Our Island, Our Water... Our Future

Submission to the Environmental Advisory Committee, Consultations on the PEI Water Act

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A Water Act is a critical first step in developing a sustainable plan for water use and protection on PEI. We appreciate this process of consultation with Islanders on the framework development for such an important piece of legislation. At this early point in the process, we have chosen to highlight what we consider the key challenges confronting the Island and its water supply in the near future and solutions to incorporate into a responsible governance framework.

A Water Act for PEI must acknowledge the challenges we face due to past, current and future stressors. Key challenges are:

- We have an altered cycle of water movement on the Island due to past and current land use. It favours increased water loss through evapotranspiration and surface runoff, and reduced groundwater infiltration
- We are failing to respond to the signs that climate change is already exacerbating that alteration of the water cycle and further reducing water retention on and in the landscape
- We have degraded our water quality through past and current land use. Current legislation and other governance mechanisms do not treat all sectors of society equally and in so doing we have allowed the actions of a few to destroy the livelihoods of many others as well as compromised the environment and the ecological services (water, carbon sequestration, flood risk reduction, ground temperature moderation, etc.) it provides
- Where best management practices do exist, we are not adapting them quickly enough to respond effectively to the additional stressors climate change is placing on soil conservation and surface water dissolved oxygen and temperature patterns. In some instances, we are failing to act altogether.

The following expands on these points and offers solutions that can be tied to legislation through a PEI Water Act.

An Altered Water Cycle

Prince Edward Island was shaped by runoff from the mountains of the mainland and melting glaciers. We have short productive rivers and long estuaries. Coldwater streams totalling more than 5,000 km are fed by thousands of groundwater springs. Seventy-five percent of the Island's surface lies less than 45 m above sea level. A prominent feature is the ridge of higher land that runs up the central portion of the province, with lowlands and peatlands to east and west. We provide this brief description because it is important to identify just how vulnerable we are to an altered water cycle. Every inch of our Island was formed by water and is intricately linked to it.

Over more than a century of land-clearing, a half century of industrial agriculture and expanding development of dense impermeable residential surfaces our landscape shows very different patterns of water movement across and through it. Some of the ways in which it has changed are:

1. The mixed wood Acadian forest that once covered most of the Island has been replaced with open field or coniferous-dominated forests (old-field white spruce stands or conifer plantations). Old growth deciduous forests with varying canopy levels and fallen debris provide a moist, cool environment during hot weather. Even though these forests use much water in summer, they require very little water for seven months each year. In winter, the organic litter layer protects soil from freezing so melt water can descend downward to the aquifer. In stark contrast are conifer stands, such as white spruce, where much evaporation occurs from snow on branches and the "barren" acid needle bed at ground surface usually freezes and promotes run-off, rather than infiltration. Even more contrasting is autumn cultivation of fields, a practice which increases freeze – thaw events and in turn increases surface runoff outside of the growing season. These conditions contribute to flashy rivers, where intense precipitation events cannot be accommodated at the soil surface and the peaks and lows in stream depth are rapid and extreme.
2. In many low gradient areas such as the central part of Kings County (headwaters of major rivers including the Fortune, St. Peters, Midgell and Morell), the proportion of standing (lentic) to free-flowing (lotic) surface water has been radically modified by both dam construction and the introduction of beavers over a half century ago. Mill ponds, other constructed ponds and hundreds of beaver dams have fragmented the stream habitat for mobile fish and invertebrates, but also changed the temperature and dissolved oxygen characteristics of those freshwater environments. Warmer water evaporates more quickly and is thereby

lost to the downstream environment. That contributes to lower stream levels and a host of other stressful conditions for the wildlife that have evolved to inhabit coldwater free-flowing streams.

3. All Islanders take from groundwater for our drinking water and industries. However, that take is concentrated in some instances, such as in the Winter River, and has devastated those freshwater environments. In some tributaries, the rate of take is greater than the rate of replenishment. This is simply not sustainable and is not responsible, no matter what the spatial scale (i.e. tributaries versus watersheds).
4. Climate change is not just a coastal problem on the Island and it is already having an impact inland. In 2014, we experienced two 1-in-100 year precipitation events (in May and December), with devastating consequences, particularly in West Prince. Water is being delivered to the Island in more intense events that provide little to no groundwater replenishment or other biological values to our land or freshwater environments.

All of these changes produce an altered water cycle, where the proportion lost to evaporation and surface runoff is increased and the proportion left to infiltrate to groundwater is decreased. We have much data already. We know that some river levels are at all-time lows and we haven't had a good year for groundwater recharge since 2009 (see supplementary graphs below). There are those who suggest we have vast quantities of water to expand resource use. We do not. There is no surplus without compromising our freshwater ecosystems or mining ancient groundwater. Climate change and flash floods combined with inappropriate land use in rural and urban settings will only exacerbate the situation.

Degraded Water Quality

Enough has already been said about the impact of industrial agriculture on Island waterways. We now have badly degraded freshwater environments that have less resilience to respond to additional stressors associated with climate change. Surface waters in our rivers, estuaries and in some instances the Northumberland Strait have:

- excess sediment (visible from space in the Northumberland Strait)
- excess nitrate – Nitrogen (mapped in the Strait & sourced to the Island)
- reduced dissolved oxygen
- elevated temperature

We have not only allowed this to happen, we have subsidized it with our tax dollars. Have we compromised the success of other resource-based industries for that of one

agricultural sector – industrial potato production?! Imagine the frustration of lobster fishers who try to make a living in the “Northumberland Strait dead zone”, oyster fishers that have to travel to multiple estuaries to find enough to make a living, eel fishers that find dead eels in their traps because of low oxygen or even worse those who are told they will have no income for a few weeks until a coastal contaminated zone has cleared! Equality of resource use and a true valuation of ecological services must be built into all legislation, not just the new Water Act.

The Solutions Embedded in Legislation

Ground- and surface-waters will likely become less available as climate change progresses. We must find ways to reverse some of the shifts we have produced in the cycling of water. To that end, a Water Act must be supported by better land use planning, better land management and an integrated approach to resource use on the Island. The magnitude of these challenges cannot be addressed with one Act.

Mechanisms to reinstate a more natural water balance include:

1. Set targets for reforestation and implement programs to reach them. Fifty percent of the surface area of each drainage basin in forest should be the goal. Focus on multi-species stands of trees and shrubs that would have occurred in deciduous forests before European settlement. This may be woven into a “carbon trading” agreement.
2. Start by removing public land from agriculture and consider converting it to forest or swapping it for land in riparian zones that should be protected.
3. Provide tax incentives to landowners who maintain forest cover and diversify old-field white spruce or other conifer-dominated forests.
4. Promote the re-establishment of wide, diversified hedgerows (and reverse the trend to field expansion) to help collect and retain snow for later addition of snowmelt water to the aquifer. These hedgerows would also enhance connectivity and abundance of wildlife.
5. Soil organic matter levels are the best mechanism to increase the capacity of agricultural soils to hold water, thereby reducing run-off and the need for irrigation. Organic matter targets (>4 %) should be built into all incentive programs that use tax-payer dollars.
6. Eliminate land use practices that contribute to excess surface runoff, including fall plowing on slopes > 5 % and exemption of corn as a row crop.
7. Instate a user pays system that is reflective of the true ecological services provided by groundwater. Incentives in urban centres to reduce use, trap

rainwater and separate and use gray water must be radically expanded and applied equally to the commercial and residential sectors.

8. Recognize the importance of peatlands for water storage and carbon sequestration. Peat mining on the Island reverses gains we may make in other areas with respect to our carbon footprint. We cannot effectively use carbon trading as a tool if we continue to mine our peat-based wetlands and we also lose water storage capacity in the process.

Water quality is as much or more so tied to better land use planning than water quantity. Legislation must treat water as an ecological service that is equally important to all sectors of society and the environment. One industry, no matter how valuable to the Island economy, cannot be allowed to impact that service.

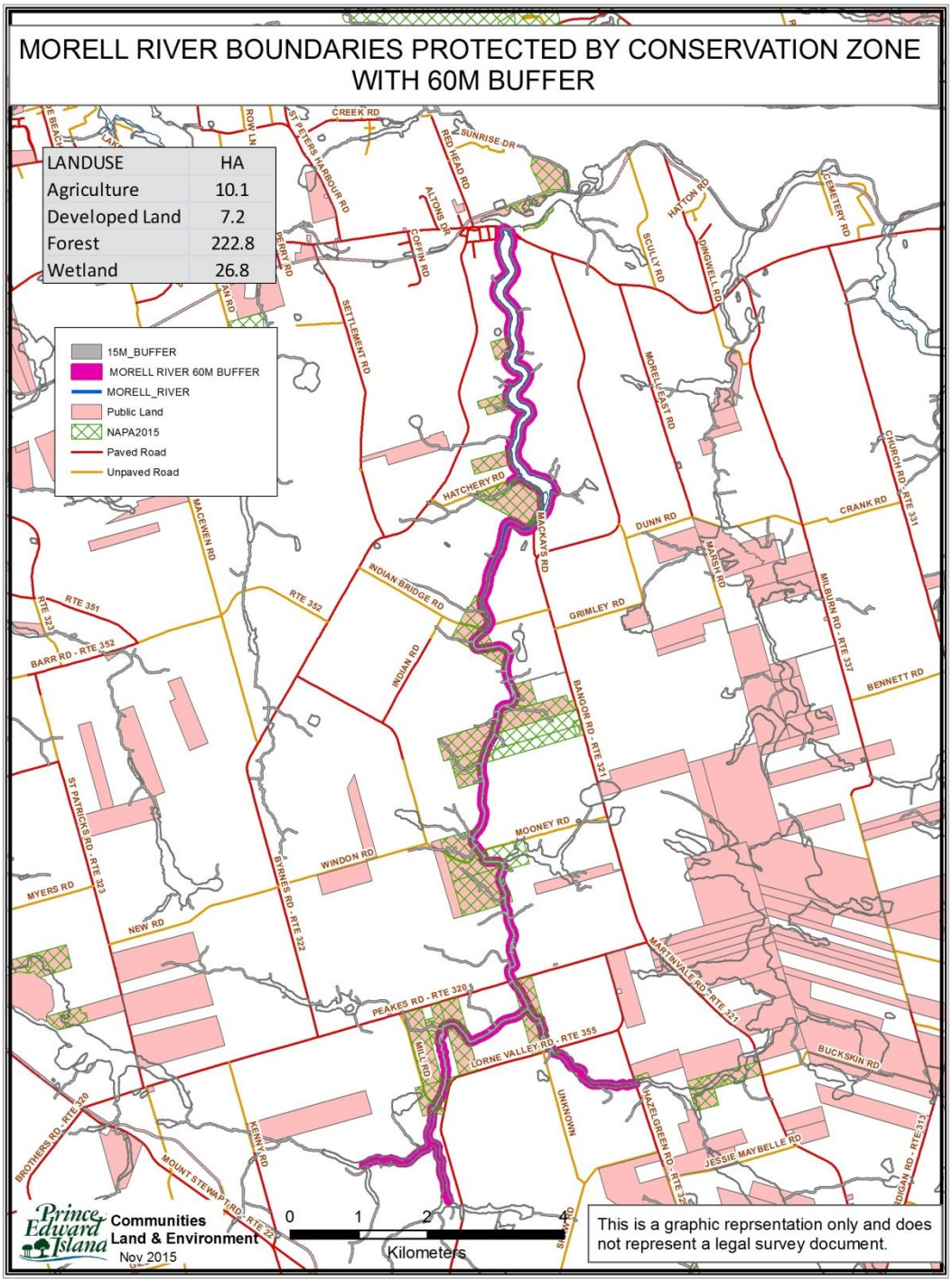
Mechanisms to restore and protect water quality include:

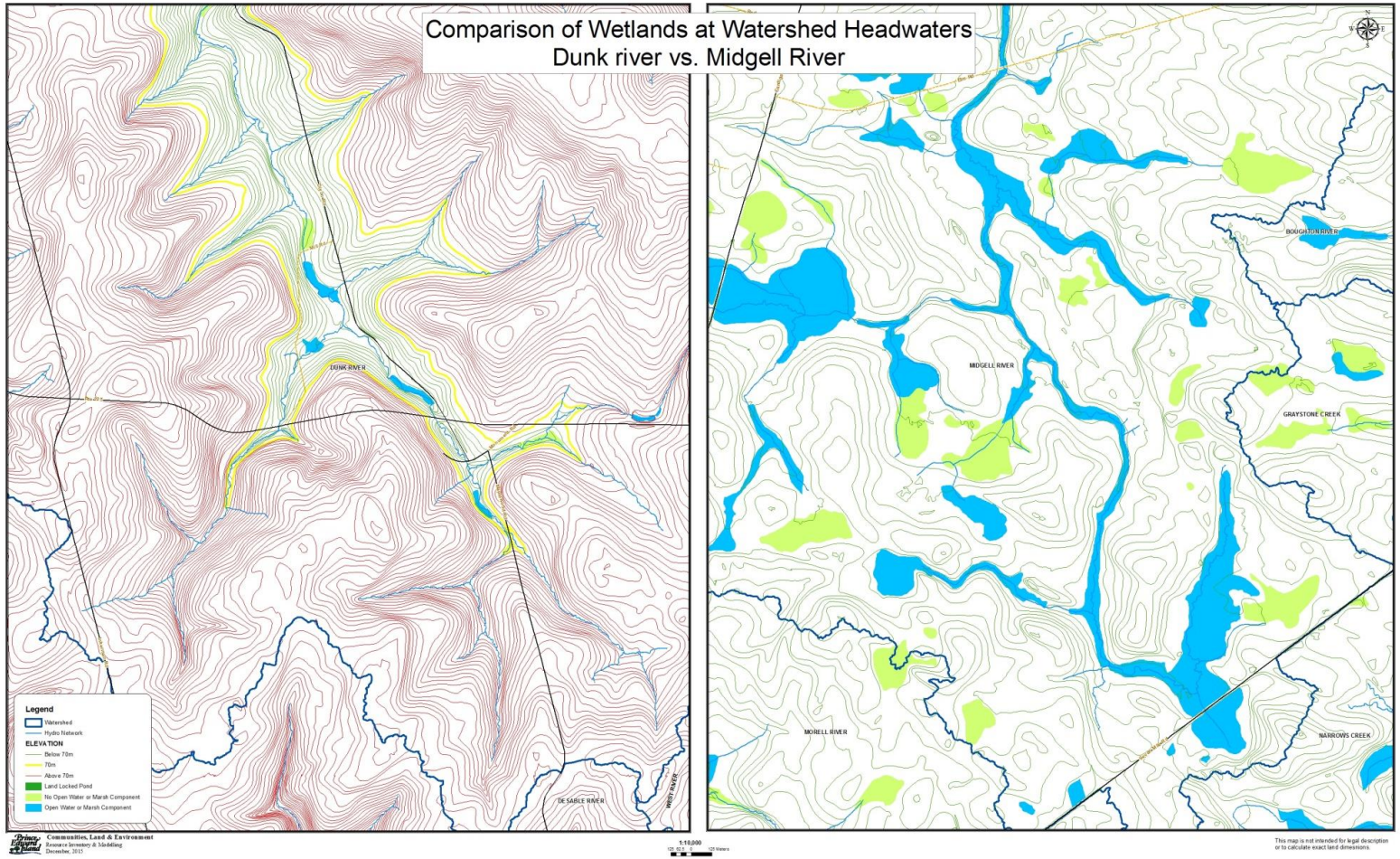
9. Afford better protection for aquatic ecosystems and their riparian zones by establishing variable width buffer zones that reflect sensitivity to erosion and runoff. Factors to consider include adjacent land use (percent forest cover in the watershed), slope length and steepness, and sensitive or rare ecosystems (see supplementary figures below for an example from the Morell River watershed of how this could work). Currently, 15 m of riparian zone habitat is protected along both sides of PEI watercourses. Greater widths (60m) have already been protected in such regions as the Morell Conservation Zone and along the complete length of both North Lake Creek and Priest Pond Creek with no compensation to landowners. However, with the current 15 m buffer width, most of our watercourses continue to be degraded, especially by deposits of sediment. Atlantic salmon and sea run brook trout are good indicators of freshwater habitat quality. Data collected to assess population levels of these fish species show declining populations in many rivers on PEI. We recommend that the province move towards establishing wider buffer zones along our watercourses, if necessary by purchasing and protecting riparian zones (under the Natural Areas Protection Act). Alternatively, if these zones were planted and maintained in long-lived Acadian tree and shrub species it should be possible to become involved with “carbon trading” and be able to offer some financial returns to landowners. Partner groups such as Island Nature Trust and the Nature Conservancy of Canada can assist in providing additional protection and stewardship for special areas.

10. Revisit guidelines and penalties for soil erosion from fields, residential developments and roads. Ensure that the resources are available to appropriately monitor those targets. Develop plans to address sediment removal from our streams, estuaries and inland waters and begin the long process of reversing sedimentation.
11. Set thresholds for nitrate – Nitrogen loading to estuaries and implement plans to prioritize the watersheds with the highest loadings for nitrate capture strategies (such as willow silviculture as a green biofuel) and conversion of low quality, marginal farmland to forest. The data to set these plans in place already exists and has been modelled (Bugden G, Jiang Y, van den Heuvel MR, Vandermeulen H, MacQuarrie KTB, Crane CJ and BG Raymond. 2014. Nitrogen loading criteria for estuaries in Prince Edward Island. Canadian Technical Report Fisheries and Aquatic Sciences 3066).
12. Adapt strategies for watershed management that will add roughness to bottoms and sides of streams to reduce in-stream erosion during violent storms which are already having negative impacts on water quality in ponds and estuaries. Fish populations can also be severely impacted by these intense storm events. In 2015, our electrofishing data indicate that the December 2014 flood destroyed most of the brook trout redds (egg nests) on Quinn's Brook (West River).
13. Establish better monitoring for chemical stressors and disease vectors in freshwater ecosystems.
14. Develop a plan to reduce the impoundment of water in watersheds where temperature and dissolved oxygen levels are being compromised for coldwater fish. As an example, the impoundment of water by man-made and beaver dams on rivers entering into St. Peter's Bay is elevating summer water temperatures and reducing oxygen levels to such a degree that they are negatively affecting populations of Atlantic salmon and brook trout. How long will it be before the mussel farming industry in the bay is also impacted? Climate change will worsen this problem, as scientists expect evaporation rates from impounded surface waters to increase by 40 % by mid-century.
15. Ensure that all flow restrictions are addressed over the long-term, by continuing to replace stream crossings with structures sized to accommodate the extreme high and low flows we can expect in the future with climate change. Develop a plan to reduce the number of stream crossings, either by road decommissioning or reduction in throughways (access from both ends but no crossing).
16. Recognize that geography plays a huge role in both water quantity and quality on PEI. We may be a small province, but there are distinct differences between watersheds depending on their topography (see supplementary graphs). The solutions we seek cannot be cookie-cutter and will require the capacity within

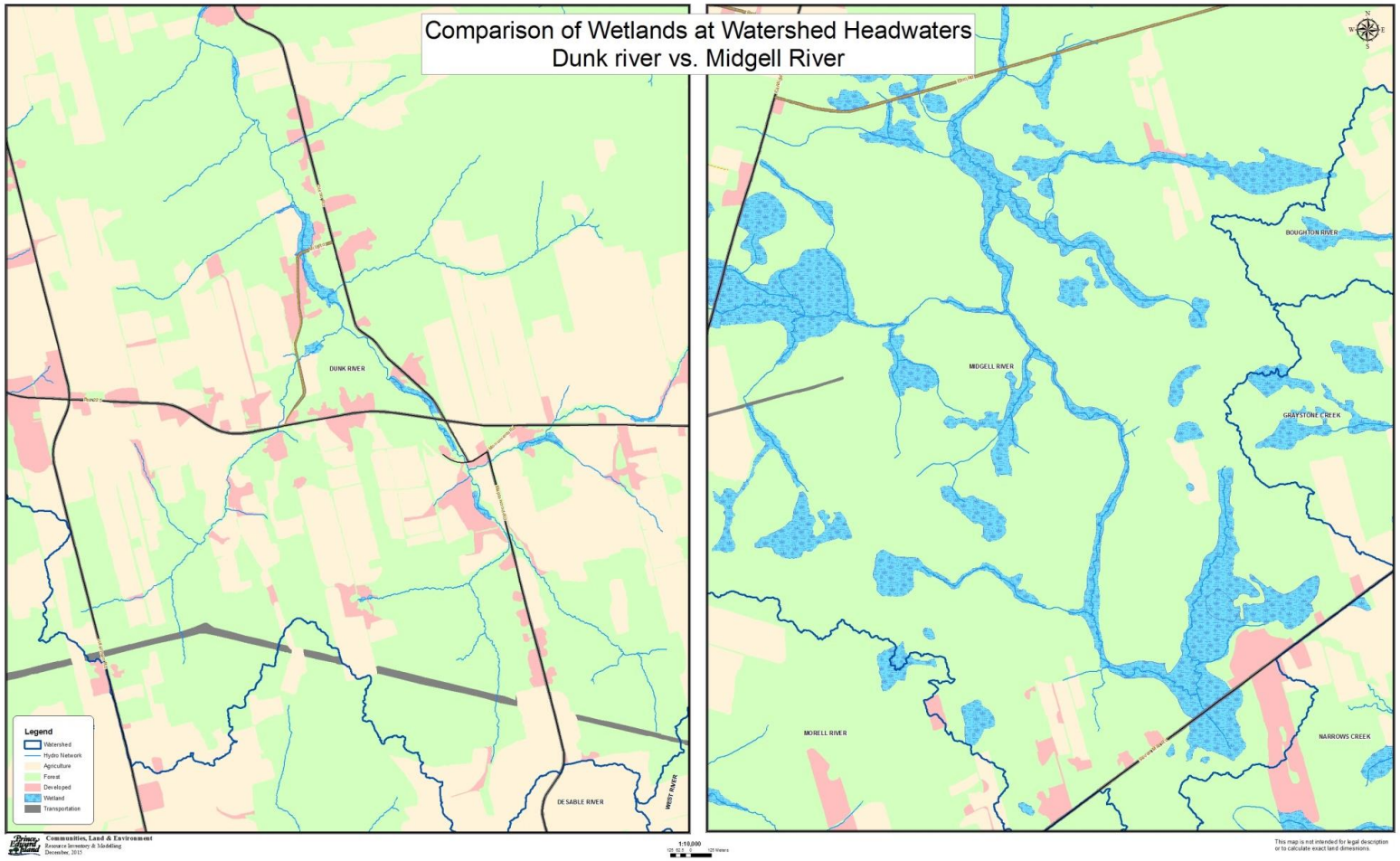
legislation to establish criteria on a watershed-by-watershed basis, founded on strong, defensible science and common sense!

In support of Point 9 above: *NAPA designation provides added protection to a wider riparian buffer*

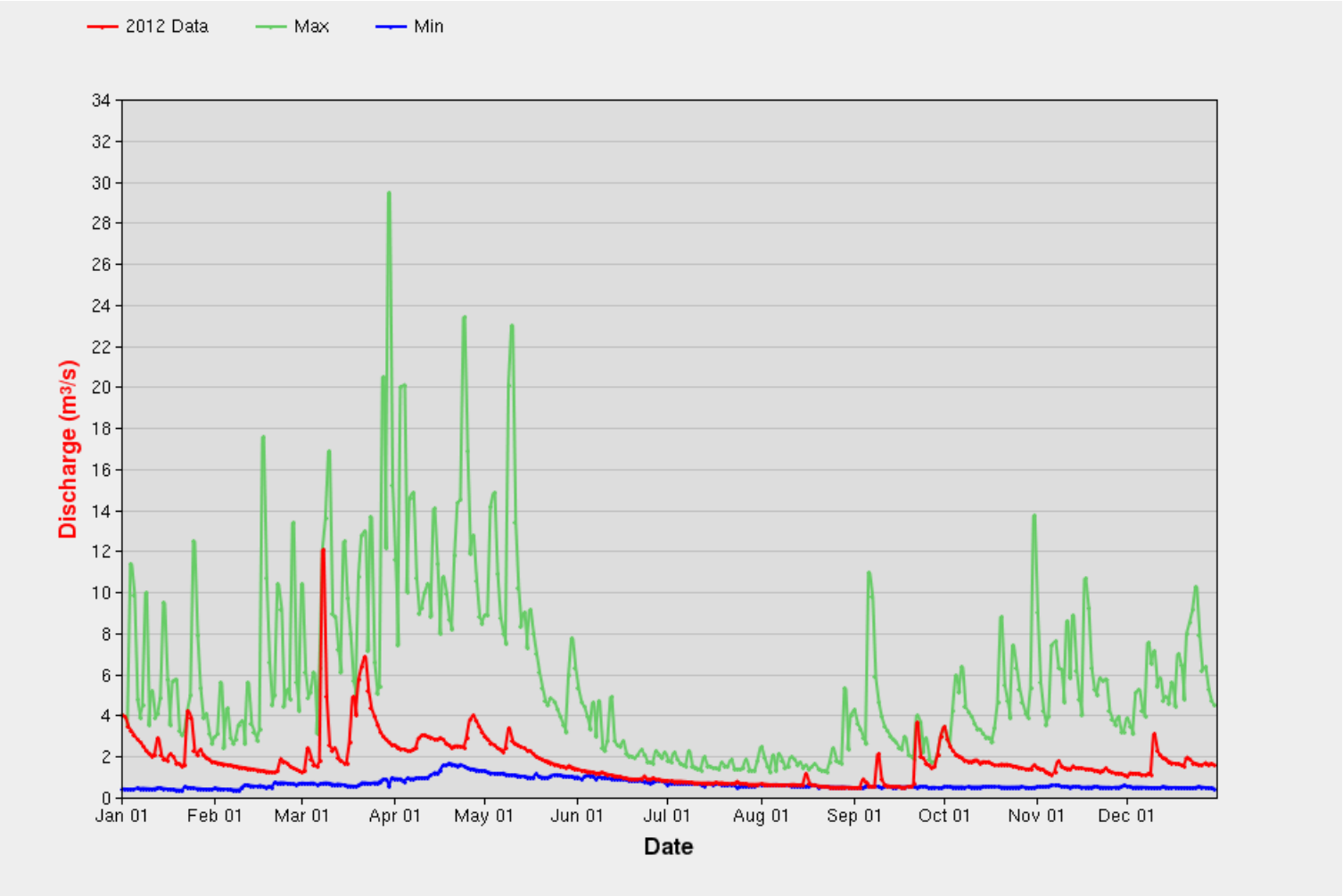




Comparison of the headwaters of two distinctly different watersheds: the Dunk River (left) with steep terrain is susceptible to soil erosion from bare fields; the Midgell River (right) with low gradients is susceptible to altered lentic: lotic ratios and elevated water temperatures from beaver and manmade dams



Supporting comparison of the headwaters of two distinctly different watersheds: the Dunk River (left) with steep terrain is also predominantly in agriculture; the Midgell River (right) with low gradients has multiple beaver and manmade dams that are flooding riparian forest ecosystems



Hydrometric data from the West (Eliot) River in 2012: during the summer months (mid-June through mid-September), flows are at historical lows. Similar graphs (available on the Environment Canada website) show this scenario in every year since 2009. Summer flows are reflective of 100% groundwater discharge and this indicates there is no surplus of this resource for this watershed.