maximum day for year 2061 would be 5,600 m^3/day and 8,000 m^3/day, respectively. The existing south intake is sized for 11,450 m^3/day. Since the installation of a new intake pipe is a large and costly undertaking, it is recommended to design the intake to accommodate for the higher flow requirements to extend its useful life. As such, it is recommended that any new intake be sized to match the existing capacity of for 11,450 m^3/day. It is also recommended that population and water projections be re-evaluated at the time of detailed design and that an allowance for additional future capacity be provided if necessary at that time.

5.0 STEP 1 – ALTERNATIVE SOLUTIONS TO ADDRESS THE PROBLEM

The process to determine and assess the preferred alternative solution for the intake replacement requires a three step approach:

Step 1 – Evaluate and determine the preferred source of water supply.

- Should the new intake remain in Picton Bay?
- Should the new intake be considered in a different water source, such as Lake Ontario, via the Wellington WTP?

Step 2 - Evaluate and determine the best location for a new intake in the preferred water source from Step 1:

- How deep?
- How far from shore?
- Are there any contaminant sources of concern nearby?
- What is the water quality of the area?

Step 3 – Evaluate and determine the best routing option to convey raw water from the preferred location in Step 2 to the water treatment plant for treatment prior to distribution.

5.1. Step 1 – Alternatives for Water Supply

The alternatives for water supply were considered with a holistic view of Picton and neighboring waterworks (i.e. Wellington WTP) as well as a long life cycle for the waterworks, beyond 2061. Questions such as: when is the next expected treatment plant expansion or what other infrastructure will be required to obtain water from a different water source, were considered.

The proposed alternatives for the Picton WTP intake replacement are as follows:

5.1.1. Base Scenario – Do Nothing

This alternative is required for evaluation under the Class EA process. It essentially identifies the existing conditions, and helps to define the extent of the problem. In this instance the “Do Nothing” alternative does not address the problem and concerns regarding water quality and vulnerability to contaminants. As such, it is not a preferred alternative.

5.1.2. Alternative 1 – New Picton WTP Intake in Picton Bay

This alternative includes a new, longer intake pipe and structure further out in Picton Bay from the existing intakes. The further and deeper intake location may provide improved water quality and reduce vulnerability to contaminants. The Picton WTP would be upgraded with a new raw water well to allow gravity flow to the existing raw water well.

In order for a fair comparison of life cycle costs between Alternative 1 and Alternatives 2, 3 and 4, which included necessary upgrades to the Wellington WTP as part of the solution to Picton’s issues, the life cycle cost for Alternative 1 considered upgrades to the Wellington WTP in order to meet its own town's future water demands. Refer to Figure 5.1 for a graphic representation of the timeline for the upgrades that would be expected at the two WTPs.

5.1.3. Alternative 2 – Central Supply of Raw Water from Wellington WTP

The main goal of this alternative is to consolidate the raw water supply of the two towns and obtain raw water from Lake Ontario via the Wellington WTP. The raw water quality at the Wellington WTP is comparatively better in terms of turbidity. Its existing IPZ vulnerability to contaminants is very low.

The upgrades required for this alternative would require the immediate construction of a new intake pipe at the Wellington WTP, complete with a new raw water well and 20km long raw water transmission main between Wellington and Picton. As a contingency measure, a raw water reservoir would also be required close to Picton in case there was a leak in the raw watermain or issues at the Wellington WTP that would prevent the supply of raw water.

Each WTP would require an upgrade and/or increase in its capacity as required by each town's future water demands. By 2042, the existing Picton WTP would likely have reached the end of its useful life and a new WTP would need to be constructed on another location or at the existing location. Refer to Figure 5.2 for a graphic representation of the timeline for the upgrades that would be expected at the two WTPs.

5.1.4. Alternative 3 – Central Supply of Treated Water from Wellington WTP by 2042

This alternative is similar to Alternative No. 2 as it starts out with a central raw water supply from Wellington WTP to Picton. However, by 2042, when the Picton WTP has reached the end of its useful life, the plan would be to decommission the existing Picton WTP and upgrade Wellington WTP's capacity to supply treated water to the Town of Wellington, Town of Picton and the Village of Bloomfield. The raw watermain and reservoir that would be constructed in the earlier stages of this option would be converted for treated water use by 2042. The main objective of this alternative would be to eventually consolidate the raw water and treated water supply from the Wellington WTP to feed both towns and the Village of Bloomfield.

Refer to Figure 5.3 for a graphic representation of the timeline for the upgrades that would be expected at the two WTPs.

5.1.5. Alternative 4 – Immediate Central Supply of Treated Water from Wellington WTP

Alternative No. 4 has the same objective as Alternative No. 3, which is to consolidate the two WTPs and use the Wellington WTP to supply treated water to both towns. However, unlike Alternative No. 3, the consolidation would be scheduled to happen the next time the existing Picton WTP was expected to require a structural or capacity upgrade. The timeline is estimated for the year 2022.

The upgrades at Wellington would require a new intake pipe sized for Wellington, Picton and Bloomfield's current and future water demands, a new raw water well, increased treatment capacity, a 20 km long treated watermain from Wellington to Picton and a treated water reservoir, for water supply contingency. Refer to Figure 5.4 for a graphic representation of the timeline for the upgrades expected at the two WTPs.

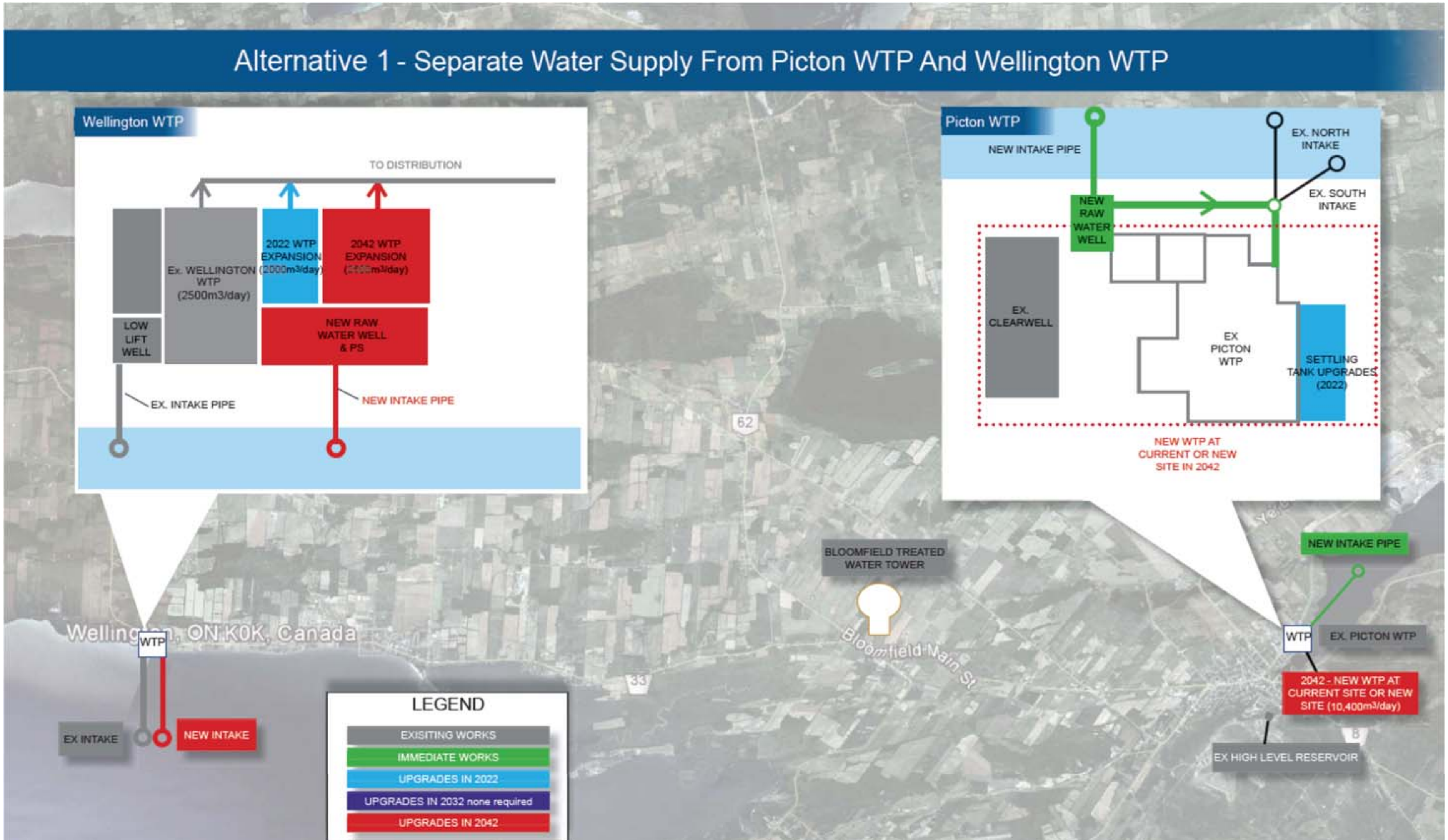
5.1.6. Other Alternatives

Other alternatives were also considered, however due to technical feasibility or economic factors, they were not investigated further.

As result of public input at the Public Information Centre, a proposed alternative was the use of Lake on the Mountain as an alternative water source. The Lake on the Mountain is strategically located at a high point several kilometers from the Town of Picton and is a popular tourist attraction. Research and calculations revealed that the rate of recharge would be insufficient to supply the demands of the Town of Picton and the Village of Bloomfield. As such, this option was not considered further.

Another option, which is similar to Alternatives 2 and 3, was the consolidation of the Quinte Area water supply system. The premise of this alternative was to use Wellington WTP as the main source of water for all neighboring communities of Picton, Bloomfield, Carrying Place and Consecon. Preliminary discussions were held by the County and consultants, however it was their opinion that this extensive water supply strategy would be far more costly than the other proposed alternatives and would not be considered any further. As discussed in Section 5.8, the life cycle costs of Alternatives 2, 3 and 4, which had distribution connections between Wellington WTP and its closest neighboring Town of Picton, already had substantially higher life cycle costs than Alternative 1. The life cycle cost to connect all the neighboring communities to Wellington WTP would be expected to be higher.

Since the focus of the Class EA and this report was to find a preferred alternative for the replacement of the Picton intake, consideration of providing water to other surrounding communities was not considered further to prevent complication and distraction from the Picton intake issue.



Note: Upgrades to Wellington WTP are shown only for a fair evaluation of life cycle costs between alternatives. Wellington WTP upgrades address only its own town's growth and does not contribute to Picton's intake solution.

Figure 5.1: Alternative No. 1 – New Picton WTP Intake in Picton Bay

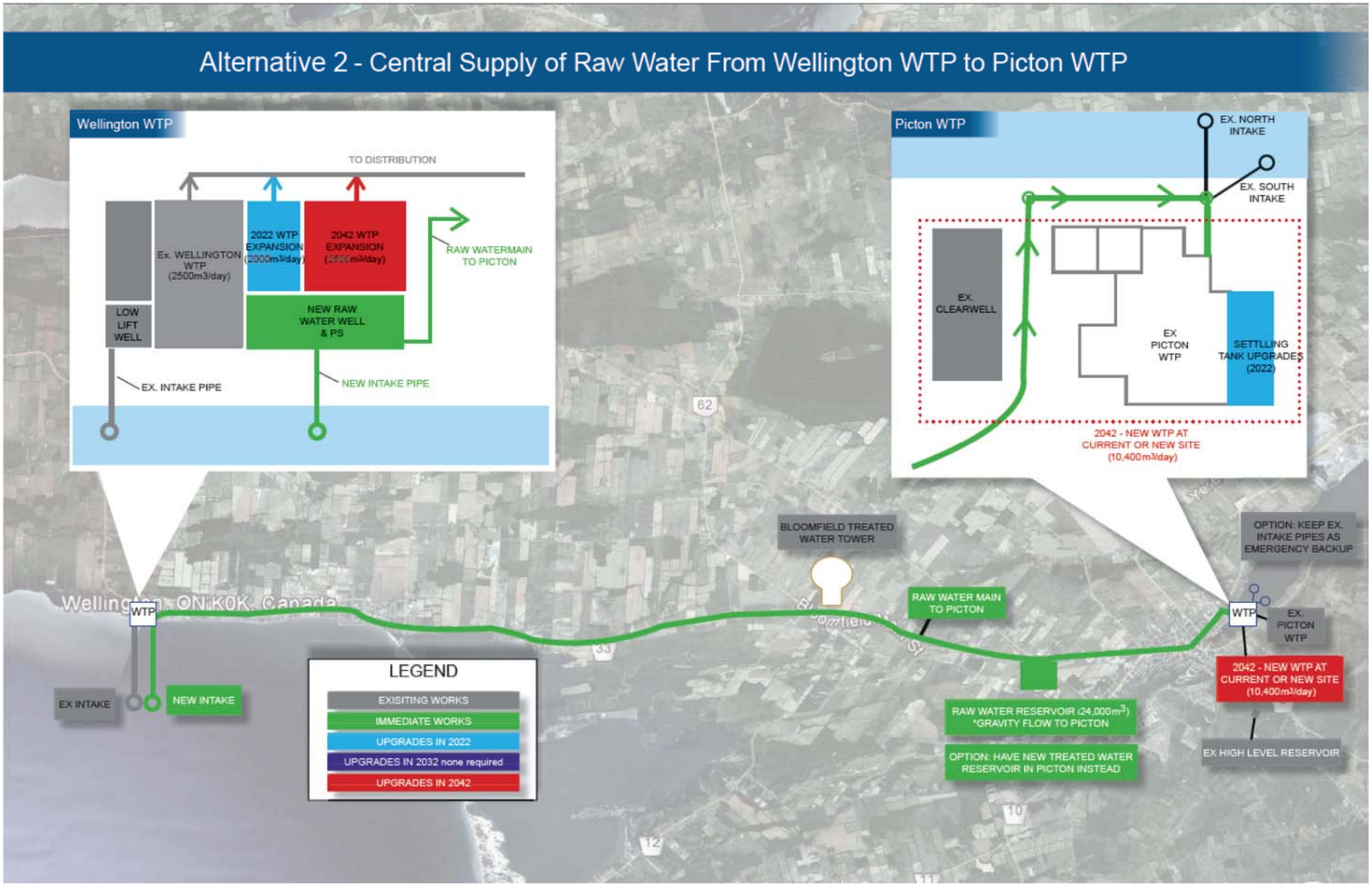


Figure 5.2: Alternative No. 2 – Central Supply of Raw Water From Wellington WTP to Picton WTP

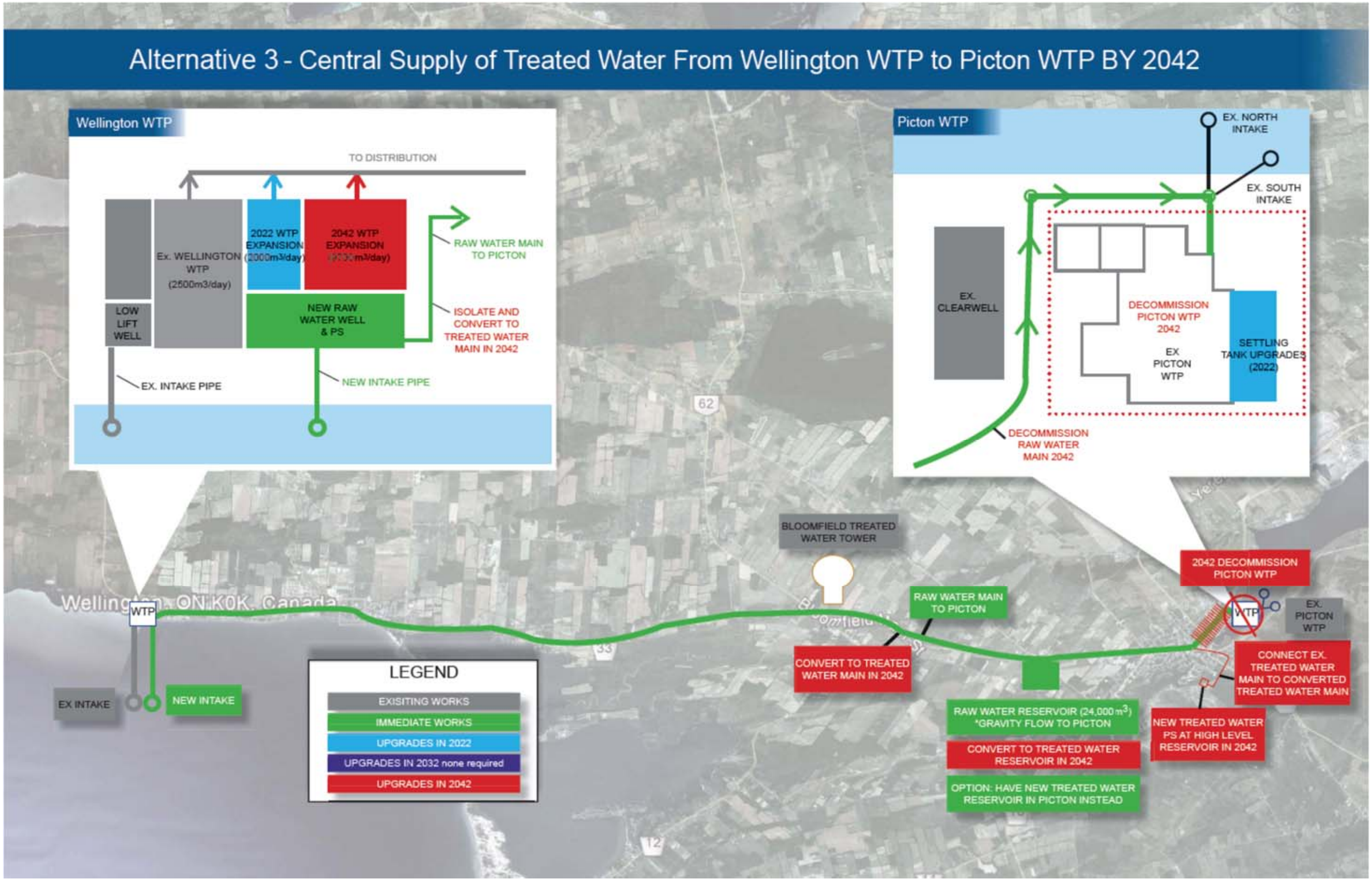


Figure 5.3: Alternative No. 3 – Central Supply of Treated Water From Wellington WTP to Picton WTP by 2042

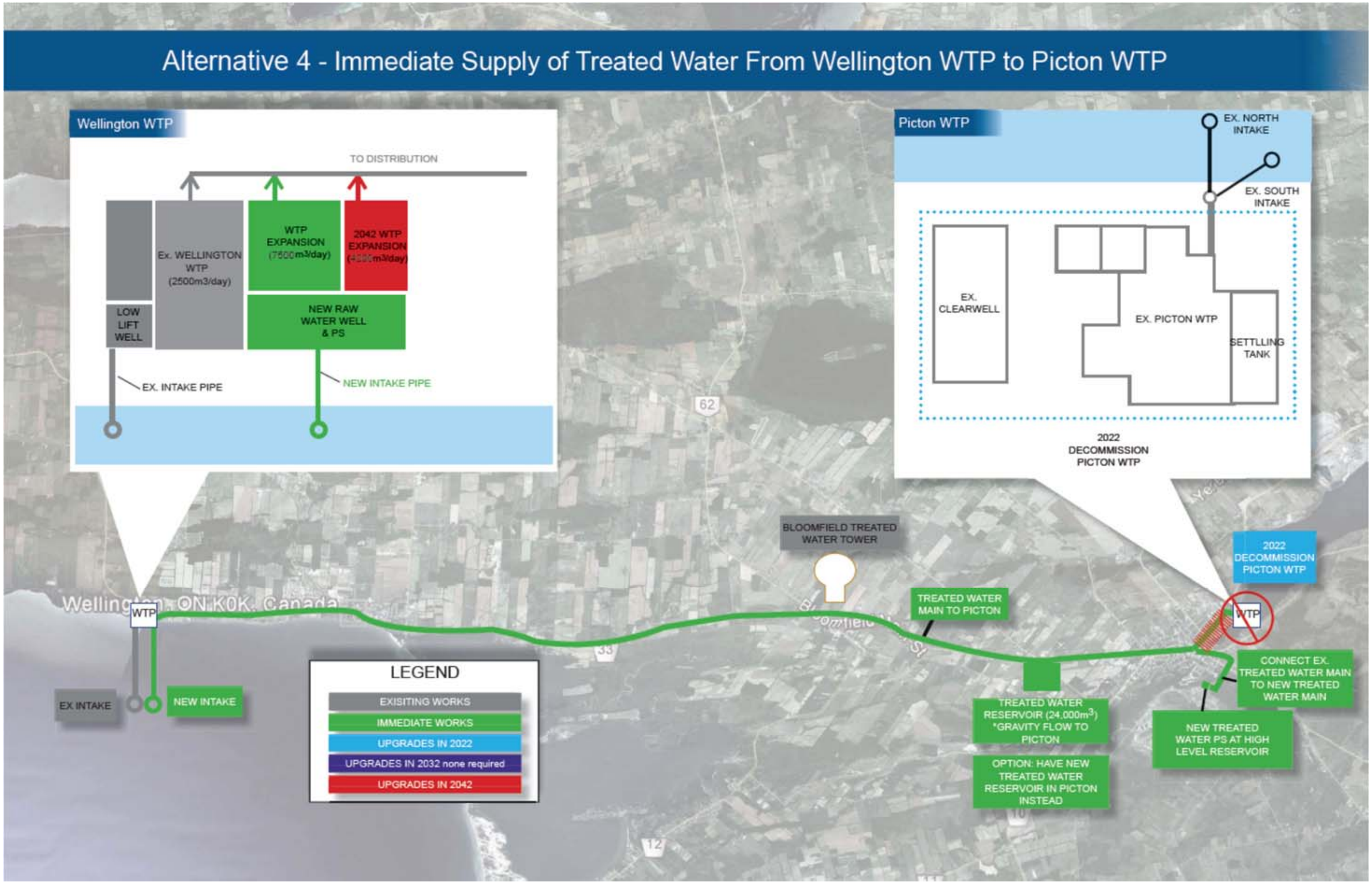


Figure 5.4: Alternative No. 4 – Immediate Central Supply of Treated Water From Wellington WTP to Picton WTP

5.2. Step 1 – Evaluation of Alternatives for Water Supply

The alternatives for water supply, in the above section, were compared based on a preliminary screening of social and environmental considerations, technical feasibility, operation & maintenance impacts/improvements, and life cycle costs. The following summarizes the criteria and possible impacts:

- **Improvement on Water Quality and Vulnerability to Contaminants:** This compares each alternative on whether there would be any improvements to the raw water quality (i.e. turbidity, suspended solids etc.) compared to the "Do Nothing" scenario. It also considers if there would be any improvements in reducing the vulnerability/risk to contaminants for the Intake Protection Zones of the new intake.

- **Environmental Impacts:** This compares the alternatives in regard to the short term and long term effects the construction and infrastructure would have on aquatic and terrestrial wildlife, vegetation and habitat.

- **Potential for Disruptions during Construction:** This indicates the relative impacts of each alternative on the disruption to residents, businesses and commercial activities due to construction (i.e. noise and vibration impacts, parking, truck access, road closures etc.).

- **Allows for Intake Renewal and Future Growth:** This criterion assesses whether the alternative would account for renewal of the intake and provide the ability and flexibility to expand for the future growth of the two towns.

- **Life Cycle Costs (Including capital, operation & maintenance etc.):** This item evaluates the overall cost of the alternative including the capital costs and operational & maintenance costs until 2061, brought back to present worth (e.g. the cost of chemicals, electricity and labour). A comparison of costs based on the present worth method allows for a fair evaluation of cost in various time periods by bringing them to a common base.

- **Constructability:** This criterion compares the alternatives in terms of how complex the required upgrades would be. It also considers the duration and staging required for the various construction phases and if there would be any technological or implementation difficulties.

- **Impact/Improvements on Operation & Maintenance Activities:** This evaluates each alternative in regard to the potential impact/hindrance or improvements to existing operation and maintenance activities (e.g. limits access for chemical deliveries, number and duration of shutdowns and tie-ins, uninterrupted supply and distribution of treated water to public, reliability of new system).

Each of these factors was given a proposed criteria weighting, for a total sum of all factor weightings of 100%. Each factor was considered on the basis of how important or adverse the impact would be if left unmitigated, and the duration of the impact and its effects. The criteria weighting was used as part of the evaluation method as described in the section below. For example, the criterion of "Improvement of Water Quality and Vulnerability to Contaminants" was a key criterion as it was the most important reason for the project in the first place. As such it was proposed to have a weighting of 25% out of 100% for this item.

The proposed criteria weighting for each factor was determined collectively by a wide range of stakeholders, including Councilors, agencies and consultants. Public input and comments regarding the criteria weighting was requested as part of the Public Information Centre. Since no public or agency comments were received regarding the weighting for the criteria, the proposed criteria weighting were used.

5.3. Evaluation Method

A simple ranking scale was used to evaluate all the alternatives to arrive at the preferred alternative. A scale of "Low – Moderate – High" negative impacts was used to simplify the evaluation process.

- A Low Negative Impact (Green) ranking means the alternative has a low impact based on the specific criteria being evaluated, and is given a score of 3 out of 3.
- A Moderate Negative Impact (Yellow) ranking means the particular alternative is placed in between the low and high ranking based on the individual criteria being evaluated, and is given a score of 2 out of 3.
- A High Negative Impact (Red) ranking means a high impact based on the individual criteria being evaluated, and is given a score of 1 out of 3.

Each alternative was then given a final score based on the sum of each criteria's weighting multiplied by the level of impact score (out of 3) for that criteria. The alternative with the highest final score would represent the preferred alternative.

For example, the "Do Nothing" scenario did not address the "Water Quality and Vulnerability to Contaminants". As such, it is given a "high negative impact" ranking and a corresponding score of 1 out of 3. The criteria weighting proposed for "Water Quality and Vulnerability to Contaminants" is 25%. So the score for that particular impact for the "Do Nothing" scenario is 1 x 0.25 = 0.25 out of 0.75.

The table shown on Table 5.1 presents a summary of the evaluation criteria and impacts for the water supply alternatives in a decision matrix. The following sections provide a written justification for the evaluation scores provided under each criterion.

5.4. Improvement on Water Quality and Vulnerability to Contaminants

In the 2009 Intake Protection Zone Delineation and Vulnerability Assessment of the existing Picton intakes, very high vulnerability to contaminant scores were given to its IPZs. IPZ-1 received a 10 out of 10 score, indicating that it was the most vulnerable to risk of contaminants and threats. IPZ-2 received a 9 out of 10 and IPZ-3a and 3b received 8 and 6 out of 10, respectively. It was also reported that there were 20 different significant drinking water threat activities taking place at 60 locations that are in the vicinity of the existing IPZs. Due to the high vulnerability scoring and the large number of drinking water threats, the "Do Nothing" option was the least favorable option for addressing the water quality and vulnerability to contaminants criterion. Therefore this option was given a score of 1 out of 3 (as noted by the red colour in the decision matrix) in this specific criterion.

Alternative 1 proposed to move the new intake out further and deeper into Picton Bay. This would help to reduce the vulnerability score and number of significant drinking water threats. A minor to moderate improvement may be obtained, in comparison to the "Do Nothing" scenario, and was given a score of 2 out of 3, as indicated with the yellow colour in the decision matrix.

Alternatives 2, 3 and 4 all scored 3 out of 3, as the new intakes would be drawing straight from Lake Ontario via the Wellington WTP. The existing Wellington intake IPZs received favorable vulnerability scores and low number of significant drinking water threats. The Wellington IPZ-1 and IPZ-2 received scored a 5 and 3.5 out of

10, respectively, for the vulnerability to contaminants. It also had 0 significant drinking water threats. The 3 out of 3 score is illustrated with the green colour on the decision matrix (Figure 5.4).

5.5. Environmental Impacts for Water Supply Alternatives

The "Do Nothing" scenario would not require any new construction, only maintenance upgrades. Therefore it would have no impact on the environment, and was given a score of 3 out of 3 (green colour) for this scenario under this criterion.

Alternative 1 would have moderate environmental impacts during the construction of the intake pipe out into Picton Bay as there is an in-water component, which would affect aquatic wildlife, vegetation and habitat. If this option was selected, mitigation measures would be employed to minimize the impact on the environment. This option was therefore given a score of 2 out of 3 (yellow colour).

Alternatives 2, 3 and 4 would require a large and long construction undertaking as these options requires a 20km long raw or treated watermain to be installed between the Wellington and Picton WTPs. The watermain would mainly be in the existing right-of-way of the road, however there are several creek and stream crossings and nearby woodlands. The in-water component could also affect aquatic wildlife, vegetation and habitat. If this option was selected, various construction methods and mitigation measures would need to be used to minimize the impact on the environment. Due to the higher impacts, this option was given a score of 1 out of 3 (red colour).

5.6. Potential for Disruptions during Construction

The "Do Nothing" scenario would not require any new construction, only maintenance upgrades. As such, no public or commercial disruptions from construction would be expected. A score of 3 out of 3 (green colour) was given for this option under this criterion.

Alternative 1 would have construction on the existing Picton WTP site and out into Picton Bay. Moderate construction disruptions, such as traffic detours, noise, vibration and dust would be expected during the short construction period. Effects on local residents and businesses will be confined to the immediate surrounding area. There would also be some recreational boating disruptions during the short in-water construction period. A score of 2 out of 3 (yellow colour) was given.

Alternatives 2, 3, and 4 would require a long and extensive construction area. The 20 km long watermain run through several neighboring communities, including Bloomfield and Hallowell. The preferred watermain route traveled along the locally used, single lane County Road 33 (Loyalist Parkway). As such, construction activities (e.g. road closures, noise, dust, etc.) would significantly impact the residents and businesses of the adjacent villages and towns. Many houses and businesses are situated along this roadway, including Picton's Main Street and Wellington's Main Street. A score of 1 out of 3 (red colour) was selected for these alternatives under this criterion.

5.7. Provision/Allowance for Intake Renewal and Future Growth

The "Do Nothing" scenario would not accommodate for intake renewal and growth potential in the Town of Picton. This option's focus would only be to maintain the existing infrastructure and does not accommodate a new intake at the end of the intakes' useful life. The existing south intake was constructed in 1928, and although the intake pipe shows minor to moderate signs of deterioration, it is unlikely the existing intakes will remain functional to match the extended lifespan of the recently upgraded water treatment plant. A score of 1 out of 3 is given for this option under this criterion.

Alternative 1 included for a new intake pipe further out in Picton Bay to replace the aging intake pipes. It also would allow for growth in the Town of Picton with timely capacity and facility upgrades at the Picton WTP as required. For comparison purposes with Alternatives 2, 3, and 4, this option also included upgrades at the Wellington WTP to accommodate the growth of its own town, however there will be no upgrades at the Wellington WTP that are associated with Picton's intake concerns. The staged upgrades would provide the County with the flexibility to alter and expand the systems, as required, to meet the transitioning future needs. Although it has been noted that the Wellington WTP had comparatively better raw water quality than Picton WTP, it would be difficult to correlate it to better future growth since both WTPs are currently producing treated water that abides by the Ontario Drinking Water Standards. It was assumed that any upgrades performed at the Picton WTP would continue to produce treated water that satisfied the Ontario Drinking Water Standards. A score of 3 out of 3 was given to this alternative under this criterion.

Alternatives 2, 3 and 4 included a new larger intake pipe at the Wellington WTP, which will then be used to obtain raw water from Lake Ontario for both the Town of Picton and the Town of Wellington. Timely expansions and upgrades for the two WTP systems would permit further development and growth in both towns. The staged upgrades would provide the County with the flexibility to expand and alter the systems, as required, to meet the transitioning future needs. A score of 3 out of 3 was given to these alternatives under this criterion.

5.8. Life Cycle Cost

Life cycle costs, including capital costs of the staged upgrades and operation and maintenance costs, were estimated for each alternative. The life cycle cost accounted for operational and maintenance costs up to 2061. In order to compare each scenario and their different upgrade timeframes equally, all costs were calculated using the present worth method so that they could be compared on a similar timeframe. A complete summary of the costs of each scenario can be found in Appendix G.

The "Do Nothing" scenario did not include any major construction expansions, however throughout the 50 year timeframe of the life cycle; it would require some structural upgrades to maintain the existing infrastructure. In 30 years, when the existing WTP reached the end of its useful life, this scenario accounted for a new WTP, maintaining the existing capacity, in order to continue operation. It does not account for any replacement of the existing intakes at the end of their useful life. It also accounted for the operational and maintenance cost of running the two WTPs. The approximate annual operational cost for each plant was provided by the Public Works Department. The life cycle cost for the "Do Nothing" scenario was $31 Million over the span of 50 years, brought back to present worth (2014 dollars). Since this scenario was the most economical, a score of 3 out of 3 was given for this option under this criterion.

Alternative 1 required separate upgrades of the Picton WTP and the Wellington WTP to provide continual treated water to their respective towns. Staged upgrades would be completed for each WTP as dictated by the town's growth. It was predicted that the existing Picton WTP would reach the end of its useful by 2042, and as such would require a completely new WTP, either at the existing site or at an alternative site. The cost of a new Picton WTP in 2042 was accounted for in the life cycle cost of this option. Operational and maintenance costs were also included. An estimated present worth value of $47 Million would be required over the 50 year cycle. A score of 2 out of 3 was given for this alternative.

Alternatives 2, 3 and 4 all required a new intake for the Wellington WTP to provide raw water for both towns, and a 20 km long watermain from Wellington to Picton. Consideration was given to the use of the existing 9 km treated watermain from Picton to Wellington for these alternatives, but the 200mm watermain has insufficient capacity to be used as a transmission main for any of the Wellington Alternatives. These options also required a reservoir for water supply contingency in case of breaks and emergencies in the long transmission main between Wellington and Picton. These alternatives also require timely upgrades to the WTP(s). The major difference between these scenarios was “if” and “when” the Picton WTP would be decommissioned and converted into a pumping station for the local distribution to the Town of Picton.

Alternative 2’s objective was to use Wellington WTP to provide raw water to both towns but to use both Wellington WTP and Picton WTP to provide treated water to their respective towns. Under this scenario, the existing Picton WTP would be replaced with a new WTP by 2042. The life cycle cost for this option, in present worth, was $67 Million. A score of 1 out of 3 was given for this alternative due to the high potential cost to the system users and the County.

Alternative 3’s objective was to use the Wellington WTP to provide raw water to both towns for the immediate future and the two WTPs would provide treated water to their respective towns. When the existing Picton WTP reached the end of its useful life in 2042, it would be decommissioned and replaced with a pumping station for local distribution. At the same time, the Wellington WTP would be expanded and upgraded to provide treated water for both towns. This option had a present worth life cycle cost estimate of $60 Million, including operational and maintenance cost changes for the decommissioned Picton WTP. This alternative received a score of 1 out of 3 due to the high potential cost to the system users and the County.

Alternative 4’s objective was similar to Alternative 3, with the slight difference that the Wellington WTP would be expanded to provide treated water to both towns immediately. The existing Picton WTP would be decommissioned and converted into a pumping station for location distribution right away. This would reduce Picton’s high annual operation and maintenance costs immediately. This alternative’s present worth life cycle cost was estimated at $61 Million. A score of 1 out of 3 was given due to the high potential cost to the system users and the County.

The actual cost to the system users would be addressed at a later date, after various unknown and undetermined factors are resolved, such as the decision on the preferred alternative, actual construction costs, approvals, and available funding etc.

5.9. Constructability/Technical Feasibility

For the “Do Nothing” scenario, there were no constructability issues since no upgrades were required. A score of 3 out of 3 was given to this scenario in this criterion.

Alternative 1 had moderate staging and logistics complexity, particularly due to the environmental constraints on the in-water works construction window. The construction of the intake pipe and the raw water well should not pose any major technical challenges if a qualified contractor is selected for the work. This option had a score of 2 out of 3 under this criterion.

Alternatives 2, 3 and 4 were complex projects due to the many large components and interrelation of these components. The construction methods of the long watermain would have to be carefully considered to minimize the environmental and socio-economic impacts. These alternatives would also have to comply with the environmental constraints on the in-water works construction window. These alternatives received a score of 1 out of 3 under this criterion.

5.10. Ability to Maintain WTP Operation during Construction

The “Do Nothing” scenario was not impacted by this criterion as no major construction was required for this option. As such a score of 3 out of 3 was given for this scenario under this criterion.

Alternative 1 would only require a minor tie-in and shutdown once the new raw water well was constructed and the new intake pipe is installed. The only tie-in would be the connection of the new raw water line between the new and existing raw water wells. The existing Picton WTP would be able to continue its normal operations during the construction of the new works. Turbidity curtains and other mitigation measures would be used to minimize the impact of construction activities on the existing intakes. A score of 3 out of 3 was given for this option.

Alternatives 2, 3 and 4 would require multiple shutdowns, tie-ins and commissioning of various facilities. However, well planned logistics and staged upgrades would help to minimize the impact on the normal operation of the WTPs. These alternatives received a score of 2 out of 3 for this criterion.

5.11. Improvement of Operation and Maintenance

The “Do Nothing” scenario did not include improvements to the aging facilities, particularly the existing intakes at Picton WTP. The facilities would continue to deteriorate and would pose increasing operation and maintenance issues over time. Turbidity issues would continue to be experienced at the Picton WTP, which result in filter operation and maintenance issues. During storm events, the turbidity of the raw water at Picton WTP would spike, resulting in the clogging of filters. The filters would need to be backwashed frequently, which would reduce the water production of the plant and add strain to the Operation staff. A score of 2 out of 3 was given to this option under this criterion.

Alternative 1 would replace the existing aged intakes at the Picton WTP with a new intake, complete with new control systems for the raw water component. The longer and deeper intake, with the specially designed intake structure, may help to reduce the impact of turbidity fluctuations. A score of 3 out of 3 was given to this option under this criterion.

Alternative 2 would provide better raw water to Picton WTP, which should experience less turbidity fluctuations. The existing aged Picton WTP intake pipes would be decommissioned and would not be a continual operation and maintenance hassle. The raw watermain and new reservoir would have to be maintained, however the design of the infrastructure would help to minimize operation and maintenance issues. This option received a score of 3 out of 3 for this criterion.

Alternatives 3 and 4 would also receive better raw water for the improved operation and maintenance of the Picton WTP filters. However there would be some operation and maintenance requirements for the new long watermain and reservoir. This could be offset by the reduced operation and maintenance strain on the County when water treatment is consolidated at the Wellington WTP and the Picton WTP is decommissioned and replaced with a pumping station. A score of 3 out of 3 was given for these two options.

Table 5.1: Decision Matrix for Alternatives for Water Supply

Topic	Criteria	Criteria Weighting (%)	Base Scenario - "Do Nothing"	Alternative #1 - New Picton WTP Intake in Picton Bay	Alternative #2 - Central Supply of Raw Water from Wellington WTP	Alternative #3 - Central Supply of Treated Water from Wellington WTP by 2042	Alternative #4 - Immediate Central Supply of Treated Water from Wellington WTP to Picton
Environment	**Addresses Water Quality Concerns and Vulnerability to Contaminants**	**25%**	No	**Yes - Better water quality compared to "Do Nothing" option**	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option
	Environmental Impact	**10%**	No	**Only during construction**	Only during construction but longer construction duration	Only during construction but longer construction duration	Only during construction but longer construction duration
Social	**Potential for Temporary Disruptions During Construction**	**5%**	No	**Moderate**	High - large construction area; long duration for various works and stages	High - large construction area; long duration for various works and stages	High - large construction area; long duration for various works and stages
	Allows for Intake Renewal and Future Growth	**25%**	No	**Yes**	Yes	Yes	Yes
Economic	**Life Cycle Cost to 2061 (in Present Worth)**	**25%**	$31M	**$47M**	$67M	$60M	$61M
Technical	**Constructability**	**5%**	No issues	**Moderate - staging and planning around environmental time constraints**	Complex - Large and long construction; extensive construction area	Complex - Large and long construction; extensive construction area	Complex - Large and long construction; extensive construction area
Operations	**Ability to Maintain WTP Operation During Construction**	**2.5%**	Yes	**Yes - Minor shutdowns**	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted
Operations	**Improves Operation and Maintenance**	**2.5%**	Aging intakes may be a risk issue; Turbidity causing filter maintenance issues	**Yes - improved filter operation due to less turbidity fluctuations**	Yes - improved filter operation due to less turbidity fluctuations	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area
		Score for Options (out of 3)	2.0	**2.3**	2.1	2.1	2.1
		Preferred Option in Percentage	66%	**77%**	69%	69%	69%

Legend:	Least Negative Impact (Score 3)	Moderate Negative Impact (Score 2)	Highest Negative Impact (Score 1)

5.12. Decision Matrix & Preferred Alternative for Water Supply

Based on the evaluation method in Section 5.3, and most evidently displayed by the preceding colored chart Table 5.1, the preferred alternative is the one that would have the least negative impact for each of the primary evaluation factors (e.g. having the most green colored fields and the least red coloured fields) and the one with the highest score.

A sensitivity analysis was also performed on the evaluation matrix to see if the ranking of the alternatives would change if the criteria weightings were modified. The criteria weightings were adjusted +/- 5% and -10% for the major factors that were collectively determined as a priority amongst the key stakeholders. The remaining percentages were distributed accordingly to the remaining criteria to keep a total of 100%. Other sensitivity analysis scenarios that were evaluated were based on an “industrial/business” perspective, “environmental” perspective, and a “public/resident” perspective. The “industrial/business” perspective had a higher concern for socio-economic factors, intake renewal and future growth for the Town and capital costs. The “environmental” perspective focused more on environmental impacts, water quality concerns, and intake renewal/future growth of the town. The “public/resident” perspective had a broad range of concerns, including water quality, costs, environmental concerns and socio-economic factors.

The sensitivity analysis revealed that even with the variations in the weighting of the factors, Alternative #1 (new Picton intake) was still ranked as first and the most preferred alternative.

The only scenario in which Alternative #1 was not ranked first was when all the important criteria were reduced by 10% each. Under this scenario, the base case of “Do Nothing” was ranked higher than Alternative #1 by 1%. However, this sensitivity analysis scenario was not realistic because such weighting did not acknowledge the primary problem at hand and the importance of water quality, intake renewal and future growth of the Town.

Summary of results and the evaluation matrices under the various sensitivity analysis scenarios can be found in Appendix H.

Therefore, the preferred alternative for the water supply is:

“Alternative No. 1: New Picton WTP Intake in Picton Bay”

This alternative is the preferred solution for the following reasons:

- Provided reduced the risk of vulnerability to contaminants
- Minor environmental impacts during construction phase
- Minor disruptions during the short construction phase
- Allowed for intake renewal and future growth
- Economically advantageous in comparison to other feasible alternatives
- Technically constructible and with shorter duration and area
- Less operation & maintenance impacts during construction and improvements after construction

6.0 STEP 2 – POSSIBLE INTAKE LOCATIONS IN PICTON BAY

Figure 6.1 shows the location of the existing Picton WTP and its two intakes along with a series of possible intake locations that have been identified (shown as “sample locations”). The green and red outlines indicated the IPZ-1 and IPZ-2 of the existing intakes and compared them to the possible new intake locations.

A variety of locations were considered for the new intake at various distances from the existing WTP and at various depths. Table 6.1 summarized the depth, distance and characteristic of the possible locations.

Table 6.1: Possible Intake Locations in Picton Bay

Location	Approximate Distance from WTP (m)	Depth (m)	Description
A	200	2.5	Between existing 2 intakes
B	1000	6	Within existing IPZ1
C	1700	7	Outside of existing IPZ2; near salt docks
D	1500	7	Within existing IPZ2; within 1km from salt docks
E	2000	8	Outside of existing IPZ2
F	2300	8	Outside of existing IPZ2; In close proximity to salt docks
G	3000	9.1	Outside of existing IPZ2;
H	3500	9.8	Outside of existing IPZ2; near Essroc Concrete Plant

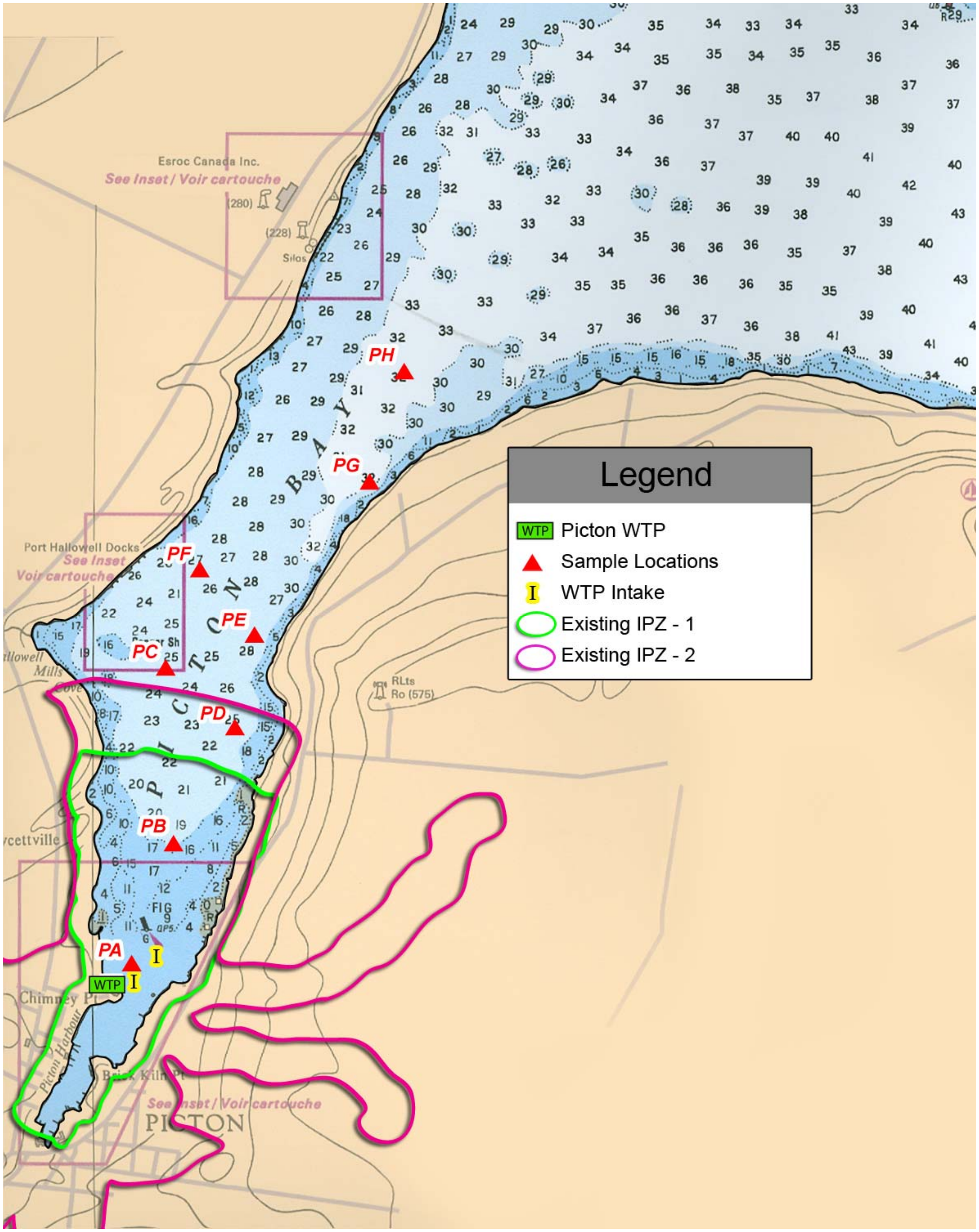


Figure 6.1: Existing and Possible New Intake Locations

6.1. Step 2 – Evaluation Criteria of New Intake Location Alternatives

The criteria used to evaluate the preferred new intake location in Picton Bay were as follows:

- **Sediment Quality:** This compared the concentration of chemicals of concern (i.e. heavy metals, PCBs, PAHs) in the sediment for each location to the "Do Nothing" scenario of the existing intakes locations.
- **Water Quality:** This compared each location on whether there are any improvements to the raw water quality (i.e. turbidity, suspended solids etc.) compared to the existing intakes locations.
- **Reduced Vulnerability/Risk of Contaminants to Intake Protection Zone:** This considered if there were any improvements in reducing the vulnerability/risk to contaminants for the Intake Protection Zones of the new intake.
- **Social/Construction Impacts:** This considered the relative impacts of each location on the disruption to residents, businesses and commercial activities due to construction (i.e. noise and vibration impacts, parking, truck access, road closures etc.) and also considered if the option will allow for intake renewal and future growth.
- **Environmental Impacts:** This compared the alternatives in regard to the effects the construction would have on aquatic and terrestrial wildlife, vegetation and habitat**.**
- **Construction Cost:** This compared the cost of construction at various intake locations, complete with a new intake pipe and structure, raw water well and upgrades at Picton WTP.

Water samples were collected and tested at the locations shown on Figure 6.1 during a calm weather day and after stormy weather conditions to see the water quality at various locations during different weather conditions. Tests on criteria such as temperature, turbidity, total coliform and total suspended solids were completed. The full report and findings can be found in Appendix I.

Sediment samples were also taken at the locations to test for heavy metals, polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs). These were chemicals that may reside in the sediment media and may pose health risks above certain levels. The full report and findings can be found in Appendix I.

Other factors contributing to water quality and improvement to vulnerability of contaminants were depth, distance from shore, proximity to contaminant sources (e.g. creek discharges, storm outfalls, drainage ditches etc.), historical plume/disturbance in area and boat traffic.

7.0 EVALUATION OF NEW INTAKE LOCATION ALTERNATIVES IN PICTON BAY

7.1. Sediment Quality of Possible Intake Locations

The sediment sampling program determined if there were contaminants in the sediment in the existing and potential intake regions and quantified the specific contaminants.

Sediment sampling locations were the same as the water sampling locations shown in Figure 6.1. The samples were analyzed for polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and heavy metals. The list of chemicals tested for and the findings are located in Appendix I.

7.1.1. Summary of Sediment Quality Monitoring Program

None of the tested sediment samples had PCBs and only 3 sampled locations had detections of 3 PAHs, however these did not exceed the lowest effect level (LEL) of the Ontario Guidelines for the Protection and Management of Aquatic Sediment Quality. The LEL is a guideline concentration that can be tolerated by a majority of the sediment-dwelling organisms. Sediments with contaminant concentrations below the LEL are considered to be “clean to marginally” polluted. The severe effect level (SEL) indicates a level of contamination that is expected to be detrimental to the majority of sediment-dwelling organisms. The Canadian Sediment Quality Guidelines for the Protection of Aquatic Life also has a probable effect level (PEL).

Every sampled location had numerous heavy metal LEL exceedances; however none of them exceeded the severe effect level (SEL).

Only Point A (existing intake location) had an exceedance of LEL and PEL with mercury, at a concentration of 1.5 ug/g compared to the LEL of 0.2 ug/g and PEL of 0.486 ug/g.

The possible new intake locations (e.g. B to H locations) all had similar heavy metal concentrations and exceedances, as shown in Table 7.1. There was no one particular location that stood out as the preferred location based on the sediment sampling data.

Although there were heavy metal LEL exceedances at all sediment sampling locations, the MOE noted that they were not concerned with the reported levels as they were below the Provincial Sediment Quality Guidelines Severe Effects Level (SEL). From the lab results, Ministry of Environment (MOE) reported that there did not appear to be any pre-existing sediment contamination in the sampled areas. The MOE correspondence can be found in Appendix J.

During the detailed design and approval stage of the project, additional discussions on any restrictions or precautions that must be undertaken with respect to the sediment with would be held with the MOE and other regulating authorities. On the basis of the above MOE comments and previous projects, costly impacts were not expected.

The complete sediment test findings can be found in the in Appendix I.

Table 7.1: Sediment Guidelines and Results at Existing and Possible Intake Locations

Heavy Metals	Sediment Standards (ug/g)					Sediment Results of Sampled Locations (ug/g)							
	Back ground	PSQG (LEL)	PSQG (SEL)	CSQG (PEL)	CSQG ISQG	A	B	C	D	E	F	G	H
Arsenic	4	6	33	17	5.9	2.6	**11**	**12.4**	**14.8**	**12**	**12**	**7.8**	**7.6**
Cadmium	1	0.6	10	3.5	0.6	<0.5	**1.2**	**1.3**	**1.5**	**1.2**	**1.2**	**0.9**	**1.1**
Chromium	31	26	110	90	37.3	7	**55**	**56**	**58**	**54**	**54**	**46**	**49**
Cobalt		50	50			6	22	26	26	25	25	24	26
Copper	25	16	110	197	35.7	14	**51**	**50**	**51**	**55**	**55**	**43**	**45**
Lead	23	31	250	91.3	35	**51**	**77**	**76**	**84**	**73**	**73**	**59**	**58**
Mercury	0.1	0.2	2	0.486	0.17	**1.53**	**0.26**	**0.21**	**0.22**	**0.22**	**0.22**	0.17	0.17
Nickel	31	16	75			15	**51**	**45**	**54**	**47**	**47**	**26**	**38**
Silver		0.5	0.5			<0.2	**1.2**	**0.6**	**0.8**	**0.6**	**0.6**	0.5	0.5
Zinc	65	120	820	315	123	46	**207**	**203**	**210**	**209**	**209**	**184**	**194**

BOLD Indicates exceedance of Provincial Sediment Quality Guideline - Lowest Effect Level (LEL)

BOLD Indicates exceedance of Provincial Sediment Quality Guideline - Severe Effect Level (SEL)

Indicates exceedance of Canadian Sediment Quality Guideline - Interim Freshwater Sediment Quality Guidelines (ISQG)

Indicates exceedance of Canadian Sediment Quality Guideline - Probable Effect Level (PEL)

7.2. Water Quality of Possible Intake Locations

A field monitoring and water sampling program was conducted to determine the water quality at various possible locations in Picton Bay for the new intake as shown in Figure 6.1 and listed in Table 6.1. The locations were chosen at various distances from the Picton WTP and at various depths.
The water quality parameters of interest were:

- Temperature
- pH
- Dissolved oxygen
- Conductivity
- Total Coliforms
- E.Coli
- Dissolved Organic Carbon
- Total Organic Carbon
- Turbidity
- Total Suspended Solids
- Total Dissolved Solids
- Total Phosphorus

Water samples were taken during normal calm weather conditions and following storm and high wind events, as it was reported that turbidity was an issue during storm and high wind events.

The sampling dates and conditions are summarized in Table 7.2.

Table 7.2: Water Sampling Event Conditions

Sampling Event	Date	Conditions at time of Sampling	Description of Conditions Prior and During Sampling
Baseline	July 14, 2011	Calm and normal; Wind N 10km/h	No rain or heavy winds
Event 1	July 26, 2011	Raining & Windy; Wind SW 20-30km/hr	Thunderstorm & heavy rain on July 25
Event 2	Oct 3, 2011	Wind N - 10km/hr	Oct 2 – Windy N 20km/hr with rain; Oct 1 – Windy N 20-30km/hr
Event 3	Oct 21, 2011	Windy – SW 20km/hr	Oct 19 – raining and windy N 20-30km/hr; Oct 20 - raining

The full report "Report on Field Program for Picton WTP Intake Replacement", dated November 2011, can be found in Appendix I.

7.2.1. Summary of XCG's Water Quality Monitoring Program

7.2.1.1 Temperature

The sampling program discovered that although there was a clear thermocline in the summer over the various depths of the water during calm weather conditions, whenever a storm or wind event swept through the area, the thermocline was no longer defined and the water temperature was quite consistent throughout all sampling locations and depths. Generally on a calm weather day, there was a decrease in temperature with increase in depth (e.g. 23-24^{o}C at 2m depth and 14^{o}C at 6-8m depth).

7.2.1.2 PH

Similar to the pattern noticed with the temperature criteria, there was a distinct decrease of pH with increased depth in all locations except for Location A, which is in shallow 2.5m water. However this pattern was non-existent if there is a storm or wind event, whereby all sampling locations and all depths would have a similar pH.

7.2.1.3 Dissolved Oxygen

Following the pattern of temperature and pH, there was a distinct decrease of dissolved oxygen (DO) with increased depth. However, with a storm or wind event, the water column appeared to become mixed and there was consistent DO throughout all depths and at all locations.

7.2.1.4 Conductivity

Similar to the above patterns observed with temperature, pH and dissolved oxygen, the conductivity of the water samples at all locations on a calm weather day increased with increased depth (e.g. ranging from 280-300 uS/cm). However, with a storm or wind event, the water column was mixed thoroughly for all locations and depths, resulting in a uniform conductivity level.

7.2.1.5 Total Coliforms

On a normal calm weather day, there appeared to be higher total coliform count for locations closer to Picton Harbour and the Picton WTP (e.g. sampling locations of A to E) compared to the sampling locations further away (e.g. sampling locations of F to H). However, as suspected from the pattern above, during storm and north wind events, the water in the entire sampling area became totally mixed, even at various depths, and the total coliform count was similar for all sampling points.

7.2.1.6 E. Coli

During normal calm weather days, most sampled locations did not detect any E.Coli except for sampling point B and D. For the storm and wind event of Oct 21, 2011, the water in all sampling locations became mixed and E.Coli count was similar throughout. The storm and wind event on Oct 3, 2011 showed a decrease in E.Coli count at the further sampling locations of F to H.

7.2.1.7 Dissolved and Total Organic Carbon

There was slight but not necessarily distinct decrease of dissolved and total organic carbon concentrations with increased distance on calm and normal days. However the results were similar for all locations during a storm and wind event.

7.2.1.8 Turbidity

Turbidity was one of the main concerns raised by Operators at the Picton WTP. On calm, normal weather day, there was a slight but not necessarily distinct improvement in turbidity levels with increased distance from the WTP. Rainfall and southwesterly wind conditions on July 26, 2011 showed improvement in turbidity with increased distance from WTP, particularly for sampling locations along the west side (e.g. Sampling locations C, F, G, and H). However northerly wind conditions in October showed varied turbidity readings at all sampling locations.

7.2.1.9 Total Suspended Solids

On a calm, normal weather day, there was improvement in total suspended solids (TSS) with increased distance from WTP, particularly for sampling locations along the west side (e.g. sampling locations C, D, E, G, and H). Rainfall and southwesterly wind conditions on July 26, 2011 showed improvement in TSS with increased distance from WTP. However northerly wind conditions in October showed varied TSS readings at all sampling locations.

7.2.1.10 Total Dissolved Solids

The results for total dissolved solids were similar throughout all sampling locations, with a decrease in total dissolved solids in the October sampling events compared to the July sampling events, possibly due to the temperature drop in the water by October, resulting in less material remaining dissolved in the water.

7.2.1.11 Total Phosphorus

The total phosphorus results appeared to be consistent throughout the sampled areas, except for spikes at location D, F, G and H during various storm and wind events.

7.2.1.12 Conclusions of XCG's Water Quality Monitoring Program

From the above summarized findings of the tested criteria, it appeared that there were improvements in water quality at sampling locations further from the current WTP on a calm weather day. During storm and wind events (particularly North winds) the entire sampled area tended to be thoroughly mixed, resulting in similar water quality conditions regardless of depth or location. This brought on the question of how frequently did the storms and northerly wind events occur. The wind and meteorological findings are summarized in Section 7.2.2.

7.2.2. Frequency of Storm and Wind Events

As reported in Section 7.2.1, the water qualities of all sampled locations appeared to be the same during storm and wind events. As such, it was important to determine the number of such events during a typical year.

Operators of Picton WTP and from the sampling report noted that the water quality significantly deteriorated when strong winds (e.g. 20 km/hr and higher) came from the North, West and Northwest direction.

Although Picton did not have specific meteorological wind information available, nearby Adolphustown (12 km NE of Picton, in a similar part of Picton Bay) experienced predominant northerly, northwesterly, or westerly winds 50% of the time in 2011. This predominantly happened between Jan to March, and Oct to December. It was also noted that there were 2-16% chance of strong winds (20km/hr and greater) during those months. Therefore, approximately 8% of the year (16% of 50%) had conditions of both high winds from the North, Northwest or West direction to stir up the lake and cause poor water quality. Information gathered from meteorological and wind mapping websites for Adolphustown is available in Appendix K and summarized in Table 7.3 below

Table 7.3: Predominant Wind Direction for Adolphustown Area (Picton)

Month	Probability of Wind Speed > 20km/hr (%)	Predominant Wind Direction							
		N	NE	E	SE	S	SW	W	NW
Jan	2							1	
Feb	14							1	
Mar	11								1
April	16				1				
May	2				1				
Jun	2					1			
July	0					1			
Aug	1					1			
Sept	1					1			
Oct	7							1	
Nov	8								1
Dec	16							1	
	Total	0	0	0	2	4	0	4	2
	% of Occurrence	0	0	0	17	33	0	33	17

It was interesting to note that the wind direction during the high tourist season (April – Sept) was predominantly South to Southeast. When winds came from this direction, it did not cause the same lake stirring effect as the Westerly and Northwesterly winds, and as such, the deeper and further out areas would have improved water quality compared to the existing intake. This was important for tourists, who may otherwise be deterred from returning to the area due to poor water quality.

Although there may be approximately 8% of the year when the weather effects will stir up the lake and cause similar water quality throughout Picton Bay, it also means that for 92% of the time, having the new intake at a further distance from the WTP and in greater depths may provide improved water quality in the absences of wind/weather impacts.

7.3. Boat Traffic

Another factor that may impact water quality, aside from storm and wind events, was boat traffic. Motor boats and other crafts may stir up the water and silt in shallow areas of the bay when passing, therefore negatively affecting the water quality nearby.

Since the Picton WTP was close to Picton Harbour, which was an active harbor for sailboat, leisure yachts and fishing boats, there was significant boat traffic in the area near the existing intakes.

There were also numerous privately owned docks along the shoreline on either side of Picton Bay, particularly on the east side along Loyalist Parkway. Homeowners often took their own boats and canoes out in the shallow water.

Located to the north of Picton WTP, approximately 2.3 km and 3.5 km away, were the Port Hallowell Salt Docks and Essroc Concrete Dock. Cargo ships were known to dock at those locations for transportation of industrial material. Although these larger vessels did not travel close to the existing intakes, these navigation routes impact the decision on where the new preferred intake location was, particularly for the further out intake options.

There was also a popular anchoring spot at Hallowell Mills Cove, south of the Port Hallowell Salt Docks. Local fishing boats frequented this Cove due to the favorable sand shoal.

Figure 7.1 was an estimate of frequently used boating areas. The more active areas were shown in a brown shade.

Although there was no particular area in Picton Bay where a boat would never be found, it was best for the new intake to avoid locations of heavy boat traffic for improved water quality.

In addition, avoiding areas of heavy boat traffic may protect the new intake from unsuspecting boaters from dropping their anchors around the intake and damaging the intake structure and pipe.

Possible intake locations such as “C” appeared to be in a good location, as they may experience less boat traffic.

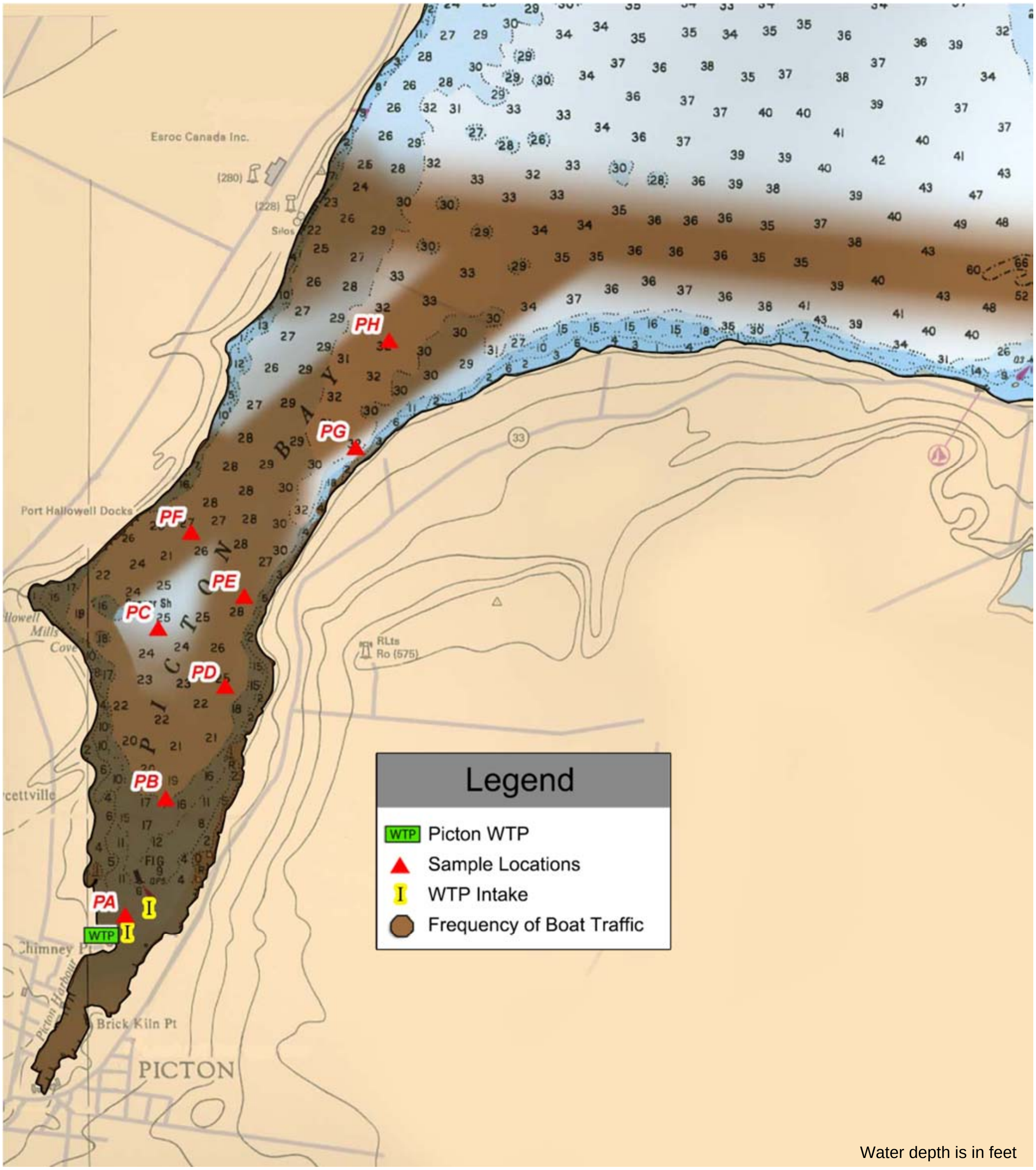


Figure 7.1: Estimated Frequent Boat Traffic Areas in Picton Bay

7.4. Proximity to Contaminant Sources

7.4.1. Storm Outfalls, Drainage Ditch and Creeks

The 2009 Intake Protection Zone Delineation and Vulnerability Assessment Study for the Picton Water Treatment System noted that there were 10 visible storm outfalls, drainage ditches and various creeks that fed into the Picton Bay area. These sites were potential transportation pathways of silt and contaminants to the existing Picton intakes. These interceptors cause a large section of the Town of Picton to be included in the existing intakes' IPZ-2 region.

Operators of Picton WTP noted that seasonal run-off from Mosquito Creek, located in close proximity to the existing Picton WTP intakes; resulted in high turbidity in the raw water. This posed problems for the operation of the filters.

Marsh Creek was located at the end of Picton Harbour. The Picton Wastewater Treatment Plant (Picton WWTP) outfall discharged into Marsh Creek.

Figure 7.2 showed the location of these sited storm outfalls, drainage ditches and creeks with reference to the existing intakes and potential new intake locations.

The preferred new intake location should be chosen to avoid or minimize the effects of these transportation pathways. Possible intake locations such as B, D and E were quite close to the existing storm outfalls and should be avoided. Locations such as C and F were further away from the contaminant sources.

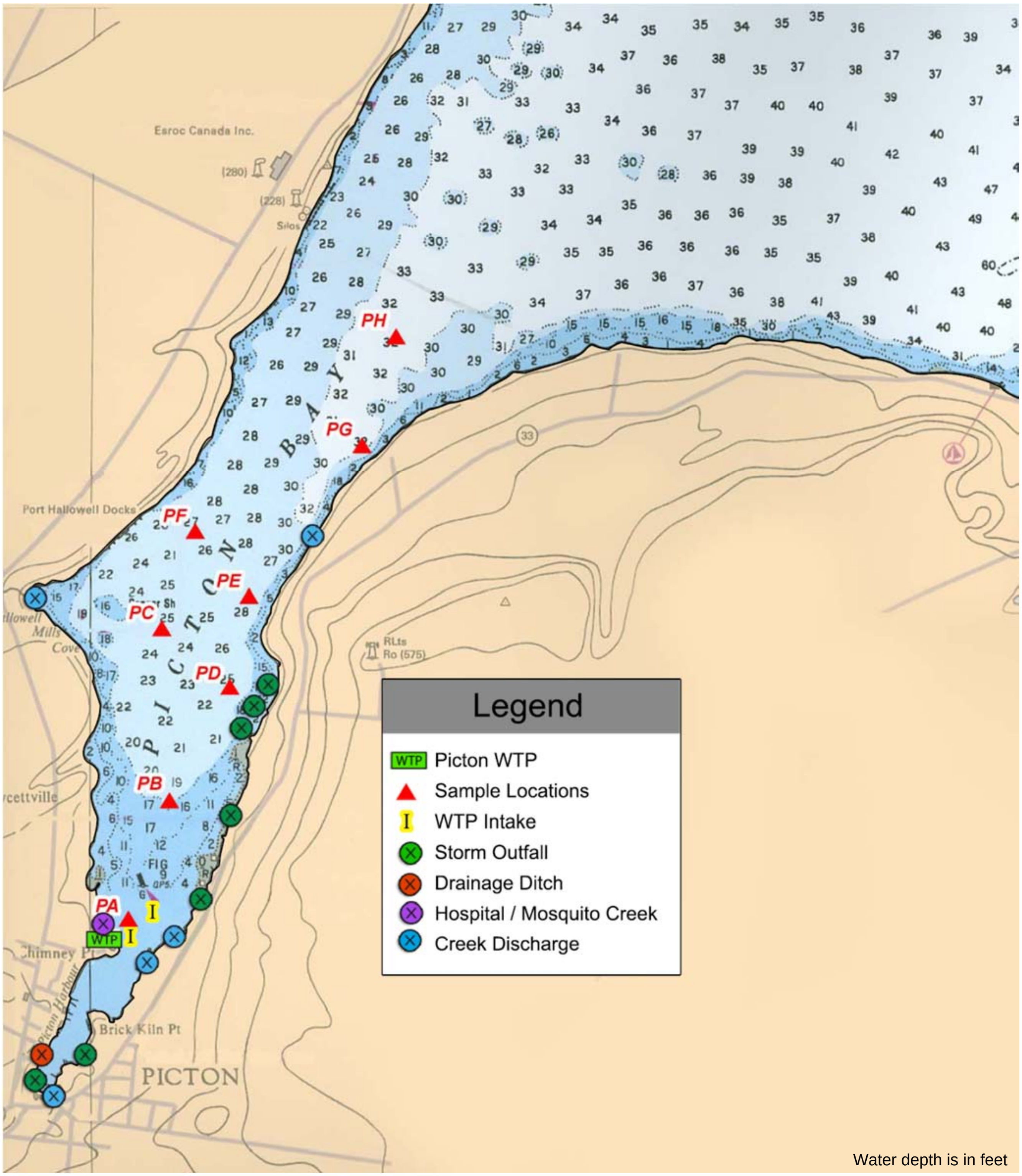


Figure 7.2: Location of Potential Contaminant Transportation Pathways

7.4.2. Aerial Photographs of Plumes

Three historic aerial photographs of the Picton Harbour were found during this study which showed that various areas were susceptible to plumes or disturbances. Although the sources of the plumes or disturbances were unknown, it was best to avoid these locations when selecting the preferred new intake location.

The first aerial photo was taken from the National Air Photo Library's (NAPL) July 1995. Figure 7.3 showed an overlay of this plume/disturbance over Picton Bay, with reference to its location, relative to the existing and possible intake locations. As the figure evidently showed, the existing intakes of the Picton WTP were in the midst of the plume (indicated in blue).

The second aerial photo was taken from the Ministry of Transportation (MTO) April 2005 aerial photo archive. Figure 7.4 showed an overlay of the plume/disturbance over Picton Bay with reference to its location relative to the existing and possible intake locations. As the figure evidently showed, the existing intakes of the Picton WTP are in the midst of the plume (indicated in maroon).

The third aerial photo was also taken from the Ministry of Transportation (MTO) April 2005 aerial photo archive. Figure 7.5 showed an overlay of another plume/disturbance over Picton Bay with reference to its location relative to the existing and possible intake locations. As the figure shows, the existing "North" intake was in the midst of the plume (indicated in purple), while the existing south intake just missed the plume. However it was uncertain whether or not the south intake was still impacted by the plume as it moved through the area.

Figure 7.6 showed an overlay of the above three plumes/disturbances over Picton Bay and the existing and possible intake locations to see the cumulative affected area of the plumes or disturbances noted in the available aerial photos.

Although there may have been other plumes or disturbances in Picton Bay that were not captured by the available aerial photos, the three aerial photos available confirmed that the existing intakes location was an area that is frequently visited by the plumes or disturbances. This also helped to indicate potential areas to avoid for the new intake.

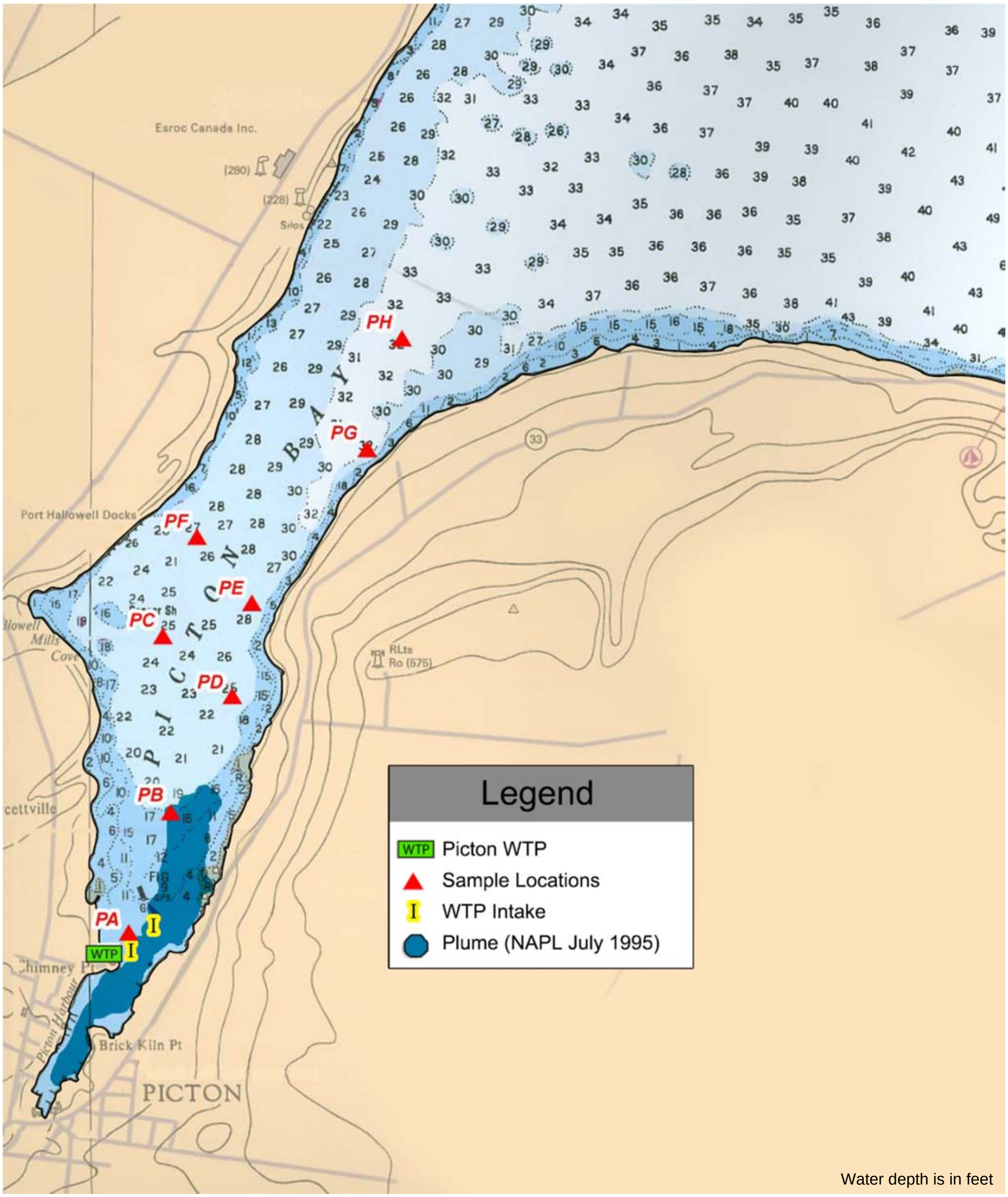


Figure 7.3: NAPL (July 1995) Aerial Photo Plume Overlay on Picton Bay Area with Existing and Possible Intake Locations

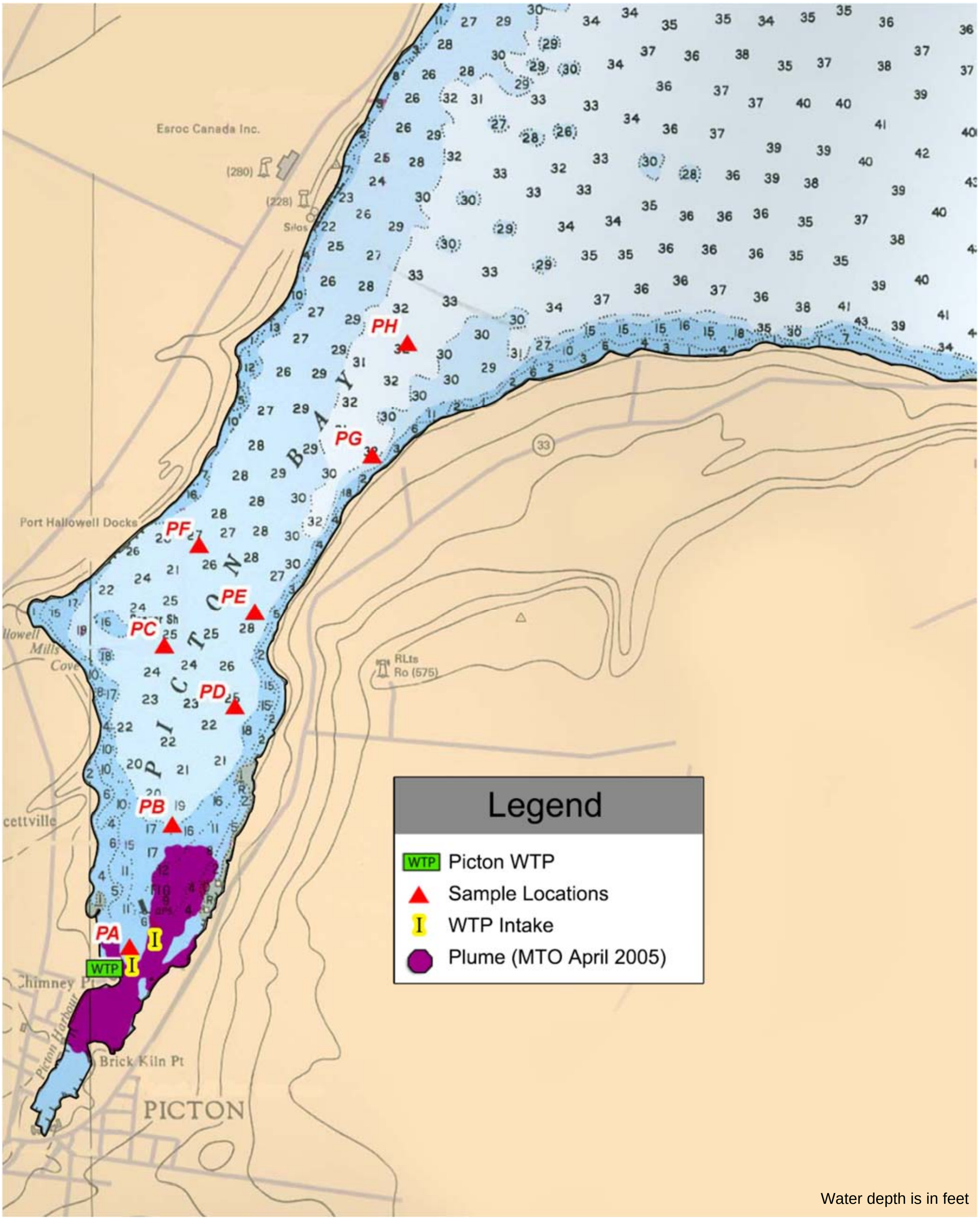


Figure 7.4: MTO (April 2005) Aerial Photo Plume Overlay on Picton Bay Area with Existing and Possible Intake Locations

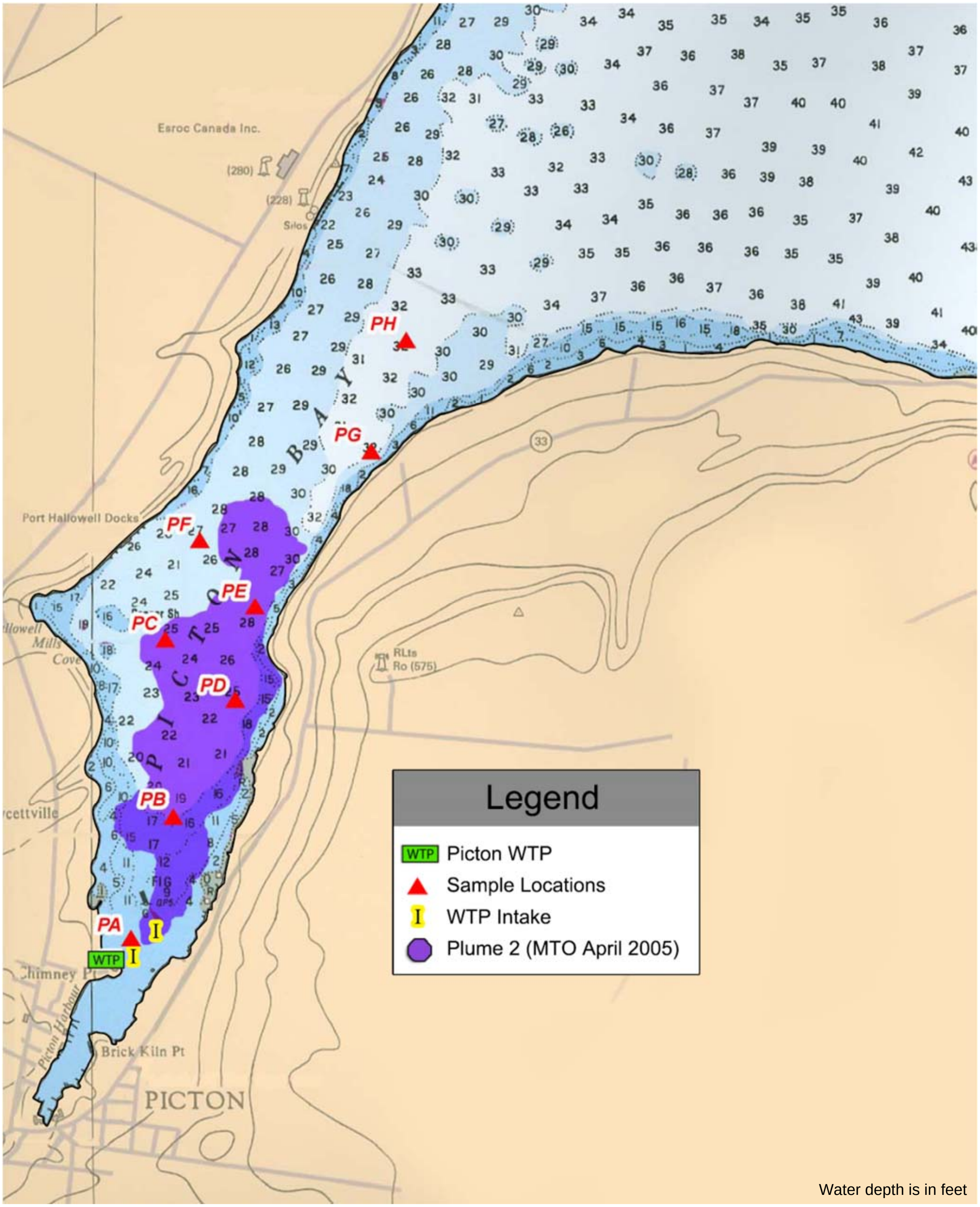


Figure 7.5: MTO (April 2005) Aerial Photo Plume Overlay on Picton Bay Area with Existing and Possible Intake Locations

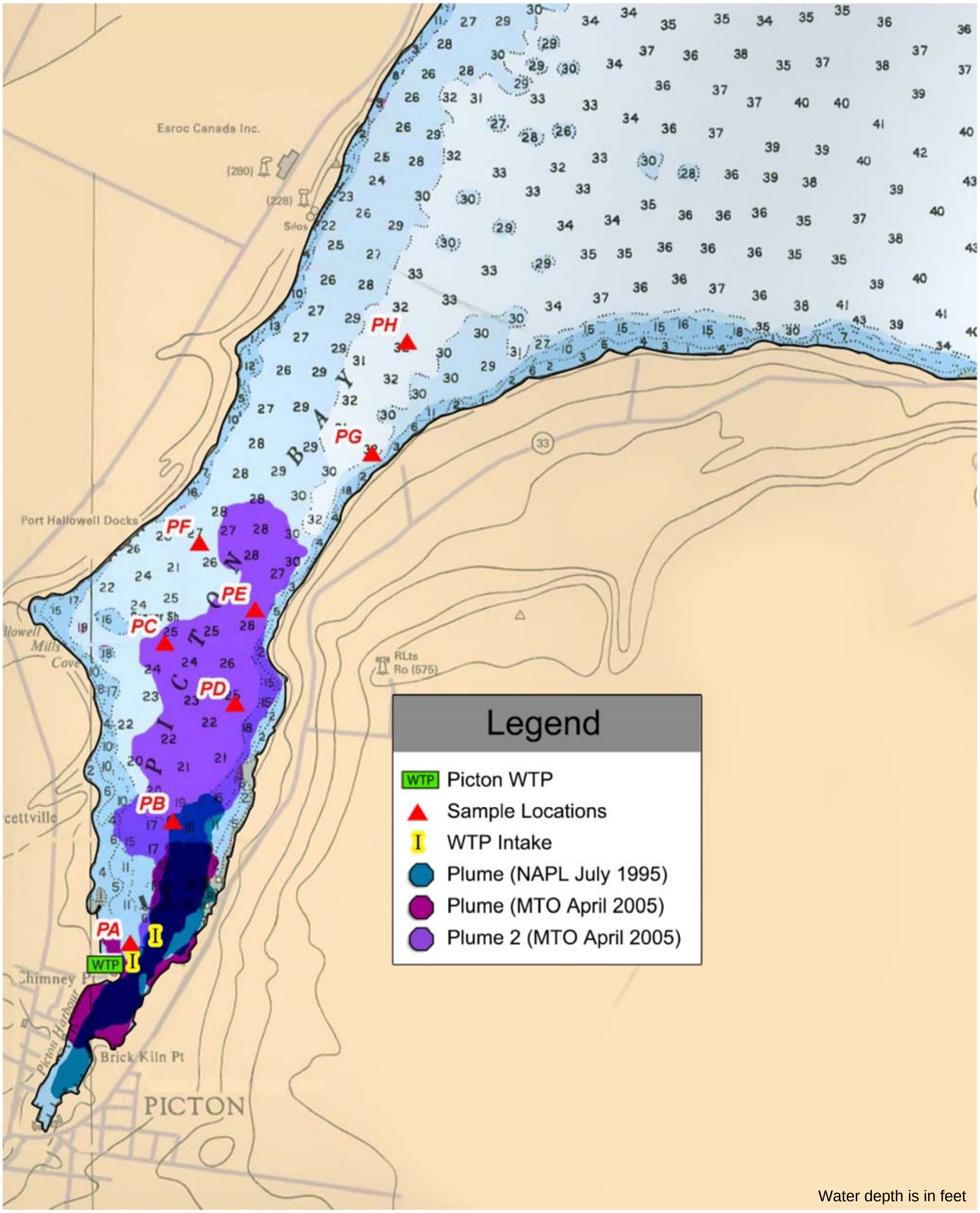


Figure 7.6: Overlay of plumes/disturbances from MTO (April 2005) and NAPL (July 1995) Aerial Photos on Picton Bay Area with Existing and Possible Intake Locations

7.5. Overview of Water Quality Factors

Figure 7.7 presented a compilation of the factors presented in Sections 7.3 and Section 7.4 (contaminant discharges, boat traffic, and plumes/disturbances).

From this figure, it would appear that locations C, F, G and H were prime areas for the new intake based on the previously discussed water quality factors.

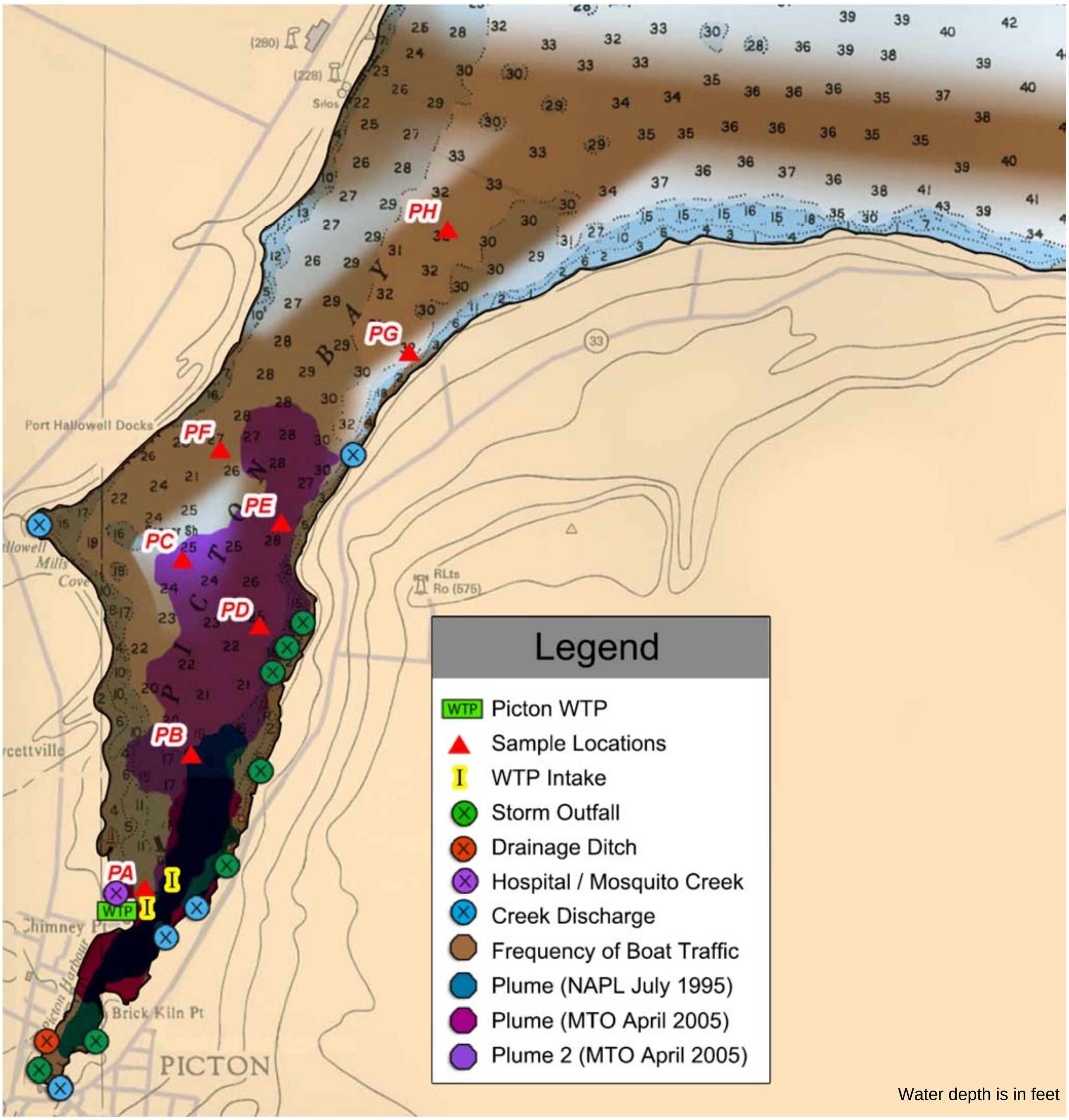


Figure 7.7 Overlay of Factors Contributing to Water Quality on Existing and Possible Intake Locations

7.6. Sizing and Cost Comparison of New Intake Pipe

The construction of the new intake project would include the following items:

1) New raw water well, complete with isolation gates and interconnecting pipe
2) Valve/isolation chamber, complete with new isolation valves for existing intake pipes
3) New intake pipe, complete with intake structure, sampling line and chemical lines for zebra mussel control

However, in determining the preferred new intake location based on construction cost, the only variable amongst the various intake locations was the distance, since the same infrastructure would be required for all new intake options.

Based on the Ministry of Environment guidelines for new intake pipes and from the preliminary hydraulic calculations, the intake pipes should be oversized to account for future water demands. The recommended intake pipe diameter and associated material cost were as presented in Table 7.4.

Table 7.4: Recommended Intake Pipe Size Based on Pipe Distance

Distance (m)	Possible Intake Locations	Min. Pipe Diameter (mm)	Cost of HDPE Pipe ($/m) in 2011
1000-1300	B	650	$206.39
1400-1900	C, D	700	$238.43
2000-2600	E, F	750	$271.86
2600-3500	G, H	800	$299.45

The construction cost of the raw water well, isolation/valve chamber and intake structure would be the same for all intake locations and was approximately $850,000.

Table 7.5 summarized the preliminary total construction cost estimate for the possible intake locations. The preliminary labour cost estimate was based on 2011 costs from a specialized intake contractor (McNally Construction Limited). The labour cost did not include disposal or remediation of any contaminated sediment. The total cost estimate included a 15% construction contingency amount.

Table 7.5: Preliminary Construction Cost Estimate for the Possible Intake Locations

New Intake Location	Distance (m)	HDPE Pipe Diam. (mm)	Estimated Intake Pipe Material Cost	Estimated Intake Pipe Labour Cost	Common Works Cost	Total Estimated Construction Cost (with 15% contingency)
B	1000	700	$0.2M	$3.0M	$0.8M	$4.5M
C	1700	750	$0.4M	$4.8M	$0.8M	$6.8M
D	1500	750	$0.4M	$4.5M	$0.8M	$6.4M
E	2000	800	$0.5M	$5.3M	$0.8M	$7.5M
F	2300	800	$0.6M	$5.7M	$0.8M	$8.1M
G	3000	900	$0.9M	$6.8M	$0.8M	$9.6M
H	3500	900	$1.0M	$7.5M	$0.8M	$10.7M

8.0 PREFERRED INTAKE LOCATION

8.1. Decision Matrix for Intake Location

To help evaluate the various criteria for the preferred intake location as outlined in Section 6, a weighted decision matrix was presented in Table 8.1 for all options, including the Status Quo/Do Nothing option.

The decision matrix compared and ranked all intake locations (including the existing intake location) to each other on specific criteria. The criteria were sediment and water quality from the field monitoring program, water quality from boat traffic and proximity to contaminant sources, and construction cost). The rankings were:

1. The lowest ranking (with a score of 1 out of 3) was shaded in red, which represented locations that performed poorly or comparatively worse in the specific criterion

2. The moderate ranking (with a score of 2 out of 3) was shaded in yellow, which represented locations that performed on average in the specific criterion

3. The highest ranking (with a score of 3 out of 3) was shaded in green, which represented locations that performed well or above average in the specific criterion

Each alternative was then given a final score based on the sum of each criteria's weighting multiplied by the level of impact score (out of 3) for that criteria. The alternative with the highest final score would represent the preferred alternative.

Table 8.1: Decision Matrix for Preferred Intake Location in Picton Bay

		Intake Locations							
Criteria	**Proposed Criteria Weighting (%)**	**Location 'PA' (Do Nothing) 200m long 2.5m deep**	**Location 'PB' 1000m long 6m deep**	**Location 'PC' 1700m long 7m deep**	**Location 'PD' 1500m long 7m deep**	**Location 'PE' 2000m long 8m deep**	**Location 'PF' 2300m long 8m deep**	**Location 'PG' 3000m long 9.1m deep**	**Location 'PH' 3500m long 9.8m deep**
Sediment Quality	5%	Fair - high Mercury concentration, but below SEL	Fair – heavy metal LEL exceedances; but below SEL	**Fair – heavy metal LEL exceedances; but below SEL**	Fair – heavy metal LEL exceedances; but below SEL	Fair – heavy metal LEL exceedances; but below SEL	Fair – heavy metal LEL exceedances; but below SEL	Fair – heavy metal LEL exceedances; but below SEL	Fair – heavy metal LEL exceedances; but below SEL
Water Quality	25%	Poor - many contributing factors	Poor - many contributing factors	**Fair – unless strong N/NW wind event occurred, in which case there were uniformly poor water quality at all locations**	Fair – unless strong N/NW wind event occurred, in which case there were uniformly poor water quality at all locations	Fair – unless strong N/NW wind event occurred, in which case there were uniformly poor water quality at all locations	Fair – unless strong N/NW wind event occurred, in which case there were uniformly poor water quality at all locations	Fair – unless strong N/NW wind event occurred, in which case there were uniformly poor water quality at all locations	Fair – unless strong N/NW wind event occurred, in which case there were uniformly poor water quality at all locations
Improvement to IPZ Vulnerability	25%	Low	Low	**Moderate**	Low	Low	Moderate	High	High
Socio/ Construction Impacts	10.0%	Moderate - does not allow for intake renewal and future growth	Moderate - possible impact on business & residents during short in-water construction	**Moderate - likely impact to local anchoring point, possible impact on business & residents during short in-water construction**	High - likely impact on residents nearby and recreational/fishing businesses during short in-water construction	High - likely impact on residents nearby and recreational/fishing businesses during short in-water construction	Moderate - possible impacts on Salt Docks transportation during short in-water construction	High - likely impacts on residents nearby and recreational/fishing businesses during short in-water construction	High - likely impacts on Essroc, Salt Docks, business & residents during short in-water construction
Environmental Impacts	10.0%	Low – no construction upgrades. However site is close to Northern Map Turtle basking area	Moderate - temporary impacts during construction of intake pipe	**Moderate - temporary impacts during construction of intake pipe**	High - Location of intake pipe in area of popular fish habitat	High - Location of intake pipe in area of abundant aquatic vegetation and popular fish habitat	High - Longer duration and area of impact due to distance of intake pipe	High - Longer duration and area of impact due to distance of intake pipe	High - Longer duration and area of impact due to distance of intake pipe
Construction Costs	25%	$0M	$4.4M	**$6.8M**	$6.4M	$7.5M	$8.1M	$9.6M	$10.6M
	Score for Options (out of 3)	1.85	1.5	**2**	1.55	1.55	1.65	1.8	1.8
	Preferred Option in Percentage	62%	50%	**67%**	52%	52%	55%	60%	60%

Legend:	Least Negative Impact (Score 3)	Moderate Negative Impact (Score 2)	Highest Negative Impact (Score 1)

8.2. Preferred Intake Location – Location "PC"

Based on the decision matrix in Table 8.1, it could be concluded that the preferred location for the new intake was Location 'PC', approximately 1700m north of the existing Picton WTP, at lake bottom depth of 7m.

From the sediment testing results and correspondence with the MOE, Location 'PC' was not considered as having pre-existing sediment contamination. All tested sediment criteria were below the Provincial Sediment Quality Guidelines Severe Effects Level (SEL).

The water quality of Location 'PC' showed improvement compared to the existing intake location due to its distance from Picton Harbour, the infrequent boat traffic, distance from potential transportation pathways of storm outfalls, drainage ditches and creeks. However it should be noted that during Northerly wind events, which stir up the entire area and depths of Picton Bay, the water quality of all evaluated locations were similarly poor.

A new IPZ delineation, vulnerability scoring and quantitative evaluation of the number of significant drinking water threats was completed based on the scenario of a new intake at Location 'PC'. As shown in Table 8.2, there was slight improvement in the new IPZ vulnerability scoring compared to the existing intake IPZ and there was dramatic decrease in the number of significant drinking water threats.

Table 8.2: Comparison of Picton Intake Vulnerabilities and Threats

Comparison Area	**Existing Picton Intakes**	**Proposed "New" Picton Intake (at Location 'PC')**
IPZ-1 Vulnerability Score	10	9
IPZ-2 Vulnerability Score	9	Within IPZ-1
IPZ-3a Vulnerability Score	8	7.2
IPZ-3b Vulnerability Score	6	4.5
Enumerated Significant Threats – Activities	20	2
Affected Parcels+ – Activities	60	2
Enumerated Significant Threats – Conditions	1	0
Affected Parcels+ - Conditions	1	0

+ "Affected parcels" represent the properties/parcels of land on which a specific drinking water threat/activity may be taking place. Some parcels may have more than one such activity on-site. The Source Water Protection Regulation applies certain restrictions/conditions on the activities of these properties due to the location of the intake.

The technical memorandum "Assessment of Proposed Intake Replacement for Picton WTP" dated August 9, 2012 details how the new IPZ vulnerability scoring and significant threats were evaluated. This report is located in Appendix L. Note that the technical report is a preliminary investigation based on information collected from previous threats identified during the original IPZ assessment. A formal IPZ assessment will need to be completed on the actual new intake location during detailed design and approval stage. The formal IPZ assessment will then undergo a review and approval process by the Ministry of Environment.

The cost for the material and labour of putting down an intake pipe out to Location 'PC' was in the middle price range and a good compromise for getting a new intake out in further and deeper waters without the prohibitive costs of a longer intake pipe.

It may be beneficial to move Location 'PC' slightly north to avoid the plume/disturbance captured by the MTO April 2005 aerial photo and the boat traffic near Hallowell Mills Cove. The relocated Location 'PC' is denoted as 'PC*' in Figure 8.1. The exact location of the new intake pipe would be evaluated in detail during the detailed design stage.

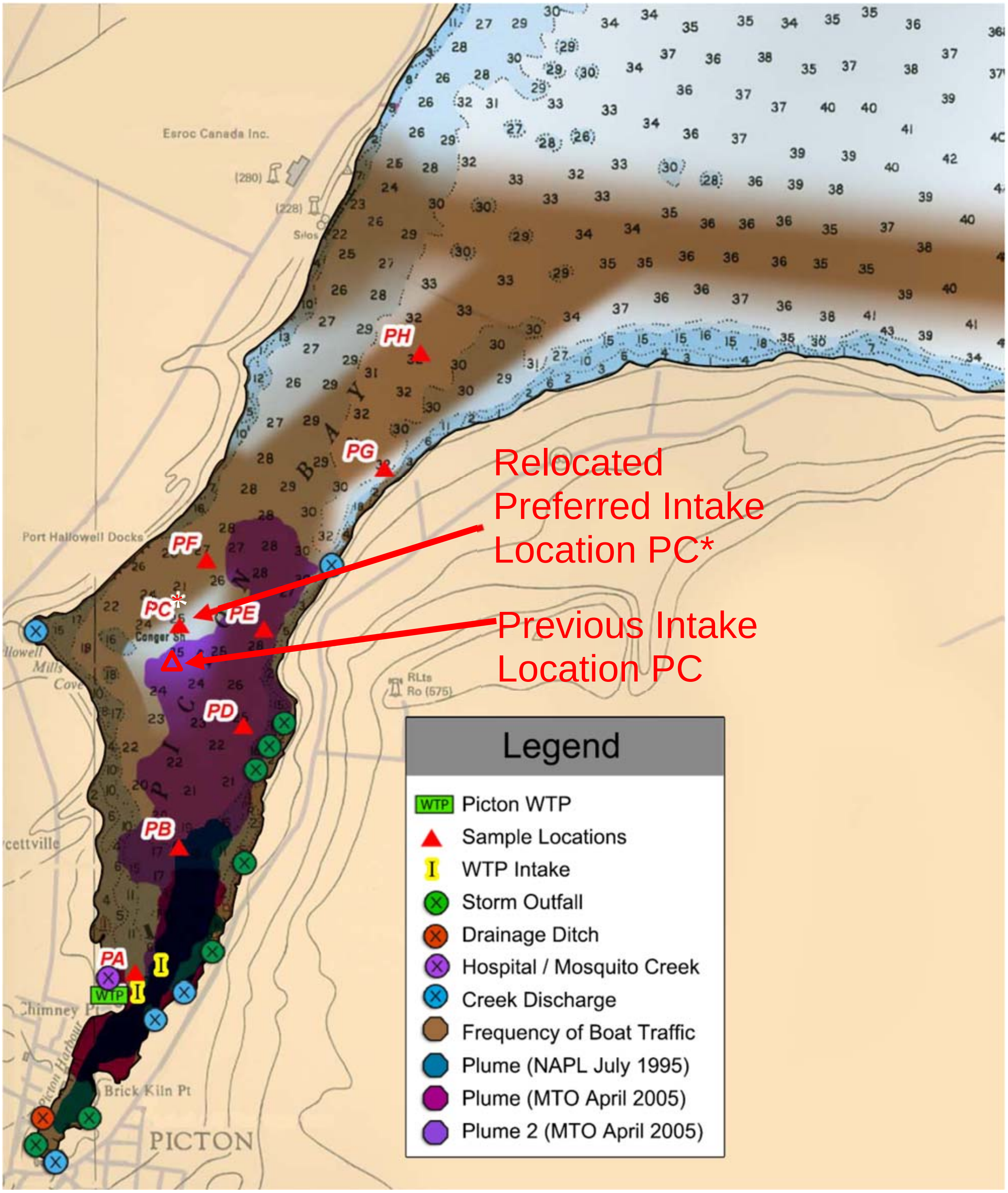


Figure 8.1: Overlay of Factors Contributing to Water Quality on Existing, Preferred and Possible Intake Locations (Preferred New Intake Location is denoted as PC*)

9.0 STEP 3 - PREFERRED INTAKE PIPE ROUTING

With the preferred intake location selected in Section 8, the next step was to determine the preferred intake pipe routing from the Picton WTP out to the selected location. The decision would be based on socioeconomic and environmental impacts, technical and cost factors.

9.1. Intake Pipe Routing Options

There were three possible intake pipe routings identified as summarized below and shown in Figure 9.1:

- Option 1 – In-water intake pipe between WTP and new intake structure location
- Option 2 – A short in-water intake pipe between the new intake structure and a new raw water pumping station by County Rd 49. A 2,400m long raw watermain along County Rd 49 to Picton WTP.
- Option 3 – A short in-water pipe between the new intake structure and a new raw water pumping station by Loyalist Parkway. A 2,500m long raw watermain along Loyalist Parkway, with connection to a short in-water pipe across the harbor to the Picton WTP.

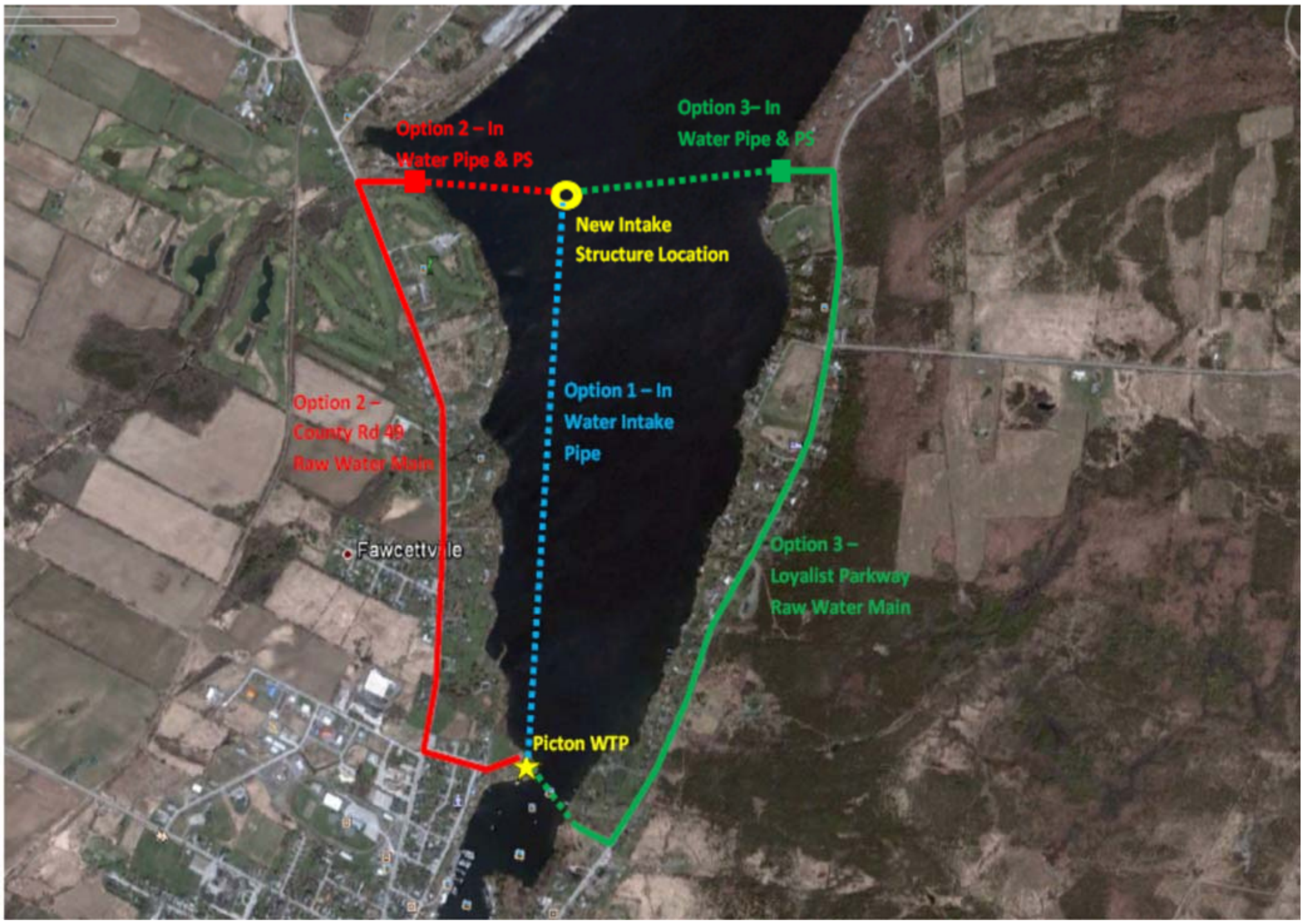


Figure 9.1: Alternative Routing of Intake Pipe from WTP to Preferred Intake Location

9.2. Socioeconomic Impacts

Although the socioeconomic impacts of the intake project would be temporary and only occur during the construction stage, it was important to consider these factors and choose an option with minimal socioeconomic impacts as they affect crucial stakeholders such as the public and local businesses. The following factors were evaluated:

- Disruptions/limited road access
- Disruptions to businesses/commercial/industrial
- Disruptions to residents
- Disruptions to boat traffic/navigation ways and recreational activities
- Requirement and difficulty of land acquisition

9.2.1. Disruptions/Limited Road Access

The options with an inland component (e.g. Options 2 and 3) would have substantial disruptions to roads and limited road access would occur during the construction of the raw watermain component.
Both inland options require a raw watermain, approximately 2,400-2,500 m long, along major arterials for the Town of Picton.

Option 2, with the raw watermain running along County Road 49, was of particular concern as the road was a popular single lane roadway between Highway 401 and the Town of Picton. County Road 49 was frequently used by trucks and tourists traveling to the Picton area. Depending on the geotechnical properties in the area, directional drilling, rather than open-cut method, may be a construction alternative to minimize the impact.

Option 3, with a raw watermain running along Loyalist Parkway (also known as Hwy 33), was also a single lane road which travels from Picton to the Glenora Ferry and other key tourist locations, such as Lake on the Mountain. The Glenora Ferry was used by local residents and tourists to commute between the Picton area to the Adolphustown area and beyond. Depending on the geotechnical properties in the area, directional drilling, rather than the open-cut method, may be a possible construction method to minimize the impact.

9.2.2. Disruptions to Businesses/Institutions

Although all routing options would have temporary disruptions to various businesses and institutions during the construction stage, some options would have greater and longer impacts than others.

Option 1, which consisted of a 1,700 m long in-water intake pipe from the WTP out to Picton Bay, may impact tourism during the short in-water work period from July to September. Approximately 150 m x 1,700 m area north of the WTP would be sectioned off and restricted for construction of the intake pipe in water. Although the restricted area was outside of the popular walleye fishing area, it may still impede certain fishing and boating activities.

Option 2, which had a raw watermain along County Rd 49, may cause disruptions and limited access to the Quinte Health Care Prince Edward County Memorial. It may also impact businesses such as Essroc, the Salt Docks and the popular Picton Golf & Country Club. Limiting access to the Town of Picton via County

Rd 49 may also affect tourist driven businesses in town. Various construction methods may be considered to minimize this impact.

Option 3, which required a raw watermain along Loyalist Parkway, would cause disruptions to the many tourism driven businesses located along the roadway. These include inns, Bed & Breakfast lodges, boat rentals, arts & craft stores. It would also restrict access to the Glenora Ferry, Lake on the Mountain and other conservation areas, which were popular tourist destinations. Various construction methods may be considered to minimize this impact.

9.2.3. Disruptions to Residents

Option 1, with the in-water intake pipe, may have restricted access to certain parts of Picton Bay during its short in-water construction period from July to September. Although the intake pipe location was not close to the shoreline and residents' docks, the restricted area may still cause minor disruptions to local residents with water lots.

Option 2, with the raw watermain along County Rd 49, may cause disruptions to residents with property along County Rd 49 or that use the road to travel into and out of Picton. Delays and lane closures may be expected during the 2,400 m long raw watermain work sometime between spring to autumn. Various construction methods may be considered to minimize this impact.

Option 3, with the raw watermain along Loyalist Parkway, would cause disruptions to residents with property along this route and for residents who used the Glenora Ferry to commute to and from the eastern areas of Adolphustown and beyond. Delays and lane closures may be expected during the 2,500 m long raw watermain work sometime between spring to autumn. Various construction methods may be considered to minimize this impact.

9.2.4. Disruptions to Boat/Navigation Ways

Option 1, which consisted of a 1,700 m long in-water intake pipe from the WTP out to Picton Bay, would impact boat traffic and navigation ways from July to September. Approximately 150 m x 1,700 m area north of the WTP would be sectioned off and restricted for construction of the intake pipe in water. Although the restricted area would not interfere with access into and out of Picton Harbour, it may still impede boating and recreational activities.

Option 2 consisted of a raw watermain along County Rd 49, pumping station and a short 700 m in-water intake pipe. The short in-water intake pipe may impact boating and recreational activities and navigation ways for the popular anchoring point at Hallowell Mills Cove. It may also hinder navigation for the Salt Docks and Essroc.

Option 3 had two sections of in-water intake pipes, approximately 200 m and 700 m in length, as shown in Figure 9.1. The 200 m in-water pipe would connect between the Picton WTP raw water well and the raw watermain on the southern portion of Loyalist Parkway. The 700 m in-water pipe will connect between the intake structure in Picton Bay and the raw water pumping station connected to the Loyalist Parkway raw watermain. Boating and recreational activities and navigation ways would be significantly impacted during the 200 m intake pipe installation as it would restrict access into and out of Picton Harbour, despite the short installation period. The 700 m intake pipe may impede boating and recreational activities and navigation ways for the Salt Docks and neighboring residents with docks.

9.2.5. Requirement and Difficulty of Land Acquisition

Both Options 2 and 3 would require land acquisition for the raw water pumping station (PS) that would be located off-site from the Picton WTP.

Option 2, which would require a PS and raw water well on the west side of Picton Bay, may have difficulty acquiring land as the interested area consists of the Picton Golf and Country Club and privately owned property. The property to the north of that area was owned and operated by the Salt Docks. It was uncertain if any of those parties would be interested in leasing the land to the County for a small pumping station.

Option 3 would require a PS and raw water well on the east side of Picton Bay. Most of the land along the east side consisted of privately owned properties. There were a few vacant or un-built areas. Topography of the land may be a concern as there could be some drastic slope from the roadway to the Bay.

9.3. Environmental Impacts

The environmental impacts of the three routing options were also considered in terms of short term and long term effects on aquatic and terrestrial wildlife, vegetation and habitat. Bowfin Environmental Consulting Inc. (Bowfin) conducted desktop and field visits of the area and their report is located in Appendix M.

No significant wetlands or Area of Natural and Scientific Interests (ANSIs) were observed in the areas of interest.

Option 1, which had the longest in-water intake pipe amongst the routing options, may temporarily affect the near shore fish habitat and aquatic vegetation by Picton WTP's Chimney Point. Mitigation measures would be undertaken and timing windows would be observed during construction to minimize the impact on aquatic wildlife and vegetation if this option was chosen.

An environmental protection area was listed within 80 m of Option 2 (along the western shore). Terrestrial habitats may be affected by the 2,400 m long raw watermain along County Rd 49. Different watermain installation methods, restrictions on certain construction activities and timing window may be used to help minimize the impact of this option.

There were a few environmental items of concern for Option 3. In terms of endangered or threatened species, two butternut trees were observed along the east side of Loyalist Parkway. Also, the short in-water intake pipe from the Picton WTP to Loyalist Parkway would require work around Chimney Point and across the harbor. The Chimney Point area was noted as having diverse aquatic vegetation and being a fish habitat. The harbor area was noted as a significant wildlife habitat due to the favourable basking conditions for the northern map turtle. Various construction methods and restriction on construction window and activities may be helpful to minimize the impact of this option.

Figure 9.2 and Figure 9.3, taken from the Natural Environment Impact Assessment Report in Appendix M, identified the aquatic and terrestrial habitat in the areas of routing Options 1, 2 and 3.

Figure 9.4 identified locations of Northern Map Turtle sightings, popular fishing spots and the location of the Butternuts, which were a species of concern.

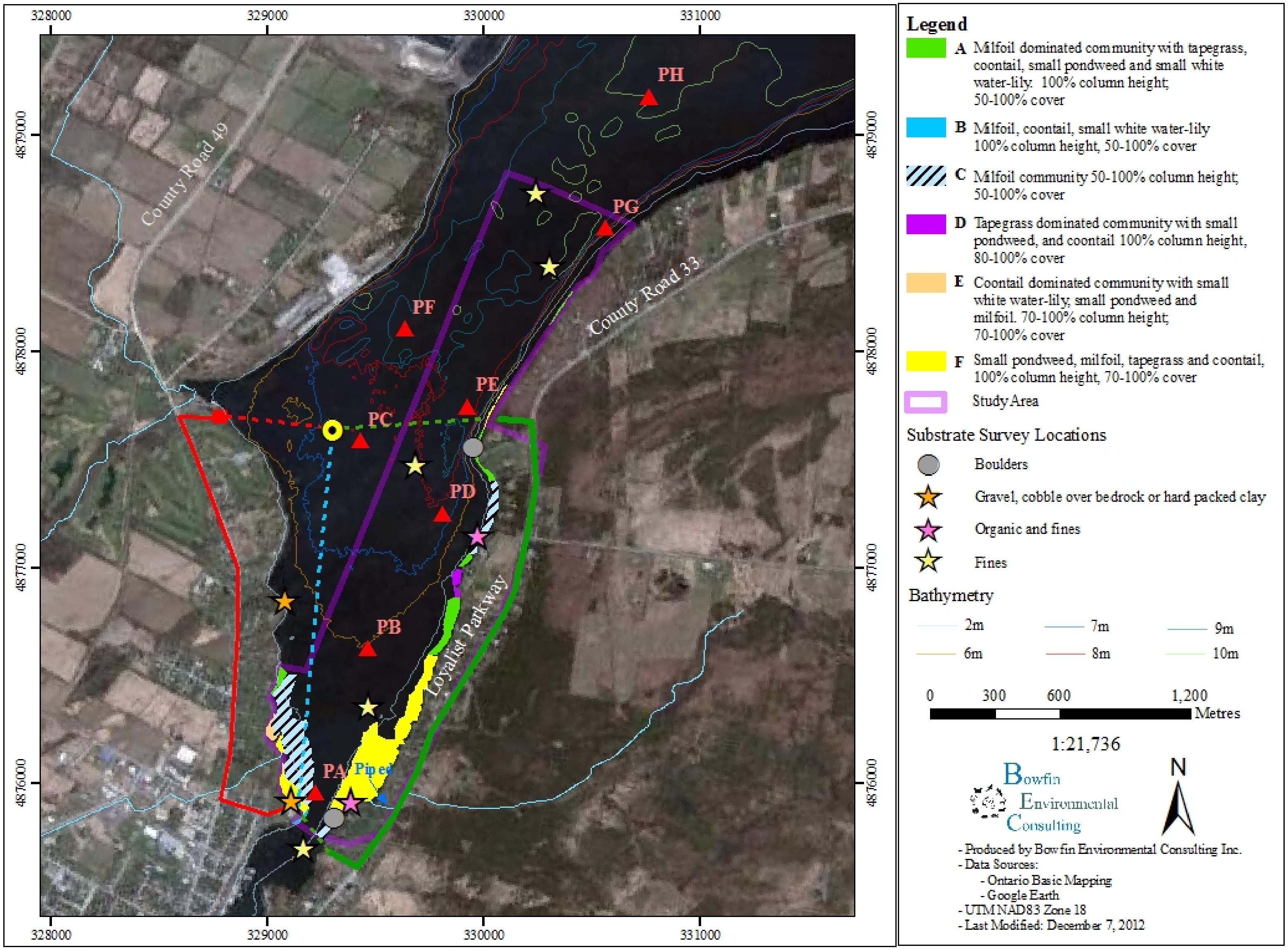


Figure 9.2: Aquatic Habitat Mapping Near Intake Pipe Routing Options

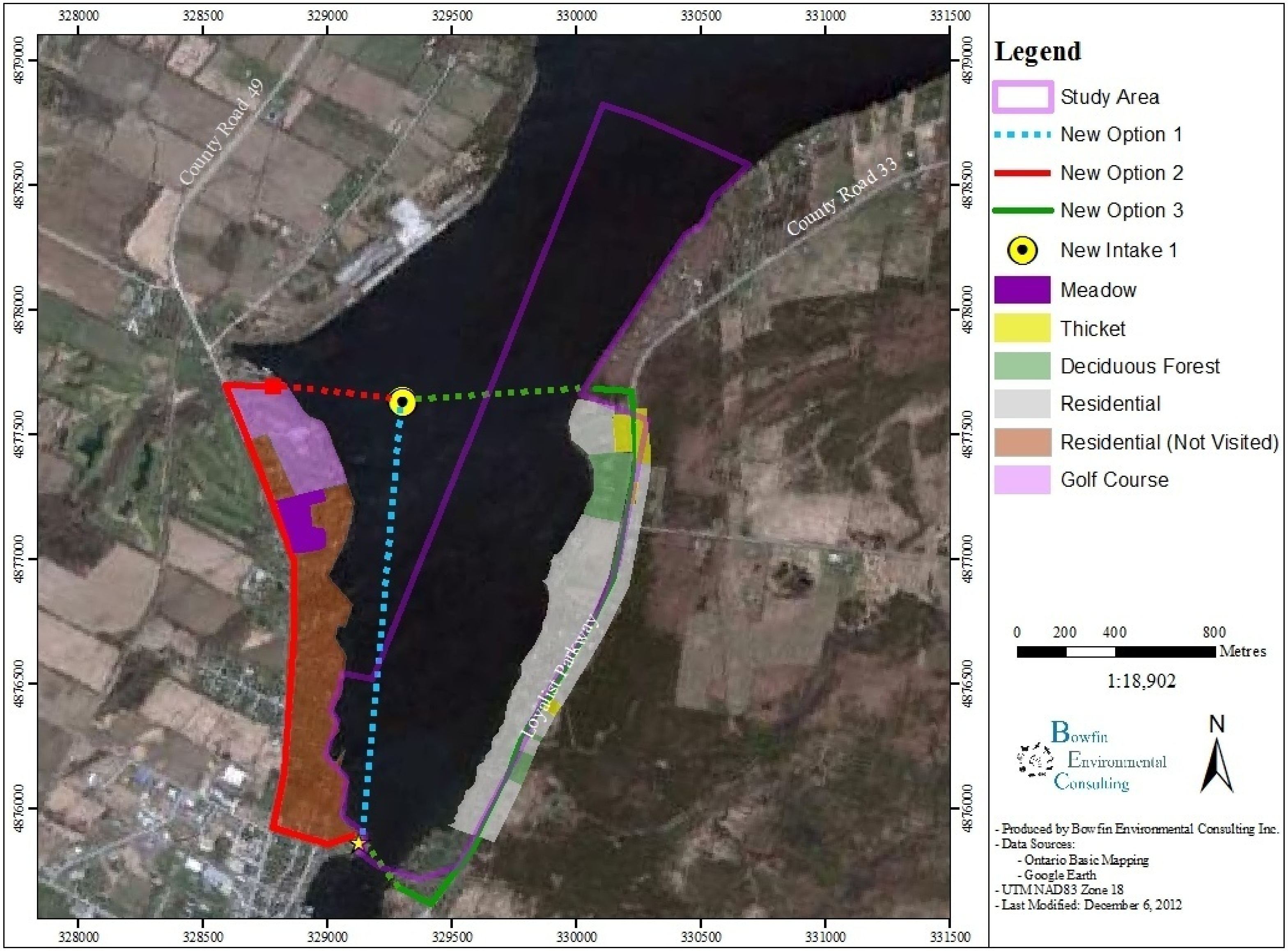


Figure 9.3: Terrestrial Habitat Mapping Near Intake Pipe Routing Options

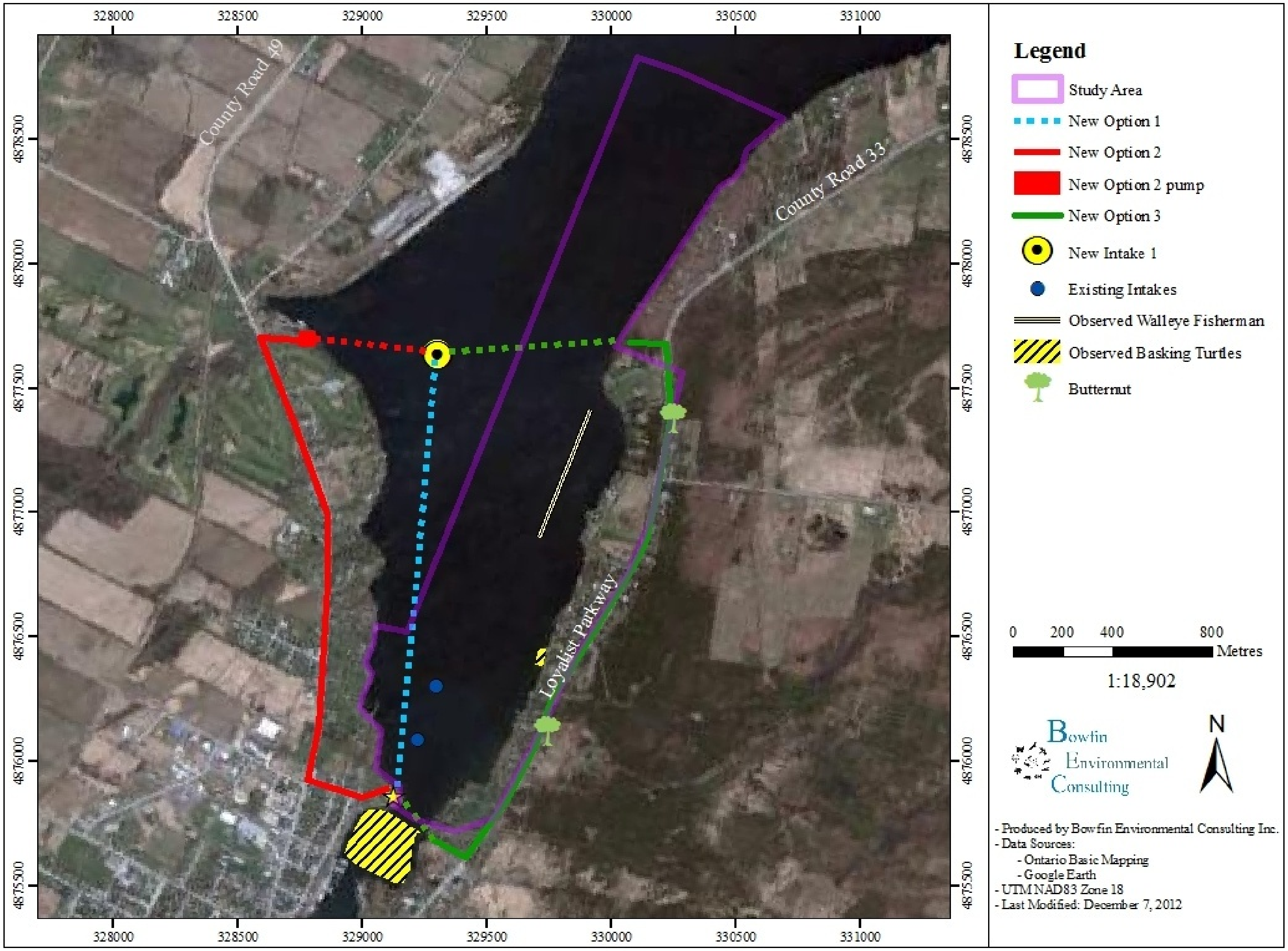


Figure 9.4: Locations of Turtle Sightings, Fishing Spots and Butternut Trees near Intake Pipe Routing Options

9.4. Constructability/Technical Feasibility

Constructability was an important technical criterion to be considered in evaluating the routing options. There were two separate construction components for each option:

1. In-Water Works

2. Onshore/Inland works

9.4.1. In-Water Works

For Option 1, the 1,700 m long intake pipe must be completed between July to September, as dictated by the environmental time restrictions. In order to accomplish this, a qualified contractor specialized in intake pipe installation would be required. RVA completed a similar sized intake project for the Town of Saugeen Shores at the Southampton WTP. A qualified contractor installed the 1,600 m long Southampton intake pipe in Lake Simcoe within the allotted, environmentally constrained timeframe. Another factor in constructability was sufficient lay down area for the contractor to set up. The Picton WTP property would provide adequate onshore/in land area to layout, assemble and stage the piping for a quick and smooth installation process.

For Option 2, the intake pipe would be 700 m in length, and thus less of a time constraint issue. However the topography and area of the land for the raw water well and pumping station were unknown at this point. There may be difficulty finding appropriate layout and staging areas for the intake pipe operation.

For Option 3, there were two separate areas where the intake pipes (200 m and 700 m long) would need to be installed. This would require two separate layout and staging areas, and two mobilization and demobilization of the barges and heavy equipment. Proper planning and staging of the two in-water works would be crucial to completing both intake pipes within the July to September window. Preparation and staging work for the short 200 m pipe could be done on the Picton WTP site; however the limited space and depth of the eastern part of the Bay may pose a problem for the barge and large equipment. The topography and area for the raw water well and pumping station property was unknown at this time. There may be difficulty finding appropriate layout and staging areas for the intake pipe operation.

Prior to any detailed design for the in-water works, a marine geotechnical investigation would be required along the preferred route to determine the lakebed depth, composition of soil/substrate and potential for interferences (i.e. large boulders, existing pipes, sunken ships, etc.). Potential for archeological interests may also be discovered during this investigation.

9.4.2. On-Short/In-Land Works

Option 1 would remain within the existing Picton WTP site. Sheeting and shoring would be required for the construction of the new, deeper, raw water well. There may be some complexity for installing the interconnecting raw watermain between the new and existing raw water well due to its proximity to the Bay and existing pipe interferences.

Option 2 had onshore/inland work components consisting of a 2,400m long raw watermain and raw water well with pumping station. Geotechnical investigations would be required to confirm the preferred method of construction. Open-cut or directional drilling may be considered for the long raw watermain. The open-cut method was the traditional watermain installation method and would be suitable for many types of terrain, however it would cause significant overland disruptions. Directional drilling would be advantageous for minimizing overland disruptions, however would be unsuitable for sand and rocky areas. For the raw water well, due to its deep depth below the water table, sheeting and shoring may be required unless there was suitable rock in the area. The timeframe for the watermain work would be approximately four to six months and the pumping station would be another four to six months.

Option 3 also had a 2,500 m long raw watermain. Geotechnical investigations would be required to determine if directional drilling or open-cut is the preferred construction method for the raw watermain. The timeframe for the watermain work would be approximately four to six months. The limited area for construction near the harbor may pose some technical challenges. Sheeting and shoring would likely be required for the construction of the new raw water well and pumping station due to the depth required. The pumping station construction would take approximately four to six months.

9.5. Operation and Maintenance

Option 1 would have minimal operational & maintenance changes as the new structures were similar to existing works and all were located on the existing Picton WTP site. The new raw water well would gravity flow into the existing raw water well and would not have much mechanical equipment, except for a few isolation valves/gates. The new intake pipe would require annual cleaning and maintenance, similar to their existing intake pipes.

Option 2, with a new raw water pumping station and long raw watermain, may require more operation and maintenance attention. The new pumping station would be located 2,400 m away from the existing WTP and would need to be monitored daily. The pumping station would consist of several large raw water pumps, instruments, valves, electrical and mechanical works. Raw watermain breaks would have to be repaired expeditiously.

Option 3, similar to Option 2, would require additional operation and maintenance attention for the new pumping station and long raw watermain. Leak detection methods, especially for the transitions between inland and onshore piping, should be considered as part of the design if this option is chosen.

9.6. Estimated Construction Cost for Routing Options

An important criterion for determining the preferred routing option would be the total construction cost. The major construction components and cost estimate for each option are summarized in Table 9.1 below.

Table 9.1: Construction Components and Cost of Intake Pipe Routing Options

Construction Components	Option 1 – In-water Intake Pipe	Option 2 – County Rd 49	Option 3 – Loyalist Parkway
In-water intake pipe	1700m long, 700mm diameter	700m long, 700mm diameter	700m long, 700mm diameter; 200m long, 400mm diameter
Raw Water Well (LxWxH)	9m x 7m x 5m	9m x 7m x 5m	9m x 7m x 5m
Raw Water Pumping Station (LxWxH)	---	15m x15m x 3m	15m x15m x 3m
Raw Watermain	---	2400m long, 400mm diameter	2500m long, 400mm diameter
Land Acquisition	---	Property on East side of County Rd 49	Property on West side of Loyalist Parkway
Construction Cost	$6.8M	$7.3M	$8.4M

The assumptions made for the cost estimate included:

- No rock excavation for raw water well or raw watermain
- Sheeting and shoring for the raw water well
- Land acquisition prices would not vary significantly (e.g. more than 15%) from current real estate prices of nearby properties along same road
- Open-cut method for raw watermain installation
- Inflation rate of 2.1% to bring 2000 watermain construction costs to 2012 costs

9.7. Decision Matrix for Preferred Routing Option

To help evaluate the various criteria for the preferred routing option to the chosen intake location as outlined in Section 8.2, Table 9.2 presents a decision matrix for all three routing options.

The decision matrix qualitatively compared all routing options to each other in a specific criterion. The criteria included socioeconomic and environmental impacts, constructability issues, operation and maintenance, as well as the construction cost. The rankings were as follows:

1. The lowest ranking (with a score of 1 out of 3) was shaded in red, which represented the least preferred/highest negative impact and effect in the specific criterion

2. The moderate ranking (with a score of 2 out of 3) was shaded in yellow, which represented moderate/average impact in the specific criterion

3. The highest ranking (with a score of 3 out of 3) was shaded in green, which represented the most preferred/least negative impact in the specific criterion

Each alternative was then given a final score based on the sum of each criterion’s weighting multiplied by the level of impact score (out of 3) for that criterion. The alternative with the highest final score would represent the preferred alternative.

Table 9.2: Decision Matrix for Intake Pipe Routing

Criteria	Impact	Criteria Weighting (%)	Option 1 - In Water only	Option 2 - County Rd 49 WM & In Water	Option 3 - Loyalist Parkway WM & In Water
Socioeconomic	Disruptions/Limited Road Access	10%	Minimal	Yes – during WM work; County Rd 49 is single lane road used to get into Picton from Hwy 401	Yes – during WM work; Loyalist Parkway is single lane road to get to Glenora Ferry and other tourist locations
Socioeconomic	Disruptions to Businesses/ Commercial/Industrial	10%	Possible – impact on water related tourism during in water works (July – Sept)	Yes – Impacts businesses/institutions on County Rd 49 - Hospital, Essroc, Salt Docks, Golf course, tourism for Town	Yes – motels/tourist lodging along the roadway; Glenora Ferry; Lake on the Mountain; water crossing may limit access to harbor during certain periods
Socioeconomic	Disruptions to Residents	10%	Possible – restricted access for residents with water lots during in-water works (July-Sept)	Yes – for residents with property on County Rd 49 and in Picton	Yes – for residents on Loyalist Parkway and who use the Glenora Ferry
Socioeconomic	Disruptions to Boat Traffic	5%	Yes - narrow restricted area north of WTP	Minor - water crossing from land PS on W side to intake location	Yes - crossing from WTP to East shoreline; crossing from land PS on E side to intake location
Socioeconomic	Land Acquisition Requirement	10%	No	Difficult - most lands are purchased; steep slope down	Difficult - most lands are purchased, but there is a small lot that does not have a house on it
Environmental	Impact on Endangered/ Species at Risk and their Habitat	10%	Possible – in-water works may affect the Northern Map Turtle and fish. Mitigation measures will be used to minimize impact	Possible – in-water works. Mitigation measures will be used to minimize impact	Possible – water crossing is near the Northern Map Turtle basking sites; 2 Butternut trees found on road. Mitigation measures will be used to minimize impact
Technical	Constructability – in-water works	5%	Moderate - 2-3 month in-water work period	Simple – short in-water work period; Layout and staging for intake pipe may be a problem depending on area.	Difficult - Two separate mobilization/demobilization, and work areas for in-water works. Layout and staging for intake pipes may be a problem depending on area.
Technical	Constructability – on shore/in land works	5%	Moderate - new raw water well in Picton WTP site; interconnecting pipe close to shoreline	Difficult – long raw watermain and PS through rocky terrain	Difficult – long raw watermain and PS through rocky terrain
Operation & Maintenance	Difficulty & Complexity to Maintain	5%	Similar to existing Picton WTP intake pipes. New raw water well on existing WTP site and no new mechanical equipment to maintain	Additional Raw Water PS facility off site and long raw watermain to maintain	Additional Raw Water PS facility off site and long raw watermain to maintain
Economic	Cost for Construction	30%	In water intake pipe - 1700m long Raw water well **$6.8M**	In-water intake pipe - 700m long Raw watermain - 2400m long, 400mm diameter (assuming rock excavation required) Raw Water Well and Pumping Station Land acquisition **$7.3M**	In-water intake pipe - 700m & 200m long Raw watermain - 2500m long, 400mm diameter (assuming rock excavation required) Raw Water Well and Pumping Station Land acquisition **$8.4M**
Score for Options (out of 3)			**2.2**	1.6	1.45
Preferred Option in Percentage			**73%**	53%	48%

Legend:	Least Negative Impact (Score 3)	Moderate Negative Impact (Score 2)	Highest Negative Impact (Score 1)

9.8. Preferred Routing Option

From the decision matrix in Table 9.2, the preferred routing option was "Option 1 – in-water intake pipe and new raw water well." This option had the fewest negative impacts.

Since Option 1 did not require a raw watermain offsite, there would be minimal disruptions/limitations to road access, and thus minimal impacts on businesses and residents along major roadways. During transportation of large equipment and material, appropriate road delineation/restriction procedures would be implemented.

For residents with neighboring water lots, there may be some restricted/limited access to certain parts of Picton Bay during July to September. Access into and out of Picton Harbour should not be restricted with this option. During design, approval and construction stages, the intake pipe routing and restricted area will be refined and minimized. The restricted areas would be clearly indicated for the safety of the local residents/businesses, tourists and the construction workers. A tight schedule for the in-water works period would be imposed and adhered to.

This option also did not pose significant construction concerns as similar construction methods (e.g. sheeting and shoring) were used to construct a facility at similar depths during the Picton WTP upgrade. Land acquisition would not be required for this option as all new facilities would be located within the existing Picton WTP property. Proper staging and preparation of the intake pipe would be completed on land to expedite the in-water component.

Option 1, with an estimated construction cost of $6.8 Million dollars, was economically advantageous compared to the other two options.

10.0 CONCEPTUAL DESIGN AND CONSTRUCTION METHODS FOR NEW INTAKE

10.1. Conceptual Design of New Intake Structure and Raw Water Well

With the preferred intake routing option selected, the intake project would include a new intake pipe and structure, raw water well and valve/isolation chamber.

During the construction of the new intake, the existing intake(s) must remain in operation in order for Picton WTP to continue distribution of treated water to the Town of Picton and the Village of Bloomfield. As such, it was proposed that a new, larger raw water well be constructed, complete with isolation gates, for the new intake pipe to connect to. A new valve and isolation chamber would also be constructed around where the existing intake pipes enter into the Picton WTP. A new pipe would connect the new raw water well to the new valve/isolation chamber, complete with isolation valves/gates. Once the new works are completed, the existing intake pipe within the chamber would be removed and an isolation valve/gate would be installed. This work would be performed under water or with an overnight work, with a short shutdown.

The advantage of the new raw water well was that even if the future Picton WTP was to be located off-site, on another property, the raw water well could be upgraded with a superstructure and pumping capability to transport the raw water to the new WTP location.

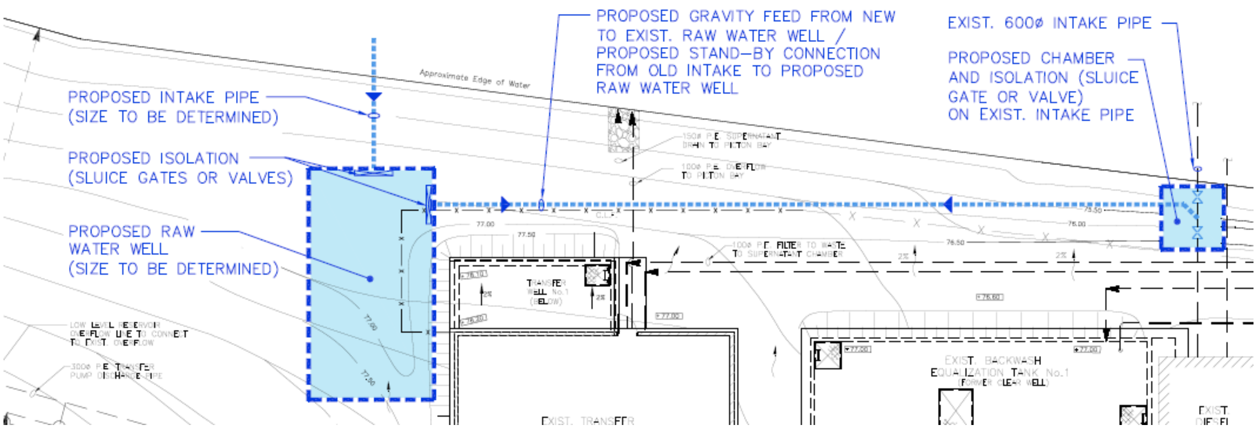


Figure 10.1: Conceptual Design of the New Raw Water Well and the New Valve/Isolation Chamber

The new intake structure would be of a similar design to that used for other great lakes WTP intakes. Instead of the wooden crib of the existing Picton intake, the new intake structure would be metal, with a horizontal octagonal dual-saucer structure to allow the water to flow through and down into the intake pipe. This design would maintain a slow/tranquil flow of the water into the intake pipe so that unsuspecting aquatic life would not be drawn into the intake pipe. The actual intake structure would be elevated above the lake bottom to deter bottom dwellers from making their homes there and clogging up the intake. Design considerations would be given on how to protect the intake structure from boat and anchor damage and locating the intake position on navigational charts. Figure 10.2 shows the proposed new intake structure.

There were discussions during the Class EA process between the technical committee, comprising of approval agencies, County of Prince Edward and the consulting teams, as to whether or not the existing intakes pipes should be kept in place after the new intake pipe is installed. Although the existing intakes could be kept in place for emergency use only, this would mean that they would still be included in the IPZ delineation and therefore the Picton WTP Intake system would still have the same level of threats as previous. The County's preference is to address this topic as part of the detailed design and approval stages once further clarification on the source water protection guidelines are obtained.

Preliminary and detailed design of the intake structure and required infrastructure would commence after the Class EA process.

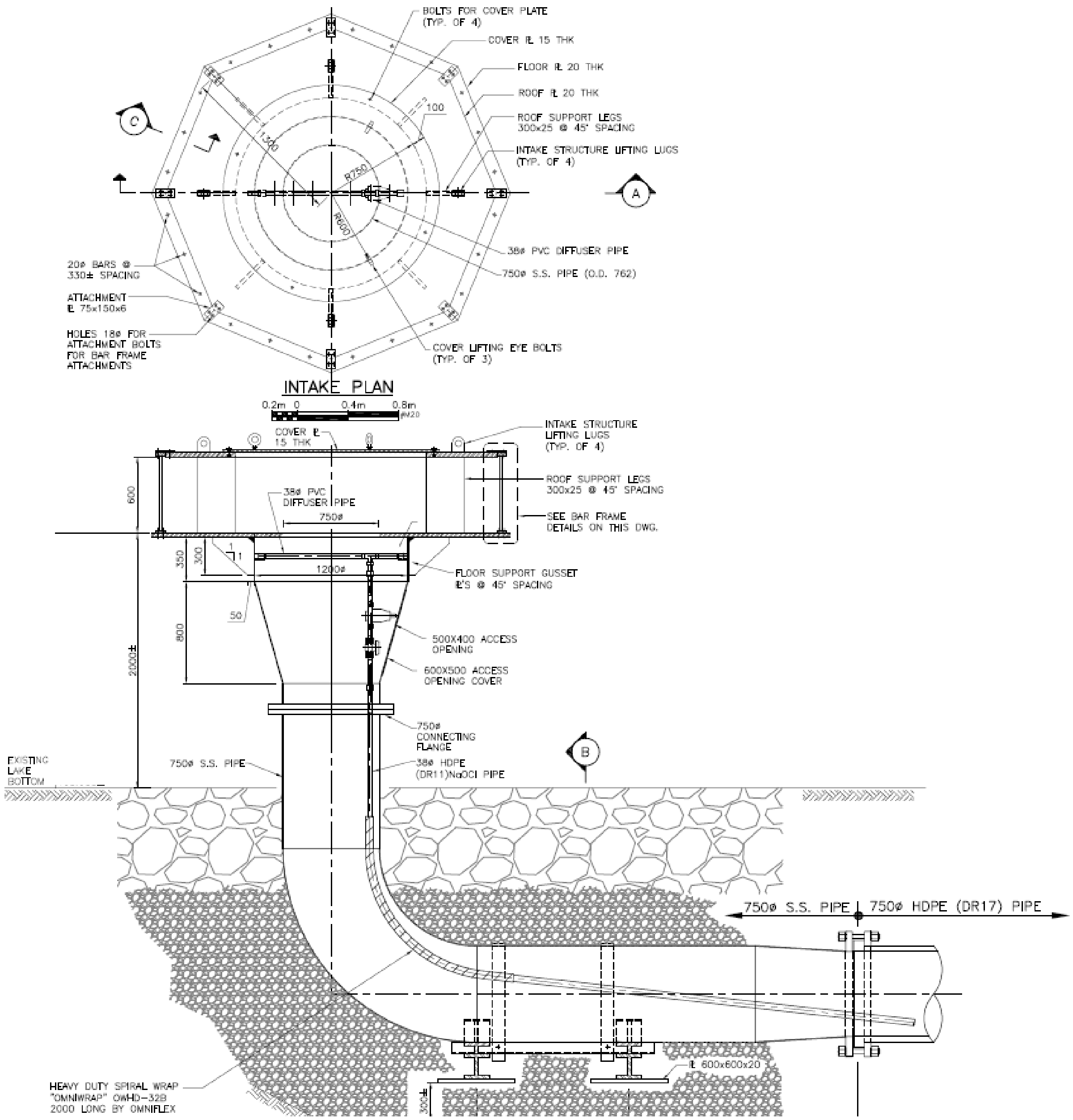


Figure 10.2: Proposed New Intake Structure

10.2. Conceptual Construction Method for Intake Pipe Installation and Mitigation Measures

A general conceptual construction method for the intake pipe installation is described below. However currently there are still several unknown variables. A marine geotechnical would have to be completed prior to the commencement of the detailed design and finalization of the construction method for the intake pipe.

The intake pipe would be a 700 mm High Density Polyethylene (HDPE) pipe. The pipe sections would be built and fused on land before being transported by boat (floated) out to the intake route and sunk using concrete ballasts. Ballasts may be used to provide additional protection against anchors. For protection against strong wave action, a layer of scour protection stone could be placed on the top of the pipe.

Depending on the soil composition and depth of the lakebed, the intake pipe could either be laid out on the bottom of the lakebed (with minor near shore trenching/dredging) or conventional open cut trenching may be used. For the near shore portions, where the lake was shallow, a temporary berm may be constructed in the water to provide an access roadway for the construction equipment to install the intake pipe. For the deeper sections, the construction equipment would be transported on a moving barge. Excavated material may be temporarily side casted and stockpiled along the sides of the trench, or may be stockpiled on shore for backfill purposes. From the sediment tests and discussion with the MOE, the sediment was classified as non-contaminated, and may be suitable for backfilling.

Turbidity curtains would be placed along the perimeter of the in-water construction area to minimize the impact of silt to the surrounding areas and to keep aquatic life out of the construction zone. This was especially important during dredging, pipe installation and backfilling operations. Silt fences would also be required for the near shore construction activities.

Environmental constraints on the in-water works construction window would be adhered to in order to minimize the impacts on aquatic wildlife, vegetation and habitat. A fish habitat study, complete with an impact analysis and compensation plan may be required to mitigate and minimize loss of fish habitat as result of the new intake pipe. Further discussion with Quinte Conservation Authority and the Department of Fisheries and Oceans would be required during the detailed design phase.

Public notices to nearby residents and businesses would be distributed prior to construction to notify and educate the public of the intended upgrades and mitigation measures undertaken to minimize construction impacts. A clear and noticeable delineation of the in-water construction area would help to safeguard the public and construction crew.

11.0 SUMMARY & CONCLUSION

Investigations from the Quinte Source Water Protection Program identified that the two existing intakes at the Picton WTP were highly vulnerable to certain risks, contaminants and fluctuating water quality. The intakes were also near the end of their useful life and may not last to accommodate the extended life of the plant that was recently upgraded in 2009.

As such, a Class Environmental Assessment was conducted to evaluate and determine the preferred alternative to address the issue. The preferred alternative comprised of a three step approach:

Step 1 – Evaluate and determine the preferred source of water supply.

Step 2 – Evaluate and determine the best location for a new intake in the preferred water source from Step 1.

Step 3 – Evaluate and determine the best routing option to convey raw water from the preferred location in Step 2 to the water treatment plant for treatment prior to distribution.

The decision matrix for Step 1 - the comparison of alternatives for water supply, determined that the preferred alternative was for the construction of a new, longer and deeper, intake pipe for Picton WTP. This alternative would provide improved raw water quality, allow for intake renewal and future growth and improves operation and maintenance. The environmental and socio-economic impacts were short term and could be mitigated. This option was also economically advantageous and technically feasible.

For Step 2, field sampling, tests, investigations and the preliminary IPZ assessment showed that 'Location PC*' was the preferable location for a new intake. This location provided a good balance between construction costs, social and environmental impacts and improved raw water quality and IPZ vulnerability.

For Step 3, the preferred routing for the new intake pipe from 'Location PC*' to the existing Picton WTP was via an in-water routing. This option had less environmental and socio-economic impacts; did not require land acquisitions and was economically advantageous.

Based on the foregoing recommendations and preferred solution determined through the Class EA process, the County of Prince Edward is in a position to proceed with marine investigations, detailed design and construction of a new intake for the Picton WTP further out in Picton Bay as indicated in Figure 8.1. The County has advised that the project will only proceed when financing is in place, and that financing for the project is currently not available.

APPENDIX A

Picton Water Treatment Plant Intake Replacement
Prince Edward County

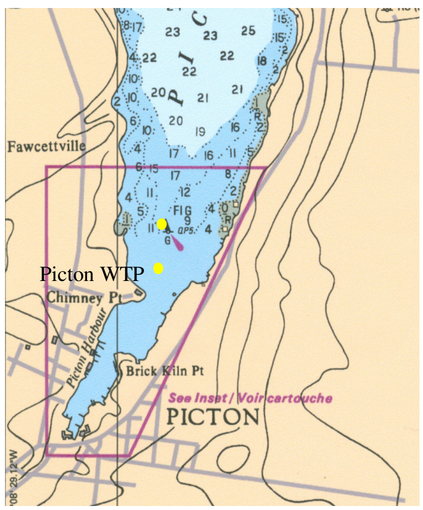
NOTICE OF STUDY COMMENCEMENT

Class Environmental Assessment

Through the Quinte Source Water Protection Region, the 2009 Intake Protection Zone Delineation and Vulnerability Assessment identified that the existing two intakes at the Picton Water Treatment Plant are vulnerable to certain risks, contaminants and fluctuations in water quality and increasing maintenance costs. At the same time, the County could benefit from an intake with a higher capacity for a possible future expansion.

In order to address the identified vulnerability and to plan for future capacity demands, the County of Prince Edward is undertaking a review of alternatives, detailed design and construction of a new replacement intake, crib and new raw water well for the Picton Water Treatment Plant. This will improve the raw water quality for Picton and Bloomfield municipal water systems.

A Municipal Class Environmental Assessment (Class EA) has been initiated to determine possible replacement intake and raw water well options. The Class EA is proceeding as a Schedule B undertaking in accordance with the Municipal Class Environmental Assessment (2007) process.



Public input and comments are welcomed for incorporation into the planning of this project, and will be received at Public Information Centres (PICs) or in writing at the address below. A further information letter will be distributed to confirm final date for the PICs. Subject to comments received, funding and the receipt of necessary approvals, the County of Prince Edward intends to proceed with the construction of this project. Please contact one of the following for further information:

County of Prince Edward Public Works Department
Mr. Joseph Angelo, P.Eng.
Project Manager
Edward Building 280 Main St., 2nd floor
Mailing address: 332 Main St. Picton,
Ontario K0K 2T0

R.V. Anderson Associates Limited
Mr. Ken Campbell, P.Eng.
Project Manager
2001 Sheppard Avenue East, Toronto,
Ontario M2J 4Z8
Tel: (416) 497-8600
Fax: (416) 497-0342
kcampbell@rvanderson.com

The Corporation of the County of Prince Edward

Picton Water Treatment Plant Intake Replacement

NOTICE OF STUDY COMMENCEMENT
Class Environmental Assessment

Through the Quinte Source Water Protection Region, the 2009 Intake Protection Zone Delineation and Vulnerability Assessment identified that the existing two intakes at the Picton Water Treatment Plant are vulnerable to certain risks, contaminants and fluctuations in water quality and increasing maintenance costs. At the same time, the County could benefit from an intake with a higher capacity for a possible future expansion.

In order to address the identified vulnerability and to plan for future capacity demands, the County of Prince Edward is undertaking a review of alternatives, detailed design and construction of a new replacement intake, crib and new raw water well for the Picton Water Treatment Plant. This will improve the raw water quality for Picton and Bloomfield municipal water systems.

A Municipal Class Environmental Assessment (Class EA) has been initiated to determine possible replacement intake and raw water well options. The Class EA is proceeding as a Schedule B undertaking in accordance with the Municipal Class Environmental Assessment (2007) process.

Public input and comments are welcomed for incorporation into the planning of this project, and will be received at Public Information Centres (PICs) or in writing at the address below. A further information letter will be distributed to confirm final date for the PICs. Subject to comments received, funding and the receipt of necessary approvals, the County of Prince Edward intends to proceed with the construction of this project. Please contact one of the following for further information:

County of Prince Edward
Public Works Department
Mr. Joseph Angelo, P.Eng.
Project Manager
Edward Building 280 Main St., 2nd floor
Mailing address:
332 Main St
Picton, ON K0K 2T0

R.V. Anderson Associates Limited
Mr. Ken Campbell, P.Eng.
Project Manager
2001 Sheppard Avenue East,
Toronto, ON M2J 4Z8
Tel: (416) 497-8600
Fax: (416) 497-0342
Email: kcampbell@rvanderson.com

OFFICIAL NOTICES

THE COUNTY
Prince Edward County, Ontario

YOU ARE INVITED TO A COMMUNITY PLANNING OPEN HOUSE

Wednesday, June 29, 2011, 7 - 9 pm
Wellington Town Hall, Main Street

This is the third community event for County Council's **Wellington Secondary Plan Project**.

Two earlier workshops have helped to create a Draft Secondary Plan which will be presented for review by all community members on June 29.

The proposed Draft Plan, when approved, will guide physical change and growth in Wellington for many years to come.

We want to know what you think about the Draft Plan before sending it to Council for consideration, so please drop by from 7 pm on, and give us your comments.

For more information contact:

- Bernard Shalka, Secondary Plans Co-ordinator, phone 613-476-2148 ext. 351 or email bshalka@pecounty.on.ca.
- Go to www.pecounty.on.ca > Top Requests; facebook.com > Plan Wellington; and twitter.com > PECplans

Please participate in shaping our community's tomorrow, today!

Gerry Murphy
Commissioner of Planning

THE COUNTY
Prince Edward County, Ontario

YOU ARE INVITED TO A COMMUNITY PLANNING OPEN HOUSE

Thursday, June 30, 2011, 7 - 9 pm
Prince Edward Community Centre

This is the third community event for County Council's **Picton-Hallowell Secondary Plan Project**.

Two earlier workshops have helped to create a Draft Secondary Plan which will be presented for review by all community members on June 30.

The proposed Draft Plan, when approved, will guide physical change and growth in Picton-Hallowell Urban Area for many years to come.

We want to know what you think about the Draft Plan before sending it to Council for consideration, so please drop by between 7 and 9 and give us your comments.

For more information contact:

- Bernard Shalka, Secondary Plans Co-ordinator, phone 613-476-2148 ext. 351 or email bshalka@pecounty.on.ca.
- Go to www.pecounty.on.ca > Top Requests; facebook.com > Plan Wellington; and twitter.com > PECplans

Please participate in shaping our community's tomorrow, today!

Gerry Murphy
Commissioner of Planning

THE COUNTY
Prince Edward County, Ontario

The Corporation of the County of Prince Edward

Picton Water Treatment Plant Intake Replacement

NOTICE OF STUDY COMMENCEMENT Class Environmental Assessment

Through the Quinte Source Water Protection Region, the 2009 Intake Protection Zone Delineation and Vulnerability Assessment identified that the existing two intakes at the Picton Water Treatment Plant are vulnerable to certain risks, contaminants and fluctuations in water quality and increasing maintenance costs. At the same time, the County could benefit from an intake with a higher capacity for a possible future expansion.

In order to address the identified vulnerability and to plan for future capacity demands, the County of Prince Edward is undertaking a review of alternatives, detailed design and construction of a new replacement intake, crib and new raw water well for the Picton Water Treatment Plant. This will improve the raw water quality for Picton and Bloomfield municipal water systems.

A Municipal Class Environmental Assessment (Class EA) has been initiated to determine possible replacement intake and raw water well options. The Class EA is proceeding as a Schedule B undertaking in accordance with the Municipal Class Environmental Assessment (2007) process.

Public input and comments are welcomed for incorporation into the planning of this project, and will be received at Public Information Centres (PICs) or in writing at the address below. 0A further information letter will be distributed to confirm final date for the PICs. Subject to comments received, funding and the receipt of necessary approvals, the County of Prince Edward intends to proceed with the construction of this project. Please contact one of the following for further information:

County of Prince Edward
Public Works Department
Mr. Joseph Angelo, P.Eng.
Project Manager
Edward Building 280 Main St., 2nd floor
Mailing address:
332 Main St
Picton, ON K0K 2T0

R.V. Anderson Associates Limited
Mr. Ken Campbell, P.Eng.
Project Manager
2001 Sheppard Avenue East,
Toronto, ON M2J 4Z8
Tel: (416) 497-8600
Fax: (416) 497-0342
Email: kcampbell@rvanderson.com

FIRST_NAME	LAST_NAME	COMPANY NAME/ADDITIONAL NAME	LOCATION	CITYTOWN	PROVINCE	COUNTY	PCODE
ERIC	SERWOTKA	HASTINGS/PRINCE EDWARD HEALTH UI	1 MILLENIUM PARKWAY SUITE 200	BELLEVILLE	ON	CANADA	K8N 4Z5
SCOTT	MANLOW	COUNTY OF PRINCE EDWARD	2 ROSS ST	PICTON	ON	CANADA	K0K 2T0
ANDY	HARRISON	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
JANICE	MAYNARD	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
DIANNE	O'BRIEN	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
JIM	DUNLOP	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
NICK	NOWITSKI	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
JAMIE	FORRESTER	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
ROBERT	QUAIFF	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
KEITH	MACDONALD	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
ALEC	LUNN	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
BARB	PROCTOR	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
HEATHER	CAMPBELL	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
BARRY	TURPIN	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
BRIAN	MARISETT	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
BEV	CAMPBELL	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
MAYOR PETER	MERTENS	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
KEVIN	GALE	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
TERRY	SHORT	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
JOHN	LA CHAPELE	C/O DEV & MUNICIPAL SERVICE CONTR	FLOOR 5 - BLUE, 100 BOROUGH DRIVE	SCARBOROUGH	ON	CANADA	M1P 4W2
VICTORIA	LESKIE	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
ROBERT	MCAULEY	COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
DON	CAZA	DIRECTOR OF WATER AND WASTEWAT	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
GLENN	KOZAK	PICTON GOLF AND COUNTRY CLUB	734 COUNTY ROAD 49	PICTON	ON	CANADA	K0K 2T0
Paul	McCoy	QUINTE CONSERVATION	2061 OLD HIGHWAY 2 RR2	BELLEVILLE	ON	CANADA	K8N 4Z2
Brad	McNevin	QUINTE CONSERVATION	2061 OLD HIGHWAY 2 RR2	BELLEVILLE	ON	CANADA	K8N 4Z2
DIRECTOR, ENVIRONMENTAL ASSESSMENT AND APPROVALS		MINISTRY OF ENVIRONMENT	2 ST. CLAIR AVENUE WEST, FLOOR 12A	TORONTO	ON	CANADA	M4V 1L5
BRIAN	KAYE	MINISTRY OF ENVIRONMENT	1259 GARDINERS ROAD, BOX 22032	KINGSTON	ON	CANADA	K7M 8S5
DAVE	BERETTA	MINISTRY OF ENVIRONMENT - BELLEVIL	345 COLLEGE ST E	BELLEVILLE	ON	CANADA	K8N 5S7
GERRY	MULDER	MINISTRY OF NATURAL RESOURCES	ONTARIO GOVERNMENT BUILDING; BEACHGROVE COMPLEX 51 HEAKES LANE	KINGSTON	ON	CANADA	K7M 9B1
TAMMY	CHUNG	MINISTRY OF NATURAL RESOURCES	Peterborough District Office; 300 Water St, 1st Floor, South Tower	PETERBOROUGH	ON	CANADA	K9J 8M5
MARGARET	Bérubé	MINISTRY OF NATURAL RESOURCES	Peterborough District Office; 300 Water St, 1st Floor, South Tower	PETERBOROUGH	ON	CANADA	K9J 8M5
LINDA	MacWILLIAMS	DEPARTMENT OF INDIAN AFFAIRS	5TH FLOOR, 25 ST. CLAIR AVENUE EAST	TORONTO	ON	CANADA	M4T 1M2
MONIQUE	MOUSSEAU	TRANSPORT CANADA	4900 YONGE ST SUITE 300	TORONTO	ON	CANADA	M2N 6A5
Jennifer	Hughes	TRANSPORT CANADA	4900 YONGE ST SUITE 300	TORONTO	ON	CANADA	M2N 6A5
Chief R. Donald	Maracle	Mohawks of the Bay of Quinte	13 Old York Road, RR#1	Deseronto	ON	CANADA	K0K 1X0
Chief James R.	Marsden	Alderville First Nation	P.O. Box 46, RR#4	Roseneath	ON	CANADA	K0K 2X0
Keith	Taylor	Quinte Conservation Authority	2061 OLD HIGHWAY 2 RR2	BELLEVILLE	ON	CANADA	K8N 4Z2
OFFICER IN CHARGE		FISHERIES AND OCEANS CANADA - CAN	PO BOX 1000	PRESCOTT	ON	CANADA	K0E 1T0
Communications Branch		Deptment of Fisheries and Oceans	200 Kent Street, 13th floor, Station 13E228	Ottawa	ON	CANADA	K1A 0E6
WENDY	LAVENDER	MINISTRY OF ENVIRONMENT - BELLEVIL	345 COLLEGE ST E	BELLEVILLE	ON	CANADA	K8N 5S7
Jacqueline	Fuller	MINISTRY OF ENVIRONMENT - PETERBO	300 Water St, 2nd floor, South Tower	PETERBOROUGH	ON	CANADA	K9J 8M5
Candy	Gibson	MINISTRY OF ENVIRONMENT - PETERBO	300 Water St, 2nd floor, South Tower	PETERBOROUGH	ON	CANADA	K9J 8M5
BARRY	BRAUN	Recreation Parks & Culture Department (Pic	332 Main St	PICTON	ON	CANADA	K0K 2T0
DAN	WIGHT	ESSROC CANADA INC	PO Box 620	PICTON	ON	CANADA	K0K 2T0
Jon	Wilkins	PRINCE EDWARD YACHT CLUB	30 Fairfield St.	PICTON	ON	CANADA	K0K 2T0
THE REEL THING FISHING PRO SHOP		The Reel Thing Fishing Pro Shop	151 Main St.	WELLINGTON	ON	CANADA	K0K 3L0
PRINCE EDWARD ROD AND GUN CLUB		PRINCE EDWARD ROD AND GUN CLUB	PO BOX 20003	PICTON	ON	CANADA	K0K 3V0
DAVE	CHATTERTON	FISH FINDER CHARTERS	RR #1	CARRYING PLAC	ON	CANADA	K0K 1L0
GERRY	DEMIANCHUK	PICTON ICE	7 MACSTEVEN DRIVE	PICTON	ON	CANADA	K0K 2T0
ARNOLD	ROBB	UNIVERSAL FAN AND BLOWERS LTD	30 BARKER'S LANE	BLOOMFIELD	ON	CANADA	K0K 1G0
IAN	CRERAR	CLEARWATER DESIGN	1959 COUNTY RD 15	PICTON	ON	CANADA	K0K 2T0
Vicki	Mitchell	Ministry of Environment –	1259 Gardiners Road, P.O. Box 22032	Kingston	Ontario	CANADA	K7M 8S5
Jean Anne	Carroll	COUNTY OF PRINCE EDWARD (Economi	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
2038787 Ontario Inc		Docks located at 35 Bridge St, Picton	14 Empire Blvd	Wellington	ON	CANADA	K0K 3L0
1213427 Ontaro Corporation	c/o Donald A Foley	Canada Salt located at White Chapel Road	2441 Diamondview Rd	Carp	ON	CANADA	K0A 1L0
Will send these out via email instead of mailing							
Vern	Amey	Town of Greater Napanee	Director of Public Works	vamey@greaternapanee.com		6133548863 x 106	
Bryan	Brooks	Town of Deseronto	Clerk	bbrooks@deseronto.ca		6133962440	
Steve	Mercer	Township of Tyendinaga	Clerk	clerk@tyendenagatownship.com		6133961944	
John	Farrell	Township of Tyendinaga	Road Supervisor	roads@tyendenagatownship.con		6133966562	

FIRST_NAME	LAST_NAME	COMPANY NAME/ADDITIONAL NAME	LOCATION	CITYTOWN	PROVINCE	COUNTY	PCODE

ALDERVILLE FIRST NATION
P.O. Box 46
11696 Second Line
Roseneath, Ontario K0K 2X0

June 30th, 2011

Att: Mr. Ken Campbell, P.Eng.

Re: Notice of Study Commencement
Class Environmental Assessement
Picton Water Treatment Plant Intake Replacement
Prince Edward County

Dear Ken,

Thank you for your consultation request to Alderville First Nation regarding the **Class Environmental Assessement for the Picton Water Treatment Plant Intake Replacement,** which is being proposed within our Traditional and Treaty Territory. We appreciate the fact that **Prince Edward County,** recognizes the importance of First Nations Consultation and that your office is conforming to the requirements within the Duty to Consult Process.

As per the Alderville First Nation Consultation Protocol, your proposed project is deemed a level 3, having minimal potential to impact our First Nations' rights, therefore, please keep Alderville apprised of any archaeological findings, burial sites or any environmental impacts, should any occur.

Although we may not always have representation at all stakeholders meetings, it is our wish to be kept apprised throughout all phases of this project. I can be contacted at the mailing address above or electronically via email, at the email address below.

In good faith and respect,

Dave Simpson
Lands and Resources
Communications Officer
Alderville First Nation

dsimpson@aldervillefirstnation.ca

Tele: (905) 352-2662
Fax: (905) 352-3242

APPENDIX B

Picton Water Treatment Plant Intake Replacement
Prince Edward County

NOTICE OF PUBLIC INFORMATION CENTRE

Class Environmental Assessment

Through the Quinte Source Water Protection Program, the 2009 Intake Protection Zone Delineation and Vulnerability Assessment identified that the existing two intakes at the Picton Water Treatment Plant are vulnerable to certain risks, contaminants and fluctuations in water quality and increasing maintenance costs. At the same time, the County could benefit from an intake with a higher capacity for a possible future expansion.

In order to address the identified vulnerability and to plan for future capacity demands, the County of Prince Edward is undertaking a review of alternatives, detailed design and construction of a new replacement intake, crib and new raw water well for the Picton Water Treatment Plant. This will improve the raw water quality for Picton and Bloomfield municipal water systems.

A Municipal Class Environmental Assessment (Class EA) has been initiated to determine possible replacement intake and raw water well options. The Class EA is proceeding as a Schedule B undertaking in accordance with the Municipal Class Environmental Assessment (2007) process.

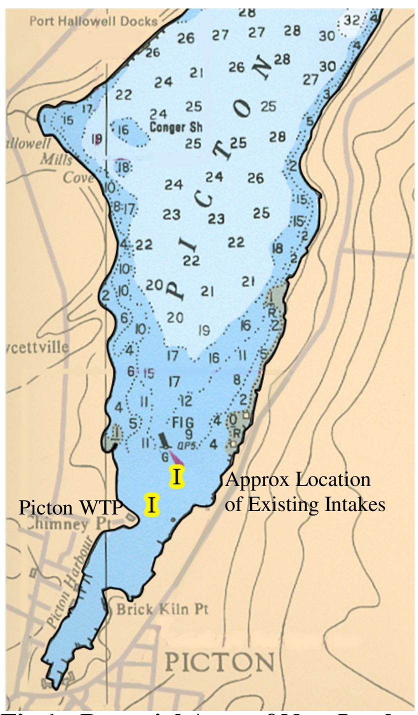


Fig 1 - Potential Area of New Intake

Public input and comments are welcomed for incorporation into the planning of this project, and will be received at the Public Information Centre (PIC). The PIC is scheduled for Thursday, May 10th, 2012 from 4pm – 8pm at the Crystal Palace – 375 Main Street, Picton, Ontario.

Subject to comments received, funding and the receipt of necessary approvals, the County of Prince Edward intends to proceed with the construction of this project. Please contact one of the following for further information:

County of Prince Edward Public Works Department
Mr. Joseph Angelo, P.Eng.
Project Manager
Edward Building 280 Main St., 2nd floor
Mailing address: 332 Main St. Picton, Ontario K0K 2T0
jangelo@pecounty.on.ca

R.V. Anderson Associates Limited
Mr. Ken Campbell, P.Eng.
Project Manager
2001 Sheppard Avenue East, Toronto, Ontario M2J 4Z8
Tel: (416) 497-8600
Fax: (416) 497-0342
kcampbell@rvanderson.com

THE COUNTY Prince Edward County, Ontario

WASTE DISPOSAL SITES - NOTICE
HOURS OF OPERATION / FEES AND CHARGES
EFFECTIVE APRIL 24, 2012

The County's Fees and Charg ; By-Law was amended by Council on April 10, 2012. The amendment has increased the charges for disp sal of bulk waste and other loose garbage, construction debris, brush and clean lumber disposal, and th sale of blue boxes.

The County will continue to o en the waste disposal sites ONLY one day per week for the remainder of 2012. The Hours of Operatio are 8 am to 4 pm on Saturday and the locations of waste disposal sites are as follows:

S phiasburgh - 35 County Road 14 (Transfer Site)
Hallowell - 1080 Shannon Road (Transfer Site)
Wellington - 275 Consecon St (Transfer Site)
Picton - 3 Church St (Transfer Site-brush and leaves not accepted)

Ameliasburgh - 45 Valley Road (Landfill Site-construction debris not accepted)
Hillier - 450 akker Road (Landfill Site-construction debris not accepted)
South Marysburgh - 1 32 Old Milford Road (Landfill Site-construction debris not accepted)

Additional information rega ding waste collection and disposal can be found at the County website at www.pecounty.on.ca or email publicworks@pecounty.on.ca or call 613.476.2148 ext 326.

THE COUNTY Prince Edward County, Ontario

Picton Water Treatment Plant Intake Replacement
Prince Edward County

NOTICE OF PUBLIC INFORMATION CENTRE
Class Environmental Assessment

Through the Quinte Sou ce Water Protection Program, the 2009 Intake Protection Zone Delineation and Vulnerabi ty Assessment identified that the existing two intakes at the Picton Water Treatment Plant ar vulnerable to certain risks, contaminants and fluctuations in water quality and increasing ma ntenance costs. At the same time, the County could benefit from an intake with a higher capac ty for a possible future expansion.

In order to address the ide ntified vulnerability and to plan for future capacity demands, the County of Prince Edward i undertaking a review of alternatives, detailed design and construction of a new repl cement intake, crib and new raw water well for the Picton Water Treatment Plant. This will mprove the raw water quality for Picton and Bloomfield municipal water systems.

A Municipal Class Environ ental Assessment (Class EA) has been initiated to determine possible replacement inta e and raw water well options. The Class EA is proceeding as a Schedule B undertaking in accordance with the Municipal Class Environmental Assessment (2007) process.

Public input and comment are welcomed for incorporation into the planning of this project, and will be received at th Public Information Centre (PIC).
The PIC is scheduled for T ursday, May 10th, 2012 from 4pm – 8pm at the Crystal Palace – 375 Main Street, Picton, (ntario.

Subject to comments rece ved, funding and the receipt of necessary approvals, the County of Prince Edward intends to roceed with the construction of this project. Please contact one of the following for further i ormation:

County of Prince Edwa d
Public Works Departme nt
Mr. Joseph Angelo, P.Eng
Project Manager
Edward Building
280 Main St., 2nd floor
Mailing address: 332 Mai St.
Picton, Ontario K0K 2T0
jangelo@pecounty.on.ca

R.V. Anderson Associates Limited
Mr. Ken Campbell, P.Eng.
Project Manager
2001 Sheppard Avenue East,
Toronto, Ontario M2J 4Z8
Tel: (416) 497-8600
Fax: (416) 497-0342
kcampbell@rvanderson.com

St. Gregory Catholic School Terrific Kids

Pictured are the Kiwanis Club Terrific Kids from St. Gregory Cathol
They include: Grace, Cooper, Dawson, Harmony, Athena, Ashley, Ju
Hailey. They are joined by principal Rob Gilmour along with Kiwani
Moore and Don Stanton.

Are you and your boat ready for s

John Gullick
Canadian Safe Boating Council

Every year thousands of boaters go out on the water without giving any thought to how prepared either they or their boats are for the season ahead.

Personal preparation involves ensuring you have on-hand your Pleasure Craft Operator Card, up to date nautical charts, a pre-departure checklist and have obtained a reliable marine weather forecast.

When it comes to vessel preparedness, one of the first things to ensure is that your boat and engine(s) are mechanically sound. Remember that, throughout most of Canada, boats have been in storage for a number of months over the winter and may not operate as efficiently as they did last season. Make sure that you follow the recommended maintenance schedule found in your boat's owner's manual.

The Canadian government also mandates that specific safety equipment be carried on board. This equipment can be of great benefit and can mean the difference between a great day out on the water and a potential disaster.

During Safe Boating Awareness Week (May 19 - 25) and throughout the entire season, the Canadian Safe Boating Council and Smartboater.ca want to remind Canadians to review their safe boating check list before heading out onto the water.

Required items vary depending on boat length but the list below highlights the things that, at minimum, need be carried on board, in good working condition and within reach each time you go out.

Compulsory Items required on a typical vessel six meters or less in length:

•The vessels license or registration if powered by a motor of 7.5 kw (10 hp) or more

•A Canadian approved flotation device (PFD) in good repair and of appropriate size for every person on board

•Fire extinguisher (dep of engine, gas tank or c ances on board).

•Watertight flashlight distress signal requireme

•Sound signalling devi

•Buoyant heaving line meters in length)

•Paddle or anchor w meters of rode and /or c

•Re-boarding device

•Bailer or manual wat

•Navigation lights

Other items to check:

•Secure batteries

•Passive ventilation th flow through below deck

•Exhaust fan or bilg removes dangerous vapo

•Flame arrester and h inboard engines

•Up-to-date charts

•Magnetic compassRa

Consider requesti tional Vessel Courtesy a totally voluntary serv ducted without penalty i found. You will simply b requirement and a re-i be offered when you ha items.

Canadian Power & S are currently the only n tal national source for th They will inspect vesse out of the water. They ca is required and give you mation about each item best for your vessel and tions and even how to p tain items or what add might be available. Volu talk to you about PFDs, holic Beverage Consun board, Sewage Disposal ture Check Lists.

Review your check li leave – Be Prepared! W a power boat, sail boat, craft, canoe, kayak or fi more information on a ing safety tips by visiti Boater.ca.

THE COUNTY Prince Edward County, Ontario

WASTE DISPOSAL SITES - NOTICE
HOURS OF OPERATION / FEES AND CHARGES
EFFECTIVE APRIL 24, 2012

The County's Fees and Charg ; By-Law was amended by Council on April 10, 2012. The amendment has increased the charges for disp)sal of bulk waste and other loose garbage, construction debris, brush and clean lumber disposal, and th sale of blue boxes.

The County will continue to o| ɔn the waste disposal sites ONLY one day per week for the remainder of 2012. The Hours of Operatio are 8 am to 4 pm on Saturday and the locations of waste disposal sites are as follows:

S phiasburgh - 35 County Road 14 (Transfer Site)
allowell - 1080 Shannon Road (Transfer Site)
Wellington - 275 Consecon St (Transfer Site)
Picton - 3 Church St (Transfer Site-brush and leaves not accepted)

Ameliasburgh - 45 Valley Road (Landfill Site-construction debris not accepted)
Hillier - 450 akker Road (Landfill Site-construction debris not accepted)
South Marysburgh - 132 Old Milford Road (Landfill Site-construction debris not accepted)

Additional information reg ding waste collection and disposal can be found at the County website at www.pecounty.on.ca ɔr email publicworks@pecounty.on.ca or call 613.476.2148 ext 326.

THE COUNTY Prince Edward County, Ontario

Picton Water Treatment Plant Intake Replacement
Prince Edward County

NOTICE OF PUBLIC INFORMATION CENTRE
Class Environmental Assessment

Through the Quinte Sou ce Water Protection Program, the 2009 Intake Protection Zone Delineation and Vulnerab ity Assessment identified that the existing two intakes at the Picton Water Treatment Plant a vulnerable to certain risks, contaminants and fluctuations in water quality and increasing m ntenance costs. At the same time, the County could benefit from an intake with a higher capa ity for a possible future expansion.

In order to address the id ntified vulnerability and to plan for future capacity demands, the County of Prince Edward undertaking a review of alternatives, detailed design and construction of a new rep acement intake, crib and new raw water well for the Picton Water Treatment Plant. This will improve the raw water quality for Picton and Bloomfield municipal water systems.

A Municipal Class Enviror nental Assessment (Class EA) has been initiated to determine possible replacement inta e and raw water well options. The Class EA is proceeding as a Schedule B undertaking i accordance with the Municipal Class Environmental Assessment (2007) process.

Public input and commer s are welcomed for incorporation into the planning of this project, and will be received at t Public Information Centre (PIC). The PIC is scheduled for hursday, May 10th, 2012 from 4pm – 8pm at the Crystal Palace – 375 Main Street, Picton,)ntario.

Subject to comments rec ived, funding and the receipt of necessary approvals, the County of Prince Edward intends t proceed with the construction of this project. Please contact one of the following for further formation:

County of Prince Edw d
Public Works Departr ent
Mr. Joseph Angelo, P.En .
Project Manager
Edward Building
280 Main St., 2nd floor
Mailing address: 332 Ma n St.
Picton, Ontario K0K 2T
jangelo@pecounty.on.c

R.V. Anderson Associates Limited
Mr. Ken Campbell, P.Eng.
Project Manager
2001 Sheppard Avenue East,
Toronto, Ontario M2J 4Z8
Tel: (416) 497-8600
Fax: (416) 497-0342
kcampbell@rvanderson.com

LUKE HEN

Kate Neale, 21, pictured Tuesday, Jan. 24, 2012 in Belleville, develo
She said she believes it resulted from her numerous indoor tannin
now says indoor tanning should be banned.

Woman hopes cancer won't

Continued from page 61

"There is just a tremendous amount of evidence."

She cited various studies that have made the connection between both the sun and tanning beds and skin cancer. They include the findings of the International Agency for Research on Cancer's study, published in a 2009 edition of the Lancet Oncology medical journal.

Both the agency and the World Health Organization list UV devices, including sunbeds, as known carcinogens. Arsenic and asbestos share the same status.

Rosen argued the studies mentioned by the tanning association's Gilroy do link the practice to cancer.

"That's showing — at an epidemiological level — people who have melanoma have a much stronger history of having been to a tanning parlour," she said.

Neale now gets her tans from a spray bottle — and hopes cancer won't return.

She has multiple biops
most of her friends ha
ning.

"At 21, who wants t
over their body? It su
feel good, but knowin
getting it again are 9
with that anxiety every

"Every single one o
advised me to never
bed again."

Her dermatologists
cuss her case.

Neale said she isn't
sue legal action; she j
vent others from havin
rience.

"I'm not doing it out
"I watched people bri
old daughters in and
that they could tan

"Now that I think o
my mind. It's not wort

Picton Water Treatment Plant Intake Replacement
Prince Edward County

NOTICE OF PUBLIC INFORMATION CENTRE
Class Environmental Assessment

Through thι Quinte Source Water Protection Program, the 2009 Intake Protection Zone Delineation nd Vulnerability Assessment identified that the existing two intakes at the Picton Water Treat nent Plant are vulnerable to certain risks, contaminants and fluctuations in water quality and ıcreasing maintenance costs. At the same time, the County could benefit from an intake with higher capacity for a possible future expansion.

In order to ddress the identified vulnerability and to plan for future capacity demands, the County of Pı nce Edward is undertaking a review of alternatives, detailed design and constructior of a new replacement intake, crib and new raw water well for the Picton Water Treatment F ant. This will improve the raw water quality for Picton and Bloomfield munic pal water systeı ıs.

A Municipal Class Environmental Assessment (Class EA) has been initiated to determine possible rep acement intake and raw water well options. The Class EA is proceeding as a Schedule B ındertaking in accordance with the Municipal Class Environmental Assessment (2007) proc ss.

Public input and comments are welcomed for incorporation into the planning of this project, and will be eceived at the Public Information Centre (PIC).
The PIC is s heduled for Thursday, May 10th, 2012 from 4pm – 8pm at the Crystal Palace – 375 Main St eet, Picton, Ontario.

Subject to c mments received, funding and the receipt of necessary approvals the County of Prince Edwa d intends to proceed with the construction of this project. Please contact one of the followin for further information:

County of rince Edward
Public Woı ks Department
Mr. Joseph ngelo, P.Eng.
Project Mar ager
Edward Bui ding
280 Main S ., 2nd floor
Mailing add ess: 332 Main St.
Picton, Ont rio K0K 2T0
jangelo@pe county.on.ca

R.V. Anderson Associates Limited
Mr. Ken Campbell, P.Eng.
Project Manager
2001 Sheppard Avenue East,
Toronto, Ontario M2J 4Z8
Tel: (416) 497-8600
Fax: (416) 497-0342
kcampbell@rvanderson.com

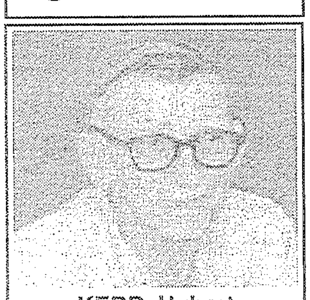
In memory of our parents
HUNTER ROBERTSON
May 26, 1931 - March 12, 1992
MARILYN ROBERTSON
February 14, 1932 - April 27, 2011

Gone Touring Together.
They walk with us down quiet paths,
And speak in wind and rain
For the magic power of memory
Gives them back to us again.
Loved and remembered always by Susan, Linda, Peter, Alex and Ryan.

DEATHS

CAHOON, Jack
Peacefully at West Lake Terrace Nursing Home, on Wednesday, April 18th, 2012, Jack Cahoon, at the age of 79. Loving father to Bev and her husband Fred Courneyea of Wellington and Jackie and her husband Brad Valleau of Hillier. Dear brother of Margaret Bett of Frankford and the late Don and Ben. Much loved grandfather to Vicky, Matthew and Kaitlyn. A celebration of Jack's life was held at The Whattam Funral Home, 33 Main Street, Picton on Monday, April 23rd at 2pm. Reverend Audrey Whitney Officiated. If desired, donations to the Loyalist Humane Society or the Canadian Cancer Society would be appreciated by the family. (Cheques only, please). Friends were invited on Monday from 1pm till the time of service at 2pm. Online donations and condolences at www.whattamfuneralhome.com

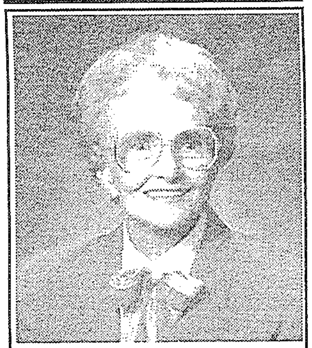
Whattam Funeral Home



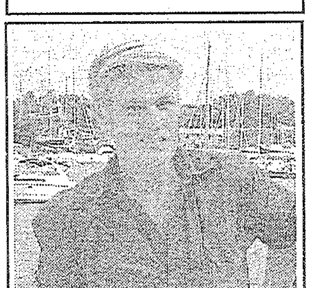
KERR, Hubert
At Quinte Health Care Prince Edward County Memorial, on Sunday, April 22nd, 2012, Hubert Kerr, former Building Contractor, of R.R. #8, Picton, at the age of 73. Beloved husband of Marilyn. Loving father of Margaret of R.R. #8, Picton, Vernon and his wife Jackie of Napanee, Ron and his partner Susan and Eleanor and her husband John Sedore of R.R. #8, Picton. Dear brother of John and his wife Pearl, Donald and his wife Carol Ann, Judy and her husband Harry Crowe and the late Geraldine Pelliter. Much loved grandpa to Robert, Chris, Tim, Sarah, Amy, Steven and Christine and his great grandchildren Cheyenne, Kaydence and Addison. Hubert rested at The Whattam Funeral Home, 33 Main Street, Picton. Funeral Service was held, on Wednesday, April 25th at 10:30am. Pastor Dennis Pringle officiated. Interment Sophiasburgh Cemetery. If desired, donations to the Prince Edward County Memorial Hospital Foundation would be appreciated by the family. Friends were invited to call on Tuesday evening from 6 till 8pm. Online donations and condolences at www.whattamfuneralhome.com

Whattam Funeral Home

DEATHS



BRYCE, Ruth Reid (Watson)
Ruth passed away peacefully on Saturday, April 14, 2012 in Belleville, Ontario, just shy of her 90th birthday. "Mum" was a gifted teacher who had a positive influence on the lives of many children in both the Hamilton and Ottawa public school systems. After retirement, she embarked on a successful second career as a travel agent, escorting much younger clients on European adventures. Family harmony was of prime importance to her. As a result, she created a warm and inviting home, which family from all corners of the globe travelled to regularly. She will be greatly missed by all of us. Predeceased by her husband James Alexander and son Roger Alexander. Survived by her daughters Sandra Carrick, wife of Thomas Howison of Newburgh, Scotland, and Gillian Margaret, wife of Robert Leek of Bloomfield, Ontario. also survived by older sisters Jenny, wife of John Jack, and Jessie wife of Alex Barnett (deceased). Much loved grandmother of Roger Howison and wife Rachel, Keith Howison, Kimi Brazier and husband Dan, Heather Milroy and husband Scot, and Kendra Leek and partner Jos van Straaten. Cherished great-grandmother of Rafferty, Rose, Nikola and Ewan. A memorial service will be held at the Westboro Chapel of Tubman Funeral Homes, 403 Richmond Road, Ottawa, Ontario on Saturday, April 21st as 2 p.m. For those who wish, donations to "Trees for Life Grove: Ruth and James Bryce", http://www.treesforlife.org.uk/groves/grovepage.php?id=5962 or a charity or your choice would be appreciated. Online condolences and memories may be forwarded to www.tubmanfuneralhomes.com



"Don't let go too soon, but don't hang on too long"
Morrie Schwartz

KENNEDY, James George (Jim)
On November 28th, 2011 the Montreal Canadiens lost their most loyal fan with the death of Jim Kennedy, at age 63 (it was downhill for the Habs after that). Jim is survived by his mother Lillian Kennedy (nee Ingram), Diane Kennedy, and is greatly missed and admired by his children Ken and Kim (Kenny and Dawna to their dad), and daughter- and son-in-law Kate and Dave King. Jim's humour and love for play will be remembered by his siblings Jean, Jerry (Wendy), Janice (Jim), and Jack (Darla), as well as his many nieces and nephews. Predeceased by his father Russell, brother and best friend John and siblings Judy, Jeffrey, sister-in-law Heather, and brother-in-law Ben. A former employee at Interface Flooring Canada, Jim's exceptional work ethic was exemplified by having never taken a sick day in his 25 years of service. Thanks for the laughs, unconditional love, and showing us the meaning of courage. A memorial will be held in the Pavilion at Lake-on-the-Mountain Resort (286 County Rd. 7, Prince Edward County) on Saturday June 9th, 2012 from 2pm-5pm. Memories of Jim will be shared at 3pm. If desired, donations can be made to the Canadian Cancer Society or Jumpstart – giving kids a sporting chance (http://jumpstart.canadiantire.ca).

DEATH

GOULD, Lori Sue
Courageously with her family at Kingston General Hospital, on Friday, April 20th, 2012, Lori Sue Gould, of Picton, formerly of St. Thomas, at the age of 53. Beloved wife of Ric. Loved daughter of Elsie and the late Lorne Wilkinson. Cherished mother to Katie and Kyle both of Picton. Dear sister of Pat, Carol, Bill, Brian, Sandra, Bruce and their families. A gathering of Lori's family and friends will be held at the Heritage Hall, 166 County Road 6 Picton, on Friday, April 27th from 2 till 4pm. If desired, donations to the Canadian Cancer Society or the Ontario Heart and Stroke Foundation would be appreciated by the family. (Cheques only, please). Arrangements entrusted to The Whattam Funeral Home, 33 Main Street, Picton.
Online donations and condolences at www.whattamfuneralhome.com

Whattam Funeral Home

DEATH

PATTON, Eleanor Isabella
Suddenly at Quinte Health Care Prince Edward County Memorial, on Saturday, April 21st, 2012, Eleanor Isabella Patton, of Kentwood Park Nursing Home, formerly of Picton, at the age of 81. Beloved wife of the late Harold. Loving companion and friend of Ron Third. Loved mother to Fiona Patton and her partner Tanya Huff of Milford and Isabelle Patton and her partner Mark Bongard of R.R. #3, Picton. By Eleanor's request, No visitation. A Memorial Service will be announced. Cremation. If desired, donations to the Canadian Mental Health or the Loyalist Humane Society would be appreciated by the family. (Cheques only, please). Arrangements entrusted to The Whattam Funeral Home, 33 Main Street, Picton.
Online donations and condolences at www.whattamfuneralhome.com

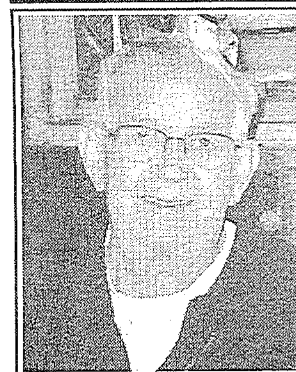
Whattam Funeral Home

DEATH

SHAW, Barbara Ruth
Suddenly on Tuesday, April 17th, 2012, Barbara Ruth Shaw, of Spring Street, Picton, formerly of Scarborough and Hawkesbury, at the age of 67. Beloved daughter of the late Frederick William Brown and Mary Edith Shaw. Loved sister of Ian and his wife Patricia of Toronto and the late Janet MacLean. Dear aunt of Catherine Chitayat, Mary Anne Shaw-Cosman, Jennifer Shaw, Heather Lantz, Shannon MacLean and Brent MacLean. A Memorial Service will be held at Picton United Church on Thursday, May 17th at 2pm. Reverend Dr. Hal Wilson officiating. If desired, donations to the Canadian Diabetes Association or Picton United Church would be appreciated by the family. (Cheques only, please). Friends may call at the Church from 1pm till the time of service at 2pm. Arrangements entrusted to The Whattam Funeral Home, 33 Main Street, Picton. Online donations and condolences at www.whattamfuneralhome.com

Whattam Funeral Home

DEATH



SISTY, Harry Frank
At Picton Manor Nursing Home on Saturday, April 14, 2012, Harry Frank Sisty of Picton, at the age of 83. Beloved husband of the late Joan. Dear father of Dan and his wife Karen of Perth, Denise and her husband Alec Galloway of Picton and Diane Bayley of Bowmanville. Dear brother of Carol Bonnell of Burlington. Sadly missed by his grandchildren Christopher, James, Sebastian, Nikkita and Sasha. In keeping with Harry's wishes, there will be no visitation or Funeral Service. If desired, donations to the Heart and Stroke Foundation would be appreciated by the family (cheques only please). Arrangements entrusted to The Whattam Funeral Home, 33 Main Street, Picton. Online donations and condolences at www.whattamfuneralhome.com

Whattam Funeral Home

OFFICIAL NOTICE

THE COUNTY Prince Edward County, Ontario

Picton Water Treatment Plant Intake Replacement Prince Edward County

NOTICE OF PUBLIC INFORMATION CENTRE Class Environmental Assessment

Through the Quinte Source Water Protection Program, the 2009 Intake Protection Zone Delineation and Vulnerability Assessment identified that the existing two intakes at the Picton Water Treatment Plant are vulnerable to certain risks, contaminants and fluctuations in water quality and increasing maintenance costs. At the same time, the County could benefit from an intake with a higher capacity for a possible future expansion.

In order to address the identified vulnerability and to plan for future capacity demands, the County of Prince Edward is undertaking a review of alternatives, detailed design and construction of a new replacement intake, crib and new raw water well for the Picton Water Treatment Plant. This will improve the raw water quality for Picton and Bloomfield municipal water systems.

A Municipal Class Environmental Assessment (Class EA) has been initiated to determine possible replacement intake and raw water well options. The Class EA is proceeding as a Schedule B undertaking in accordance with the Municipal Class Environmental Assessment (2007) process.

Public input and comments are welcomed for incorporation into the planning of this project, and will be received at the Public Information Centre (PIC).
The PIC is scheduled for Thursday, May 10th, 2012 from 4pm – 8pm at the Crystal Palace – 375 Main Street, Picton, Ontario.

Subject to comments received, funding and the receipt of necessary approvals, the County of Prince Edward intends to proceed with the construction of this project. Please contact one of the following for further information:

County of Prince Edward
Public Works Department
Mr. Joseph Angelo, P.Eng.
Project Manager
Edward Building
280 Main St., 2nd floor
Mailing address: 332 Main St.
Picton, Ontario K0K 2T0
jangelo@pecounty.on.ca

R.V. Anderson Associates Limited
Mr. Ken Campbell, P.Eng.
Project Manager
2001 Sheppard Avenue East,
Toronto, Ontario M2J 4Z8
Tel: (416) 497-8600
Fax: (416) 497-0342
kcampbell@rvanderson.com

COMING EVENTS

CAR SHOW
Canadian Tire Parking Lot
Every Thursday 6pm - 8pm
Info: 613-476-1621
Laverne

CHERRY VALLEY UNITED CHURCH
Smorgasbord Dinner
Sat., May 5th
5-6:30pm
Adults $14
Children $6

HERITAGE HALL BUFFET DINNER
STUFFED ROAST PORK
Sunday, May 6th
Serving 4pm - 7pm
$10 per person
613-476-2342
166 County Rd 6
*No Reservations

Don't miss out! Read the Classifieds for community events.

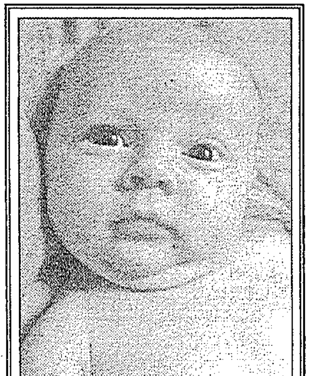
COMING EVENTS

Bloomfield United Church
ROAST BEEF DINNER
Saturday May 12
4:30-6:30pm
Adults $13 or 2/$25
Children $8
Everyone welcome
Info: 613-476-5760

PERSONAL

MAN 71, seeking lady companion 65+, no strings just friendship, 613-393-2029 Bloomfield

BIRTHS



TERPSTRA
Brady is thrilled to announce the arrival of his little brother, BENNETT RUSSELL on March 24th at 1:09am weighing 6 lbs 10 oz. Proud parents are Chris & Kristin. Ben is the third grandchild for Rusty & Cheryl Carter and the ninth for Dini and the late Bill Terpstra. Thanks to Dr. Chanda and the girls on Quinte 7 for the wonderful care!

CARDS OF THANKS

HEARTFELT THANKS. Vi Williams and family would like to express deep gratitude to the many friends and colleagues who sent condolences and support after the passing of our dear husband and father, Russ Williams on February 15. A memorial service and celebration of life was held in the family cemetery in Sweaburg, Ontario on April 21. We will never forget the generosity of spirit everyone has shown and appreciate the many donations which were made in memory of Russ. The many kindnesses were overwhelming and remind us of just how valued and loved he was. Thank you to all.

I would like to thank my friends for helping me celebrate my birthday. Their flowers and gifts were more than I could imagine. My daughter did a wonderful job planning and really surprised me with a limo tour plus an upcoming adventure for the two of us. Thanks again to all, Judy McConnell

MEMORIAM

In memory of
SHERI KULLY
March 27, 1948 to April 23, 2002

Creator of Christmas in the Village

Ten years have passed and we still miss her so much. Her enthusiasm and insight of what Bloomfield needed was an inspiration for all. Sheri is hanging Christmas decorations, gardening, and walking her beloved dogs in Heaven.

Remembered by her Bloomfield friends and colleagues.

MEMORIAMS

LIGHTFOOT, Robert Alan. Loving father, who passed away May 4th, 1977.
Time has passed with so much seemingly missed. Yet with each moment that defines us....we know you were there. Like a hand upon our shoulder your memory and love will always be there for us to embrace.
Forever loved and missed daughter Carol, son Richard and families.

SLAVEN, In loving memory of a dear son and brother, Harry Paul Slaven, 1965 -1988.
Loving memories of one so dear,
Treasured still with a love sincere,
In our hearts he is living yet,
We loved him too dearly to forget.
Always remembered by Mom and family.

WALKER (Taylor). In loving memory of our dear sister Betty Marie, who passed away May 18, 1974.
Never more than a thought away;
Quietly remembered every day,
No need for words, except to say,
Still loved, still missed, in every way.
Sadly missed and always loved by Elva, Bob and Deanna.

In Sympathy

MEMORIAM

In Loving Memory of

AARON WHALEN
September 21, 1979 - May 7, 2011

Loved so much, so full of life... gone much too soon.
We miss you and think of you every day.
You will always be remembered in the stories we tell our children about their Uncle Aaron!
Love, Sheena, Dan, Brennan, Aleena and the rest of the Whalen family

MEMORIAM

ROBERT GARBUTT
In loving memory of a dear father who passed away April 29, 2008
Remember him with a smile today,
He was not one for tears,
Recall to mind the way he spoke,
And all the things he said,
His strength, his stance, the way he walked,
Remember these instead.
The good advice he'd give us,
His eyes that shone with laughter,
So much of him will never die, but live on ever after.
As we loved you, so we miss you,
Kelly, Graham and Jason

OFFICIAL NOTICE

Notice
Therapy on the Bay
179 Georges Road, RR2 Picton, Ontario K0K 2T0
613-476-0044 and 613-476-5484

I, Marilyn Holland-Foster, as of April 18, 2012, am no longer affiliated with, nor responsible for any debts, liabilities, or injuries incurred in the operation of the business known as Therapy on the Bay, operated by Arnold Bruce Foster, known as Bruce Foster.

I, Marilyn Holland-Foster, as of April 18, 2012, am no longer responsible for any debts, liabilities or injuries incurred by Arnold Bruce Foster, known as Bruce Foster.

Signed at Picton, Ontario Canada April 30, 2012.

OFFICIAL NOTICES

THE COUNTY
Prince Edward County, Ontario

WASTE DISPOSAL SITES - NOTICE
HOURS OF OPERATION / FEES AND CHARGES
EFFECTIVE APRIL 24, 2012

The County's Fees and Charges By-Law was amended by Council on April 10, 2012. The amendment has increased the charges for disposal of bulk waste and other loose garbage, construction debris, brush and clean lumber disposal, and the sale of blue boxes.

The County will continue to open the waste disposal sites ONLY one day per week for the remainder of 2012. The Hours of Operation are 8 am to 4 pm on Saturday and the locations of waste disposal sites are as follows:

Sophiasburgh - 35 County Road 14 (Transfer Site)
Hallowell - 1080 Shannon Road (Transfer Site)
Wellington - 275 Consecon St (Transfer Site)
Picton - 37 Church St (Transfer Site-brush and leaves not accepted)

Ameliasburgh - 245 Valley Road (Landfill Site-construction debris not accepted)
Hillier - 450 Bakker Road (Landfill Site-construction debris not accepted)
South Marysburgh - 1132 Old Milford Road (Landfill Site-construction debris not accepted)

Additional information regarding waste collection and disposal can be found at the County website at www.pecounty.on.ca or email publicworks@pecounty.on.ca or call 613.476.2148 ext 326.

THE COUNTY
Prince Edward County, Ontario

Picton Water Treatment Plant Intake Replacement
Prince Edward County
NOTICE OF PUBLIC INFORMATION CENTRE
Class Environmental Assessment

Through the Quinte Source Water Protection Program, the 2009 Intake Protection Zone Delineation and Vulnerability Assessment identified that the existing two intakes at the Picton Water Treatment Plant are vulnerable to certain risks, contaminants and fluctuations in water quality and increasing maintenance costs. At the same time, the County could benefit from an intake with a higher capacity for a possible future expansion.

In order to address the identified vulnerability and to plan for future capacity demands, the County of Prince Edward is undertaking a review of alternatives, detailed design and construction of a new replacement intake, crib and new raw water well for the Picton Water Treatment Plant. This will improve the raw water quality for Picton and Bloomfield municipal water systems.

A Municipal Class Environmental Assessment (Class EA) has been initiated to determine possible replacement intake and raw water well options. The Class EA is proceeding as a Schedule B undertaking in accordance with the Municipal Class Environmental Assessment (2007) process.

Public input and comments are welcomed for incorporation into the planning of this project, and will be received at the Public Information Centre (PIC).
The PIC is scheduled for Thursday, May 10th, 2012 from 4pm – 8pm at the Crystal Palace – 375 Main Street, Picton, Ontario.

Subject to comments received, funding and the receipt of necessary approvals, the County of Prince Edward intends to proceed with the construction of this project. Please contact one of the following for further information:

County of Prince Edward
Public Works Department
Mr. Joseph Angelo, P.Eng.
Project Manager
Edward Building
280 Main St., 2nd floor
Mailing address: 332 Main St.
Picton, Ontario K0K 2T0
jangelo@pecounty.on.ca

R.V. Anderson Associates Limited
Mr. Ken Campbell, P.Eng.
Project Manager
2001 Sheppard Avenue East,
Toronto, Ontario M2J 4Z8
Tel: (416) 497-8600
Fax: (416) 497-0342
kcampbell@rvanderson.com

FIRST_NAME	LAST_NAME		COMPANY NAME/ADDITIONAL NAME	LOCATION	CITYTOWN	PROVINCE	COUNTY	PCODE
ERIC	SERWOTKA	**	HASTINGS/PRINCE EDWARD HEALTH UNIT	1 MILLENIUM PARKWAY SUITE 200	BELLEVILLE	ON	CANADA	K8N 4Z5
MERLIN J.	DEWING		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
SCOTT	MANLOW		COUNTY OF PRINCE EDWARD	2 ROSS ST	PICTON	ON	CANADA	K0K 2T0
ANDY	HARRISON		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
JANICE	MAYNARD		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
DIANNE	O'BRIEN		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
JIM	DUNLOP		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
NICK	NOWITSKI		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
JAMIE	FORRESTER		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
ROBERT	QUAIFF		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
KEITH	MACDONALD		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
ALEC	LUNN		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
BARB	PROCTOR		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
HEATHER	CAMPBELL		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
BARRY	TURPIN		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
BRIAN	MARISETT		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
BEV	CAMPBELL		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
MAYOR PETER	MERTENS		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
KEVIN	GALE		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
TERRY	SHORT		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
JOHN	LA CHAPELE	**	C/O DEV & MUNICIPAL SERVICE CONTROL CENTRE	FLOOR 5 - BLUE, 100 BOROUGH DRIVE	SCARBOROUGH	ON	CANADA	M1P 4W2
VICTORIA	LESKIE		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
ROBERT	MCAULEY		COUNTY OF PRINCE EDWARD	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
DON	CAZA		DIRECTOR OF WATER AND WASTEWATER SERVICE	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
GLENN	KOZAK		PICTON GOLF AND COUNTRY CLUB	734 COUNTY ROAD 49	PICTON	ON	CANADA	K0K 2T0
Paul	McCoy		QUINTE CONSERVATION	2061 OLD HIGHWAY 2 RR2	BELLEVILLE	ON	CANADA	K8N 4Z2
Brad	McNevin		QUINTE CONSERVATION	2061 OLD HIGHWAY 2 RR2	BELLEVILLE	ON	CANADA	K8N 4Z2
DIRECTOR, ENVIRONMENTAL ASSESSMENT AND APPROVALS BRA			MINISTRY OF ENVIRONMENT	2 ST. CLAIR AVENUE WEST, FLOOR 12A	TORONTO	ON	CANADA	M4V 1L5
BRIAN	KAYE		MINISTRY OF ENVIRONMENT	1259 GARDINERS ROAD, BOX 22032	KINGSTON	ON	CANADA	K7M 8S5
DAVE	BERETTA		MINISTRY OF ENVIRONMENT - BELLEVILLE AREA OF	345 COLLEGE ST E	BELLEVILLE	ON	CANADA	K8N 5S7
GERRY	MULDER		MINISTRY OF NATURAL RESOURCES	ONTARIO GOVERNMENT BUILDING; BEACHGROVE COMPLEX 51 HEAKES LANE	KINGSTON	ON	CANADA	K7M 9B1
TAMMY	CHUNG		MINISTRY OF NATURAL RESOURCES	Peterborough District Office; 300 Water St, 1st Floor, South Tower	PETERBOROUGH	ON	CANADA	K9J 8M5
MARGARET	Bérubé		MINISTRY OF NATURAL RESOURCES	Peterborough District Office; 300 Water St, 1st Floor, South Tower	PETERBOROUGH	ON	CANADA	K9J 8M5
LINDA	MacWILLIAMS		DEPARTMENT OF INDIAN AFFAIRS	5TH FLOOR, 25 ST. CLAIR AVENUE EAST	TORONTO	ON	CANADA	M4T 1M2
MONIQUE	MOUSSEAU		TRANSPORT CANADA	4900 YONGE ST SUITE 300	TORONTO	ON	CANADA	M2N 6A5
Jennifer	Hughes		TRANSPORT CANADA	4900 YONGE ST SUITE 300	TORONTO	ON	CANADA	M2N 6A5
Chief R. Donald	Maracle		Mohawks of the Bay of Quinte	13 Old York Road, RR#1	Deseronto	ON	CANADA	K0K 1X0
Chief James R.	Marsden		Alderville First Nation	P.O. Box 46, RR#4	Roseneath	ON	CANADA	K0K 2X0
Keith	Taylor		Quinte Conservation Authority	2061 OLD HIGHWAY 2 RR2	BELLEVILLE	ON	CANADA	K8N 4Z2
OFFICER IN CHARGE			FISHERIES AND OCEANS CANADA - CANADIAN COAS	PO BOX 1000	PRESCOTT	ON	CANADA	K0E 1T0
Communications Branch			Deptment of Fisheries and Oceans	200 Kent Street, 13th floor, Station 13E228	Ottawa	ON	CANADA	K1A 0E6
WENDY	LAVENDER		MINISTRY OF ENVIRONMENT - BELLEVILLE AREA OF	345 COLLEGE ST E	BELLEVILLE	ON	CANADA	K8N 5S7
Jacqueline	Fuller		MINISTRY OF ENVIRONMENT - PETERBOROUGH DIS	300 Water St, 2nd floor, South Tower	PETERBOROUGH	ON	CANADA	K9J 8M5
Candy	Gibson		MINISTRY OF ENVIRONMENT - PETERBOROUGH DIS	300 Water St, 2nd floor, South Tower	PETERBOROUGH	ON	CANADA	K9J 8M5
BARRY	BRAUN		Recreation Parks & Culture Department (Picton Marina)	332 Main St	PICTON	ON	CANADA	K0K 2T0
DAN	WIGHT		ESSROC CANADA INC	PO Box 620	PICTON	ON	CANADA	K0K 2T0
Jon	Wilkins		PRINCE EDWARD YACHT CLUB	30 Fairfield St.	PICTON	ON	CANADA	K0K 2T0
THE REEL THING FISHING PRO SHOP			The Reel Thing Fishing Pro Shop	151 Main St.	WELLINGTON	ON	CANADA	K0K 3L0
PRINCE EDWARD ROD AND GUN CLUB			PRINCE EDWARD ROD AND GUN CLUB	PO BOX 20003	PICTON	ON	CANADA	K0K 3V0
DAVE	CHATTERTON		FISH FINDER CHARTERS	RR #1	CARRYING PLAC	ON	CANADA	K0K 1L0
GERRY	DEMIANCHUK		PICTON ICE	7 MACSTEVEN DRIVE	PICTON	ON	CANADA	K0K 2T0
ARNOLD	ROBB		UNIVERSAL FAN AND BLOWERS LTD	30 BARKER'S LANE	BLOOMFIELD	ON	CANADA	K0K 1G0
IAN	CRERAR		CLEARWATER DESIGN	1959 COUNTY RD 15	PICTON	ON	CANADA	K0K 2T0
Vicki	Mitchell		Ministry of Environment – Environmental	1259 Gardiners Road, P.O. Box 22032	Kingston	Ontario	CANADA	K7M 8S5
Jean Anne	Carroll		COUNTY OF PRINCE EDWARD (Economic Developmer	332 MAIN ST	PICTON	ON	CANADA	K0K 2T0
2038787 Ontario Inc			Docks located at 35 Bridge St, Picton	14 Empire Blvd	Wellington	ON	CANADA	K0K 3L0
1213427 Ontaro Corporation	c/o Donald A Foley		Canada Salt located at White Chapel Road	2441 Diamondview Rd	Carp	ON	CANADA	K0A 1L0
		**** indicates not confirmed**						
Will send these out via email instead of mailing								
Peter	Dafoe		Town of Greater Napanee	Utilities Manager	pdafoe@greaternapanee.com		6133548863 x 105	
Bryan	Brooks		Town of Deseronto	Clerk	bbrooks@deseronto.ca		6133962440	
Steve	Mercer		Township of Tyendinaga	Clerk	clerk@tyendinagatownship.con		6133961944	
John	Farrell		Township of Tyendinaga	Road Supervisor	roads@tyendinagatownship.coi		6133966562	

APPENDIX D

R.V. Anderson Associates Limited
environment · infrastructure

2001 Sheppard Avenue East Suite 400
Toronto Ontario M2J 4Z8 Canada
Tel 416 497 8600 Fax 416 497 0342
Web www.rvanderson.com

MEETING NOTES

COUNTY OF PRINCE EDWARD

PICTON WATER TREATMENT PLANT REPLACEMENT INTAKE
Project No. 112356

TECHNICAL ADVISORY COMMITTEE – MEETING #1

DATE: Thursday, June 23, 2011; 10:30am – 2:00pm

PLACE: Edward Building
280 Main Street, 2nd Floor
Picton, ON

PROJECT NO.: RVA #112356

PRESENT:

Name	Job Title	Organization
Robert McAuley	Commissioner	Prince Edward County (PEC)
Joe Angelo	Project Manager	Prince Edward County (PEC)
Don Caza	Director of Water/Wastewater	Prince Edward County (PEC)
Bev Campbell	PE Councilor	Prince Edward County (PEC)
Janice Maynard	PE Councilor	Prince Edward County (PEC)
Keith Taylor	Project Manager	Quinte Conservation Authority (QCA)
Catherine Sinclair	Regulations Officer	Quinte Conservation Authority (QCA)
Brad McNevin	Fisheries Biologist and Liaison with Department of Fisheries and Oceans	Quinte Conservation Authority (QCA)
Rick Topping	Lands and Waters Technical Specialist	Ministry of Natural Resources (MNR)
Wendy Lavender	Liaison	Ministry of Environment (MOE)
Jacqueline Fuller	Supervisor, Safe Drinking Water Branch	Ministry of Environment (MOE)
Candy Gibson	Drinking Water Inspector	Ministry of Environment (MOE)
Ken Campbell	Project Manager	R.V. Anderson Associates Ltd (RVA)
Rika Law	Process Coordinator	R.V. Anderson Associates Ltd (RVA)
Simon Chun	Summer Intern	R.V. Anderson Associates Ltd (RVA)
Cameron Smith	Senior Project Manager	XCG Consultants (XCG)
Janet Noyes	Project Manager	XCG Consultants (XCG)
Michelle Lavictoire	Environmental Consultant	Bowfin Environmental Consulting (BEC)

NOT PRESENT: Jennifer Hughes, Transport Canada

The purpose of the meeting: Technical Advisory Committee Meeting #1

DISCUSSION:		ACTION BY:
1.	**TEAM INTRODUCTIONS AND LINES OF COMMUNICATION**	
	Names and positions listed above. All parties introduced themselves and their role with their organization. Some additional points coming out of the discussion are as follows: • Katie Novacek will be the primary contact with the Ontario Ministry of Natural Resources (MNR). She is the coordinator of MNR resources and reviews (will get comments back on species at risk, fisheries issue, ecology concerns, biologist concerns, construction time window, other permits and approvals) • Wendy Lavender (MOE) requested that Vicki Mitchell, MOE Class EA Coordinator to be added to the distribution list and kept in the loop regarding the project	
2.	**PROJECT PRESENTATION – BACKGROUND INVESTIGATIONS AND ALTERNATIVES**	

	2.1 Problem and Opportunity Statement
	See Class EA Brief attached herein
	2.2 Possible Intake Location Alternatives
	2.2.1 Comments from Keith Taylor (QCA)
	• “Red Zone” is existing IPZ1 – high vulnerability score of 10 (highest possible) as a result of significant threats to the existing intake
	  ◦ 48 septic systems on east side of Picton Bay
	  ◦ 2 WWTP effluent discharges
	  ◦ 3 fuel threats
	  ◦ 18 agricultural threats
	• “Blue Zone” is existing IPZ2 – represents a four hour travel of water
	• “Green zone” is total contributing watershed
	• Intakes should be moved outside of IPZ1 to decrease the vulnerability, however too far north will be close to the existing salt docks.	

DISCUSSION:		ACTION BY:

	• From earlier discussions, RVA designed Option 1 to be located outside of existing IPZ1. Option 2A and 2B is outside of existing IPZ2. Option 3 is far from existing IPZ1 and IPZ2.
	
	2.2.2 Comments from Bev Warden
	
	• History in the area in question include:
	  • previous ship building (ca. late 1800s)
	  • shipping/receiving.
	  • coal storage
	  • canning facility
	
	• PEC informed RVA of the historical industries in the area to provide foresight into sediment sample results and the impacts as result of previous activities.
	
	2.2.3 Comments from Joe Angelo
	
	• The west side of the bay might be an interesting location for proposed intake (if it requires primarily a land route) since there was a former railway line running through that location that might make the work simpler
	
	• Most of the boat traffic through area seems to be pleasure craft. Ships going to harbor will be 1 – 3 times weekly – these are primarily due to industry (i.e. Essroc).
	
	2.3 Proposed Raw Water Well Concept
	
	• RVA described their preliminary concepts regarding the raw water well at the water treatment plant. Design intent: new intake pipe enters into new raw water well on west side of property. The new raw water well connects to the a new valve chamber where the new raw water well connecting pipe will connect to the existing intake pipe, complete with isolation valves on either pipe, for redundancy to ensure that raw water can still be fed to the WTP during construction. This design will also allow for future expansion since a future low lift pumping station can be placed on top of the new raw water well and both the new and existing intake pipe can flow into the new raw water well and pumped to a future WTP that may be located off the current property.
	
	• QCA raised a question about the IPZ and vulnerability rating and significant threats that would still be an issue if the existing intake pipe was to remain active. Further discussion and design will be required to determine best approach.
		RVA

DISCUSSION:		ACTION BY:
	2.4 Typical Construction Method • RVA presented photos of a previous intake project completed (Southampton Intake Project). • Individual segments of pipe (polyethylene, thick walled pipes) are fused to become a continuous length of pipe on shore, which are then towed out along the route of the intake; concrete collars are added for weight and designed to float when the pipe is not fully submerged (to help with towing the pipe out on the water) and yet will sink when fully submerged. • A barge is used for borehole (geotechnical) investigation and during construction. A clamshell bucket off the barge is used for excavation and most work is done on the surface. • At shoreline, material is excavated and trenched with sheetpiling. A silt curtain is used to for silt containment and control. **2.5 XCG Findings** • XCG presented their preliminary findings. XCG has been gathering background data from the source water protection evaluation (containing a variety of sources – drinking water, plant and Great Lakes data) completed 4-5 years ago. Raw water quality obtained from the plant noted bacteriological data in raw water. • Two sediment samples were identified, one in Marsh Creek (irrelevant) and one 500m north of the existing intake (1 sample in 1 day in 2000). Exceedances include: metals – arsenic, chromium, cadmium, lead, zinc. XCG reported that further raw water and sediment samples around the particular intake options would help to confirm the optimal intake location **2.6 Bowfin Environmental Field Visit Findings** • Bowfin presented their preliminary findings. A field visit was conducted by Bowfin during the week of June 12 – 18 for species investigation and habitat mapping. Bowfin noted 'silty substrate' and no large shoreland habitats were identified. A few turtles (Map Turtles – species of concern) were spotted in the local area, but nothing else noteworthy. Bowfin will conduct their last field visit for further habitat mapping in August and will review the shoreline issue, particularly in regard to where the piping will be stored and assembled. • Robert McAuley noted that PEC has made a commitment to DFO to improve fish habitat, in the near shore area, and the RVA/Bowfin should be aware of this.	
3.	**UPDATE OF CLASS EA PROCESS**	

DISCUSSION:		ACTION BY:
	• RVA presented a summary of the Class EA Process. • Two existing intakes are vulnerable to risks and fluctuations in the raw water quality. Maintenance costs may be an issue as well. • PEC would like to review alternatives, design and construct a new intake – including a new crib and raw water well. The construction must be environmentally friendly, economical, reliable and easy to operate. Must meet the short and long term needs of the Town of Picton. • The solution is to be executed with minimize shutdowns and interruptions to the Town. The Notice of Commencement was published on Town's website and papers as well as mailed out to relevant agencies and industries. The next step would be to finalize proposed locations of the new intake, issue a Notice of Public Information Centre and conduct the Public Information Centre to present the possible intake locations to the public and receive comments back from the public.	
4	**PROJECT SCHEDULE**	
	4.1 RVA presented a general timeline for the project schedule with the milestones being: • Class EA – May 2011 – October 2011 o Class EA (enhanced schedule B) – at least 1 PIC; PEC has additional provisions in place to conduct an additional PIC if desired • Approvals – ongoing process • Design – October 2011 – December 2011 • Construction – TBD based on funding availability, and approvals.	
5	**APPROVALS INPUT**	
	5.1 QCA – Keith Taylor, Catherine Sinclair and Brad McNevin • Keith is responsible for source water protection and will be doing the new IPZ study once the new intake location is finalized. Also if existing intake is to remain in service, the IPZ would be impacted and existing IPZs will be in the same vulnerability zone as before. • QCA has a "Level 3" agreement with DFO, so they will be able to review and approve the application on DFO's behalf (including any fish habitat compensation plan). QCA will continue to keep DFO in the loop, but if a HADD (Harmful Alteration, Disruption or Destruction of Fish Habitat) was triggered, it may involve the DFO (authorizations	

DISCUSSION:	ACTION BY:
etc.) • Brad will be involved with reviewing the applications. The application process may take approximately 5 weeks to review. Details regarding all phases of construction are required. Habitat mapping to be necessary to confirm what is required in the affected areas. • QCA has not identified anything currently for species at risk (may not be an issue in the Picton Bay). • QCA said that Sue Watson (Environment Canada) may have some monitoring data of algae at various bay locations; Brad will see where the sampling points are and try to get some raw water quality data if they apply to this project. • DFO and PEC are in correspondence about incorporating fish habitat compensation during the intake replacement project as result of fish habitat loss in the harbor (RVA obtained letter from Rob (PEC) regarding their discussion with Chris Strand (DFO)). Summary of requirements are as below: o need to provide for 300m^2 of replacement fish habitat o no in water work between Mar 15-July 15; if any in-water o works need to be conducted, there must be in-water sediment barriers o sediment/erosion controls; isolation measures o stabilization and revegetation of disturbed areas o inspection during in-water works; monitoring program after in-water works completed	
5.2 MOE – Wendy Lavender, Jacqueline Fuller, Candy Gibson	
• Class EA process and contact in Kingston is Vicki Mitchell • Approvals – C of A amendment, MOE is moving towards a municipal licensing permit. PTTW may be required and up for renewal	
• Bruce Hawkins – Manager of Operations – may become involved in the Class EA process (responsible for surface water – i.e. sediment control etc.). Jacqueline to see if Bruce can provide any information for raw water and sediment in the Bay of Quinte. A freedom of information request could also be submitted for other information.	**MOE**
• Brad says that some sampling points have been identified due to the BQRAP (Bay of Quinte Remedial Action Plan) and frequency of sampling will vary (e.g. algae tests bi-weekly).	

DISCUSSION:		ACTION BY:

	5.3 MNR – Rick Topping
	
	• Rick Topping is in charge of Crown land applications
	
	• Work permits under the Public Lands Act will be required. Katie Novacek is the main contact; She is the coordinator of MNR resources and reviews (will get comments back on species at risk, fisheries issue, ecology concerns, biologist concerns, construction time window, other permits and approvals).
	
	• MNR requires an actual proposal before they can review a project.
	
	• RVA to apply for:
	
	  • Work permit (include Bowfin's findings and overview of project description) – commence work permit approval ASAP to allow MNR time to review and provide comments.
	
	  • Crown Easement (apply for Crown Easement after the installation is completed so that a survey can be performed to know exactly where the Crown Easement covers). One time cost of $1000 admin fee if funded by the Province, otherwise there could be an annual fee.
	
	• Note there will be a narrow construction/in water timeframe – July 1 – Sept 15, may be able to extend to Oct. 1 if there is no evidence of impact on the white fish in area of interest
	
	• Federal EA may be triggered if there is federal funding or if potential area of intake is on federal land
	
	• PEC to get in touch with their lawyers/surveyors (Roger Pickard) to conduct a "Title Search" (Rob advised that Barry Braun (Parks and Recreation) is looking into the search).
		RVA
		
		PEC

6	**NEXT STEPS**	
	• Bowfin to continue with their last field visit in August along shoreline on east and west side of the bay as well as along intended intake options • XCG to provide a quote and sampling plan for raw water and sediment sampling for various potential intake locations and see if the raw water and sediment data shows any improvement to the existing raw water and sediment at the existing intake. This will determine where intake should be located or if "do nothing/do something else" option is more viable (i.e. connecting Wellington or Trenton WTP through trunk main extension instead of upgrading Picton WTP), XCG plans to get a baseline on a clear day and perform sampling during storm events or turbid days	**BEC** **XCG**

DISCUSSION:		ACTION BY:
	• RVA to contact intake contractors to discuss possible construction methodology and mobilization requirements – this may lead to easement applications at Essroc or Canada Salt (other possibilities are Picton Airport, Lafarge) • RVA to contact approval agencies to see if they're interested in cost sharing for the raw water and sediment sampling program.	**RVA** **RVA**

Next meeting date and location - TBD.

Notes prepared by: Simon Chun

Distribution: All

PLEASE ADVISE THE WRITER OF ANY ERRORS OR OMISSIONS WITHIN 1 WEEK OF RECEIPT OF THESE NOTES

Picton Water Treatment Plant Intake Replacement Project

Problem and Opportunity Statement:

Through the Quinte Source Water Protection Region, the 2009 Intake Protection Zone Delineation and Vulnerability Assessment identified that the two existing intakes at the Picton Water Treatment Plant are vulnerable to certain risks, contaminants, fluctuations in water quality and increasing maintenance costs. At the same time, the County could benefit from an intake with a higher capacity for a possible future expansion.

In order to reduce the identified vulnerability and to plan for the future, the County is undertaking a review of alternatives, design and construction of a new replacement intake and crib for the Picton WTP, complete with a new raw water well to connect to the existing WTP.

The preferred solution for these works would be constructible, environmentally friendly, affordable, reliable, easy to maintain and operate and would meet both the short and long term needs of the County. The solution must be achievable with minimal interruption to the operation of the existing water treatment plant. The possible alternatives and preferred solution will be screened through a Municipal Class EA process and developed through final design.

Choosing the Preferred Alternative

We have developed a preliminary list of alternatives, as identified below, as possible options to be evaluated during the Class EA. To assist in visualization of the approach, we have prepared the attached sketch **SK-1**, outlining the possible alternatives.

Alternatives include:

1. Do nothing (required by the Class EA document).

2. Extend existing intake.

3. New intake to beyond existing Intake Protection Zone (IPZ) 1.

4. New intake to beyond existing IPZ-2.

5. New intake to beyond existing IPZ-2 with pumping station and feeder main.

6. New intake well into existing IPZ-3.

There are a number of factors that would affect the selection of the preferred alternative. Generally, these issues will be represented through the evaluation criteria and would include:

- **Environmental Background Review.** Potential terrestrial and aquatic environmental concerns associated with the intake will be identified through habitat mapping (substrate, water depths, spring conditions, aquatic vegetation, etc.) and visual wildlife observations (of amphibians, reptiles, birds, fish, mammals) by our environmental specialists from Bowfin Environmental. This will be used to identify impacts of each alternative and potential mitigation measures.

- **Water Quality.** The intake must be placed at a location that will supply the Picton WTP with good quality source water for years to come. Our water resources specialists from XCG Consultants will use their experience defining the zones of influence for the Quinte Conservation Authority IPZ studies to assist in determining the desired locations for the proposed intake crib. For example, the water quality will likely be a deciding factor on the intake location—whether the intake extends beyond existing IPZ-1, IPZ-2, or well into IPZ-3.

- **Sediment Quality.** While preparing this proposal, we contacted Quinte Conservation and obtained some sediment quality testing results. As part of the evaluation of the alternatives, we will assess the sediment quality in terms of constructability of the intake pipe, as it may significantly impact the cost of the construction, possibly making it nonviable.

  For example, if the sediment is not contaminated and the approval agencies do not have other concerns, the intake pipe can be installed by a "dredging and sidecasting" method that would not require any soil disposal, since the same material will be used to backfill the pipe. However, if the sediment is contaminated, it would have to be disposed in a shore-based landfill site, which would increase construction costs.

  It is also possible that the approval agencies will ask that contaminated material not be disturbed, which would introduce the possibility of other construction techniques, such as tunnelling. Tunnelling for a project of this size and type should be avoided if possible, since it is typically not cost-effective for smaller diameter pipelines.

  If contaminated soil is found, we propose to work with agencies to help develop a cost-effective solution to address it. Our experience includes many past projects requiring solutions to handle contaminated soil, such as the use of environmental dredging equipment, and on-shore staging and management for the material dredged from the bottom of the Cataraqui River during our river crossings for multiple pipes.

Obtaining Approvals

Approvals for marine construction projects have become more difficult over the past 5 years and depend on the completeness of the supplied information. Therefore, the approach for approvals should be consultative, cooperative, and detailed.

A number of agencies will likely be involved in this project, including Quinte Conservation Authority, Department of Fisheries and Oceans (DFO), Ministry of the Environment (MOE), Ministry of Natural Resources (MNR), and Transport Canada. Each of these agencies will have their own requirements to be satisfied and should be consulted throughout the project to obtain timely approval.

To help mitigate schedule delays, we propose to create a Technical Advisory Committee at the start of the project. This committee will include representatives from the above agencies, as well as PEC staff, and will meet at key points to review information to date and achieve agreement on important decisions.

We will stay in touch with Quinte Conservation and the other agencies throughout the Class EA process to keep them informed and to extract requirements, conditions, and limitations that later will be included in our design. The goal will be obtain approval-in-principle during the Class EA stage, then work with the agencies to integrate requirements directly into the design as it progresses.

The approvals for this project will include:

- **Ministry of the Environment (MOE) Certificate of Approval,** since the intake is subject to the MOE's drinking water intake protection, mixing zone, and dispersion considerations, as well as a plume evaluation.

- **Ministry of Natural Resources (MNR) Work Permit,** subject to construction time frame limitations for in-water works (which could significantly affect the construction schedule and costs). Should there be endangered species in the work area, a Species at Risk permit will be required. In addition, if a coffer dam is used, a permit will be required under the Lakes and Rivers Improvement Act.

- **Department of Fisheries and Oceans (DFO) Permit to Take Fish by Means Other Than Fishing,** depending on the construction technique, especially if sub-surface blasting is required. DFO will also be involved in assessing compensation requirements in situations where there is "Harmful Alteration and Destruction of Fish Habitat (HADD)." If there is a HADD, we would need authorization under the Fisheries Act. Regardless of the HADD status, we anticipate that a Letter of Advice from DFO will be required.

- **Quinte Conservation Authority Approval** required under O.Reg. 178/06 for alterations to shorelines and watercourses. Their approval will also be necessary in regard to fish habitat issues.

- **Transport Canada Approvals** under the Navigable Water Act and for the Coast Guard. Transport Canada will also have concerns regarding any impacts to shipping and boater safety.

There are a couple of other potential approvals that were not specifically mentioned in the Terms of Reference but could be required. We will evaluate their applicability early in the project and work with PEC if they are necessary:

- **Federal EA.** A Federal EA may be triggered by either an authorization under the Fisheries Act or under the Navigable Waters Act. Early and ongoing engagement with both federal and provincial agencies is key to identifying issues of concern early enough in the project that mitigation measures can be directly integrated into the process without impacting the schedule. Carefully documenting the scope of the project and factors to be considered should result in a defensible EA document, which is important to prevent delays.

  We have experience with Federal EAs, and would integrate the Federal EA requirements directly into the Class EA process to reduce impacts to the schedule. We have relationships already in place with regulatory stakeholders and are currently undertaking a Federal EA process for the City of Ottawa.

- **Ministry of Culture (MOC) Approval.** On past water intake projects, we did not have to obtain any particular approval from this agency. However, we understand that on some of the latest projects in 2010, the Owner had to obtain a Marine Archaeological Permit. We will evaluate the need for this permit early in the project.

Choosing the Preferred Design

The existing Picton WTP is currently being upgraded, giving it a projected life of approximately 25 years. The intake upgrade, therefore, needs to be able to supply water to the existing WTP, as well as allow for a future connection to a new WTP (whether at the same site or elsewhere).

Once the preferred alternative has been decided, we will develop a list of alternative design concepts to review during Phase 3 of the Class EA. Features that will be addressed during design include:

- **Intake crib:** The design will focus on preventing sediment suction, protecting fish habitat by designing low velocities of the water around the crib, and minimizing effect on the boating traffic and fishing activities, as well as by frazil ice, wave action, and winter freeze conditions.

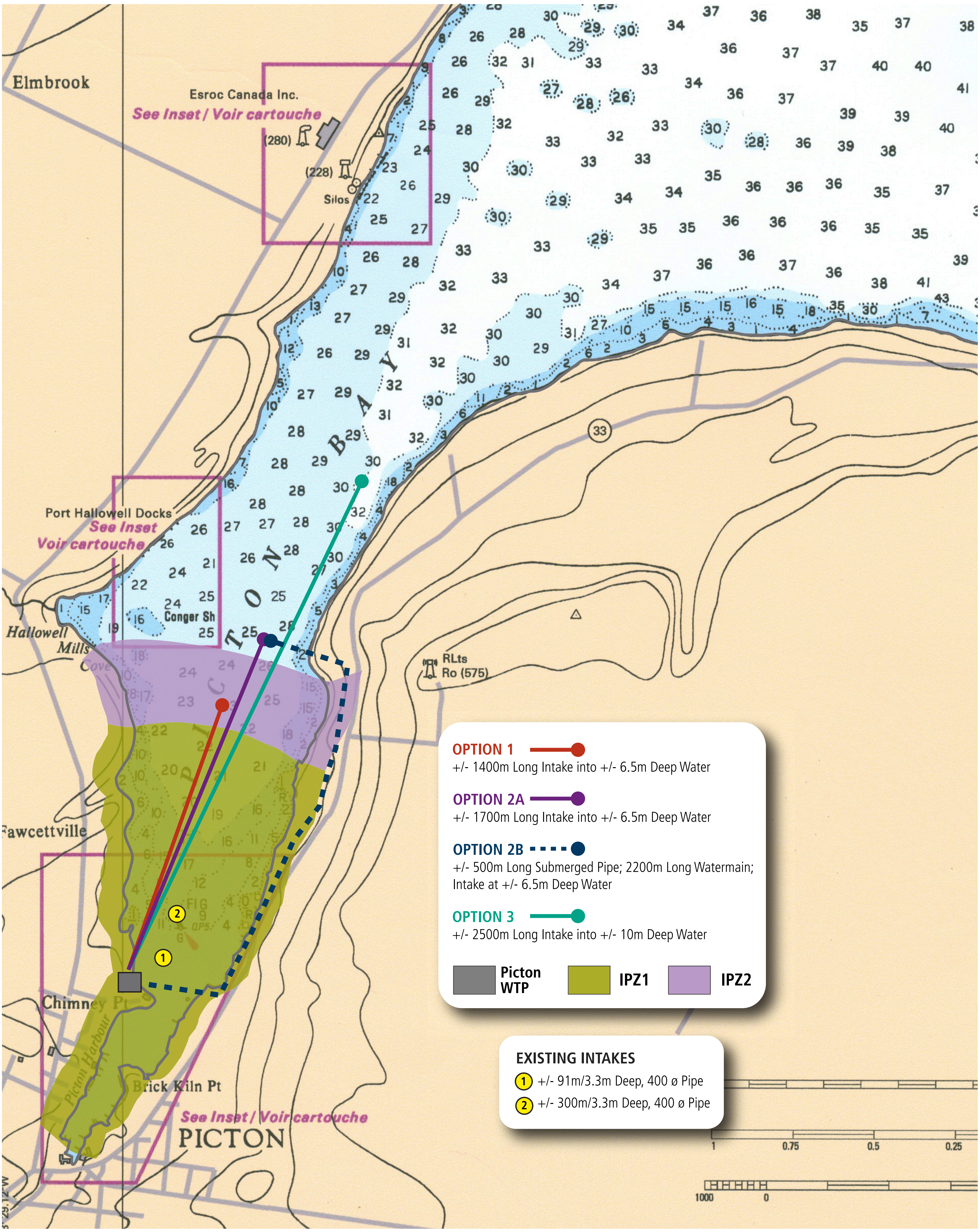
- **Intake pipe:** The design will focus on Zebra mussel control, acceptable flow velocity and friction, pipe material and size selection, and maintenance features.

- **Raw water well:** The new raw water well could be located at the existing WTP site with either of alternatives 3, 4, 5, and 6 listed above, located strategically to allow the existing raw water well to be fed by gravity flow. The structure should include provisions to allow twinning, as well as pumping to a new WTP when required, to help address future needs.

- **Redundancy:** One important issue associated with intakes is the issue of redundancy. In other words, how will the WTP be supplied with raw water if the intake needs to be taken out of service for maintenance or repair? Often the most obvious solution to "double up" the intake pipe is not financially viable.

  Based on our knowledge of the site, one viable option would be to maintain service and to incorporate one of the two existing intake pipes into the on-site piping scheme. This option is particularly attractive, as the gravity pipe that would have to be constructed between the new and the old raw water well could be used to reverse the flow from the old intake to the new raw water well (see sketch SK-2). Minor improvements or pipe extension on land would be a fairly inexpensive solution to provide the WTP with the required redundancy.

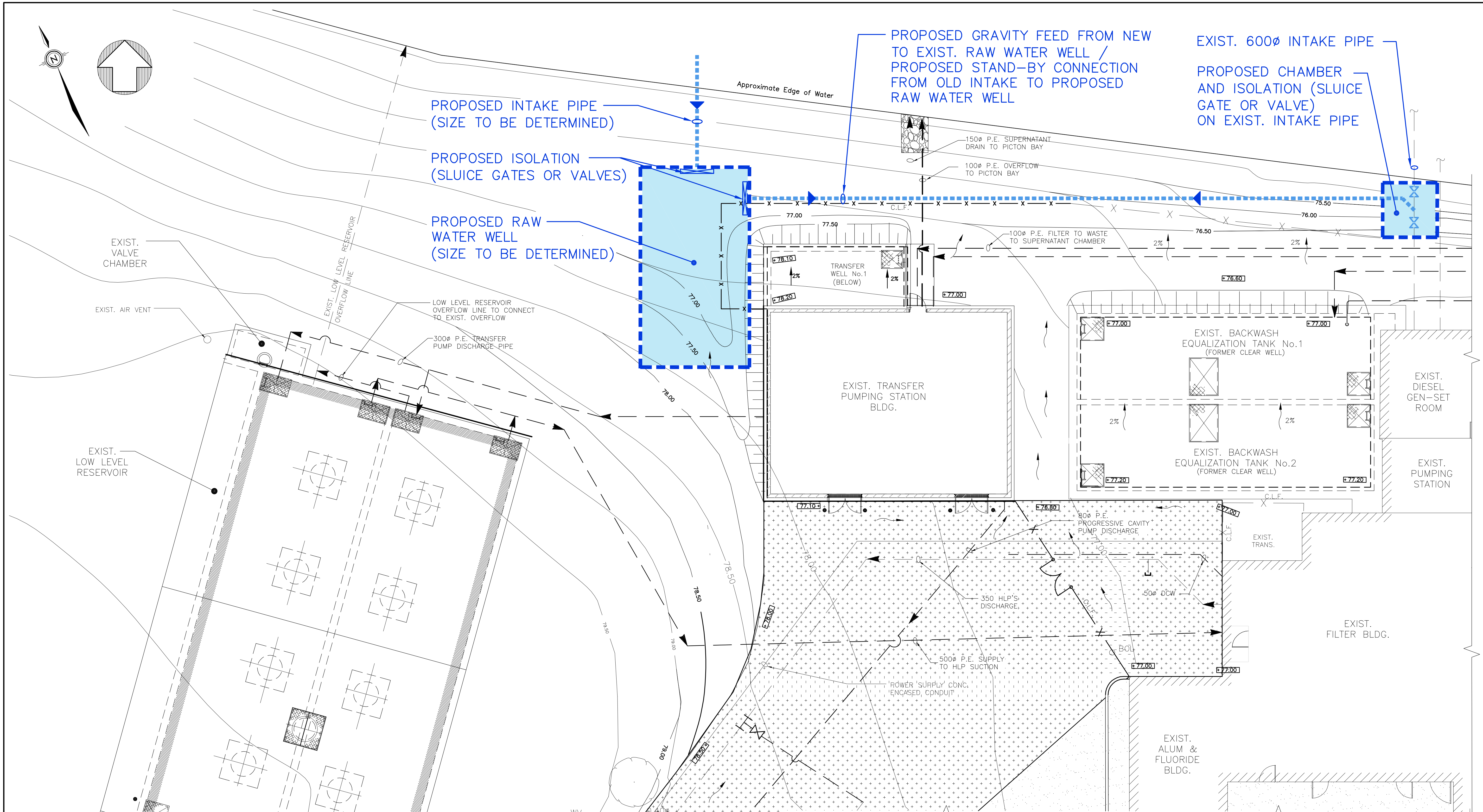
- **Cost-effectiveness:** During design selection, we would also look at material selection and associated costs with materials and construction, to deliver the most cost-effective solution while maintaining an acceptable level of quality.



Lake Depth in feet

R.V. Anderson Associates Limited
engineering · environment · infrastructure

SK1: ALTERNATIVES
PICTON WATER TREATMENT PLANT INTAKE

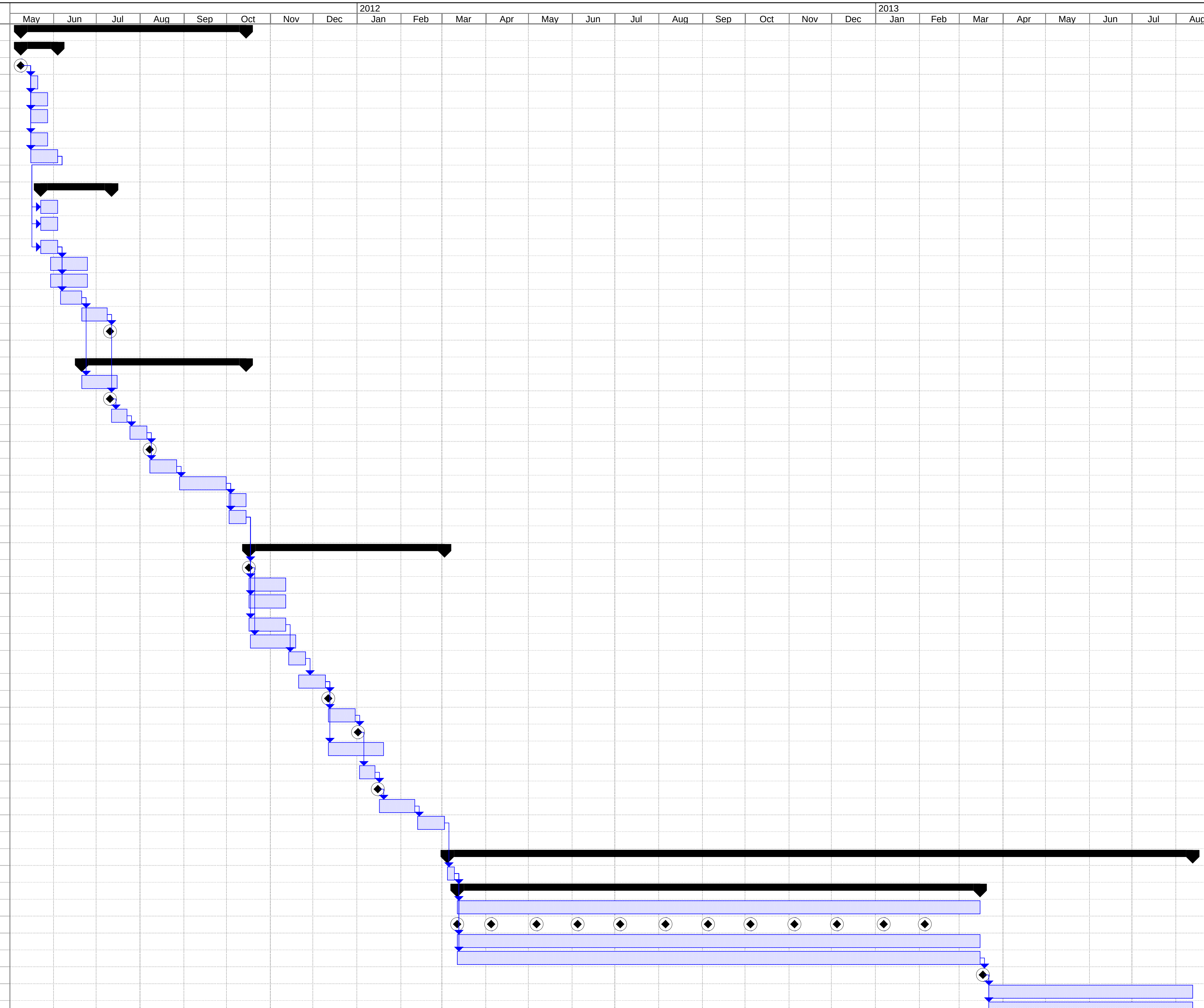


THE COUNTY Prince Edward County, Ontario	PRINCE EDWARD COUNTY	Date MAR. 2011 Scale AS SHOWN
R.V. Anderson Associates Limited engineering · environment · infrastructure	Dwg. Title PICTON WATER TREATMENT PLANT INTAKE CLASS EA – RFP# 2011-PW-003	SK-2

R.V. Anderson Associates Limited
engineering · environment · infrastructure

FIGURE 6: PROJECT SCHEDULE
PICTON WATER TREATMENT PLANT INTAKE
(WITH CLASS EA SCHEDULE B OPTION)

ID	Task Name
1	**Preliminary Engineering**
2	**PHASE 1**
3	Start up meeting - initiate and plan the project. Establish objectives
4	Notify residents, businesses, agencies + Issue Notice of Commencement
5	Review reports/data/maps & confirm growth, population & land - project 25 yrs
6	Identify nature and extent of the problem & opportunity, how the objectives will be met and finalize problem & opportunity
7	Inventory natural, social and economic environments; water quality
8	Consult key review agencies (QC, MNR, DFO, MOE and Aboriginal Groups)
9	
10	**PHASE 2A**
11	Identify potential alternative solutions using the IPZ Study results
12	Utilize exisitng survey, geotechnical & hydrogeological information, address the PTTW. Also evaluate existing navigational maps, bathymetry, etc.
13	Define capacity & water quality and identify impacts on the environment
14	Develop alternative solutions (technical, O&M, staging, environment, cost)
15	Identify impacts of the alternatives on environments & mitigating measures
16	Evaluate alernative, sensitivity analysis & summarize
17	Workshop meetings with agencies - proposed alternatives & evaluation criteria
18	Meet with the County to review alternatives and to identify preferred alternative
19	
20	**PHASE 2B**
21	Prepare and submit Natural Environment Impact Assessment Study
22	Prepare and Issue Newsletter
23	Prepare information & display package for PIC & submit to PEC
24	Meet with PEC & relevant agencies (QC, MNR, DFO, MOE, Abooriginal)
25	Conduct PIC
26	Prepare draft Phase 1 & 2 Report and submit to PEC for comments
27	Issue Notice of Completion and start 30-day review period
28	Review feedback and answer inquires during 30-day review period
29	Incorporate and address comments and finalize Phases 1 & 2 Report
30	
31	**Detailed Design & Approvals**
32	Design start up meeting - define objectives, confirm schedule
33	Review existing information, identify requirement for additional investigation
34	Identify alternative design concepts for the preferred solution and prepare concepts, layout, identify property & easement requirements & cost estimates
35	Prepare hydraulic calculations, design details, assess constructability issues
36	Detailed comparison of the designs and select a preferred design solution
37	Prepare cost estimates for preferred design (engineering contingencies, life cycle costs, land easement and mitigation costs)
38	Prepare 50% design and submit to PEC for comments
39	Meet with PEC to review comments to 50% design
40	Prepare 90% design and sumit to PEC for comments
41	Meet with PEC to review comments to 90% design
42	Prepare application packages and obtain approvals from approval agencies (QC, MNR & DFO, MOE, Navigable Waters & Coast Guard, PEC Building Department, Site plan approval)
43	Prepare and update project schedule and construction cost estimate
44	Present the Final Design to PEC Council or at a Public Meeting
45	Provide services during tendering (assuming 3 weeks)
46	Review tender submission, evaluate and provide letter recommendation
47	
48	**Tender Assistance & Contract Administration**
49	Pre-construction Services (Meeting, TOR for PEC to commission materials testing subconsultant, etc.)
50	Contract Administration (assuming 12 months construction)
51	Shop drawings review
52	Meetings (11 monthly + 1 pre-construction)
65	Day to Day administration (8 hrs per week for 52 weeks)
66	Full time (10 hrs/day for 52 weeks)
67	Commissioning and Training
68	As-Built Drawings & Operations Manual
69	One Year Maintenance



R.V. Anderson Associates Limited
environment · infrastructure

2001 Sheppard Avenue East Suite 400
Toronto Ontario M2J 4Z8 Canada
Tel 416 497 8600 Fax 416 497 0342
Web www.rvanderson.com

MEETING NOTES

COUNTY OF PRINCE EDWARD

PICTON WATER TREATMENT PLANT REPLACEMENT INTAKE
Project No. 112356

TECHNICAL ADVISORY COMMITTEE – MEETING #2

DATE: Tuesday, April 24, 2012; 8:30am – 11:30am

PLACE: Edward Building
280 Main Street, 2nd Floor
Picton, ON

PROJECT NO.: RVA #112356

PRESENT:

Name	Job Title	Organization
Robert McAuley	Commissioner	Prince Edward County (PEC)
Joe Angelo	Project Manager	Prince Edward County (PEC)
Don Caza	Director of Water/Wastewater	Prince Edward County (PEC)
Dan Cassidy	Supervisor of Water/Wastewater	Prince Edward County (PEC)
Kayla Beach	Compliance Officer	Prince Edward County (PEC)
Bev Campbell	Prince Edward Councilor	Prince Edward County (PEC)
Janice Maynard	Prince Edward Councilor	Prince Edward County (PEC)
Jacqueline Fuller	Supervisor, Safe Drinking Water Branch	Ministry of Environment (MOE)
Candy Gibson	Drinking Water Inspector	Ministry of Environment (MOE)
James Lebow	Drinking Water Inspector	Ministry of Environment (MOE)
Ken Campbell	Project Manager	R.V. Anderson Associates Ltd (RVA)
Rika Law	Project Coordinator	R.V. Anderson Associates Ltd (RVA)
Janet Noyes	Project Manager	XCG Consultants (XCG)
Michelle Lavictoire	Environmental Consultant	Bowfin Environmental Consulting (BEC)

NOT PRESENT: Keith Taylor, Quinte Conservation Authority
Catherine Sinclair, Quinte Conservation Authority
Brad McNevin, Quinte Conservation Authority
Rick Topping, Ministry of Natural Resources
Katie Novacek, Ministry of Natural Resources
Tammy Chung, Ministry of Natural Resources
Margaret Bérubé, Ministry of Natural Resources
Wendy Lavender, Ministry of Environment
Vicki Mitchell, Ministry of Environment
Jennifer Hughes, Transport Canada
Cameron Smith, XCG Consultants

The objective of the meeting:

- To review and discuss the Picton intake replacement alternatives as proposed in the Public Information Centre (PIC) Panelboards, attached.
- To receive and address comments from involved agency and stakeholders prior to presenting the material at the upcoming Public Information Centre

DISCUSSION:		ACTION BY:
1.	**TEAM INTRODUCTIONS AND LINES OF COMMUNICATION**	
	All present parties introduced themselves and their role with their organization. Some additional points coming out of the discussion and prior correspondence are as follows: • James Lebow will be the inspector for the Belleville area in lieu of Candy Gibson and should be kept in the correspondence in place of Candy. • Tammy Chung and Margaret Bérubé are the primary contact with the Ontario Ministry of Natural Resources (MNR) in place of Katie Novacek.	
2.	**PROJECT PRESENTATION – PIC PANELBOARDS**	
	2.1 Summary of PIC Panelboards • Problem & Opportunity – Through the Intake Protection Zone Vulnerability Assessment, it was determined that the existing Picton Water Treatment Plant (WTP) intakes were in areas of high vulnerability to contaminant sources and fluctuating water quality. There is also a need to expand the intake to allow for future town growth. • 3 Step approach to determine preferred solution: 1. Step 1 – Evaluate & determine preferred source of water supply. Decision: Remaining in Picton Bay is preferred, compared to going to Lake Ontario via Wellington WTP, due to adequate water quality further out in Picton Bay, economic advantages and reduced environmental & socioeconomic impacts 2. Step 2 – Evaluate & determine preferred location in the preferred water source. Decision: Location 'PC' is preferred due to deeper depths, improved water quality and IPZ vulnerability, financial viability, moderate/reduced environmental & socioeconomic impacts 3. Step 3 – Evaluate & determine preferred routing to convey water from the preferred location back to the WTP. Decision: In-water routing directly to Picton WTP is preferred, compared to the land options (raw watermain, PS & short in-water intake pipe), due to reduced environmental & socioeconomic impacts and economic advantages.	

DISCUSSION:	ACTION BY:
2.2 Comments Received Regarding PIC Panelboards	
Slides 11-12: Evaluation Criteria & Decision Matrix for Water Supply Alternatives	
• PEC advised that the criteria weighting for this section should primarily focus on 'water quality', 'allowance for future growth' and 'construction costs', and they should be of equal value. The remaining criteria can take the residual percentage. RVA to revisit the criteria weighting.	RVA
• Economic costs presented should be life cycle costs (including operation & maintenance and source water protection costs). RVA to revisit the alternative water supply options with this and confirm the result of the decision matrix.	RVA
Slide 16 & 18: Evaluation Criteria and Decision Matrix of New Intake Location	
• Rename criteria "IPZ vulnerability" to "Improvements to IPZ vulnerability" and 'medium' to 'moderate'	RVA
• MOE reported that their technical department is reviewing the sediment data and will provide their comments regarding the findings.	MOE
Slide 17: Possible Intake Locations and Factors of Water Quality Concerns	
• PEC advised that there is a popular local anchoring point by the Salt Docks that may impact Location "PC". PEC to provide port guides/charts/documentation to show specific areas of the anchoring points. RVA to update the graphics and decision matrix as required.	PEC RVA
• MOE questioned if the impact of road salt was evaluated as part of the water quality sampling program since the preferred location was close to the Salt Docks. XCG responded that although salt concentrations were not explicitly tested, the conductivity test would include chloride concentrations (which may be correlated to salt concentrations). All tested locations had similar conductivity readings.	
Slide 18: Decision Matrix for Possible New Intake Location	
• MOE questioned if there will be a new IPZ study performed for the new 'preferred' location. After some discussion, it was determined that that was not part of the scope of work, but qualitatively there is some improvement in the IPZs by moving further out into the Bay and away from the shore, as there will be fewer outfalls or other designated contaminant sources within the IPZs.	
• For the base scenario ('Do Nothing'), the environmental impacts should be noted as 'not applicable' and the ranking changed to 'least negative impact' and highlighted in green.	RVA
• Consider renaming the "Socioeconomic Impacts" criteria to	RVA

	DISCUSSION:	ACTION BY:
	"Construction Impacts" or separating them.	
	Slide 21: Evaluation Criteria for Routing Options	
	• PEC advised that the criteria weighting for the 'Land Acquisition Requirement' impact should be ranked equal to the other socioeconomic criteria at 10% as the land acquisition process could be difficult and a 'show-stopper' for certain options if land is not available.	RVA
	Slide 22: Decision Matrix for Routing Options	
	• PEC questioned if there will be a back flushing option for the new intake similar to Wellington WTP, which requires flushing due to movement of the local sand into the pipe. RVA responded that maintenance of the intake pipe will be considered during detailed design. XCG and BEC commented that the sand movement issue may not be of concern at Picton WTP as they had a difficult time taking a sediment grab sample at the preferred location because the lakebed was quite hard.	RVA
	• BEC advised that if directional drilling was not viable for the first initial length of the new intake pipe to avoid the aquatic vegetation area, then Option 3's environmental criteria status should be changed to "most negative impact" and highlighted as red in comparison to the other options.	RVA
	Slide 24: What's Next	
	• PEC advised that the proposed timeline is very tight and that more time should be allotted to address public comments prior to issuing the Notice of Completion. RVA to consider and revise schedule.	RVA
	• MOE questioned if approval finalization was expected for the end of 2012 as it is a very aggressive timeline. RVA clarified that the tentative aim was to finalize design for end of 2012, but understands that the schedule may be postponed due to unforeseen issues. The approval process is ongoing and will be noted as such.	RVA
	Summary of Discussion	
	• It was agreed that, subject to the various comments noted above, the recommended solution coming out of the evaluations completed to date appeared to be reasonable.	
3.	**PROJECT SCHEDULE**	
	3.1 RVA presented a general timeline for the project schedule with the milestones being: • Public Information Centre – May 10, 2012	

DISCUSSION:		ACTION BY:
	• Address concerns from PIC – 3 weeks after PIC • Issue Notice of Completion – 2-3 weeks after addressing concerns (depending on number of comments received) • 30 Day Review Period – commence with Notice of Completion, duration for 1 month • Geotechnical & Marine Investigations – tentative - Summer 2012 • Approvals – ongoing process • Design – 4 to 5 months after Class EA Finalized • Construction – TBD based on funding availability, and approvals.	

Next meeting date and location – To be determined.

Notes prepared by: Rika Law

Distribution: All

PLEASE ADVISE THE WRITER OF ANY ERRORS OR OMISSIONS WITHIN 1 WEEK OF RECEIPT OF THESE NOTES

APPENDIX E

Picton Water Treatment Plant Intake Replacement
Prince Edward County

NOTICE OF STUDY COMPLETION

Class Environmental Assessment

To address the risk to contaminants, fluctuating raw water quality, and the need for intake renewal the County is proposing to replace the existing two intakes at the Picton Water Treatment Plant.

Through the Class EA process, the preferred alternative was determined to be the replacement of the existing intakes with a new intake further out in Picton Bay, with an in-water intake pipe to a new raw water well at the Picton Water Treatment Plant.

The County has completed this study in accordance with Schedule "B" of the Municipal Class Environmental Assessment (Class EA). A Class EA report has been prepared to document the planning and decision-making processes followed. Notices of the Study of Commencement and the Public Information Center were distributed to the public, interested parties and regulatory agencies.

By this Notice, the report is being placed on public record for a 30-day review period in accordance with the requirements of the Municipal Class EA. The Class EA report is available for review at the following locations starting Thursday, October 2, 2014. We are interested in receiving your comments on this study.

County of Prince Edward Clerks Office 332 Main St. Picton, ON K0K 2T0	Prince Edward County Public Library, Picton Branch 208 Main St. Picton, ON, K0K 2T0	County of Prince Edward Engineering Development and Works Office Edward Building, 280 Main St.,2nd Floor, Picton, ON K0K 2T0
County of Prince Edward Website in the "Public Notices" section: http://www.pecounty.on.ca		

Subject to comments received, the County intends to proceed with the geotechnical investigations and detailed design of this project when funding becomes available. Please provide written comments to one of the following members of the Project Team by Friday, Oct 31, 2014.

County of Prince Edward Engineering Development and Works Department
Mr. Joseph Angelo, P.Eng.
Project Manager
Edward Building 280 Main St., 2nd floor
Mailing address: 332 Main St. Picton, Ontario K0K 2T0
jangelo@pecounty.on.ca

R.V. Anderson Associates Limited
Mr. Ken Campbell, P.Eng.
Project Manager
2001 Sheppard Avenue East,
Toronto, Ontario, M2J 4Z8
Tel: (416) 497-8600
Fax: (416) 497-0342
kcampbell@rvanderson.com

During this 30-day review period, if concerns regarding this project cannot be resolved in discussion with the County, a person or party may request the Minister of Environment to make an order for the project to comply with Part II of the Environmental Assessment Act (referred to as a Part II Order), which addresses "individual environmental assessments". Requests must be received by the Minister at the address below by **Friday, October 31, 2014,** with a copy sent to the members of the Project Team. If no request is received by this date, the County will proceed with the detailed design of this project as outlined in the Class EA report.

APPENDIX F

CORPORATION OF THE COUNTY OF PRINCE EDWARD

PICTON WATER TREATMENT PLANT INTAKE REPLACEMENT PROJECT

TECHNICAL MEMORANDUM

FOR THE

PREFERRED INTAKE LOCATION

AT THE

PICTON WATER TREATMENT PLANT

Prepared for:

County of Prince Edward

R.V. Anderson Associates Limited
engineering · environment · infrastructure

2001 Sheppard Avenue East Suite 400
Toronto Ontario M2J 4Z8 Canada
Tel 416 497 8600 Fax 416 497 0342
www.rvanderson.com

Picton WTP Intake Replacement

Technical Memorandum – Preferred Intake Location

Appendices

Appendix A – XCG - Report on Field Program for Picton WTP Intake Replacement

Appendix B – 2001 Adolphustown Wind Information

1. INTRODUCTION

The County of Prince Edward is responsible for the supply and treatment of drinking water for the Town of Picton and Village of Bloomfield via the Picton Water Treatment Plant (WTP).

Through the Quinte Source Water Protection Program, the 2009 Intake Protection Zone Delineation and Vulnerability Assessment identified that the existing two intakes at the Picton Water Treatment Plant are vulnerable to certain risks, contaminants and fluctuations in water quality and increasing maintenance costs. Local residents have also issued complaints about taste and odour and water quality issues in general. As such, the County of Prince Edward is interested in replacing their existing two intakes with a new intake.

In April 2011, the County retained R.V. Anderson Associates Limited to conduct a Municipal Class Environmental Assessment (Class EA) and to prepare the design for an intake replacement.

This technical memorandum presents the evaluation of alternatives to address the water quality issue, assessment on the preferred intake location and the optimal routing to get to the preferred intake location. Each section will be evaluated based on a variety of qualitative, quantitative and cost factors.

1.1 BACKGROUND

The Picton WTP is located on a small peninsula in Picton Bay. The existing facility has two intakes to draw raw water from Lake Ontario:

- The primary intake is the 400mm diameter “South” intake that is approximately 91m from the WTP in 3.3m deep water in Picton Bay. This intake is equipped with a wooden crib, screened inlet, zebra mussel control, and a sampling line.
- The secondary intake is the 400mm diameter “North” intake that is approximately 305m from the WTP in 3.3m deep water. This intake consists only of the intake pipe with a metal cage over the inlet. It does not have an intake crib or zebra mussel control.

The Picton WTP employs conventional filtration and chlorine disinfection for water treatment. The Picton WTP consists of four (4) spiral flocculation tanks, two (2) sedimentation tanks, four (4) gravity filters, a clear well/low level reservoir. Chlorine is injected into the filtered water prior to entry into the clear well to achieve primary disinfection.

The original construction of the Picton WTP, including the primary “South” intake, was completed in 1928. Various additions followed over the years. An emergency “North” intake was added during an expansion in 1958. A major upgrade was done in 1994 that increased capacity by adding two new filter cells, chemical storage and a high lift pumping system for the Bloomfield waster distribution system. Due to the aging infrastructure and new Ministry of Environment regulations on residue management, the County of Prince Edward retained R. V. Anderson Associates Limited (RVA) in 2008, to design the additional upgrades for the WTP, including a retrofitted clearwell, a new transfer building, new process equipment and electrical works, as well as a new residue management system.

Table 1.1 below shows the current rated capacity of the Picton WTP and its average and maximum daily demands.

Table 1.1: Current Picton WTP Capacity (based on 2010-2013 data)

	Flow Rate (Total)
Capacity of “South” intake (at minimum Lake level of 73.6m)	11,450 m^3/day
Rated WTP Capacity	10,400m^3/day (120L/s)
Maximum daily demand	4,600 m^3/day
Average daily demand	3,206 m^3/day
Minimum daily demand	1,819 m^3/day

1.2 EXISTING CONDITION OF INTAKES

Out of the two existing Picton WTP intakes, only one is used at a time to supply raw water from Picton Bay, Lake Ontario, to the raw water well.

The primary intake is the “South” intake and was constructed with the original WTP in 1928. Despite the age of the existing south intake, the wooden crib floor is still in relatively good condition, and the intake pipe shows only minor to moderate signs of deterioration.

The secondary or “North” intake was constructed in 1952 as part of an expansion to the WTP. The existing “North” intake also shows minor to moderate signs of deterioration.

The intakes require annual cleaning of zebra mussels through water blasting. Nearby weeds/vegetation are also removed in order to keep the intakes in working condition.

The approximate location of the two existing intakes, the Picton WTP, and the existing Intake Protection Zones (IPZs) are as shown in Figure 1.2. The IPZ is defined as “the area that is related to a surface water intake and within which it is desirable to regulate or monitor drinking water threats." (Clean Water Act 2006 O.Reg. 287/07). There are three levels of IPZs and they are defined as follows:

- IPZ-1: Primary protection area around the intake.
- IPZ-2: Secondary protection area around the intake.
- IPZ-3: All surface watercourses upstream of the intake and that may contribute water to that intake.

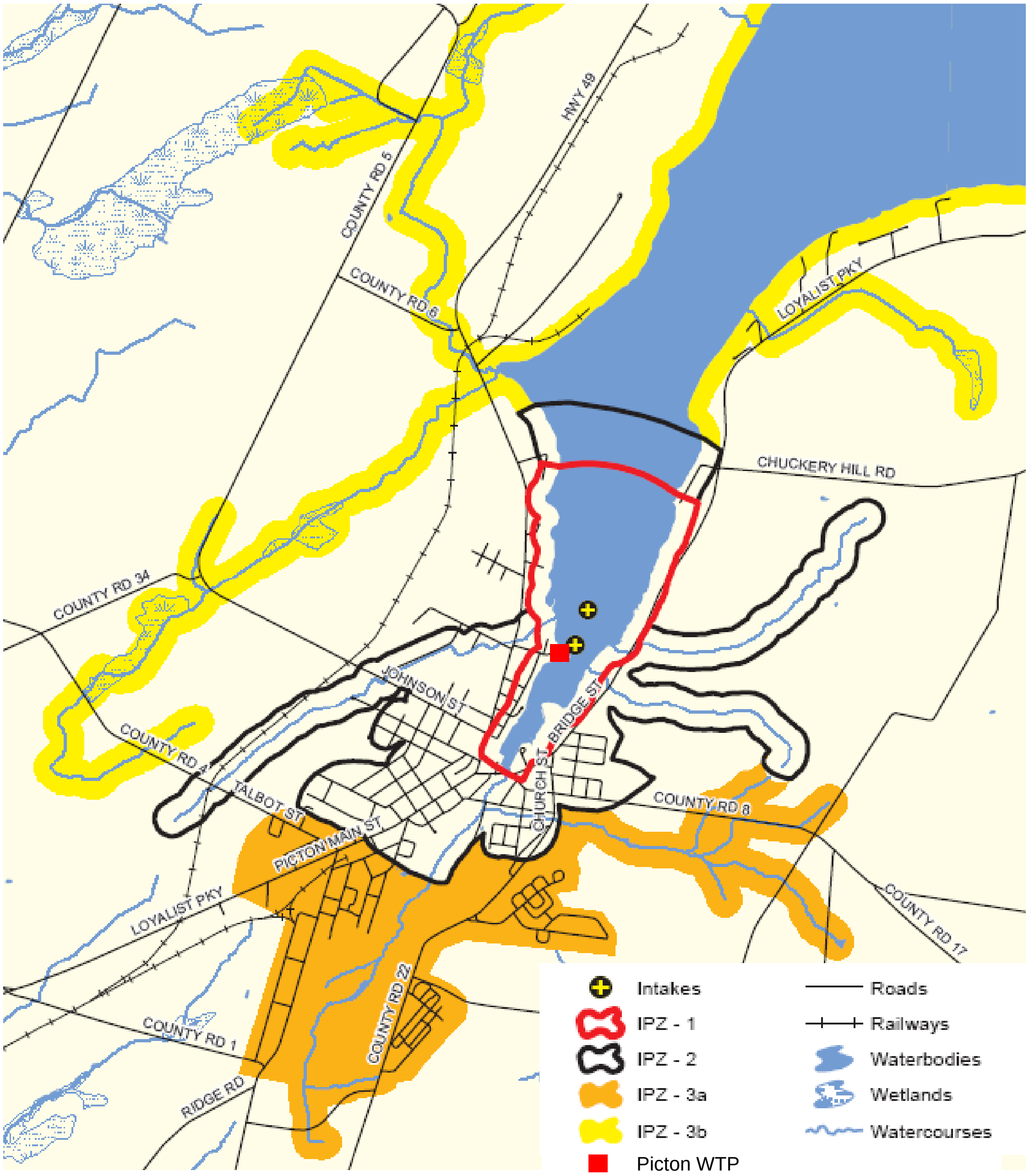


Figure 1.2: Existing Picton WTP Intakes and the IPZ Mapping

The figure is taken from the XCG October 2009 Technical Memorandum on the Intake Protection Zone Delineation and Vulnerability Assessment for Picton Water Treatment Plant System to Quinte Conservation.

1.3 CONCERNS WITH EXISTING INTAKES

The County has reported various concerns regarding the existing intakes, namely, the age of the intakes and the fluctuating raw water quality due to the intakes' location. Studies driven by the Source Water Protection Program have also noted high vulnerability to sources of contaminants in the existing intakes IPZs.

Residents have reported seasonal taste and odour issues during summer and autumn. Taste and odour concerns are typically related to the algae blooms during the summer to fall season. These algae blooms produce chemicals such as Geosmin or 2-Methylisoborneol (MIB), which give the water an earthy or musty odour.

Operators of the Picton WTP reported that the treatment plant experiences wide fluctuations in turbidity. Operators have noted turbidity ranges from 0.100 NTU to 100 NTU in their raw water. Various factors are suspected to contribute to the high turbidity, such as seasonal run-offs from the neighboring Mosquito Creek or when winds from the North and Northwest stir up the shallow portion of Picton Bay. High turbidity causes clogging of filters and reduced filter runs, i.e. the Operators must backwash the filters more frequently. This results in increased operation difficulties, wasting of treated water, downtime for the filters, and possible concerns in keeping up to the water demand.

Operators have also raised concerns regarding the frequent boat traffic around the intakes. The reason for their concern is that boat traffic may contribute to turbidity issues and an unsuspecting boater may lower their anchor on the intake structure/pipe, causing damage.

There are several storm outfalls/drainage ditches at Picton Harbour and surrounding shorelines that feed into Picton Bay, all within close proximity to the existing two intakes. The Picton Wastewater Treatment Plant also discharges its effluent into Picton Harbour.

The XCG 2009 Technical Memorandum on the Intake Protection Zone Delineation and Vulnerability Assessment for Picton Water Treatment Plant System was completed as part of the Source Water Protection initiative sponsored by Quinte Conservation. The study examined and quantified how vulnerable the IPZs of the existing intakes were to sources of contaminants. The results in Table 1.3 showed that the vulnerability scores were very high, where 10 was the maximum and 1 was the minimum.

Table 1:3 Vulnerability Factors for Picton Intakes' IPZs

Picton Intakes' IPZ	IPZ-1	IPZ-2	IPZ-3a	IPZ-3b
Area Vulnerability Factor (10 = max; 1 = min)	10	9	8	6

The high scores were due to the shallow depth of the intakes, their close distance to shore, and turbidity events as a result of nearby creeks, run-offs and boat traffic.

The Picton WTP was recently upgraded in 2009 to extend the facility's life for another 20 years. It is uncertain if the existing intakes will be in functional condition to match the plant's extended lifespan.

In response to all of the issues and concerns presented, it is recommended that a new intake be considered to replace the existing intake(s) of the Picton WTP. The new intake would be located in deeper water, further from Picton Harbour so that it will be away from heavy boat traffic and contaminant sources such as storm outfalls, creeks and the Picton Wastewater Treatment Plant outfall.

2. CURRENT AND FORECASTED POPULATION AND WATER DEMANDS

In order to confirm if a new intake is required to account for future growth, it is necessary to determine a design flow rate for the intake and size the new intake pipe accordingly. The following sections summarize the current and future population in the Picton area and the forecasted water demand.

2.1 CURRENT AND FORECASTED POPULATION

According to the 2006 Canada wide census, the population of the Town of Picton and the Village of Bloomfield are 3,890 and 640, respectively. The Corporation of the County of Prince Edward official website reports a population of 3,705 people for the Town of Picton and 575 for the Village of Bloomfield. Table 2.1 shows the 2006 census data for the population in Prince Edward County from 1991 to 2006.

Table 2.1: Canadian 2006 Census – Population and Population Changes in Prince Edward County from 1991 to 2006.

Population and Population Changes
Former Municipalities / Current Wards
Prince Edward County
1991 - 2006

	1991	1996	1991-1996	2001	1996-2001	2006	2001-2006
	Count	Count	% Change	Count	% Change	Count	% Change
Picton	4,386	4,673	6.5	4,343	-7.1	3,890	-10.5
Bloomfield	689	687	-0.3	643	-6.4	640	0.0
Wellington	1,426	1,691	18.6	1,743	3.1	1,740	0.0
Ameliasburgh	5,357	5,571	4.0	5,796	4.0	5,930	2.5
Athol	1,416	1,383	-2.3	1,379	-0.3	1,490	8.0
Hallowell	4,349	4,577	5.2	4,509	-1.5	4,440	-1.5
Hillier	1,804	1,851	2.6	1,927	4.1	2,110	9.5
N. Marysburgh	1,258	1,312	4.3	1,303	-0.7	1,390	6.5
S. Marysburgh	968	1,018	5.2	1,013	-0.5	1,100	9.6
Sophiasburgh	2,110	2,283	8.2	2,245	-1.7	2,750	22.5
Total	23,763	25,046	5.4	24,901	-0.6	25,500	2.4

Source: Census of Canada
Note: 2006 figures based on County staff allocations of Dissemination Area data, some of which crosses ward boundaries

The current average water consumption of the Town of Picton and the Village of Bloomfield is approximately 6000 m^3/day, as per Table 1.1.

The County of Prince Edward's Official Plan forecasts that the county's entire population will see an anticipated increase of 7,000 people by the year 2021. This will equal a total population of 32,000 people in the entire County.

However, the Ontario Ministry of Finance forecasts that the County's permanent population will only reach 28,280 by 2031, which means an increase of only 2,020 people across the entire County. Table 2.2 presents the Ontario Ministry of Finance's predicted population growth in Prince Edward County until 2036.

Table 2.2: Ontario Ministry of Finance - Population and Growth Rates for Prince Edward County until 2036.

Five-Year Populations and Growth Rates
Prince Edward County and Ontario
1991 - 2036

	Prince Edward		Ontario	
Year	**Population**	**% Change**	**Population**	**% Change**
1991	23,760	6.0	10,084,885	10.8
1996	25,050	5.4	10,753,573	6.6
2001	24,900	-0.6	11,410,046	6.1
2006	25,500	2.4	12,028,895	5.4
2011	26,260	3.0	13,069,180	8.6
2016	26,510	1.0	14,196,580	8.6
2021	27,010	1.9	15,089,560	6.3
2026	27,680	2.5	16,019,590	6.2
2031	28,280	2.2	16,944,320	5.8
2036	28,790	1.8	17,848,558	5.3

Sources: Census of Canada 1991 – 2006 and Ontario Ministry of Finance 2011- 2036

Note: MOF projections include low, medium and high growth scenarios. This table uses the MOF's medium ("reference") scenario.

The information in Table 2.2 depicts that the population is not expected to increase significantly in the County of Prince Edward for the next 20 years, despite the County's official plans. To be conservative, the design flows for the future intake will be based on the high population growth data from the County's Official Plans.

Neither the census nor the County's plans specifically allocate what percentage of these new residents is expected to reside in the Town of Picton and the Village of Bloomfield.

From the County's Official Plan Report, the number of new houses applied in the Picton area between the years of 2004-2009 is 7.3% of the entire County, as shown in Table 2.3. We have used this percentage as the estimate to allocate forecasted residents into the Town of Picton and Village of Bloomfield compared to the other regions. It is estimated that there would be approximately 511 (7.3% of 7,000 as reported by PEC's official plan) new residents in the Picton area in by 2021. Since PEC's Official Plan does not provide a growth forecast to 2031, we have assumed a linear growth in population. This would mean approximately 1022 new residents in the Picton area by 2031.

Table 2.3: County of Prince Edward Official Plan - New Home Building Permits by Ward in Prince Edward County from 2004 to 2010.

New Home Building Permits by Ward
Prince Edward County
2004 to 2010

	Picton	Bloomfield	Wellington	Ameliasburgh	Athol	Hhallowell	Hillier	Nnorth Marysburg	South Marysburgh	Sophiasburgh	TOTAL No.
2004	6	0	22	36	13	20	19	20	4	14	154
2005	5	0	19	30	2	28	10	16	6	13	129
2006	8	1	29	29	3	18	9	14	1	14	126
2007	10	1	26	26	24	16	13	12	10	18	156
2008	16	0	25	29	5	18	11	11	5	15	135
2009	12	0	18	13	26	6	5	7	6	10	103
2010	8	0	7	15	3	11	6	9	9	10	78
No.	57	2	139	163	73	106	67	80	32	84	881
%	7.1	0.2	17.3	20.3	9.1	13.2	8.3	10.0	4.0	10.5	100

2.2 CURRENT AND FORECASTED WATER DEMAND

Using the conservative population growth data from the PEC's Official Plan and assuming a constant per capita consumption of 0.7 m^3/day/person and a constant peaking factor (e.g. max day/average day) of 1.4, the 2031 design flows are 4,100 m^3/day for average day demand and 5,800 m^3/day for maximum day demand. This is summarized in Table 2.2 below.

The Ministry of Environment design guidelines for a new intake recommend that the intake pipe be sized in excess of 20 years as the cost of material is small compared to the labour and effort in performing the work. The PEC Official Plans did not provide population or expected growth data beyond the 20 years. Following the above population growth and water demand assumptions, the predicted average day and maximum day demand by 2061 (approximately 50 years) would be 5,600 m^3/day and 8,000 m^3/day, respectively.

Table 2.2: Current and Forecasted Future 2031 Average and Maximum Day Demands.

	Current Flow Rate (Total)	**Future Predicted (2031) Flow Rate (Total)**	**Future Predicted (2061) Flow Rate (Total)**
Maximum daily demand	4,600 m^3/day	5,800 m^3/day	8,000 m^3/day
Average daily demand	3,206 m^3/day	4,100 m^3/day	5,600 m^3/day

Since the installation of a new intake pipe is a large and costly undertaking, it is recommended to design the intake to accommodate for the higher flow requirements to extend its useful life. As such, it is recommended that the new intake be sized similar to the existing intake for 11,450 m^3/day.

3. POSSIBLE INTAKE LOCATIONS

A variety of locations were considered for the new intake at various distances from the existing WTP and at various depths.

Factors that affected selection of possible intake location were as follows:

- Sediment quality of location
- Water quality of location
  - Normal conditions
  - Windy/stormy conditions
- Boat traffic
- Proximity to contaminant sources
  - Storm drainage/creek/WWTP effluent
  - Aerial plumes
- Cost of Construction

3.1 SEDIMENT QUALITY OF POSSIBLE INTAKE LOCATIONS

XCG was retained to conduct a sediment sampling program to determine if there were contaminants in the sediment in the existing and potential intake regions and to quantify the specific contaminants.

Sediment sampling locations were the same as the water sampling locations shown in Figure 3.1.1. The samples were analyzed for polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and heavy metals. The following list presents the heavy metal testing criteria:

- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium

- Chromium
- Cobalt
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Vanadium
- Zinc

3.1.1 SUMMARY OF XCG'S SEDIMENT QUALITY MONITORING PROGRAM

None of the tested sediment samples had PCBs and only 3 sampled locations had detections of 3 PAHs, however these did not exceed the lowest effect level (LEL) of the Ontario Guidelines for the Protection and Management of Aquatic Sediment Quality. The LEL is a guideline concentration that can be tolerated by a majority of the sediment-dwelling organisms. Sediments with contaminant concentrations below the LEL are considered to be "clean to marginally" polluted. The severe effect level (SEL) indicates a level of contamination that is expected to be detrimental to the majority of sediment-dwelling organisms. The Canadian Sediment Quality Guidelines for the Protection of Aquatic Life also has a probable effect level (PEL).

Every sampled location had numerous heavy metal LEL exceedances; however none of them exceeded the severe effect level (SEL).

Only Point A (existing intake location) had an exceedance of LEL and PEL with mercury, at a concentration of 1.5ug/g compared to the LEL of 0.2ug/g and PEL of 0.486ug/g.

The possible intake locations (e.g. B to H locations) all had similar heavy metal concentrations and exceedances, as shown in Table 3.1.1. There was no one particular location that stood out as the preferred location based on the sediment sampling data.

Although there were heavy metal LEL exceedances at all sediment sampling locations, the concentrations were below the Severe Effects Level (SEL) and should not be a cause for alarm.

Should a new location be selected, additional discussions with the Ministry of Environment (MOE) and other regulating authorities will be necessary to establish what actions or restrictions will be required as a result of these contaminant levels. On the basis of previous projects, costly impacts are not expected.

The complete sediment test findings can be found in the XCG report "Report on Field Program for Picton WTP Intake Replacement", dated November 2011, in Appendix A.

Table 3.1.1: Sediment Guidelines and Results at Existing and Possible Intake Locations

Heavy Metals	Sediment Standards (ug/g)					Sediment Results of Sampled Locations (ug/g)							
	Back ground	PSQG (LEL)	PSQG (SEL)	CSQG (PEL)	CSQG ISQG	A	B	C	D	E	F	G	H
Arsenic	4	6	33	17	5.9	2.6	**11**	**12.4**	**14.8**	**12**	**12**	**7.8**	**7.6**
Cadmium	1	0.6	10	3.5	0.6	<0.5	**1.2**	**1.3**	**1.5**	**1.2**	**1.2**	**0.9**	**1.1**
Chromium	31	26	110	90	37.3	7	**55**	**56**	**58**	**54**	**54**	**46**	**49**
Cobalt		50	50			6	22	26	26	25	25	24	26
Copper	25	16	110	197	35.7	14	**51**	**50**	**51**	**55**	**55**	**43**	**45**
Lead	23	31	250	91.3	35	**51**	**77**	**76**	**84**	**73**	**73**	**59**	**58**
Mercury	0.1	0.2	2	0.486	0.17	**1.53**	**0.26**	**0.21**	**0.22**	**0.22**	**0.22**	0.17	0.17
Nickel	31	16	75			15	**51**	**45**	**54**	**47**	**47**	**26**	**38**
Silver		0.5	0.5			<0.2	**1.2**	**0.6**	**0.8**	**0.6**	**0.6**	0.5	0.5
Zinc	65	120	820	315	123	46	**207**	**203**	**210**	**209**	**209**	**184**	**194**

BOLD Indicates exceedance of Provincial Sediment Quality Guideline - Lowest Effect Level (LEL)

BOLD Indicates exceedance of Provincial Sediment Quality Guideline - Severe Effect Level (SEL)

Indicates exceedance of Canadian Sediment Quality Guideline - Interim Freshwater Sediment Quality Guidelines (ISQG)

Indicates exceedance of Canadian Sediment Quality Guideline - Probable Effect Level (PEL)

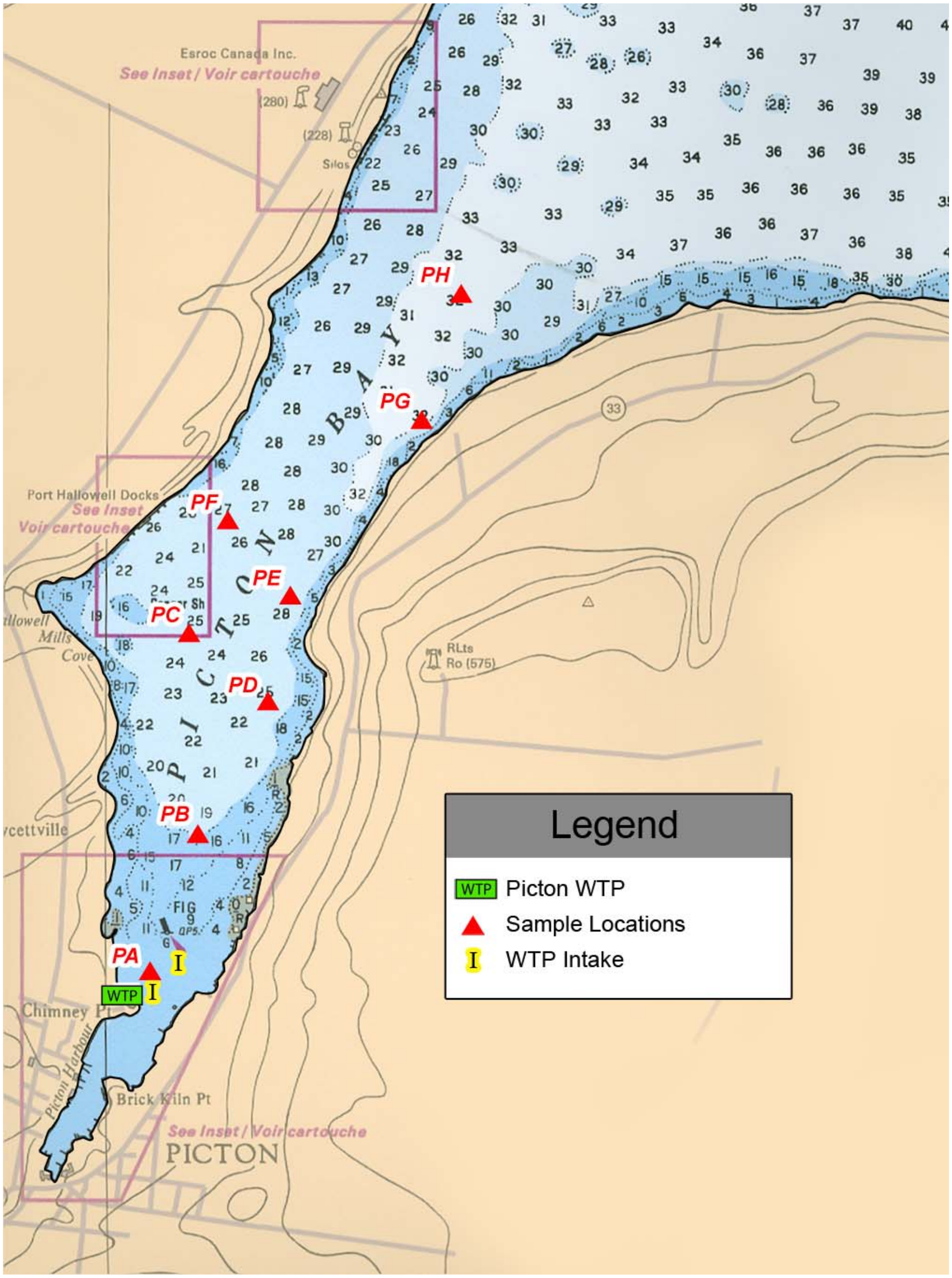


Figure 3.1.1: Sediment and Water Sampling Locations at the Existing and Possible New Intake Regions

3.2 WATER QUALITY OF POSSIBLE INTAKE LOCATIONS

XCG also conducted a field monitoring and water sampling program to determine the water quality at various possible locations in Picton Bay for the new intake as shown in Figure 3.1.1 and listed in Table 3.2.1. The locations were chosen at various distances from the Picton WTP and at various depths.

Table 3.2.1: Water Sampling Locations for Possible Intake Locations

Location	Approximate Distance from WTP (m)	Depth (m)	Description
A	200	2.5	Between existing 2 intakes
B	1000	6	Within existing IPZ1
C	1700	7	Within existing IPZ2; near salt docks
D	1500	7	Within existing IPZ2; within 1km from salt docks
E	2000	8	Outside of existing IPZ2
F	2300	8	Outside of existing IPZ2; In close proximity to salt docks
G	3000	9.1	Outside of existing IPZ2;
H	3500	9.8	Outside of existing IPZ2; near Essroc Concrete Plant

The water quality parameters of interest were:

- Temperature
- pH
- Dissolved oxygen
- Conductivity
- Total Coliforms
- E.Coli
- Dissolved Organic Carbon
- Total Organic Carbon
- Turbidity
- Total Suspended Solids
- Total Dissolved Solids
- Total Phosphorus

Water samples were taken during normal calm weather conditions and following storm and high wind events, as it was reported that turbidity was an issue during storm and high wind events.

The sampling dates and conditions are summarized in Table 3.2.2.

Table 3.2.2: Water Sampling Event Conditions

Sampling Event	Date	Conditions at time of Sampling	Description of Conditions Prior and During Sampling
Baseline	July 14, 2011	Calm and normal; Wind N 10km/h	No rain or heavy winds
Event 1	July 26, 2011	Raining & Windy; Wind SW 20-30km/hr	Thunderstorm & heavy rain on July 25
Event 2	Oct 3, 2011	Wind N - 10km/hr	Oct 2 – Windy N 20km/hr with rain; Oct 1 – Windy N 20-30km/hr
Event 3	Oct 21, 2011	Windy – SW 20km/hr	Oct 19 – raining and windy N 20-30km/hr; Oct 20 - raining

The full XCG report "Report on Field Program for Picton WTP Intake Replacement", dated November 2011, can be found in Appendix A.

3.2.1 SUMMARY OF XCG'S WATER QUALITY MONITORING PROGRAM

3.2.1.1 TEMPERATURE

The XCG sampling program discovered that although there is a clear thermocline in the summer over the various depths of the water during calm weather conditions, whenever a storm or wind event swept through the area, the thermocline was no longer defined and the water temperature difference was quite consistent throughout all sampling locations and depths. Generally on a calm weather day, there is a decrease in temperature with increase in depth (e.g. 23-24^{o}C at 2m depth and 14^{o}C at 6-8m depth).

3.2.1.2 PH

Similar to the pattern noticed with the temperature criteria, there is a distinct decrease of pH with increased depth in all locations except for Location A, which is in shallow 2.5m water. However this pattern is non-existent if there is a storm or wind event, whereby all sampling locations and all depths have a similar pH.

3.2.1.3 DISSOLVED OXYGEN

Following the pattern of temperature and pH, there is a distinct decrease of dissolved oxygen (DO) with increased depth. However, with a storm or wind event, the water column appears to become mixed and there is consistent DO throughout all depths and at all locations.

3.2.1.4 CONDUCTIVITY

Similar to the above patterns observed with temperature, pH and dissolved oxygen, the conductivity of the water samples at all locations on a calm weather day increase with increase depth (e.g. ranging from 280-300 uS/cm). However, with a storm or wind event, the water column is mixed thoroughly for all locations and depths, resulting in a uniform conductivity level.

3.2.1.5 TOTAL COLIFORMS

On a normal calm weather day, there appears to be higher total coliform count for locations closer to Picton Harbour and the Picton WTP (e.g. sampling locations of A to E) compared to the sampling locations further away (e.g. sampling locations of F to H). However, as suspected from the pattern above, during storm and north wind events, the water in the entire sampling area become totally mixed, even at various depths, and the total coliform count is similar for all sampling points.

3.2.1.6 E. COLI

During normal calm weather days, most sampled locations did not detect any E.Coli except for sampling point B and D. For the storm and wind event of Oct 21, 2011, the water in all sampling locations became mixed and E.Coli count was similar throughout. The storm and wind event on Oct 3, 2011 showed a decrease in E.Coli count at the further sampling locations of F to H.

3.2.1.7 DISSOLVED AND TOTAL ORGANIC CARBON

There is slight but not necessarily distinct decrease of dissolved and total organic carbon concentrations with increased distance on calm and normal days. However the results are similar for all locations during a storm and wind event.

3.2.1.8 TURBIDITY

This is one of the main concerns raised by Operators at the Picton WTP. On calm, normal weather day, there is a slight but not necessarily distinct improvement in turbidity levels with increased distance from the WTP. Rainfall and southwesterly wind conditions on July 26, 2011 showed improvement in turbidity with increased distance from WTP, particularly for sampling locations along the west side (e.g. Sampling locations C, F, G, and H). However northerly wind conditions in October showed varied turbidity readings at all sampling locations.

3.2.1.9 TOTAL SUSPENDED SOLIDS

On a calm, normal weather day, there is improvement in total suspended solids (TSS) with increased distance from WTP, particularly for sampling locations along the west side (e.g. Sampling locations C, D, E, G, and H). Rainfall and southwesterly wind conditions on July 26, 2011 showed improvement in TSS with increased distance from WTP. However northerly wind conditions in October showed varied TSS readings at all sampling locations.

3.2.1.10 TOTAL DISSOLVED SOLIDS

The results for total dissolved solids were similar throughout all sampling locations, with a decrease in total dissolved solids in the October sampling events compared to the July sampling events, possibly due to the temperature drop in the water by October, resulting in less material remaining dissolved in the water.

3.2.1.11 TOTAL PHOSPHORUS

The total phosphorus results appear to be consistent throughout the sampled areas, except for spikes at location D, F, G and H during various storm and wind events.

3.2.1.12 CONCLUSIONS OF XCG'S WATER QUALITY MONITORING PROGRAM

From the above summarized findings of the tested criteria, it appeared that there were improvements in water quality as the locations were further from the current WTP on a calm weather day. During storm and wind events (particularly North winds) the entire sampled area tended to be thoroughly mixed, resulting in similar water quality conditions regardless of depth or location. This brings about the question of how frequently do the storms and northerly wind events occur. The wind and meteorological findings are summarized in Section 3.2.2.

3.2.2 FREQUENCY OF WIND AND STORM EVENTS

As reported in Section 3.2.1, the water qualities of all sampled locations appear to be the same during storm and wind events. As such, it is important to determine the number of such events during a typical year.

Operators of Picton WTP and from the XCG sampling report noted that the water quality significantly deteriorated when strong winds (e.g. 20km/hr and higher) came from the North, West and Northwest direction.

Although Picton does not have specific meteorological wind information available, nearby Adolphustown (12 km NE of Picton, in a similar part of Picton Bay) experience predominant northerly, northwesterly, or westerly winds 50% of the time in 2011. This predominantly happens between Jan to March, and Oct to December. It was also reported that there were 2-16% chance of strong winds (20km/hr and greater) during those months. Therefore, approximately 8% of the year (16% of 50%) will have conditions of both high winds from the North, Northwest or West direction to stir up the lake and cause poor water quality. Information gathered from meteorological and wind mapping websites for Adolphustown is available in Appendix B and summarized in Table 3.2.2 below.

Table 3.2.2: Predominant Wind Direction for Adolphustown Area (Picton)

Month	Probability of Wind Speed > 20km/hr (%)	Predominant Wind Direction							
		N	NE	E	SE	S	SW	W	NW
Jan	2							1	
Feb	14							1	
Mar	11								1
April	16				1				
May	2				1				
Jun	2					1			
July	0					1			
Aug	1					1			
Sept	1					1			
Oct	7							1	
Nov	8								1
Dec	16							1	
	Total	0	0	0	2	4	0	4	2
	% of Occurrence	0	0	0	17	33	0	33	17

It is interesting to note that the wind direction during the high tourist season (April – Sept) is predominantly South to Southeast. When winds come from this direction, it does not cause the same lake stirring effect as the Westerly and Northwesterly winds, and as such, the deeper and further out areas will have improved water quality compared to the existing intake. This is important for tourists, who may otherwise be deterred from returning to the area due to poor water quality.

This would appear to conclude that stationing the new intake at a further distance from the WTP and in greater depths should provide improved water quality approximately 92% of the time due wind events alone.

3.3 BOAT TRAFFIC

Another factor that may impact water quality, aside from storm and wind events, is boat traffic. Motor boats and other crafts may stir up the water and silt in shallow areas of the bay when passing, therefore negatively affecting the water quality nearby.

Since the Picton WTP is close to Picton Harbour, which is an active harbor for sailboat, leisure yachts and fishing boats, there is significant boat traffic in the area near the existing intakes.

There are also numerous privately owned docks along the shoreline on either side of Picton Bay, particularly on the east side along Loyalist Parkway. Homeowners often take their own boats and canoes out in the shallow water.

Located to the north of Picton WTP, approximately 2.3km and 3.5km away, are the Port Hallowell Salt Docks and Essroc Concrete Dock. Cargo ships have been known to dock at those locations for transportation of industrial material. Although these larger vessels do not travel close to the existing intakes, these navigation routes impact the decision on where the new preferred intake location is, particularly for the further out intake options.

Figure 3.3 is an estimate of frequently used boating areas. The more active areas are shown in a brown shade.

Although there is no particular area in Picton Bay where a boat will never be found, it is best for the new intake to avoid locations of heavy boat traffic for improved water quality.

In addition, avoiding areas of heavy boat traffic may protect the new intake from unsuspecting boaters from dropping their anchors around the intake and damaging the intake structure and pipe.

Possible intake locations such as “C” appear to be in a good location, as they may experience less boat traffic.

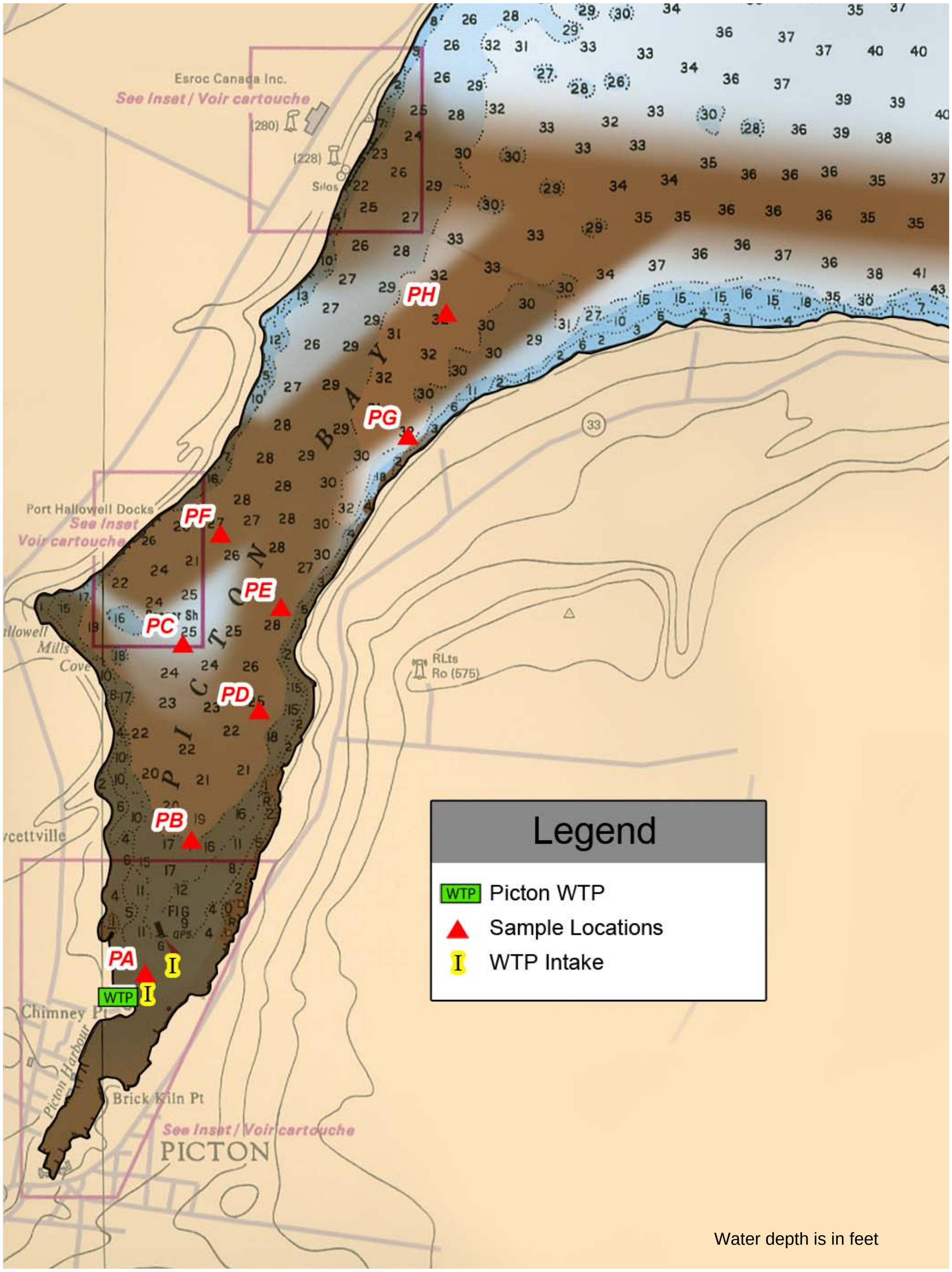


Figure 3.3: Estimated Frequent Boat Traffic Areas in Picton Bay

3.4 PROXIMITY TO CONTAMINANT SOURCES

3.4.1 STORM OUTFALLS, DRAINAGE DITCH AND CREEKS

The XCG 2009 Intake Protection Zone Delineation and Vulnerability Assessment Study for the Picton Water Treatment System noted that there were 10 visible storm outfalls, drainage ditches and various creeks that fed into the Picton Bay area. These sites are potential transportation pathways of silt and contaminants to the existing Picton intakes. These interceptors cause a large section of the Town of Picton to be included in the existing intakes' IPZ-2 region.

Operators of Picton WTP have noted that seasonal run-off from Mosquito Creek, located in close proximity to the existing Picton WTP intakes, result in high turbidity in the raw water. This poses problems for the operation of the filters.

At the end of Picton Harbour is Marsh Creek, which is where the Picton Wastewater Treatment Plant (Picton WWTP) outfall is located. The effluent from the Picton WWTP is a crucial source of water for Picton Harbour.

Figure 3.4.1 shows the location of these sited storm outfalls, drainage ditches and creeks with reference to the existing intakes and potential new intake locations.

The preferred new intake location should be chosen to avoid or minimize the effects of these transportation pathways. Possible intake locations such as B, D and E are quite close to the existing storm outfalls and should be avoided. Locations such as C and F are further away from the contaminant sources.

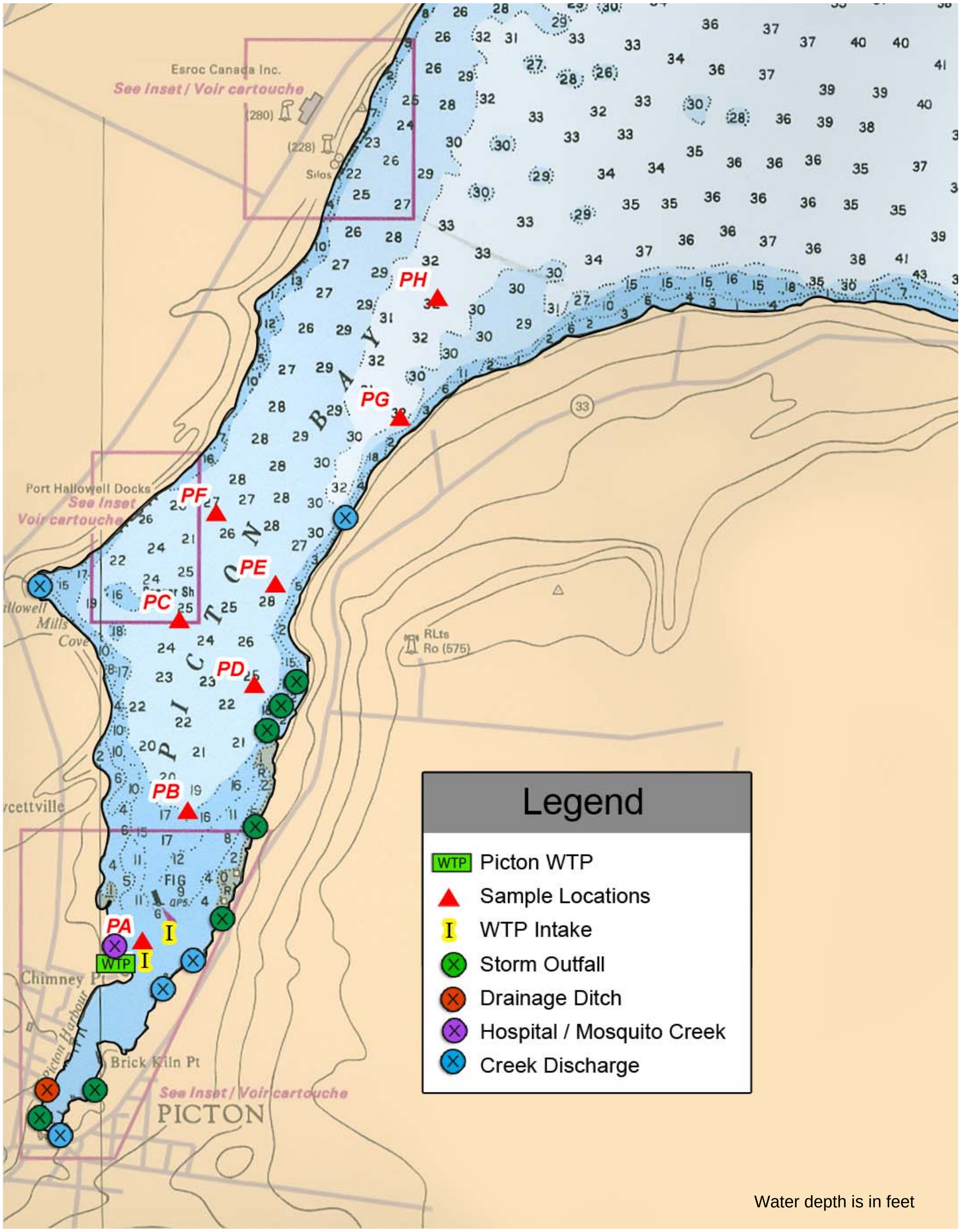


Figure 3.4.1: Location of Potential Contaminant Transportation Pathways

3.4.2 AERIAL PHOTOGRAPHS OF PLUMES

Three historic aerial photographs of the Picton Harbour were found during this study which showed that various areas were susceptible to plumes or disturbances. Although the sources of the plumes or disturbances are unknown, it is best to avoid these locations when selecting the preferred new intake location.

The first aerial photo was taken from the National Air Photo Library's (NAPL) July 1995. Figure 3.4.2.1 shows an overlay of this plume/disturbance over Picton Bay, with reference to its location, relative to the existing and possible intake locations. As the figure shows evidently, the existing intakes of the Picton WTP are in the midst of the plume (indicated in brown).

The second aerial photo was taken from the Ministry of Transportation (MTO) April 2005 aerial photo archive. Figure 3.4.2.2 shows an overlay of the plume/disturbance over Picton Bay with reference to its location relative to the existing and possible intake locations. As the figure shows evidently, the existing intakes of the Picton WTP are in the midst of the plume (indicated in maroon).

The third aerial photo was also taken from the Ministry of Transportation (MTO) April 2005 aerial photo archive. Figure 3.4.2.3 shows an overlay of another plume/disturbance over Picton Bay with reference to its location relative to the existing and possible intake locations. As the figure shows, the existing "North" intake is in the midst of the plume (indicated in purple), while the existing south intake just missed the plume. However it is uncertain whether or not the south intake was still impacted by the plume as it moved through the area.

Figure 3.4.2.4 shows an overlay of the above three plumes/disturbances over Picton Bay and the existing and possible intake locations to see the cumulative affected area of the plumes or disturbances noted in the available aerial photos.

Although there may have been other plumes or disturbances in Picton Bay that were not captured by the available aerial photos, the three aerial photos available confirm that the existing intakes location is an area that is frequently visited by the plumes or disturbances. This also helps to indicate potential areas to avoid for the new intake.

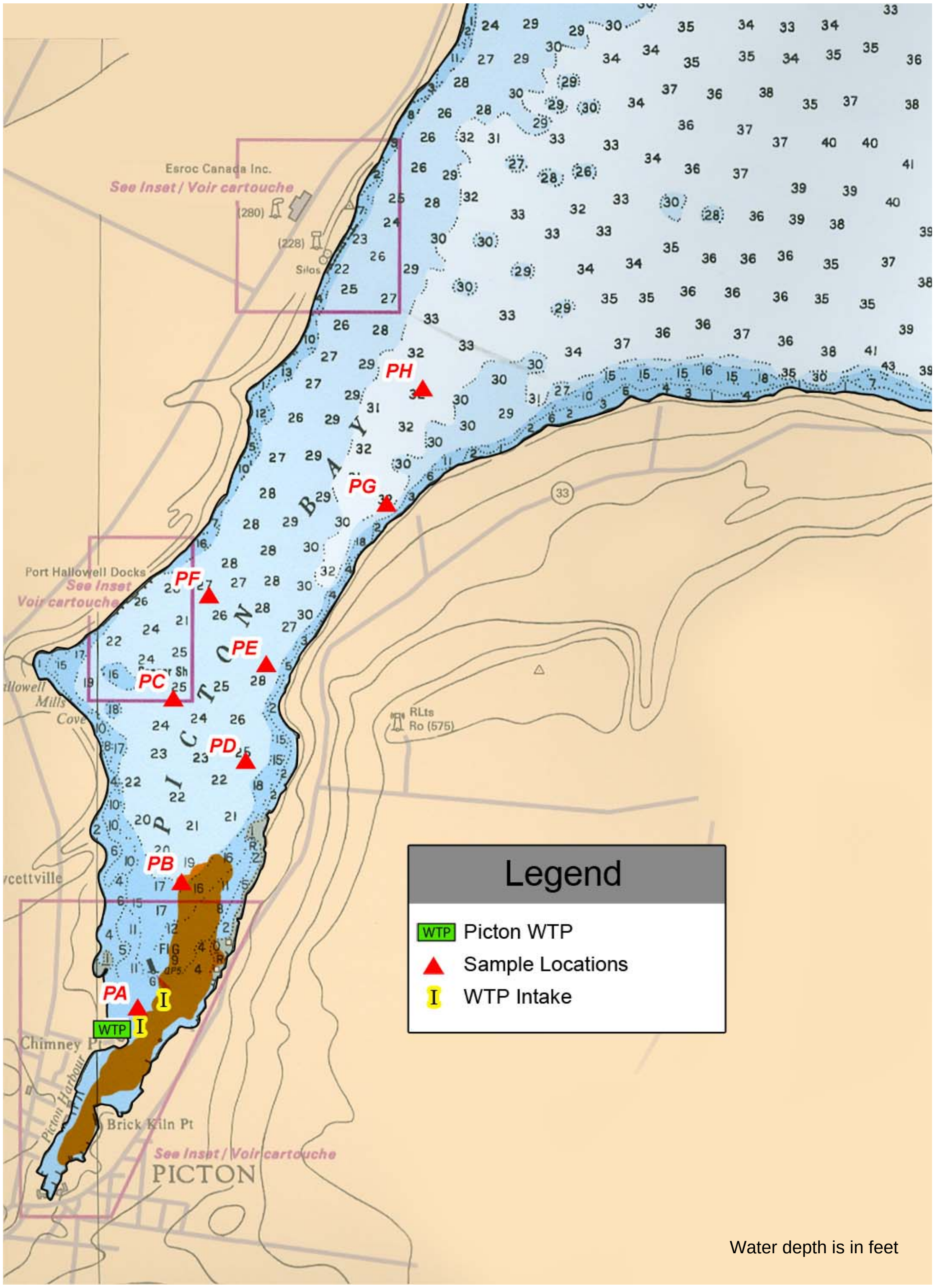


Figure 3.4.2.1: NAPL (July 1995) Aerial Photo Plume Overlay on Picton Bay Area with Existing and Possible Intake Locations

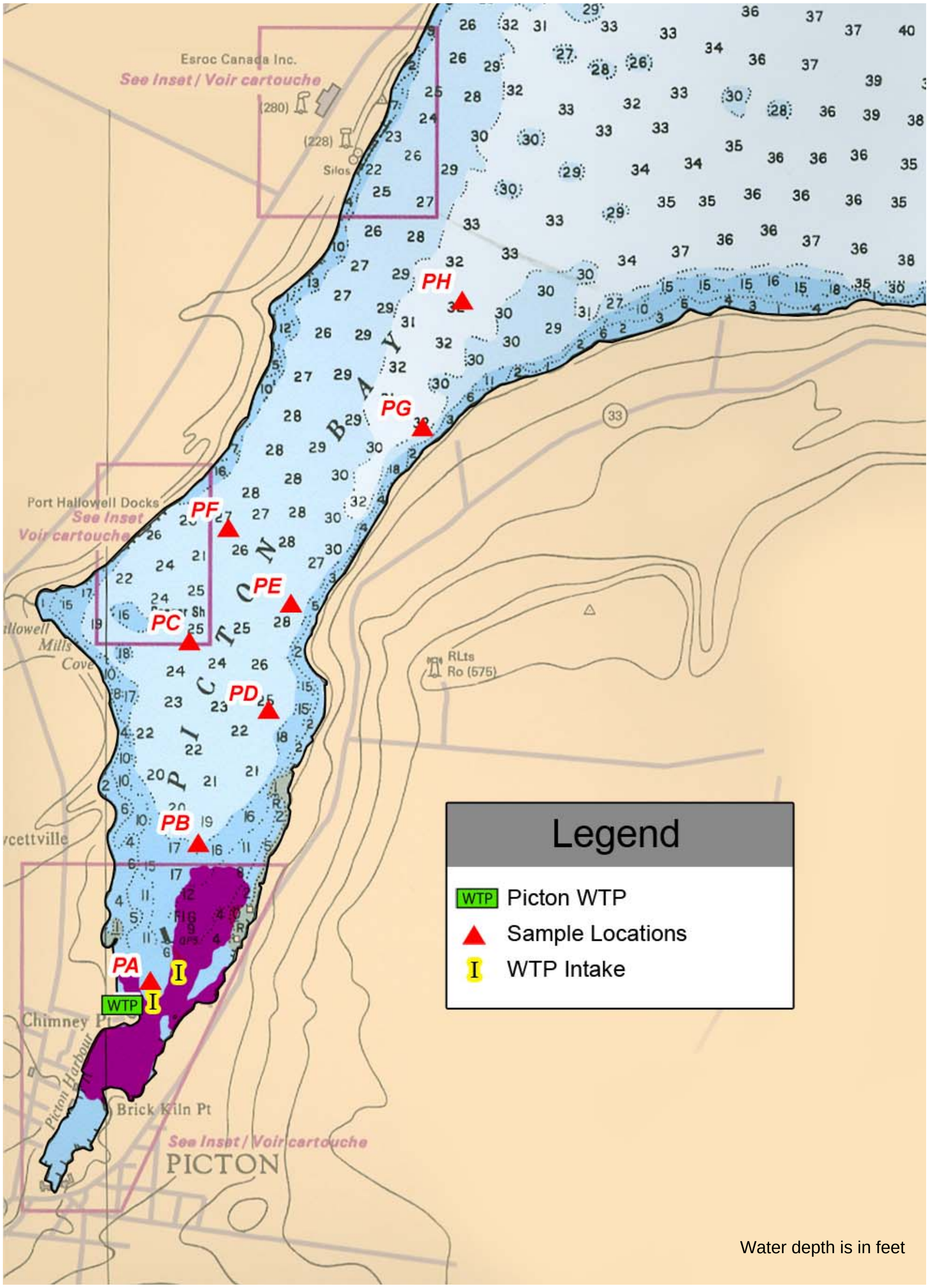


Figure 3.4.2.2: MTO (April 2005) Aerial Photo Plume Overlay on Picton Bay Area with Existing and Possible Intake Locations

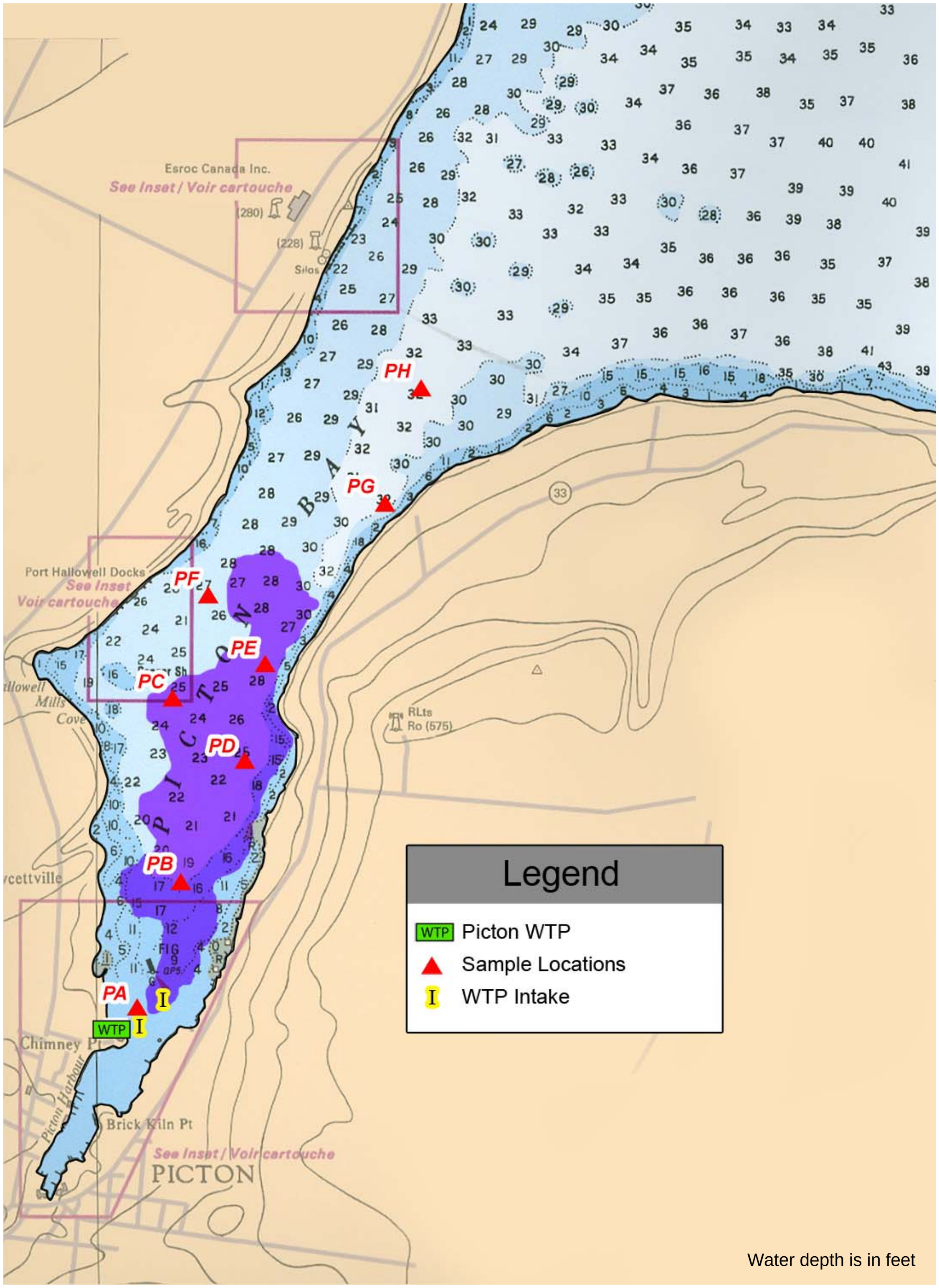


Figure 3.4.2.3: MTO (April 2005) Aerial Photo Plume Overlay on Picton Bay Area with Existing and Possible Intake Locations

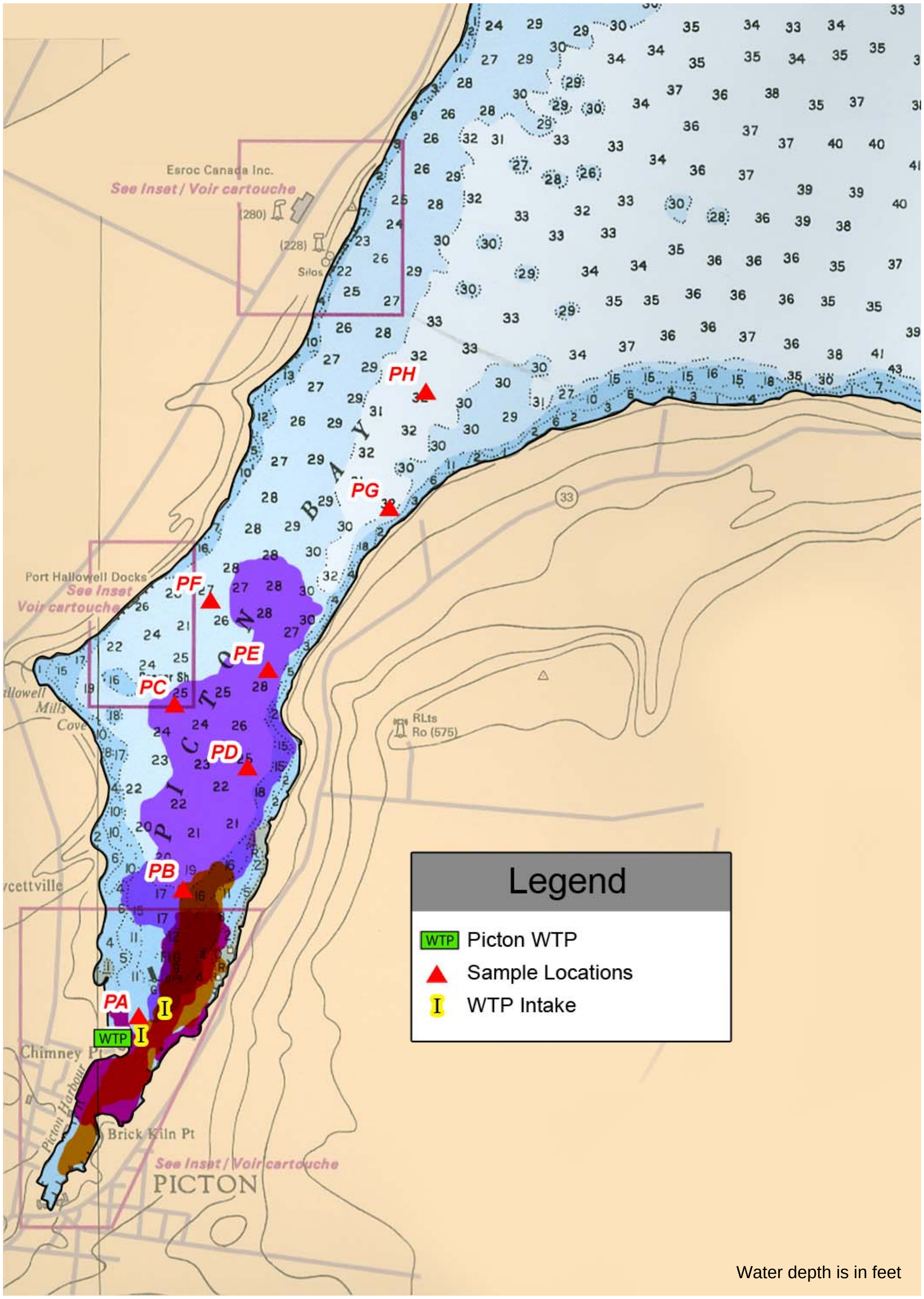


Figure 3.4.2.4: Overlay of plumes/disturbances from MTO (April 2005) and NAPL (July 1995) Aerial Photos on Picton Bay Area with Existing and Possible Intake Locations

3.5 OVERVIEW OF WATER QUALITY FACTORS

Figure 3.5 presents a compilation of the factors presented in Sections 3.3 and Section 3.4 (contaminant discharges, boat traffic, and plumes/disturbances).

From this figure, it would appear that locations C, F, G and H are prime areas for the new intake based on water quality.

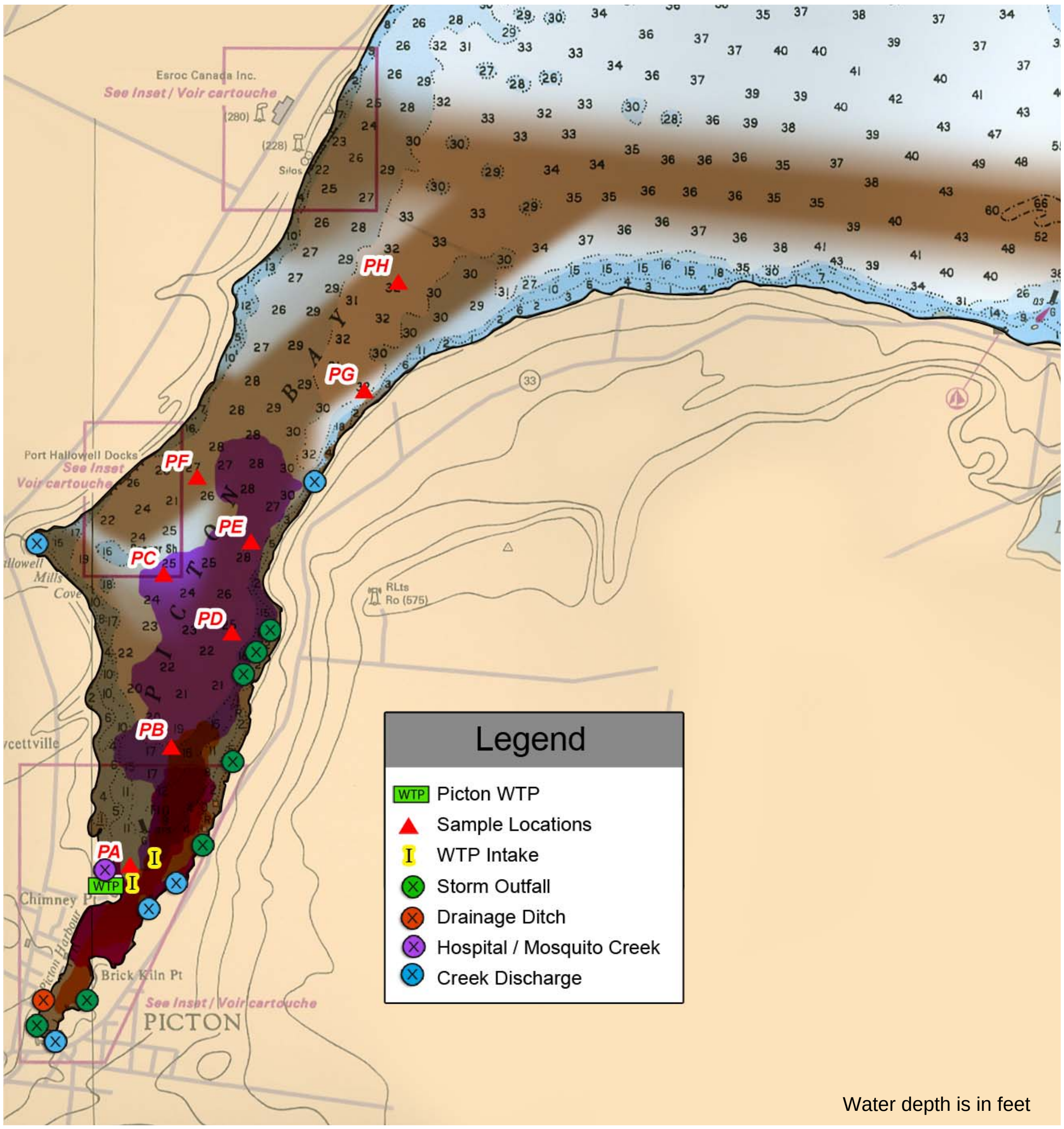


Figure 3.5 Overlay of Factors Contributing to Water Quality on Existing and Possible Intake Locations

3.6 SIZING AND COST COMPARISON OF NEW INTAKE PIPE

The construction of the new intake project will include the following items:

1) New raw water well, complete with isolation gates and interconnecting pipe
2) valve/isolation chamber, complete with new isolation valves for existing intake pipes
3) New intake pipe, complete with intake structure, sampling line and chemical lines for zebra mussel control

However, in determining the preferred new intake location based on construction cost, the only variable amongst the various intake locations is the distance, since the same infrastructure will be required for all new intake options.

From the preliminary hydraulic calculations and based on the Ministry of Environment guidelines for new intake pipes to oversize the pipe to account for 150% of current water demands (e.g. 180L/s), the recommended intake pipe diameter and associated material cost is as presented in Table 3.6.1.

Table 3.6.1: Recommended Intake Pipe Size Based on Pipe Distance

Distance (m)	Possible Intake Locations	Min. Pipe Diameter (mm)	Cost of HDPE Pipe ($/m) in 2011
1000-1300	B	650	$206.39
1400-1900	C, D	700	$238.43
2000-2600	E, F	750	$271.86
2600-3500	G, H	800	$299.45

The construction cost of the raw water well, isolation/valve chamber and intake structure will be the same for all intake locations and is approximately $850,000.

Table 3.6.2 summarizes the preliminary total construction cost estimate for the possible intake locations. The preliminary labour cost estimate was based on 2011 costs from a specialized intake contractor (McNally Construction Limited). The labour cost does not include disposal or remediation of contaminated sediment. The total cost estimate includes a 15% construction contingency amount.

Table 3.6.2 Preliminary Construction Cost Estimate for the Possible Intake Locations

New Intake Location	Distance (m)	HDPE Pipe Diam. (mm)	Estimated Intake Pipe Material Cost	Estimated Intake Pipe Labour Cost	Common Works Cost	Total Estimated Construction Cost (with 15% contingency)
B	1000	700	$0.2M	$3.0M	$0.8M	$4.5M
C	1700	750	$0.4M	$4.8M	$0.8M	$6.8M
D	1500	750	$0.4M	$4.5M	$0.8M	$6.4M
E	2000	800	$0.5M	$5.3M	$0.8M	$7.5M
F	2300	800	$0.6M	$5.7M	$0.8M	$8.1M
G	3000	900	$0.9M	$6.8M	$0.8M	$9.6M
H	3500	900	$1.0M	$7.5M	$0.8M	$10.7M

4. PREFERRED INTAKE LOCATION

4.1 DECISION MATRIX FOR INTAKE LOCATION

To help evaluate the various criteria for the preferred intake location as outlined in Section 3, a weighted decision matrix is presented in Table 4.1 for all options, including the Status Quo/Do Nothing option.

The decision matrix compares and ranks all intake locations (including the existing intake location) to each other in a specific criteria. The criteria are sediment and water quality from XCG's field monitoring program, water quality from boat traffic and proximity to contaminant sources, and construction cost). The rankings are:

1. The lowest ranking (with a score of 1) is shaded in red, representing locations that performed poorly or comparatively badly in the specific criteria
2. The middle ranking (with a score of 2) is shaded in yellow, representing locations that performed on average in the specific criteria
3. The highest ranking (with a score of 3) is shaded in green, representing locations that performed well or above average in the specific criteria.

The total score is calculated for each intake location and the one with the highest aggregate score is the preferred intake location.

Table 4.1: Decision Matrix for Preferred Intake Location

Intake Location	Distance (m)	Depth (m)	Criteria					Scoring			Weighted Total
			Sediment Test from XCG Field Sampling	Water Quality from XCG Field Sampling	Frequency of Boat Traffic	Proximity to Contaminant Sources	Estimated Construction Cost	1	2	3	
A (Status Quo)	200	2.5	Fair – heavy metal LEL exceedance	Poor - many contributing factors	High	Close	annual Maintenance	3	1	1	8
B	1000	6	Fair – heavy metal LEL exceedances	Poor - many contributing factors	High	Close	$4.5M	4	1	0	6
C	**1700**	**7**	**Fair – heavy metal LEL exceedances**	**Fair; unless N wind event**	**Low**	**Far**	**$6.8M**	**1**	**2**	**2**	**11**
D	1500	7	Fair – heavy metal LEL exceedances	Fair unless N wind event	Medium	Close	$6.0M	2	3	0	8
E	2000	8	Fair – heavy metal LEL exceedances	Fair unless N wind event	Medium	Medium	$7.5M	1	4	0	9

F	2300	8	Fair – heavy metal LEL exceedances	Fair; unless N wind event	Medium	Far	$8.1M	2	2	1	9
G	3000	9.1	Fair – heavy metal LEL exceedances	Fair; unless N wind event	Medium	Medium	$9.6M	2	3	0	8
H	3500	9.8	Fair – heavy metal LEL exceedances	Fair; unless N wind event	Low	Far	$10.7M	2	1	2	10

4.2 PREFERRED INTAKE LOCATION – LOCATION C

Based on the decision matrix in Table 4.1, it can be concluded that the preferred location for the new intake is Location C, approximately 1700m North of the existing Picton WTP, at lake bottom depth of 7m. It may be beneficial to move Location C slightly North to avoid the plume/disturbance captured by the MTO April 2005 aerial photo. The exact location of the new intake pipe will be evaluated in detail during the detailed design stage.

All possible intake locations, except for the existing intake location, have various heavy metal concentrations above the LEL in the Ontario Sediment Standard. The MOE will be consulted to determine the restrictions that will be required for the construction of the intake pipe at this location. This consultation should be completed prior to the final intake selection and completion of the Class EA process.

The water quality of Location C shows improvement compared to the existing intake location due to its distance from Picton Harbour, the infrequent boat traffic, distance from potential transportation pathways of storm outfalls, drainage ditches and creeks. However it should be noted that during Northerly wind events, which stir up the entire area and depths of Picton Bay, the water quality of all evaluated locations are similarly poor.

The cost for the material and labour of putting down an intake pipe out to Location C is in the middle price range and a good compromise for getting a new intake out in further and deeper waters without the prohibitive costs of a longer intake pipe.

As such, the preferred new intake location would be area Location C as noted on Figure 4.2.

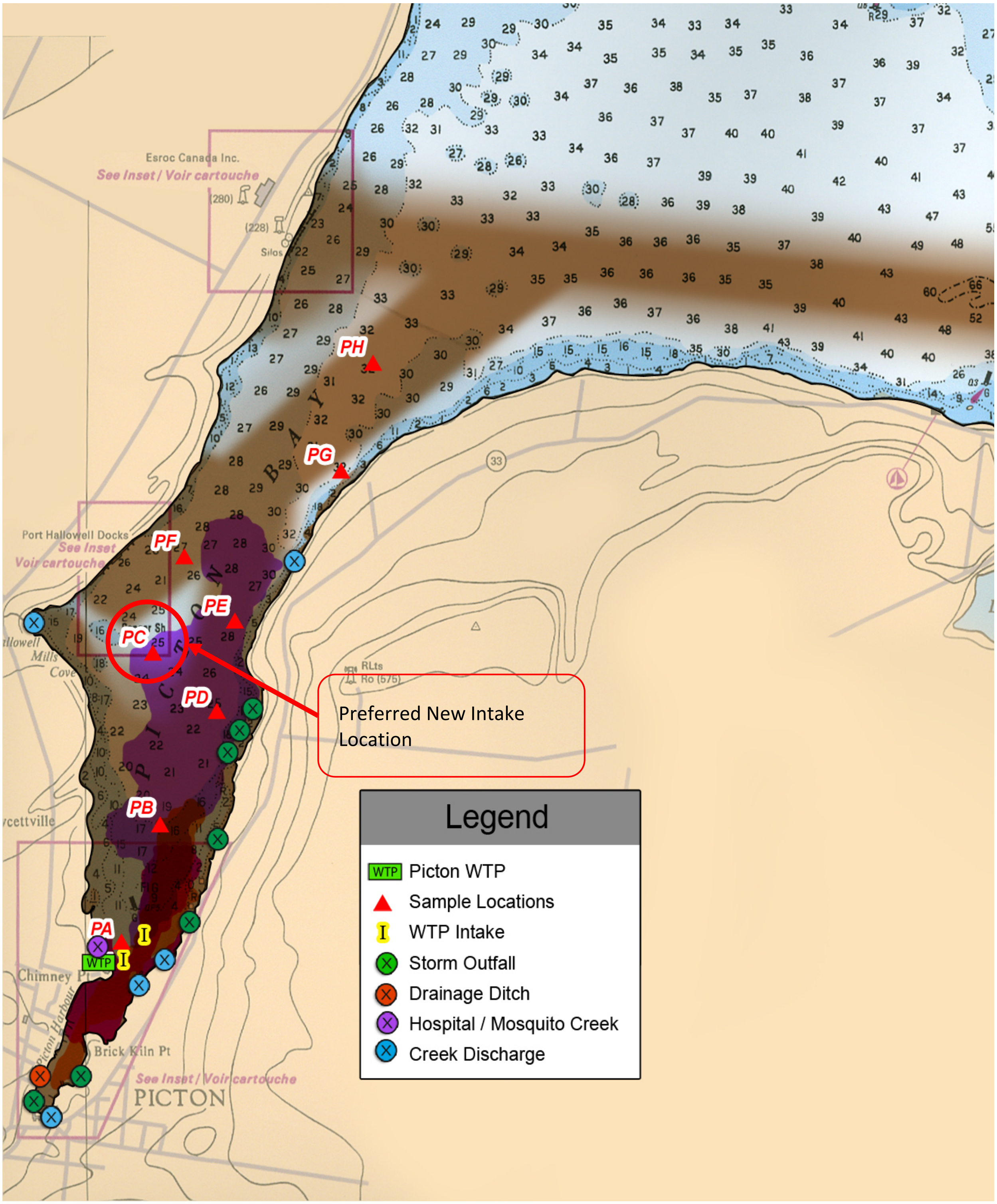


Figure 4.2: Overlay of Factors Contributing to Water Quality on Existing, Preferred and Possible Intake Locations

4.3 CONCEPTUAL DESIGN OF NEW INTAKE STRUCTURE AND RAW WATER WELL

With the preferred intake routing option selected, the intake project would include a new intake pipe and structure, raw water well and valve/isolation chamber.

During the construction of the new intake, the existing intake(s) must remain in operation in order for Picton WTP to continue distribution of treated water to the Town of Picton and the Village of Bloomfield. As such, it is proposed that a new, larger raw water well be constructed, complete with isolation gates, for the new intake pipe to connect to. A new valve and isolation chamber would also be constructed around where the existing intake pipes enter into the Picton WTP. A new pipe would connect the new raw water well to the new valve/isolation chamber, complete with isolation valves/gates. Once the new works are completed, the existing intake pipe within the chamber would be removed and an isolation valve/gate would be installed. This work would be performed under water or with an overnight work, with a short shutdown.

The advantage of the new raw water well is that even if the future Picton WTP was to be located off-site, on another property, the raw water well can be upgraded with a superstructure and pumping capability to transport the raw water to the new WTP location.

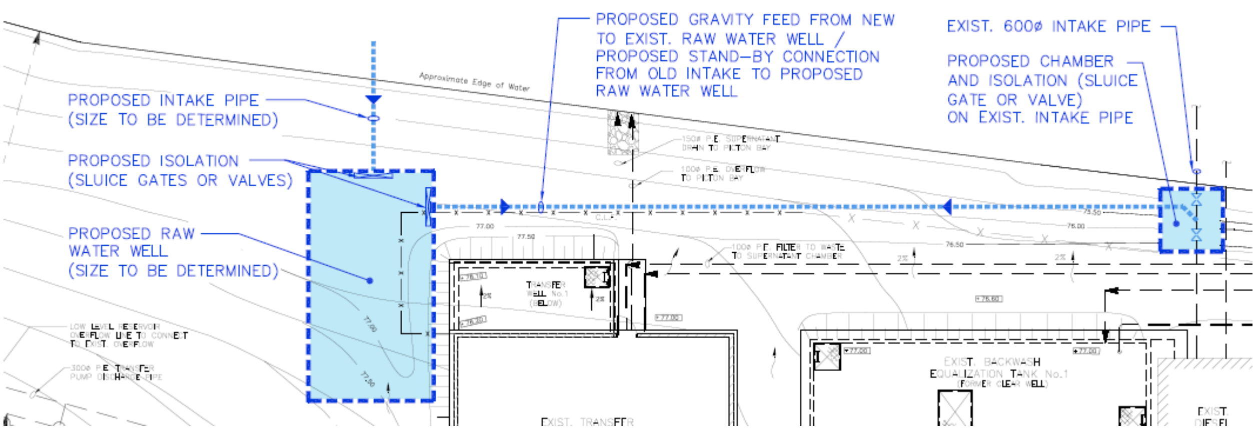


Figure 4.3.1: Conceptual Design of the New Raw Water Well and the New Valve/Isolation Chamber

The new intake structure would be of a similar design to that used for other great lakes WTP intakes. Instead of the wooden crib of the existing Picton intake, the new intake structure would be metal, with a horizontal octagonal dual-saucer structure to allow the water to flow through and down into the intake pipe. This design would maintain a slow/tranquil flow of the water into the intake pipe so that unsuspecting aquatic life would not be sucked into the intake pipe. The actual intake structure would be elevated above lake bottom to deter bottom dwellers from making their homes there and clogging up the intake. Figure 4.3.2 shows the proposed new intake structure.

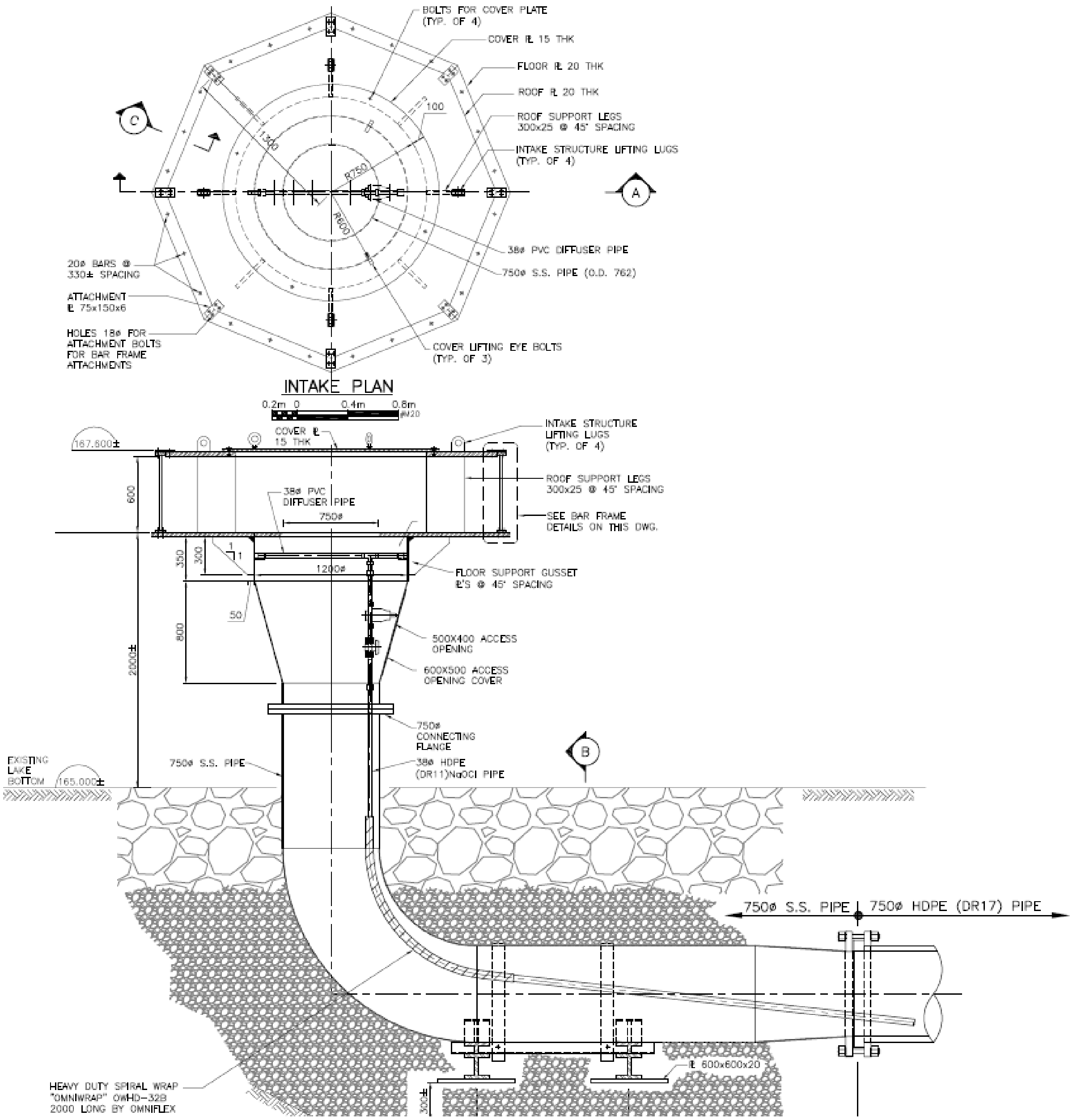


Figure 4.3.2 Proposed New Intake Structure

Preliminary and detailed design of the intake structure and required infrastructure will take place after the Class EA process.

APPENDIX G

Base Scenario - No Upgrades or Expansion to Picton & Wellington Except for Continued Maintenance/Operation of WTP

Inflation Rate	2.1%
Interest Rate	2.1%

Picton

Structural upgrade of existing settling tanks in 10 years to keep WTP operational

New WTP in 30 years to keep WTP operational — 2.69484 million Gal/day

In 10 years

Settling Tank Upgrade	Volume (m3)	Design Capacity (	Cost by Formula (199	Cost @ present (2014)	Cost in present worth (from 2022 to 2014)	
Rehab cost (1999) = e^(11.89+0.976^2)*D^0.478	299.71	0.080681932	$113,474.68	**$154,983.37**	**$131,243.91**	Reference Material #1
Other Structural Upgrades				**$400,000.00**	**$338,730.31**	
				$554,983.37	**$469,974.21**	

future year	2022
present year	2014

In 30 years	Specifics for Formula	Qty	**Cost from Formula (1**	**Cost @ present (2014)**	**Cost in present worth (from 2041 to 2014)**	**Comments/Source**
Valves (various sizes)			$175,000.00	$239,014.46	$133,568.30	
Control Valves (various sizes)			$590,000.00	$805,820.19	$450,315.99	
Watermeters			$165,000.00	$225,356.49	$125,935.83	
Chlorine for Disinfection cost = e^(10.4+1.070^2/2)*D^0.684			$114,751.68	$156,727.49	$87,583.92	Reference Material #1
Clearwell cost = e^(14.02+0.464^2/2)*D^0.739			$2,842,650.35	$3,882,483.11	$2,169,645.58	Reference Material #1
Conventional Filter Plant cost = e^(14.444+0.537^2/2)*D^(0.881)			$5,186,418.86	$7,083,594.95	$3,958,520.89	Reference Material #1
Sedimentation/Flocculation cost = e^(12.754+0.75^2/2)*D^(0.608)			$837,338.77	$1,143,634.72	$639,096.67	Reference Material #1
Treated Water Reservoir cost = e^(13.641+0.559^2/2)*D^0.694	Capacity MG	2.69484	$1,953,688.43	$2,668,341.66	$1,491,147.68	Reference Material #1
Pumps (raw water pumps; finished water pumps) cost = e^(10.967+1.137^2/2)*D^0.713			$224,181.01	$306,185.74	$171,105.58	Reference Material #1
SCADA Costs cost = e^(10.770+1.484^2/2)*D^0.578			$253,754.32	$346,576.87	$193,677.34	Reference Material #1
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0.831	kw	300	$156,622.74	$213,914.85	$119,541.90	Reference Material #1
			$12,499,406.16	$17,071,650.52	**$9,540,139.68**	new upgraded WTP

future year	2042
present year	2014

Reference Material:

1) EPA 1999 Drinking Water Infrastructure Needs Survey - Modeling the Cost of Infrastructure; Cadmus Group Inc., Feb 2001

Picton WTP - Base Scenario	
Total Const Cost @ 2014	**Total Const Cost (brought back to present worth)**
$17,626,633.89	**$10,010,113.89**

Base Scenario Life Cycle Cost (Picton & Wellington)	
in 2014	Present Worth
$51,226,633.89	**$31,042,720.68**

Base Scenario - Life Cycle Cost	
in 2014	Present Worth
$51,226,633.89	**$31,042,720.68**

Operation & Maintenance Cost - Picton

Year	Full Cost in present yr	Cost in present worth
2014	500000	50000
2015	500000	489715.9647
2016	500000	479643.4522
2017	500000	469778.1119
2018	500000	460115.6826
2019	500000	450651.9908
2020	500000	441382.9488
2021	500000	432304.5532
2022	500000	423412.8827
2023	500000	414704.0966
2024	500000	406174.4335
2025	500000	397820.2091
2026	500000	389637.815
2027	500000	381623.717
2028	500000	373774.4535
2029	500000	366086.6341
2030	500000	358556.9384
2031	500000	351182.114
2032	500000	343958.9755
2033	500000	336884.4031
2034	500000	329955.3409
2035	500000	323168.7962
2036	500000	316521.8376
2037	500000	310011.5941
2038	500000	303635.2538
2039	500000	297390.0625
2040	500000	291273.3227
2041	500000	285282.3925
2042	500000	279414.6841
2043	500000	273667.6632
2044	500000	268038.8474
2045	500000	262525.8055
2046	500000	257126.1562
2047	500000	251837.5673
2048	500000	246657.7544
2049	500000	241584.4803
2050	500000	236615.5537
2051	500000	231748.8283
2052	500000	226982.2021
2053	500000	222313.6161
2054	500000	217741.054
2055	500000	213262.5407
2056	500000	208876.1417
2057	500000	204579.9625
2058	500000	200372.1474
2059	500000	196250.8789
2060	500000	192214.377
2061	500000	188260.8981
total O&M Cost	$24,000,000.00	$14,894,719.14
		brought back to present worth

Picton O&M	
Total O&M Cost @ 2014	**Total O&M Cost (brought back to present worth)**
$24,000,000.00	**$14,894,719.14**

Base Scenario - No Upgrades or Expansion to Picton & Wellington Except for Continued Maintenance/Operation of WTP

Inflation Rate	2.1%
Interest Rate	2.1%

Wellington

No upgrades or expansions - just maintain existing plant

Wellington Construction Cost

Present Works	Lump sum/unit price	Qty	Labour Costs	Subtotal Cost	Assumptions
No works need to be upgraded. No WTP expansions				0	No immediate upgrades needed at Wellington plant

Operation & Maintenance Cost - Wellington

Year	Full Cost in present yr	Cost in present worth
2014	200000	200000
2015	200000	195886.3859
2016	200000	191857.3809
2017	200000	187911.2448
2018	200000	184046.273
2019	200000	180260.7963
2020	200000	176553.1795
2021	200000	172921.8213
2022	200000	169365.1531
2023	200000	165881.6387
2024	200000	162469.7734
2025	200000	159128.0837
2026	200000	155855.126
2027	200000	152649.4868
2028	200000	149509.7814
2029	200000	146434.6537
2030	200000	143422.7754
2031	200000	140472.8456
2032	200000	137583.5902
2033	200000	134753.7612
2034	200000	131982.1364
2035	200000	129267.5185
2036	200000	126608.735
2037	200000	124004.6377
2038	200000	121454.1015
2039	200000	118956.025
2040	200000	116509.3291
2041	200000	114112.957
2042	200000	111765.8736
2043	200000	109467.0653
2044	200000	107215.539
2045	200000	105010.3222
2046	200000	102850.4625
2047	200000	100735.0269
2048	200000	98663.10177
2049	200000	96633.79214
2050	200000	94646.22149
2051	200000	92699.53133
2052	200000	90792.88083
2053	200000	88925.44646
2054	200000	87096.4216

Year	Full Cost in present yr	Cost in present worth
2055	200000	85305.01626
2056	200000	83550.45667
2057	200000	81831.98499
2058	200000	80148.85895
2059	200000	78500.35157
2060	200000	76885.7508
2061	200000	75304.35926
total O&M Cost	$9,600,000.00	$6,137,887.65
		brought back to present worth

Wellington O&M	
Total O&M Cost @ 2014	**Total O&M Cost (brought back to present worth)**
$9,600,000.00	$6,137,887.65

Alternative 1 - Separate Raw and Treated Water Supplies for Picton & Wellington								Inflation Rate	2.1%	
								Interest Rate	2.1%	
Picton										
new intake pipe - now	130	L/s								
new raw water well - now	11232	m3/day								
upgrade settling tanks in 10 years										
Upgrade WTP/new WTP in 30 years	2.9674944	million Gal/day								
new reservoir in 30 years (for fire storage, EQ and emergency storage)	5000	m3								
Picton Construction Cost										
Present Works										
Raw Water Well	**Lump sum/unit price**	**Qty**	**Labour Costs**	**Subtotal Cost**	**Assumptions**					
Excavation & Disposal	10000			$10,000	estimated at 50% of New Transfer Bldg from Picton WTP					
Sheeting & Vertical Trenching	87500			$87,500	estimated at 50% of New Transfer Bldg from Picton WTP					
Dewatering	20000			$20,000	2x picton costs (not much dewatering needed there, but now may be different)					
Concrete, rebar, formwork ($/m3)	1500	143		$214,500	estimated at 33% of NTB concrete & rebar & formwork (assuming raw water well dimensions LxWxH - 5x9x7					
hatches	2000	2		$4,000						
ladder	2000	2		$4,000						
gates	5000	2		$10,000						
interconnecting pipe ($/m)	300	50	20640	$35,640	HDPE pipe with middle price range (230-390); 3 ppl @ 8hrs, 4 days; $65/ppl & $150 eqpt rental					
Isolation Chamber										
valves	1500	2		$3,000						
isolation chamber (precast manhole sections)	2500	3	10320	$17,820	3 ppl @ 8hrs, 2 days; $65/ppl & $150 eqpt rental					
Intake Pipe Structure										
intake structure (supply & install)	200000			$200,000	from similar Southampton project					
HDPE Sampling Line (supply & install; sampling pump & controls)	70000			$70,000	from similar Southampton project					
HDPE Chlorination line (supply & install; incl 2 diffusers)	60000			$60,000	from similar Southampton project					
Intake Pipe Only										
Intake Pipe (Mat & Labour, Eqpt etc.)	238.43	1700	4800000	**$5,205,331**	**total cost for intake pipe construction**					
				$5,941,791	**Total construction cost for Picton Raw Water Well & Intake Pipe**					
In 10 years										
Settling Tank Upgrade	**Volume (m3)**	**Design Capacity (**	**Cost by Formula (199**	**Cost @ present (2014)**	**Cost in present worth (from 2022 to 2014)**					
Rehab cost (1999) = e^(11.89+0.976^2)*D^0.478	299.71	0.080681932	$113,474.68	**$154,983.37**	**$131,243.91**	Reference Material #1		future year		2022
Other Structural Upgrades				**$400,000.00**	**$338,730.31**			present year		2014
				$554,983.37	**$469,974.21**					
In 30 years	Specifics for Formula	Qty	**Cost from Formula (1**	**Cost @ present (2014)**	**Cost in present worth (from 2041 to 2014)**	**Comments/Source**				
Valves (various sizes)			$175,000.00	$239,014.46	$133,568.30			future year		2042
Control Valves (various sizes)			$590,000.00	$805,820.19	$450,315.99			present year		2014
Watermeters			$165,000.00	$225,356.49	$125,935.83					
Chlorine for Disinfection cost = e^(10.4+1.070^2/2)*D^0.684			$122,571.41	$167,407.66	$93,552.31	Reference Material #1				
Clearwell cost = e^(14.02+0.464^2/2)*D^0.739			$3,052,500.26	$4,169,095.48	$2,329,812.99	Reference Material #1				
Conventional Filter Plant cost = e^(14.444+0.537^2/2)*D^(0.881)			$5,646,034.63	$7,711,336.74	$4,309,321.44	Reference Material #1				
Sedimentation/Flocculation cost = e^(12.754+0.75^2/2)*D^(0.608)			$887,871.69	$1,212,652.43	$677,665.79	Reference Material #1				
Treated Water Reservoir (Fire, EQ and Emergency Storage for future)	1590000	250000		$1,840,000.00	$1,028,246.04	excavation, concrete, formwork, disposal, dewatering				
Pumps (raw water pumps; finished water pumps) cost = e^(10.967+1.137^2/2)*D^0.713			$240,128.00	$327,966.09	$183,277.08	Reference Material #1				
SCADA Costs cost = e^(10.770+1.484^2/2)*D^0.578			$268,291.40	$366,431.57	$204,772.72	Reference Material #1				
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0.831	kw	300	$156,622.74	$213,914.85	$119,541.90	Reference Material #1				
			$11,304,020.12	$15,438,995.95	$9,656,010.39	new upgraded WTP				
Reference Material:				**Picton WTP Upgrades - Opt 1**			**Alternative #1 Life Cycle Cost (Picton & Wellington Upgrades)**			
1) EPA 1999 Drinking Water Infrastructure Needs Survey - Modeling the Cost of Infrastructure; Cadmus Group Inc., Feb 2001				**Total Const Cost @ 2014**	**Total Const Cost (brought back to present worth)**		in 2014	Present Worth		
				$21,935,770.32	**$16,067,775.60**		**$70,523,376.68**	**$47,073,531.60**		

				Total O&M Cost @ 2012	Total O&M Cost (brought back to present worth)
Operation & Maintenance Cost - Picton				$24,000,000.00	$15,344,719.14
Year	**Full Cost in present yr**	**Cost in present worth**			
2014	500000	500000		**Alternative #1 Life Cycle Cost**	
2015	500000	489715.9647		in 2014	Present Worth
2016	500000	479643.4522		**$70,523,376.68**	**$47,073,531.60**
2017	500000	469778.1119			
2018	500000	460115.6826			
2019	500000	450651.9908			
2020	500000	441382.9488			
2021	500000	432304.5532			
2022	500000	423412.8827			
2023	500000	414704.0966			
2024	500000	406174.4335			
2025	500000	397820.2091			
2026	500000	389637.815			
2027	500000	381623.717			
2028	500000	373774.4535			
2029	500000	366086.6341			
2030	500000	358556.9384			
2031	500000	351182.114			
2032	500000	343958.9755			
2033	500000	336884.4031			
2034	500000	329955.3409			
2035	500000	323168.7962			
2036	500000	316521.8376			
2037	500000	310011.5941			
2038	500000	303635.2538			
2039	500000	297390.0625			
2040	500000	291273.3227			
2041	500000	285282.3925			
2042	500000	279414.6841			
2043	500000	273667.6632			
2044	500000	268038.8474			
2045	500000	262525.8055			
2046	500000	257126.1562			
2047	500000	251837.5673			
2048	500000	246657.7544			
2049	500000	241584.4803			
2050	500000	236615.5537			
2051	500000	231748.8283			
2052	500000	226982.2021			
2053	500000	222313.6161			
2054	500000	217741.054			
2055	500000	213262.5407			
2056	500000	208876.1417			
2057	500000	204579.9625			
2058	500000	200372.1474			
2059	500000	196250.8789			
2060	500000	192214.377			
2061	500000	188260.8981			
total O&M Cost	$24,000,000.00	$15,344,719.14			
		brought back to present worth			

Alternative 1 - Separate Raw and Treated Water Supplies for Picton & Wellington

Alternative 1 - Separate Raw and Treated Water Supplies for Picton & Wellington					Inflation Rate	2.1%		
Wellington					Interest Rate	2.1%		
new intake pipe in 30 yrs	130	L/s						
WTP upgrades by 2000m3/day in 10 yrs	0.5284	MG/Day						
WTP upgrades by 2500m3/day in 30 yrs	0.6605	MG/Day						
Wellington Construction Cost								
Present Works	**Lump sum/unit price**	**Qty**	**Labour Costs**	**Subtotal Cost**	**Assumptions**			
No works need to be upgraded				**0**	No immediate upgrades needed at Wellington plant			
In 10 Years								
Wellington Upgrade to Meet Its Own 2021 Needs (1	**Specifics for Formula**	**Qty**	**Cost (1999)**	**Cost @ present (2014)**	**Cost in present worth (from 2022 t0 2014)**	**Comments/Source**		
Valves (various sizes)			$59,000.00	$80,582.02	$68,238.93			
Control Valves (various sizes)			$86,000.00	$117,458.54	$99,466.91		future year	2022
Watermeters			$11,000.00	$15,023.77	$12,722.51		present year	2014
Chlorine for Disinfection cost = e^(10.4+1.070^2/2)*D^0.684			$37,651.39	$51,424.16	$43,547.30	Reference Material #1		
Clearwell cost = e^(14.02+0.464^2/2)*D^0.739			$852,764.44	$1,164,703.06	$986,300.56	Reference Material #1		
Conventional Filter Plant cost = e^(14.444+0.537^2/2)*D^(0.881)			$1,234,520.38	$1,686,104.14	$1,427,836.43	Reference Material #1		
Sedimentation/Flocculation cost = e^(12.754+0.75^2/2)*D^(0.608)			$310,955.71	$424,702.35	$359,648.89	Reference Material #1		
Pumps (raw water pumps; finished water pumps) cost = e^(10.967+1.137^2/2)*D^0.713			$70,161.89	$95,826.90	$81,148.68	Reference Material #1		
SCADA Costs cost = e^(10.770+1.484^2/2)*D^0.578			$98,955.03	$135,152.48	$114,450.60	Reference Material #1		
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0	kw	300	$156,622.74	$213,914.85	$181,148.61	Reference Material #1		
			$2,917,631.58	**$3,984,892.25**	**$3,374,509.43**			
In 30 Years								
Wellington Upgrade to Meet Its Own 2061 Needs (3	**Specifics for Formula**	**Qty**	**Cost (1999)**	**Cost @ present (2014)**	**Cost in present worth (from 2042 to 2014)**	**Comments/Source**		
Valves (various sizes)			$175,000.00	$239,014.46	$133,568.30			
Control Valves (various sizes)			$590,000.00	$805,820.19	$450,315.99		future year	2042
Watermeters			$165,000.00	$225,356.49	$125,935.83		present year	2014
Chlorine for Disinfection cost = e^(10.4+1.070^2/2)*D^0.684			$43,859.89	$59,903.70	$33,475.95	Reference Material #1		
Clearwell cost = e^(14.02+0.464^2/2)*D^0.739			$1,005,647.05	$1,373,509.65	$767,557.53	Reference Material #1		
Conventional Filter Plant cost = e^(14.444+0.537^2/2)*D^(0.881)			$1,502,712.80	$2,052,400.52	$1,146,941.69	Reference Material #1		
Sedimentation/Flocculation cost = e^(12.754+0.75^2/2)*D^(0.608)			$356,139.23	$486,413.87	$271,822.36	Reference Material #1		
Pumps (raw water pumps; finished water pumps) cost = e^(10.967+1.137^2/2)*D^0.713			$82,261.78	$112,352.89	$62,786.10	Reference Material #1		
SCADA Costs cost = e^(10.770+1.484^2/2)*D^0.578			$112,577.57	$153,758.10	$85,924.54	Reference Material #1		
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0	kw	reuse diesel fror	$0.00	$0.00	$0.00	Reference Material #1		
			$4,033,198.32	**$5,508,529.87**	**$3,078,328.27**			
New Wellington Intake Pipe & Structure (in 30 yrs)	**Lump sum/unit price**	**Qty**	**Labour Cost**	**Cost @ present (2014)**	**Cost in present worth (from 2042 to 2014)**	**Assumptions**		
Intake Pipe (Mat & Labour, Eqpt etc.)	238.43	1475	4462500	$4,814,184.25	$2,690,307.54	**total cost for intake pipe construction**		
intake structure (supply & install)	200000			$200,000.00	$111,765.87			
HDPE Sampling Line (supply & install; sampling pump	70000			$70,000.00	$39,118.06			
HDPE Chlorination line (supply & install; incl 2 diffuse	60000			$60,000.00	$33,529.76			
Raw Water Well								
Excavation & Disposal	10000			$10,000.00	$5,588.29	estimated at 50% of New Transfer Bldg from Picton WTP		
Sheeting & Vertical Trenching	87500			$87,500.00	$48,897.57	estimated at 50% of New Transfer Bldg from Picton WTP		
Dewatering	20000			$20,000.00	$11,176.59	2x picton costs (not much dewatering needed there, but now may be different)		
Concrete, rebar, formwork ($/m3)	1500	143		$214,500.00	$119,868.90			
hatches	2000	2		$4,000.00	$2,235.32			
ladder	2000	2		$4,000.00	$2,235.32			
gates	5000	2		$10,000.00	$5,588.29			
				$5,494,184.25	**$3,070,311.51**			
		Total cost for 30 yr upgrade		**$11,002,714.12**	**$6,148,639.78**			
Reference Material:				**Wellington WTP Upgrades - Opt 1**				
1) EPA 1999 Drinking Water Infrastructure Needs Survey - Modeling the Cost of Infrastructure; Cadmus Group Inc., Feb 2001				**Total Cost @ 2014**	**Total Cost (brought back to present worth)**			
				$14,987,606.37	**$9,523,149.21**			

Operation & Maintenance Cost - Wellington				
Year	**Full Cost in present yr**	**Cost in present worth**	Total O&M Cost @ 2014	Total O&M Cost (brought back to present worth)
2014	200000	200000	$9,600,000.00	$6,137,887.65
2015	200000	195886.3859		
2016	200000	191857.3809		
2017	200000	187911.2448		
2018	200000	184046.273		
2019	200000	180260.7963		
2020	200000	176553.1795		
2021	200000	172921.8213		
2022	200000	169365.1531		
2023	200000	165881.6387		
2024	200000	162469.7734		
2025	200000	159128.0837		
2026	200000	155855.126		
2027	200000	152649.4868		
2028	200000	149509.7814		
2029	200000	146434.6537		
2030	200000	143422.7754		
2031	200000	140472.8456		
2032	200000	137583.5902		
2033	200000	134753.7612		
2034	200000	131982.1364		
2035	200000	129267.5185		
2036	200000	126608.735		
2037	200000	124004.6377		
2038	200000	121454.1015		
2039	200000	118956.025		
2040	200000	116509.3291		
2041	200000	114112.957		
2042	200000	111765.8736		
2043	200000	109467.0653		
2044	200000	107215.539		
2045	200000	105010.3222		
2046	200000	102850.4625		
2047	200000	100735.0269		
2048	200000	98663.10177		
2049	200000	96633.79214		
2050	200000	94646.22149		
2051	200000	92699.53133		
2052	200000	90792.88083		
2053	200000	88925.44646		
2054	200000	87096.4216		
2055	200000	85305.01626		
2056	200000	83550.45667		
2057	200000	81831.98499		
2058	200000	80148.85895		
2059	200000	78500.35157		
2060	200000	76885.7508		
2061	200000	75304.35926		
total O&M Cost	$9,600,000.00	$6,137,887.65		
		brought back to present worth		

Alternative 2 - Central Supply of Raw Water From Wellington to Picton

Inflation Rate	2.1%
Interest Rate	2.1%

Picton

upgrade settling tanks in 10 years		
New WTP in 30 years	2.9674944	million Gal/day
new reservoir inbetween for contingency (72hr max day storage)	23496	m3

Picton Construction Cost

Present Works	Lump sum/unit price	Qty	Labour Costs	Subtotal Cost	Assumptions
No works need to be upgraded				0	No immediate upgrades needed at Wellington plant

In 10 years

Settling Tank Upgrade	Volume (m3)	Design Capacity (M(	Cost by Formula (1999)	Cost @ present (2014)	Cost in present worth (from 2022 to 2014)	Reference
Rehab cost (1999) = e^(11.89+0.976^2)*D^0.478	299.71	0.080681932	$113,474.68	**$154,983.37**	**$131,243.91**	Ref Mat #1
Other Structural Upgrades				**$400,000.00**	**$338,730.31**	
				$554,983.37	**$469,974.21**	

future year	2022
present year	2014

In 30 years

	Specifics for Formula	Qty	Cost from Formula (1999	Cost @ present (2014)	Cost in present worth (from 2041 to 2014)	Reference
Valves (various sizes)			$175,000.00	$239,014.46	$133,568.30	
Control Valves (various sizes)			$590,000.00	$805,820.19	$450,315.99	
Watermeters			$165,000.00	$225,356.49	$125,935.83	
Chlorine for Disinfection cost = e^(10.4+1.070^2/2)*D^0.684			$122,571.41	$167,407.66	$93,552.31	Ref Mat #1
Clearwell cost = e^(14.02+0.464^2/2)*D^0.739			$3,052,500.26	$4,169,095.48	$2,329,812.99	Ref Mat #1
Conventional Filter Plant cost = e^(14.444+0.537^2/2)*D^(0.881)			$5,646,034.63	$7,711,336.74	$4,309,321.44	Ref Mat #1
Sedimentation/Flocculation cost = e^(12.754+0.75^2/2)*D^(0.608)			$887,871.69	$1,212,652.43	$677,665.79	Ref Mat #1
Treated Water Reservoir (m3) for 72 hrs of storage cost = e^(13.641+0.5	Capacity MG	4.59592004	$2,829,774.99	$3,864,897.99	$2,159,818.50	Ref Mat #1
Pumps (raw water pumps; finished water pumps) cost = e^(10.967+1.137^2/2)*D^0.713			$240,128.00	$327,966.09	$183,277.08	Ref Mat #1
SCADA Costs cost = e^(10.770+1.484^2/2)*D^0.578			$268,291.40	$366,431.57	$204,772.72	Ref Mat #1
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0.831	kw	300	$156,622.74	$213,914.85	$119,541.90	Ref Mat #1
			$14,133,795.11	**$19,303,893.94**	**$10,787,582.85**	new upgraded WTP

future year	2042
present year	2014

Picton WTP Upgrades - Opt 2

Total Cost @ 2014	Total Cost (brought back to present worth)
$19,858,877.30	**$11,257,557.07**

Total O&M Cost @ 2012	Total O&M Cost (brought back to present worth)
$24,000,000.00	$15,344,719.14

O&M cost provided by PEC Ops staff: Picton WTP $500,000/yr, Wellington WTP $200,000/yr

Alternative #2 Life Cycle Cost (Picton & Wellington Upgrades)

in 2012	Present Worth
$91,216,227.41	**$67,456,929.55**

Reference Material:

1) EPA 1999 Drinking Water Infrastructure Needs Survey - Modeling the Cost of Infrastructure; Cadmus Group Inc., Feb 2001

Operation & Maintenance Cost - Picton			Operation & Maintenance Cost - Wellington		
Year	Full Cost in present yr	Cost in present worth	Year	Full Cost in present yr	Cost in present worth
2014	500000	500000	2014	200000	200000
2015	500000	489715.9647	2015	200000	195886.3859
2016	500000	479643.4522	2016	200000	191857.3809
2017	500000	469778.1119	2017	200000	187911.2448
2018	500000	460115.6826	2018	200000	184046.273
2019	500000	450651.9908	2019	200000	180260.7963
2020	500000	441382.9488	2020	200000	176553.1795
2021	500000	432304.5532	2021	200000	172921.8213
2022	500000	423412.8827	2022	200000	169365.1531
2023	500000	414704.0966	2023	200000	165881.6387
2024	500000	406174.4335	2024	200000	162469.7734
2025	500000	397820.2091	2025	200000	159128.0837
2026	500000	389637.815	2026	200000	155855.126
2027	500000	381623.717	2027	200000	152649.4868
2028	500000	373774.4535	2028	200000	149509.7814
2029	500000	366086.6341	2029	200000	146434.6537
2030	500000	358556.9384	2030	200000	143422.7754
2031	500000	351182.114	2031	200000	140472.8456
2032	500000	343958.9755	2032	200000	137583.5902
2033	500000	336884.4031	2033	200000	134753.7612
2034	500000	329955.3409	2034	200000	131982.1364
2035	500000	323168.7962	2035	200000	129267.5185
2036	500000	316521.8376	2036	200000	126608.735
2037	500000	310011.5941	2037	200000	124004.6377
2038	500000	303635.2538	2038	200000	121454.1015
2039	500000	297390.0625	2039	200000	118956.025
2040	500000	291273.3227	2040	200000	116509.3291
2041	500000	285282.3925	2041	200000	114112.957
2042	500000	279414.6841	2042	200000	111765.8736
2043	500000	273667.6632	2043	200000	109467.0653
2044	500000	268038.8474	2044	200000	107215.539
2045	500000	262525.8055	2045	200000	105010.3222
2046	500000	257126.1562	2046	200000	102850.4625
2047	500000	251837.5673	2047	200000	100735.0269
2048	500000	246657.7544	2048	200000	98663.10177
2049	500000	241584.4803	2049	200000	96633.79214
2050	500000	236615.5537	2050	200000	94646.22149
2051	500000	231748.8283	2051	200000	92699.53133
2052	500000	226982.2021	2052	200000	90792.88083
2053	500000	222313.6161	2053	200000	88925.44646
2054	500000	217741.054	2054	200000	87096.4216
2055	500000	213262.5407	2055	200000	85305.01626
2056	500000	208876.1417	2056	200000	83550.45667
2057	500000	204579.9625	2057	200000	81831.98499
2058	500000	200372.1474	2058	200000	80148.85895
2059	500000	196250.8789	2059	200000	78500.35157
2060	500000	192214.377	2060	200000	76885.7508
2061	500000	188260.8981	2061	200000	75304.35926
total O&M Cost	$24,000,000.00	$15,344,719.14	total O&M Cost	$9,600,000.00	$6,137,887.65
		brought back to present worth			brought back to present worth

Alternative 2 - Central Supply of Raw Water From Wellington to Picton					Inflation Rate	2.1%			
Wellington					Interest Rate	2.1%			
new intake pipe, raw water well, raw water PS now	170	L/s	3.232553717	MG/Day					
Raw water transmission line (400mm, 20,000m)									
Raw water reservoir (72hr storage)	23496	m3							
WTP upgrades by 2000m3/day in 10 yrs	0.5284	MG/Day							
WTP upgrades by 2500m3/day in 30 yrs	0.6605	MG/Day							
Wellington Construction Cost									
Present Works									
Intake Pipe & Structure	**Lump sum/unit price**	**Qty**	**Labour Costs**	**Subtotal Cost**	**Assumptions**	**Subtotal Cost**	**Assumptions**		
Intake Pipe (Mat & Labour, Eqpt etc.)	238.43	1475	4462500	**$4,814,184.25**	**total cost for intake pipe construction**				
intake structure (supply & install)	200000			$200,000.00					
HDPE Sampling Line (supply & install; sampling pump & controls)	70000			70000					
HDPE Chlorination line (supply & install; incl 2 diffusers)	60000			60000					
Raw Water Well									
Excavation & Disposal	10000			$10,000.00	1/2 of NTB from Picton WTP				
Sheeting & Vertical Trenching	87500			$87,500.00	1/2 of NTB from Picton WTP				
Dewatering	20000			$20,000.00	2x picton costs (not much dewatering needed there, but now may be different)				
Concrete, rebar, formwork ($/m3)	1500	143		$214,500.00					
hatches	2000	2		$4,000.00					
ladder	2000	2		$4,000.00					
gates	5000	2		$10,000.00					
Raw Pumping Station									
Concrete, rebar, formwork ($/m3)	1500	120.5		$180,750.00	Cost estimate formula for new PS cost = e^(12.446+1.077^2/2)*D^0.644 where D = Million Gallons/Day				
Pumps (170L/s, TDH) 1 duty, 1 standby	70000	2		140000	$966,611.52	yr -1999			
Piping				200000	$1,320,195.04	yr- 2014			
				$7,335,129.29					
	Lump sum/unit price (1999)	**Qty**	**Cost from 1999**	**Cost @ present (2014)**					
Raw Water transmission line (500mm)	489.2388451	20000	$9,784,776.90	**$13,364,018.23**	including mat, install, excav, backfill, dewatering, restoration (if using Millennium Trail or along road)				
Raw Water Reservoir @ Warings Corner	**Lump sum/unit price (1999)**	**Qty**	**Cost from 1999**	**Cost @ present (2014)**					
Sheeting & Shoring	$3,500,000.00	2		$7,000,000.00		$14,564,780.48	Options - buried tank		
Excavation & Disposal & Dewatering	50	23496		$1,174,780.48		**$7,564,780.48**	Options - on ground tank		
Concrete, Rebar, Formwork ($/m3)	1500	4260		$6,390,000.00		$11,064,780.48	**Average cost of tank**		
InGround Raw Water Reservoir (m3) for 72 hrs of storage	cost = e^(13.641+0.559^2/2)*D	6.20754004	$3,486,194.13	$4,761,433.23	formula from ref material #1; seems too low				
In 10 Years									
Wellington Upgrade to Meet 2021 Capacity (2000m3/day extra)	**Specifics for Formula**	**Qty**	**Cost (1999)**	**Cost @ present (2014)**	**Cost in present worth (from 2022 t0 2014)**	**Reference**			
Valves (various sizes)			$59,000.00	$80,582.02	$68,238.93				
Control Valves (various sizes)			$86,000.00	$117,458.54	$99,466.91		future year		2022
Watermeters			$11,000.00	$15,023.77	$12,722.51		present year		2014
Chlorine for Disinfection cost = e^(10.4+1.070^2/2)*D^0.684			$37,651.39	$51,424.16	$43,547.30	Ref Mat #1			
Clearwell cost = e^(14.02+0.464^2/2)*D^0.739			$852,764.44	$1,164,703.06	$986,300.56	Ref Mat #1			
Conventional Filter Plant cost = e^(14.444+0.537^2/2)*D^(0.881)			$1,234,520.38	$1,686,104.14	$1,427,836.43	Ref Mat #1			
Sedimentation/Flocculation cost = e^(12.754+0.75^2/2)*D^(0.608)			$310,955.71	$424,702.35	$359,648.89	Ref Mat #1			
Pumps (raw water pumps; finished water pumps) cost = e^(10.967+1.137^2/2)*D^0.713			$70,161.89	$95,826.90	$81,148.68	Ref Mat #1			
SCADA Costs cost = e^(10.770+1.484^2/2)*D^0.578			$98,955.03	$135,152.48	$114,450.60	Ref Mat #1			
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0.831	kw	300	$156,622.74	$213,914.85	$181,148.61	Ref Mat #1			
			$2,917,631.58	**$3,984,892.25**	**$3,374,509.43**				
				cost seems low - more likely $10M					

Wellington Construction Cost

In 30 Years

Wellington Upgrade to Meet Its Own 2061 Needs (2500m3/day e	**Specifics for Formula**	**Qty**	**Cost (1999)**	**Cost @ present (2014)**	**Cost in present worth (from 2042 t0 2014)**	**Reference**
Valves (various sizes)			$175,000.00	$239,014.46	$133,568.30	
Control Valves (various sizes)			$590,000.00	$805,820.19	$450,315.99	
Watermeters			$165,000.00	$225,356.49	$125,935.83	
Chlorine for Disinfection cost = e^(10.4+1.070^2/2)*D^0.684			$43,859.89	$59,903.70	$33,475.95	Ref Mat #1
Clearwell cost = e^(14.02+0.464^2/2)*D^0.739			$1,005,647.05	$1,373,509.65	$767,557.53	Ref Mat #1
Conventional Filter Plant cost = e^(14.444+0.537^2/2)*D^(0.881)			$1,502,712.80	$2,052,400.52	$1,146,941.69	Ref Mat #1
Sedimentation/Flocculation cost = e^(12.754+0.75^2/2)*D^(0.608)			$356,139.23	$486,413.87	$271,822.36	Ref Mat #1
Pumps (raw water pumps; finished water pumps) cost = e^(10.967+1.137^2/2)*D^0.713			$82,261.78	$112,352.89	$62,786.10	Ref Mat #1
SCADA Costs cost = e^(10.770+1.484^2/2)*D^0.578			$112,577.57	$153,758.10	$85,924.54	Ref Mat #1
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0.831	kw	reuse diesel fror	$0.00	$0.00	$0.00	Ref Mat #1
			$4,033,198.32	**$5,508,529.87**	**$3,078,328.27**	

future year	2042
present year	2014

cost seems low - more likely $10M

Wellington WTP Upgrades - Opt 2	
Total Cost @ 2014	**Total Cost (brought back to present worth)**
$37,757,350.11	**$34,716,765.69**
Total O&M Cost @ 2014	Total O&M Cost (brought back to present worth)
$9,600,000.00	$6,137,887.65

Reference Material:

1) EPA 1999 Drinking Water Infrastructure Needs Survey - Modeling the Cost of Infrastructure; Cadmus Group Inc., Feb 2001

Alternative 3 - Central Supply of Raw then Treated Water From Wellington to Picton								Inflation Rate	2.1%
								Interest Rate	2.1%
Picton									
upgrade settling tanks in 10 years									
New Picton PS and demolition of existing Picton WTP in 30 yrs	100	L/s							
	1.901502187	MG/day							
Picton Construction Cost									
Present Works	**Lump sum/unit price**	**Qty**	**Labour Costs**	**Subtotal Cost**	**Assumptions**				
No works need to be upgraded				**0**	No immediate upgrades needed at Picton plant				
In 10 years									
Settling Tank Upgrade	**Volume (m3)**	**Design Capacity (MG**	**Cost by Formula (1999)**	**Cost @ present (2014)**	**Cost in present worth (from 2022 to 2014)**	**Reference**			
Rehab cost (1999) = e^(11.89+0.976^2)*D^0.478	299.71	0.080681932	$113,474.68	$154,983.37	$131,243.91	Ref Mat #1	future year		2022
Other Structural Upgrades				$400,000.00	$338,730.31		present year		2014
				$554,983.37	**$469,974.21**				
In 30 years	Lump sum/unit price	Qty		**Cost @ present (2014)**	**Cost in present worth (from 2041 to 2012)**	**Assumptions**			
New Picton PS (Treated Water)									
superstructure	450000			$450,000.00	$251,473.22	from Picton NTB costs (15x15m2 room and wetwell)			
pumps (100L/s, TDH 76m)	40000	4		$160,000.00	$89,412.70	2 jockey; 3 large pumps			
Piping (to get from PS to WM)	100000			$100,000.00	$55,882.94				
SCADA Costs = e^(10.770+1.484^2/2)*D^0.578				$207,435.63	$115,921.12	Ref Mat #1	future year		2042
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0.831	kW	300		$156,622.74	$87,525.38	Ref Mat #1	present year		2014
Demolition/Decommissioning of existing Picton WTP				$500,000.00	$279,414.68				
				$1,574,058.36	**$879,630.04**				
				cost seems low - probably $3M at end of it all					
				Picton WTP Upgrades - Opt 3					
				Total Cost @ 2014	**Total Cost (brought back to present worth)**				
Reference Material:				**$2,129,041.73**	**$1,349,604.25**				
1) EPA 1999 Drinking Water Infrastructure Needs Survey - Modeling the Cost of Infrastructure; Cadmus Group Inc., Feb 2001				Total O&M Cost @ 2014	Total O&M Cost (brought back to present worth)				
				$14,500,000.00	$11,004,062.66				
				O&M cost (PEC Ops staff): Picton WTP $500,000/yr until 2042; $0 from 2042 onwards (Treatment at Wellington only)					
				Wellington WTP O&M cost $200,000/yr until 2042, then increases to $450,000 due to additional cost from expanded works					
				Alternative #3 Life Cycle Cost (Picton & Wellington Upgrades)					
				in 2014	**Present Worth**				
				$76,871,397.38	**$59,667,044.90**				

Operation & Maintenance Cost - Picton

Year	Full Cost in present yr	Cost in present worth
2014	500000	500000
2015	500000	489715.9647
2016	500000	479643.4522
2017	500000	469778.1119
2018	500000	460115.6826
2019	500000	450651.9908
2020	500000	441382.9488
2021	500000	432304.5532
2022	500000	423412.8827
2023	500000	414704.0966
2024	500000	406174.4335
2025	500000	397820.2091
2026	500000	389637.815
2027	500000	381623.717
2028	500000	373774.4535
2029	500000	366086.6341
2030	500000	358556.9384
2031	500000	351182.114
2032	500000	343958.9755
2033	500000	336884.4031
2034	500000	329955.3409
2035	500000	323168.7962
2036	500000	316521.8376
2037	500000	310011.5941
2038	500000	303635.2538
2039	500000	297390.0625
2040	500000	291273.3227
2041	500000	285282.3925
2042	500000	279414.6841
2043	Picton WTP decommissioned	
2044		
2045		
2046		
2047		
2048		
2049		
2050		
2051		
2052		
2053		
2054		
2055		
2056		
2057		
2058		
2059		
2060		
2061		
total O&M Cost	$14,500,000.00	$11,004,062.66
		brought back to present worth

Operation & Maintenance Cost - Wellington

Year	Full Cost in present yr	Cost in present worth	
2014	200000	200000	
2015	200000	195886.3859	
2016	200000	191857.3809	
2017	200000	187911.2448	
2018	200000	184046.273	
2019	200000	180260.7963	
2020	200000	176553.1795	
2021	200000	172921.8213	
2022	200000	169365.1531	
2023	200000	165881.6387	
2024	200000	162469.7734	
2025	200000	159128.0837	
2026	200000	155855.126	
2027	200000	152649.4868	
2028	200000	149509.7814	
2029	200000	146434.6537	
2030	200000	143422.7754	
2031	200000	140472.8456	
2032	200000	137583.5902	
2033	200000	134753.7612	
2034	200000	131982.1364	
2035	200000	129267.5185	
2036	200000	126608.735	
2037	200000	124004.6377	
2038	200000	121454.1015	
2039	200000	118956.025	
2040	200000	116509.3291	
2041	200000	114112.957	
2042	200000	111765.8736	
2043	450000	246300.8969	assume 50% of picton O&M costs are carried forward to Wellington for chemcial & equipment repairs
2044	450000	241234.9626	
2045	450000	236273.2249	
2046	450000	231413.5406	
2047	450000	226653.8106	
2048	450000	221991.979	
2049	450000	217426.0323	
2050	450000	212953.9983	
2051	450000	208573.9455	
2052	450000	204283.9819	
2053	450000	200082.2545	
2054	450000	195966.9486	
2055	450000	191936.2866	
2056	450000	187988.5275	
2057	450000	184121.9662	
2058	450000	180334.9326	
2059	450000	176625.791	
2060	450000	172992.9393	
2061	450000	169434.8083	
total O&M Cost	$14,350,000.00	$8,308,215.89	
		brought back to present worth	

Alternative 3 - Central Supply of Raw then Treated Water From Wellington to Picton					Inflation Rate	2.1%			
Wellington					Interest Rate	2.1%			
new intake pipe, raw water well, raw water PS now	170	L/s	3.232553717	MG/Day					
Raw water transmission line (400mm, 20,000m)									
Raw water reservoir (72hr storage)	23496	m3							
WTP upgrades by 2000m3/day in 10 yrs	0.5284	MG/Day							
WTP upgrades by 9700m3/day for total 14,200m3/day in 30 yrs	2.56274	MG/Day							
Wellington Construction Cost									
Present Works									
Intake Pipe & Structure	**Lump sum/unit price**	**Qty**	**Labour Costs**	**Subtotal Cost**	**Assumptions**				
Intake Pipe (Mat & Labour, Eqpt etc.)	238.43	1475	4462500	**$4,814,184.25**	**total cost for intake pipe construction**				
intake structure (supply & install)	200000			$200,000.00					
HDPE Sampling Line (supply & install; sampling pump & controls)	70000			70000					
HDPE Chlorination line (supply & install; incl 2 diffusers)	60000			60000					
Raw Water Well									
Excavation & Disposal	10000			$10,000.00	1/2 of NTB from Picton WTP				
Sheeting & Vertical Trenching	87500			$87,500.00	1/2 of NTB from Picton WTP				
Dewatering	20000			$20,000.00	2x picton costs (not much dewatering needed there, but now may be different)				
Concrete, rebar, formwork ($/m3)	1500	143		$214,500.00					
hatches	2000	2		$4,000.00					
ladder	2000	2		$4,000.00					
gates	5000	2		$10,000.00					
Raw Pumping Station									
Concrete, rebar, formwork ($/m3)	1500	120.5		$180,750.00	Cost estimate formula for new PS cost = e^(12.446+1.077^2/2)*D^0.644 where D = Million Gallons/Day				
Pumps (150L/s, TDH) 1 duty, 1 standby	50000	2		100000	$966,611.52	yr -1999			
Piping				200000	$1,320,195.04	yr- 2014			
				$7,295,129.29					
	Lump sum/unit price (199	**Qty**	**Cost from 1999**	**Cost @ present (2014)**					
Raw Water transmission line (400mm)	489.2388451	20000	$9,784,776.90	**$12,819,927.68**					
Raw Water Reservoir @ Warings Corner	**Lump sum/unit price (199**	**Qty**	**Cost from 1999**	**Cost @ present (2014)**	**Reference/Assumptions/options**				
Sheeting & Shoring	$3,500,000.00	2		$7,000,000.00		$14,564,780.48	Options - buried tank		
Excavation & Disposal & Dewatering	50	23496		$1,174,780.48		**$7,564,780.48**	Options - on ground tank		
Concrete, Rebar, Formwork ($/m3)	1500	4260		$6,390,000.00					
InGround Raw Water Reservoir (m3) for 72 hrs of storage	cost = e^(13.641+0.559^2/	6.20754004	$3,486,194.13	$4,761,433.23	Ref Material #1				
In 10 Years									
Wellington Upgrade to Meet 2021 Capacity (2000m3/day extra)	**Specifics for Formula**	**Qty**	**Cost (1999)**	**Cost @ present (2014)**	**Cost in present worth (from 2022 to 2014)**	**Reference**			
Valves (various sizes)			$59,000.00	$80,582.02	$68,238.93	Ref Mat #1			
Control Valves (various sizes)			$86,000.00	$117,458.54	$99,466.91	Ref Mat #1		future year	2022
Watermeters			$11,000.00	$15,023.77	$12,722.51	Ref Mat #1		present year	2014
Chlorine for Disinfection cost = e^(10.4+1.070^2/2)*D^0.684			$37,651.39	$51,424.16	$43,547.30	Ref Mat #1			
Clearwell cost = e^(14.02+0.464^2/2)*D^0.739			$852,764.44	$1,164,703.06	$986,300.56	Ref Mat #1			
Conventional Filter Plant cost = e^(14.444+0.537^2/2)*D^(0.881)			$1,234,520.38	$1,686,104.14	$1,427,836.43	Ref Mat #1			
Sedimentation/Flocculation cost = e^(12.754+0.75^2/2)*D^(0.608)			$310,955.71	$424,702.35	$359,648.89	Ref Mat #1			
Pumps (raw water pumps; finished water pumps) cost = e^(10.967+1.137^2/2)*D^0.713			$70,161.89	$95,826.90	$81,148.68	Ref Mat #1			
SCADA Costs cost = e^(10.770+1.484^2/2)*D^0.578			$98,955.03	$135,152.48	$114,450.60	Ref Mat #1			
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0.831	kw	300	$156,622.74	$213,914.85	$181,148.61	Ref Mat #1			
			$2,917,631.58	**$3,984,892.25**	**$3,374,509.43**				
				cost seems low - more likely $10M					

Wellington Construction Cost

In 30 Years

Wellington Upgrade to Meet Picton & Wellington 2061 Needs (9700 m3/day extr	**Specifics for Formula**	**Qty**	**Cost (1999)**	**Cost @ present (2014)**	**Cost in present worth (from 2042 to 2014)**	**Reference**
Valves (various sizes)			$175,000.00	$239,014.46	$133,568.30	Ref Mat #1
Control Valves (various sizes)			$590,000.00	$805,820.19	$450,315.99	Ref Mat #1
Watermeters			$165,000.00	$225,356.49	$125,935.83	Ref Mat #1
Chlorine for Disinfection cost = e^(10.4+1.070^2/2)*D^0.684			$110,873.66	$151,430.91	$84,624.04	Ref Mat #1
Clearwell cost = e^(14.02+0.464^2/2)*D^0.739			$2,739,001.24	$3,740,919.47	$2,090,535.67	Ref Mat #1
Conventional Filter Plant cost = e^(14.444+0.537^2/2)*D^(0.881)			$4,961,771.21	$6,776,771.87	$3,787,059.14	Ref Mat #1
Sedimentation/Flocculation cost = e^(12.754+0.75^2/2)*D^(0.608)			$812,137.40	$1,109,214.76	$619,861.78	Ref Mat #1
Pumps (raw water pumps; finished water pumps) cost = e^(10.967+1.137^2/2)*D^0.713			$216,289.36	$295,407.34	$165,082.30	Ref Mat #1
SCADA Costs cost = e^(10.770+1.484^2/2)*D^0.578			$246,488.47	$336,653.20	$188,131.69	Ref Mat #1
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0.831	kw	500	$239,447.95	$327,037.27	$182,758.03	Ref Mat #1
			$10,256,009.28	**$14,007,625.96**	**$7,827,872.76**	

future year	2042
present year	2014

Convert Raw watermains & reservoir into Treated Water Use (in 30 years)	**Unit price**	**Quantity**		**Cost at Present (2014)**	**Cost in Present Worth**	
disinfection & cleaning of watermain & reservoirs	100000			$100,000.00	$55,882.94	
upgrade/replace valves & MH	100000			$100,000.00	$55,882.94	
connection/twinning of watermains	500	40		$20,000.00	$11,176.59	assume 10m of WM connection every 5km
				$220,000.00	**$122,942.46**	

Reference Material:

1) EPA 1999 Drinking Water Infrastructure Needs Survey - Modeling the Cost of Infrastructure; Cadmus Group Inc., Feb 2001

Wellington WTP Upgrades - Opt 3	
Total Cost @ 2012	**Total Cost (brought back to present worth)**
$45,892,355.65	**$39,005,162.10**
Total O&M Cost @ 201	Total O&M Cost (brought back to present worth)
$14,350,000.00	$8,308,215.89

Alternative 4 - Central Supply of Treated Water From Wellington to Picton Now

Inflation Rate	2.1%
Interest Rate	2.1%

Picton

New Picton PS and demolition of existing Picton WTP in 10 yrs	100	L/s
	1.901502187	MG/day

Picton Construction Cost

Present Works	Lump sum/unit price	Qty	Labour Costs	Subtotal Cost	Assumptions
No works need to be upgraded				0	No immediate upgrades needed at Picton plant

In 10 years	Lump sum/unit price	Qty		Cost @ present (2014)	Cost in present worth (from 2041 to 2014)	Assumptions
New Picton PS (Treated Water)						
superstructure	150000			$150,000.00	$127,023.86	from Picton NTB costs (15x15m2 room)
pumps (100L/s, TDH 76m)	40000	4		$160,000.00	$135,492.12	2 jockey; 3 large pumps
Piping (to get from PS to WM)	100000			$100,000.00	$84,682.58	
SCADA Costs = e^(10.770+1.484^2/2)*D^0.578				$207,435.63	$175,661.83	Ref Mat #1
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0.831	kW	300		$156,622.74	$132,632.17	Ref Mat #1
Demolition/Decommissioning of existing Picton WTP				$500,000.00	$423,412.88	
				$1,274,058.36	**$1,078,905.45**	

future year	2022
present year	2014

Picton WTP Upgrades - Opt 3	
Total Cost @ 2014	**Total Cost (brought back to present worth)**
$1,274,058.36	**$1,078,905.45**

Total O&M Cost @ 2014	Total O&M Cost (brought back to present worth)
$4,500,000.00	$4,147,005.59

O&M cost (PEC Ops staff): Picton WTP $500,000/yr until 2022; $0 from 2022 onwards (Treatment at Wellington only)

Wellington WTP O&M cost $200,000/yr until 2022, then increases to $450,000 due to additional cost from expanded works

Reference Material:

1) EPA 1999 Drinking Water Infrastructure Needs Survey - Modeling the Cost of Infrastructure; Cadmus Group Inc., Feb 2001

Alternative #4 Life Cycle Cost (Picton & Wellington Upgrades)	
in 2014	**Present Worth**
$72,942,349.04	**$61,261,952.16**

Operation & Maintenance Cost - Picton		
Year	**Full Cost in present yr**	**Cost in present worth**
2014	500000	500000
2015	500000	489715.9647
2016	500000	479643.4522
2017	500000	469778.1119
2018	500000	460115.6826
2019	500000	450651.9908
2020	500000	441382.9488
2021	500000	432304.5532
2022	500000	423412.8827
2023	Picton WTP decommissioned	
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
2036		
2037		
2038		
2039		
2040		
2041		
2042		
2043		
2044		
2045		
2046		
2047		
2048		
2049		
2050		
2051		
2052		
2053		
2054		
2055		
2056		
2057		
2058		
2059		
2060		
2061		
total O&M Cost	$4,500,000.00	$4,147,005.59
		brought back to present worth

Operation & Maintenance Cost - Wellington			
Year	**Full Cost in present yr**	**Cost in present worth**	
2014	200000	200000	
2015	200000	195886.3859	
2016	200000	191857.3809	
2017	200000	187911.2448	
2018	200000	184046.273	
2019	200000	180260.7963	
2020	200000	176553.1795	
2021	200000	172921.8213	
2022	200000	169365.1531	
2023	450000	373233.687	assume 50% of picton O&M costs are carried forward to Wellington for chemcial & equipment repairs
2024	450000	365556.9902	
2025	450000	358038.1882	
2026	450000	350674.0335	
2027	450000	343461.3453	
2028	450000	336397.0081	
2029	450000	329477.9707	
2030	450000	322701.2446	
2031	450000	316063.9026	
2032	450000	309563.078	
2033	450000	303195.9628	
2034	450000	296959.8068	
2035	450000	290851.9166	
2036	450000	284869.6539	
2037	450000	279010.4347	
2038	450000	273271.7284	
2039	450000	267651.0562	
2040	450000	262145.9904	
2041	450000	256754.1532	
2042	450000	251473.2157	
2043	450000	246300.8969	
2044	450000	241234.9626	
2045	450000	236273.2249	
2046	450000	231413.5406	
2047	450000	226653.8106	
2048	450000	221991.979	
2049	450000	217426.0323	
2050	450000	212953.9983	
2051	450000	208573.9455	
2052	450000	204283.9819	
2053	450000	200082.2545	
2054	450000	195966.9486	
2055	450000	191936.2866	
2056	450000	187988.5275	
2057	450000	184121.9662	
2058	450000	180334.9326	
2059	450000	176625.791	
2060	450000	172992.9393	
2061	450000	169434.8083	
total O&M Cost	$19,350,000.00	$11,736,744.43	
		brought back to present worth	

Alternative 4 - Central Supply of Treated Water From Wellington to Picton Now					Inflation Rate	2.1%	
Wellington					Interest Rate	2.1%	
new intake pipe, raw water well, raw water PS now	170	L/s	3.232553717	MG/Day			
Treated water transmission line (400mm, 20,000m) now							
Treated water reservoir (72hr storage) now	23496	m3					
WTP upgrades by 7500m3/day for total 10000m3/day now	1.97332288	MG/Day					
WTP upgrades by 4200m3/day for total 14200m3/day in 30 yrs	1.10964	MG/Day					
Wellington Construction Cost							
Present Works							
Intake Pipe & Structure	**Lump sum/unit price**	**Qty**	**Labour Costs**	**Subtotal Cost**	**Assumptions**		
Intake Pipe (Mat & Labour, Eqpt etc.)	238.43	1475	4462500	**$4,814,184.25**	**total cost for intake pipe construction**		
intake structure (supply & install)	200000			$200,000.00			
HDPE Sampling Line (supply & install; sampling pump & controls)	70000			70000			
HDPE Chlorination line (supply & install; incl 2 diffusers)	60000			60000			
Raw Water Well							
Excavation & Disposal	10000			$10,000.00	1/2 of NTB from Picton WTP		
Sheeting & Vertical Trenching	87500			$87,500.00	1/2 of NTB from Picton WTP		
Dewatering	20000			$20,000.00	2x picton costs (not much dewatering needed there, but now may be different)		
Concrete, rebar, formwork ($/m3)	1500	143		$214,500.00			
hatches	2000	2		$4,000.00			
ladder	2000	2		$4,000.00			
gates	5000	2		$10,000.00			
Raw Pumping Station							
Concrete, rebar, formwork ($/m3)	1500	120.5		$180,750.00	Cost estimate formula for new PS cost = e^(12.446+1.077^2/2)*D^0.644 where D = Million Gallons/Day		
Pumps (150L/s, TDH) 1 duty, 1 standby	50000	2		100000	$966,611.52	yr -1999	
Piping				200000	$1,266,445.82	yr- 2014	
				$7,241,380.07			
	Lump sum/unit price (199	**Qty**	**Cost from 1999**	**Cost @ present (2014)**	**Assumptions**		
Treated Water transmission line (400mm)	489.2388451	20000	$9,784,776.90	**$13,364,018.23**	Existing bloomfield WM size 200mm; but too small for existing Picton flows; need to build new WM or PS		
Treated Water Reservoir @ Warings Corner	**Lump sum/unit price (199**	**Qty**	**Cost from 1999**	**Cost @ present (2012)**	**Reference/Assumptions/options**		
Sheeting & Shoring	$3,500,000.00	2		$7,000,000.00		$14,564,780.48	Options - buried tank
Excavation & Disposal & Dewatering	50	23495.60954		$1,174,780.48		**$7,564,780.48**	Options - on ground tank
Concrete, Rebar, Formwork ($/m3)	1500	4260		$6,390,000.00			
InGround Raw Water Reservoir (m3) for 72 hrs of storage	cost = e^(13.641+0.559^2/	6.20754004	$3,486,194.13	$4,567,580.54	Ref Material #1		
Wellington Upgrade to Meet Picton & Wellington Needs (5300 m3/day ex	**Specifics for Formula**	**Qty**	**Cost (1999)**	**Cost @ present (2014)**	**Reference**		
Valves (various sizes)			$175,000.00	$239,014.46	Ref Mat #1		
Control Valves (various sizes)			$590,000.00	$805,820.19	Ref Mat #1		
Watermeters			$165,000.00	$225,356.49	Ref Mat #1		
Chlorine for Disinfection cost = e^(10.4+1.070^2/2)*D^0.684			$92,723.54	$126,641.53	Ref Mat #1		
Clearwell cost = e^(14.02+0.464^2/2)*D^0.739			$2,257,932.74	$3,083,877.60	Ref Mat #1		
Conventional Filter Plant cost = e^(14.444+0.537^2/2)*D^(0.881)			$3,941,282.81	$5,382,991.96	Ref Mat #1		
Sedimentation/Flocculation cost = e^(12.754+0.75^2/2)*D^(0.608)			$692,815.54	$946,245.34	Ref Mat #1		
Pumps (raw water pumps; finished water pumps) cost = e^(10.967+1.137^2/2)*D^0.713			$179,516.79	$245,183.49	Ref Mat #1		
SCADA Costs cost = e^(10.770+1.484^2/2)*D^0.578			$211,928.77	$289,451.66	Ref Mat #1		
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0.831	kw	500	$239,447.95	$327,037.27	Ref Mat #1		
			$8,545,648.15	**$11,671,619.99**	**cost may be a bit low, maybe $15M**		

Wellington Construction Cost						
In 30 Years						
Wellington Upgrade to Meet Picton & Wellington Needs (6400m3/day ext	**Specifics for Formula**	**Qty**	**Cost (1999)**	**Cost @ present (2014)**	**Cost in present worth (from 2042 to 2012)**	**Reference**
Valves (various sizes)			$175,000.00	$239,014.46	$133,568.30	Ref Mat #1
Control Valves (various sizes)			$590,000.00	$805,820.19	$450,315.99	Ref Mat #1
Watermeters			$165,000.00	$225,356.49	$125,935.83	Ref Mat #1
Chlorine for Disinfection cost = e^(10.4+1.070^2/2)*D^0.684			$62,543.05	$85,421.10	$47,735.82	Ref Mat #1
Clearwell cost = e^(14.02+0.464^2/2)*D^0.739			$1,475,533.73	$2,015,279.44	$1,126,197.33	Ref Mat #1
Conventional Filter Plant cost = e^(14.444+0.537^2/2)*D^(0.881)			$2,373,413.79	$3,241,601.26	$1,811,501.99	Ref Mat #1
Sedimentation/Flocculation cost = e^(12.754+0.75^2/2)*D^(0.608)			$488,211.34	$666,797.55	$372,626.05	Ref Mat #1
Pumps (raw water pumps; finished water pumps) cost = e^(10.967+1.137^2/2)*D^0.713			$119,081.32	$162,640.90	$90,888.51	Ref Mat #1
SCADA Costs cost = e^(10.770+1.484^2/2)*D^0.578			$151,942.98	$207,523.26	$115,970.09	Ref Mat #1
Emegency Power cost = e^(6.942+0.748^2/2)*KW^0.831	kw	500	$239,447.95	$327,037.27	$182,758.03	Ref Mat #1
			$5,840,174.16	**$7,976,491.92**	**$4,457,497.94**	
				cost may be a bit low, maybe $15M		
				Wellington WTP Upgrades - Opt 3		
				Total Cost @ 2014	**Total Cost (brought back to present worth)**	
Reference Material:				**$47,818,290.68**	**$44,299,296.70**	
1) EPA 1999 Drinking Water Infrastructure Needs Survey - Modeling the Cost of Infrastructure; Cadmus Group Inc., Feb 2001				Total O&M Cost @ 20	Total O&M Cost (brought back to present worth)	
				$19,350,000.00	$11,736,744.43	

future year	2042
present year	2014

APPENDIX H

Sensitivity Analysis Results - Water Supply Alternative

Summary of Results

Sensitivity Scenario	Base Scenario - "Do Nothing"	Alternative #1 - New Picton WTP Intake	Alternative #2 - Central Supply of Raw Water from Wellington WTP	Alternative #3 - Central Supply of Treated Water from Wellington WTP by 2042	Alternative #4 - Immediate Central Supply of Treated Water from Wellington WTP to Picton (New intake at Wellington WTP only)	Max Percentage	Preferred Alternative/Comments
Base comparison - 25% water quality; 10% env; 5% disrup; 25% intake renewal/future growth; 25% cost; 5% tech; 5% O&M	66%	**77%**	69%	69%	69%	77%	Alternative #1 - New Picton WTP Intake
Change major criteria up by 5%	60%	**78%**	75%	75%	75%	78%	Alternative #1 - New Picton WTP Intake
Change major criteria down by 5%;	72%	**77%**	65%	65%	65%	77%	Alternative #1 - New Picton WTP Intake
Change major criteria up by 10% (not possible - 3 x 35% is above 100%)	Scenario not possible as weighting exceeds 100% (3x35%)						
Change major criteria down by 10%;	**78%**	77%	61%	61%	61%	78%	Base Scenario - Do Nothing; However this weighting scenario is not realistic as it disregards the problem
Industry Perspective - less concern for water quality, more for local disruptions, intake renewal/future growth, cap cost	73%	**76%**	61%	61%	61%	76%	Alternative #1 - New Picton WTP Intake
Environmental agency perspective - more concern for water quality, env, intake renewal/future growth	66%	**76%**	68%	68%	68%	76%	Alternative #1 - New Picton WTP Intake
Resident Perspective - more concern for water qualtiy, env, local disrup, intake renewal/future growth, costs	70%	**74%**	65%	65%	65%	74%	Alternative #1 - New Picton WTP Intake
Counsel/PEC Perspective - same as base comparison	66%	**77%**	69%	69%	69%	77%	Alternative #1 - New Picton WTP Intake

Decision Matrix for Water Supply Alternatives

Base Case - without any sensitivity analysis modifications

Topic	Criteria	Weighting of Critera (%)	Base Scenario - "Do Nothing"	Alternative #1 - New Picton WTP Intake	Alternative #2 - Central Supply of Raw Water from Wellington WTP	Alternative #3 - Central Supply of Treated Water from Wellington WTP by 2042	Alternative #4 - Immediate Central Supply of Treated Water from Wellington WTP to Picton (New intake at Wellington WTP only)
			Alternatives				
Environment	**Addresses Water Quality Concerns and Vulnerability to Contaminants**	**25%**	No	**Yes - Better water quality compared to "Do Nothing" option**	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option
Environment	**Environmental Impact**	**10%**	No	**Only during construction**	Only during construction but longer construction duration	Only during construction but longer construction duration	Only during construction but longer construction duration
Socio/ Economic	**Potential for temporary disruptions during construction (road closures; noise, vibration, dust, truck traffic)**	**5.0%**	No	**Moderate**	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages
Socio/ Economic	**Allows for Intake Renewal and Future Growth**	**25%**	No	**Yes**	Yes	Yes	Yes
Socio/ Economic	**Life Cycle Cost to 2061 (in present worth)**	**25%**	$31M	**$47M**	$67M	$60M	$61M
Technical	**Constructability (ease of construction, duration, construction staging)**	**5%**	N/A	**Moderate - staging and planning around environmental time constraints;**	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area
Operations	**Ability to Maintain WTP Operation during construction**	**2.5%**	N/A	**Yes - Minor shutdowns**	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted
Operations	**Improves Operation and Maintenance**	**2.5%**	Aging intakes may be a risk issue; Turbidity causing filter maintenance issues	**Yes - improved filter operation due to less turbidity fluctuations**	Yes - improved filter operation due to less turbidity fluctuations	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area
		Result of Screening	Not a preferred alternative - does not address concern of water quality and vulnerability to contaminants	**Preferred Alternative - addresses water quality concerns; temporary/minor impact on environment & operations, constructible, economical advantage over other alternatives**	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage
		Score for Options (out of 3)	1.975	**2.3**	2.075	2.075	2.075
		Preferred Option in Percentage (Best option = 100%)	66%	**77%**	69%	69%	69%

Least Negative Impact (Score 3)

Moderate Negative Impact (Score 2)

Most Negative Impact (Score 1)

Decision Matrix for Water Supply Alternatives

Sensitivity Analysis - Major Criteria (red font) increased by 5%

Topic	Criteria	Weighting of Critera (%)	Base Scenario - "Do Nothing"	**Alternative #1 - New Picton WTP Intake**	Alternative #2 - Central Supply of Raw Water from Wellington WTP	Alternative #3 - Central Supply of Treated Water from Wellington WTP by 2042	Alternative #4 - Immediate Central Supply of Treated Water from Wellington WTP to Picton (New intake at Wellington WTP only)
Environment	**Addresses Water Quality Concerns and Vulnerability to Contaminants**	**30%**	No	**Yes - Better water quality compared to "Do Nothing" option**	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option
Environment	**Environmental Impact**	**3%**	No	**Only during construction**	Only during construction but longer construction duration	Only during construction but longer construction duration	Only during construction but longer construction duration
Socio/ Economic	**Potential for temporary disruptions during construction (road closures; noise, vibration, dust, truck traffic)**	**2.5%**	No	**Moderate**	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages
Socio/ Economic	**Allows for Intake Renewal and Future Growth**	**30%**	No	**Yes**	Yes	Yes	Yes
Socio/ Economic	**Life Cycle Cost to 2061 (in present worth)**	**30%**	$31M	**$47M**	$67M	$60M	$61M
Technical	**Constructability (ease of construction, duration, construction staging)**	**3%**	N/A	**Moderate - staging and planning around environmental time constraints;**	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area
Operations	**Ability to Maintain WTP Operation during construction**	**1.3%**	N/A	**Yes - Minor shutdowns**	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted
Operations	**Improves Operation and Maintenance**	**1.3%**	Aging intakes may be a risk issue; Turbidity causing filter maintenance issues	**Yes - improved filter operation due to less turbidity fluctuations**	Yes - improved filter operation due to less turbidity fluctuations	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area
		Result of Screening	Not a preferred alternative - does not address concern of water quality and vulnerability to contaminants	**Preferred Alternative - addresses water quality concerns; temporary/minor impact on environment & operations, constructible, economical advantage over other alternatives**	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage
		Score for Options (out of 3)	1.7875	**2.325**	2.2375	2.2375	2.2375
		Preferred Option in Percentage (Best option = 100%)	60%	**78%**	75%	75%	75%

Least Negative Impact (Score 3)

Moderate Negative Impact (Score 2)

Most Negative Impact (Score 1)

Decision Matrix for Water Supply Alternatives

Sensitivity Analysis - Major Criteria (red font) decreased by 5%

			Alternatives				
Topic	**Criteria**	**Weighting of Critera (%)**	Base Scenario - "Do Nothing"	**Alternative #1 - New Picton WTP Intake**	Alternative #2 - Central Supply of Raw Water from Wellington WTP	Alternative #3 - Central Supply of Treated Water from Wellington WTP by 2042	Alternative #4 - Immediate Central Supply of Treated Water from Wellington WTP to Picton (New intake at Wellington WTP only)
Environment	**Addresses Water Quality Concerns and Vulnerability to Contaminants**	**20%**	No	**Yes - Better water quality compared to "Do Nothing" option**	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option
Environment	**Environmental Impact**	**10%**	No	**Only during construction**	Only during construction but longer construction duration	Only during construction but longer construction duration	Only during construction but longer construction duration
Socio/ Economic	**Potential for temporary disruptions during construction (road closures; noise, vibration, dust, truck traffic)**	**10.0%**	No	**Moderate**	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages
Socio/ Economic	**Allows for Intake Renewal and Future Growth**	**20%**	No	**Yes**	Yes	Yes	Yes
Socio/ Economic	**Life Cycle Cost to 2061 (in present worth)**	**20%**	$31M	**$47M**	$67M	$60M	$61M
Technical	**Constructability (ease of construction, duration, construction staging)**	**10%**	N/A	**Moderate - staging and planning around environmental time constraints;**	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area
Operations	**Ability to Maintain WTP Operation during construction**	**5.0%**	N/A	**Yes - Minor shutdowns**	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted
Operations	**Improves Operation and Maintenance**	**5.0%**	Aging intakes may be a risk issue; Turbidity causing filter maintenance issues	**Yes - improved filter operation due to less turbidity fluctuations**	Yes - improved filter operation due to less turbidity fluctuations	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area
		Result of Screening	Not a preferred alternative - does not address concern of water quality and vulnerability to contaminants	**Preferred Alternative - addresses water quality concerns; temporary/minor impact on environment & operations, constructible, economical advantage over other alternatives**	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage
		Score for Options (out of 3)	2.15	**2.3**	1.95	1.95	1.95
		Preferred Option in Percentage (Best option = 100%)	72%	**77%**	65%	65%	65%

Least Negative Impact (Score 3)
Moderate Negative Impact (Score 2)
Most Negative Impact (Score 1)

Decision Matrix for Water Supply Alternatives

Sensitivity Analysis - Major Criteria (red font) decreased by 10%

Topic	Criteria	Weighting of Critera (%)	Base Scenario - "Do Nothing"	Alternatives Alternative #1 - New Picton WTP Intake	Alternative #2 - Central Supply of Raw Water from Wellington WTP	Alternative #3 - Central Supply of Treated Water from Wellington WTP by 2042	Alternative #4 - Immediate Central Supply of Treated Water from Wellington WTP to Picton (New intake at Wellington WTP only)
Environment	**Addresses Water Quality Concerns and Vulnerability to Contaminants**	15%	No	**Yes - Better water quality compared to "Do Nothing" option**	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option
Environment	**Environmental Impact**	**15%**	No	**Only during construction**	Only during construction but longer construction duration	Only during construction but longer construction duration	Only during construction but longer construction duration
Socio/ Economic	**Potential for temporary disruptions during construction (road closures; noise, vibration, dust, truck traffic)**	**15.0%**	No	**Moderate**	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages
Socio/ Economic	**Allows for Intake Renewal and Future Growth**	15%	No	**Yes**	Yes	Yes	Yes
Socio/ Economic	**Life Cycle Cost to 2061 (in present worth)**	15%	$31M	**$47M**	$67M	$60M	$61M
Technical	**Constructability (ease of construction, duration, construction staging)**	**10%**	N/A	**Moderate - staging and planning around environmental time constraints;**	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area
Operations	**Ability to Maintain WTP Operation during construction**	**7.5%**	N/A	**Yes - Minor shutdowns**	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted
Operations	**Improves Operation and Maintenance**	**7.5%**	Aging intakes may be a risk issue; Turbidity causing filter maintenance issues	**Yes - improved filter operation due to less turbidity fluctuations**	Yes - improved filter operation due to less turbidity fluctuations	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area
		Result of Screening	Not a preferred alternative - does not address concern of water quality and vulnerability to contaminants	**Preferred Alternative - addresses water quality concerns; temporary/minor impact on environment & operations, constructible, economical advantage over other alternatives**	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage
		Score for Options (out of 3)	2.325	**2.3**	1.825	1.825	1.825
		Preferred Option in Percentage (Best option = 100%)	78%	**77%**	61%	61%	61%

Least Negative Impact (Score 3)

Moderate Negative Impact (Score 2)

Most Negative Impact (Score 1)

Decision Matrix for Water Supply Alternatives

Sensitivity Analysis - Industrial Perspective - favors factors of "growth", "socio/econ", and "cost" (red font)

Topic	Criteria	Weighting of Critera (%)	Base Scenario - "Do Nothing"	**Alternative #1 - New Picton WTP Intake**	Alternative #2 - Central Supply of Raw Water from Wellington WTP	Alternative #3 - Central Supply of Treated Water from Wellington WTP by 2042	Alternative #4 - Immediate Central Supply of Treated Water from Wellington WTP to Picton (New intake at Wellington WTP only)
Environment	**Addresses Water Quality Concerns and Vulnerability to Contaminants**	**15%**	No	**Yes - Better water quality compared to "Do Nothing" option**	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option
Environment	**Environmental Impact**	**5%**	No	**Only during construction**	Only during construction but longer construction duration	Only during construction but longer construction duration	Only during construction but longer construction duration
Socio/ Economic	**Potential for temporary disruptions during construction (road closures; noise, vibration, dust, truck traffic)**	**25.0%**	No	**Moderate**	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages
Socio/ Economic	**Allows for Intake Renewal and Future Growth**	**25%**	No	**Yes**	Yes	Yes	Yes
Socio/ Economic	**Life Cycle Cost to 2061 (in present worth)**	**25%**	$31M	**$47M**	$67M	$60M	$61M
Technical	**Constructability (ease of construction, duration, construction staging)**	**3%**	N/A	**Moderate - staging and planning around environmental time constraints;**	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area
Operations	**Ability to Maintain WTP Operation during construction**	**1.3%**	N/A	**Yes - Minor shutdowns**	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted
Operations	**Improves Operation and Maintenance**	**1.3%**	Aging intakes may be a risk issue; Turbidity causing filter maintenance issues	**Yes - improved filter operation due to less turbidity fluctuations**	Yes - improved filter operation due to less turbidity fluctuations	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area
		Result of Screening	Not a preferred alternative - does not address concern of water quality and vulnerability to contaminants	**Preferred Alternative - addresses water quality concerns; temporary/minor impact on environment & operations, constructible, economical advantage over other alternatives**	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage
		Score for Options (out of 3)	2.1875	**2.275**	1.8375	1.8375	1.8375
		Preferred Option in Percentage (Best option = 100%)	73%	**76%**	61%	61%	61%

Least Negative Impact (Score 3)

Moderate Negative Impact (Score 2)

Most Negative Impact (Score 1)

Decision Matrix for Water Supply Alternatives

Sensitivity Analysis - Environmental Perspective - favors factors related to environment (red font)

			Alternatives				
Topic	**Criteria**	**Weighting of Critera (%)**	Base Scenario - "Do Nothing"	**Alternative #1 - New Picton WTP Intake**	Alternative #2 - Central Supply of Raw Water from Wellington WTP	Alternative #3 - Central Supply of Treated Water from Wellington WTP by 2042	Alternative #4 - Immediate Central Supply of Treated Water from Wellington WTP to Picton (New intake at Wellington WTP only)
Environment	**Addresses Water Quality Concerns and Vulnerability to Contaminants**	**25%**	No	**Yes - Better water quality compared to "Do Nothing" option**	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option
Environment	**Environmental Impact**	**25%**	No	**Only during construction**	Only during construction but longer construction duration	Only during construction but longer construction duration	Only during construction but longer construction duration
Socio/ Economic	**Potential for temporary disruptions during construction (road closures; noise, vibration, dust, truck traffic)**	**5.0%**	No	**Moderate**	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages
Socio/ Economic	**Allows for Intake Renewal and Future Growth**	**25%**	No	**Yes**	Yes	Yes	Yes
Socio/ Economic	**Life Cycle Cost to 2061 (in present worth)**	**15%**	$31M	**$47M**	$67M	$60M	$61M
Technical	**Constructability (ease of construction, duration, construction staging)**	**3%**	N/A	**Moderate - staging and planning around environmental time constraints;**	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area
Operations	**Ability to Maintain WTP Operation during construction**	**1.3%**	N/A	**Yes - Minor shutdowns**	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted
Operations	**Improves Operation and Maintenance**	**1.3%**	Aging intakes may be a risk issue; Turbidity causing filter maintenance issues	**Yes - improved filter operation due to less turbidity fluctuations**	Yes - improved filter operation due to less turbidity fluctuations	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area
		Result of Screening	Not a preferred alternative - does not address concern of water quality and vulnerability to contaminants	**Preferred Alternative - addresses water quality concerns; temporary/minor impact on environment & operations, constructible, economical advantage over other alternatives**	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage
		Score for Options (out of 3)	1.9875	**2.275**	2.0375	2.0375	2.0375
		Preferred Option in Percentage (Best option = 100%)	66%	**76%**	68%	68%	68%

Least Negative Impact (Score 3)
Moderate Negative Impact (Score 2)
Most Negative Impact (Score 1)

Decision Matrix for Water Supply Alternatives

Sensitivity Analysis - Resident/Public Perspective - favors factors of "water quality", "env", "growth", "socio/econ", and "cost" (red font)

			Alternatives				
Topic	**Criteria**	**Weighting of Critera (%)**	Base Scenario - "Do Nothing"	**Alternative #1 - New Picton WTP Intake**	Alternative #2 - Central Supply of Raw Water from Wellington WTP	Alternative #3 - Central Supply of Treated Water from Wellington WTP by 2042	Alternative #4 - Immediate Central Supply of Treated Water from Wellington WTP to Picton (New intake at Wellington WTP only)
Environment	**Addresses Water Quality Concerns and Vulnerability to Contaminants**	**25%**	No	**Yes - Better water quality compared to "Do Nothing" option**	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option	Yes - Wellington's intake has significantly better water quality compared to "Do Nothing" option
Environment	**Environmental Impact**	**10%**	No	**Only during construction**	Only during construction but longer construction duration	Only during construction but longer construction duration	Only during construction but longer construction duration
Socio/ Economic	**Potential for temporary disruptions during construction (road closures; noise, vibration, dust, truck traffic)**	**15.0%**	No	**Moderate**	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages	High - large construction area and long duration for various works and stages
Socio/ Economic	**Allows for Intake Renewal and Future Growth**	**20%**	No	**Yes**	Yes	Yes	Yes
Socio/ Economic	**Life Cycle Cost to 2061 (in present worth)**	**25%**	$31M	**$47M**	$67M	$60M	$61M
Technical	**Constructability (ease of construction, duration, construction staging)**	**3%**	N/A	**Moderate - staging and planning around environmental time constraints;**	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area	Complex - Large construction undertaking; long duration; extensive construction area
Operations	**Ability to Maintain WTP Operation during construction**	**1.3%**	N/A	**Yes - Minor shutdowns**	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted	Yes - Multiple shutdowns and tie-ins, but operation should not be significantly impacted
Operations	**Improves Operation and Maintenance**	**1.3%**	Aging intakes may be a risk issue; Turbidity causing filter maintenance issues	**Yes - improved filter operation due to less turbidity fluctuations**	Yes - improved filter operation due to less turbidity fluctuations	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area	Yes - improved filter operation due to less turbidity fluctuations; Picton WTP converted to simple PS; 1 single Wellington WTP for entire area
		Result of Screening	Not a preferred alternative - does not address concern of water quality and vulnerability to contaminants	**Preferred Alternative - addresses water quality concerns; temporary/minor impact on environment & operations, constructible, economical advantage over other alternatives**	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage	Not a preferred alternative - addresses concern, but complex construction and long duration; economical disadvantage
		Score for Options (out of 3)	2.0875	**2.225**	1.9375	1.9375	1.9375
		Preferred Option in Percentage (Best option = 100%)	70%	**74%**	65%	65%	65%

Least Negative Impact (Score 3)
Moderate Negative Impact (Score 2)
Most Negative Impact (Score 1)

APPENDIX K

addicted to the wind! WINDFINDER.com

Weather symbols

= North
= North northeast
= Northeast
= clouds & visibility okay

Share

Like
Tweet 0
0

Configuration

Change units

Surfspot

Nearby forecast locations
Nearby weatherstations
Tide forecast
Weather & surf webcams
Surf- & sailing schools
Surf- & sailing shops
Kite- & windsurf spotguide

Homepage weather

» Wind forecast for your website
» Set up your own weather station
» Set up your own webcam
» Contribute weather data

Past weather

» Historical weather data

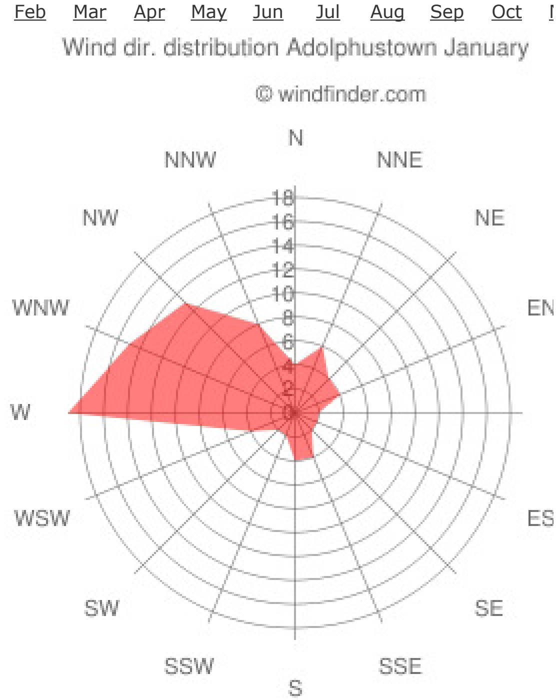
Advertising

Windfinder - Wind & weather statistic Adolphustown

Wind statistic | Wind report | Forecast | Super Forecast | Nearby

Adolphustown (ADOLPHUS)
Statistics based on observations taken between 6/2010 - 12/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10
Dominant Wind dir.										
Wind probability > = 4 Beaufort (%)	2	14	11	16	2	2	0	1	1	7
Average Wind speed (Knots)	4	6	6	6	4	4	4	4	4	5
Average air temp. (°C)	-6	-2	1	8	16	21	25	23	19	12
Select month (Help)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct



Wind direction Distribution January(%)

About Windfinder.com

- » Contact
- » Advertising
- » Shop

Bookmark

SHARE

Meet us online

News feed
Twitter
Facebook

Help

- » Units
- » Forecast r
- » Historical

Weather symbols

= North
= North northeast
= Northeast
= clouds & visibility okay

Share

Like
Tweet 0
0

Configuration

Change units

Surfspot

Nearby forecast locations
Nearby weatherstations
Tide forecast
Weather & surf webcams
Surf- & sailing schools
Surf- & sailing shops
Kite- & windsurf spotguide

Homepage weather

» Wind forecast for your website
» Set up your own weather station
» Set up your own webcam
» Contribute weather data

Past weather

» Historical weather data

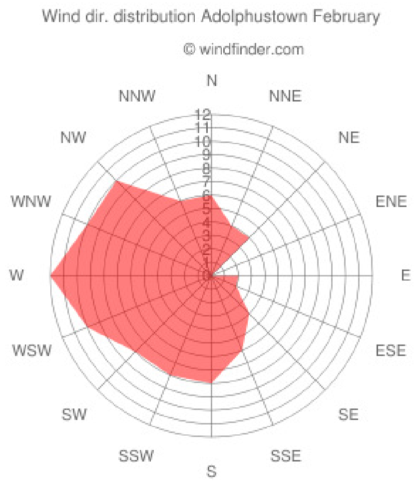
Advertising

Windfinder - Wind & weather statistic Adolphustown

Wind statistic | Wind report | Forecast | Super Forecast | Nearby

Adolphustown (ADOLPHUS)
Statistics based on observations taken between 6/2010 - 12/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	SUM 1-12
Dominant Wind dir.													
Wind probability > = 4 Beaufort (%)	2	14	11	16	2	2	0	1	1	7	8	16	**6**
Average Wind speed (Knots)	4	6	6	6	4	4	4	4	4	5	5	6	**4**
Average air temp. (°C)	-6	-2	1	8	16	21	25	23	19	12	7	0	**10**
Select month (Help)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year



Wind direction Distribution February(%)

Weather symbols

= North
= North northeast
= Northeast
= clouds & visibility okay

Share

Like
Tweet 0
0

Configuration

Change units

Surfspot

Nearby forecast locations
Nearby weatherstations
Tide forecast
Weather & surf webcams
Surf- & sailing schools
Surf- & sailing shops
Kite- & windsurf spotguide

Homepage weather

» Wind forecast for your website
» Set up your own weather station
» Set up your own webcam
» Contribute weather data

Past weather

» Historical weather data

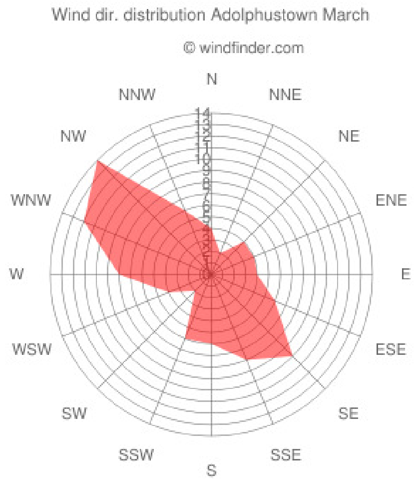
Advertising

Windfinder - Wind & weather statistic Adolphustown

Wind statistic | Wind report | Forecast | Super Forecast | Nearby

Adolphustown (ADOLPHUS)
Statistics based on observations taken between 6/2010 - 12/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	SUM 1-12
Dominant Wind dir.													
Wind probability > = 4 Beaufort (%)	2	14	11	16	2	2	0	1	1	7	8	16	**6**
Average Wind speed (Knots)	4	6	6	6	4	4	4	4	4	5	5	6	**4**
Average air temp. (°C)	-6	-2	1	8	16	21	25	23	19	12	7	0	**10**
Select month (Help)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year



Wind direction
Distribution
March(%)

Weather symbols

= North
= North northeast
= Northeast
= clouds & visibility okay

Share

Like
Tweet 0
0

Configuration

Change units

Surfspot

Nearby forecast locations
Nearby weatherstations
Tide forecast
Weather & surf webcams
Surf- & sailing schools
Surf- & sailing shops
Kite- & windsurf spotguide

Homepage weather

» Wind forecast for your website
» Set up your own weather station
» Set up your own webcam
» Contribute weather data

Past weather

» Historical weather data

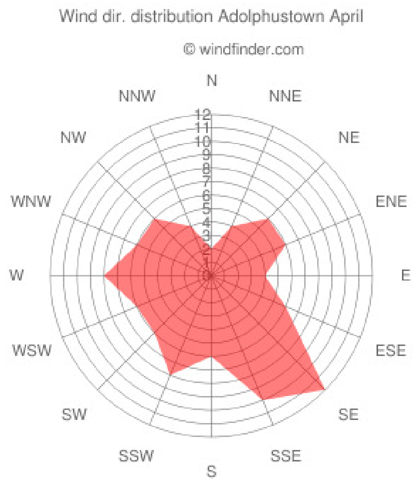
Advertising

Windfinder - Wind & weather statistic Adolphustown

Wind statistic | Wind report | Forecast | Super Forecast | Nearby

Adolphustown (ADOLPHUS)
Statistics based on observations taken between 6/2010 - 12/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	SUM 1-12
Dominant Wind dir.													
Wind probability > = 4 Beaufort (%)	2	14	11	16	2	2	0	1	1	7	8	16	**6**
Average Wind speed (Knots)	4	6	6	6	4	4	4	4	4	5	5	6	**4**
Average air temp. (°C)	-6	-2	1	8	16	21	25	23	19	12	7	0	**10**
Select month (Help)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year



Wind direction
Distribution
April(%)

addicted to the wind! WINDFINDER.com

Weather symbols

= North
= North northeast
= Northeast
= clouds & visibility okay

Share

Like
Tweet 0
0

Configuration

Change units

Surfspot

Nearby forecast locations
Nearby weatherstations
Tide forecast
Weather & surf webcams
Surf- & sailing schools
Surf- & sailing shops
Kite- & windsurf spotguide

Homepage weather

» Wind forecast for your website
» Set up your own weather station
» Set up your own webcam
» Contribute weather data

Past weather

» Historical weather data

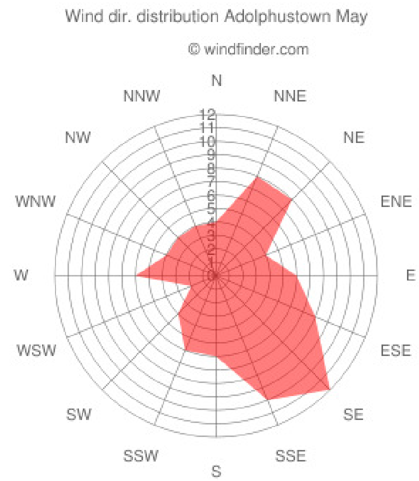
Advertising

Windfinder - Wind & weather statistic Adolphustown

Wind statistic | Wind report | Forecast | Super Forecast | Nearby

Adolphustown (ADOLPHUS)
Statistics based on observations taken between 6/2010 - 12/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	SUM 1-12
Dominant Wind dir.													
Wind probability > = 4 Beaufort (%)	2	14	11	16	2	2	0	1	1	7	8	16	**6**
Average Wind speed (Knots)	4	6	6	6	4	4	4	4	4	5	5	6	**4**
Average air temp. (°C)	-6	-2	1	8	16	21	25	23	19	12	7	0	**10**
Select month (Help)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year



Wind direction Distribution May(%)

Weather symbols

= North
= North northeast
= Northeast
= clouds & visibility okay

Share

Like
Tweet 0
0

Configuration

Change units

Surfspot

Nearby forecast locations
Nearby weatherstations
Tide forecast
Weather & surf webcams
Surf- & sailing schools
Surf- & sailing shops
Kite- & windsurf spotguide

Homepage weather

» Wind forecast for your website
» Set up your own weather station
» Set up your own webcam
» Contribute weather data

Past weather

» Historical weather data

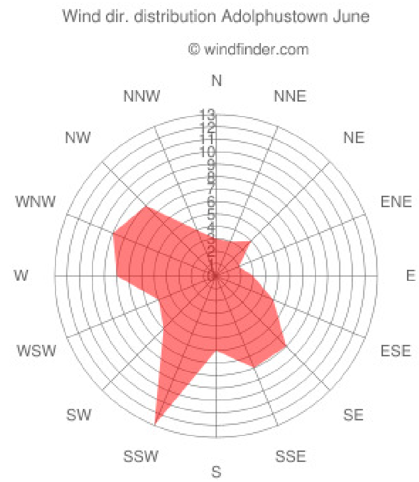
Advertising

Windfinder - Wind & weather statistic Adolphustown

Wind statistic | Wind report | Forecast | Super Forecast | Nearby

Adolphustown (ADOLPHUS)
Statistics based on observations taken between 6/2010 - 12/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	SUM 1-12
Dominant Wind dir.													
Wind probability > = 4 Beaufort (%)	2	14	11	16	2	2	0	1	1	7	8	16	**6**
Average Wind speed (Knots)	4	6	6	6	4	4	4	4	4	5	5	6	**4**
Average air temp. (°C)	-6	-2	1	8	16	21	25	23	19	12	7	0	**10**
Select month (Help)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year



Wind direction Distribution June(%)

Weather symbols

= North
= North northeast
= Northeast
= clouds & visibility okay

Share

Like
Tweet 0
0

Configuration

Change units

Surfspot

Nearby forecast locations
Nearby weatherstations
Tide forecast
Weather & surf webcams
Surf- & sailing schools
Surf- & sailing shops
Kite- & windsurf spotguide

Homepage weather

» Wind forecast for your website
» Set up your own weather station
» Set up your own webcam
» Contribute weather data

Past weather

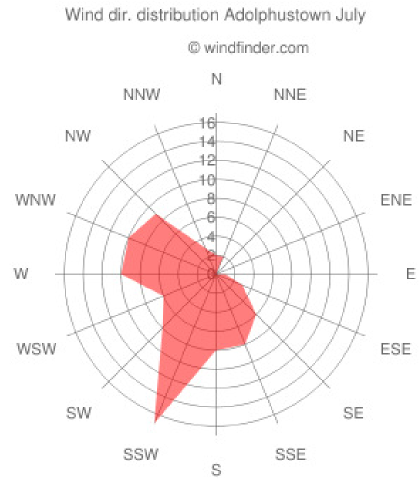
» Historical weather data

Windfinder - Wind & weather statistic Adolphustown

Wind statistic | Wind report | Forecast | Super Forecast | Nearby

Adolphustown (ADOLPHUS)
Statistics based on observations taken between 6/2010 - 12/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	SUM 1-12
Dominant Wind dir.													
Wind probability > = 4 Beaufort (%)	2	14	11	16	2	2	0	1	1	7	8	16	**6**
Average Wind speed (Knots)	4	6	6	6	4	4	4	4	4	5	5	6	**4**
Average air temp. (°C)	-6	-2	1	8	16	21	25	23	19	12	7	0	**10**
Select month (Help)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year



Wind direction
Distribution
July(%)

Weather symbols

= North
= North northeast
= Northeast
= clouds & visibility okay

Share

Like
Tweet 0
0

Configuration

Change units

Surfspot

Nearby forecast locations
Nearby weatherstations
Tide forecast
Weather & surf webcams
Surf- & sailing schools
Surf- & sailing shops
Kite- & windsurf spotguide

Homepage weather

» Wind forecast for your website
» Set up your own weather station
» Set up your own webcam
» Contribute weather data

Past weather

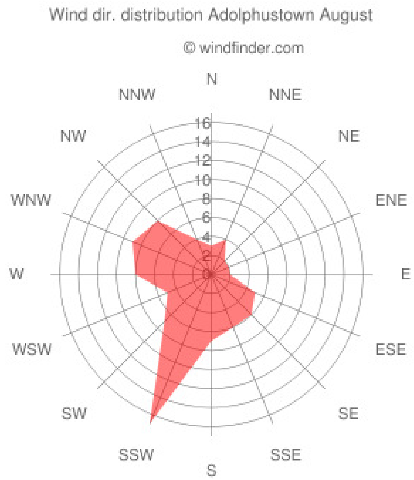
» Historical weather data

Windfinder - Wind & weather statistic Adolphustown

Wind statistic | Wind report | Forecast | Super Forecast | Nearby

Adolphustown (ADOLPHUS)
Statistics based on observations taken between 6/2010 - 12/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	SUM 1-12
Dominant Wind dir.													
Wind probability > = 4 Beaufort (%)	2	14	11	16	2	2	0	1	1	7	8	16	**6**
Average Wind speed (Knots)	4	6	6	6	4	4	4	4	4	5	5	6	**4**
Average air temp. (°C)	-6	-2	1	8	16	21	25	23	19	12	7	0	**10**
Select month (Help)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year



Wind direction Distribution August(%)

addicted to the wind!

Weather symbols

= North
= North northeast
= Northeast
= clouds & visibility okay

Share

Like
Tweet 0
0

Configuration

Change units

Surfspot

Nearby forecast locations
Nearby weatherstations
Tide forecast
Weather & surf webcams
Surf- & sailing schools
Surf- & sailing shops
Kite- & windsurf spotguide

Homepage weather

» Wind forecast for your website
» Set up your own weather station
» Set up your own webcam
» Contribute weather data

Past weather

» Historical weather data

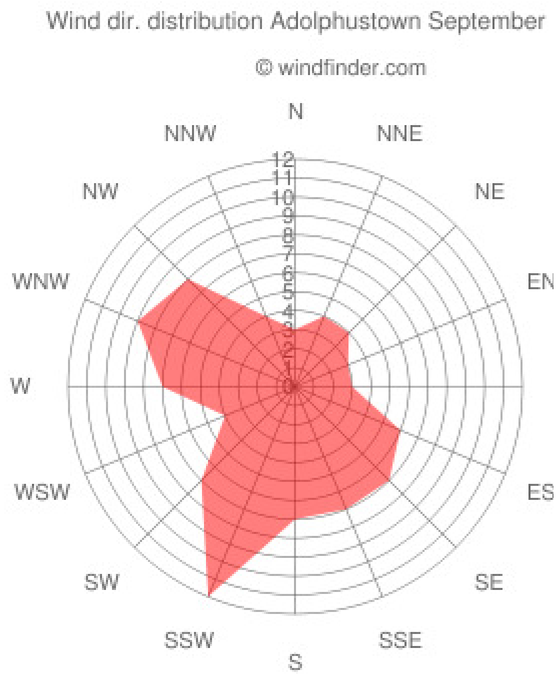
Advertising

Windfinder - Wind & weather statistic Adolphustown

Wind statistic | Wind report | Forecast | Super Forecast | Nearby

Adolphustown (ADOLPHUS)
Statistics based on observations taken between 6/2010 - 12/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10
Dominant Wind dir.										
Wind probability > = 4 Beaufort (%)	2	14	11	16	2	2	0	1	1	7
Average Wind speed (Knots)	4	6	6	6	4	4	4	4	4	5
Average air temp. (°C)	-6	-2	1	8	16	21	25	23	19	12
Select month (Help)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct



Wind direction Distribution September(%)

addicted to the wind! WINDFINDER.com

Weather symbols

= North
= North northeast
= Northeast
= clouds & visibility okay

Share

Like
Tweet 0
0

Configuration

Change units

Surfspot

Nearby forecast locations
Nearby weatherstations
Tide forecast
Weather & surf webcams
Surf- & sailing schools
Surf- & sailing shops
Kite- & windsurf spotguide

Homepage weather

» Wind forecast for your website
» Set up your own weather station
» Set up your own webcam
» Contribute weather data

Past weather

» Historical weather data

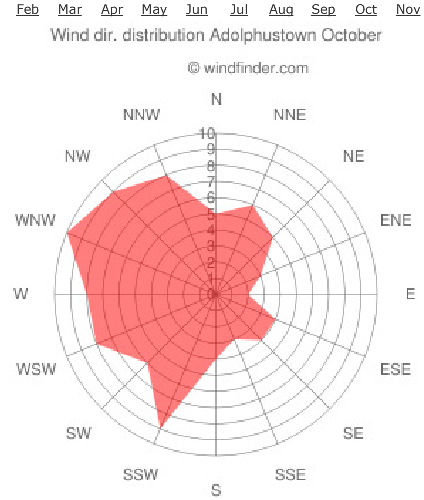
Advertising

Windfinder - Wind & weather statistic Adolphustown

Wind statistic | Wind report | Forecast | Super Forecast | Nearby

Adolphustown (ADOLPHUS)
Statistics based on observations taken between 6/2010 - 12/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	SUM 1-12
Dominant Wind dir.													
Wind probability > = 4 Beaufort (%)	2	14	11	16	2	2	0	1	1	7	8	16	**6**
Average Wind speed (Knots)	4	6	6	6	4	4	4	4	4	5	5	6	**4**
Average air temp. (°C)	-6	-2	1	8	16	21	25	23	19	12	7	0	**10**
Select month (Help)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year



Wind direction
Distribution
October(%)

Weather symbols

= North
= North northeast
= Northeast
= clouds & visibility okay

Share

Like
Tweet 0
0

Configuration

Change units

Surfspot

Nearby forecast locations
Nearby weatherstations
Tide forecast
Weather & surf webcams
Surf- & sailing schools
Surf- & sailing shops
Kite- & windsurf spotguide

Homepage weather

» Wind forecast for your website
» Set up your own weather station
» Set up your own webcam
» Contribute weather data

Past weather

» Historical weather data

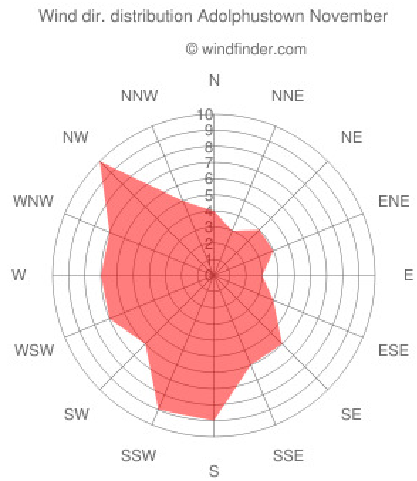
Advertising

Windfinder - Wind & weather statistic Adolphustown

Wind statistic | Wind report | Forecast | Super Forecast | Nearby

Adolphustown (ADOLPHUS)
Statistics based on observations taken between 6/2010 - 12/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	SUM 1-12
Dominant Wind dir.													
Wind probability > = 4 Beaufort (%)	2	14	11	16	2	2	0	1	1	7	8	16	**6**
Average Wind speed (Knots)	4	6	6	6	4	4	4	4	4	5	5	6	**4**
Average air temp. (°C)	-6	-2	1	8	16	21	25	23	19	12	7	0	**10**
Select month (Help)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year



Wind direction Distribution November(%)

addicted to the wind! WINDFINDER.com

Weather symbols

= North
= North northeast
= Northeast
= clouds & visibility okay

Share

Like
Tweet 0
0

Configuration

Change units

Surfspot

Nearby forecast locations
Nearby weatherstations
Tide forecast
Weather & surf webcams
Surf- & sailing schools
Surf- & sailing shops
Kite- & windsurf spotguide

Homepage weather

» Wind forecast for your website
» Set up your own weather station
» Set up your own webcam
» Contribute weather data

Past weather

» Historical weather data

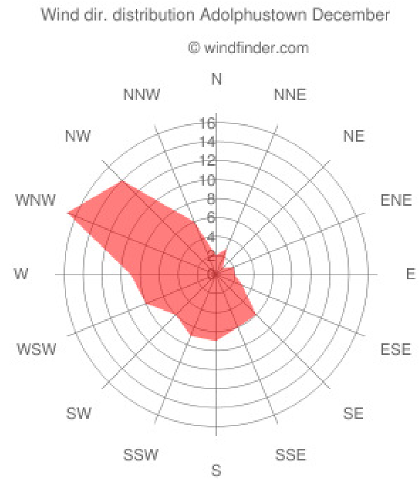
Advertising

Windfinder - Wind & weather statistic Adolphustown

Wind statistic | Wind report | Forecast | Super Forecast | Nearby

Adolphustown (ADOLPHUS)
Statistics based on observations taken between 6/2010 - 12/2011 daily from 7am to 7pm local time.

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	SUM 1-12
Dominant Wind dir.													
Wind probability > = 4 Beaufort (%)	2	14	11	16	2	2	0	1	1	7	8	16	**6**
Average Wind speed (Knots)	4	6	6	6	4	4	4	4	4	5	5	6	**4**
Average air temp. (°C)	-6	-2	1	8	16	21	25	23	19	12	7	0	**10**
Select month (Help)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year



Wind direction Distribution December(%)

APPENDIX L

XCG Environmental Engineers & Scientists
XCG CONSULTANTS LTD.
T 613 542 5888 F 613 542 0844 | kingston@xcg.com
6 Cataraqui Street, Woolen Mill, West Wing, Suite 105, Kingston, Ontario, Canada K7K 1Z7

Date:	August 9, 2012	**XCG File No.: 1-030-72-01**
To:	Rika Law (RVA)	
cc:	Joe Angelo (PEC); Ken Campbell (RVA)	
From:	Janet Noyes (XCG)	
Re:	Assessment of Proposed Intake Replacement for Picton WTP	

1. BACKGROUND

As discussed in XCG's Proposal, dated June 11, 2012, the MOE provided comments on the Class EA assessment of the alternative solutions for the Picton Water Treatment Plant. As noted by Ms. Wendy Lavender (MOE Liaison for the Quinte Source Protection Regions) a more detailed assessment and comparison of the Intake Protection Zones (IPZs), vulnerabilities and significant threats between the existing intakes, the proposed intake and the Wellington WTP intake were recommended.

As part of these comments, Ms. Wendy Lavender (MOE) identified concerns with respect to Source Water Protection. A summary of her comments are listed below:

- Delineation of the new intake protection zones for the proposed intake has not been completed.
- Identification of the vulnerability of the proposed intake has not been completed.
- Clarification on the classification of the proposed intake (Type A or Type D) should be considered.
- Consultation with Quinte source protection staff and Quinte Source Protection Committee to understand the implications of changes in delineation and vulnerability for this proposed intake is encouraged.
- Comparison of the vulnerability scores and significant threats with existing intake, proposed intake and Wellington Intake.

2. DISCUSSIONS WITH QUINTE CONSERVATION

Janet Noyes and Colin Clarke, of XCG, met with Keith Taylor (Source Water Protection Project Manager) and Bryon Keene (Water Resources Manager) of Quinte Conservation (QC), on June 22, 2012, to discuss various topics with respect to identifying new IPZs and vulnerabilities for the proposed intake location for the Picton WTP.

2.1 *Intake Classification:*

The Picton intake had originally be classified as a Great Lakes intake (Type A) but after an initial assessment of the IPZs as a Type A intake, Quinte SPR requested that the intake classification be changed to a Type D intake to be consistent with the other intakes in the Bay of Quinte Region, such as Belleville, Deseronto and Point Anne.

Both Keith Taylor and Bryon Keene indicated that the Intake should remain a Type D intake. Therefore the proposed new location for the Picton WTP intake will still be classified as a Type D intake.

2.2 *Delineation of IPZs:*

The technical rules regarding the delineation of the intake protection zones for a Type D intake have not changed since the original work was completed in 2009. The IPZ-1 is defined by a 1-km radius circle within the waterbody and where it touches the land, extends perpendicular to the shoreline to a maximum distance of 120 metres or the Regulation Limit.

Discussions on the IPZ-2 delineation resulted in considering a two-hour time of travel (TOT) within contributing waterbodies. Previously for Picton, the IPZ-2 was defined by using a four-hour time of travel but with the lack of direct discharges in close proximity to the intake, the Quinte Conservation members consider the minimum two-hour TOT mentioned in the Technical Rules[1] to be sufficient. All other intakes on the Bay of Quinte use a two-hour TOT for the IPZ-2 delineation.

The IPZ-3 would again be separated into two separate regions: IPZ-3a and IPZ-3b, as before with all the southern contributions (from the Picton area) designated as the IPZ-3a and the northern contributions designated as the IPZ-3b.

2.3 *Vulnerability Scoring:*

Vulnerability scoring for surface water intakes is based on two factors that are multiplied together: Source Vulnerability Factor (Vfs) and the Zone Vulnerability Factor (Vfz). In completing the vulnerability analysis for the other IPZs on the Bay of Quinte, Dillon Consulting developed a methodology for calculating the vulnerability factors for each intake. QC provided one of Dillon's reports[2] to XCG that described the methodology that was developed and requested that XCG follow the same methodology for determining the vulnerabilities for the proposed intake for Picton.

---

[1] Ministry of Environment, Technical Rules: Assessment Report - Clean Water Act, 2006. November 16, 2009.

[2] Dillon Consulting, Intake Protection Zone Studies, Napanee Backup Supply, Quinte Conservation.

2.4 *Significant Threats:*

Significant Threats for the proposed IPZ for Picton would be enumerated following the same methodology XCG used for the original Picton assessment, which identified threats using the MOE's Threats Tables[3].

2.5 *Decommissioning of Existing Intakes:*

One additional point that was raised by QC staff was the consideration of the existing intakes with regards to Source Water Protection. If the municipality chooses to keep one or both of the existing intakes operational as a secondary intake, the existing IPZ delineations will have to remain as well as any IPZs identified for a new intake.

3. IPZ DELINEATION

3.1 *IPZ-1*

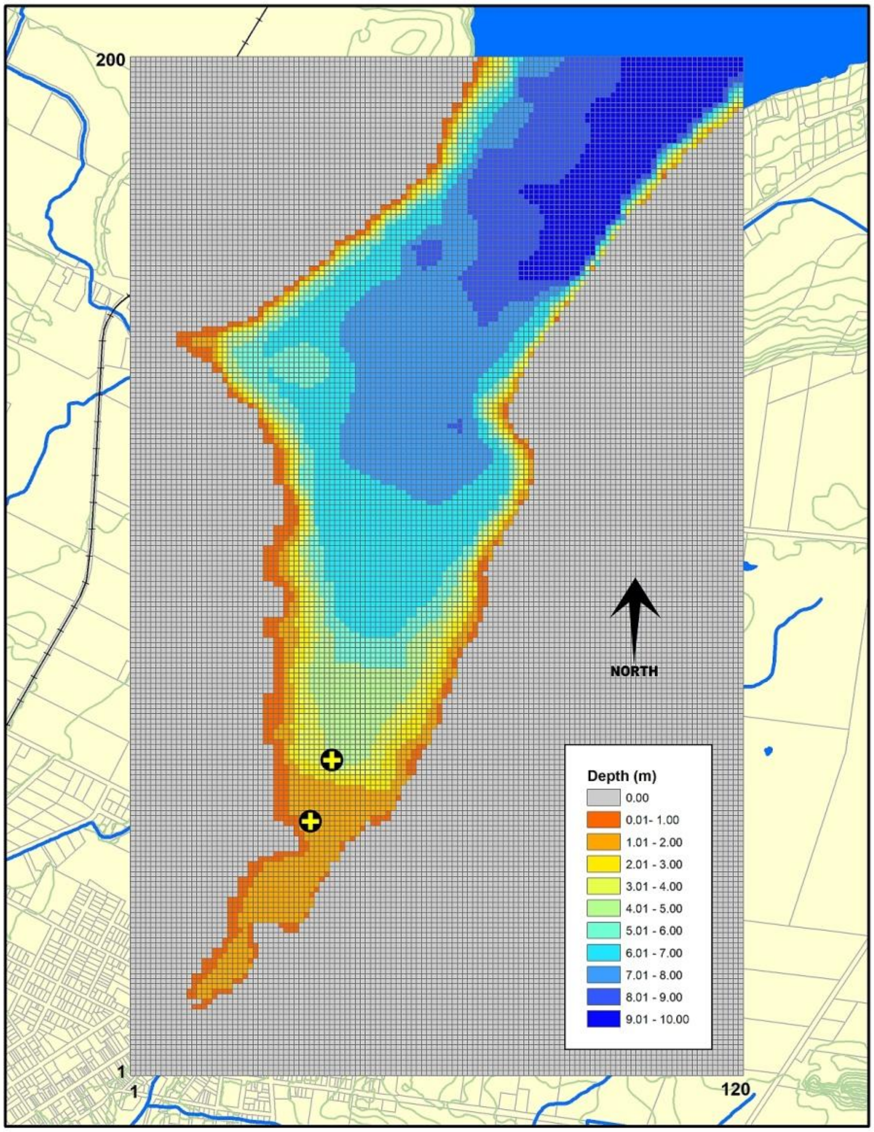
As a Type D intake, the delineation of the IPZ-1 is straightforward, as discussed earlier. A 1-km radius circle, centred on the proposed intake location (Z 18T 329513 E, 4877795 N), was drawn and where the circle intersects with the shoreline, a perpendicular delineation to the 120 metre offset was applied. The resulting IPZ-1 is shown in Figure 2.

3.2 *IPZ-2*

A field-truthed hydrodynamic model had been set up for the previous delineation of the IPZ-2 for the Picton Intake. This model extended northward, beyond the location of the proposed new intake and therefore this model was revisited to define the IPZ-2 for the proposed new intake. Figure 1 illustrates the model grid boundary.

[3] Ministry of Environment, December 12, 2008. Tables of Drink Water Threats - Clean Water Act, 2006.

Figure 1 Picton Bay Bathymetry and Model Grid



The model was developed using US EPA's Environment Fluid Dynamics Code, EFDC. EFDC was developed originally by the Virginia Institute of Marine Science in 1992 and the most recent version (August 2002) is supported by the US Environmental Protection Agency (US EPA, Region 4 – Environmental Fluid Dynamics Code, Hydro Version, Release 1.00, U.S. Environmental Protection Agency, Region 4, Atlanta, Georgia, August, 2002). EFDC solves the three-dimensional, vertically hydrostatic, free surface, turbulent averaged equations of motions for a variable density fluid, and is ideally suited for delineation of mixing zones for outfalls or capture zones for intakes.

Inputs to the model require data detailing bathymetry, flow and level. The model was run in steady state conditions and the effects of storage were not evaluated. Bathymetry data was collected from navigation charts. Field truthing of the model had been previously completed using drogue studies and simulating these observations with the model. Appropriate parameter adjustment had already been completed so that the model was able to reasonably simulate the observed data.

With the field-truthed model developed the bankfull stream flows, water levels and wind speeds were input into the model.

New inputs to the model included estimating 2-year flows for the two creeks that discharge into Picton Bay along the west shoreline directly west of the proposed intake location. To complete this analysis, XCG used the Regional Flood Frequency methodology[4] and followed the following four steps:

1. **Measure Drainage Area**: Using GIS techniques the drainage area was estimated to be approximately 11.9 km^2.
2. **Determine the Region**: From Figure 5.1.1 (Moin & Shaw), the region was determined to be Region 1.
3. **Verify Region**: Using Table 5:1.1 (Moin & Shaw), Region 1A was verified to be within range used to define the relationship.
4. **Estimate Q_2:** The 2-year flow (Q_2) was calculated using the following equation:

   $Q_2 = C*A^n$

   Where: $C = 0.22$; $n = 1$

   $Q_2 = 2.62\ m^3/s$.

This flow was input into the existing model at the grid cell identified as the stream discharge point.

The wind speed selected for the modelling efforts was determined by analyzing ten years of hourly wind data at the Trenton A weather station. Each wind speed was binned by direction into one of eight quadrants (North, Northeast, East, Southeast, South, Southwest, West and Northwest). The annual maxima for each direction were determined. The two year return period wind speed for each direction was approximated by averaging the developed annual maxima time series in each direction.

Wind duration was assumed to be non-limiting; meaning that the determined wind speeds lasted sufficiently long to fully develop the surface current. This is a conservative assumption. Fetch was evaluated and was found to be less than 20 km in all instances. As a conservative measure the evaluated fetch was set to a uniform

[4] Moin S.M.A. and M.A. Shaw, 1985. Regional Flood Frequency Analysis for Ontario Streams, Volume 1. Single Station Analysis for Index Method. Water Planning and Management Branch, Inland Water Directorate, Environment Canada, pg. 118.

20 km in the northerly and southerly directions and a conservative fetch of 10 km was assumed for winds from the westerly direction.

Using the binned two-year winds, based on Trenton A data, the 2-hour time of travel in the northeast, south and southwest directions to be less than the 1 km radius IPZ-1 circle. To the east and west, the 2-hour time of travel did not reach to the shoreline and therefore it was not necessary to extend the IPZ-2 up the streams contributing from the west. Therefore the IPZ-2 does not extend beyond the IPZ-1 delineation in any direction.

3.3 IPZ-3

IPZ-3 delineations require identification of all contributing watercourses upstream of the intake of interest and a 120 metre (or Regulation Limit) buffer around the high water mark of the water body for each intake.

The Bay of Quinte System (including Trent, Moira and several other watersheds) constitutes a large watershed with intakes located in a different section of the water way, either up or downstream for one or more of the other intakes. Originally the IPZ-3s were to be delineated as tessellated forms, all fitting together as individual, not overlapping, puzzle pieces. With the final Technical Rules released in November 2008, the definition of the IPZ-3 has resulted in the inclusion of all contributing water courses upstream of the intake.

Discussions with Quinte Conservation and the Trent Conservation Coalition have come to the consensus that due to the overwhelming size of the entire watershed, each intake will be assessed and the IPZ-3 delineated keeping with the tessellated approach.

With this approach, any threats in the contributing watershed upstream of the next intake will be better addressed with the assessment of vulnerability of the closest intake. This methodology was carried forward with this reassessment as well and the former overall IPZ-3 footprint for Picton remains the same. See Figures 3 and 4 for the delineation of the IPZ-3 for the proposed new Picton intake.

IPZ-3s may be further divided into subsections to allow for different vulnerability scores to be applied to different sections of the IPZ-3s. Subdivision of the IPZ-3s is discussed in the vulnerability sections.

4. ASSESSMENT OF VULNERABILITY

As mentioned above, Dillon developed a methodology for identifying Source and Area vulnerability factors that determine the vulnerability scores of the various delineated IPZs. Each vulnerability factor is equal to the minimum applicable vulnerability factor plus a number of indicators listed in the Guidance Module that were to be included in determining the vulnerability factors.

4.1 Source Vulnerability Factor

Rule 95 of the Technical Rules identifies that for the Source Vulnerability Factor (Vfs), the following factors shall be considered: raw water quality, depth of intake and distance from shore. For a Type D intake the range of source vulnerability factors is 0.8 to 1.0. These requirements are slightly different from when Dillon presented their methodology so XCG revised the Dillon method slightly.

$Vfs = Vfs_{min} + I_{rw} + I_{id} + I_{od}$

Where: Vfs_{min} = Minimum Vfs Value (0.8)

I_{rw} = raw water indicator (max 0.067)

I_{id} = intake depth indicator (max 0.067)

I_{od} = offshore distance indicator (max 0.067)

I_{rw}: As XCG's field study noted that there was not much difference in water quality the various test locations throughout the Bay, the ambient water quality is expected to be somewhat similar to the actual monitored Picton data. Aluminum was the only water quality parameter identified as an issue, and it was identified as possibly being contributed from backwash, which would not be an issue with the new intake. Therefore I_{rw} is considered to be 0.00.

I_{id}: Using the ranges described in the Dillon Methodology, an intake depth of 10 metres or more is considered ideal and would not add to the minimum factor. A depth of 2 metres or less is the worst case. The preferred location is described as being in 7.5 metres of water so a small addition would be considered for this intake depth. I_{id} is 0.02.

I_{od}: Once again using the ranges described in the Dillon Methodology, an offshore distance of 1000 metres or more is considered ideal and would not add to the minimum factor. A distance of 250 metres or less is the worst case. The closest shoreline is located 425 metres from the preferred intake location so the I_{od} is recommended to be 0.05.

Using the formula above:

$Vfs = Vfs_{min} + I_{rw} + I_{id} + I_{od}$

$Vfs = 0.8 + 0.00 + 0.02 + 0.05$

$= 0.87$

As the Source Vulnerability Factors are to be represented by a single decimal point, the factor is rounded to 0.9.

4.2 Area Vulnerability Factors

The area vulnerability factors are derived for each separate zone. For the IPZ-1, the area vulnerability factor is set at 10 (Technical Rule #88).

For the case of the proposed new Picton intake, there is no IPZ-2 delineated so no vulnerability factor is required.

4.2.1 Methodology

According to Rule 92 of the Technical Rules the following factors are to be considered when determining the vulnerability factors for IPZ-2 and IPZ-3: percentage of area that is composed of land, land cover, soil type, permeability of the land, slope of the land, hydrogeological and hydrological conditions that contribute through transport pathways and in the case of IPZ-3s, the distance from the intake. The range of area vulnerability factors for IPZ-3s is 1 to 9.

Following the Dillon methodology but modifying it to reflect the updated rules, the Area Vulnerability Factors were determined using this equation:

$Vfa = Vfa_{min} + I_{pa} + I_{lc} + I_{st} + I_{sl} + I_{tp} + I_{d}$

Where: Vfa_{min} = Minimum Vf_a Value (1)

I_{pa} = percent area that is land (max 1)

I_{lc} = land cover (max 1)

I_{st} = soil type and permeability (max 1)

I_{sl} = slope of the buffer lands (max 1)

I_{tp} = presence of transport pathways (max 2)

I_{d} = distance from intake (max 2)

The presence of transport pathways and distance from the intake were factors that were given a higher weighting for the area vulnerability factors. For the case of Picton, the IPZ-3 was subdivided into two different areas and assigned different vulnerability scores within the IPZ-3 based on the factors mentioned above. As mentioned earlier and in discussions with QC staff, the IPZ-3 is to be divided into two areas:

1. IPZ-3a is defined as the southern portion of the IPZ-3 and includes all contributions from the Town of Picton and the small creeks that flow through the Town such as Hospital Creek and Marsh Creek as well as a number of stormwater contributions.
2. IPZ-3b is defined as the northern portion of the IPZ-3 that includes all the additional contributions that could occur from the rest of Picton Bay and all drainage south of Belleville to the Glenora Ferry crossing between the Deseronto IPZ delineation and the main Napanee IPZ delineation in Lake Ontario.

4.2.2 Vfa Assignment - IPZ-3a

I_{pa}: There is significant portion of the IPZ-3a that is land mass with the very southern portion of Picton Bay and small tributaries included as water bodies. Greater than 50% of the area is land and therefore the I_{pa} is considered to be 1.

I_{lc}: The majority of the land cover in IPZ-3a is considered urban and as such increases the potential for runoff generation. Therefore the I_{lc} is given a maximum score of 1.

I_{st}: Soil types in Prince Edward County are typically clays and loams with obvious rock outcroppings. In IPZ-3a there is a large area of Percy fine sandy loam as well as areas of Ameliasburg loam, Farmington loam and Darlington loam. All of these soil types are considered to have good drainage and would reduce runoff potential. Therefore an I_{st} of 0.5 is applied to this zone.

I_{sl}: As noted above there is a high escarpment that runs along the western shoreline while a more gradual slope is evident along the eastern side. There is a strong topographic sloping towards the water in the IPZ-3a and therefore the I_{sl} is set at 1.

I_{tp}: There are a number of stormwater outfalls located within the IPZ-3a as well as creeks that drain or flow through the urban areas of the IPZ-3a. Therefore the I_{tp} is set at the maximum of 2 for the IPZ-3a.

I_d: The final factor is distance from the intake. As the majority of the IPZ-3a is located within 5 km of the intake and there is not IPZ-2 buffer area, it is considered to be close and the resulting I_d factor is recommended to be 1.5, just below the maximum of 2.

Using the formula above:

$$Vfa = Vfa_{min} + I_{pa} + I_{lc} + I_{st} + I_{sl} + I_{tp} + I_d$$

$$Vfa = 1 + 1 + 1 + 0.5 + 1 + 2 + 1.5$$

$$= 8.0$$

As the Area Vulnerability Factors are to be represented by a whole number, the factor is rounded to 8.

4.2.3 *Vfa Assignment - IPZ-3b*

I_{pa}: There is significant portion of the IPZ-3b is water with the entire middle section of the Bay of Quinte being included. Therefore I_{pa} is considered to be 0.

I_{lc}: The majority of the land cover in IPZ-3b is considered rural agricultural or residential land and the potential for runoff generation is moderate. Therefore the I_{lc} is given a moderate score of 0.5.

I_{st}: In the IPZ-3b there is a large area rock outcrop on the top of the escarpment along the western shore. Large deposits of Lansdowne clay and Napanee clay are found on the eastern shorelines. These soil types are considered to have poor drainage and would increase runoff potential. Therefore an I_{st} of 1.0 is applied to this zone.

I_{sl}: Similar to the IPZ-3a there is a high escarpment that runs along the western shoreline of the IPZ-3b while a more gradual slope is evident along the eastern side. There is a strong topographic sloping towards the water in the IPZ-3b and therefore the I_{sl} is set at 1.

I_{tp}: There are no stormwater outfalls located within the IPZ-3b and two nearby creeks and other tributaries located a fair distance from the outfall in this zone. Therefore the I_{tp} is set at 0.5 for the IPZ-3b.

I_d: The final factor is distance from the intake. The IPZ-3b extends a significant distance from the intake (approximately 60 km) and is not considered to be excessively close and the resulting I_d factor is recommended to be 0.5.

Using the formula above:

$Vfa = Vfa_{min} + I_{pa} + I_{lc} + I_{st} + I_{sl} + I_{tp} + I_d$

$Vfa = 1 + 0 + 0.5 + 1 + 1 + 0.5 + 0.5$

$= 4.5$

As the Area Vulnerability Factors are to be represented by a whole number, the factor is rounded to 5.

4.3 Vulnerability Scores

The vulnerability factors for each IPZ are summarized in Table 1.

Table 1 Vulnerability Factors

Intake	Source Vulnerability Factor (0.8-1.0)	Area Vulnerability Factor			
		IPZ-1 (10)	IPZ-2 (7-9)	IPZ- 3 (Range 1-9)	
				IPZ-3a	IPZ-3b
Picton	0.9	10	N/A	8	5

As shown in Table 1 above, the IPZ-3 for Picton was sub-divided into two zones. IPZ-3a includes all upstream areas on Marsh Creek and storm sewered areas in the Town of Picton; this area was assigned a vulnerability factor of 8. The IPZ-3b includes the rest of Picton Bay and all drainage south of Belleville to the Glenora Ferry crossing; the Vfa assigned to the IPZ-3b was 5.

The vulnerability score for each zone of each intake is obtained by multiplying the source vulnerability factor (Vfs) by the area vulnerability factor (Vfa) as follows:

$$V = Vfa \times Vfs$$

In Table 2, the resulting Vulnerability Scores are presented.

Table 2 Vulnerability Ratings

Intake	IPZ-1	IPZ-2	IPZ-3	
			IPZ-3a	IPZ-3b
Picton	9	N/A	7.2	4.5

5. SIGNIFICANT DRINKING WATER THREATS

A list of the prescribed drinking water threats is shown in Table 3.

Table 3 List of Prescribed Drinking Water Threats

PDWT Number	Prescribed Drinking Water Threat
1	The establishment, operation or maintenance of a waste disposal site within the meaning of Part V of the Environmental Protection Act.
2	The establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.
3	The application of agricultural source material to land.
4	The storage of agricultural source material.
5	The management of agricultural source material.
6	The application of non-agricultural source material to land.
7	The handling and storage of non-agricultural source material.
8	The application of commercial fertilizer to land.
9	The handling and storage of commercial fertilizer.
10	The application of pesticide to land.
11	The handling and storage of pesticide.
12	The application of road salt.
13	The handling and storage of road salt.
14	The storage of snow.
15	The handling and storage of fuel.
16	The handling and storage of a dense non-aqueous phase liquid.
17	The handling and storage of an organic solvent.
18	The management of runoff that contains chemicals used in the de-icing of aircraft.
19*	An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body.
20*	An activity that reduces the recharge of an aquifer.
21	The use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm-animal yard. O. Reg. 385/08, s. 3.
Note: * indicates that threat is not water quality threat.	

The methodology for identifying significant threats is detailed in XCG's report[5]. The nine step process is outlined below:

1. Review vulnerable area delineation and vulnerability scoring.

[5] XCG Consultants Ltd., March 2010. Draft Technical Memorandum, Quinte Source Protection Region, Significant Threats Enumeration for Picton Drinking Water System.

2. Review appropriate information databases.
3. Conduct field reconnaissance survey.
4. Overlay parcel fabric.
5. Evaluate potentially significant threats based on land use, vulnerability score and known circumstances.
6. Enumerate potential significant threats and number of parcels affected.
7. Send letters out to land owners of parcels identified as potentially significant threats.
8. Follow up with interview and/or site visit to collect information regarding specific circumstances.
9. Enumerate identified significant threats.

For this analysis, no additional updating of the referenced databases or confirmation of the windshield survey information was completed for this assessment. No landowners were interviewed to confirm or clarify any of the information that identified the land parcel as a potentially significant threat.

Having the vulnerability scores defined, the identification and enumeration of significant drinking water threats was completed using the available information collected during the previous threats identification work.

As significant threats can only be identified in areas that have a vulnerability score of 8 or higher for a surface water intake, for the proposed intake location only the IPZ-1 could possibly contain significant threats. The resulting enumeration of Potential Significant Threats for the proposed Picton Intake is shown below in Table 4.

Table 4 Potential Significant Drinking Water Threats

Prescribed Drinking Water Threat (PDWT)*	Score to Trigger a Significant Threat	
	Vulnerability Score = 9	
	Affected Parcels**	No. of PDWT
10. The application of pesticide to land.	1	1
13. The handling and storage of road salt.	1	1
Total Number of Affected Parcels	**2**	**2**

Note:
* Prescribed Drinking Water Threats, Clean Water Act (2006) – O. Reg. 287/07, 1.1(1)
** "Affected parcels" represents the number of parcels on which a specific activity may be taking place. Some parcels may have more than one activity on-site.

There was no historical information on existing contaminated sites within the IPZ-1 and therefore no significant threats due to Conditions.

6. COMPARISON OF VULNERABILITIES AND THREATS

This assessment of IPZ delineations, vulnerabilities and identification of significant threats has been completed with the assumption that the existing intakes are to be replaced by a “new” Picton intake and the existing intakes are decommissioned or removed. If in the event that one or both of the existing intakes is left in place as a secondary water source, the existing IPZs and associated vulnerabilities and threats would remain in addition to a new IPZ and identified threats. The comparisons completed below consider the “new” Picton intake to be in operation without the existing intakes operational.

As suggested by the MOE, Table 5 below summarizes the vulnerabilities and enumerated significant threats for the existing Picton intakes compared to the proposed "new" Picton Intake. Table 6 also compares the "new" Picton intake with various other intakes in the Bay of Quinte Area including the Wellington Intake on Lake Ontario.

Table 5 Comparison of Picton Intake Vulnerabilities and Threats

Comparison Area	Existing Picton Intakes	Proposed "New" Picton Intake
IPZ-1 Vulnerability Score	10	9
IPZ-2 Vulnerability Score	9	N/A
IPZ-3a Vulnerability Score	8	7.2
IPZ-3b Vulnerability Score	6	4.5
Enumerated Significant Threats - Activities	20	2
Affected Parcels - Activities	60	2
Enumerated Significant Threats - Conditions	1	0
Affected Parcels - Conditions	1	0

As summarized in the above table, there are significantly less enumerated parcels with significant threats in the proposed new intake location. As well the Vulnerability Scores are less, indicating that the proposed new intake would provide a less vulnerable intake and associated contributing areas.

Table 6 Comparison of Area Vulnerabilities and Threats

Comparison Area	Wellington (Type A)	Existing Picton Intakes	Belleville	Deseronto	Proposed "New" Picton Intake
IPZ-1 Vulnerability Score	5	10	9	9	9
IPZ-2 Vulnerability Score	3.5	9	8.1	8.1	N/A
IPZ-3a Vulnerability Score	N/A	8	7.2	7.2	7.2
IPZ-3b Vulnerability Score	N/A	6		2.7	4.5
Parcels with Significant Threats	0	60	1	10	2

Comparison with other Bay of Quinte Intakes indicates that the assigned vulnerabilities to the "new" intake are scored similarly to the other Bay of Quinte intakes. The Wellington intake is scored lower due to its classification as a Type A intake in Lake Ontario and the depth and distance from shore.

Figure 2
IPZ - 1
Preferred Intake
Picton

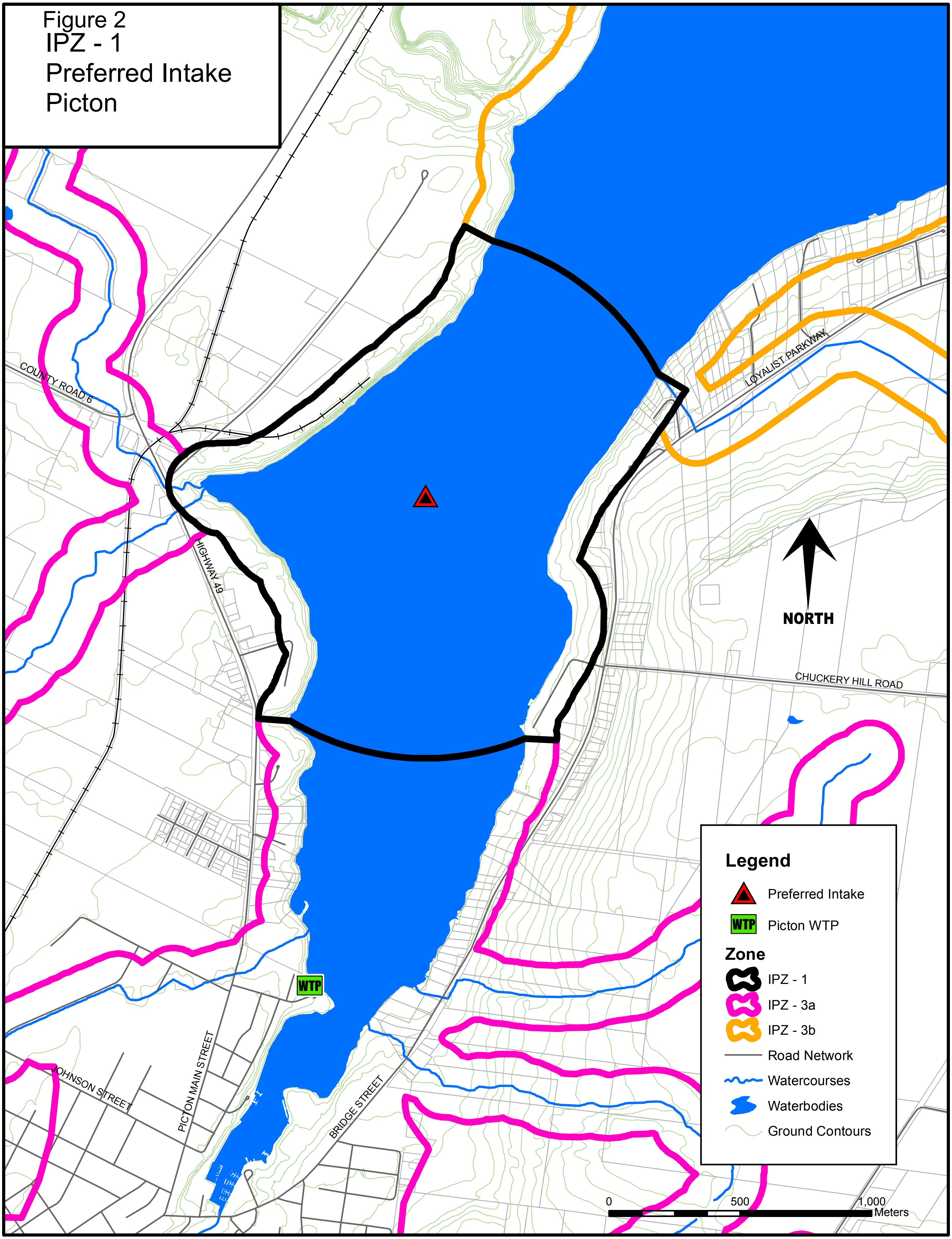


Figure 3
IPZ - 3a / 3b
Preferred Intake
Picton

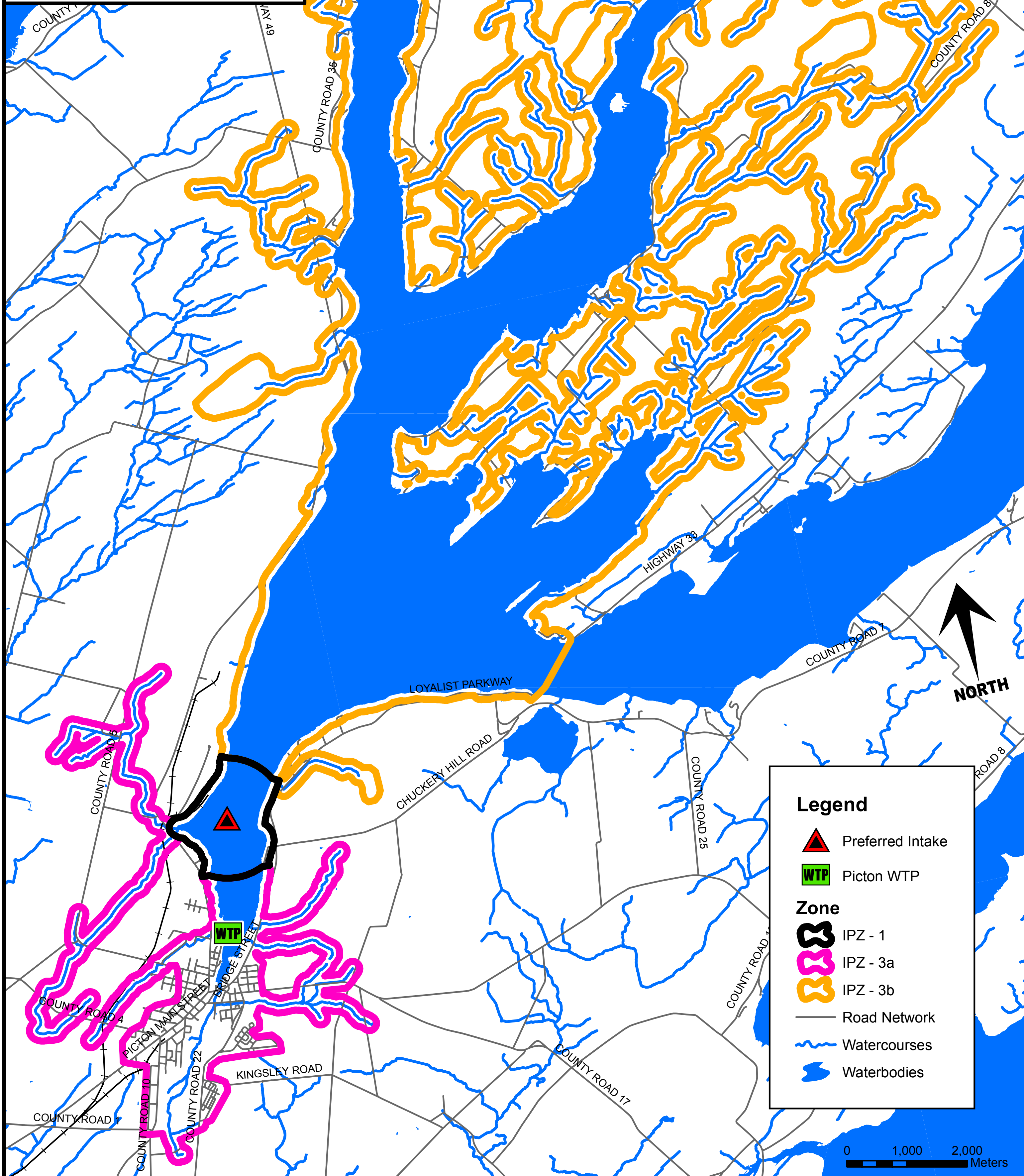
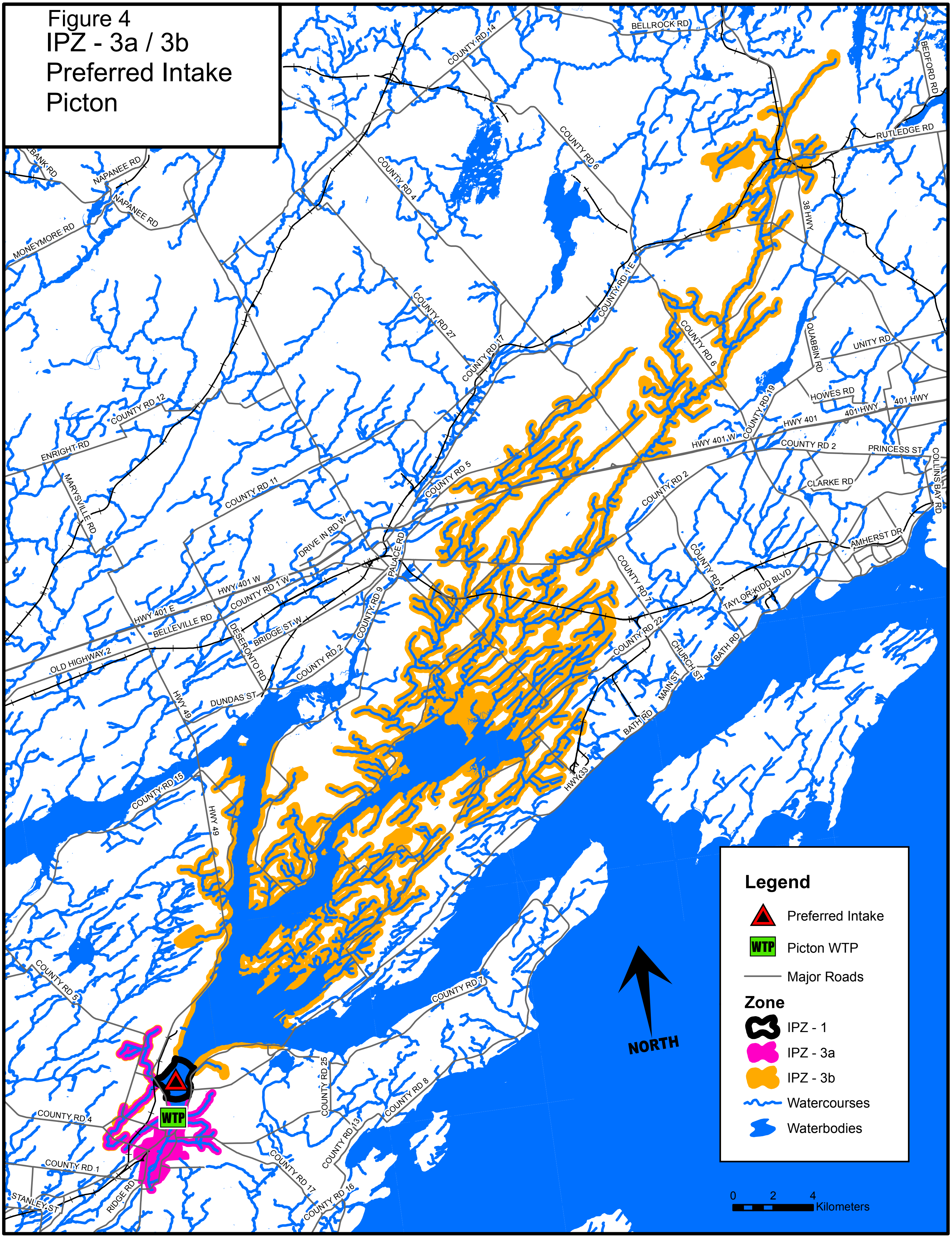


Figure 4
IPZ - 3a / 3b
Preferred Intake
Picton



APPENDIX M

PROPOSED

NEW PICTON
WATER TREATMENT PLANT
INTAKE

Natural Environment

Preliminary Impact Assessment
of Preferred Options

Version 1.0

Prepared for:
R.V. Anderson

Prepared by:
Bowfin Environmental Consulting

March 2012
(Updated December 2012)

Table of Contents

List of Figures

List of Tables

List of Photographs

1.0 INTRODUCTION

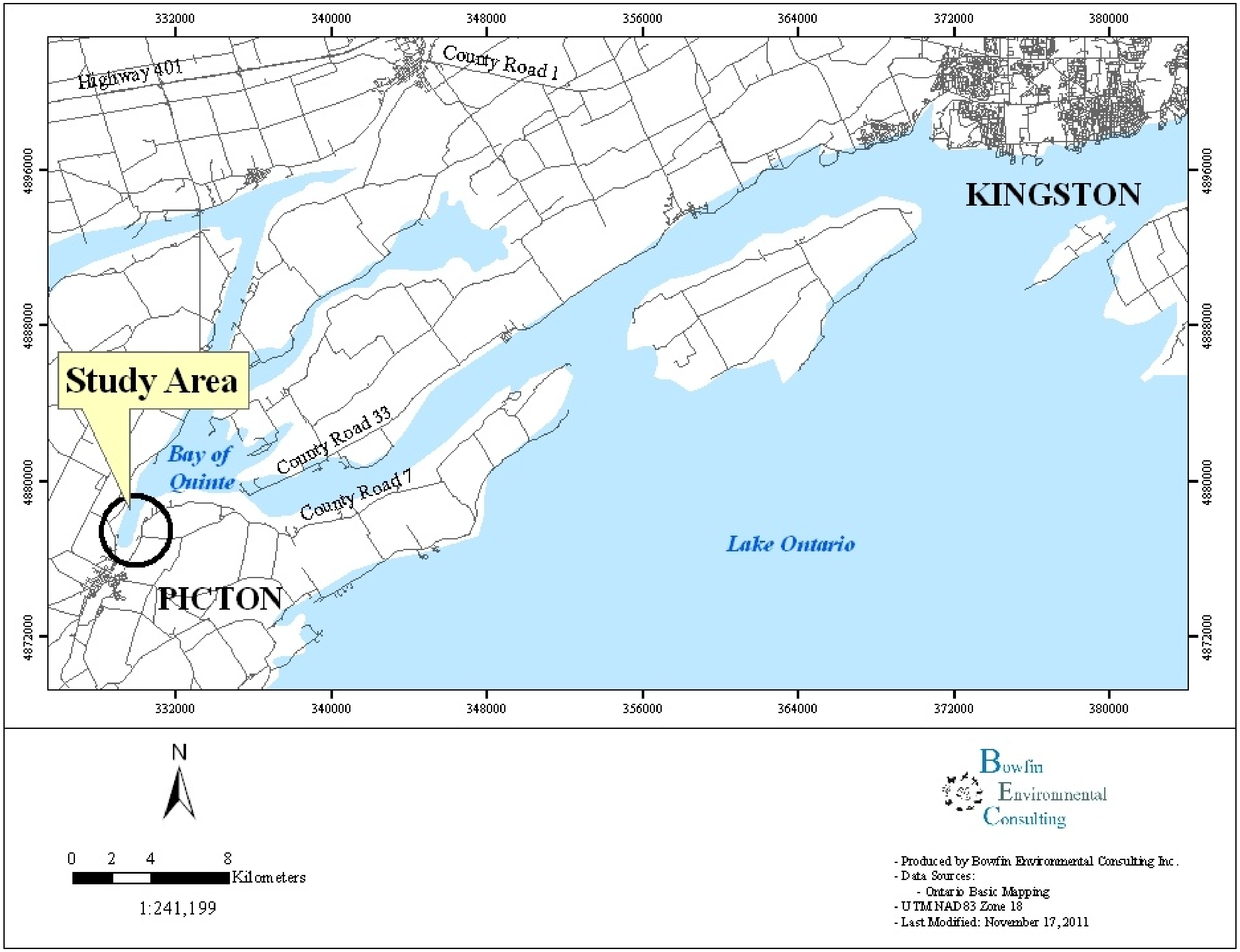
The Corporation of the County of Prince Edward, hereafter referred to as the Proponent, is proposing to construct a new water intake for the existing facility in Picton, Ontario. The Picton Water Treatment Plant (WTP) is located along the shore of Picton Bay at the end of Spencer Street. This facility services the Town of Picton and the Village of Bloomfield. Originally built in 1928, the facility has recently undergone upgrades and is expected to be in operation for a minimum of 25 years. After which time a new facility could be built.

The existing WTP can obtain its raw water from one of two existing intakes; referred to as the north and south intakes. The north intake is frequently plugged and is not outfitted with any means to control zebra mussels as such typically only the south intake is utilized. The intake lengths are approximately 305 m and 91 m for the north and south, respectively. Both are located in 3.3 m deep water. The proponent would like to investigate the requirements for a new intake.

R.V. Anderson Associates Limited was retained to complete a Class EA and engineering assignment with the goal of determining the preferred location of a new intake, the design of the intake and identifying the requirements for a piped connection for a new raw water well. Bowfin Environmental Consulting (Bowfin) forms part of the environmental assessment team and will be providing information and assessment of the natural environment.

This report provides a summary of the background data summarizes the existing conditions based on field surveys completed in 2011 and begins to identify potential constraints and sensitive natural environmental features in order to assist with route selection. Final mitigation measures and impact assessment will be completed during the detailed design stage.

Figure 1 Location of Study Area



1.1 Project Area Description

The study area is located in Picton, Ontario approximately 40 km west of the city of Kingston (Figure 1). The existing WTP is situated on the shores of the Bay of Picton which forms part of the Middle Bay of the Bay of Quinte. The Bay of Quinte is located on the northeastern shores of Lake Ontario, within the eastern basin of the lake. The Bay of Quinte is approximately 100 km long and has a maximum width of 2 km. The surficial area of the Bay of Quinte is 254 km^2. The average water depth within Middle Bay is 3.5 to 5.2 m (OMNR 2010). Fish movement between the Picton Bay and Lake Ontario is unhindered.

During Phase 1, there were four proposed options considered for the new intake. These were referred to as options 1, 2a, 2b and 3. The total length of each option was roughly 1400 m, 1700 m, 2700 m and 2500 m, respectively. The entire routes for options 1, 2a and 3 were in-water; option 2b included a 2200 m long watermain along the eastern shore. The intakes for options 1, 2a and 2b were at a water depth of 6.5 m and Option 3 of 10 m (Figure 2). These options have been changed based on a review of the Phase 1 technical reports.

There are now three route alignment options and one new intake option. The new intake would be located at a depth of approximately 7 m. The new alignments are described below. The routes of both the old and new options are depicted on Figure 2. From this point forward the options will be referred to as Options 1, 2 and 3 and only these the new options will be discussed (Figure 3).

Option 1 would consist of a route that is entirely in-water. The pipeline length would be approximately 1.8 km. The route travels north from the existing WTP.

Option 2 would follow County Road 49 veering to the east to reach the shoreline. The watermain portion is approximately 2.4 km in length and the in-water portion approximately 0.5 km long. Note that this option was not considered during Phase 1 and as such the terrestrial mapping was completed by satellite imaging interpretation. Also note that there is little information available for the nearshore habitats for this option; however the offshore area was surveyed.

Option 3 would begin in-water veering to the east from the existing WTP for approximately 0.2 km. The route would then continue on-land heading north on the Loyalist Parkway before turning back to the west. The watermain portion would be approximately 2.6 km in length. The route would then continue another 0.7 km offshore until reaching the proposed location of the new intake. Note that this option is similar to the old Option 2b.

Figure 2 Comparison of the Old and New Route Alignments

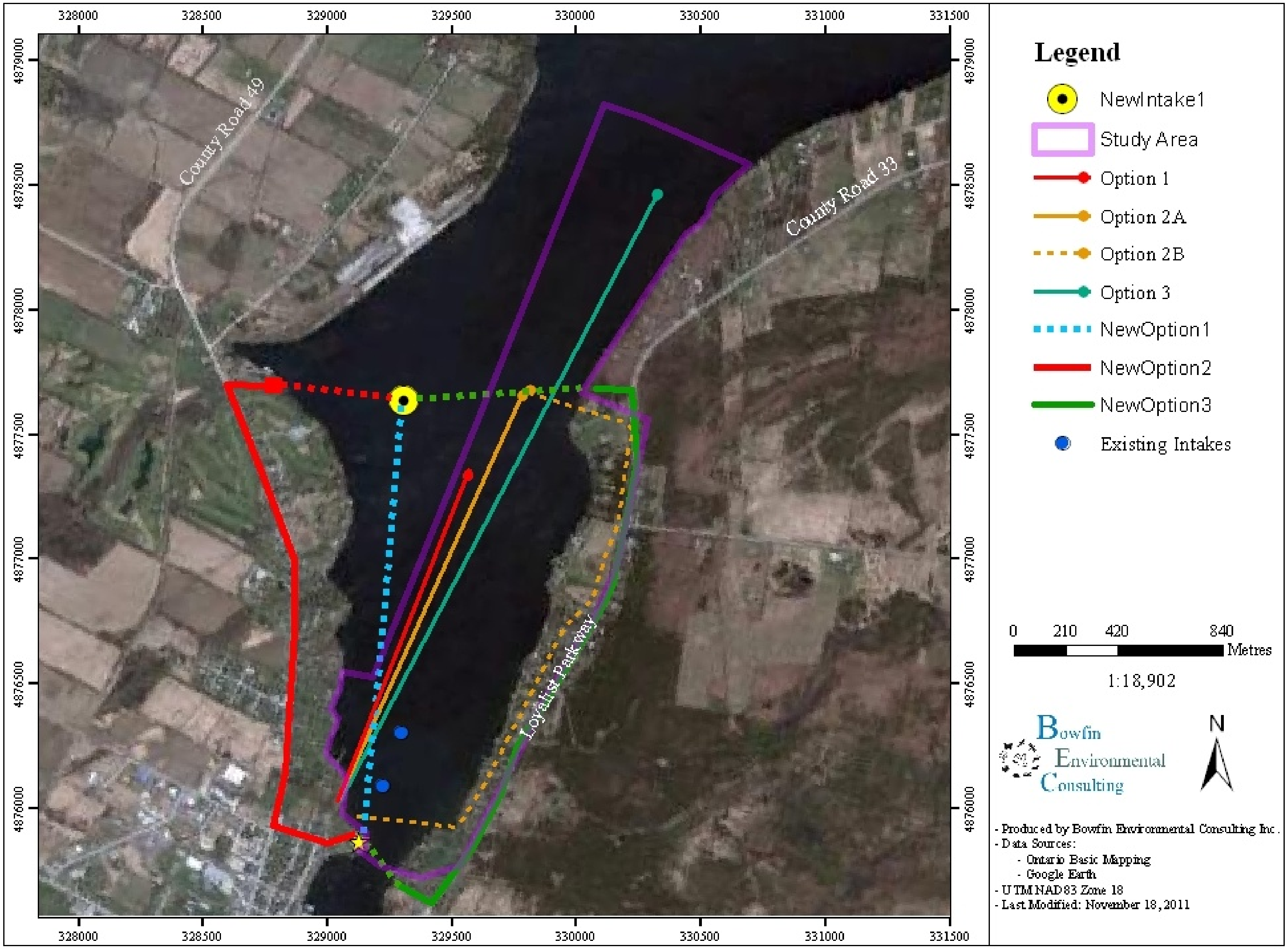
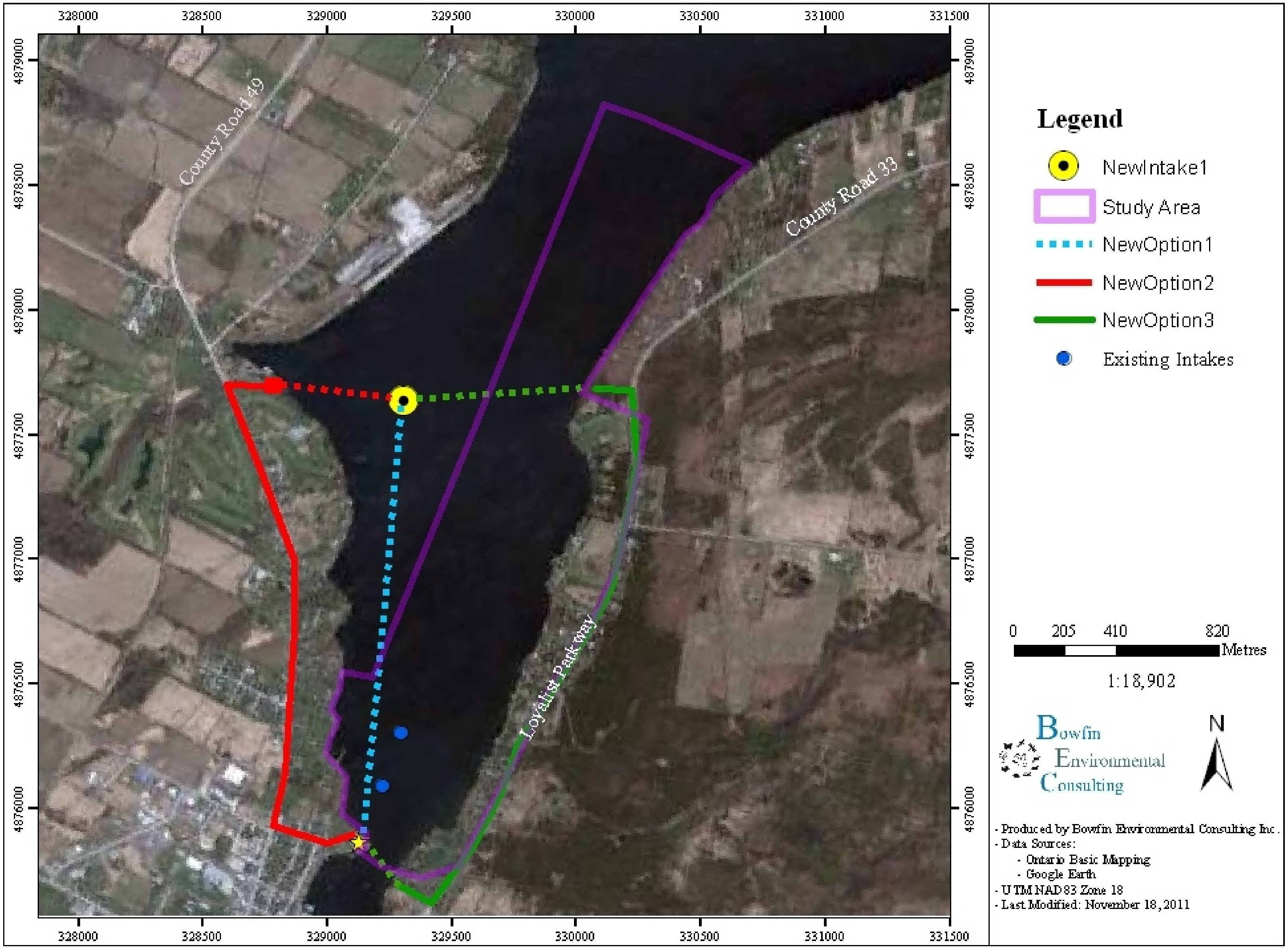


Figure 3 Proposed Route Alignments under Consideration for Phase 2



2.0 METHODOLOGY

2.1 Review of Background Information

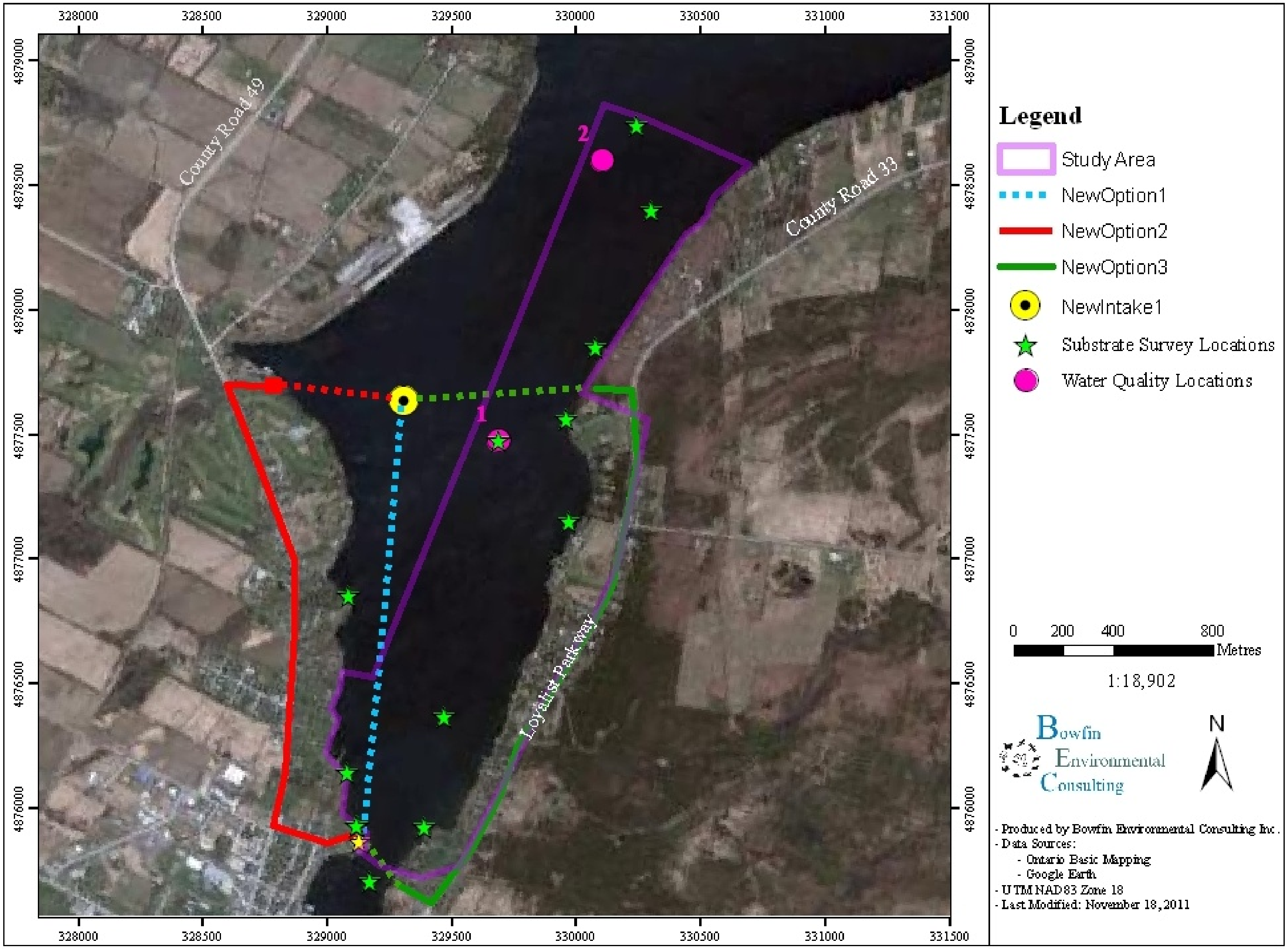
A review of available background information was conducted in order to identify potential environmental concerns and to supplement the data gathered by Bowfin. This included identifying natural heritage features within the project area including: the habitat of endangered or threatened species, significant wetlands, fish habitat, significant areas of natural and scientific interest, significant woodlands, and significant wildlife habitat. Background information was requested from the Peterborough District of the Ontario Ministry of Natural Resources (OMNR), Land Information Ontario (LIO) and Quinte Conservation Authority (QCA). Databases related to natural features were searched and analyzed, including: Natural Heritage Information Centre (NHIC), Make-a-Map, Ontario Crown Land Use Atlas, Ontario Renewable Resource Atlas, Atlas of Breeding Birds of Ontario (ABBO), and Conservation Ontario.

2.2 Habitat Description

2.2.1 Aquatic Habitat

An investigation into the types of in-water habitats located within the study area was completed in order to provide input on the preferred location and potential impacts of the proposed intake. This was completed by boating through the area with Humminbird side scan sonar. The images from the sonar were interpreted in order to describe the cover and substrate types. The area was surveyed twice; once during the early spring prior to aquatic vegetation growth and once during late summer near the end of the growing season. The substrate types were confirmed using a small grab and an underwater video camera (Figure 4). The aquatic vegetation was described from information collected during visual observations at the surface and with the Hummingbird. The fish habitat description was based on the methodologies described in *Productive Capacity of Littoral Habitats in the Great Lakes: Field Sampling Procedures (1988-1995)* by Valere (1996). This includes the collection of the following information: aquatic vegetation community description, riparian vegetation description, substrate, presence/absence and identification of structure and topography (onshore and offshore). The information collected was used to produce a map illustrating the habitat types encountered. Water quality data (dissolved oxygen, temperature, turbidity) was also recorded. Note that while only the shoreline within the study area was mapped, the offshore survey included the entire bay from east to west (including the area where the new Option 2 would travel in-water).

Figure 4 Location of Sediment Samples and Water Quality Sites



2.2.2 Terrestrial Habitat Description

A general description of the habitat along the watermain route of Option 3 was collected by walking along the roadside and by boating along the shoreline. Note that since the location of the watermain route is unknown at this time, no effort was made to contact private landowners to gain access to their properties. Also note that Option 2 was proposed following the completion of field work and as such no field visits were made to this alignment. The habitat mapped along Option 2 was completed by satellite imaging interpretation.

Vegetation community types were determined based on the appropriate methodologies such as: *Ontario Wetland Evaluation System, Southern Manual* (OWES) for wetland habitats and the *Ecological Land Classification for Southern Ontario* (ELC) for terrestrial habitats. Nomenclature used in this report follows the Southern Ontario Plant List (Bradley, 2007) for both common and scientific names which are based on Newmaster *et al.* (1998). Authorities for scientific names are given in Newmaster *et al.* (1998).

2.3 Incidental Wildlife Observations

While no community sampling or specific surveys were completed any incidental observations of wildlife was recorded during the site visits.

3.0 BACKGROUND REVIEW

The background review of the available on-line databases indicated that there are no known provincially significant wetlands (PSW), provincial parks, ANSIs, provincial wildlife area, or significant woodlands in or within 120 m of the study area. Mapping provided by LIO was combined with information taken from the Official Plan and communications with Peterborough District MNR and is depicted on Figure 5 and summarized in Table 1.

Option 2 is located within 80 m of an area designated as Environmental Protection on Schedule E of the Prince Edward County Official Plan. This area is identified as a swamp on mapping provided by LIO (Figure 5).

The Napanee Limestone Plain Important Bird Area (IBA) located to the north (1.1 km) is listed as having an important grassland and alvar bird habitat (Figure 5). While there was no significant wildlife habitat indicated within this area, the potential for habitat of SAR or of conservation value exists and is discussed in Section 5.1 and 5.3.

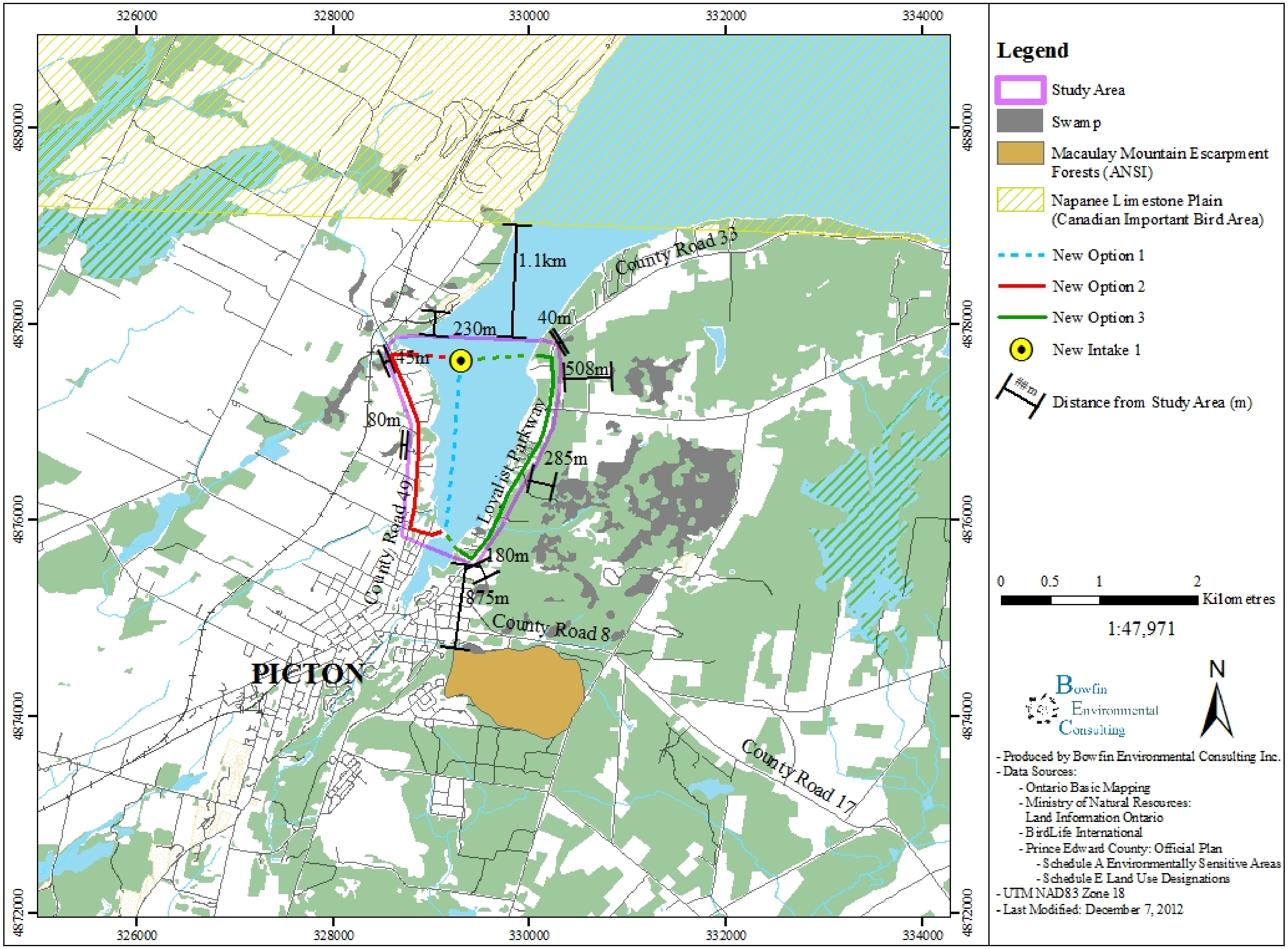
Table 1 Summary of Available Background Information on the Existing Natural Features Located on the Subject Lands or the Adjacent Lands

Natural Heritage Feature	Present within Study Area	Present on Adjacent Lands (120m)
Provincially Significant Wetlands	No	No
Unevaluated Wetlands	No	Yes Several unevaluated wetland swamp communities were identified on the mapping provided by LIO (Figure 5). MNR Peterborough indicated that an unevaluated wetland is present in Lot 18, Conc. SE of the Carrying Place (along Loyalist Road).
Areas of Natural and Scientific Interest (ANSIs)	No	No Macaulay Mountain Escarpment Forest is over 120 m from the study area.
Habitats or species designated by ESA (provincially)	Potential is discussed in Section 5.1.	
Habitats designated or proposed of rare, vulnerable, threatened or endangered birds and fish (federal)	Potential is discussed in Section 5.3.	
Fish Habitat	Yes MNR has provided the following information: • Walleye fishery is present in Picton Bay. • Picton Bay is a cold water. • Potential spawning habitat for walleye, whitefish, largemouth bass and other species. • No known fish sanctuaries are present. • Un-named tributary to Picton Bay is situated in Lot 18,	

Natural Heritage Feature	Present within Study Area	Present on Adjacent Lands (120m)
	Conc. SW of the Carrying Place. No fish information is available for this tributary.	
Significant Woodlands	No	Woodlands are found adjacent to Option 3. Peterborough MNR has indicated that there is a potential for deer wintering habitat to be present in the woodlands however there is no designated deer wintering areas in this location.
Significant Valleylands	No	No
Significant Wildlife Habitat (SWH)	None confirmed. MNR has indicated the potential for the eastern shoreline of Picton to provide SWH.	No

Sources of background information: Make-a-Map, LIO mapping provided following a request made directly to LIO, Renewable Energy Atlas, Atlas of Breeding Birds of Ontario Website, OP (Prince Edward), Google Satellite Imaging, and as verified during site investigations

Figure 5 Summary of Natural Features Located in or near the Project Area (based on background information)



3.1 Habitat and Community Information

As indicated above, the study area is located within Picton Bay, Bay of Quinte. The maximum water depths indicated on the navigation chart 2069 is 10 m. The information on the chart indicates that the gradient is gentle and the only structure noted was Conger Shoal (located on the northwest side of the study area). The Bay of Quinte is managed as a warm and cold water fishery and has an in-water timing constraint from September 15th till June 30th, inclusive (no in-water work during this time period) (MNR Peterborough).

QCA officials indicated they had little fisheries information on the EA project area. There were no species at risk (SAR) mapped for the study area on the Quinte Conservation Map 5 from the Conservation Ontario website.

A list of 50 species known or believed to be present in the Bay of Quinte was developed using the information provided by the LOMU annual reports and information provided by MNR Peterborough (Table 2). The majority of these species consists of common sport and panfish as well as forage fish species with the exceptions of: silver lamprey, lake sturgeon, river redhorse and American eel. These exceptions are discussed further in sections 5.1 and 5.3 of this report.

Since the Bay of Quinte forms part of the eastern basing of Lake Ontario, a complete species list for Lake Ontario was obtained from LOMU and will be considered as potentially occurring within the EA study area. A list of 113 species from Lake Ontario was compiled from information provided by LOMU and is provided in Appendix A. The list includes an additional 9 fish species with SAR or special concern ranking: spotted gar, grass pickerel, chain pickerel, lake chubsucker, pugnose shiner, bridle shiner, silver chub, channel darter and deepwater sculpin. These exceptions are discussed further in sections 5.1 and 5.3 of this report.

Table 2 List of Fish Species Known to Occur within Bay of Quinte

Species Name	Scientific Names	Trophic Class	Thermal Regime	Federal Status	Provincial Status	SRank
silver lamprey	*Ichthyomyzon fossor*	parasitic	cool/warm	SC	SC	S3
sea lamprey	*Petromyzon marinus*	parasitic	cold			SNA
lake sturgeon	*Acipenser fulvescens*	insectivore	cold/cool		THR	S2
longnose gar	*Lepisosteus osseus*	piscivore	warm			S4
bowfin	*Amia calva*	piscivore	warm			S4
alewife	*Alosa pseudoharengus*	planktivore	cold			SNA
gizzard shad	*Dorosoma cepedianum*	planktivore/omnivore	cool			S4
chinook salmon	*Oncorhynchus tshawytscha*	piscivore	cold			SNA
Atlantic salmon	*Salmo salar*	piscivore	cold			S1
brown trout	*Salmo trutta*	piscivore	cold/cool			SNA
lake trout	*Salvelinus namaycush*	piscivore	cold			S5
lake whitefish	*Coregonus clupeaformis*	insectivore	cold			S5
lake herring	*Coregonus artedi*	planktivore	cold			S5
rainbow smelt	*Osmerus mordax*	planktivore	cold			S5
northern pike	*Esox lucius*	piscivore	cool			S5
mooneye	*Hiodon tergisus*	generalist	cool/warm			S4
white sucker	*Catostomus commersoni*	insectivore / omnivore	cool			S5
silver redhorse	*Moxostoma anisurum*	insectivore	cool			S4
shorthead redhorse	*Moxostoma macrolepidotum*	insectivore	warm			S5
river redhorse	*Moxostoma carinatum*	insectivore	cool	SC	SC	S2
common carp	*Cyprinus carpio*	omnivore	warm			SNA
golden shiner	*Notemigonus crysoleucas*	omnivore	cool			S5
emerald shiner	*Notropis atherinoides*	insectivore	cool			S5
common shiner	*Luxilus cornutus*	insectivore	cool			S5

Species Name	Scientific Names	Trophic Class	Thermal Regime	Federal Status	Provincial Status	SRank
spottail shiner	*Notropis hudsonius*	insectivore	cold/cool			S5
brown bullhead	*Ameiurus nebulosus*	insectivore	warm			S5
channel catfish	*Ictalurus punctatus*	insectivore/piscivore	warm			S4
stonecat	*Noturus flavus*	insectivore	warm			S4
American eel	*Anguilla rostrata*	piscivore/insectivore	cool		END	S1?
banded killifish	*Fundulus diaphanus*	insectivore	cool			S5
burbot	*Lota lota*	piscivore	cold/cool			S5
threespine stickleback	*Gasterosteus aculeatus*	insectivore	cold			S4
trout-perch	*Percopsis omiscomaycus*	insectivore	cold			S5
white perch	*Morone americana*	insectivore	warm			SNA
white bass	*Morone chrysops*	insectivore/piscivore	warm			S4
rock bass	*Ambloplites rupestris*	insectivore / piscivore	cool			S5
pumpkinseed	*Lepomis gibbosus*	insectivore	warm			S5
bluegill	*Lepomis macrochirus*	insectivore	warm			S5
smallmouth bass	*Micropterus dolomieui*	insectivore / piscivore	warm			S5
largemouth bass	*Micropterus salmoides*	insectivore / piscivore	warm			S5
black crappie	*Pomoxis nigromaculatus*	insectivore / piscivore	cool			S4
yellow perch	*Perca flavescens*	insectivore / piscivore	cool			S5
walleye	*Stizostedion vitreum*	piscivore	cool			S5
johnny darter	*Etheostoma nigrum*	insectivore	cool			S5
logperch	*Percina caprodes*	insectivore	cool / warm			S5
brook silverside	*Labidesthes sicculus*	insectivore	cool/warm			S4
freshwater drum	*Aplodinotus grunniens*	insectivore	warm			S5
mottled sculpin	*Cottus bairdi*	insectivore	cold			S5
slimy sculpin	*Cottus cognatus*	insectivore	cold			S5
round goby	*Neogobius melanostomus*	insectivore	cool			SNA

(Christie, 1973; Coker et al. 2001; Cumore-Vokey and Crossman, 2000; Eakins, 2009; MTO, 2006, OMNR 2010)

List Updated November 14, 2011

SRANK DEFINITIONS

S1 Critically Imperiled, Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2 Imperiled, Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3 Vulnerable, Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4 Apparently Secure, Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5 Secure, Common, widespread, and abundant in the nation or state/province.
SU Unrankable, Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNA Not Applicable, A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#S# Range Rank, A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
? Inexact Numeric Rank—Denotes inexact numeric rank

SARO STATUS DEFINITIONS

END Endangered: A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA.
THR Threatened: A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
SC Special Concern: A species with characteristics that make it sensitive to human activities or natural events.

SARA STATUS DEFINITIONS

END Endangered, a wildlife species facing imminent extirpation or extinction.
THR Threatened, a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
SC Special Concern, a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

4.0 FIELD SURVEY RESULTS

This section provides a summary of the habitat description for the aquatic and terrestrial environments as well as the incidental wildlife observation. The data was collected on June 15th and August 31st, 2011. A summary of the field conditions is listed in Table 3.

Table 3 Summary of Dates, Times of Site Investigations

Date	Start time	End time	Total No. of Staff Hours	Air Temperature (min-max) °C	Weather
June 15, 2011	0800h	1430h	13.0	25.0 (10.2-25.0)	Clear skies, light air
August 31, 2011	0830h	1445h	14.5	25.0 (14.9-25.0)	Overcast, light air

Min-Max Temp taken from: Environment Canada. 2011. National Climate Data and Information Archive - [Online] Available: http://www.climate.weatheroffice.gc.ca [October 31, 2011].

4.1 Aquatic Environment

4.1.1 Water Quality

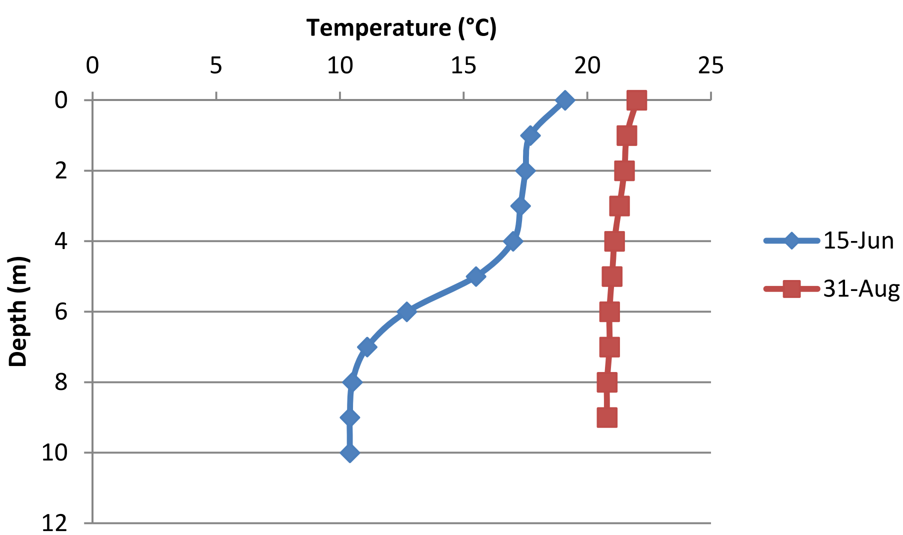
Water quality information recorded consisted of water temperature, conductivity, total dissolved solids (TDS), pH and dissolved oxygen (DO) were recorded during both visits and are summarized in Table 4 and Figures 6 and 7. Overall these values were consistent throughout the sampling period. Of the parameters sampled, Provincial Water Quality Objective guidelines exist for pH and DO; the results fell within the acceptable ranges.

Table 4 Water Quality Results

DATE	TIME	DEPTH (m)	D.O. (mg/L)	Water Temp. (°C)	AIR TEMP. (°C)	Conductivity (µs)	TDS (ppm)	pH	Secchi (m)	Max. Depth (m)
15-Jun-11	1130h	surface	10.10	19.1	25	216	132	7.57	3.75	10.6
31-Aug-11	1318h	surface	8.98	22	25	273	139	8.23	2	9

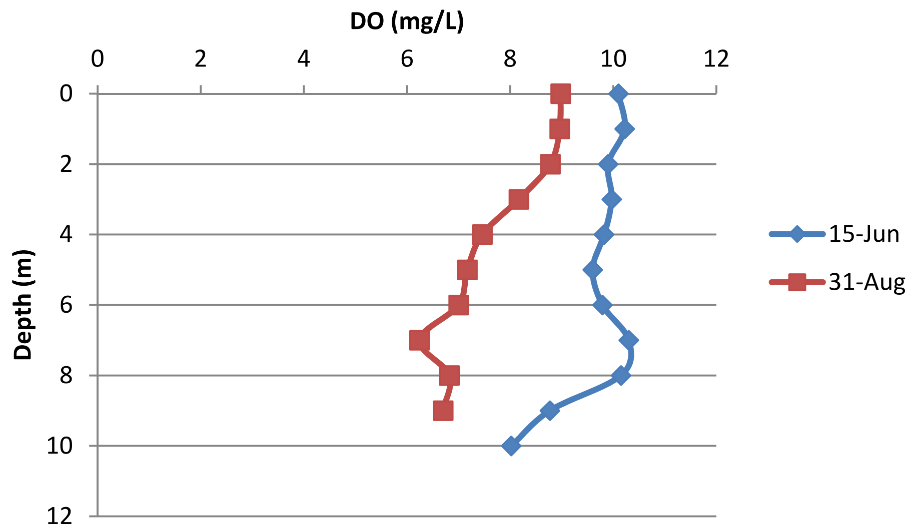
A small thermocline was observed on the June 15th visit, with surface waters temperature of 19°C and the waters at depth of 10°C. No thermocline was observed during the August visit (Figure 6).

Figure 6 Water Temperature Profiles, 2011



The DO profile indicated a slight change in water temperature between the surface readings of 9-10 mg/L and the readings at depth of 6-8 mg/L (Figure 7).

Figure 7 Dissolved Oxygen Profiles, 2011



4.1.2 Aquatic Environment (Riparian and In-water)

The land is developed on both sides of the bay with residential and commercial properties. The majority of the eastern shoreline consisted of landscaped yards, though some residential properties on the northern end of the study area were still forested (Photos 1 & 2). Various shoreline protection measures were observed, such as cement retaining walls, gabion baskets and boulders (Photos 3 & 4).

The shoreline was also heavily developed on the western side however, the presence of the escarpment limited shoreline access along much of the area and as such there is a larger treed riparian area on the western side (Photos 5 & 6). A golf course is present on the northern end of the western shoreline.

Photo 1 Landscaped residential area with rock protection of banks, east shore, June 15, 2011

Photo 2 Forested shoreline, with hidden residences, east shore, June 15, 2011.

Photo 3 Concrete retaining wall along residential property, east shore, June 15, 2011

Photo 4 Boulder protection along eastern shoreline, June 15, 2011

Photo 5 Landscaped yards on western shoreline, June 15, 2011.

Photo 6 Bedrock escarpment on western shore, June 15, 2011

There was one tributary located on the south western side of the study area (Figure 8). This tributary is not accessible to fish from Picton Bay as the result of the suspended culvert (Photo 7). Note that base mapping identifies another tributary further to the north along Option 3. This tributary was not surveyed.

Photo 7 Confluence of western tributary with Picton Bay, June 15, 2011

The tributary noted in the background review from MNR in Lot 18 Conc. SE of Carrying Place is piped to the west of Loyalist Parkway (Photo 8).

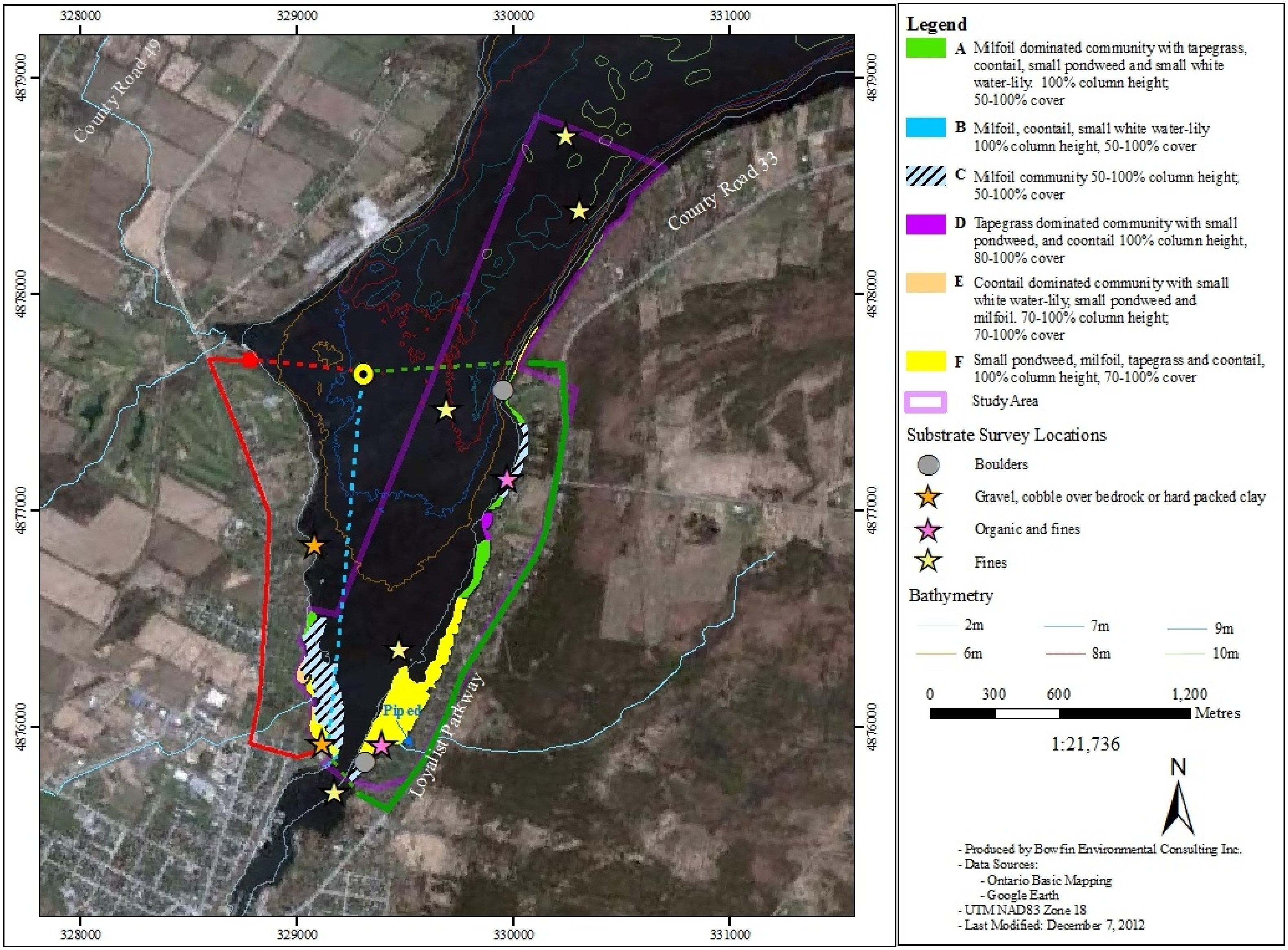
Photo 8 Looking towards Picton Bay. Tributary would be located on the right side of the photograph, June 15, 2011.

The topography of Picton Bay, within the study area, was fairly flat with the water depth varying from 2 m to 10 m over a south to north distance of 2 km. The substrate was fairly consistent and with the exception of the long, narrow bay on the southeastern side, the penetration of the grab was poor. Suggesting that the substrate consisted of fine layer of fines over bedrock or hard pan clay. The survey points on the western shore consisted primarily of gravel, cobble with some fines over flat bedrock or flat hardpan clay (Figure 8). The center of the bay and the northern portion of the eastern side contained a shallow layer of fines, primarily silty (Figure 8). As mentioned above, the substrate included a deeper layer of organic with fines in the nearshore area of the long, narrow bay on the southeastern side. Scattered boulders where also observed at the north and south end of this bay.

The aquatic vegetation within Picton Bay was limited to roughly the 2 m depth contour (Figure 8). This coincides with the secchi depth readings described above of 2-3.7 m (Table 4). The largest communities were located on the southern side of the study area where the 2 m contour was as far as 188 m from shore. There were three primary vegetation communities which were all submergent. The largest community was dominated by small pondweed with Eurasian milfoil, tapegrass, and coontail. The vegetation within this community reached the surface and provided 70-100% cover. The second community was almost exclusively milfoil and varied in height from 50% of the water column to surface and provided 50-100% in-water cover. The third community was also dominated by milfoil but contained other species (tapegrass, coontail, small pondweed and small white water-lily). This community reached the surface and provided 50-100% cover.

Two other smaller communities are described. One was dominated by tapegrass and also contained small pondweed and coontail. The vegetation reached the surface and provided 80-100% cover. The other was a very narrow band of vegetation along the edge of the northeast side of the study area. This community primarily consisted of coontail but also contained small white water-lily and small pondweed. Here the vegetation reached 70% of the column height up to the surface and provided 70-100% cover.

Figure 8 Aquatic Habitat Mapping (note that the study area for the aquatic vegetation communities focused on the eastern shore)



4.2 Terrestrial Environment

As mentioned above, the terrestrial habitat along both sides was highly developed primarily by residences. Those on the eastern side were mostly fully landscaped to the shore however there remained a few areas with thicket and deciduous forest habitats. These areas are described below. A list of the plant species observed is provided in Appendix B. Note that the western terrestrial habitat was not walked as this option was added to the proposed alignments following the completion of the field work.

4.2.1 Residential Habitat (eastern side)

The residential areas consisted of manicured lawns with native and ornamental plantings up to and / or including the roadside ditch (Photos 9-11). The vegetation within the ditches was dominated by: grasses, reed canary grass, chicory, bird's foot-trefoil, teasel, wild carrot, and catnip.

Photo 9 Residential Area (June 15th, 2011)

Photo 10 Residential Area (August 31st, 2011)

Photo 11 Residential Area (August 31st, 2011)

4.2.2 Deciduous Forest (eastern side)

The deciduous forest canopy was dominated by sugar maple followed by Manitoba maple. The canopy height was 5-8 m tall and canopy cover was 80%. The understory was 3 m tall and dominated by sugar maple followed by common buckthorn, and staghorn sumac. The ground cover consisted of grasses, Canada goldenrod, and poison ivy.

Photo 12 Deciduous Forest - Sugar Maple (August 31st, 2011)

Photo 13 Deciduous Forest - Sugar Maple (August 31st, 2011)

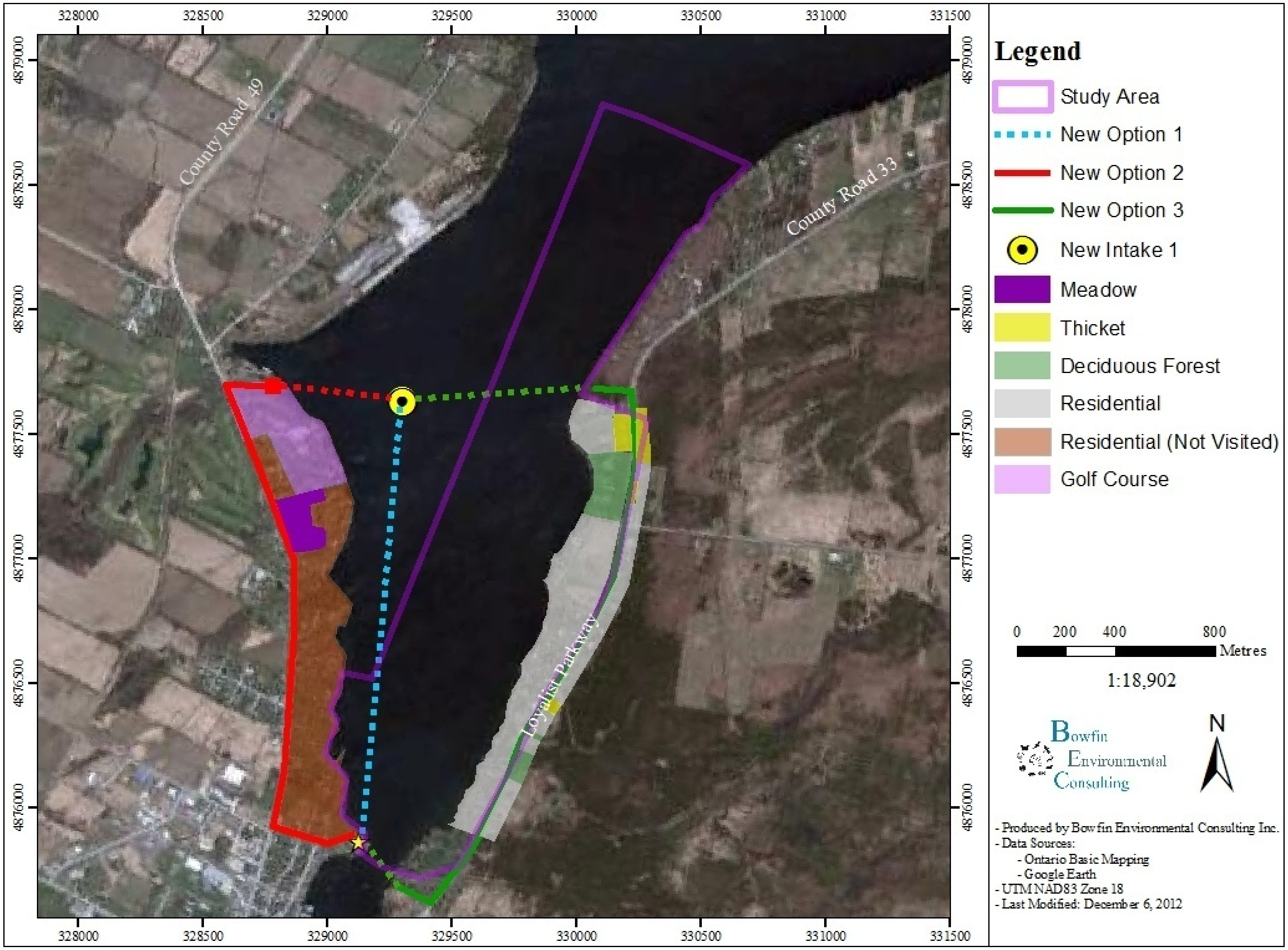
4.2.3 Thicket (eastern side)

The thicket habitat was primarily dominated by staghorn sumac with varying amounts of common buckthorn and wild red raspberry. Some thickets also included tree species (always less than 25%). These species included: red cedar, bur oak, sugar maple, Manitoba maple, American elm and black maple. The most common ground vegetation species were: grasses, bladder campion, bittersweet nightshade, Canadian goldenrod, poison ivy, wild carrot and bird's foot-trefoil. Wild grape and Virginia creeper was also present as were ornamental species such as lilacs.

Photo 14　　Thicket 1 (June 15th, 2011)

Photo 15　　Thicket 2 (August 31st, 2011)

Figure 9 Terrestrial Habitat Mapping



4.3 Incidental Wildlife Observations

During the two site visits, 35 species were observed including 4 fish species, 1 butterfly, 1 turtle and 29 birds (Table 5). All of the species are commonly observed with the exception of northern map turtle. The northern map turtle is a Special Concern species both provincially and federally. This species is known to occur within Picton Bay. The majority of the sightings were located outside of the study area, within the marina; however one small turtle was observed basking within the study area on the eastern shore (Figure 10). The monarch butterfly is also worth noting as it is a species listed as Special Concern both provincially; this species was observed during the August visit.

Other observations include a local fishing spot for walleye (shown on Figure 10) and breeding Canada geese and mallards.

Table 5 List of Fauna Observed during the Site Visits

Common Name	Scientific Name	Srank	Provincial Status (SARO)	Federal Status (SARA)
FISH				
Common Carp	*Cyprinus carpio*	SNA		
Bullhead sp.	*Ameiurus sp.*			
Pumpkinseed	*Lepomis gibbosus*	S5		
walleye / sauger	*Sander vitreum / canadense*			
BUTTERFLIES				
Monarch	*Danaus plexippus*	S2N, S4B	SC	SC
REPTILES				
Northern Map Turtle	*Graptemys geographica*	S3	SC	SC
BIRDS				
Double-crested Cormorant	*Phalacrocorax auritus*	S5B		
Great Blue Heron	*Ardea herodias*	S4		
Turkey Vulture	*Cathartes aura*	S5B		
Canada Goose	*Branta canadensis*	S5		
Mallard	*Anas platyrhynchos*	S5		
Osprey	*Pandion haliaetus*	S5B		
Ring-billed Gull	*Larus delawarensis*	S5B, S4N		
Common Tern	*Sterna hirundo*	S4B		
Great Horned Owl	*Bubo virginianus*	S4		
Mourning Dove	*Zenaida macroura*	S5		
Belted Kingfisher	*Ceryle alcyon*	S4B		
Northern Flicker	*Colaptes auratus*	S4B		
Eastern Phoebe	*Sayornis phoebe*	S5B		
Blue Jay	*Cyanocitta cristata*	S5		

Common Name	Scientific Name	Srank	Provincial Status (SARO)	Federal Status (SARA)
American Crow	*Corvus brachyrhynchos*	S5B		
Purple Martin	*Progne subis*	S4B		
Tree Swallow	*Tachycineta bicolor*	S4B		
Black-capped Chickadee	*Poecile atricapilla*	S5		
Red-breasted Nuthatch	*Sitta canadensis*	S5		
American Robin	*Turdus migratorius*	S5B		
Gray Catbird	*Dumetella carolinensis*	S4B		
European Starling	*Sturnus vulgaris*	SNA		
Cedar Waxwing	*Bombycilla cedrorum*	S5B		
Yellow Warbler	*Dendroica petechia*	S5B		
Chestnut-sided Warbler	*Dendroica pensylvanica*	S5B		
Chipping Sparrow	*Spizella passerina*	S5B		
Song Sparrow	*Melospiza melodia*	S5B		
Common Grackle	*Quiscalus quiscula*	S5B		
American Goldfinch	*Carduelis tristis*	S5B		

Ranking and Status Updated: October 31, 2011

SRANK DEFINITIONS

S2 Imperiled, Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3 Vulnerable, Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4 Apparently Secure, Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5 Secure, Common, widespread, and abundant in the nation or state/province.
SNA Not Applicable, A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#S# Range Rank, A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
SAB Breeding accidental.
SAN Non-breeding accidental.
SZB Breeding migrants/vagrants.
SZN Non-breeding migrants/vagrants.
? Inexact Numeric Rank—Denotes inexact numeric rank

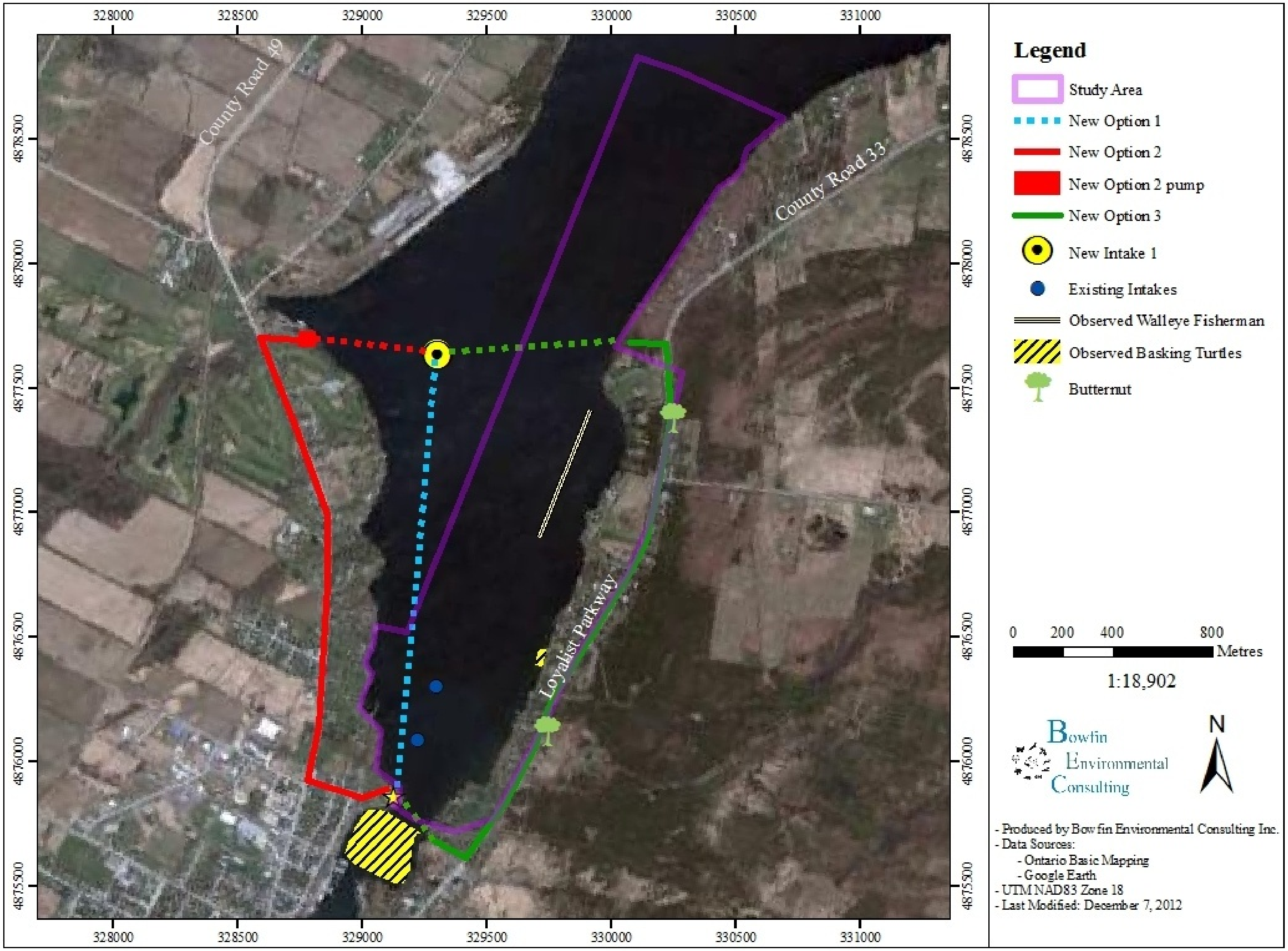
SARO STATUS DEFINITIONS

END Endangered: A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA.
SC Special Concern: A species with characteristics that make it sensitive to human activities or natural events.

SARA STATUS DEFINITIONS

END Endangered, a wildlife species facing imminent extirpation or extinction.
THR Threatened, a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

Figure 10 Location of Turtle Sightings, Fishing Spots and Butternuts



5.0 SIGNIFICANT NATURAL FEATURES

The combined results from the review of background information and the field visits confirmed that there are no provincially significant wetlands or ANSIs within the study area. The remaining natural features (habitat of endangered or threatened species, fish habitat, woodland and significant wildlife habitat) could occur and are discussed below.

5.1 Habitat of Species at Risk (Endangered or Threatened)

This section contains information on any species that are listed as Endangered or Threatened by the provincial and bird and fish listed as Endangered or Threatened by the federal governments (note with respect to the federal *Species at Risk Act*, only fish and bird species are protected outside of federal land). The only SAR sightings within the study area were the two butternuts, located on the east side of Loyalist Parkway (Figure 10). The search of the NHIC databases for the surrounding 30 km resulted in a list of 15 potential species: lake sturgeon, eastern musk turtle, Blanding's turtle, gray ratsnake, least bittern, king rail, common nighthawk, chimney swift, red-headed woodpecker, loggerhead shrike, bobolink, cerulean warbler, Henslow's sparrow, four-leaved milkweed and butternut (Table 6).

A search was made for the plant SAR to confirm their presence/absence within the project area, only the two butternuts were found (Figure 10). No other plant SAR is considered to occur within the study area.

Of the fauna listed in Table 6, five (least bittern, king rail, loggerhead shrike, bobolink and Henslow's sparrow) are not considered as occurring within the area of potential impact for Options 1 or 3, based on the habitats encountered and the locations of the proposed route alternatives for the intake. With regards to Option 2, least bittern, king rail and loggerhead shrike are considered unlikely to occur. The habitat on the west side of County Road 49 contains some agricultural lands which could provide habitat for the grassland species: bobolink and Henslow's sparrow. The one meadow polygon located on the western side near the north end of the alignment appears to be an abandoned field and is less than 3.5 ha in size and as such is too small to support these birds SAR with the possible exception of bobolink. Bobolink typically require larger areas however they have been found in smaller areas and sites which are 4 ha in size and larger usually need to be assessed during the breeding bird season. The remaining species are considered as potentially occurring.

Table 6 Potential SAR within the General Area (OMNR 2006, NHIC)

Common Name	Scientific Name	Preferred Habitat	Potential to Occur	SRANK	Provincial Status	Federal Status	Reference	Last Observed
FISH								
Lake Sturgeon	*Acipenser fulvescens*	Bottoms of lakes and large rivers.	Yes, all options.	S2	THR		COSEWIC 2000	
REPTILES								
Eastern Musk Turtle	*Sternotherus odoratus*	Shallow slow moving water with a soft substrate.	Yes, all options.	S3	THR	THR	Edmonds 2002	1987
Blanding's Turtle	*Emydoidea blandingii*	Shallow water, large marshes, shallow lakes or similar such water bodies.		S3	THR	THR	COSEWIC 2005	26/05/2004
Gray Ratsnake	*Pantherophis spiloides*	Deciduous forest and forest edge.		S3	THR	THR	Kraus et al 2010	1976
BIRDS								
Least Bittern	*Ixobrychus exilis*	Freshwater marshes, ditches, creeks, rivers and lakes with tall emegent vegetation	No	S4B	THR	THR	COSEWIC 2009	24/06/2002
King Rail	*Rallus elegans*	Variety of freshwater marshes and marsh-shrub swamp habitats		S2B	END	END	COSEWIC 2000	30/06/2005
Common Nighthawk	*Chordeiles minor*	Open habitats	Yes, all options	S4B	SC	THR	COSEWIC 2007	
Chimney Swift	*Chaetura pelagica*	Urban areas where they nest and roost in chimneys and other manmade structures.		S4B, S4N	THR	THR	Peterson 1980	
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Open deciduous woodland.		S4B	SC	THR	Peterson 1980	
Loggerhead Shrike	*Lanius ludovicianus*	Pastures, marginal farmland, and wetlands.	No	S2B	END	END	Environment Canada 2010	08/07/1979
Bobolink	*Dolichonyx oryzivorus*	Primarily in forage crops, and grassland habitat.	Option 2 only	S4B	THR		COSEWIC 2010	

Common Name	Scientific Name	Preferred Habitat	Potential to Occur	SRANK	Provincial Status	Federal Status	Reference	Last Observed
Cerulean Warbler	*Dendroica cerulea*	Deciduous forest, especially in river valleys.	Yes within adjacent lands of Option 3	S3B	THR	SC	COSEWIC 2003	25/06/1989
Henslow's Sparrow	*Ammodramus henslowii*	Weedy fields.	Option 2 only.	SHB	END	END	Environment Canada 2010	01/07/1996
PLANTS								
Four-leaved Milkweed	*Asclepias quadrifolia*	Dry to mesic deciduous forest.	Yes within adjacent lands Option 3.	S1	END		COSEWIC 2010	07/2010
Butternut	*Juglans cinerea*	Variety of sites, grows best on well-drained fertile soils in shallow valleys and on gradual slopes	Present along Option 3. Possibly present along Option 2.		END	END	COSEWIC 2003	

Ranking and Status Updated: December 5, 2012

SRANK DEFINITIONS

SH Possibly Extirpated (Historical), Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.

S1 Critically Imperiled, Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.

S2 Imperiled, Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.

S3 Vulnerable, Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 Apparently Secure, Uncommon but not rare; some cause for long-term concern due to declines or other factors.

SAB Breeding accidental.

SZB Breeding migrants/vagrants.

SARO STATUS DEFINITIONS

END	Endangered: A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA.
THR	Threatened: A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
SC	Special Concern: A species with characteristics that make it sensitive to human activities or natural events.

SARA STATUS DEFINITIONS

END	Endangered, a wildlife species facing imminent extirpation or extinction.
THR	Threatened, a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
SC	Special Concern, a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

5.2 Fish Habitat

The fish habitat encountered within Picton Bay consisted primarily of unvegetated deep water habitat suitable for pelagic species with the exception of the nearshore (up to a depth of near 2 m). The nearshore was well vegetated with submergent species such as small pondweed, Eurasian milfoil, coontail and tapegrass. The in-water cover was restricted to the submergent aquatic vegetation, a few boulders along the eastern shoreline, some of the bank protection and the drop-offs in the northern half of the study area.

The offshore gradient within Picton Bay had a gentle slope with the water depth varying from 2 m to 10 m over a south to north distance of 2 km. The substrate was fairly consistent with gravel, cobble and fines over bedrock or hard pan clay on the western side; fines over bedrock or hardpan clay through the centre and organic and fines within the long, narrow bay on the eastern side.

The shorelines on both sides were heavily developed and for the most part the riparian vegetation was restricted to manicured grass with native and ornamental plantings.

The western tributary traversed by Option 2 within the study area was not accessible to fish from the bay as a result of the height of the escarpment. The tributary located to the north of Option 2 was not surveyed. The eastern tributary located along Option 3 (Lot 18, Concession SE of the Carrying Place) was piped on the west site of Loyalist Parkway.

The background information lists 50 fish species as occurring within the entire Bay of Quinte. It is anticipated that many of these species could occur within the study area. While, at this time, additional information on known spawning habitat is unknown, it is anticipated that several species such as lake whitefish, alewife, golden shiner, emerald shiner, carp, brown bullhead, pumpkinseed, largemouth bass and yellow perch could utilize the area for spawning. The study area is noted as a trophy walleye fishery area and is also expected to provide nursery and foraging habitat for many species within the aquatic vegetation communities and foraging habitat for larger, pelagic species within the open water habitat. The area is also likely used by fish for migrations to and from Lake Ontario.

5.3 Significant Wildlife Habitat

The significant wildlife habitat for this project is considered as habitat that has been identified as seasonal concentrations of animals, highly diverse areas, rare vegetation communities or specialized wildlife habitat. This includes habitat of species of conservation value. While species of conservation value are not protected by the *Endangered Species* Act or the *Species at Risk Act* effort should be made to protect these species when present. During the review of background information, the only significant wildlife habitat identified was the IBA (Napanee Limestone Plain) and a common reed grass organic shallow marsh (S4 ranking). This IBA was listed as important for grassland and alvar bird species and its located 1.1 km from the study area. The mapping for the common reed grass marsh has been requested from OMNR Kingston; however based on the field investigations, this plant community is not considered as occurring within the study area and furthermore is not considered as being “rare” (S4 ranking).

The potential for the study area to provide habitat for species of conservation value[1] was also considered. A list of potential species was obtained from NHIC and is provided in Appendix C. During the field visits, searches for the presence of these species and any other that was not listed, were completed. The only species observed were the northern map turtle and monarch. The southern portion of the study area with the gentle banks and aquatic vegetation is considered as potential habitat for the turtle. The monarch was observed during early migration. The monarch is a large butterfly found typically in open habitats and migrates to Mexico for overwintering. In Canada, this species is closely associated with a variety of milkweed species which is feed upon by the larvae (Layberry et al 1998). No large concentrations of milkweeds were observed along Option 3 as such this option would not have any measurable impact on the monarch. Again, it is noted that should Option 2 be chosen then additional field work would be required.

5.4 Woodlands

The only potential significant woodlands within the study area are those located on the northeast shore and along the east side of the Loyalist Parkway. These areas would only be impacted should Option 3 be chosen and if its route travelled through these areas. As these sites are located on private property, no assessment of their significance has been completed at this time.

5.5 SUMMARY

During the background review and field visits to the bay and the eastern side the following natural environmental features were considered: habitat of endangered or threatened species, provincially significant wetlands, fish habitat, ANSIs, significant wildlife habitat and significant woodlands. During the process it was determined that there were no provincially significant wetlands or ANSIs within the study area. An Environmental Protection area was listed within

[1] Species of conservation value are those species which are listed as Special Concern provincially or federally or those species ranked as S1-S3 and not listed as Endangered or Threatened.

80 m to the west of Option 2 (on the western shore). LIO mapping indicates that this area is a swamp.

In terms of habitat of endangered or threatened species, the only confirmed habitat / species was the two butternuts located on the east side of Loyalist Parkway. However, the possibility of other SAR occurring exists (fish, turtles as well as birds which prefer deciduous forests, open habitat, and rural habitat). Additional field work would be required on the western side, should Option 2 continue to be considered.

The fish habitat was that located in Picton Bay which provides habitat for cold to warm water fish species. The diverse habitat with dense aquatic vegetation and soft substrates in the southern portion of the study area and fines and rocky substrate in the central and northern ends provides a variety of potential spawning habitat for such species as (but not limited to): alewife, gizzard shad, lake whitefish, bowfin, common carp, golden shiner, spottail shiner, rock bass, pumpkinseed, largemouth bass and yellow perch. The southern end with its dense macrophyte beds also provides nursery habitat.

The only significant wildlife habitat identified to date is that of the northern map turtle. The majority of this habitat is located outside of the study area; however the southern portion could provide habitat for this species.

The potential for significant woodlands to occur remains possible and should be considered during route selection.

There are currently three alignment options and one new intake option. It is recommended that the following areas be avoided as much as possible:

- All aquatic vegetation communities
- Nearshore habitat (shoreline to the 2 m contour)
- Forested or wooded areas
- Areas identified as being used by northern map turtle

It is also noted that additional field work would be required if Option 2 is chosen as the terrestrial habitat and nearshore areas have not been assessed for this route. Additional field work could also be required depending on the exact alignment of Option 3 (i.e. if the forested areas are to be impacted).

6.0 PRELIMINARY IMPACT ASSESSMENT

The construction of a new water intake has the potential to impact the terrestrial and aquatic habitats during the construction, operation and decommissioning phases. This section looks at the typical impacts that could occur based on the three route alignments and the location of the proposed new intake. Note this section is only a preliminary impact assessment and will need to be updated during the detailed design. The significance of the potential impacts may be positive or negative and can be measured using three different criteria:

1. Area affected may be:
    a. local in extent signifying that the impacts will be localized within the project area
    b. regional signifying that the impacts may extend beyond the immediate project area.

2. Duration of the impact was rated as:
    a. short term (construction phase, 1-1.5 years)
    b. medium term (2-4 years)
    c. long term (>4 years).
    d. repeated

3. Magnitude of the impact may be:
    a. negligible signifying that the impact is not noticeable
    b. minor signifying that the project's impacts are perceivable and require mitigation
    c. moderate signifying that the project's impacts are perceivable and require mitigation as well as monitoring and/or compensation
    d. major signifying that the project's impacts would destroy the environmental component within the project area.

The potential impacts associated with the construction, operation and decommissioning of a new water intake are discussed in the following sections. No effort is made at this time to analyze the impacts. This will be completed under detailed design phase; when the preferred option is chosen and the construction methods are known.

6.1 Potential Impacts during Construction Phase Outline

This section examines the potential impacts during construction of the new intake. At this time the construction method is not known and it is noted that the construction methodology may be different depending on the alignment chosen. This section may need to be updated as more information comes available. The net impact would be determined at the detailed design stage.

It is anticipated that one or more of the following activities would be required during the construction phase:

- De-watering may be required along the shoreline where the tie-ins are located
- Clearing of terrestrial vegetation at the tie-ins and along the watermains of Options 2 & 3
- Excavation, contouring and backfilling of upland habitat at the tie-ins and along the watermains of Options 2 & 3
- Dredging, tunneling and/or blasting for the construction of the in-water portions of the pipelines and for the construction of the intake
- Pouring of cement within nearshore or offshore (it is anticipated that all pouring will be completed onshore).

The potential impacts associated with these activities are:

1. Decrease in surface water quality
    a. Re-suspension of sediments during clearing, excavation and backfilling along the shorelines and during in-water dredging and/blasting;
    b. Introduction of cement during pouring.

2. Terrestrial Habitat and Species
    a. Disruption to wildlife and bird populations as a result of the loss of terrestrial habitat during clearing and excavation and / or increase in noise and light pollution;
    b. Impacts to terrestrial SAR (Endangered or Threatened, provincially and/or migratory birds listed federally); and
    c. Impacts to terrestrial species of conservation concern (SC, S1-S3).

3. Aquatic Habitat and Species
    a. Alteration, disruption and/or destruction to fish habitat through construction of the tie-ins, the in-water portions of the alignments and the new intake;
    b. Impacts to aquatic SAR (Provincially and/or Federally Listed as Endangered, Threatened); and
    c. Impacts to aquatic species of conservation concern (SC, S1-S3).

4. Accidents or malfunctions
    a. Spills from project machines during construction activities; and
    b. Spread of invasive species.

Several of these potential impacts may be reduced or eliminated through the use of mitigation measures. These mitigation measures are described below and are summarized in Tables 7-9.

6.1.1 Surface Water Quality

Summary and Potential Impact Analysis

Water quality may be impacted during the construction of the new intake and pipeline as the result of clearing, backfilling, contouring, excavation, dredging, tunneling and/or blasting. Additionally impacts could occur should cement be poured on site for the new intake.

Comparison of Impacts Associated with each Alternative

The potential to impact surface water quality increases with the increasing number of tie-ins and length of pipeline (Table 7). The options are colour coded with green being the lowest level of impact and red the highest.

Table 7 Ranking of Alternatives in Terms of Potential to Impact Surface Water

Option	Number of Tie-Ins	Length of Pipeline (km)
1	1	1.8
2	2	0.5
3	3	0.9

Typical Mitigation Measures

- Any in-water work along the shorelines would be completed in the dry;
- Offshore in-water work should be completed within turbidity curtains;
- Offshore in-water work should be suspended during periods of high wind events;
- Work activities within 30 m any waterbody will require the installation of sediment / erosion control measures, such as sediment fencing, to prevent the movement of suspended sediments outside of the work area.
- A sediment control plan would be submitted for regulatory approval prior to permitting.
- Isolated work areas would be dewatered using appropriate pumps; the water would be discharged over an appropriately sized vegetated area or to a sediment containment feature. A variety of methods are available to ensure that the water removed during dewatering does not create erosion or introduce suspended sediments upon its re-entry into the natural system. These include sediment bags at the end of the pump, rock check

dams, straw bale settling ponds or allowing the water to pass through a fully vegetated area.

  - The contractor would be responsible to ensure that the water re-entering the system is clean and does not cause erosion or the re-suspension of sediments.
  - An appropriate sediment monitoring program is recommended.

- Any removal of riparian vegetation should be minimized and removal should be completed using small machinery.
- Bank erosion may be reduced by leaving a minimum of 60 cm stump in place from trees removed along the shoreline, whenever possible.
- Any stock piles of soil or fill material would be stored at least 30 m from the river and protected by silt fencing.
- Additional materials (*i.e.* rip rap, filter cloth and silt fencing) should be readily available in case they are needed promptly for erosion and/or sediment control.
- The sediment fencing would not be removed until the terrestrial vegetation has become re-established.
- Both sediment fencing and the silt curtains would require maintenance.
- Monitoring of sedimentation outside of the sediment fencing and silt curtains should occur throughout the day.

6.1.2 Terrestrial Habitat and Species (including SAR and Species of Conservation Concern)

Summary and Potential Impact Analysis

Terrestrial Habitat

The amount of terrestrial habitat impacted is anticipated to be low regardless of the option chosen as much of the area is developed. However, loss of terrestrial vegetation could occur at any one of the tie-ins and along the two proposed options with watermains (Options 2 & 3). The habitat within the study area is primarily residential and commercial.

Terrestrial Flora

The potential impacts to terrestrial flora on the western side have not been assessed in the field. It is noted that the majority of this area is residential or forms part of the golf course. On the eastern side (Optioni 3), there were two butternuts observed, no other SAR or any species of conservation concern were found

Terrestrial Fauna

The majority of the construction activities would occur within an area that is already disturbed. Most impacts associated with the wildlife species are related to the change in habitat or through increased noise and light pollution during construction. No terrestrial SAR or species of conservation concern or their habitats were observed within the eastern side of the project area. Two small unevaluated wetlands, described as swamp by LIO, are located within 45 m and 80 m of Option 2.

Comparison of Impacts Associated with each Alternative

The potential to impact terrestrial habitats and species increases with the increasing number of tie-ins, proximity to natural habitats, and area and type of habitats cleared. At this time the area to be cleared is unknown as such the length of watermain is used for comparison purposes. [Note that the area cleared for the tie-in at the WTP will be the same or similar regardless of the option chosen]. The options are colour coded with green being the lowest level of impact and red the highest (Table 8).

Table 8 Ranking of Alternatives in Terms of Potential to Impact Terrestrial and Wetland Habitat and Species

Option	Number of Tie-Ins	Length of Watermain (km)	Types of Terrestrial Habitats to be Cleared for Watermain	Proximity to Natural Areas
1	1	0.0	none	none
2	2	2.4	*roadside, residential or golf course	**swamp, meadow, agricultural fields
3	3	2.6	*roadside, residential areas, woodland, butternut	**woodland, thicket

* This ranking is subjective at this time. Should all of the habitat to be cleared along either Option 2 or 3 consist entirely of disturbed areas (i.e. roadside, residential, golf course) and provided that no SAR or protected habitat of SAR is impacted, then there would be no difference in the ranking of these two alternatives.

** As the habitat along the western side has not been confirmed and since the value of the woodland on the eastern side and any natural habitat on the western side has been evaluated this item cannot be properly ranked.

Typical Mitigation Measures

The following mitigation measures should be considered in addition to those listed for surface water quality:

- The areas where the vegetation would be removed should be minimized and clearly delineated (i.e. snow fencing).
- No work within 25 m of a butternut unless it has been assessed and a conclusion on the potential to harm or kill the individual has been made and the appropriate measures followed as per MNR requirements. Note that no work which could harm or kill a retainable individual can be completed without having obtained the necessary approvals from MNR beforehand.
- Butternuts not intended for removal and that are within 25 m of the construction area shall be protected by placing snow fencing outside of their drip lines.
- Small equipment should be utilized in order to prevent harming woody vegetation not intended for removal.
- If possible the stumps (60 cm of trunk) should be left in place to maintain erosion control from any tree proposed to be removed from the banks and the top of the cliff.
- Where possible, re-vegetate with native vegetation following the completion of the construction phase.
- Removal of woody vegetation would not occur during the breeding bird season from April 15th to July 31st inclusive, unless a qualified biologist has searched the site for nests and concluded that no nests are present, no more than 5 days prior to clearing.
- When possible work should be completed during daylight.
- Vehicles and equipment should have the appropriate mufflers installed.
- Do not remove any vegetation along or within 30 m of the shoreline until appropriate erosion control measures have been erected.

Should any other SAR species or its protected habitat be encountered then additional mitigation measures / time constraints will likely be required.

6.1.3 Aquatic Habitat and Species

Summary and Potential Impact Analysis

The potential to impact the aquatic environment will be the same for all options in terms of the construction process and location of the new water intake. The potential during construction of the pipelines will be dependent on the number of tie-ins, area of impact (excavation, dredging), and sensitivity of area impacted. As with the terrestrial habitat, the area of impact to the aquatic environment is not known at this time and as such the ranking will be based on the length of pipeline.

Comparison of Impacts Associated with each Alternative

The potential to impact aquatic habitats and species increases with the increasing number of tie-ins, area and type of habitats cleared and sensitivities of habitats. At this time the area to be cleared is unknown as such the length of the pipelines is used for comparison purposes. [Note that the area cleared for the tie-in at the WTP and the impacts associated with the construction of the new intake will be the same or similar regardless of the option chosen]. There were no fish SAR or their protected habitats located within the study area. The potential impacts to spawning habitat can mostly be mitigated through the use of in-water timing constraints however it is noted that impacts to areas with aquatic vegetation will take longer to return to pre-construction conditions. That being said, the habitats are fairly uniform in terms of their value to aquatic fauna and there are no limited habitats.

The options are colour coded with green being the lowest level of impact and red the highest (Table 9).

Table 9 Ranking of Alternatives in Terms of Potential to Impact Surface Water

Option	Number of Tie-Ins	Length of Pipeline (km)	Types of Aquatic Habitats to be Affected	Sensitiveness
1	1	1.8	Milfoil dominated community (community C on Figure 8)	Fish spawning Turtle foraging and possibly overwintering
2	2	0.5	Nearshore community is unknown, based on contours it is likely to impact little aquatic vegetation. Sandy shoals.	
3	3	0.9	Much of the southern section will travel through the navigation channel (unvegetated) North section will travel through a very narrow band of small pondweed (Community F, Figure 8)	

Typical Mitigation Measures

The following mitigation measures should be considered in combination with those listed for the sections above:

- The construction activities not occur between September 15th and June 30th (fisheries timing constraint). This fisheries constraint encompasses the turtle hibernation period (October to April) and as such will also protect turtles.
- Minimize impacts to aquatic vegetation.
- When feasible, directional drill / tunnel the tie-ins.

- Pumping of isolated work areas should be completed using pumps that are no larger than 3 inches in diameter. If larger pumps are required, then the pump should be placed in a box with 13 mm mesh screening, in addition to the installation of fish screen on the pump itself, to prevent impingement.
- A qualified biologist would be on-site during the de-watering process in order to remove any stranded aquatic fauna.
- If the coffer dam of an in-water isolated work is breached, then it will need to be dewatered again and fauna salvaged as per above.
- No blasting in water is anticipated. Should this change, the *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters* (Wright and Hopky 1998) should be followed.
- Shorelines, where construction activities including laydown yards will take place, should be fenced off (properly installed sediment fencing may suffice) prior to June to prevent turtle access during the nesting period (June to September). If not installed prior to June, then the area should be surveyed for turtle nests prior to any disturbance. Should a nest be encountered the area will be protected by snow fencing.

Note that the inclusion of rock protection over portions of the pipeline may also provide enhancement to fish habitat.

6.1.4 Accidents and malfunctions

Although the likelihood of accidents and malfunctions occurring would be minimized by following the mitigation measures outlined below, should accidents and/or malfunctions occur they have the possibility of presenting serious impacts and require consideration.

All equipment working in or near the water should be well maintained, clean and free of leaks. Maintenance on construction equipment such as refueling, oil changes or lubrication would only be permitted in designated area located at a minimum of 30 m from the shoreline in an area where sediment erosion control measures and all precautions have been made to prevent oil, grease, antifreeze or other materials from inadvertently entering the ground or the surface water flow. If machinery was recently used in another waterbody, then the equipment should be thoroughly cleaned to prevent the potential spread of invasive species. Machinery that will be working in or around the river should utilize biodegradable hydraulic fluids.

On-shore maintenance of construction equipment such as refueling, oil changes or lubrications would only be permitted within a staging area located at a minimum of 30 m from the shoreline where control measures would be installed or applied to prevent oil, grease, antifreeze or other materials from inadvertently entering the ground or the surface water flow.

Emergency spill kits would be located on site. The crew would be fully trained on the use of clean-up materials in order to minimize impacts of any accidental spills. The area would be monitored for leakage and in the unlikely event of a minor spillage the project manager would halt the activity and corrective measures would be implemented. Any spills would be immediately reported to the MOE Spills Action Centre (1800 268-6060).

6.2 Operation Phase

In order to be able to predict the potential impacts associated with the operation of the proposed intake, information on the approach velocities will be required. The operation impacts will be the same regardless of the route alignment. The degree of potential impacts will be dependent on the final design of the intake.

6.2.1 Discussion of Potential Impacts

Potential Impacts during Operation Outline

During the operation of the new intake there is a potential for impacts to occur as a result of fish entrainment and accidents and/or malfunctions during maintenance activities.

The potential impacts to the natural environment associated with these activities are:

1. Aquatic habitat and species
    - i. Fish entrainment
2. Accidents or malfunctions
    - a. Spills from machinery during maintenance activities.

Aquatic Habitat and Species

Summary and Potential Impact Analysis

The mitigation of fish mortality will be addressed through project design which will incorporate a low approach intake velocity and trash rack to account for fish swimming capabilities to minimize entrainment. It is recommended that the approach velocities be kept at or below 0.7 m/s.

Accidents and malfunctions

Although the likelihood of accidents and malfunctions occurring would be minimized by following the mitigation measures outlined below, should accidents and/or malfunctions occur they have the possibility of being serious and need to be considered before they happen.

All maintenance equipment working in or near the water should be well maintained, clean and free of leaks. Spill kits would be located on site. The crew would be fully trained on the use of clean-up materials in order to minimize impacts of any accidental spills. The area would be monitored for residual and in the unlikely event of a minor spillage the project manager would halt the activity and corrective measures would be implemented. Any spills would be immediately reported to the MOEE Spills Action Centre (1800 268-6060).

6.3 Decommissioning Phase

At this time, it is anticipated that the decommissioning would consist of abandonment of the existing intake pipes. This would likely occur during the construction phase and as such no additional impacts would be expected.

6.4 Cumulative Effects

The combined results from the review of background information and the field visits confirmed that there are no provincially significant wetlands or ANSIs within the study area. The remaining natural features (habitat of endangered or threatened species, fish habitat, woodland and significant wildlife habitat) could occur and are discussed below. It is noted that unevaluated wetlands are located within the adjacent lands of Option 2.

7.0 RANKING SUMMARY

It is anticipated that the majority of the impacts discussed in the section above can be mitigated during the detailed design phase. It is noted that there are several unknown factors in the ranking of Option 2; however, as this alignment would likely follow the roadway shoulder and then would travel through a residential area or golf course, it is likely that any environmental impacts could be mitigated and/or compensated. None of the options should be eliminated based on environmental concerns alone. In Table 10 below, the green indicates that the natural feature is not a concern and orange indicates that it could potentially be impacted but that these impacts can be reduced or eliminated through mitigation and/or compensation, as required.

Table 10 Summary of Ranking of Three Alternatives

Natural Feature	Option 1	Option 2	Option 3
PSW			
ANSIs			
Protected SAR Habitat		unknown	
SAR (individual)		unknown	Butternuts
Fish Habitat	Impacts most habitat, but the majority is located in deep water habitat and the portion of the aquatic vegetation which would be impacted is located near the navigation channel.	Affects least amount of habitat and most is deeper water habitat within aquatic vegetation. Travels near two sandy shoals.	Affects less habitat than Option 1.
Woodland			
Significant Wildlife Habitat		unknown	
Species of Conservation Concern Habitat	Potential map turtle hibernation areas	unknown	Potential map turtle hibernation area. Southern section of pipeline close to turtle basking features

8.0 REFERENCES

Ambrose, J.D. (2002). Update COSEWIC status report on the climbing prairie rose Rosa setigera in Canada, in COSEWIC assessment and update status report on the climbing prairie rose Rosa setigera in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-15 pp.

Bradley, David. (2007). Southern Ontario Vascular Plant Species List. Prepared by Southern Science and Information Section, Ontario Ministry of Natural Resources, Peterborough, Ontario. 57pp.

Christie, W.J. (1973). A review of the changes in the fish species composition of Lake Ontario. Great Lakes Fishery Commission. Technical Report No. 23.

Coker, G.A, C.B. Portt, and C.K. Minns. (2001). Morphological and Ecological Characteristics of Canadian Freshwater Fishes. Can. MS Rpt. Fish. Aquat. Sci. 2554: iv+89p.

COSEWIC.(2000a). COSEWC assessment and update status report on the lake sturgeon Acipenser fulvescens in Canada. Committee on the Status of Endanfered Wildlife in Canada. Ottawa xi +107pp.

COSEWIC. (2000b). COSEWIC assessment and update status report on the King Rail Rallus elegans in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 10 pp.

COSEWIC. (2002). COSEWIC assessment and status report on the northern map turtle Graptemys geographica in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 34 pp.

COSEWIC. (2003). COSEWIC assessment and update status report on the Cerulean Warbler Dendroica cerulea in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 25 pp.

COSEWIC. (2003). COSEWIC assessment and status report on the butternut Juglans cinerea in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 32 pp.

COSEWIC. (2005). COSEWIC assessment and update status report on the Blanding's Turtle Emydoidea blandingii in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii + 40 pp.

COSEWIC. (2007). COSEWIC assessment and update status report on the Common Nighthawk Chordeiles minor in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 25 pp.

COSEWIC. (2008). COSEWIC assessment and update status report on the Short-eared Owl Asio flammeus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. (2009). COSEWIC assessment and update status report on the Least Bittern Ixobrychus exilis in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 36 pp.

COSEWIC. (2010). COSEWIC assessment and status report on the Bobolink Dolichonyx oryzivorus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 42 pp.

COSEWIC. (2010). COSEWIC assessment and status report on the Four-leaved Milkweed Asclepias quadrifolia in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. X + 40pp.

COSEWIC. (2010). COSEWIC assessment and status report on the Monarch Danaus plexippus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 43 pp.

Cudmore-Vokey, B. and E.J. Crossman. (2000). Checklists of the fish fauna of the Laurentian Great Lakes and their connecting channels. Can.MS Rpt. Fish. Aquat. Sci. 2550:v+39p.

Dunkle, S.W. (2000). Dragonflies through binoculars: A field guide to dragonflies of North America. Oxford University Press.

Eakins, R.J. (2009). Ontario freshwater fishes life history database Version 3.57. [Online] Available: http://www.fishdb.ca/home.htm [June 10, 2009]

Edmonds, J. (2002). COSEWIC status report on the stinkpot Sternotherus odoratus in Canada, in COSEWIC assessment and status report the stinkpot Sternotherus odoratus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-18 pp.

eFlora. (2011). Flora of North America. [Online]. eFlora. Available: http://www.efloras.org/flora_page.aspx?flora_id=1 [September 12, 2011].

Environment Canada. (2010). Amended Recovery Strategy for the Henslow's Sparrow (Ammodramus henslowii) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vi + 23 pp.

Environment Canada. (2010). Recovery Strategy for the Loggerhead Shrike, migrans subspecies (Lanius ludovicianus migrans), in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. viii + 35 pp.

Environmental Guide for Fish and Fish Habitat, Section 5: Sensitivity of Fish and Fish Habitat, October 2006. Ministry of Transportation of Ontario

Fischer, L. (2002). COSEWIC status report on the milksnake Lampropeltis triangulum in Canada in COSEWIC assessment and status report on the milksnake Lampropeltis triangulum in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-29 pp.

Kraus, T., B. Hutchinson, S. Thompson and K. Prior. (2010). Recovery Strategy for the Gray Ratsnake (Pantherophis spiloides) – Carolinian and Frontenac Axis populations in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 23 pp.

Lam, E. (2004). Damselflies of the Northeast: A guide to the species of eastern Canada and the northeastern United States. Biodiversity Books. New York.

Layberry R., Hall, P., and J. Lafontaine. (1998). The butterflies of Canada. NRC Research Press, Canada Institute for Scientific and Technical Information. University of Toronto Press Toronto Canada.

Newmaster, S.G., A. Lehela, P.W.C Uhlig, S. McMurray and M.J. Oldham. (1998). Ontario plant list. Ontario Ministry of Natural Resources, Ontario Forest Research Institute, Sault Ste. Marie, ON, Forest Research Information Paper No. 123. 550 pp. + appendices.

OWES (1993). Ontario Wetland Evaluation System. Southern Manual NEST Technical Manual TM-002 March 1993.

OMNR (2001). Ecological land Classification for Southern Ontario: Training Manual SCSS TM 01, March 2001.

OMNR (2010). Bay of Quinte Fisheries management Plan. Prepared by OMNR and BQFAC. July 2010. 143 p.

Ontario Ministry of Natural Resources. (2011). Lake Ontario Fish Communities and Fisheries: 2010 Annual Report of the Lake Ontario Management Unit. Ontario Ministry of Natural Resources, Picton, Ontario, Canada.

Official Plan of the County of Prince Edward County September 2004.

Peterson, R.T. (1980). A field guide to the birds: A completely new guide to all the birds of eastern and central North America. Houghton Mifflin Company, Boston.

Phipps, J.B., and M. Muniyamma. (1980). A taxonomic revision of Crataegus (Rosaceae) in Ontario. Can. J. Bot. 58: 1621-1699.

Scott, W.B., and E.J. Crossman. (1998). Freshwater fishes of Canada. Galt House Publications LTD. Ontario.

Valere, B. G. (1996). Productive Capacity of Littoral Habitats in the Great Lakes: Field Sampling Procedures (1988-1995). Canadian manuscript Report of Fisheries and Aqutic Sciences No. 2384: 50 p.

Voss, E.G. (1985). Michigan flora: a guide to the identification and occurrence of the native and naturalized seed-plants of the state. Cranbrook Institute of Science Bulletin 59 and University of Michigan Herbarium. Michigan.

APPENDIX A List of Fish Species in Lake Ontario

Lake Ontario Fish Species List (Bay of Quinte Catch Highlighted)

Species Name	Scientific Names	Trophic Class	Thermal Regime	Federal Status	Provincial Status	SRank
American brook lamprey	*Ichthyomyzon appendix*		cold			S3
silver lamprey	*Ichthyomyzon fossor*	parasitic	cool/warm	SC	SC	S3
sea lamprey	*Petromyzon marinus*	parasitic	cold			SNA
lake sturgeon	*Acipenser fulvescens*	insectivore	cold/cool		THR	S2
longnose gar	*Lepisosteus osseus*	piscivore	warm			S4
spotted gar	*Lepisosteus oculatus*	piscivore	warm	THR	THR	S1
bowfin	*Amia calva*	piscivore	warm			S4
alewife	*Alosa pseudoharengus*	planktivore	cold			SNA
American shad	*Alosa sapidissima*	planktivore	cold			S1
gizzard shad	*Dorosoma cepedianum*	planktivore/omnivore	cool			S4
pink salmon	*Oncorhynchus gorbuscha*	piscivore	cold			SNA
kokanee	*Oncorhynchus nerka*	planktivore				SNA
coho salmon	*Oncorhynchus kisutch*	piscivore	cold			SNA
chinook salmon	*Oncorhynchus tshawytscha*	piscivore	cold			SNA
rainbow trout	*Oncorhynchus mykiss*	piscivore	cold			SNA
Atlantic salmon	*Salmo salar*	piscivore	cold			S1
brown trout	*Salmo trutta*	piscivore	cold/cool			SNA
Arctic char	*Salvelinus alpinus*	piscivore/generalist	cold			SU
lake trout	*Salvelinus namaycush*	piscivore	cold			S5
lake whitefish	*Coregonus clupeaformis*	insectivore	cold			S5
lake herring	*Coregonus artedi*	planktivore	cold			S5
round whitefish	*Prosopium cylindraceum*	insectivore	cold			S4
rainbow smelt	*Osmerus mordax*	planktivore	cold			S5
northern pike	*Esox lucius*	piscivore	cool			S5
muskellunge	*Esox masquinongy*	piscivore	warm			S4
grass pickerel	*Esox americanus vermiculatus*	piscivore	warm	SC	SC	S3
chain pickerel	*Esox niger*	piscivore	cool/warm			SNA
central mudminnow	*Umbra limi*	insectivore / omnivore	cool / warm			S5

Species Name	Scientific Names	Trophic Class	Thermal Regime	Federal Status	Provincial Status	SRank
mooneye	*Hiodon tergisus*	generalist	cool/warm			S4
quillback	*Carpiodes cyprinus*	omnivore	cool			S4
longnose sucker	*Catostomus catostomus*	insectivore	cold			S5
white sucker	*Catostomus commersoni*	insectivore / omnivore	cool			S5
lake chubsucker	*Erimyzon sucetta*	insectivore	warm	END	THR	S2
northern hog sucker	*Hypentelium nigricans*	insectivore	warm			S4
bigmouth buffalo	*Ictiobus cyprinellus*	insectivore/piscivore	warm			S4
silver redhorse	*Moxostoma anisurum*	insectivore	cool			S4
golden redhorse	*Moxostoma erythrurum*	insectivore	warm			S4
shorthead redhorse	*Moxostoma macrolepidotum*	insectivore	warm			S5
greater redhorse	*Moxostoma valenciennesi*	insectivore	cool/warm			S3
river redhorse	*Moxostoma carinatum*	insectivore	cool	SC	SC	S2
goldfish	*Carassitus auratus*	omnivore	warm			SNA
northern redbelly dace	*Phoxinus eos*	herbivore	cool / warm			S5
finescale dace	*Phoxinus neogaeus*	insectivore	cool			S5
lake chub	*Couesius plumbeus*	insectivore	cold			S5
common carp	*Cyprinus carpio*	omnivore	warm			SNA
grass carp	*Ctenopharyngodon idella*	herbivore	warm			SNA
brassy minnow	*Hybognathus hankinsoni*	omnivore / herbivore	cool			S5
hornyhead chub	*Nocomis biguttatus*	insectivore	cool			S4
river chub	*Nocomis micropogon*	insectivore ?	cool			S4
golden shiner	*Notemigonus crysoleucas*	omnivore	cool			S5
pugnose shiner	*Notropis anogenus*	herbivore	cool	END	END	S2
emerald shiner	*Notropis atherinoides*	insectivore	cool			S5
bridle shiner	*Notropis bifrenatus*	planktivore	cool	SC	SC	S2
common shiner	*Luxilus cornutus*	insectivore	cool			S5
blackchin shiner	*Notropis heterodon*	insectivore	cool/warm			S5
blacknose shiner	*Notropis heterolepis*	insectivore	cool/warm			S4

Species Name	Scientific Names	Trophic Class	Thermal Regime	Federal Status	Provincial Status	SRank
spottail shiner	*Notropis hudsonius*	insectivore	cold/cool			S5
rosyface shiner	*Notropis rubellus*	insectivore	warm			S4
spotfin shiner	*Cyprinella spiloptera*	insectivore	warm			S4
sand shiner	*Notropis ludibundus*	insectivore	warm			S4
mimic shiner	*Notropis volucellus*	insectivore	warm			S5
bluntnose minnow	*Pimephales notatus*	omnivore	warm			S5
fathead minnow	*Pimephales promelas*	omnivore	warm			S5
blacknose dace	*Rhinichthys atratulus*	insectivore / generalist	cool			S5
longnose dace	*Rhinichthys cataractae*	insectivore	cool			S5
creek chub	*Semotilus atromaculatus*	insectivore / generalist	cool			S5
fallfish	*Semotilus corporalis*	insectivore	cool			S4
pearl dace	*Margariscus margarita*	insectivore	cold/cool			S5
central stoneroller	*Campostoma anomalum*	herbivore	cool/warm			S4
striped shiner	*Luxilus chrysocephalus*	insectivore	cool			S4
silver chub	*Macrhybopsis storeriana*	insectivore	cool	SC	SC	S2
yellow bullhead	*Ameiurus natalis*	insectivore	warm			S4
brown bullhead	*Ameiurus nebulosus*	insectivore	warm			S5
channel catfish	*Ictalurus punctatus*	insectivore/piscivore	warm			S4
stonecat	*Noturus flavus*	insectivore	warm			S4
tadpole madtom	*Noturus gyrinus*	insectivore	warm			S4
American eel	*Anguilla rostrata*	piscivore/insectivore	cool		END	S1?
banded killifish	*Fundulus diaphanus*	insectivore	cool			S5
burbot	*Lota lota*	piscivore	cold/cool			S5
brook stickleback	*Culaea inconstans*	insectivore	cool			S5
threespine stickleback	*Gasterosteus aculeatus*	insectivore	cold			S4
ninespine stickleback	*Pungitius pungitius*	insectivore	cold			S5
trout-perch	*Percopsis omiscomaycus*	insectivore	cold			S5
white perch	*Morone americana*	insectivore	warm			SNA
white bass	*Morone chrysops*	insectivore/piscivore	warm			S4
rock bass	*Ambloplites*	insectivore / piscivore	cool			S5

Species Name	Scientific Names	Trophic Class	Thermal Regime	Federal Status	Provincial Status	SRank
	rupestris					
green sunfish	*Lepomis cyanellus*	insectivore/piscivore	warm			S4
pumpkinseed	*Lepomis gibbosus*	insectivore	war m			S5
bluegill	*Lepomis macrochirus*	insectivore	warm			S5
longear sunfish	*Lepomis megalotis*	insectivore	warm			S3
smallmouth bass	*Micropterus dolomieui*	insectivore / piscivore	warm			S5
largemouth bass	*Micropterus salmoides*	insectivore / piscivore	warm			S5
white crappie	*Pomoxis annularis*	insectivore / piscivore	cool			S4
black crappie	*Pomoxis nigromaculatus*	insectivore / piscivore	cool			S4
yellow perch	*Perca flavescens*	insectivore / piscivore	cool			S5
walleye	*Stizostedion vitreum*	piscivore	cool			S5
raindow darter	*Etheostoma caeruleum*	insectivore	cool			S4
Iowa darter	*Etheostoma exile*	insectivore	cool			S5
fantail darter	*Etheostoma flabellare*	insectivore	cool			S4
least darter	*Etheostoma microperca*	insectivore	cool/warm			S4
johnny darter	*Etheostoma nigrum*	insectivore	cool			S5
logperch	*Percina caprodes*	insectivore	cool / warm			S5
channel darter	*Percina copelandi*	insectivore	cool/ warm	THR	THR	S2
blackside darter	*Percina maculata*	insectivore	cool			S4
tessellated darter	*Etheostoma olmstedi*	insectivore	cool			S4
rudd	*Scardinius erythrophthalmus*	insectivore	cool			SNA
brook silverside	*Labidesthes sicculus*	insectivore	cool/warm			S4
freshwater drum	*Aplodinotus grunniens*	insectivore	warm			S5
mottled sculpin	*Cottus bairdi*	insectivore	cold			S5
slimy sculpin	*Cottus cognatus*	insectivore	cold			S5
spoonhead sculpin	*Cottus ricei*	insectivore	cold			S4
deepwater sculpin	*Myoxocephalus thompsonii*	insectivore	cold	THR		S4
round goby	*Neogobius*	insectivore	cool			SNA

Species Name	Scientific Names	Trophic Class	Thermal Regime	Federal Status	Provincial Status	SRank
	melanostomus					

(Christie, 1973; Coker et al. 2001; Cumore-Vokey and Crossman, 2000; Eakins, 2009; MTO, 2006, OMNR 2010)

List Updated November 14, 2011

SRANK DEFINITIONS

S1 Critically Imperiled, Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.

S2 Imperiled, Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.

S3 Vulnerable, Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 Apparently Secure, Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 Secure, Common, widespread, and abundant in the nation or state/province.

SU Unrankable, Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

SNA Not Applicable, A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

S#S# Range Rank, A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

? Inexact Numeric Rank—Denotes inexact numeric rank

SARO STATUS DEFINITIONS

END Endangered: A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA.

THR Threatened: A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.

SC Special Concern: A species with characteristics that make it sensitive to human activities or natural events.

SARA STATUS DEFINITIONS

END Endangered, a wildlife species facing imminent extirpation or extinction.

THR Threatened, a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

SC Special Concern, a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

APPENDIX B List of Plant Species Observed within the Project Area

Common Name	Scientific Name	Srank	Provincial Status (SARO)	Federal Status (SARA)
Algae sp.	*Algae sp.*			
Blue Green Algae	*Cyanobacteria*			
Eastern Red Cedar	*Juniperus virginiana*	S5		
Eastern White Cedar	*Thuja occidentalis*	S5		
White Spruce	*Picea glauca*	S5		
Red Pine	*Pinus resinosa*	S5		
Manitoba Maple	*Acer negundo*	S5		
Silver Maple	*Acer saccharinum*	S5		
Sugar Maple	*Acer saccharum*	S5		
Black Maple	*Acer nigrum*	S4?		
Western Poison-ivy	*Rhus radicans ssp. rydbergii*	S5		
Staghorn Sumac	*Rhus typhina*	S5		
Wild Carrot	*Daucus carota*	SNA		
Wild Parsnip	*Pastinaca sativa*	SNA		
Common Milkweed	*Asclepias syriaca*	S5		
Common Ragweed	*Ambrosia artemisiifolia*	S5		
Ox-eye Daisy	*Chrysanthemum leucanthemum*	SNA		
Chicory	*Cichorium intybus*	SNA		
Field Hawkweed	*Hieracium caespitosum ssp. caespitosum*	SNA		
Goldenrod sp.	*Solidago sp.*			
Canada Goldenrod	*Solidago canadensis*	S5		
Common Sow-thistle	*Sonchus oleraceus*	SNA		
Meadow Goat's-beard	*Tragopogon pratensis ssp. pratensis*	SNA		
White Birch	*Betula papyrifera*	S5		
Viper's Bugloss	*Echium vulgare*	SNA		
Field Penny-cress	*Thlaspi arvense*	SNA		
Bladder Campion	*Silene latifolia*	SNA		
Common Coontail	*Ceratophyllum demersum*	S5		
Common Teasel	*Dipsacus fullonum ssp. sylvestris*	SNA		
Trailing Crown-vetch	*Coronilla varia*	SNA		
Bird's-foot Trefoil	*Lotus corniculatus*	SNA		
Black Medick	*Medicago lupulina*	SNA		
White Sweet-clover	*Melilotus alba*	SNA		
Black Locust	*Robinia pseudo-acacia*	SNA		
Bur Oak	*Quercus macrocarpa*	S5		
Wild Black Currant	*Ribes americanum*	S5		
Eurasian Water-milfoil	*Myriophyllum spicatum*	SNA		

Common Name	Scientific Name	Srank	Provincial Status (SARO)	Federal Status (SARA)
Shagbark Hickory	*Carya ovata*	S5		
Butternut	*Juglans cinerea*	S3?	END	END
Black Walnut	*Juglans nigra*	S4		
Catnip	*Nepeta cataria*	SNA		
Water-lily Family	*Nymphaeaceae*			
Small White Water-lily	*Nymphaea odorata*	S5?		
White Ash	*Fraxinus americana*	S5		
Lilac sp.	*Syringa sp.*			
Phlox sp.	*Phlox sp.*			
Great Water Dock	*Rumex orbiculatus*	S4S5		
Canada Anemone	*Anemone canadensis*	S5		
Common Buckthorn	*Rhamnus cathartica*	SNA		
Rose sp.	*Rosa sp.*			
Wild Red Raspberry	*Rubus idaeus ssp. strigosus*	S5		
Mountain-ash sp.	*Sorbus sp.*			
Prickly-ash	*Zanthoxylum americanum*	S5		
Eastern Cottonwood	*Populus deltoides ssp. deltoides*	SU		
Weeping Willow	*Salix babylonica*	SNA		
Pussy Willow	*Salix discolor*	S5		
Crack Willow	*Salix fragilis*	SNA		
Butter-and-eggs	*Linaria vulgaris*	SNA		
Bittersweet Nightshade	*Solanum dulcamara*	SNA		
American Basswood	*Tilia americana*	S5		
American Elm	*Ulmus americana*	S5		
Virginia Creeper	*Parthenocissus inserta*	S5		
Riverbank Grape	*Vitis riparia*	S5		
Canada Waterweed	*Elodea canadensis*	S5		
Tapegrass	*Vallisneria americana*	S5		
Naiad sp.	*Najas sp.*			
Grass Family	*Poaceae*			
Reed Canary Grass	*Phalaris arundinacea*	S5		
Curly Pondweed	*Potamogeton crispus*	SNA		
Leafy Pondweed	*Potamogeton foliosus*	S5		
Sago Pondweed	*Potamogeton pectinatus*	S5		
Small Pondweed	*Potamogeton pusillus*	S4S5		
Richardson's Pondweed	*Potamogeton richardsonii*	S5		
Broad-leaved Cattail	*Typha latifolia*	S5		

Ranking and Status Updated: October 31, 2011

SRANK DEFINITIONS

S4 Apparently Secure, Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 Secure, Common, widespread, and abundant in the nation or state/province.

SNA Not Applicable, A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#S# Range Rank, A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
? Inexact Numeric Rank—Denotes inexact numeric rank

SARO STATUS DEFINITIONS
END Endangered: A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA.

SARA STATUS DEFINITIONS
END Endangered, a wildlife species facing imminent extirpation or extinction.

APPENDIX C List of Potential Species of Conservation Value

Common Name	Scientific Name	Preferred Habitat	SRANK	Provincial Status	Federal Status	Reference	Last Observed
DRAGONFLIES							
Horned Clubtail	*Arigomphus cornutus*	Ponds or watercourses with no noticeable flow. Frequently with marsh or bog habitat along the shoreline.	S3			Dunkle 2000	16/06/2000
Lilypad Clubtail	*Arigomphus furcifer*	Marshy lakes.	S3			Dunkle 2000	27/06/1924
DAMSELFLIES							
Azure Bluet	*Enaillagma aspersum*	Shallow ponds, lakes and bogs.	S3			Lam 2004	20/09/1996
BUTTERFLIES							
Juniper Hairstreak	*Callophrys gryneus*	Juniper floodplains	S2			Layberry et al 1998	23/06/1994
Monarch	*Danaus plexippus*	Old fields, meadows, roadsides confined to places were milkweed sp. grow.	S4B, S2N	SC	SC	COSEWIC 2010	
FISH							
Bloater	*Coregonus hoyi*	Deep lakes	S4			Scott & Crossman 1998	07/07/1928
Greater Redhorse	*Moxostoma valenciennesi*	Little is known. Spawns in fast flowing waters. After spawn can be found in shallow slow moving areas.	S3			Scott & Crossman 1998	13/07/1986
REPTILES							
Northern Map Turtle	*Graptemys geographica*	Large waterbodies.	S3	SC	SC	COSEWIC 2002	17/05/1987

Common Name	Scientific Name	Preferred Habitat	SRANK	Provincial Status	Federal Status	Reference	Last Observed
Milksnake	*Lampropeltis triangulum*	Found within open forest, forest edges, meadows, and cultivated areas.	S3	SC	SC	Fischer 2002	28/05/1990
BIRDS							
Black Tern	*Chlidonias niger*	Breed in freshwater marshes	S3B	SC		Peterson 1980	06/1991
Short-eared Owl	*Asio flammeus*	Open areas.	S2N, S4B	SC	SC	COSEWIC 2008	
Common Nighthawk	*Chordeiles minor*	Open habitats	S4B	SC	THR	COSEWIC 2007	
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Open deciduous woodland.	S4B	SC	THR	Peterson 1980	
PLANTS							
A Moss	*Hypnum revolutum*	Open sites, and rock faces	S2			eFlora 2009	08/1981
Carolina Whitlow-grass	*Draba reptans*	Field and sandy banks.	S3			Voss 1985	12/05/1994
Giant Pinedrops	*Pterospora andromedea*	Associated with dry woods containing conifers and a well-developed needle duff.	S2			Voss 1985	27/07/1901
Brainerd's Hawthorn	*Crataegus brainerdii*	Dry ground in open woodland, along sandy roadsides, bluffs, river banks, fields, and pastures	S2			Phipps & Muniyamma 1980	03/06/1978
Prairie Rose	*Rosa setigera*	Shrub thickets and old fields.	S3	SC	SC	Ambrose 2002	19/07/1944
Green Arrow-arum	*Peltandra virginica*	Shallow water and muddy banks at edges of rivers and lakes, swamp	S2			Voss 1985	01/06/1986

Common Name	Scientific Name	Preferred Habitat	SRANK	Provincial Status	Federal Status	Reference	Last Observed
		forest along river.					
Blunt-scaled Oak Sedge	*Carex albicans var. albicans*	Wooded slopes, woodland clearings.	S3			Voss 1985	1980
Few-fruited Sedge	*Carex oligocarpa*	Deciduous woods.	S3			Voss 1985	04/07/2008
Ram's-head Lady's Slipper	*Cypripedium arietinum*	Dunes, along shores, or inland under Jake pine and oak and also in coniferous swamps.	S3			Voss 1985	Pre 1986
Northern Dropseed	*Sporobolus heterolepis*	On sandy, loamy soils in open areas with dry to moderate moisture. Typically in prairies.	S3			Voss 1985	15/06/1873

Ranking and Status Updated: October 31, 2011

SRANK DEFINITIONS

SH Possibly Extirpated (Historical), Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.

S1 Critically Imperiled, Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.

S2 Imperiled, Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.

S3 Vulnerable, Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 Apparently Secure, Uncommon but not rare; some cause for long-term concern due to declines or other factors.

SAB Breeding accidental.

SZB Breeding migrants/vagrants.

SARO STATUS DEFINITIONS

SC Special Concern: A species with characteristics that make it sensitive to human activities or natural events.

SARA STATUS DEFINITIONS

END Endangered, a wildlife species facing imminent extirpation or extinction.
THR Threatened, a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
SC Special Concern, a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.