

# **Integrated Watershed Management Plan**

**For the Petitcodiac River Watershed**

# **2012**



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The Petitcodiac Watershed Alliance (PWMG-GSBP Inc.) is a non-profit environmental science and education organization that promotes sustainable use of the Petitcodiac River and its tributaries. In addition since 1997, the group has been involved in a monitoring program of established sites in Petitcodiac tributaries of concern or interest. These sites are evaluated using the following stream health indicators: temperature, dissolved oxygen, total coliforms, E. coli. Nitrates, Phosphorous, sediment, specific conductivity, T.D.S. and pH. More information about the group's activities can be found on the following web-site: [www.petitcodiacwatershed.org](http://www.petitcodiacwatershed.org). This project was made possible through the generous contributions of our sponsors and supporters:

The Village of Salisbury

The village of Memramcook



MONCTON FISH & GAME ASSOCIATION

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## Executive Summary

This watershed management plan is intended to support public and stakeholder discussions concerning stewardship of the Petitcodiac River and its watershed. This process is being led by the Petitcodiac Watershed Monitoring Group.

The Petitcodiac River is a major drainage basin in Southeastern New Brunswick. It stretches from the boundaries of Fundy National Park to Shepody Bay. The total drainage area of the Petitcodiac Watershed is 26,000 square kilometers and it has more than 30 tributaries. It is home to more than 110,000 people and is one of the most heavily populated and fastest growing regions within the province of New Brunswick, most of whom live within an hours drive of the tri-city area of Moncton, Riverview and Dieppe. The watershed contains a diversity of natural forms and ecological regions and must support a wide range of human land uses.

In 1998, the Petitcodiac Watershed Monitoring Group was asked by the Government of New Brunswick to provide a Provisional Water Classification document for the Petitcodiac River basin. This watershed management plan is intentionally designed to build upon that document to achieve our three primary goals: the safety and security of our drinking water, the maintenance of healthy and functional aquatic ecosystems, and the restoration of degraded aquatic habitat.

In developing this Integrated Watershed Management Plan (IWMP), the PWMG took into account:

- A watershed approach that considered both surface and groundwater issues, and the interactions of water, plants, animals and human activities within the watershed.
- Watershed monitoring reports on water quality in the Petitcodiac River for the last 12 years. Habitat surveys on more than half of the tributaries of the Petitcodiac River which included information on macro-invertebrate communities and electrofishing surveys.
- The development of a public stakeholder engagement process to identify, discuss and remedy identifiable problems in our watershed and to build support for the implementation of this watershed management plan.

The PWMG recognizes that stakeholders have accomplished, and are in the process of doing much to improve conditions in the watershed. Considerable scientific work has taken place over the past few years. However, much work and research remains to be done, including the examination of our own assessment tools that we use to support ongoing watershed planning activities.

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## **1. THE PETITCODIAC WATERSHED MONITORING GROUP (PWMG)**

This watershed management plan is intended to support and promote stakeholder and public engagement in creating and implementing a stewardship plan for our watershed. A process guided by the Petitcodiac Watershed Monitoring Group.

The PWMG was founded in 1998 by the Université de Moncton and the provincial government of the Province of New Brunswick with funding from the New Brunswick Environmental Trust Fund. It was incorporated as a non-profit organization in 2002. Our membership includes municipalities, and individuals representing government departments, industry, educational institutions, conservation groups, agricultural representatives, recreational and tourism interests. The PWMG is also known as the Petitcodiac Watershed Alliance (PWA).

### **PWMG VISION**

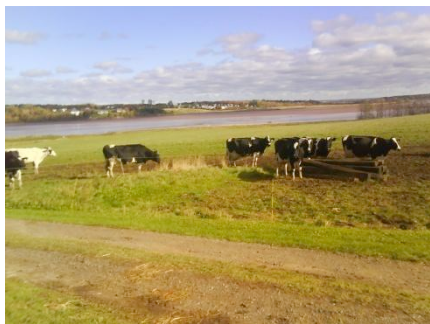
People working together to ensure a healthy watershed for current and future generations.

### **PWMG Mission**

To restore and protect the ecological services that our watershed provides to the community by fostering awareness of the importance of water quality and habitat sustainability into the future.

### **Decision Making Process**

As an incorporated non-profit organization, the PWMG is governed by a Board of Directors whose members are representative of stakeholders living in, or having an interest in the Petitcodiac River and its watershed. Our Board of Directors endeavours to build consensus to support recommendations for actions that affect the watershed. In the absence of consensus, the board will use a majority vote to make decisions in order to move forward. In such cases, minority views will be recorded.



## **2. PWMG GOALS AND OBJECTIVES**

### **#1. To maintain and improve water quality in the Petitcodiac River and its watershed.**

A water class has already been assigned to the major rivers and streams in the Petitcodiac watershed in accordance with the definitions contained in the New Brunswick Water Classification Program. However, there are numerous minor streams that still require classification, most of them located in rural regions of our watershed. The PWMG will work at expanding our current classification documentation to include these previously excluded streams.

### **#2. To maintain and improve ecosystem health in the Petitcodiac River and watershed.**

Aquatic ecosystem health objectives, based upon water classification and biotic potential should be developed for all major waterbodies and riparian areas in our watershed. This will help us ensure that environmental impacts from resource use and/or extraction do not result in loss of aquatic health or biodiversity so as to affect the health and wellbeing of the surrounding communities that depend upon the watershed.

This may include an assessment the land use in our watershed so that the use of our resources does not unacceptably affect the ecological integrity of the watershed. It also requires that knowledge and understanding of the importance of a healthy aquatic ecosystem are improved through outreach and education to stakeholders.

### **#3. The development of strategies that support sustainable use of the watershed so as to provide drinking water, healthy aquatic ecosystems and economies for future generations.**

Management strategies and plans to protect groundwater and surface water must be developed in consultation with watershed stakeholders and the public so that the plan meets economic, social, health and environmental needs. Sustainable use of our aquatic resources will insure that those same essential resources will still be available for future generations.

### **#4. To ensure that water management and land use planning operate in a way that protects water resources and aquatic habitats.**

In a municipal land management plan, a municipality sets goals and objectives for land use within its boundaries. It is important that municipalities also promote the objectives of a good watershed management plan. The seven municipalities in our watershed need to work together to address cross-boundary issues on a watershed basis. For this to happen our municipalities should consider the integration of land use and common watershed management goals. A municipality should encourage and support programs to protect, clean-up and rehabilitate natural ecosystems since it has a direct impact upon the health and well being of its citizens. (Ministry of Environment and Energy of Ontario, 1992)

### **3. INTEGRATED WATERSHED MANAGEMENT PLANS**

A watershed management plan is a document prepared by members of a watershed community that describes the actions required over time to achieve a sustainable and healthy watershed. It is a roadmap for managing our resources with an outlook towards the future.

Integrated Watershed Management Plans (IWMPs) must cross numerous jurisdictional boundaries in order to integrate water and land management practices. Currently, IWMPs are not referred to directly in New Brunswick's provincial legislation. There is no specific statutory framework in place to require the adoption and implementations of IWMPs. This leaves the implementation of our IWMP recommendations dependent on the voluntary choices and actions of decision-makers, such as Ministers of the current provincial government and municipal councilors, industry executives, Boards of Directors of non-government organizations, landowners and recreational users of private and public lands. The Province of New Brunswick is currently working on legislative tools that may be able in the future to approve, adopt and implement specific recommendations, such as watershed management plans.

Municipalities, as leaders in local land-use policy and planning, will be asked to use the IWMP to guide the development and implementation of their Municipal Development Plans, land-use bylaws, and the identification and implementation of best management practices. Industry and landowners will be asked to work with the PWMG, governments and other watershed stakeholders to continuously improve their water and land management practices. Individual users of both public and private lands will be asked to minimize their individual impacts on the watershed by practicing and promoting conservation and responsible recreation in the watershed.

The PWMG watershed management plan is based upon three basic principles.

1. Watersheds must be managed sustainably.

- Water resources must be managed and conserved to meet current and evolving needs without compromising the ability of future generations to meet their own needs.

2. Water is a vital component of the environment.

- Water is recognized as one of New Brunswick's most important natural assets.
- The aquatic environment, including the diversity of aquatic life, must be protected.
- The natural ecosystem is the primary user of all water resources.

3. Watersheds must be managed in consultation with the public.

- The public must be involved in water management and decision-making.
- Information sharing and open communication must be provided for.
- Opportunities for public education must be supported.

In an effort to design good stewardship guidelines based upon the needs of each stakeholder group in our watershed, the PWMG is committed to working with the following stakeholder groups over the next five years:

Municipalities  
Agricultural producers  
Forestry operations  
Golf clubs  
Private corporations  
Federal and Provincial Governments and departments  
Private landowners  
Other Non-government Organizations

### **What Makes a Plan Integrated?**

Watershed management plans are considered integrated because:

- The planning process is inclusive and broad and combines the needs of diverse watershed stakeholders.
- There is recognition of the balance between the ecosystem, community and economic health.
- The process respects the integration of activities on the land and their impact on water.

### **What is a Watershed?**

A watershed is a topographically defined area of land where the water within it flows to a common point. In our watershed, that common point is the Petitcodiac River. Within a watershed, surface and groundwater are generally connected as water flows across the landscape and through waterways or vertically through the various layers of soil and substrate.

This movement of water across and through the landscape connects an area hydrologically. Any activity that affects water quality, quantity, or flow rate in one part of the watershed may affect locations downstream. Understanding this connectivity within a watershed is helpful when planning or managing activities for the future. For this reason, to protect our water it makes sense to protect our watersheds. The watershed-based management system provides a way to consider a wide range of issues along with a community's vision for the future of the watershed under a single framework. Working within watersheds rather than political boundaries, such as towns or municipalities, the planning process can address water quality, quantity, community and habitat issues beyond the scope of single jurisdictions like towns or municipalities.



## The Benefits of Planning at the Watershed Level

There are many benefits to watershed planning, they include:

- Providing local boards with a framework to prioritize limited resources, target activities and programs to areas that need greater protection, or to areas where limited resources will be most effective.
- Providing community members with an opportunity to discuss watershed issues and an active voice in protecting watershed resources most important to their communities.
- Providing a baseline from which to measure the success of management efforts.
- Providing a better understanding of how activities on the land influence water quality and quantity.
- Fostering a personal connection to the landscape we live in among watershed citizens.
- Ensuring activities upstream are respectful of downstream residents.

The PWMG watershed management process is an ongoing community-driven project that requires support and knowledge of the residents of our watershed. It also requires technical information from provincial and federal government departments.

As part of an ongoing management process, the PWMG will make the following documents available to the public:

- **State of the watershed reports.**  
This annual report will outline the current status of the watershed and a watershed report card that evaluates watershed health indicators at a glance.
- **A Drinking Water Protection Plan**  
A plan to assess the threats to drinking water resources throughout the watershed and steps that outline what we need to do to protect drinking water resources for municipalities and private well owners.
- **An annually updated Integrated Water Management Plan**  
Our watershed management plan is an actively evolving document that identifies issues relating to the protection, conservation and restoration of water, aquatic ecosystems and drinking water sources in the watershed. It will contain common objectives, policies and recommendations. It will also link water management with land use planning and identify ways to implement the plan.

#### **4. PWMG STUDIES IN THE PETITCODIAC RIVER WATERSHED**

The PWMG has been monitoring water quality and collecting aquatic habitat quality data on our watershed for more than a decade. In the last 10 years the following documents have been produced:

##### **Water Quality Reports from 2005 - 2010**

Reports that outline the results of our water quality monitoring activities in the Petitcodiac Watershed during the ice-free months of each year. These reports can be accessed through our website at:

[http://petitcodiacwatershed.org/water\\_quality\\_reports](http://petitcodiacwatershed.org/water_quality_reports)

##### **Links to PWMG Habitat Assessments and Surveys**

Halls Creek Watershed : A Description of Natural and Human Influences (2002)

[http://l.b5z.net/i/u/6058300/f/Halls\\_Creek\\_Watershed -  
A Description of Natural and Human Influences.pdf](http://l.b5z.net/i/u/6058300/f/Halls_Creek_Watershed_-_A_Description_of_Natural_and_Human_Influences.pdf)

Stream Habitat Assessment: Mapleton Park Brooks (2005)

[http://l.b5z.net/i/u/6058300/f/Mapleton\\_park\\_stream\\_habitat\\_assessment\\_2005.pdf](http://l.b5z.net/i/u/6058300/f/Mapleton_park_stream_habitat_assessment_2005.pdf)

The Memramcook River Water Quality Report 1997-2002

[http://l.b5z.net/i/u/6058300/f/memramcook\\_water\\_quality\\_report\\_1997-2002.pdf](http://l.b5z.net/i/u/6058300/f/memramcook_water_quality_report_1997-2002.pdf)

The Petitcodiac River Water Quality report 1997-2002

[http://l.b5z.net/i/u/6058300/f/Petitcodiac\\_water\\_classification\\_report\\_1997-2001.pdf](http://l.b5z.net/i/u/6058300/f/Petitcodiac_water_classification_report_1997-2001.pdf)

The Rabbit Brook habitat Assessment

[http://l.b5z.net/i/u/6058300/f/Rabbit\\_Brook\\_Habitat\\_Assessment\\_2005.pdf](http://l.b5z.net/i/u/6058300/f/Rabbit_Brook_Habitat_Assessment_2005.pdf)

The State of Jonathan Creek

[http://l.b5z.net/i/u/6058300/f/State\\_of\\_Jonathan\\_Creek\\_2005.pdf](http://l.b5z.net/i/u/6058300/f/State_of_Jonathan_Creek_2005.pdf)

Jonathan Creek Culvert Inventory

[http://l.b5z.net/i/u/6058300/f/Jonathan\\_Creek\\_Culvert\\_Inventory\\_2007.pdf](http://l.b5z.net/i/u/6058300/f/Jonathan_Creek_Culvert_Inventory_2007.pdf)

Stream Fencing Report 2004

[http://l.b5z.net/i/u/6058300/f/Stream\\_fencing\\_report\\_2004.pdf](http://l.b5z.net/i/u/6058300/f/Stream_fencing_report_2004.pdf)

Pollett River Habitat Assessment

[http://l.b5z.net/i/u/6058300/f/Pollett\\_River\\_Habitat\\_Assessment\\_Final\\_report\\_2010.pdf](http://l.b5z.net/i/u/6058300/f/Pollett_River_Habitat_Assessment_Final_report_2010.pdf)

Hydrological and Water Quality Assessment of the Petitcodiac River (2000)

[http://l.b5z.net/i/u/6058300/f/Hydrological\\_and\\_Water\\_Quality\\_Assessment\\_Petitcodiac\\_Wat  
ershed.pdf](http://l.b5z.net/i/u/6058300/f/Hydrological_and_Water_Quality_Assessment_Petitcodiac_Watershed.pdf)

## **5. WATER QUALITY IN THE PETITCODIAC WATERSHED**

Since 2005, the Petitcodiac Watershed Monitoring Group has been collecting and summarizing water quality data in the form of “Water Quality Reports” on tributaries within the Petitcodiac Watershed. These reports are intended to provide a scientific basis for decisions to be made that might have an effect upon the watershed. Our reports include information on ecological conditions and land use problems that have been reported to us in the watershed.

Eleven indicators of water quality health have been used to assess the water quality of 22 streams in our watershed. These include pH, conductivity, salinity, dissolved oxygen, nitrates, phosphates, total coliforms, E. coli, temperature, total dissolved solids and suspended sediment counts. These indicators are summarized and used to assess the overall health of the watershed in our Water Quality Reports. The overall health in our watershed is fair but some streams show ecological damage as a result of land based activities.

For the streams in our watershed where water quality is assessed, the healthiest streams were found to be those in the Memramcook region. Streams that flow through urban centers tended to be in general decline and in regions where human populations or animal populations were high. Generally water quality is worse in areas where land activity is more intense and riparian zones and wetlands have been damaged or destroyed.

Impact activities noted in our watershed include agricultural activities. The streams most affected by agriculture are the Little and North Rivers. High phosphate and nitrate levels were also found in the streams that ran through golf courses and higher than normal sediment levels were noted in streams along tracts of land where forestry and development activities were taking place.

Discharge from the greater Moncton sewerage treatment plant continues to be the major point source of contamination in the Petitcodiac River. Most contamination originates from a wide variety of non-point sources of contamination and these are much more difficult to identify. More effort needs to be devoted to assessing the cumulative affects of land based activities to curb the production of non-point pollution.

A Provisional Water Classification document was created by the PWMG in 2002. In this document, streams were classified according to defined water quality parameters. The objective of this document was to serve as a public record of baseline water quality in the streams assessed with the primary goal of ensuring water quality is not degraded through land based activities. Since the creation of the Provisional Water Classification document the PWMG has been working with stakeholder groups to manage and minimize the impacts of their activities. This watershed management plan is a natural progression resulting from that original document. We hope that our stakeholders will embrace as an opportunity to work together on common watershed management goals.

## **6. WHY WE NEED AN INTEGRATED WATERSHED MANAGEMENT PLAN**

Current climate change models for Atlantic Canada suggest that there will be changes in the atmospheric components of the water cycle in our region. This will result in changes in evaporation rates, storm severity, increased temperatures (air and water) and possibly droughts. The changing atmospheric conditions will result in significant alterations within the natural ecosystem of our watershed. These changes will impact species diversity, habitat health, and the social and economic aspects of our communities.

Although Canada as a whole experienced an increase in temperature, Atlantic Canada underwent slight cooling during the last fifty years. One of the reasons for this is that the earth's average temperature has been increasing, causing ice caps in Greenland and Northern Canada to melt. The cooler air and water temperatures associated with the melted ice has been flowing downward through the Atlantic Ocean causing a cooling effect on Atlantic Canada. An increase in greenhouse gas emissions is expected to result in a changing and more variable climate in Atlantic Canada. There will likely be a higher frequency of weather extremes such as unusually severe storms, drought and less winter snow cover. It is expected that there will also be a rise in sea-levels which would increase the risk of floods, coastal erosion and sedimentation around our coast lines. The future variability predicted in climate change models for this region will also result in possible decreases in soil moisture, increases in the seasonal amounts of surface water runoff, and possibly declines in water levels in groundwater aquifers and surface water systems (streams and lakes). It will also impact species at risk through the invasion of new species and increased habitat pressures.

Climate change has the potential to undermine many of the ecosystem remedial actions that we have already undertaken. The human populations living in Atlantic Canada have great flexibility and the ability to adapt to climate change but many of our wildlife species will not be able to adapt to rapid rates of ecosystem change. Climate change will increase the stress load on species that are already at risk making it imperative that we examine how our activities make our ecosystems less resilient to changes in climate. Some of these impacts can be mitigated through good watershed management and planned intervention.

### **WATERSHED MANAGEMENT ISSUES RELATED TO CLIMATE CHANGE**

#### **Flood Control**

Flooding impacts will be a direct result of more severe weather giving more intense rainfalls. There will also likely be an increase in winter thaw events which will have an impact upon watercourses and watersheds. In urban areas, severe storms could result in an increase in urban flood issues such as storm sewer surcharging, street flooding and basement flooding. In areas with combined storm and sanitary services, overflows may become more commonplace since our current municipal infrastructure would not be able to handle the increased surface water runoff.

## **Erosion Control**

There is a need to develop watershed management strategies to mitigate the impacts of urbanization on urban rivers and streams. Increased surface water run-off that results from development activities in urban regions of a watershed can increase the erosion rates of a watercourse. Erosion is a natural process related to the fluvial geomorphology of a watercourse. A stable hydrological system has a balance of erosion and deposition rates. Increases in surface water runoff upset the hydrological balance and results in increased wearing of stream banks. Increased storm frequencies and increases in the amounts of precipitation will further disrupt hydrological imbalance. Should climate change lead to increases in the frequency of severe storms and in the frequency of the channel forming flows, it can be expected that our rivers and streams will react to reflect the changes in flow rates. An increase in the rates of freeze and thaw events will also create instability of stream banks, lead to stream bank failure (slumping), and further add to erosion problems already occurring.

## **Stormwater Management**

Stormwater management reflects a program specifically designed to mitigate impacts related to changes within the hydrologic cycle due to urbanization. Ideally stormwater management should encompass issues of water quality and quantity. If the amount of surface water runoff increases, the facilities that we currently have in place to manage stormwater may no longer be sufficient in providing water quality control.

## **Fisheries Management**

Maintaining a healthy aquatic system for aquatic populations of all species is highly dependent upon established flow regimes within a watershed. The base flows of most streams are dependent upon consistent groundwater recharge rates and certain fish populations are highly dependent upon the lower water temperatures (thermal refuges) provided by groundwater discharges into freshwater ecosystems. Changes in air temperatures and low flow rates during seasons of drought will place enormous stress on our salmonid populations and other cold water fish species in Atlantic Canada. Changes in groundwater temperatures and stream flow rates have the potential to result in cold water habitats being completely lost and a shift in the types of fisheries that our watershed may be able to support. The changes will be most dramatic in the watercourses that have been degraded by human activity.

## **Terrestrial Management**

Watershed Management programs and policies also encompass terrestrial habitats. A forested ecosystem will typically absorb 99% of all precipitation and minimize the amount of surface water run-off directed into a stream or water body. When a forest is clear-cut it increases surface water run-off and decreases the amount of water that infiltrates into the soil. According to a study done in the province of Quebec, when more than 50% of a watershed is clear-cut, there is a moderate probability that the change in peak flow resulting from precipitation events will be severe enough to modify the watercourse morphology and aquatic habitat. These effects can last for up to 35 years, until the forest has had enough time to regenerate itself.



Erosion, overland run-off and increased sedimentation due to exposed soils and dirt roads all contribute to water quality problems within forested ecosystems. Climate change and increased storm events will likely exacerbate the problem. On the other hand leaving a forest intact will protect a watershed from the negative effects of climate change. Extreme storm events have become five times more frequent in New Brunswick in the last 10 years.

The protection of topsoil, riparian zones and habitat corridors are also important components of a watershed management plan; this in turn will protect streams from changes in the hydrological cycle and changes in land use. They are also measures that can be used to protect the habitat of our native flora and fauna.

### **Ecosystem Services in our watershed**

Natural ecosystems provide human societies with many essentials, these include: food, recreation, fuel, drinking water, clean air, pharmaceutical products, energy, wood and fiber products. These goods are used to drive essential components of our economies. We tend to understand the need to protect the types of ecosystem resources from which we derive direct economic benefit. There is another level of resources directly supplied by our ecosystem that are often overlooked, and those are the services that are the life support systems for all species. These include the purification of air and water, detoxification and decomposition of wastes, regulation of the climate, regeneration of soil fertility, and maintenance of biodiversity, from which key ingredients of our agricultural, pharmaceutical, and industrial enterprises are derived.

Ecosystem services in our watershed that should be documented, evaluated and monitored include:

1. Forests, and the role they play in regulating the water cycle, mitigating floods, carbon sequestering, droughts, erosion, siltation, and critical species populations.
2. Wetlands and the role that they play in nutrient recycling, water purification, mitigating floods and droughts, and providing critical habitat for species populations.
3. Estuaries and the role they play in flood control, sediment control, water purification, fisheries/wildlife habitat, coastal protection, nutrient cycling and tourism.
4. Riparian zones and the role that they play in protecting water quality and aquatic habitat in our watershed.

Human impacts upon our ecosystem services are escalating and this threatens their ability to function. The primary threats to ecosystem services are often associated with land use changes, introductions of invasive species, or releases of toxic chemicals.

## **7. RECOMMENDATIONS TO MEET CONCERNS RAISED BY STAKEHOLDERS**

Based upon the survey results (found in the appendix), consultations with stakeholders and our objectives as an organization, we propose to work on the following recommendations for the next five years.

### **7.1**

The PWMG should work with each one of the stakeholder groups listed in section 2 (municipalities, agricultural producers, forestry operations, golf clubs, private corporations, federal and provincial governments, private landowners, other non-government organizations) to develop beneficial management practices as they pertain to the protection of water quality and quantity.

### **7.2**

The PWMG should work to improve the capacity of our organization to analyze water quality and quantity parameters. The collection of data from specific locations in the watershed is to be used to guide the PWMG in mitigation projects that are most likely to have a positive influence on water quality and quantity.

Changes in water quality and quantity due to either broad-scale stresses (e.g., climate change, long-range transport of contaminants) or direct use (e.g., industrial, agricultural, resource extraction) must be detected as soon as reasonably possible through regular, systematic monitoring. Early detection is essential for timely corrective or adaptive action.

Furthermore, monitoring of water resources by PWMG must be done for the benefit of society and the ecosystem as a whole. The analysis and interpretation must be scientifically objective and must not be influenced by special interest groups, private or public. Reporting must be regular and free from political interference.

### **7.3**

The PWMG should continue working with other Non-Government Organizations (NGO's) who work in our watershed to reach the goals outlined in this management plan. We also acknowledge that the battle for financial resources from the same limited funding sources can at times become a point of stress for any NGO, but the best way to manage limited resources is to find ways to work together and reduce or minimize redundancy.

### **7.4**

The PWMG should begin working towards the restoration of degraded aquatic habitat and the recognition of critical habitat in our watershed in an effort to improve environmental resiliency. Resiliency is the capacity of a system to survive, adapt, and grow in the face of unforeseen changes or catastrophic events. A healthy environment

will create a population of species that are more resilient to the changes that will likely result from climate change. (Center for resilience at the Ohio state University)

## 7.5

The PWMG should look for more opportunities to educate watershed citizens about climate change, ecosystem services, and the protection of water quality and quantity.

Our vision for a healthy and sustainable watershed will become reality only if it is shared - by government agencies at all levels; by landowners and land managers; and by the people who live here. Informing the residents of our watershed in schools, community groups, even one-on-one - is an essential component of this plan.



"What's in the Water?" Lab with high school students at the Irishtown Nature Park.

Crandall university student sampling macro-invertebrates



Envirothon 2011

## 8. ACTION PLANS FOR THE IMPLEMENTATION OF RECOMMENDATIONS

8.1

The PWMG will work with stakeholders to develop beneficial management practices as they pertain to the protection of water quality and quantity.

- In 2012, the PWMG will work with municipalities and the agricultural community to develop this watershed management plan as it pertains to climate change, ecosystem services and water protection.
- The PWMG will review the policies of all municipalities within our watershed that deal with the management of surface and storm water management.
- The PWMG will promote the sharing of information between municipalities about watershed management policies.
- The PWMG will encourage municipalities to work with developers to prevent surface water run-off problems.
- The PWMG will work with all of the municipalities in our watershed to ensure that strategies are in place that will help our communities adapt to climate change.
- The PWMG will work to bring the seven municipalities within our watershed together to develop common policies on watershed and environmental issues.
- The PWMG will review the Federal and Provincial policies designed to protect freshwater resources in our province as they pertain to agriculture.
- The PWMG will work directly with individuals who work in the agricultural sector to review water management strategies.
- The PWMG will work directly with the agricultural community to develop beneficial management strategies to protect freshwater and groundwater resources in our watershed.
- The PWMG will work towards the documentation, assessment and restoration of degraded watercourses within municipal boundaries and within agricultural operations.
- The PWMG will work with local municipalities and private landowners to develop strategies to protect drinking water resources.
- The PWMG will work with all municipalities and the agricultural community to increase the resiliency of our ecosystem in an effort to moderate the changes that will result from climate change.
- The PWMG will work directly with the agricultural community and municipalities in an effort to identify knowledge gaps as they pertain to climate change and watershed protection.
- In subsequent years (2013 to 2016) the PWMG will develop the capacity to work with the remaining stakeholder groups.

## 8.2

The PWMG should work to improve the capacity of our organization to analyze water and habitat parameters, and use the data to guide the PWMG in mitigation projects that are most likely to have a positive influence on water and habitat quality.

- The PWMG will work to re-assess current monitoring protocols and develop water quality assessment criteria specific to each stream in our watershed according to biotic potential. We will work with volunteers and stakeholders to collect water quality data and use the data as a reference to assess the long term success or failure of our organization with regards to the primary goal of maintaining and/or improving water and habitat quality in our watershed.
- Water quality data that has been collected for the last decade will be used to provide baseline data for each stream in our watershed.
- The PWMG will work towards the development of the capacity of our organization to monitor groundwater resources.
- The PWMG will develop aquatic health indicators for each tributary of the Petitcodiac River that can be used to monitor habitat improvement or degradation. This information will be added to our provisional water classification report.
- The PWMG will begin noting and recording the presence and size of wetlands in our watershed. These will be added to our provisional water classification report.
- The PWMG will begin noting and recording the size of forests in our watershed and the rate or degree of deforestation.
- The PWMG will begin monitoring the condition of the Petitcodiac estuary.
- Streams that have not been identified and classified in our 2002 Provisional Water Classification report should be classified and added to our Provisional Water Classification document.
- The PWMG will work in partnership with the PFRC and begin documenting the presence of species at risk and designating their habitat as critical.



### 8.3

The PWMG should continue working with other Non-Government Organizations (NGO's), governments, corporations, industries, and stakeholders to reach the goals outlined in this management plan.

NGO's that the PWMG currently work with include: The Fundy Biosphere Reserve, The Conservation Council of New Brunswick, the Fundy Model Forest, The Petitcodiac Sportsman's Association, Moncton Fish and Game, The Petitcodiac Fish Recovery Coalition, The Elgin Eco-Center, The New Brunswick Environmental Network, The New Brunswick Forestry Association, The Irishtown Nature Park, The Petitcodiac Riverkeepers and Fort Folly First Nations. We will remain open to working with any NGO that will help us obtain our objectives.

- The PWMG will seek to work in co-operation with all stakeholders with the objective of improving and maintaining water and habitat quality in rural and urban streams.
- The PWMG will seek opportunities to work with district planning commissions in an effort to protect critical habitat outside of municipal boundaries.

### 8.4

The PWMG will continue to work towards the restoration of degraded aquatic habitat in our watershed in an effort to improve environmental resiliency.

- In 2012 the PWMG plans to work with the City of Moncton to restore a section of Jonathan Creek. (2012)
- The PWMG has collected extensive data on most of the streams in the Petitcodiac Watershed and will begin developing mitigation plans for all degraded habitat. This is a shared common objective of the Petitcodiac Fish Recovery Coalition and we will continue to work with coalition members to complete this objective. (2012-2017)
- The PWMG will work towards the identification of all sources of contamination from both point and non-point sources, determine if pollutant loads are affecting habitat quality and design a remediation plan to reduce or eliminate all pollution sources.



PFRC Members Electrofishing an Abboiteaux that drains into the Petitcodiac River.

## 8.5

The PWMG should look for opportunities to educate watershed citizens about :

- i) Climate change,
- ii) Ecosystem services,
- iii) Protection of water quality and quantity

- Leverage points, from an industrial standpoint, are the points within a system where small changes can induce big results. The PWMG must find the leverage points in our watershed by working with and examining all the activities of our stakeholders. We must also examine our own strategies and make certain that the information that we are collecting and using is accurate and the best available.
- From our watershed management survey, we can see that there are knowledge gaps in our citizen's perception of watershed issues. The education of our watershed citizens is a leverage point in our watershed. There is a need within our communities to take complex scientific information, break it down, and provide it as information that is relative to each individual. By providing information to our watershed citizens, we can promote positive changes in behaviors that will result in better water resource protection.
- The PWMG will work with stakeholders to develop specific strategies to help communities and ecosystems identify and adapt to the problems and risks associated with climate change as it pertains to water quality and quantity issues.
- The PWMG will work with stakeholders to develop specific strategies to help communities and ecosystems to the problems and risks associated with climate change.
- The PWMG will work towards educating the population in general about the importance of the ecosystem systems provided by the watersheds and the value of the services that are provided.
- The PWMG will provide our watershed citizens information on the importance of water conservation.



PFRC members Installing the Fort Folly Habitat recovery smolt wheel in the Pollett River

## 9. DESIRED WATERSHED MANAGEMENT OUTCOMES

The implementation of this IWMP will contribute toward achieving the following outcomes:

- **Source water protection:**

By developing and implementing our objectives for water quality and quantity, combined with our educational programs and beneficial management practices for stakeholders, it should be possible to provide source water protection for all streams in our watershed.

- **Groundwater protection:**

By working with private landowners and municipalities without municipal water supply systems, we should be able to develop strategies to protect groundwater quality and quantity. Groundwater quality is an important “quality of life” component necessary for a sustainable future economy.

- **Healthy waterbodies and riparian areas:**

By developing and implementing objectives necessary for maintaining water quality and quantity, combined with identifying and implementing beneficial management practices for our stakeholders, our goal of maintaining and protecting healthy aquatic ecosystems will be achieved.



Macro-invertebrate sample from the Pollett River



A frog from the Petitcodiac River

## Appendix

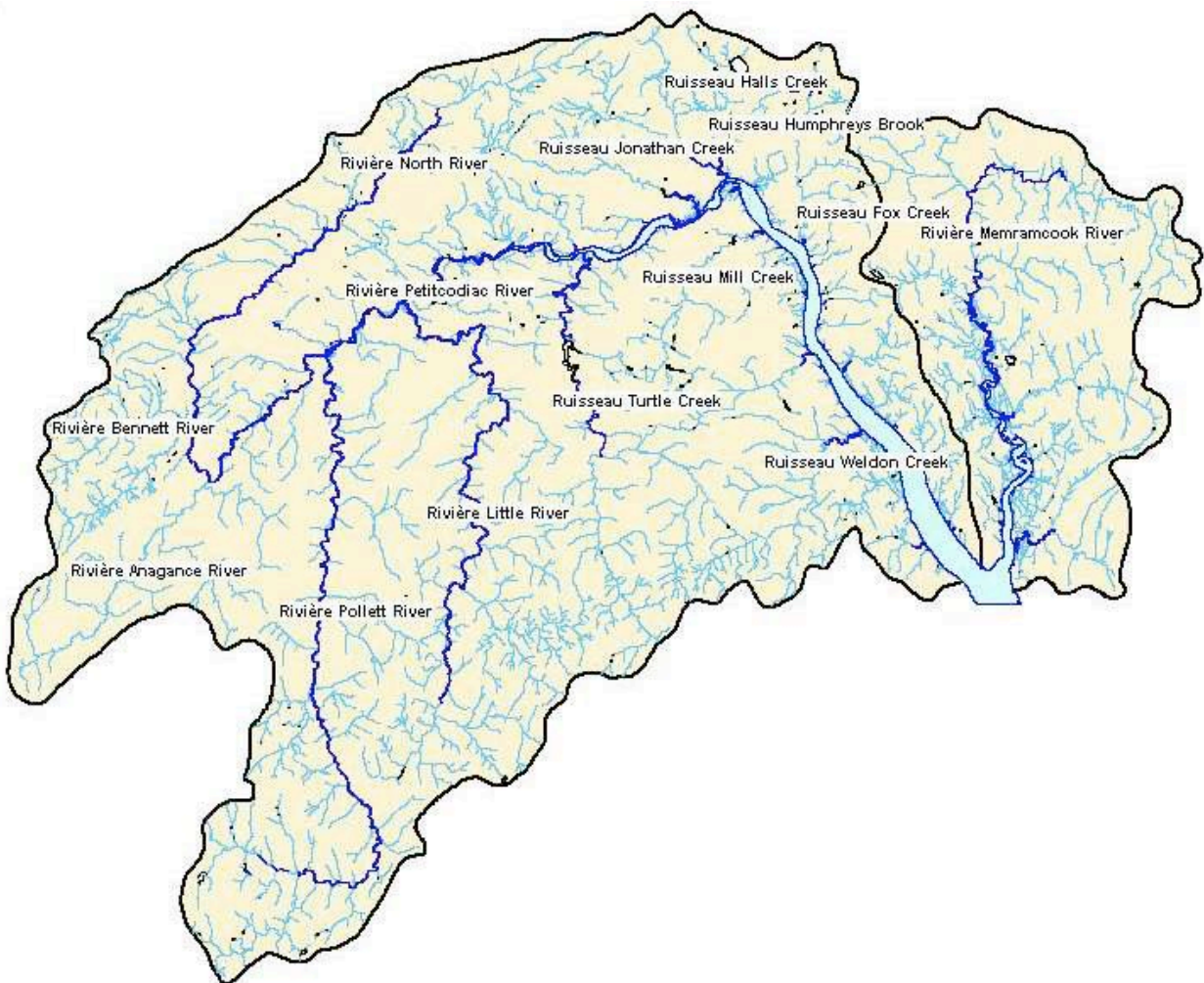
### **1. THE PETITCODIAC RIVER ESTUARY AND WATERSHED**

The Petitcodiac River is located in southeastern New Brunswick at the head of Shepody Bay and it is the 13<sup>th</sup> largest drainage basin entirely contained within provincial boundaries. It is a vastly unique and dynamic system, emptying into a macro-tidal estuary, which begins at the head-of-tide in Salisbury. The head-of-tide at Salisbury marks the end point of the river, which means much of what is considered the Petitcodiac River is actually the Petitcodiac River estuary. The estuary experiences tides with an amplitude of 11m and a tidal prism of 450 km<sup>3</sup>. The estuary waters also carry an unparalleled Total Suspended Solids (TSS) load of 30,000 mg/L, giving the Petitcodiac its nickname, the Chocolate River. Another unique characteristic of the Petitcodiac is its tidal bore, which was historically in the order of 1 to 2 m in height.

Many species of diadromous fish move through the Petitcodiac River system and its estuary. The estuary is a physically demanding environment due to constantly changing water levels, its velocities, and the extremely high TSS load. Diadromous fish moving through the system use the tidal bore to move upstream, saving energy and reducing the amount of time that they must spend exposed to the potentially harmful high TSS load. The Petitcodiac River was once populated by 13 diadromous species of fish including: Atlantic salmon, American shad, American eel, gaspereau, sturgeon and brook trout.

The Petitcodiac Watershed is also home to more than 100,000 people, most of whom live in the tri-community area of Moncton, Riverview and Dieppe. There are five additional municipalities located within the watershed, Memramcook, Salisbury, Dorchester, Hillsborough and Petitcodiac. The watershed contains a complex diversity of natural land forms and ecological regions, and supports a wide variety of human land uses.

## The Petitcodiac River Watershed





## **2. ISSUES IDENTIFIED BY STAKEHOLDERS**

The Petitcodiac Watershed Monitoring Group has summarized and identified the concerns raised by stakeholders about watershed issues from eight community wide forums held during the spring, summer and fall of 2011.

### **1. Water quantity:**

Concerns were expressed over the quantity of water in local streams and how clearcutting activities in the headwaters of streams may result in an increased flooding risk to landowners downstream. Recent flooding events resulted in thousands of dollars in property damage to homes, a net loss in timber as a result of large trees being uprooted in floodplains and infrastructure damage to rural bridges, some of which has yet to be repaired. Concerns were also expressed regarding the ability of the Pollett River to sustain flow rates during dry spells if clearcutting activity all along the stream continues at current rates. Older residents could recall dry summers when stream flow was next to nothing with forests intact. Some expressed concern that portions of streams may be allocated to oil and gas companies for shale gas production. Concerns were expressed over the causeway issue; most people expressed concern that the causeway issue was still not resolved, since the gates could still be closed. Residents upstream of the causeway were happy that the gates were open and fish passage had been restored. Residents of Riverview surprisingly did not express regret over the loss of their headpond “lake” or marina.

### **2. Ground water quantity:**

Some residents expressed concerns over development activity that has resulted in the loss of private drinking water wells in other parts of the province and in our watershed. The concerns were linked to mining activity and shale gas exploration /production which has started in the Petitcodiac watershed. Even with compensation measures proposed by the government in place, people do not want to lose the value of their property as a result of industrial development. It was pointed out that there is more than just monetary value to personal property. In other regions of the watershed six (Memramcook) water wells have mysteriously gone dry.

Smaller municipalities within the watershed expressed concern over their ability to protect groundwater resources in order to supply drinking water to residents should it become necessary in the future.

### 3. **Water quality:**

Concerns over the development of shale gas industries and the potential of the industry to contaminate both freshwater and drilled wells. One resident believed that their drinking water might have already been contaminated and expressed frustration over not knowing what to test their water for. Concern was expressed over the potential of success of the restocking efforts of Inner Bay of Fundy Salmon in the Pollett River if the impact of declining water quality as a result of land use activities, water levels and water temperatures is not addressed. Some believe that there are drinking water wells that are affected by agricultural activity resulting in high coliform and nitrate levels. Concern was also expressed over the presence of old water wells on abandoned properties or water wells drilled (some by industry) but not in use that have the potential to contaminate aquifers. Construction of dirt roads and sedimentation of watercourses as a direct result of forestry activities and agricultural contamination of streams through the application of animal manures close to streams, just before rain events or even on the snow or frozen ground during winter months. Untreated sewage is entering streams in both rural and urban areas.

### 4. **Habitat quality:**

Habitat quality concerns included: the destruction of habitat by the development of shale gas drilling pads and an extensive network of roads connecting them. The destruction of forest habitat through clearcutting activities. Loss of old growth Acadian forest, no old trees for cavity nesting birds, no refuge for large mammals. Spraying of tree plantations for elimination of hardwoods which results in a loss of foraging opportunities for deer. Expansive clearcuts planted in only a few varieties of trees, mostly softwoods. Recreational use of all terrain vehicles through watercourses, within watercourses and up and down riparian zones. Development in both rural and urban areas that results in the destruction of riparian zones and wetlands. Unregulated development in rural areas, especially in floodplains. Barriers to fish passage – dams and culverts. Damage to riparian zone in private woodlots and waterfront development.

### 5. **Knowledge Issues:**

People requested information on well water maintenance and monitoring, septic system maintenance – how to tell when it's not working right, septic field requirements and proper maintenance. Some expressed concern over the lack of water conservation effort in our watershed. People don't seem to know about riparian zone requirements or the importance of maintaining riparian zones on their properties. People don't understand why government issues permits for the establishment of certain industries along watercourses (particular concerns were raised about specific auto salvage operations). Little knowledge exists about the invasive and endangered species present in our watershed. Some were surprised that there were water quality or habitat issues in our watershed.

## 6. Other concerns:

Lack of enforcement of regulations by governments, lack of rural planning by regional planning commissions, lack of the ability of different government departments to work together. Illegal dumping sites. Some concern over the possibility of negative attention brought to specific industries through our watershed management plan.

## Watershed Survey Results

As part of the consultation process, citizens were asked to voluntarily participate in a watershed survey. The survey questions and results are as follows. Those that chose to participate in the survey were asked to rate on a scale of 1 to 5 how much they agreed with the following statements, with 1 as not important and 5 as very important. Participants were also encouraged to make comments to explain their position on any point if they wanted to. The survey was voluntary and 22 people chose to respond to the survey. The survey was made available on-line through our web-site and publically through our public consultation process. The entire survey is available in the appendix.

1. The PWA should continue to monitor and work to improve freshwater resources in the Petitcodiac watershed.

Rating : 5 (21/22)

Percentage : 95%

Rating : 4 (1/22)

Percentage : 5%

Comments : none

2. The PWA should work to protect and monitor groundwater quantity and quality in our watershed.

Rating : 5 (18/22)

Percentage : 82%

Rating : 4 (2/22)

Percentage : 9%

Rating : 2 (2/22)

Percentage : 9%

Comments : « The government should be doing this, PWMG should be a watchdog. »

3. Water and land-use planning should be linked at the watershed level.

Rating : 5 (16/22)

Percentage : 82%

Comments :

Rating : 4 (2/22)

Percentage : 9%

Rating : 3 (2/22)

Percentage : 9%

4. Water quality goals and objectives need to be established and monitored in our watershed.

Rating : 5 (18/22)

Percentage : 82%

Comments :

Rating : 4 (2/22)

Percentage : 9%

Rating : 2 (2/22)

Percentage : 9%

5. It is important that we actively protect drinking water resources in our watershed.

Rating : 5 (18/22)

Percentage : 82%

Comments :

Rating : 3 (2/22)

Percentage : 9%

Rating : 2 (2/22)

Percentage : 9%

6. Riparian zones should be restored along the banks of all streams in our watershed.

Rating : 5 (13/22)

Percentage : 59%

Comments :

Rating : 4 (5/22)

Percentage : 23%

Rating : 3 (4/22)

Percentage : 18%

7. It is important that wetlands be protected and maintained in our watershed.

Rating : 5 (15/22)

Percentage : 68%

Comments :

Rating : 4 (4/22)

Percentage : 18%

Rating : 3 (3/22)

Percentage : 14%

8. The environmental impacts of industry should be monitored and minimized.

Rating : 5 (16/22)	Rating : 4 (3/22)	Rating : 3 (2/22)	Rating : 1 (1/22)
Percentage : 73%	Percentage : 14%	Percentage : 9%	Percentage : 5%

Comments :

9. The effects of municipal and industrial expansion need to be minimized or reduced.

Rating : 5 (12/22)	Rating : 4 (3/22)	Rating : 3 (4/22)	Rating : 2 (1/22)	Rating : 1 (1/22)
Percentage : 55%	Percentage : 14%	Percentage : 18%	Percentage : 4.5%	Percentage : 4.5%

Comments :

10. The net loss of forested land should be minimized or reduced.

Rating : 5 (14/22)	Rating : 4 (4/22)	Rating : 3 (1/22)	Rating : 1 (2/22)
Percentage : 64%	Percentage : 18%	Percentage : 4%	Percentage : 9%

Comments :

11. The impact of camping and other recreational activities on public land need to be minimized or reduced.

Rating : 5 (8/22)	Rating : 4 (0/22)	Rating : 3 (5/22)	Rating : 2 (3/22)	Rating : 1 (6/22)
Percentage : 36%	Percentage : 0%	Percentage : 23%	Percentage : 14%	Percentage : 27%

Comments :

12. General knowledge of the importance of a healthy aquatic ecosystem needs to increase.

Rating : 5 (15/22)	Rating : 4 (2/22)	Rating : 3 (3/22)	Rating : 2 (2/22)
Percentage : 68%	Percentage : 9 %	Percentage : 14%	Percentage : 9%

Comments : Appreciation needs to increase.



13. We need to increase our knowledge of groundwater quality and quantity in our watershed.

Rating : 5 (15/22)	Rating : 4 (2/22)	Rating : 3 (4/22)	Rating : 1 (1/22)
Percentage : 68%	Percentage : 9%	Percentage : 9%	Percentage : 4%

Comments :

14. It is important that we understand the impacts of resource, municipal, industrial, and agricultural developments on our groundwater resources.

Rating : 5 (16/22)	Rating : 4 (4/22)	Rating : 3 (1/22)	Rating : 1 (1/22)
Percentage : 73%	Percentage : 18%	Percentage : 4.5%	Percentage : 4.5%

Comments :

15. Management plans and strategies should be developed to protect our groundwater resources.

Rating : 5 (14/22)	Rating : 4 (6/22)	Rating : 3 (1/22)	Rating : 1 (1/22)
Percentage : 66%	Percentage : 27%	Percentage : 4.5%	Percentage : 4.5%

Comments :

16. We need more cooperation and communication among landowners, developers, industries and government to improve water quality issues.

Rating : 5 (18/22)	Rating : 4 (2/22)	Rating : 3 (2/22)	Rating : 1 (0/22)
Percentage : 82%	Percentage : 9%	Percentage : 9%	Percentage : 0%

Comments :

17. The provincial government of New Brunswick should fund or provide long-term water quality monitoring and planning in our watershed.

Rating : 5 (19/22)

Percentage : 86%

Rating : 4 (2/22)

Percentage : 9%

Rating : 3 (1/22)

Percentage : 5%

Rating : 1 (0/22)

Percentage : 0%

Comments :

18. The PWA should continue to work with stakeholders, industries and municipalities to improve water quality and develop a water resource management plan for our watershed.

Rating : 5 (22/22)

Percentage : 100%

Rating : 4 (0/22)

Percentage : 0%

Rating : 3 (0/22)

Percentage : 0%

Rating : 1 (0/22)

Percentage : 0%

Comments :

19. We need to begin to evaluate the changes or risks to our water supply that could result from climate change and/or groundwater diversions.

Rating : 5 (14/22)

Percentage : 64%

Rating : 4 (4/22)

Percentage : 18%

Rating : 3 (3/22)

Percentage : 14%

Rating : 1 (1/22)

Percentage : 5%

Comments :

20. In your opinion, does the Petitcodiac Watershed Alliance have a role to play in protecting freshwater and groundwater resources?

Responses : 22 people wrote » yes »

Additional comments included :

- It is the only one.
- A non-governmental organisation, which communicates easily with all stakeholders, is an essential element.
- I believe that is their reason for being.
- Fresh water but not groundwater.

21. Would you like to be informed of the progress that we are making in terms of watershed management and restoration?

21 people indicated that they would be interested in our progress.

Extra comments made by some of the participants who said yes:

- It is very important.
- Already am (a PWMG member)
- Probably by public meetings or newspaper or annual reports. Find a reporter.
- Newspaper and virtual media.

22. Is there anything in our watershed management approach that you feel is not necessary or is there something that you think we are missing?

- Water conservation seems to be a gap – efforts to promote water conservation.
- More emphasis on the manner of residential & other development particularly informing the consumers of these developments is needed! We need a gold/silver/bronze designation given to developments based on their protection of water quality and flow regime. Homeowners & landscapers need to be more protective on this front during land development.
- Industrial development and resource extraction has to happen but at less cost to our environment.
- Not that I know of yet.
- PWA should be involved with the issue of building permit by town planning.
- A jail to put lawbreakers and throw away the key!
- Time will tell. Probably more info sessions.
- No.
- Drum up more publicity and let public know how to get more involved and join the Alliance.
- Our mission needs to be narrowly focused on freshwater streams if we hope to have an impact given our limited resources.

23. If you would like to be added to our mailing list, please fill in the form below:

16 people provided contact information

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