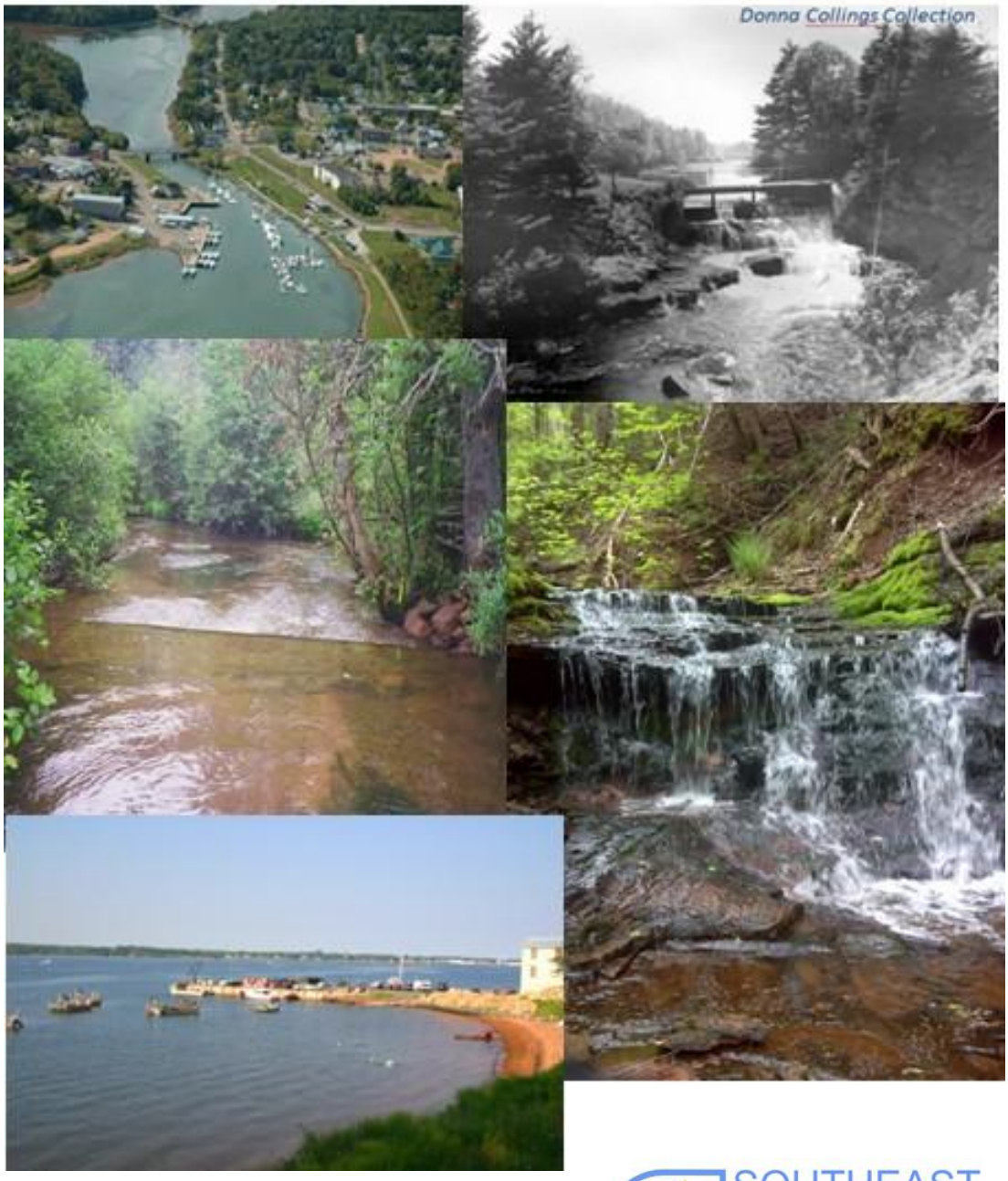
Montague-Valleyfield and Area Watershed Management Plan

– Prepared by Southeast Environmental Association 2016 –



SOUTHEAST ENVIRONMENTAL ASSOCIATION

SEA Change! SEA Solutions! SEA the Future!

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Executive Summary

The usual definition of a watershed is an area of land that drains to a common downstream point with the land and water within the area connected by a network of waterways, drainage systems, and groundwater sources; however, this connectivity extends beyond streams, rivers and groundwater supplies. It extends to the plants and animals that depend upon them for life and to the communities where people, businesses, and industries are interconnected by this common water resource. People's activities can have an impact the health of the watershed, just as the watershed has an impact on the health of those in the community.

An engaged public is the key to a healthy and sustainable watershed which will support the long-term interests of the area's watershed communities. The goal of the Montague-Valleyfield & Area Watershed Management Plan (MVWMP) is to protect, enhance, and restore the water, land, aquatic and terrestrial habitats without diminishing the economic, social, cultural and environmental health of residents and stakeholders. This plan is a living document which will help guide the work of SEA and reflects the concerns, goals and objectives indicated by residents and stakeholders present at community meetings held in the winter of 2016 and 2008. Now that the Goals and Objectives have been identified, work can begin to improve the Montague-Valleyfield watershed area.

This document contains eight sections: INTRODUCTION; BACKGROUND INFORMATION; WATERSHED MANAGEMENT ISSUES; CONTRIBUTING FACTORS TO WATERSHED MANAGEMENT ISSUES; CURRENT MANAGEMENT ISSUES; WATERSHED PLANNING PROCESS; VISION STATEMENT, GOALS & OBJECTIVES; and IMPLEMENTATION.

- The **INTRODUCTION** covers the relationship, both past and present-day that watershed communities have with the rivers.

- Secondly, **BACKGROUND INFORMATION** outlines the specific characteristics of the Montague-Valleyfield River watershed including land use, population and watershed conditions.

- Thirdly, **WATERSHED MANAGEMENT ISSUES** address the issues that are influencing the current state of the watershed and the problems they may cause.

- Next, **CONTRIBUTING FACTORS TO WATERSHED MANAGEMENT ISSUES** discusses the potential causes of environmental degradation within the watershed. From this, the community can determine the best way to address the issues.

- **CURRENT MANAGEMENT STATUS** provides a recap of the issues and how things look moving forward.

- **WATERSHED PLANNING PROCESS** describes the process that brought this document to fruition and how its contents accurately reflect the hopes and needs of the watershed communities.

- **VISION STATEMENT, GOALS, OBJECTIVES, AND STRATEGIES** identify the specific course of action that will be implemented to address the concerns of the watershed stakeholders. As the core of this document, this section details in a prioritized manner the specific methods needed to enhance the watershed.

The watershed community identified the following Vision Statement and Goals:

VISION STATEMENT

"A healthy community, identifying and promoting sustainable environmental practices specific to our watershed with special consideration for renewable resource based industries."

GOALS

1. Preserve and Enhance the Quality and Quantity of Ground and Surface Water, Protecting it for Future Generations;
2. Restore and Protect Fish and Wildlife Habitat;
3. Promote Active Living and Increase Recreational Opportunities;
4. Foster Stewardship Ideals and Reward Those Who Strive to Achieve Them;
5. Manage Watershed Resources by Encouraging Cooperation and Respect among Residents, Landowners, and Stakeholders;
6. Improve Communication and Provide Educational Opportunities;
7. Identify and Conserve Sites of Historical Significance and Unique Environmental Areas.

Finally, **IMPLEMENTATION** emphasizes the fact that the watershed planning process must be ongoing and will require continued attention. In addition, this section illustrates the need for collaboration between the communities, the Montague-Valleyfield Watershed Enhancement Committee, Southeast Environmental Association, and the Municipal, Provincial, and Federal governments if watershed management is to be successful.

Acknowledgements

The Montague-Valleyfield Watershed Management Planning Group provided direction for completion of the current document. They include:

Jackie Bourgeois	Jennifer Smith
Melissa Leard	Lawrence Millar
Ian Petrie	Allison Walsh

We also want to acknowledge the members of a previous planning group whose input has helped to create the document we have today. The 2008-2010 Planning Group members include:

Sara Jane Bell	Tina MacKenzie	Daniel Martens	Wilfred Nicholson
Dale Thompson	Jayne MacDonald	Sid Watts	Edgar Dewar
John Rowe	Jim Sutton	Ellen O'Brien	Janice Taylor
Tom Macleod	Charlie Trainor	Carl Balsor	
Robert Benoit	Ray McGarry	Peter Verleun	

Community Involvement

Special thanks to the residents and stakeholders who attended the watershed-planning meetings and information workshops. Their comments, suggestions, and input are the foundation of the Montague-Valleyfield Watershed Management Plan.

Additional Contributors

2016

Kate MacQuarrie – Dept. of Communities, Land & Environment (Guest Speaker)

Rosie MacFarlane – Dept. of Communities, Land & Environment (Guest Speaker)

Mary Finch – Watershed Alliance (Guest Speaker)

2008

Cindy Crane – Dept. of Environment, Energy, and Forestry (Guest Speaker)

Bruce Raymond – Dept. of Environment, Energy, and Forestry (Guest Speaker)

Andrew Ing – Dept. of Environment, Energy, and Forestry (GIS Support)

Mary Lynn McCourt – Dept. of Environment, Energy, and Forestry (GIS Support)

Andrew Daggett – Town of Montague Chief Administrative Officer (Technical Advice)

Allan Greene – Town of Montague (Technical Advice)

Shane MacIsaac – Dept. of Fisheries and Oceans (Technical Advice)

Fred Cheverie - Souris & Area Wildlife Branch Coordinator (Technical Advice)

Yefang Jiang – Dept. of the Environment, Energy, and Forestry (Groundwater Modeling)

PEI Watershed Management Fund

The Watershed Management Fund (WMF) of the PEI Department of Communities, Land & Environment provides support to community-based watershed organizations that are involved in the watershed planning process, with an emphasis on a holistic watershed approach. The WMF provided direct financial assistance for the Montague-Valleyfield & Area Watershed Management Plan.

Watershed Management Plan Co-writers

This document was written and edited by Melissa Leard and Jackie Bourgeois.

1.0 Introduction

There has always been a close bond between the Montague-Valleyfield Rivers and the residents of its watershed. The rivers and their tributaries have provided the surrounding communities with a variety of livelihoods, ensuring growth and stability for the area. The rivers have also provided industry, transportation, and recreation from the time of the first settlers and the relationship between the people and the rivers is comprehensive, complex and ongoing, providing both resources and leisure activities. In 2004, the Canadian Heritage River designation was given to the Three Rivers, of which the Montague and Valleyfield Rivers are a part of, thus providing the recognition and importance of this area now and in the future.

The watershed is environmentally, economically, and socially an integral part of the region. Environmentally the rivers, forests, and open lands are home to large numbers of aquatic and terrestrial plants and animals that have formed important individual ecosystems that together function as a single unit – the Montague-Valleyfield River watershed. The health of one ecosystem can have an enormous effect on another, thus, maintaining equilibrium within the watershed is of paramount importance.

Economically, the rivers have and continue today, to provide income support to some watershed communities and their residents. In the past, shipbuilding, electricity producing dams, saw and gristmills were prevalent, while today the aquaculture, recreational fishers/boaters, and tourist industries are the major user groups of the rivers. Recent problems such as invasive species, nutrient enrichment, and siltation threaten the long-term health of the rivers and the industries they support.

Socially, the Montague-Valleyfield River watershed has always provided a variety of recreational and leisure time activities to satisfy almost anyone. Angling has long been a favorite pastime, as has hunting, hiking, boating, and bird watching and today the rivers still provide a place for social gatherings, everything from festivals and weddings, to fishermen

discussing their catches. Residents enjoy a beneficial relationship with the land and waterways that make up the watershed and protecting and preserving it is very important to them.

Prince Edward Island is solely dependent on groundwater for its drinking water. The quality and quantity of this groundwater is a priority to the Montague-Valleyfield River watershed residents. Nitrates, bacterial contamination, and land use practices are just some of the issues that have the potential to adversely affect the groundwater supply. Groundwater nitrate levels, for example, while low in this area, 2 to 3 mg/L, are much higher in other areas of the province, prompting the need for swift actions to ensure levels are lowered or at the very least maintained.

Watershed residents, communities, businesses, and industries are dependent on an abundant and safe source of water, making it exceedingly important to preserve, protect, and enhance this valuable resource.

Water quality problems such as eutrophication and anoxic events, fish kills, bacterial contamination and shellfish closures, soil erosion, and other land use issues have been long-term problems for the Montague-Valleyfield River. The Southeast Environmental Association realizes that the potential of the Montague-Valleyfield River watershed was impeded by years of human interference, but has the potential through watershed management planning, of a rich and productive future.

The Montague-Valleyfield Watershed Planning Group (MVWPG) believes that this watershed management plan, developed from input gathered from watershed stakeholder, will serve as a catalyst to begin the changes necessary to appropriately manage the watershed, creating a legacy for future generations.

2.0 Watershed Planning Process

A critical component of watershed management planning is the engagement and collaboration of all sectors that use or affect water quality, quantity and supply. SEA understands that continual stakeholder engagement is essential to a successful planning process. Those affected by proposed management strategies must have the opportunity:

- ✓ to understand the current state of the watershed;
- ✓ to provide input;
- ✓ to become effective stewards of watershed health; and
- ✓ to participate in integrated watershed planning.

Cooperation between all groups of people is essential in the formulation and implementation of an effective management plan. This plan is the result of a series of community meetings and workshops held in 2008/2009 and 2016. It reflects the vision, goals, and objectives of the watershed community (residents and all other interested parties).

In an effort to educate and inform stakeholders, a series of three watershed management planning information sessions were held during the winter of 2008 and again in 2016. During these sessions stakeholders were asked to identify issues, concerns, and a future vision of the watershed.

Three public information sessions on a variety of topics concerning the watershed were also conducted. These sessions covered topics that included: nutrient enrichment in surface water and watershed planning and management. Immediately following these information sessions, a Watershed Planning Advisory Group was formed. This Group consists of stakeholders from varied occupations and from most communities within the watershed. The Group used the information gathered at these meetings to develop a vision statement, goals, objectives, and management strategies for the watershed. The information presented in this plan was formally approved by the stakeholders in March of 2016.

3.0 Vision Statement, Goals and Objectives

The following vision statement, goals, objectives, and management strategies have been developed from the input that community stakeholders provided during the meetings held in the winter of 2015/16 and have become the foundation of this plan.

3.1 Vision Statement

"A healthy community, identifying and promoting sustainable environmental practices specific to our watershed with special consideration for renewable resource based industries."

3.2 Goals and Objectives

Goal 1 – Preserve and Enhance the Quality and Quantity of Ground and Surface Water, Protecting it for Future Generations

Goal 2 – Restore and Protect Fish and Wildlife Habitat

Goal 3 – Promote Active Living and Increase Recreational Opportunities

Goal 4 – Foster Stewardship Ideals and Reward Those Who Strive to Achieve Them

Goal 5 – Manage Watershed Resources by Encouraging Cooperation and Respect among Residents, Landowners, and Stakeholders

Goal 6 – Improve Communication and Provide Educational Opportunities

Goal 7 – Identify and Conserve Sites of Historical Significance and Unique Environmental Areas

Goal 1 – Preserve and Enhance the Quality and Quantity of Ground and Surface Water, Protecting it for Future Generations

Residents and stakeholders of the Montague/Valleyfield River watersheds have identified water quality and quantity as the main issue of concern within their watershed. The drinking water, from either ground or surface water, is vulnerable to point and non-point pollution sources, which could put people's health at risk. Having a reliable water supply is also critical to the growth and success of the watershed community. Protecting our water sources will help secure the future of the watershed.

Objective 1 – Identify water quality and quantity deficiencies and establish management strategies for those deficiencies.

It is necessary to identify the sources of water quality and quantity deficiencies, making it possible to institute corrective actions.

Objective 2 – Determine water quality trends.

High nitrate and bacteria levels threaten the long term health of the watershed; information on these is required to develop an action plan.

Objective 3 – Enhance groundwater and surface water quality and encourage water conservation.

Residents and stakeholders of the Montague-Valleyfield River Watersheds believe that water is an extremely valuable resource and should be treated as such. Protecting and preserving it will be the responsibility of the communities, landowners, and residents. The quality and quantity of the drinking water will be a primary concern and it is hoped that the efforts will eliminate red water events, anoxic conditions, and prohibition orders in shellfish growing areas, as well as increase fish and wildlife habitats in the streams, rivers, and estuary.

Objective 4 – Determine and address sources of high water consumption and areas where stream/river flow could be increased.

Prince Edward Islanders are among the largest water users in Canada and conservation has not been a high priority. As an essential resource, water should be used as efficiently as possible and protected for the future. Stream flow is a critical factor in maintaining the viability of aquatic habitat, water quality, the movement of sediment through the streambed, and the basic functions of many organisms including salmonid fish, and the insects that support them. The amount of ground water has a direct influence on stream flow volume.

Goal 2 - Restore and Protect Fish and Wildlife Habitat

The conservation and management of watershed resources are of great importance to residents, landowners and stakeholders. The conservation and proliferation of wildlife, the maintenance and restoration of habitat, and an overall increase in watershed health are priorities. Public dedication and commitment together with their support and assistance will be key in achieving the goal.

Objective 5 – Continue watershed enhancement while working to establish protected areas.

Watershed enhancement work has focused mainly on fish habitat with only minor work being done in other areas. Directing efforts to encompass all aspects of the watershed will ensure a healthy and balanced ecosystem.

Goal 3 – Promote Active Living and Increase Recreational Opportunities

Montague/Valleyfield stakeholder's feel active living should be a part of everyone's daily life. Encouraging everyone to become active and providing information on how to achieve this is important. Enhancing existing recreational opportunities within the watershed and creating new ones will help watershed residents achieve their goals.

Objective 6 – Create new and improve existing public access points to the Montague and Valleyfield Rivers.
Provide more public access to the rivers.

Objective 7 – Increase existing and develop new recreational activities that take advantage of the potential of the watershed.
The Montague-Valleyfield watersheds provide many recreational opportunities but there is still extraordinary potential to further expand existing activities while developing new ones.

Objective 8 – Promote safety during all active living and recreational activities.
It is important to address safety and liability issues related to recreational activities.

Goal 4 – Foster Stewardship Ideals and Reward those Who Strive to Achieve them
Stakeholders of the Montague-Valleyfield River watershed know that promoting, monitoring, and conserving the ecological health and biodiversity of the area is vital and recognizing those who participate is essential.

Objective 9 – Encourage watershed stakeholder to take advantage of programs, funding opportunities, and services with regard to stewardship and assist them in this process.
There are many opportunities for watershed stakeholders to begin new or enhance existing, stewardship activities.

Goal 5 – Manage Watershed Resources by Encouraging Cooperation and Respect among Residents, Landowners, and Stakeholders
Efforts to reduce the environmental footprint on the Montague-Valleyfield watershed are important to all stakeholders. Each individual must decide how he or she will reduce their footprint and what method of reduction best suits their needs. Not everyone will agree on what should be done first or how it should be accomplished, but everyone understands that the ultimate goal is the same and can be achieved by cooperating and respecting each other's decisions.

Objective 10 – Promote awareness of issues that affect resource-based industries.
Knowledge and awareness of the issues facing resource based industries allows positive communications to begin and a more open dialogue to take place, allowing a mutual respect to develop among the stakeholders.

Objective 11 – Promote public consultations on projects that could have an adverse environmental impact on the watershed.
Residents and landowners requested that they be made aware of projects that may have an adverse impact on the watershed.

Goal 6 – Improve Communication and Provide Educational Opportunities
Montague-Valleyfield River watershed Stakeholders stated that improving communications and having educational opportunities will help them achieve their watershed management goals. Improved communications and the access to current and relevant information will provide Stakeholder with the ability to support their watershed management decisions.

Objective 12 – Increase environmental awareness.
Awareness of current global and local environmental issues provide stakeholders with the information needed to make informed decisions regarding their watershed.

Goal 7 – Identify and Conserve Sites of Historical Significance and Unique Environmental Areas
Montague-Valleyfield River watershed Stakeholders stated that maintaining links to their past, by recognizing and conserving historically significance sites and by maintaining unique environmental areas is important and these actions will preserve the heritage of the area for future generations.

Objective 13 – Identify and Conserve Sites of Historical Significance and Unique Environmental Areas.
The cultural heritage and environmental uniqueness of the area are important to conserve.

Objective 14 –Work with landowners, communities, and governments to ensure sites of historical significance and unique environmental areas remain intact for future generations.
Provide information and guidance on how best the conserve these site.

4.0 Background Information

4.1 History

4.1.1 Southeast Environmental Association

The Southeast Environmental Association (SEA) is non-profit organization established in 1992 to protect, maintain and enhance the ecology of southeastern Prince Edward Island for the environmental, social and economic well-being of PEI residents. SEA is governed by a Board of Directors consisting of volunteers representing various sectors of society including business, seniors, youth and land owners.

SEA manages an area covering approximately 731km^2 which includes six major watersheds: Boughton, Cardigan, Brudenell, Montague-Valleyfield, Sturgeon and Murray Rivers, making up 26 sub-watershed systems in total. With 13% of total land coverage, it is the largest watershed management region in Prince Edward Island.

SEA encourages, leads and seeks funding for projects that help achieve the following objectives:

1. **Education:** To raise public awareness of the importance of making responsible and appropriate personal choices on issues that affect water quality and the environment.
2. **Research:** To foster the study of water quality, biodiversity, development and its impacts on the environment.
3. **Community:** To engage the community and provide environmental learning opportunities.
4. **Governance:** To support the goals of SEA and advocate for regional sustainability.

4.1.2 Montague-Valleyfield and Area Watershed

Montague-Valleyfield and Area Watershed Management Plan includes the Montague watershed, the Valleyfield watershed and Lower Montague watershed regions. The 172km of streams in these 200km^2 watersheds drain into the Georgetown Harbour and Cardigan Bay. The Montague-Valleyfield rivers are also known as part of *The Three Rivers*, a heritage river system that played an important role in the development of the communities in the area. The Montague River was one of the earliest human travel corridors in PEI. With the connection to the Brudenell and Cardigan Rivers, an interior river ferry system was established leading to transportation, commerce and regional development (Canadian 2001). In the mid-1800s, Montague and area was known for its fine harbours and it was in this area where some of the first estuaries were used for mussel aquaculture. In 1899, the first hydro-electric dam in PEI was built in Valleyfield then moved to Knox's Dam, in 1905, to meet growing demand from Montague. By the early 1920s, Montague Electric Company was producing the cheapest power east of Ontario (2001). The Keith's Mill Trail, which still exists today, was the main route used to travel between Montague and Victoria Cross from 1890 to 1928.

The Montague-Valleyfield watershed extends to the Caledonia Hills, one of only two hill lands on the Island. Post-glacial sea-level change is evident at drowned forest sites in the Lower Montague watershed (Canadian 2001). The Klondyke Road, a designated scenic heritage road, is located in the Montague-Valleyfield watershed where in the early 1900s, sawmills and several homesteads were located along this road. Colonel Weatherbie, known in military circles

as the "Father of Canadian Munitions" was the last settler to live on the road (Tourism 2015).

4.2 Physical Description

4.2.1 Montague-Valleyfield Watershed

The Montague-Valleyfield watershed is located in southeastern Kings County of Prince Edward Island (Figure 1). The rivers and tributaries of this watershed drain into the Georgetown Harbour before empting into Cardigan Bay and ultimately into the Northumberland Strait. The watershed covers an area of 198km^2 (19,819ha). It is gently sloped, but in some areas, elevations exceed 115 metres. The total length of rivers and streams is 172km with swamps and marshes providing water storage areas and natural filtering systems for pollutants, and wildlife habitat.

Figure 1: Montague-Valleyfield watershed boundary.

Montague is the only town located within the Montague-Valleyfield watershed; however, there are numerous smaller communities within its boundaries (Figure 2). The headwaters for the rivers are located in Oceanview and Lewes areas. Valley, Iona, Grandview, Lyndale, Head of Montague, Victoria Cross, Union Road, Greenfield, Valleyfield, Heatherdale, Kilmuir, Bellevue,

Brooklyn, Glenwilliam, Caledonia, Klondyke Road, Lower Montague and Brudenell are just some of the communities within this area.

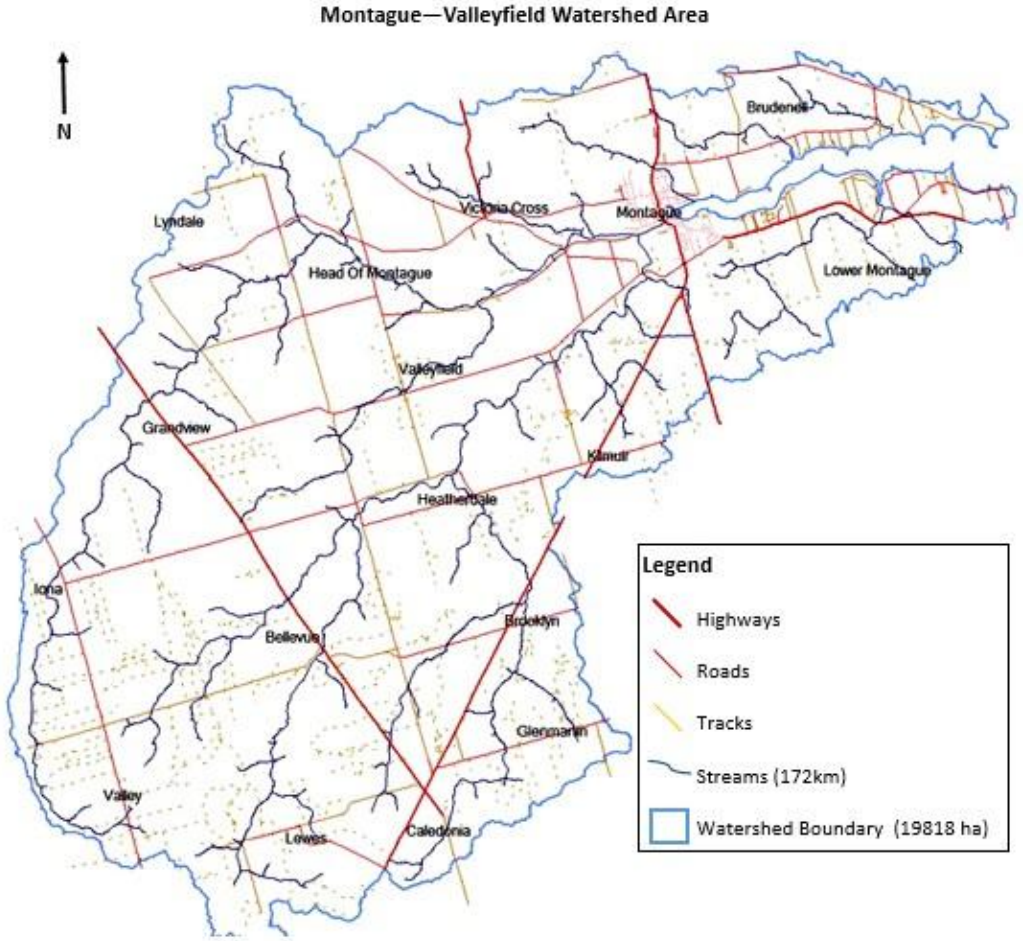

Figure 2: Montague-Valleyfield map showing the communities, streams, roads and track that make the watershed.

The Montague-Valleyfield watershed is cross-cut with a mixture of red clay and paved roads that pass by farmlands, forested areas, coastlines, and through rural and urban areas. Resource-based industries such as agriculture, fishing, forestry, aquaculture, and tourism are the areas major employers, making the economy largely seasonal.

The Montague-Valleyfield River watershed possesses a variety of unspoiled habitats; forests and mixed woodlots interspersed with mixed farmland and hedgerows, marshes, ponds, and shorelines dot the landscape, providing an excellent environment for local wildlife. Migrating waterfowl frequent the estuary and farmlands, while trout and salmon live and spawn

throughout the rivers and streams. Red fox, eastern coyote, beaver, ruffed grouse, snowshoe hare, woodcock, and many other species thrive in these habitats, intensifying the need to preserve the natural state of these areas.

The town of Montague is located on the Montague River and, as the slogan suggests, *Montague the Beautiful* is one of the more picturesque towns in PEI. The Montague River divides this town of approximately 1900 residents in a north-south direction. Its waterfront serves as homeport to fishermen and recreational boaters and has become the site of many tourist-oriented activities. The town has a central water system that is supplied by two wells with a pumping capacity of 1,364 L/min. The sewage treatment plant has a primary treatment system of water-chlorine & wastewater-aerated lagoon, with a secondary treatment consisting of a wastewater-settling pond.

4.2.1.1 Land Use

The 19,819 hectares that make up the Montague-Valleyfield watershed is comprised of 10,484 hectares of forest, this is 53% of the area (Figure 3). Agricultural land covers 6,854 hectares or 35% of the area. Developed land which includes commercial, industrial, institutional, recreational, residential, transportation and urban land covers 7% of the watershed. Lands classified as wetland makes up 494 hectares, or 3% with the remaining 3% of the land is abandoned or has no evident use.

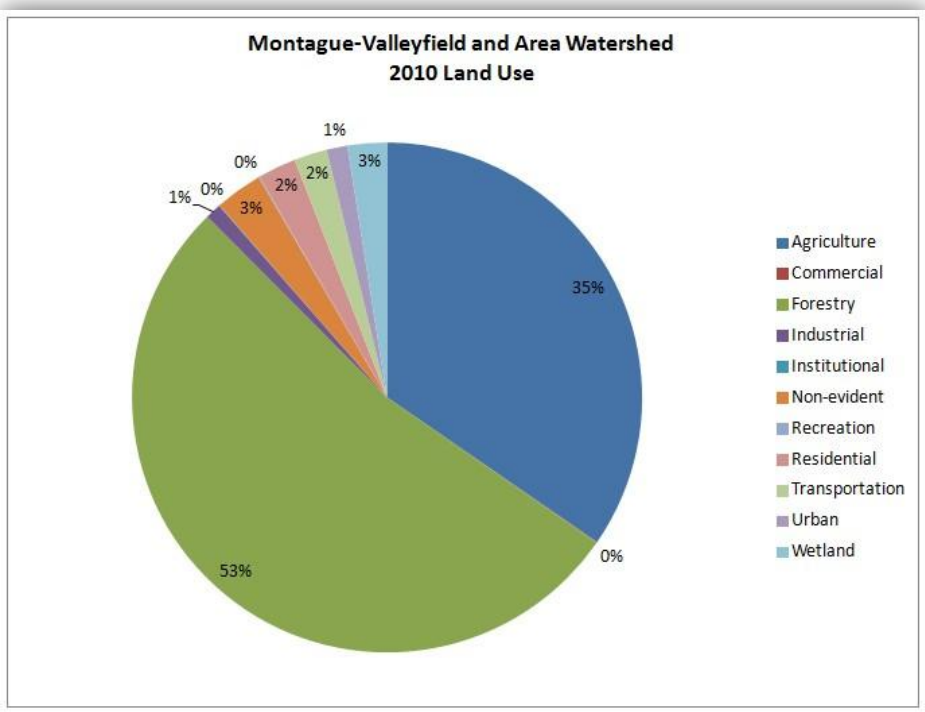

Figure 3: The land use for the Montague-Valleyfield watershed based on 2010 data.

4.2.1.2 Wetlands and Sand Dunes

Wetlands are a critical component in the efficient functioning of our water system. Once viewed as useless land and assigned very little practical value, it is now known that wetlands perform a number of essential functions that enable the watershed to prosper. Wetland vegetation is capable of purifying surface water by filtering out pollutants, including nitrates, bacteria, and pesticides that enter the watercourse via runoff (Souris 2010). Wetlands help regulate the flow of water. They absorb excess water from spring thaws or heavy rains; a natural mechanism to control flooding (Souris 2010). Wetlands contribute greatly to the biodiversity of an area. Many species of plants and animals have evolved to effectively exploit this niche and therefore depend on the maintenance of these areas for their survival (Souris 2010). Amphibians, waterfowl and songbirds all rely on some component of wetlands to breed, feed or find cover. Wetlands are home to many unique plants such as Northern Pitcher Plant and Round-leaved Sundew, two carnivorous plants that feed on insects. Wetlands provide recreational opportunities such as fishing, hiking and birding. The value wetlands provide to a

watershed often goes unrecognized, so it is imperative that these areas remain undeveloped as they are vital to the health of waterways and communities.

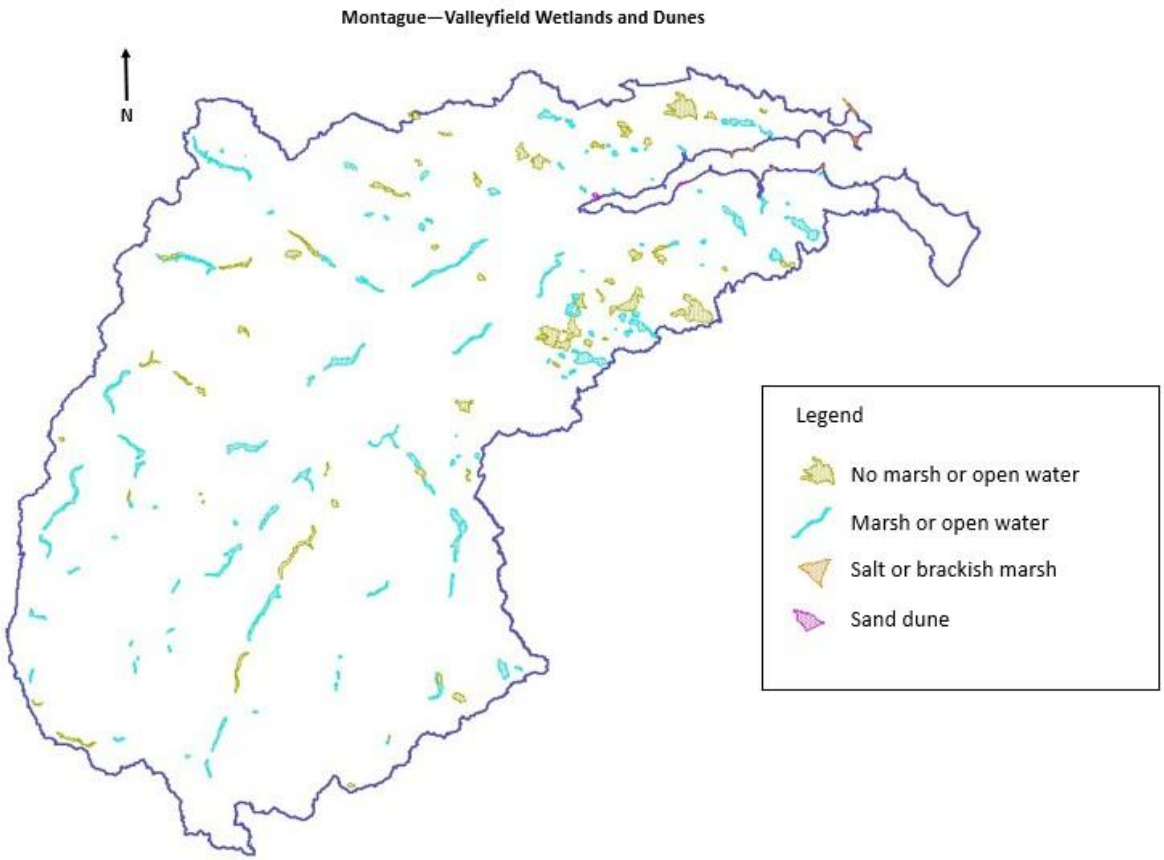

Figure 4: The wetland distribution in the Montague-Valleyfield Watershed.

There are 494 hectares of wetland in the Montague-Valleyfield watershed (Figure 4). Although wetlands only account for 3% of the total area, they play a significant role in the health of the watershed. There are a number of different types of wetlands in the area. Wetlands with *no marsh or open water* in the watershed makes up 47.2%. This includes bogs, meadow, shrub swamp and wood swamp. Wetlands with a *marsh and open water* component such as open water wetland, deep marsh, shallow marsh and coastal inlets make up 52.5%. *Salt marsh* and *sand dunes* are very rare in the area and cover only 0.3% of the land respectively. The most common wetland in the area is shrub swamps; a community dominated by dense, low-growing, woody shrubs or small trees such as alders, dogwoods, and willows.

4.2.1.3 Forestry

Prince Edward Island belongs to the Acadian Forest Region. Key species of the Acadian Forest include Red Spruce, Yellow Birch, Eastern Hemlock, Sugar Maple, Red Oak, Eastern White Pine, American Beech and White Ash. In the 1800's, PEI was covered with forests dominated by these large, shade-tolerant species. Red pine trees were used to produce masts 22 metres tall and 60 cm in diameter (MacPhail 2012). Less than 100 years later, the forest cover on the Island was reduced from 95% to 30% (Figure 5). Today, almost 45% of the land is covered in forest with only 9000 scattered hectares of the hardwood dominant shade tolerate forest remaining (2012). Much of the forests in PEI are made up of poor quality trees, growing in poor soils on grounds that were once an agricultural field (2012).

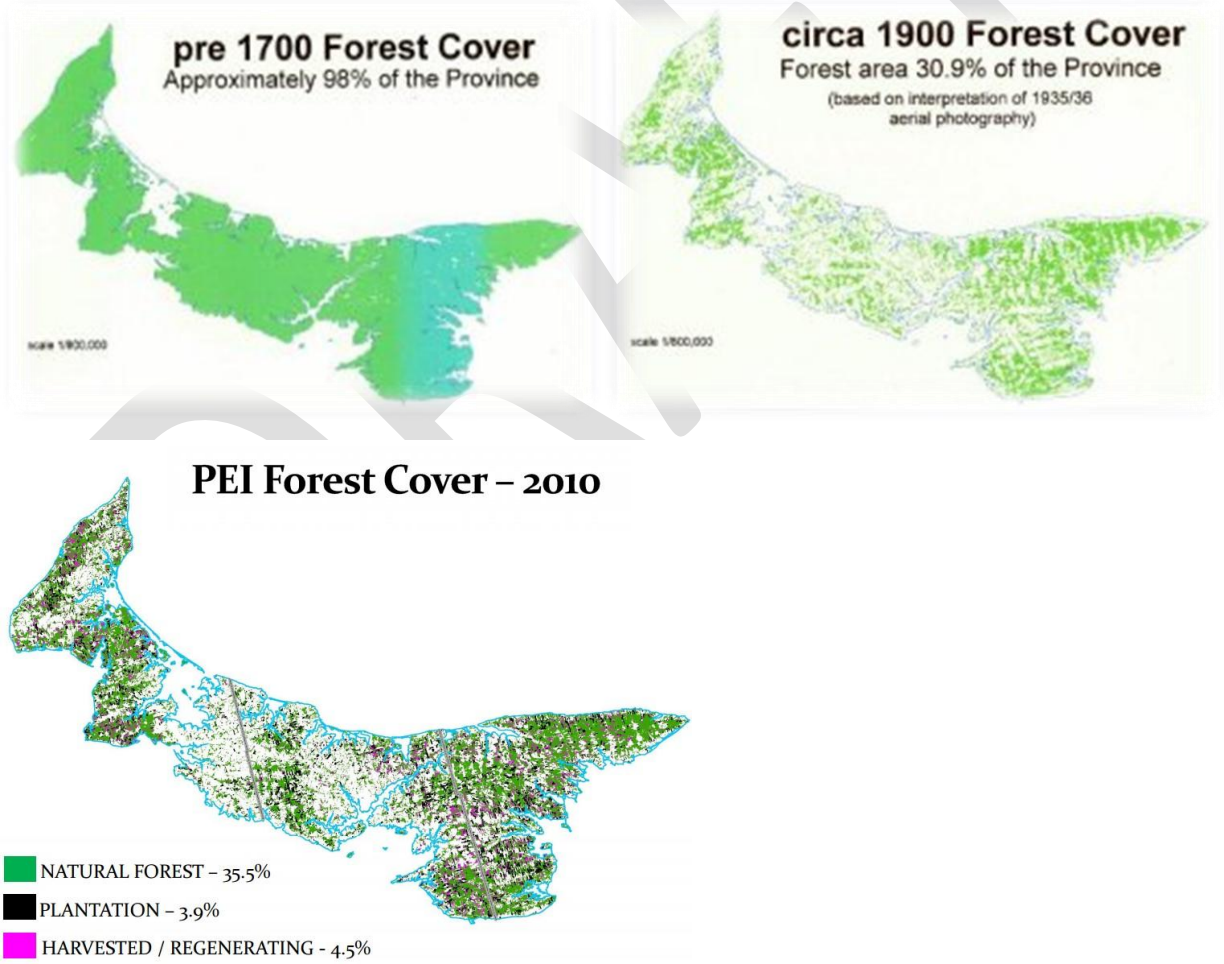

Figure 5: Forest cover in Prince Edward Island pre 1700, circa 1900 (maps provided by PEI Government) and in 2010 (MacQuarrie 2015).

Up to 88% of the forests found in PEI are owned by 16,000 private woodlot owners. In the Montague-Valleyfield watershed 53% of the land is forested; most of it privately owned (Figure 6). This watershed is fortunate to have this much woodland, and it is important to maintain and enhance it. A chart presented by Kate MacQuarrie at the 2015 PEI Watershed Alliance AGM shows that forest cover plays a role in the abundance of nitrates in a stream (Figure 7). In rivers that have more forest cover, such as Valleyfield River, Montague River and Bear River the nitrate levels are relatively low. Along the Wilmot River there is less than 20% forest cover and an average 6.5mg/L of nitrates in the water; a value that is well over the Canadian Council of Ministers of the Environment's (CCME) nitrate guideline for freshwater aquatic fish.

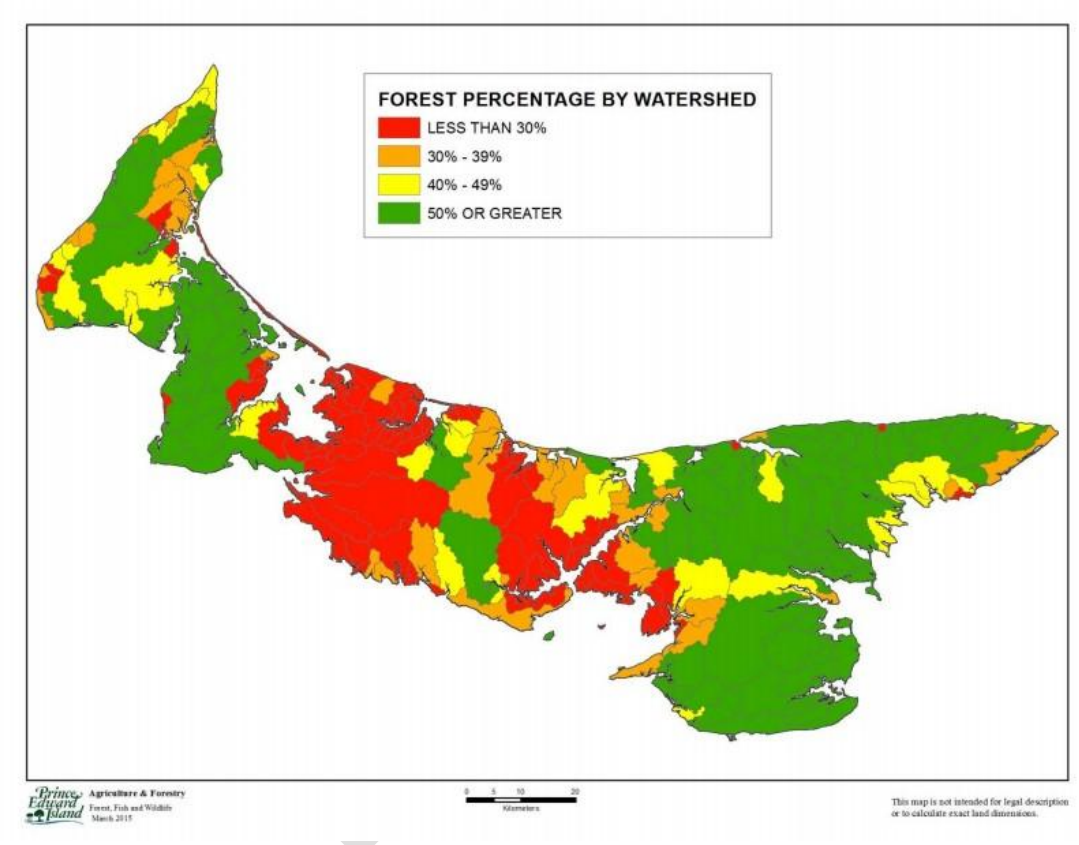

Figure 6: Percentage of forest cover by watershed. Montague-Valleyfield watershed, along with all other watersheds in the SEA region except Brudenell, is over 50% forested.

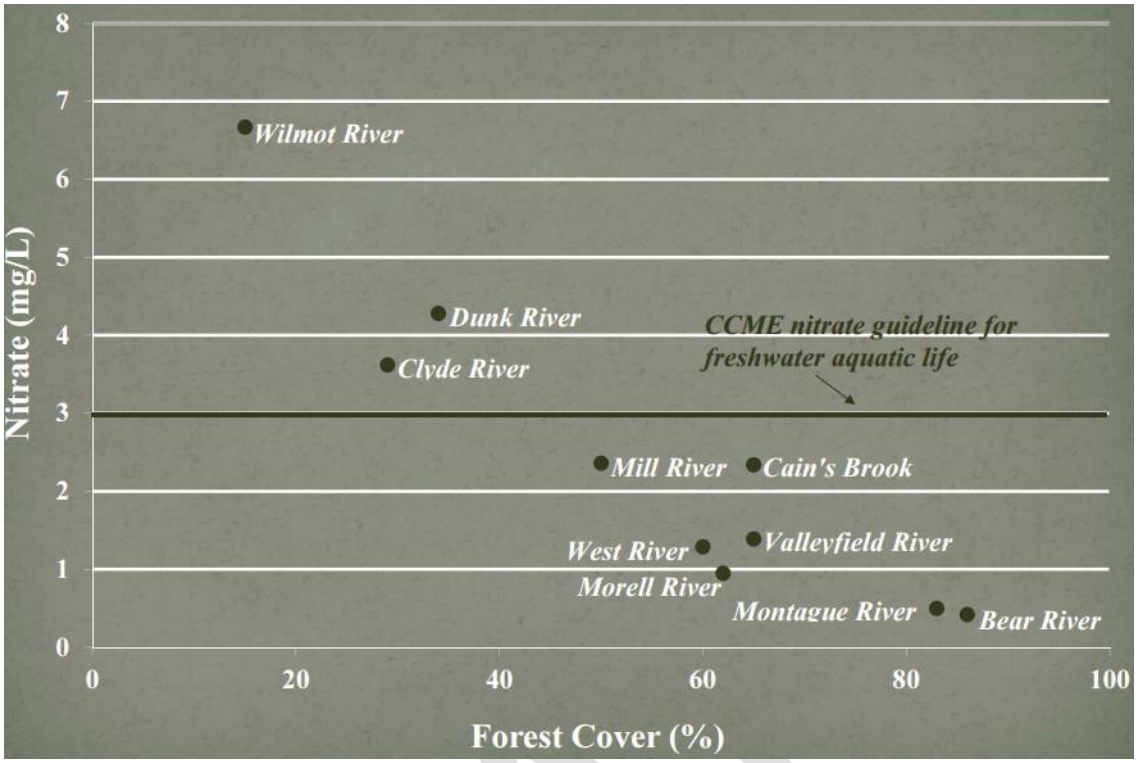

Figure 7: Correlation between forest cover and the nitrate levels in a stream presented by Kate MacQuarrie at the 2015 PEI Watershed Alliance AGM.

There are a number of programs and initiatives offered to help private woodlot owners manage their forests for a number of different values. The *PEI Woodlot Owners Association* is a group for woodlot owners who encourage Islanders to create more sustainable forest ecosystems and forest resources in PEI. Forests are very valuable from an economic and environmental stand-point. With proper management, the value of these forests can be sustained.

4.2.1.4 Protected Areas

There are a limited number of protected areas in the Montague-Valleyfield watershed. The only provincially designated wildlife management area in the watershed covers a region of 48.9 hectares of estuary from Knox's Dam and Sutherlands Hole out past the Montague Marina. This area is protected under the Fish and Game Act. Shooting is prohibited in this area. The Valleyfield Demonstration Woodlot is one of only six, forest management properties established by the PEI Government. These woodlots are designed to provide woodlot owners, forest contractors and the general public with visible evidence of the results of proper forest

management. The Valleyfield Woodlot covers 90 hectares of forest on the Dalmaney Road and is one of the best birding locations in PEI.

4.2.2 Lower Montague Watershed

The Lower Montague watershed is also located in southeastern Kings County of Prince Edward Island. It includes the area after Aitken's Point and extends around St. Andrew's Point (formerly known as Wightman's Point). This watershed does not have any tributaries or streams; water that falls drains off the land into the mouth of the Montague River, Brudenell River and St. Mary's Bay.

This small watershed encompasses an area of 258.94 hectares (2.59km^2) which is approximately 72% forested lands (Figure 8). About 15% of the land is developed, 5% is used for agriculture, 2% is wetland and the remaining 6% is abandoned land or has no evident land use.

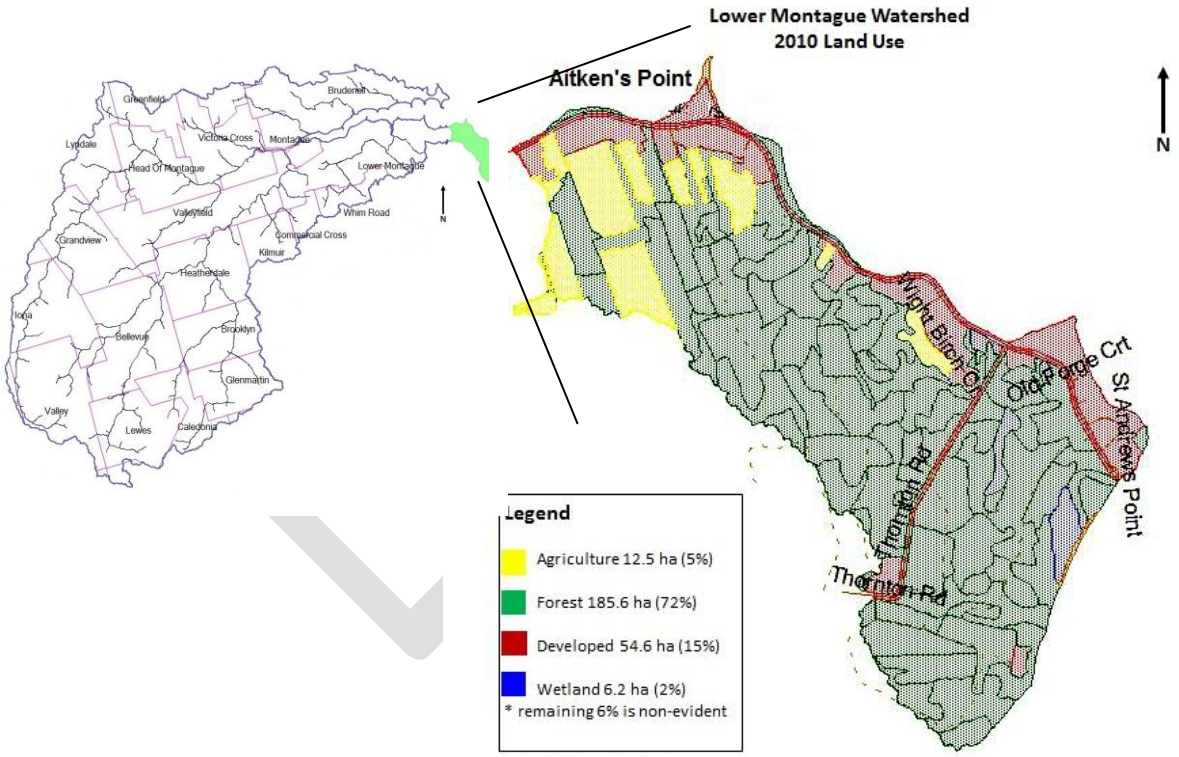

Figure 8: Land use in the Lower Montague watershed.

The Lower Montague watershed has very little developed or cleared land. There is one paved road through the area with some clay roads. The watershed is on the coast of the Montague River and St. Mary's Bay. This is an excellent site for watching for sea birds, seals and other aquatic species. With very little human activity in the area, there is great habitat for wildlife.

4.3 Population Trends

The majority of the watershed area is covered in Lot 59, Lot 61 and the Town of Montague, according to Statistics Canada. By using the population data for these areas, not all of the watershed is included, while areas outside the watershed area may be. Values may not be accurate but trends for the area can be seen (Figure 9). The Montague-Valleyfield watershed area saw a 2% decrease in population from 2006 to 2011. Approximately 38% of the population is over 55 years of age, 34% is between 25 and 55, while the remaining 28% is less than 25 years old. This shows that the Montague-Valleyfield watershed population is aging, although there are only slight number variations between the age classes. The number of private dwellings for all three areas is 1,918. A rough estimate of the population is 3,895 – 52.6% female and 47.4% male. The well-being indicators for this area are low with many families earning $39,000 a year or less.

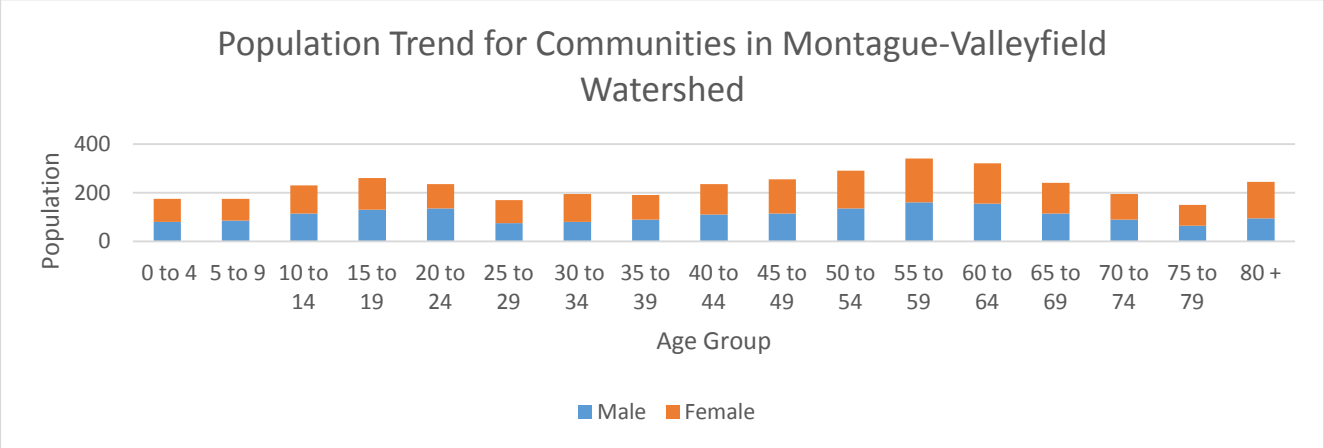

Figure 9: Population of the Town of Montague, Lot 59 and Lot 61, three areas that make up most of the Montague-Valleyfield watershed.

4.4 Water Quality

4.4.1 Surface Water Quality Monitoring

In 2013, SEA teamed up with St. Mary's University Geography Department to take part in the Community-University Research Alliance Program (CURA). This program was developed to increase community capacity for integrated water monitoring and management in Canada and internationally. This program allows postsecondary institutions and communities to share information and data collected through water sampling. SEA completes water quality testing weekly, throughout the year when weather and staffing allow. There are 23 sites tested in the SEA region, 9 sites are located in the Montague-Valleyfield watershed (Figure 10).

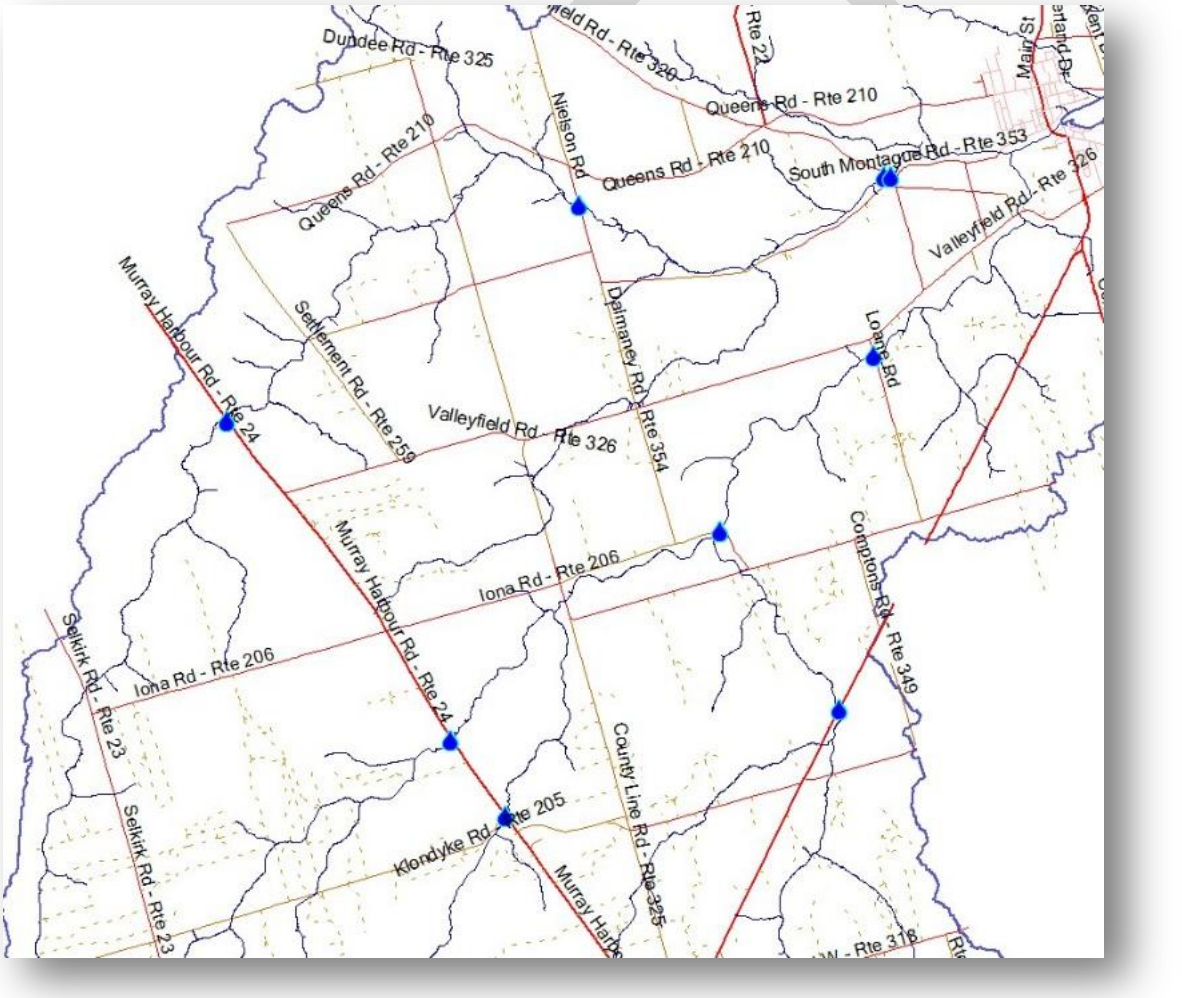

Figure 10: Water quality sites test by SEA in the Montague-Valleyfield watershed.

The *Wet-Pro Field Kit* is used to complete the water testing which uses a YSI Pro Plus handheld monitoring unit. It is used to measure:

- Conductivity: measure of water's capability to pass electric flow
    - Compared to 1990 data, there has been a slight increase in the conductivity indicating an increase in ions in the water
    - Values are in healthy range of 100-2000µS/cm range (Fondriest 2015)

- Salinity: total concentration of all dissolved salts in the water
    - Salinity values are normal (<0.5ppt) (Fondriest 2015)
    - high salinity sometimes at site near Montague River estuary, where water may be brackish

- Dissolved Oxygen: level of free, non-compound oxygen present in the water
    - Levels below 4mg/L are concerning (Fondriest 2015)
    - No concern in the freshwater stream, levels remain around 7-12mg/L throughout the year
    - Montague River estuary has been anoxic in the past

- pH: how acidic or basic a body of water is on a logarithmic scale
    - too high or too low, the aquatic organisms will die; 6.5 to 9.0 is tolerable for fish (Fondriest 2015)
    - Both rivers average a more basic environment, around 8.

- Total Dissolved Solids: sum of all ion particles that are smaller than 2 microns
    - Should not exceed 2000mg/L in freshwater (Fondriest 2015)
    - Level remain well below 2000mg/L except where water may be brackish

- Temperature: how warm, or cold the water is
    - Influenced by air temperature and fluctuate with the seasons

- Nitrates: form of nitrogen found in several terrestrial and aquatic ecosystems
    - Essential plant nutrient that can result in excess growth
    - 0.1 to 4mg/L is acceptable in freshwater (Fondriest 2015)
    - Freshwater stream in area have levels below 2mg/L (Fondriest 2015)

4.4.2 Community Aquatic Monitoring Program

The Community Aquatic Monitoring Program (CAMP) offers guidance for environmental community groups monitoring the health of their local watershed. Through monitoring methods established by the Department of Fisheries and Oceans (DFO), community groups are conducting a science-based program to examine the health of bays and estuaries throughout the Gulf Region. There are two sites in the Lower Montague watershed that are sampled, St. Andrew's Point and Aitken's Point. At each site, a seine net is hauled to determine the fish and crustacean species present in that area. Some of the species collected include black-spotted stickleback, mummichog, Atlantic silverside, smooth flounder, winter flounder and green crab. While at the sites, vegetation and sediment condition are observed and water samples are collected. All data collected is used to assess the overall health of the estuaries.

In 2015 a total of 9 different species were caught during sampling but many in low numbers. There were 1,791 organisms netted, with Sand Shrimp making up 98%. In 2015, the sites in the SEA region yielded some of the lowest catch numbers on the Island. The catch numbers from St. Andrew's Point have dropped from 1,451 in 2012, to 255 in 2015. Aitken's Point showed a recent decline but rebounded in 2015.

4.4.3 Canadian Aquatic Biomonitoring

CABIN is a program maintained by Environment Canada used to assess the health of freshwater ecosystems in Canada. It is based on the *network of networks* approach that promotes inter-agency collaboration and data-sharing to achieve consistent and comparable reporting on freshwater quality and aquatic ecosystem conditions. SEA partnered with this program to take observations and make scientific assessments of our streams using comparable standards. CABIN is completed in late summer or fall. In 2015, SEA staff and volunteers completed CABIN at 10 sites in the region; four sites were in the Montague-Valleyfield watershed.

During CABIN sampling, benthic macroinvertebrate species such as mayfly, caddisfly and dragonfly larvae are collected using a kick-net. Other parameters measured to help determine stream health include: riparian zone ecology, uplands land use, stream velocity, substrate,

stream width, water temperature, dissolved oxygen, pH, conductivity and turbidity. The presence or absence of certain organisms can indicate if a stream is impaired or not (Table 1). The presence of caddisflies, mayflies and stoneflies (EPT) is an indicator of good health (EcoSpark 2013). The presence of sowbugs can indicate poor health, as they are associated with sewage (2013). A high percentage of one group can indicate poor biodiversity. High and low values of true flies (Diptera) indicate poor stream quality (2013). The percentage of Diptera dropped from 35.8% to 9.2% in one year, which is probably the result of spraying for blackflies.

Table 1: Results from CABIN studies completed at a site on the Montague River in 2013 and 2014.

Organisms	2013	Result	2014	Result
% Worm	0.40%	Unimpaired	0%	unimpaired
%Midge	31%	possibly impaired	3.90%	unimpaired
% Sowbug	0%	Unimpaired	0%	unimpaired
% Snail	0%	possibly impaired	0%	possibly impaired
# of Groups	9 Orders	Impaired	7 Orders	impaired
% Dominant Group	31% midges	Unimpaired	37.9% mayfly	unimpaired
% EPT	51%	Unimpaired	69.60%	unimpaired
% Diptera	35.80%	Unimpaired	9.20%	impaired
% Insects	91.60%	Impaired	97.70%	impaired

4.5 Fish and Wildlife

There is a variety of fish and wildlife in the Montague-Valleyfield watershed area. Evidence of eastern coyote, red fox, American beaver and snowshoe hare, and other mammals, can be seen along the streams. Brook trout and rainbow trout are present in the rivers. Common ravens,

blue jays, black-capped chickadee and bald eagles are not hard to hear or see in the watershed. These animals are all well-known and can be identified by the average person. There are many other organisms that exist in the area, but their presence is not well-known. As part of the watershed management plan, SEA would like to complete surveys in the area to develop an inventory of wildlife species present. This information will allow for changes in population and species diversity to be monitored. As well, research opportunities may be presented.

4.5.1 The Status of Atlantic Salmon

With 172 km of stream in the Montague-Valleyfield watershed, there is great opportunity for a viable recreational fishery. Brook trout are continually stocked and remain at healthy population levels, although they are struggling in other PEI streams. To add some excitement to the recreational fisheries sector, Rainbow trout were stocked in PEI streams in the 1920s (Cairns 2010). While they are a great angling fish, they are an invasive species and their introduction has placed added pressure on the native fish. PEI Fish and Wildlife often extends the rainbow trout season as a means of population control.

In 1999, SEA conducted a fishway assessment at the Maritime Electric Pond. Over the course of the survey (May 27 to November 19, 1999), a total of 1,223 brook trout were recorded moving upstream and 25 downstream (Boyce 1999). Five rainbow, 12 salmon grilse and one American eel were trapped. During this time a fish kill occurred upstream of the ladder killing over 2,500 fish. No recent fish surveys have been conducted on these rivers by SEA.

The Atlantic salmon populations have been declining within their range for a number of years. In the 1970's, Islanders showed an interest in rebuilding the salmon stock in PEI and salmon were released in the Valleyfield River for a number of years. From 1983 to 1993, there was only a 1.9% return rate of the released salmon (Cairns 2010). Salmon stocking continued into the early 2000's, but return rate continued to remain low. Within the last 10 years, the Atlantic salmon populations in the Montague-Valleyfield River appear to have completely disappeared (Guignion 2009).

Results from a fish fence survey show that the salmon population in the Valleyfield River declined in 1994, but was showing an increase by over 60 fish in 1996 (Figure 11) (Cairns 2012). The majority of the fish were smaller, early run salmon which is common in large rivers (2012). Anglers that reported their catches (caught and kept, caught and released) to Fish and Wildlife from 1995 to 2011, did not catch salmon after 1998 in the Valleyfield River (2012) (Figure 12). Brian Dempsey of Valleyfield Angling Association reported seeing salmon kelts in the Valleyfield Pond in 2008 (Guignion 2009). The more recent disappearance of salmon in the Valleyfield River has given this river a Class 4 ranking.

Montague River is a Class 5 river, indicating the salmon population disappeared before 2002. Angling reports show that salmon were caught in the Montague River up to 2005, though these may have been strays from the Valleyfield River (Cairns 2012). It is important to note, these numbers are based on responses to mail-out surveys, so numbers may be on the low side if some fishers chose not to respond. From 1994-2011, the numbers of people who fished the Montague and Valleyfield Rivers regularly was estimated (Figure 13). Based on this estimation, the number of anglers in the area is declining. Atlantic salmon have been catch and release only in PEI since 2009.

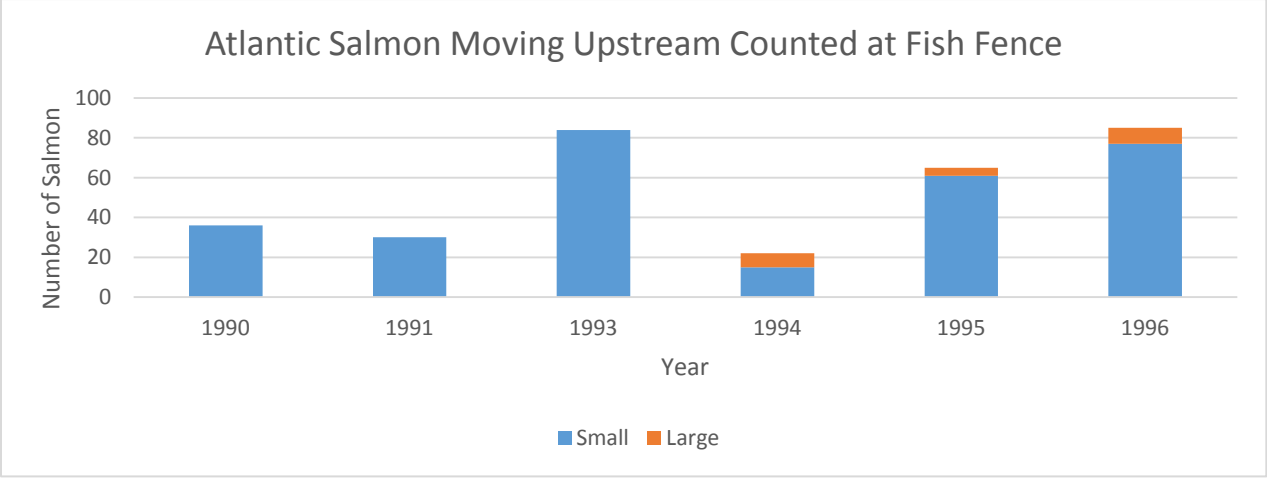

Figure 11: Number of salmon counted in a fish fence as they move upstream in the Valleyfield River from 1990 – 1996. Blue indicate small (<63cm) salmon and orange is large (>63cm) salmon.

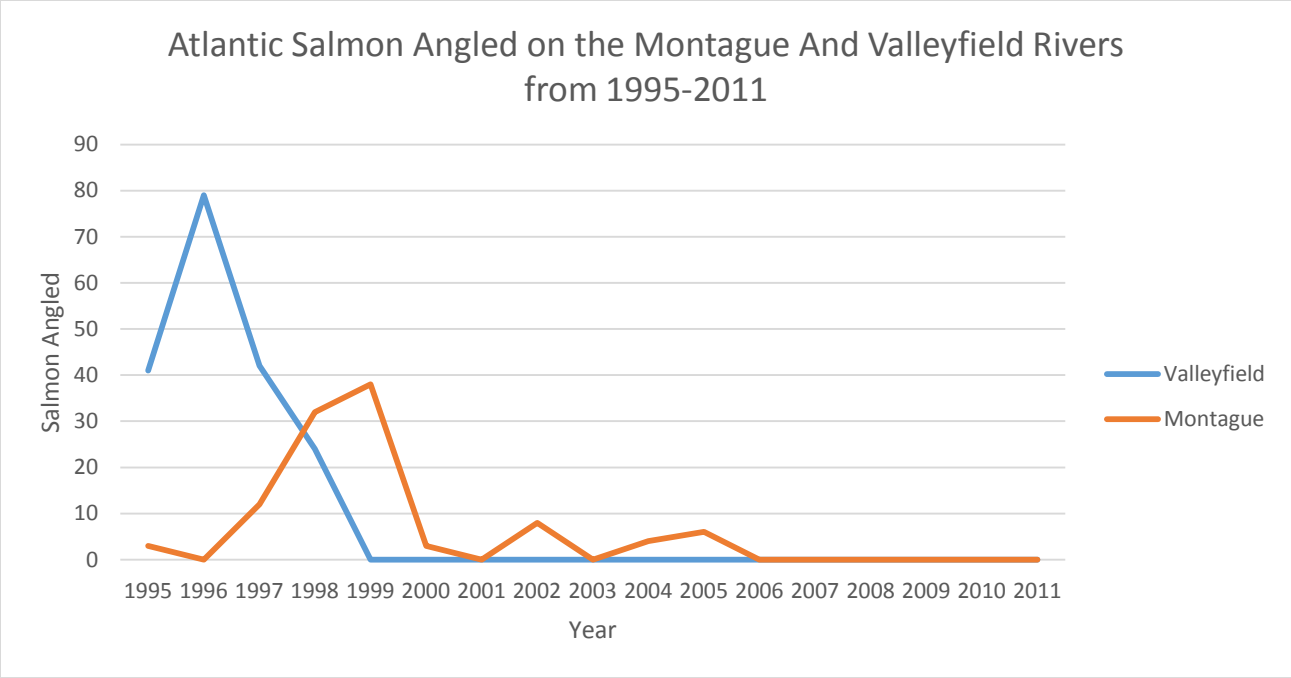

Figure 12: Angler reports on Atlantic salmon catches in the Valleyfield and Montague Rivers from 1995 – 2011.

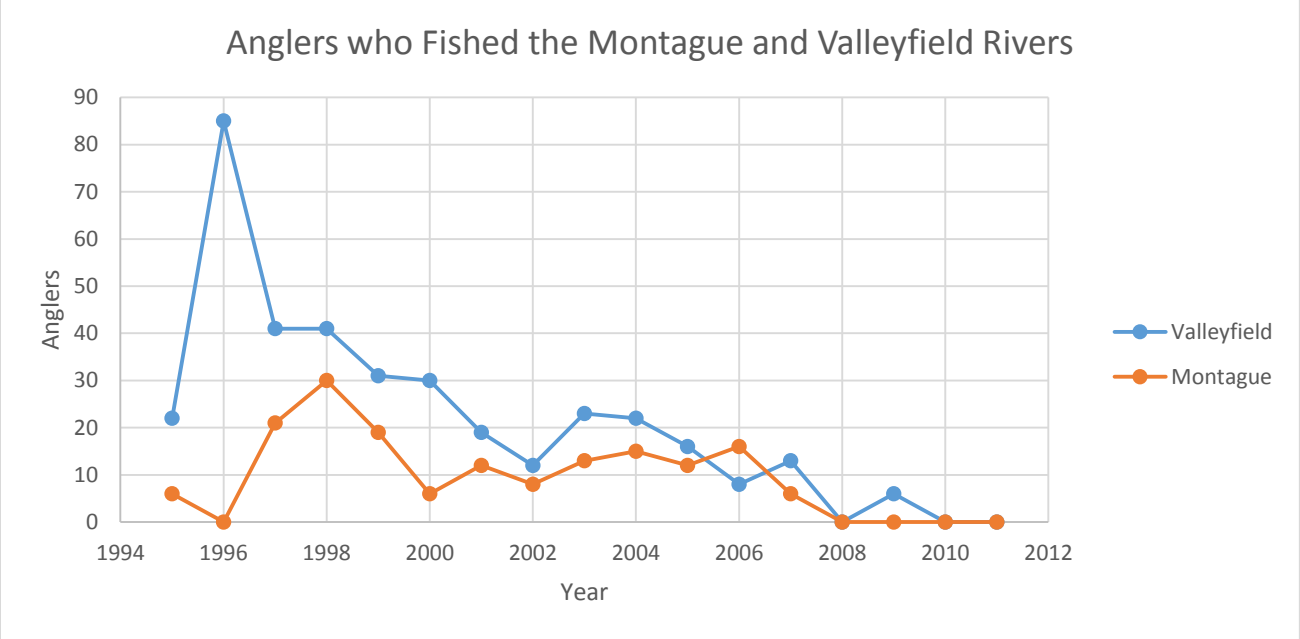

Figure 13: Estimated number of anglers in the Montague and Valleyfield River from 1994-2011.

4.6 Riparian Zones and Assessments

Riparian zones are the land adjacent to rivers, streams, pond and wetlands. They have a many important functions in the ecosystem such as improving water quality, absorbing and storing water, flood control, recharging groundwater reserves, protecting stream banks and protecting habitat (PEI 2008). Degradation of riparian zones can result in a number of problems for streams, river and wetlands such as sedimentation, increased nitrate levels, loss of habitat and cover (2008).

In order to maintain healthy riparian zones, the PEI Government legislated a 15-metre buffer zone in 1999. A buffer zone is a protected area alongside a watercourse and wetlands. For freshwater streams, they are measured from the edge of the stream bed (2008). In a buffer zone, a permit is required to:

- Alter or disturb the ground or soil
- Dump any material or objects of any kind
- Remove soil or rocks
- Build, repair or remove structures or obstructions of any kind
- Operate vehicles or non-agricultural equipment
- Cut down live trees and shrubs

SEA staff completed riparian assessments on the Montague and Valleyfield Rivers in recent years to determine the health of the waterway. During these assessments a series of questions were answered at each *reach* focusing on vegetative cover, invasive species presence, root-mass protection, beaver activity, human activity, streambed quality and pollution, as well as, surrounding land use and crossing conditions. Each *reach* receives a health rating score and from this, the overall health of the stream can be determined. In Figure 14, both rivers appear healthy but still require work. Fish habitat, spawning areas, natural springs, blockages, buffer

zone violations, siltation, and areas that require brush-mats or tree plantings are noted and marked with a GPS unit (Global Positioning System).

Riparian assessments allow watershed groups to examine the conditions of the stream before completing stream work. The findings play a crucial part in the development of a watershed management plan for the area, as it addresses the issues in the stream and surrounding land.

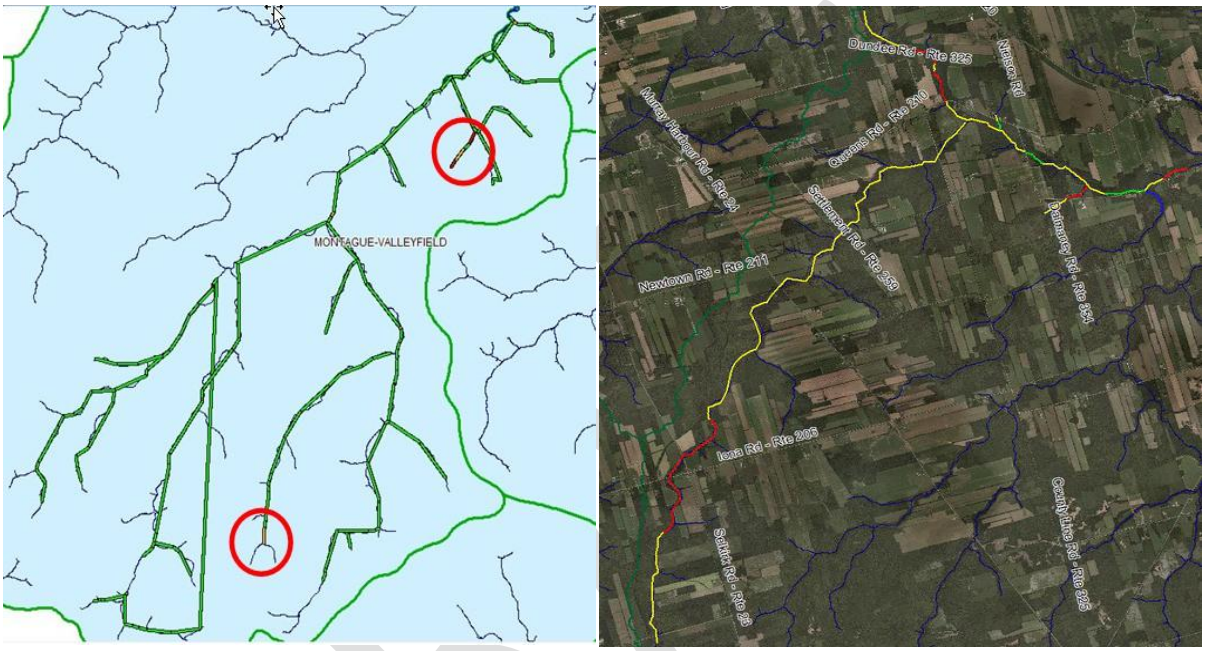

Figure 14: Results of the Valleyfield River (left) and Montague River (right) stream assessments. Green indicates the reach scored 80% or higher, yellow is 59-79% and red is below 59%.

5.0 Watershed Management Issues

5.1 Runoff

With 35% of the land in the Montague-Valleyfield watershed used for agricultural purposes there is always a concern of surface water run-off from fields entering the streams during the spring thaw, or after a heavy rain. With climate change, there also is a concern for unusual temperature trends and heavy rainfall events throughout the winter months leaving ploughed fields bare and susceptible to erosion. There are also a number of clay roads in the area that contribute to silt in the rivers. Figure 15 shows a clay road near the Head of Montague having a

depth of at least 2 feet below ground level. Roads that are poorly graded create water chutes leading directly into the streams – this is especially evident during severe heavy rainfall events. Soil entering a stream causes sedimentation and likely carries hydraulic oils, fertilizers, pesticides, and other similar chemicals into the stream. Introduction of these substances threaten the health of the ecosystem.

Figure 15: Nielson Road (Rte 354) showing the road approximately 2 feet below ground level.

5.1.1 Pesticides and Fertilizers

Pesticides are any substance used to kill, repel or control certain forms of plant or animal life that are considered to be pests (Permaculture 2008). There are a number of different types of pesticides used to target different groups of organisms, such as insecticides for bugs and fungicides for fungus. At certain levels, these products are lethal to fish.

Fertilizers are any material that is applied to soils or plant tissues to supply essential nutrients for plant growth. Nitrogen and phosphorus are essential nutrients for plants and are found in

fertilizers. An excess amount of nitrates and phosphates in a water system can result in algal bloom and excess plant growth, which can lead to water quality problems.

5.1.1.1 Eutrophication and Anoxic Events

Like most estuaries in PEI, the Montague estuary suffers from nutrient enrichment. The result is significant primary production of *Ulva lactuca*, commonly known as sea lettuce, which can lead to anoxic or low oxygen conditions. This event is referred to as *eutrophication*. The word "enrichment" usually has positive connotations, but nutrient enrichment in the rivers, streams, and estuaries causes environmental problems and has the potential to cause significant economic problems. These high concentrations of nutrients can lead to excessive and often unsightly growth of aquatic plants that can interfere with the local fishing, aquaculture, and tourist industries (Commission 2008). Decaying aquatic plants can produce foul odours and can affect how water tastes. As the plants begin to decay, oxygen in the water is used up. The decrease in oxygen concentration can result in the loss of fish and other aquatic life.

The problems in the Montague-Valleyfield Rivers are not easily addressed, as there are many potential sources of nutrient enrichment within the watershed including a sewage treatment plant, a fish processing plant, vegetable processing plant, on-site septic systems, and agricultural inputs. Records show that the Montague River was anoxic from 2002-2012 (PEI 2014). The nitrate concentration in the Montague River has been showing a decrease since 2004 at a site upstream of Knox's Dam (2014) (Figure 16). Valleyfield River system has also been showing a decrease since 2014 at the Loane Road sampling site. The decrease in nitrate concentration correlates with the decrease in potato production on the Island (2014) (Figure 17).

Figure 16: Picture of anoxic waters in the Montague estuary taken July 25, 2008.

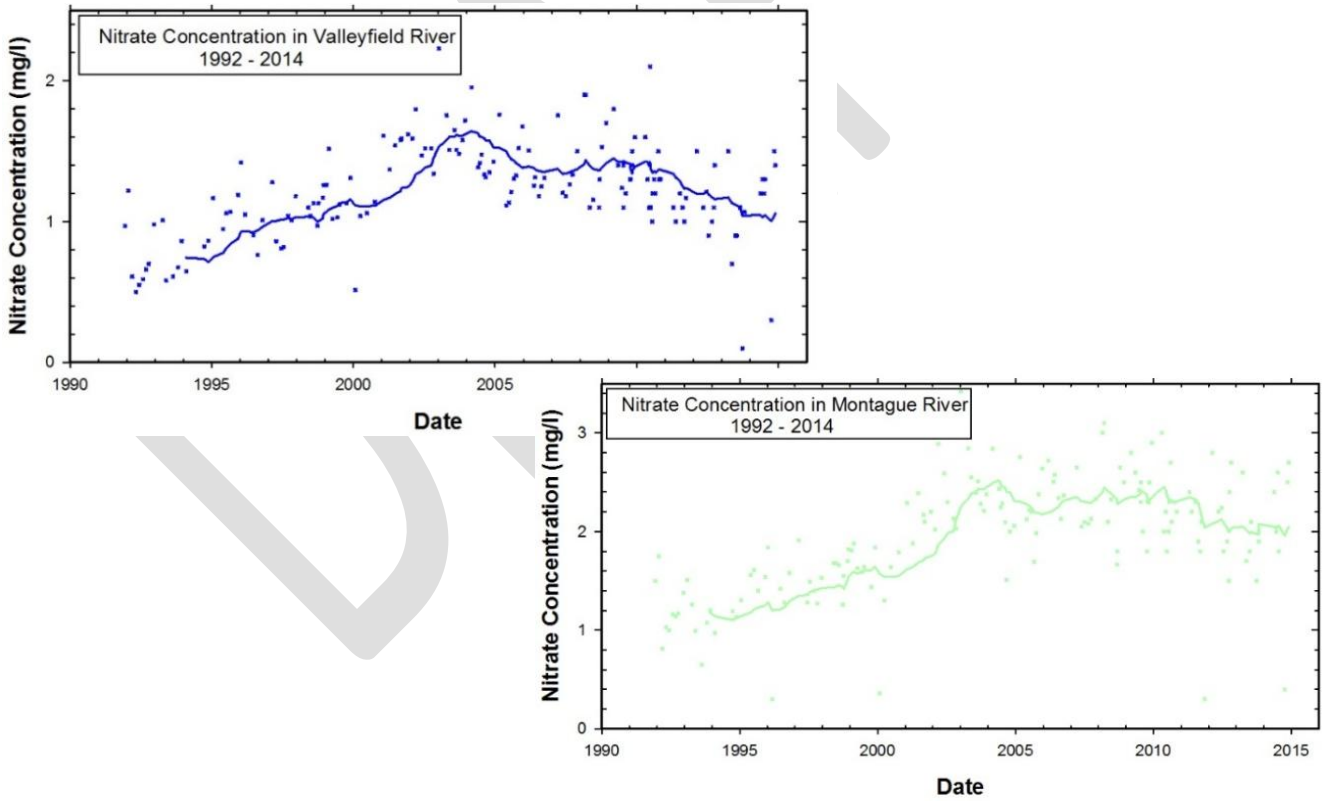

Figure 17: Nitrate concentrations in the Valleyfield River and Montague River from 1992-2014 (Government of PEI).

Nitrates have been detected in groundwater in the watershed (Figure 18). In 2007-2008, 7.3% of the land in the area was used for potato production (Commission 2008). During this time groundwater in the watershed average 3-5mg/L of nitrates, an increase from 2-3mg/L measured in 2000-2005 (2008). Nitrate levels in drinking water should not exceed 10mg/L.

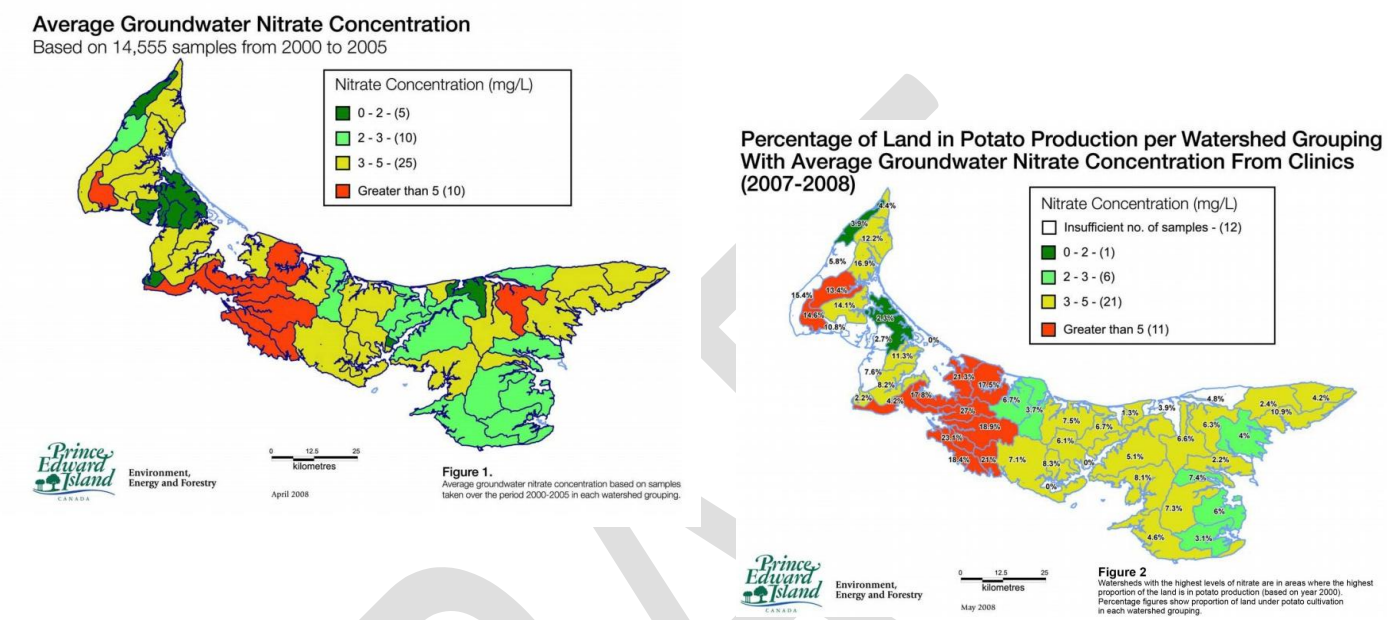

Figure 18: Nitrate concentrations and percentage land in potato production across PEI. (Nitrates in Groundwater Report, Government of PEI 2008).

5.1.1.2 Fish Kills

A 'fish kill' can be defined as the significant and sudden death of fish, shellfish and other aquatic animals. Large numbers of animals dying over a short period of time, usually in a defined area, characterizes such events. Fish die as a result of a wide variety of natural and unnatural causes such as stress, suffocation, water pollution, and toxic algae, all having a disastrous result on the species and area affected.

On July 12, 1999, a major fish kill on the Valleyfield River was reported. The fish kill affected approximately the bottom eight kilometres of the river, from Heatherdale down to the confluence of the Montague River. Heavy thundershowers occurred in the area on Saturday, July 10, 1999 (Figure 19 & 20).

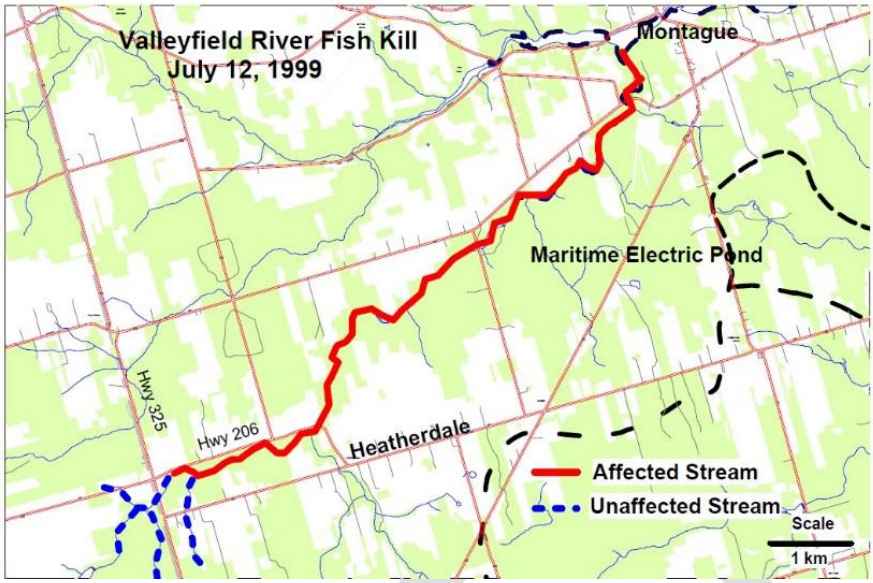

Figure 19: Section of stream affected by the July 12, 1999 fish kill in the Valleyfield River.

There were four potato fields near the upper most extent of the fish kill. The average slope in the fields was 5% and the entire headland of three of these fields had been tilled to a depth of 7 to 8 inches, and plowed to the edge of the ditch. The fourth field was also cropped in potatoes up and down the slope. There was a grassed headland and a buffer of pine trees between the lower portion of the field and the highway ditch. The fields were located from 100 to 200 metres from the Valleyfield River, depending on the location.

The full extent of the fish kill was not evident on Monday, July 12, 1999, the water was still extremely silty and only approximately 100 fish were collected on the first day of the investigation. On Tuesday, July 13, 1999, the full magnitude of the fish kill became clear. All sizes and species of fish were affected. There were 2,491 speckled or brook trout, 14 rainbow trout and 1 North American eel collected during the cleanup activities. The number of fish collected would be a conservative estimate of the number of fish that were killed. The presence of Azinphos Methyl residues in the fish livers indicated that the pesticide was the probable cause of the fish kill.

Figure 20: Dead fish collected following a fish kill in the Valleyfield River on July 12, 1999 after pesticides from a nearby field entered the stream during a heavy rain event.

The Government of PEI has been involved in pesticide monitoring for a number of years. After 21 fish kills occurred from 1999-2002, annual testing has been completed in Island streams since 2003. The current Pesticide Monitoring Program includes sampling of groundwater, surface water and finfish/shellfish from sites across the province. A site on the Montague River was tested in 2011; there were no traceable levels of pesticides in the water (Table 2). In 2014, three different pesticides were detected at low levels. Pesticide levels in Valleyfield River have not been documented.

Date	Weather	Pesticide	Pesticide	Pesticide
July 29	Normal	Chlorantraniliprole – 0.05ng/ml	Clothianidin – 0.01ng/ml	-
August 18	Wet	Chlorantraniliprole – 0.04ng/ml	Clothianidin – 0.02ng/ml	-
August 21	Normal	Chlorantraniliprole – 0.04ng/ml	Clothianidin – 0.01ng/ml	-
September 9	Normal	Chlorantraniliprole – 0.04ng/ml	Clothianidin – 0.02ng/ml	Thiamethoxam – 0.01ng/ml

Table 2: Concentrations of pesticides detected during the Pesticide Monitoring Program of the Montague River in 2014.

Chlorantraniliprole is an insecticide that is slightly toxic to freshwater fish and extremely toxic to aquatic invertebrates (CRAAQ 2015). It is persistent, with a 125 to 231 day half-life in water. Clothianidin and Thiamethoxam both have a lower toxicity to freshwater fish and invertebrates, but are highly toxic to bees (2015). Although the pesticide concentration may appear to be very low, they may move up the food chain and become magnified; this process is referred to as biomagnification. Pesticides runoff into a stream and enter algae cells; the algae are consumed by invertebrates, which are then consumed by minnows. A trout eats a number of minnows and then is eaten by an eagle. With each step in the food chain, the concentration of the pesticide increases. Many pesticides are fat-soluble and are therefore stored in the adrenals, testes, thyroid, liver and kidneys allowing for accumulation (Permaculture 2008).

5.1.2 Soil Erosion and Sedimentation

Soil that enters streams is not always contaminated with fertilizers or pesticides, but it still poses a threat to the ecosystem. The presence of particles in the water can influence the water quality. The conductivity will increase, as well as the temperature which influences the dissolved oxygen levels. Changes in these parameters will affect the aquatic organisms.

Soil erosion is considered by many to be the most serious environmental problem in PEI. So often streams all over the Island “run red.” Sediment originating from agricultural and forestry activities, highway construction and maintenance, and other development have negatively impacted the Montague-Valleyfield River watershed in a number of ways. Pools, ponds, and springs have been filled in with sediment, shellfish beds and trout spawning areas have been covered over, water temperatures have increased, and water depth has been reduced throughout the tributaries, rivers, and estuary.

All of these events have had detrimental effects on the wildlife that inhabit the watersheds as they disrupt normal feeding and reproductive patterns. Soil loss from agricultural areas is the primary means for phosphorus to enter watercourses (Figure 21). This compound binds to soil particles and is transported to watercourses during runoff events. In addition to degrading aquatic habitats, the soil quality is impacted by the loss of humus from excessive erosion.

Farmers in the watershed are implementing soil conservation practices such as grassed waterways, terracing, farmable berms, and strip cropping.

Figure 21: Surface water runoff near Valleyfield River fish kill site during an intense rainfall event on July 27, 1999.

The pond on the Valleyfield River at the Loane Road crossing is filling in with sediment entering upstream of the bridge. Each year the amount of sediment appears to increase and the water depth is reduced. There is no distinct source of the sedimentation. This is a major area for concern in the watershed.

5.2 Bacterial Contamination

Faecal Coliform is a group of bacteria, including Escherichia coli (E.coli), which exists in the intestines of mammals and can be found in their feces. This bacterium can make their way into groundwater and streams through agricultural runoff, septic systems or sewage discharge, or infiltration of domestic and/or wild animal faecal matter (Water 2007). The presence of Fecal Coliform bacteria indicates contamination of water with faecal waste that may contain other harmful, or disease causing organisms including bacteria, viruses, or parasites (2007). Drinking water contaminated with these organisms can cause stomach and intestinal illness. Non-detectable faecal coliform/100ml is the accepted value for drinking water. In a river system, an increase of Fecal Coliform (*E. coli*) results in the closure of the shellfish fishery.

5.2.1 Shellfish Closure

Bacterial contamination is typical of many PEI estuaries, Montague River included. Sections along this river often exceed the acceptable levels of Fecal Coliform and therefore the fishery is closed. When an area is closed, it is both illegal and unsafe to harvest shellfish. Shellfish feed by filtering microscopic organisms from the water, harmful bacteria, viruses and biotoxins can build up in their tissues (Canadian 2012). When consumed by people, severe, potentially fatal illness may result such as Paralytic Shellfish Poisoning (PSP), Amnesic Shellfish Poisoning (ASP) and Diarrhetic Shellfish Poisoning (DSP) (2012). The toxins that cause these illnesses are not destroyed by cooking.

5.3 Freshwater Stream Blockages

The Montague and Valleyfield rivers have seen very little stream restoration work for a number of years. As a result, there are blockages to flow which prevents, or minimizes movement of aquatic organisms. Many of these blockages have been caused by nature and with some attention, can be removed without much difficulty. Other blockages are the result of human disturbance such as felling trees across waterways, or clear-cutting to the stream edge which destabilizes the bank, thus causing erosion and release of woody debris. Old and poorly constructed crossings found on abandoned trails and field access roads are collapsing into the streams; these will require more time and more resources to remedy.

5.3.1 Natural Blockages

The 2013 riparian assessment of the Valleyfield River covered 79.2 km of stream. There were a total of 11 major blockages, 25 medium blockages and 1 minor blockage recorded. During the 2014 riparian assessment of the Montague River, covering a total of 24.3 km, a total of 93 blockages were recorded. Of these, 37 were classified as major, altering water flow and impeding fish passage. The remaining 56 resulted in 19 medium blockages and 37 minor blockages. Chainsaw work will be required to deal with majority of these blockages (major and medium).

Not all blockages need to be removed from a stream, as they provide great cover for fish and other aquatic organisms. The problem arises when the fish cannot get through, water flow is reduced and silt is building up. Cleaning up a blockage to allow passage can be achieved while leaving cover for fish.

5.3.2 Beaver Activity

The Montague River riparian assessment reported 25 cases of beaver activity such as downed trees, dams and lodges. Beaver activity was less on the Valleyfield River but they were still present with seven dams, one which is quite large. Beavers are a *keystone species* and they play a unique and crucial way an ecosystem functions; without beaver, the wetland habitat they create would not exist. The presence of beaver dams is not always a negative thing. The wetlands they create provides habitat for many plants and animals, as well as hunting, angling, trapping and non-consumptive use opportunities. Issues arise, however, when the numbers of dams become too plentiful not allowing *anadromous* fish to pass through, or if the dam is located close to the *head of tide*. Dams can trap silt, cause severe flooding issues, and alter water chemistry parameters that, if changed, affect fish survival rates. It is evident that beavers exist in many streams in the SEA region and it is important to consider both the negative and positive impacts of this animal when developing a management plan.

5.3.3 Alder Growth

There are two species of alder found along PEI streams, Speckled Alder and Green Alder. These shrubs provide beneficial cover for fish, put nitrogen back into the soil, anchor soil and provide a food source for many organisms. Alders grow very rapidly and are some of the first plants to emerge after a disturbance. As a result, many sections of stream become clogged with alders, some growing so low that they create blockages and hold back sediment which alters the stream bed and water depth. While it is not beneficial to remove alders completely, sometimes cases occur where major overgrowth needs to be removed in order to restore stream function (Figure 22).

Figure 22: Alder overgrowth encroaching on stream affecting water flow.

5.3.4 Poor Crossing Conditions

As part of the riparian assessment process, an analysis of each of the crossings is completed. It is noted whether the crossing is *well designed*, *badly designed* or *impeding fish passage*. The materials used to build the crossing and the condition it is in is also recorded. An example of the best crossing is one with a wide bridge, a flat-bottom culvert or a wide culvert (Figure 23).

Figure 23: Examples of good crossings.

A badly designed crossing is one that is too small, has an onion (pool below crossing) or has signs of sediment entering the stream from the adjacent road. Crossings that impede fish passage are those that have collapsed, create a hanging culvert, or are clogged with debris. A hung culvert is any culvert with a drop of over 15cm where fish likely cannot pass (Figure 24).

Figure 24: Examples of hung culverts indicative of a fish passing impediment.

There were a total of 55 stream crossings marked during the assessment of the Valleyfield River (Figure 25). Of these crossings, 13 were considered defective and blocking fish passage. This included hanging culverts and collapsed crossings. Seven crossings were poorly designed and did not appear to be impeding fish passage; though these crossings will need repairs before they become a fish passage problem. In the 24.3km of stream assessed along the Montague River, 10 crossings were evaluated and three were in poor condition and should be repaired.

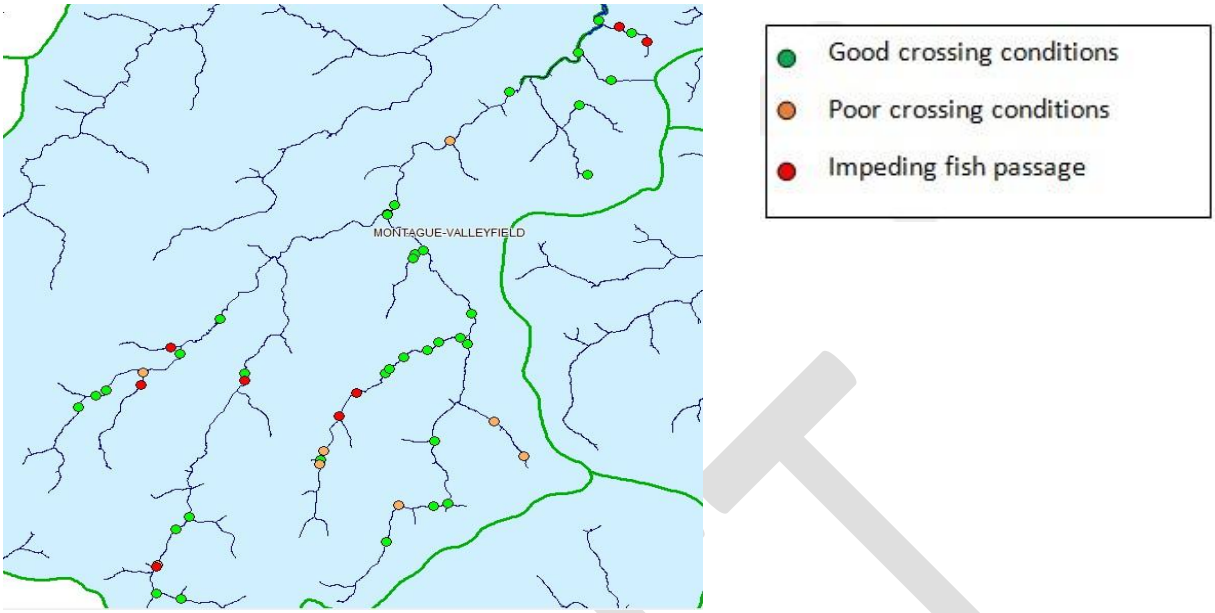

Figure 25: Crossing assessment of the Valleyfield River that was completed in 2013.

5.4 Loss of Biodiversity

Biodiversity, or biological diversity, is a term used to describe the variety of life on Earth. This variety occurs at different levels from genes to ecosystems (Bernstein 2010). Extinction of a species is a natural occurrence. Since the existence of humans, the natural rate of extinction has increased drastically due habitat loss from development, movement of invasive species and exploitation, among other factors (2010). The loss of biodiversity is considered one of the major threats to the human species. It is hard to know the role all organisms play, but it is important to understand that "human beings are intimately connected with the animals, plants and microbes we share this small planet with, and totally dependent on the goods and services they provide (2010)."

There are a number of native species threatened due to human activity. Habitat loss is affecting the bobolink, barn swallow and Atlantic salmon, along with a number of other species. Introduction of *P. destructans*, an exotic pathogen, has played a key role on the loss of the Little Brown Bat population. Invasive plant and animal species are threatening many ecosystems.

5.4.1 Habitat Loss

The Montague-Valleyfield and Area watershed is fortunate to be made up primarily of natural areas (56% of wetland/forest), including a vast stream system, since these areas provide critical habitat for a variety of important organisms. It is imperative that these areas be sustained for years to come to ensure a healthy ecological future for the area. While population levels on PEI have been relatively stable, there have been marginal increases in recent years which have resulted in more land being developed. As land becomes developed, significant habitat can be lost, or may go unnoticed. Having a watershed management plan in place is a good way to ensure that critical habitats are protected. Many of the streams in the Montague-Valleyfield system are in poor condition and, as a result, good fish habitat is lacking. Agricultural fields provide good habitat for a variety of birds and mammals but populations can be affected during harvest, or with pesticide use. By using sustainable farm practices, both the farmer and the wildlife can benefit.

There are a number of programs available that offer support for enhancing wildlife habitat, such as the National Wetland Conservation Fund, Habitat Stewardship for Species at Risk, Small Marsh Program, and Growing Forward 2. Although land may not have a commercial value, it is important to see the environmental values it provides.

5.4.2 Invasive Species

According to the PEI Invasive Species Council, an invasive species is any organism that is not native to an area and threatens the environmental, economic and social health of that area. Once a population is removed from its natural ecosystem and introduced to a new area it no longer has natural predators and pathogens to keep it under control. For this reason, invasive species often out-compete native species. Not all non-native species are considered invasive; some can exist without causing any concern. The United Nations lists the introduction of invasive species as the second largest threat to biodiversity next to habitat loss, which invasive species can contribute to. Once an invasive species is established, eradicating it is almost impossible. Earlier management efforts can help reduce the spread and keep populations under control.

Some of the invasive species causing issues in the Montague-Valleyfield watershed are Japanese Knotweed, Glossy Buckthorn, Wild Cucumber, Green Crab and Canada Waterweed. Japanese Knotweed can be found in large patches throughout the watershed and has been found along the stream system. This aggressive shrub will create thick stands that will quickly shade out native species. Glossy buckthorn is an ornamental shrub introduced from Europe that tolerates a wide range of habitats. It has great reproductive success in this climate and out-competes many native plants. Wild cucumber is a vine that grows on shrubs and trees and can eventually choke out these species.

Green crabs are one of the 100 worst invasive species in the world. Introduced from Europe and Northern Africa, this aggressive crab threatens the shellfish industry; however, CAMP results for the SEA region and PEI show a decline in green crab populations over the past two years. Canada waterweed (Elodea Canadensis) is a perennial plant often used in aquariums. Although native to Nova Scotia and New Brunswick, it is not native to PEI and once introduced to natural waterways; it can cause a number of issues. This rapidly growing plant creates a monoculture, degrades fish habitat, alters water chemistry and reduces water movement. Canada waterweed was first detected at Knox's Dam in 2005, likely as a result of aquarium waste, and has been a challenge to get rid of after a number of attempts and removal methods; it continues to be a major problem at this site.

5.4.3 Species at Risk

According to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) there are 24 species at risk in Canada that are found in PEI. Seven of these are listed as *endangered* and *at risk of extirpation*. Seven are *threatened* and therefore at risk of becoming endangered. The remaining 10 are under *special concern* as population numbered are nearing threatened levels. Here are some species on that list.

Table 3: Species at Risk on PEI.

Species	Status	Cause
Little Brown Bat	Endangered	White-nosed Syndrome
Piping Plover	Endangered	Predation, human disturbance and habitat loss
Bobolink	Threatened	Agricultural practices, habitat loss and fragmentation,

		pesticide use
Olive-sided Flycatcher	Threatened	Uncertain
Common Nighthawk	Threatened	Loss of food source and habitat
Bank Swallow	Threatened	Loss of habitat, pesticide use
Barn Swallow	Threatened	Loss of habitat
Barrow's Goldeneye	Special Concern	Loss of habitat from forest degradation
Short-eared Owl	Special Concern	Loss of habitat and pesticide use
Eastern Wood-pewee	Special Concern	Loss of wintering habitat and food availability
American Eel	Threatened	Habitat degradation
Atlantic Salmon*	Special Concern	Freshwater habitat quality
Gypsy Cuckoo Bumble Bee	Endangered	Decline of nest hosts, pesticide use and disease
Yellow-Banded Bumble Bee	Endangered	Pesticide use, habitat loss and disease
Monarch Butterfly	Special Concern	Loss of habitat at wintering grounds

*Atlantic salmon population are special concern in Canada but have been extirpated from streams in the Montague-Valleyfield watershed. Last record of salmon activity was at the Maritime Electric Pond in 2008.

5.5 Water Use

5.5.1 Water Act

Unlike the other provinces in Canada, PEI is solely dependent on groundwater as the only source of potable water. Groundwater is susceptible to a number of contaminants such as nitrates and bacteria. The Government of PEI is working to develop a water act with the assistance of the public. The goal of the Water Act is to protect the quality and quantity of the Island's water and ensure that our water supply is healthy and sustainable now and into the future. There are a number of concerns when it comes to water use in PEI. In the Montague-Valleyfield watershed, nitrate levels in drinking water have seen a decrease; however, in areas with extensive farming there is always a risk of nitrates getting into well water. The farming industry has placed added pressure on crop farmers to produce larger yields. As a result, more water is required, especially during the dry season. Drilling of deep water wells would enable

access to water but this could potentially threaten the health of the aquifer which receives approximately 1000 mm annual water recharge. Not enough is known about the groundwater supply on PEI and therefore, it is important that Islanders understand and participate in the role that the Water Act will play in the protection of Island groundwater.

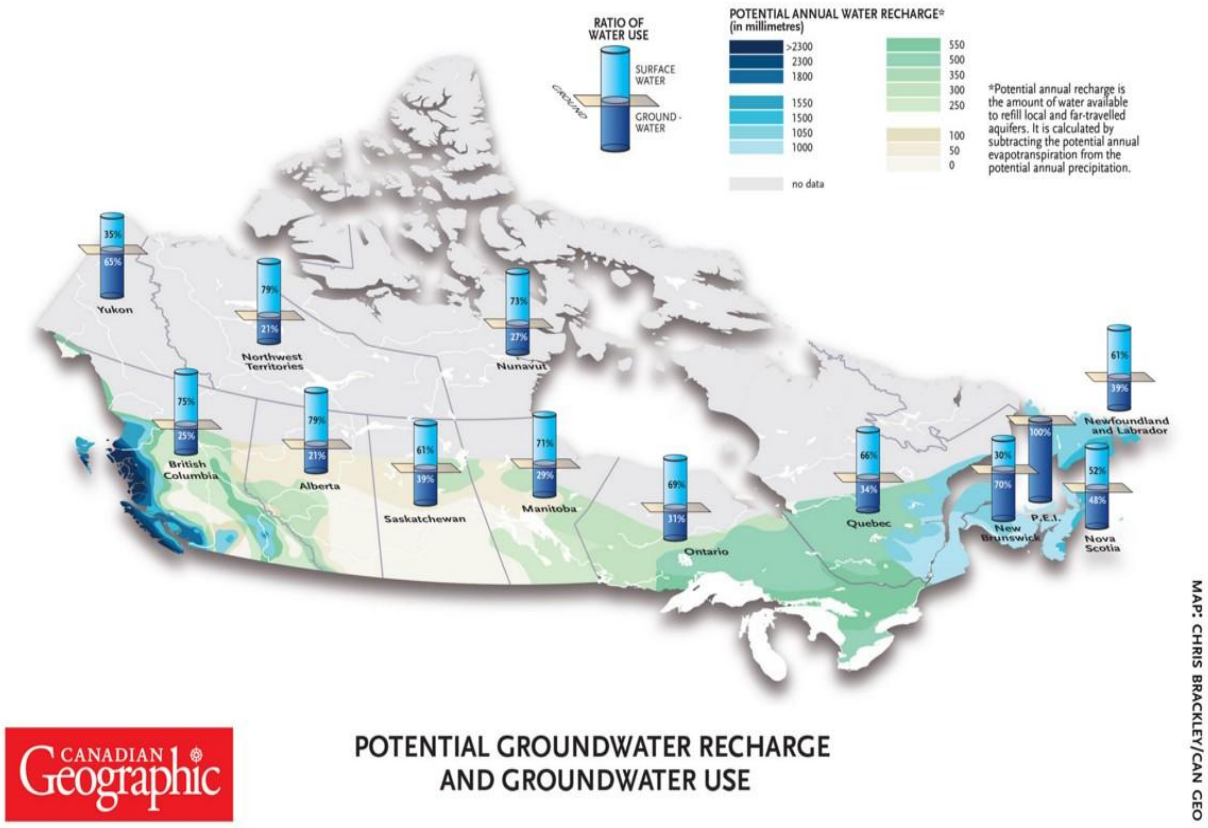

Figure 26: Groundwater recharge and groundwater use in Canada.

5.5.2 Well field Protection

Being the only town in the Montague-Valleyfield watershed, Montague is the only area with a municipal water supply. Many of the dwellings in the watershed, including 25% of the dwellings in Montague, have water supplied from a private well. A well field is an area containing more than one pumping station that supplies water to a public water system. The well field for the Town of Montague consists of two underground wells on the north side of the town located behind the Kings County Memorial Hospital (Figure 27). Provincial government legislation

requires all municipalities to develop a management plan to protect their water supply. As such, the Town of Montague Zoning Bylaw outlines the well field protective zones. The following restrictions apply within three specific protective zones which represent different "time of travel" to the well:

250-Day Zone

- No sewage treatment or solid waste facilities
- No use of chlorinated solvents
- No quarries or excavation pits
- No underground petroleum storage tanks
- No on-site sewage disposal
- No manure/agro-chemical storage or application
- No petroleum hydrocarbon storage

5-Year Zone

- No sewage treatment or solid waste facilities
- No use of chlorinated solvents
- No quarries or excavation pits
- No underground petroleum storage tanks
- Limits on application of manure or agro-chemicals

25-Year Zone

- No sewage treatment or solid waste facilities
- No use of chlorinated solvents
- No quarries or excavation pits

Since majority of the well field protection area is located outside of the town's limits, the Town has very little control over it. The well field area is all located within the Montague-Valleyfield watershed, so it is important to include in the watershed management plan. There used to be a well field located in the south of Montague, but those wells were capped after the high school was built in 2010.

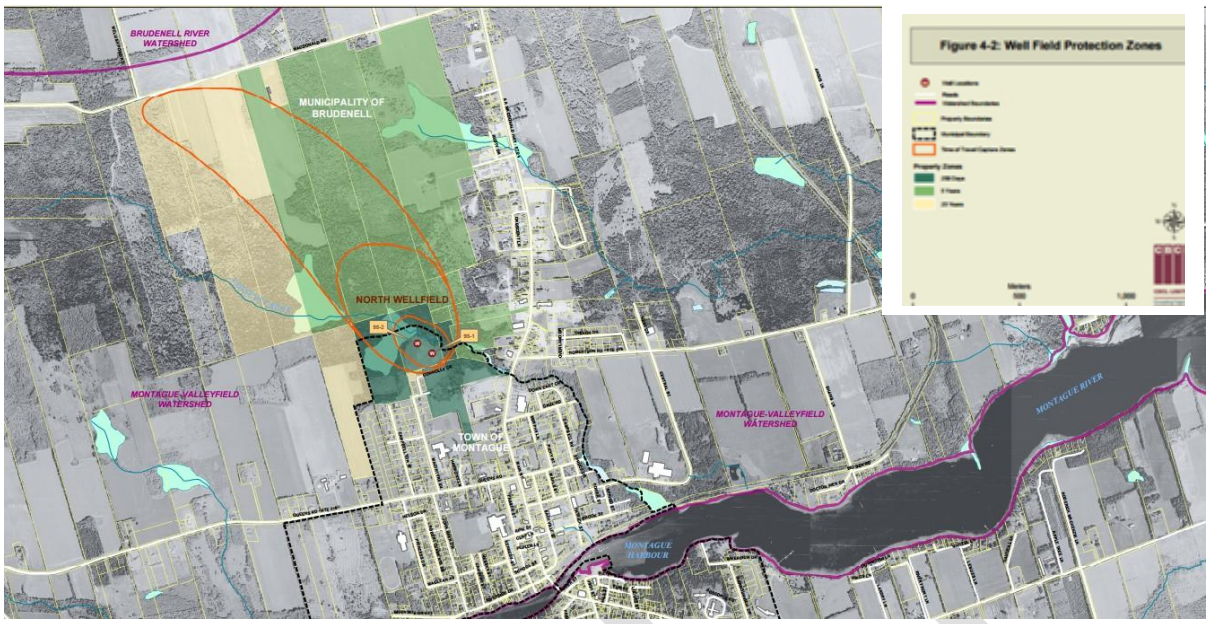

Figure 27: Town of Montague Well Field Protection Area located in the northern area of the town and outside town limits. The area highlighted in dark green is the 250-day zone, light green indicates the 5-year zone and yellow is the 25-year zone.

5.6 Community Engagement

Community engagement is the process by which community benefit organizations, such as SEA, and individuals build ongoing, permanent relationships to apply a collective vision for the benefit of a community, or in this case the watershed. As a non-profit organization, SEA is dependent on the support of the public. Over the past 10 years, public involvement and support for the SEA organization diminished due to provincial funding restrictions that would have allowed SEA to perform restoration and habitat enhancement work that were a priority for community residents. These funding restrictions, therefore, had a negative effect on SEA's ability to keep people engaged. Because our environment is so important, SEA is looking for new ways to increase community engagement and is developing new initiatives and interactive projects. Some of these projects include:

- Trails Development & Trail App
- Harvey Moore Wildlife Sanctuary Project
- Environmental Education Programs
- SEA's Pollinator Park & Community Food Gardens

As a watershed group, there are so many opportunities for projects and activities, but the public needs to be involved in order to be successful. Too many people have disconnected from the natural world and as a result the individual and environment are both suffering. It is important to have a relationship with nature; it's where we all came from and where we will all return, so be active in your watershed and engaged with your community.

6.0 Contributing Factors to Watershed Management Issues

A number of watershed management issues occur naturally; however, with human influence the magnitude of these issues, and the rate and the frequency at which they occur, are altered. Since humans have such a high impact on the environment and its health, it is important to implement a watershed management strategy.

6.1 Impacts of Climate Change

Climate change is defined as the change in long-term weather patterns experienced in a region (NASA 2015). While this event occurs naturally, it is believed that human activity is impacting the rate and severity at which it is occurring.

As we experience climate change, PEI can expect to see an increase in storm events and a change in storm intensity. Rising sea levels, storm surge and coastal erosion will become more common and can lead to property damage, shoreline instability, loss of/damaged sand dunes, and increased habitat/species loss. Saltwater intrusion into groundwater is expected in some areas. Heavy rain events can cause major flooding events and will cause sediment loss/redistribution, both with serious runoff concerns. There will be periods of extreme drought to excessive moisture, causing a shift in the water table. There will be milder winters, early extended thaws, late springs and early frosts, all having an impact of various plant and animal species survival.

Higher temperatures and longer growing seasons could benefit agriculture and forestry, but there will be added stress to water resources. Native plant species that prefer cool, wet climate will be forced to adapt or disappear altogether. New pest and disease problems will develop as temperature warm. Fish and other wildlife species may be lost as habitats change and new fish and bird distribution/migration patterns may result.

PEI "is particularly sensitive to climate change as it has vulnerable coastlines and significant economic reliance on weather-sensitive natural resources." As the climate continues to change, Islanders are asked to do their part in reducing the impacts of global warming. As stated in *PEI's Strategy for Reducing the Impacts of Global Warming* (no date), "adapting to climate change does not negate the need to continue to reduce emissions. A continued commitment to do so improves the chances of success adaptation and reduces the potential for suffering the harmful consequences of climate change."

6.2 Land Use Management Practices

Land use practices have a huge impact on the health of a watershed. The land that surrounds a stream can help or hinder the water in a number of ways. A stream running through a cropped field is highly susceptible to run-off; a stream with high number of crossings is more susceptible to fish passage issues. While the 15 metre buffer zone does provide some protection to the waterway, it is not always enough. The more the land is developed or altered, the more stress is placed on the environment, as a result ecosystems and their inhabitants suffer. It is important that Islanders manage their land use with the environment and sustainability in mind as these components ultimately effect economic development, resources availability, and quality of life (Task 2013).

PEI has never had comprehensive land use policies that apply to the whole Island. About 10% of the municipalities in PEI have individual land use plans (2010). In the Montague-Valleyfield watershed, Montague and Lower Montague both have land use plans. Together these

municipalities make up 26km^2, or 13%, of the total area of Montague-Valleyfield watershed, leaving the majority of the land with no land use plan.

After the 2009 *Report of the Commission on Land and Local Governance* suggested comprehensive land use planning for the whole Island, the Government of PEI established the Task Force of Land Use Policy. The Task Force was tasked to develop detailed recommendations for provincial land use policies and their implementation. In April of 2013, the Government of PEI released the draft Provincial Land Use Policies with the following vision:

> "We recognize and value the importance of the land and the water - our Island's natural resources, and the heritage we have inherited in our landscape, watersheds and communities. Responsible stewardship of the Island's resources provides benefits to Islanders and ensures our Island is healthy and sustainable for future generations. Effective planning and decisions about land use will help us change our approach to the Island's sustainability, enhance the well-being of Islanders and offer certainty and transparency in decisions about the environment and investment."

Land use planning is closely linked to watershed planning, as land is a huge component of a watershed. The land use policies will address many of the issues the Montague-Valleyfield watershed is facing. The land use plan aims to protect the quality and quantity of water. Prime agricultural land will be protected and the working rural landscape preserved. All natural area and heritage resources, such as beaches, dunes, marsh and wetland will be preserved. Land that provided valuable resources will be protected and undergo sustainable management. Healthy, vibrant and sustainable communities will be encouraged, something SEA is striving for. Land use and infrastructure planning, including environmental, social and economic impacts, will be integrated to optimize existing services before expansions and costs will be considered.

This document is the consultation draft that has been used for public discussion and feedback. The final Provincial Land Use Policies document has not been released yet. This document will provide land use policies that will allow the residents of the Montague-Valleyfield watershed and the Island to manage the land, while keeping the best interest of the environment and future generations in mind.

6.3 Agricultural Practices

As evident in the watershed management issues section, agricultural is not the only activity that poses a risk to water. Manufacturing, development, forestry, waste disposal and urban runoff all can threaten a waterway. With 35% of the land in the Montague-Valleyfield watershed, agriculture is an important issue as it has a greater potential to cause harm.

Agriculture practices, when implemented sustainably, can maintain the quality of soil and water. These practices, referred to as *Best Management Practices*, conserve soil and water without reducing productivity. Through management of erosion control, runoff and groundwater contamination can be reduced. A nutrient management plan can also prevent the runoff of nitrates and other compounds into waterways. Integrated Pest Management allows pest problems to be monitored and assessed continually.

According to Agriculture and Agri-Food Canada (2014), in order to have best management practice for soil erosion, it is important to know what type of soil makes up a field. The texture of a soil will dictate potential risks. Sandy soils have large spaces between particles, which provide rapid downward water movement. Substances can move deep into the soil and potentially the groundwater. Silty soils are most at risk for erosion from surface runoff. Clay soil becomes very compact when wet, allowing surface water to flow quite readily. Water erosion can be reduced with proper crop rotation, cover cropping, conservation tillage, contour cropping, vegetated buffer strips and grassed waterways (2014). Wind erosion can occur but with proper agricultural practices, such as residue enhancing crop rotations, cover cropping, reduced tillage, shelterbelts and annual barriers it can be controlled.

A nutrient management plan can be developed to prevent over-application of fertilizers and manure. This plan aims to increase crop yield and quality while decreasing the fertilizer input cost (2014). It is important to apply the right amount for the targeted yield, while using the right product. Applying the fertilizer close to the plant and when the plant needs it, may allow

uptake before it is lost. Pests are becoming resistant to a number of pesticides used today, this is allowing for the introduction of new pests, causing greater issues. Integrated Pest Management aims to keep the number of pests down, while decreasing pesticide resistance (2014).

6.4 Regulation and Enforcement

The Investigation and Enforcement Division in PEI is responsible for enforcing provincial legislation. In PEI there are six full-time conservation officers, two seasonal conservation officers and two seasonal Pesticide Inspectors. They patrol PEI's highways, seashores, farmlands and natural areas. In 2012, there were 166 charges laid and 136 issued warnings, in efforts to preserve and protect the environment. The majority of the charges laid were for environmental protection, off highway vehicle, and wildlife conservation (Figure 28).

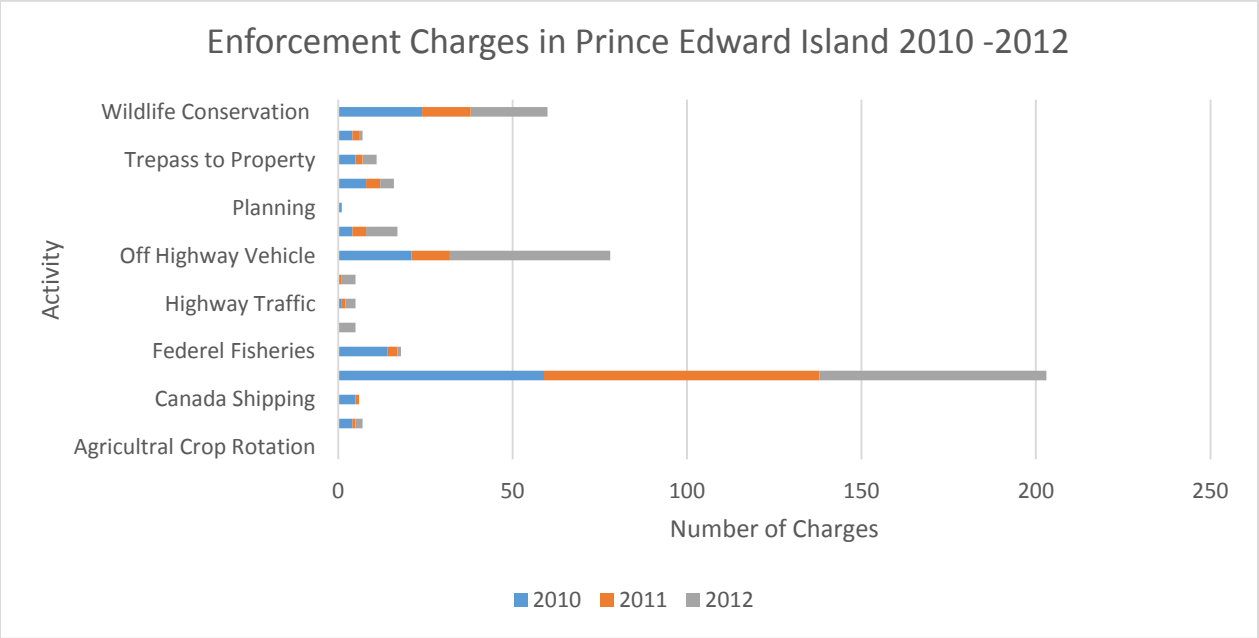

Figure 28: The enforcement charges laid in 2010 – 2012 by officers in Prince Edward Island provide by the Department of Justice and Public Safety.

Conservation authorities play a key role in protecting and improving water quality and quantity. They have expertise and experience to assist in designing and delivering effective watershed management. Public cooperation, understanding of rules and regulations, along with

enforcement will play an important role in the success of the Montague-Valleyfield watershed management.

7.0 Current Management Status

Although there are many problems currently facing the Montague-Valleyfield watershed, it is important to maintain a balanced perspective. Conditions throughout the watershed, although exhibiting some variation, are generally at a state where the application of proper management techniques can still have a significant effect. Nitrate levels in the groundwater, for example, are not so high as to approach dangerous levels for drinking water and are in fact seeing a decrease; they should continue to be monitored. Implementing better soil and nutrient management techniques may continue to aid in reduction.

The majority of the watercourses in the watershed are bordered by sufficient riparian zones, which provide suitable habitat for fish and other wildlife. The goal is to simply ensure that these riparian zones are maintained, or expanded on in places that require it.

Air quality in the Montague-Valleyfield watershed and southeastern PEI is generally good. The long-range transport of air pollution is the single largest component that contributes to poor air quality events in the watershed. Although local emissions are minimal, transport of pollutants from nearby heavily populated and industrialized regions (i.e. eastern USA, Ontario, Quebec) can result in poor air quality in PEI. SEA recognizes the importance of clean air; however, considering that the majority of pollution originates elsewhere and is to a great extent beyond the scope of what can be accomplished through watershed management in Montague-Valleyfield, air quality was not raised as an issue that can be addressed through this management plan.

Perhaps the best feature of the Montague-Valleyfield watersheds is the people of the area. Community members are knowledgeable, enthusiastic, concerned, and most importantly,

willing to do what is necessary to help improve the situation. Increasingly, agriculture producers in the area are taking initiative of more responsible and environmentally sound methods. Strip cropping, terracing, and farmable berms are all ways in which area farmers have used better management practices, and it is important that this group be recognized and rewarded for these efforts and be encouraged to continue these practices. In addition, work that Transportation and Public Works has done to catch silt running in ditches before entering streams has been effective, but needs to be maintained and increased in some areas. Minor stream enhancement work in the Valleyfield River has been effective and should be continued, and expanded upon, on a regular basis to improve fish and wildlife habitat throughout the watershed.

The Montague-Valleyfield watershed is not in a state of complete disrepair, but is in need of enhancement work, maintenance, and protection. With stakeholder involvement and a willingness to change, past mistakes can be translated into future progress.

8.0 Implementation

Watershed Planning is an ongoing process that requires a stable source of funding in order to be successful. Implementation will be ongoing indefinitely, and this plan will need to be revisited regularly as conditions change and the needs of the community evolve.

The planning process in the Montague/Valleyfield River watersheds have been very successful to this point and holds great potential for the future. The Montague/Valleyfield River watershed communities have demonstrated their willingness to adopt watershed planning and the Montague/Valleyfield Watershed Planning Advisory Group (MVWPAG) has the capacity to proceed with management plan implementation. However, without additional funding over the long term, the planning process will not be successful. It is hoped that the various potential sources of funding (Provincial Government, Federal Government, and NGO's) will recognize the importance of watershed planning and collaborate to help ensure that sufficient funds are available for Montague/Valleyfield Rivers and all other interested watersheds.

Although the involvement of all three levels of government is essential to the success of this management plan, it is fundamentally important that community members within the watershed actively participate in its implementation. The watershed is a natural resource that is critically important to the success of the community, and as such, it is the responsibility of the people to support and protect it. The Montague/Valleyfield Watershed Planning Advisory Group encourages everyone to become involved and contribute to the enhancement of the community's watershed.

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