



Water Extraction Policy for PEI

Department of Environment,
Labour and Justice

November 30, 2013

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Purpose and scope of the policy

■ Purpose:

- Provide for orderly and sustainable* use of the Province's water resources

*Sustainable - meets ecological and human needs

■ Scope

- Provides criteria for determining acceptable rates of withdrawal for groundwater and surface water resources
 - The criteria is "blind" to the purpose of the withdrawal...
 - Other policies, regulations etc. determine whether specific types of withdrawals are permitted or what conditions might be applied to such approvals
- Provides a process for application of the criteria
- Respects, within reason, the rights already granted to existing users
- Can provide guidance in cases where it is possible to adjust historic extraction rates/allocations to more closely match those suggested under the new criteria

Goals of the Policy

- Science based
 - Consistent approach across the Province
 - Integrates groundwater and surface water considerations
 - Based on expected local impacts by attempting to address regional hydrologic variability
 - Process allows for verification of initial estimated impacts
- Balanced
 - Strikes a reasonable balance between human consumptive water needs and ecological considerations
- Practical
 - Does not place an un-reasonable burden on proponents
 - Process for determination is manageable by Department
- Predictable
 - “Screens out” unrealistic expectations for water allocation at the start of the process
 - Provides water users with reasonable assurance of supply in the long term

Availability of Surface Water on PEI

- Limited high volume sources of fresh water, availability dictated geographically
- Significant variability in seasonal flow rates
 - Max flow generally available at times when water is not needed
- Summer flows highly dependant on groundwater discharge (base-flow)
- Requires significant treatment for use in potable applications
- Supports aquatic habitat / wildlife and is used for irrigation



Availability of Groundwater on PEI

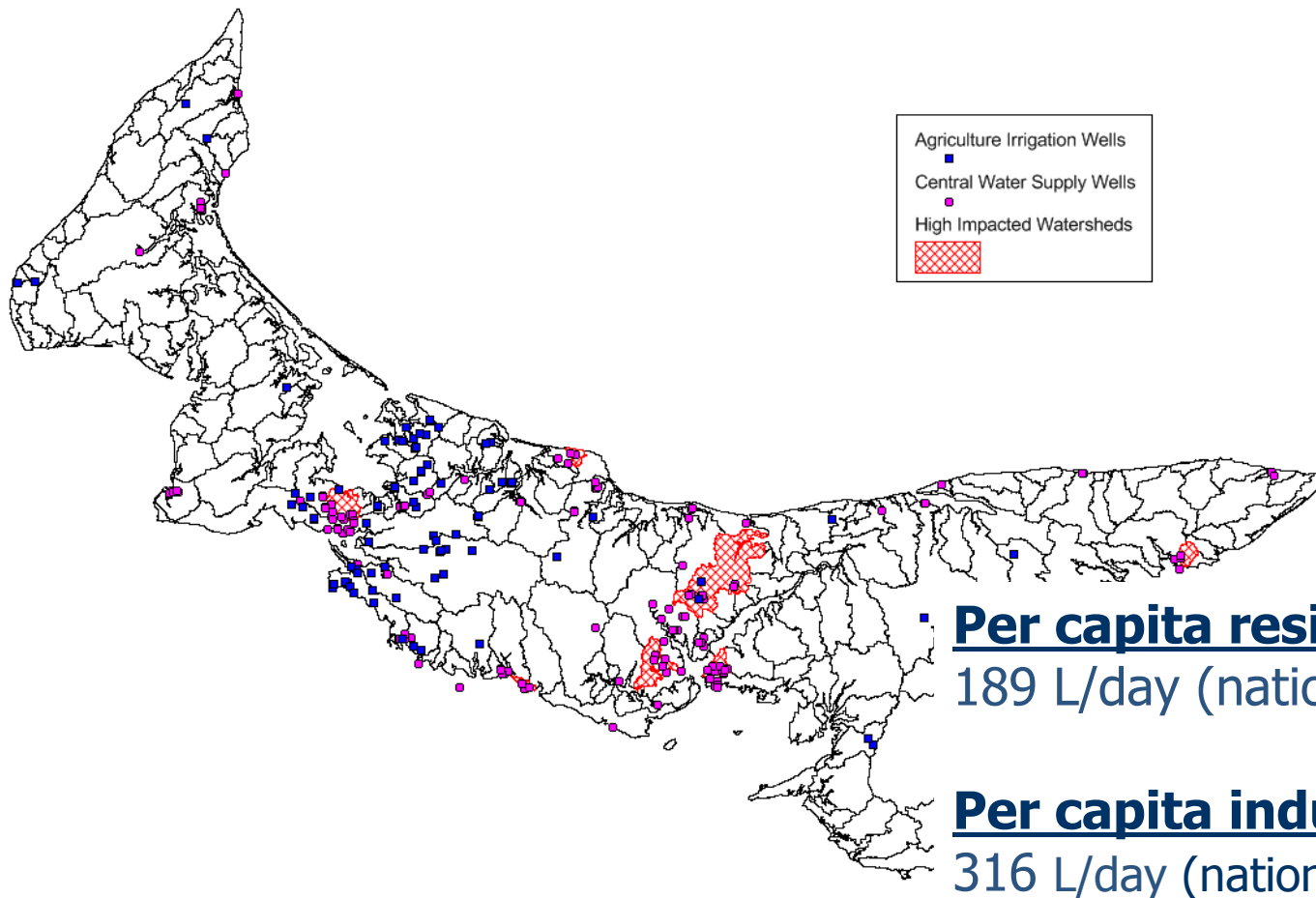
- Represents the key source of water for most human use in the Province
- Useable quantities of groundwater can be found virtually anywhere in the Province
- Annual recharge rates in PEI are high
 - ~ 385,000 m³ per km² /yr
 - Equivalent volume of 154 Olympic pools
 - Equivalent flow rate of 165 igpm
 - About the amount of water used by a community of 4000 to 5000 people.
- Groundwater storage >> annual groundwater flux
 - Not highly sensitive to short term weather patterns
 - Provides a stable and predictable source of water



Consumptive Use of water on PEI

How much do we use?

- Current annual groundwater extraction rates are estimated to represent <2 % of total annual recharge
- Water demand is unevenly distributed geographically and temporally (eg. irrigation vs. municipal)



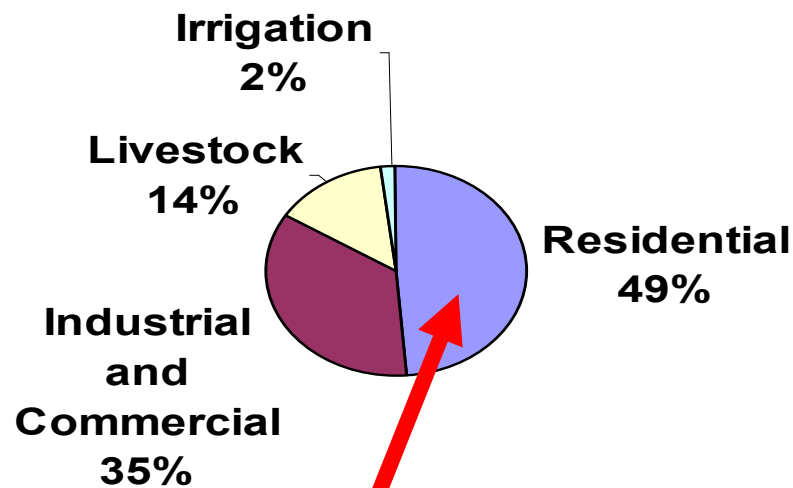
■ **Per capita residential water use:**
189 L/day (national average 274 L/d)

■ **Per capita industrial water use:**
316 L/day (national average 236 L/day)

Use of water on PEI

Who uses it?

PEI water use by sector



Of the groundwater we extract Island wide

- 2% is consumed directly by humans
- 47% is used for other sanitary purposes required to support human health
- 51% is used for industry, irrigation etc

Breakdown of residential use:

Drinking/cooking 4%
Bathing and personal use 28%
Laundry and dishes 23%
Toilets 45%

Regional Variability:

- While the general geology, physiography and hydrology of the Province is relatively similar, there are some regional differences:
 - Stream flow in some western rivers and streams is “flashier” and on average, well yields in the western part of the province tend to be lower than elsewhere in the Province
 - Detailed hydrogeological studies have been conducted in only selected areas of the province
 - Groundwater recharge rates and the nature of groundwater – surface water interaction are likely to differ somewhat by region
 - Even on a local scale hydrogeological conditions can vary significantly
 - Model results do not always match empirical data
- As a result of these factors the impact of water withdrawals must be assessed
 - on the basis of site specific conditions
 - verified by empirical evidence

Evolution of the science and regulatory regimes for water extraction on PEI

- Approaches to regulating the extraction of water in the Province have evolved according to the available
 - Science
 - Technology
 - Societal awareness / values
- Prior to the early 1990's groundwater and surface water resources were generally considered separately
 - From a scientific perspective
 - From a regulatory perspective
- Between early 1990's and 2010
 - Recognition of the importance of groundwater – surface water interaction
- Since 2010
 - Full integration of groundwater and surface water withdrawal impacts on stream flow.

History: Pre 1990

■ Groundwater extraction

- 6" wells or > 50 igpm
 - requires permit + testing,
 - no specific process or criteria for evaluation of impacts...Focus on
 - feasibility
 - impacts of nearby groundwater users

■ Surface Water extraction:

- Regulated activity but not heavily utilized or enforced
- DFO requirement for "**maintenance flow**" based on 25% of mean annual flow
- No widespread monitoring network to evaluate impacts of withdrawals

Groundwater: 1992-2010

- Applied to all wells > 50 igpm or for central water supply
- 2 step process
 - Groundwater Exploration Permit
 - Permission to construct test well(s)
 - Testing requirements / analysis of impacts required
 - Groundwater Extraction Permit
 - Required before well(s) put in service
 - Amount of withdrawal based on assessment of test results/reports
- Assessment criteria:
 - Extraction is less than 50% of annual recharge (generally based on the entire catchment) ...ensures sustainable groundwater resources
 - Well interference - extraction does not adversely impact other well owners
 - Criteria believed to afford some protection to surface water flows, but not based on rigorous scientific evaluation

Surface water: 1994 - present

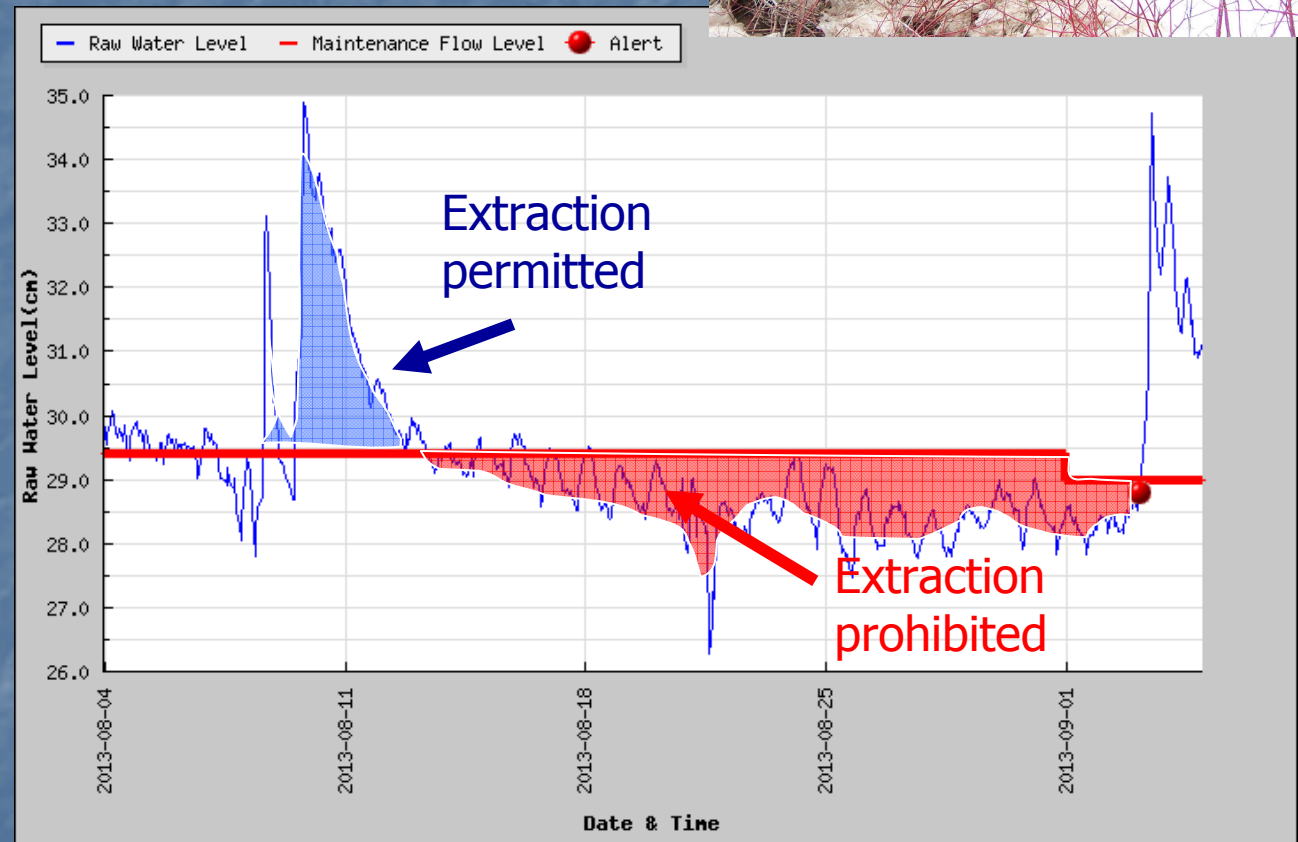
- Watercourse or Wetland Activity Permit withdrawal:
 - > 50 igpm or
 - total daily withdrawal > 10,000 gallons
- Assessment criteria:
 - Maintenance flow must be maintained at 70% of the median **monthly** flow.
 - Determined by prorating maintenance flow for the nearest long-term flow monitoring station against the location of the application
 - Water withdrawals only permitted when actual stream flow is above maintenance flow.
- Demand for permits may exceed availability of water
- Water may not be available when most needed



Managing surface water withdrawals



- Real time water level measurements
- Water extraction permitted when water level (**blue line**) is above monthly maintenance flow (**red line**)



Moving Forward....

- Gaps
 - Surface water and groundwater treated as separate resources
 - Groundwater
 - Criteria based on recharge
 - Calculated annually
 - Surface water
 - Criteria based on stream flow (volume in excess of maintenance flow)
 - Maintenance flow calculated monthly
 - Impacts of extraction on surface water assessed
 - on basis of statistical treatment of stream flow
 - not tied directly to impacts on habitat or aquatic organisms
 - Existing groundwater extraction policy not necessarily protective of stream flow, especially during low flow periods.
- Canadian Rivers Institute was retained to address these issues and provide recommendations to the Province.

Input from the Canadian Rivers Institute

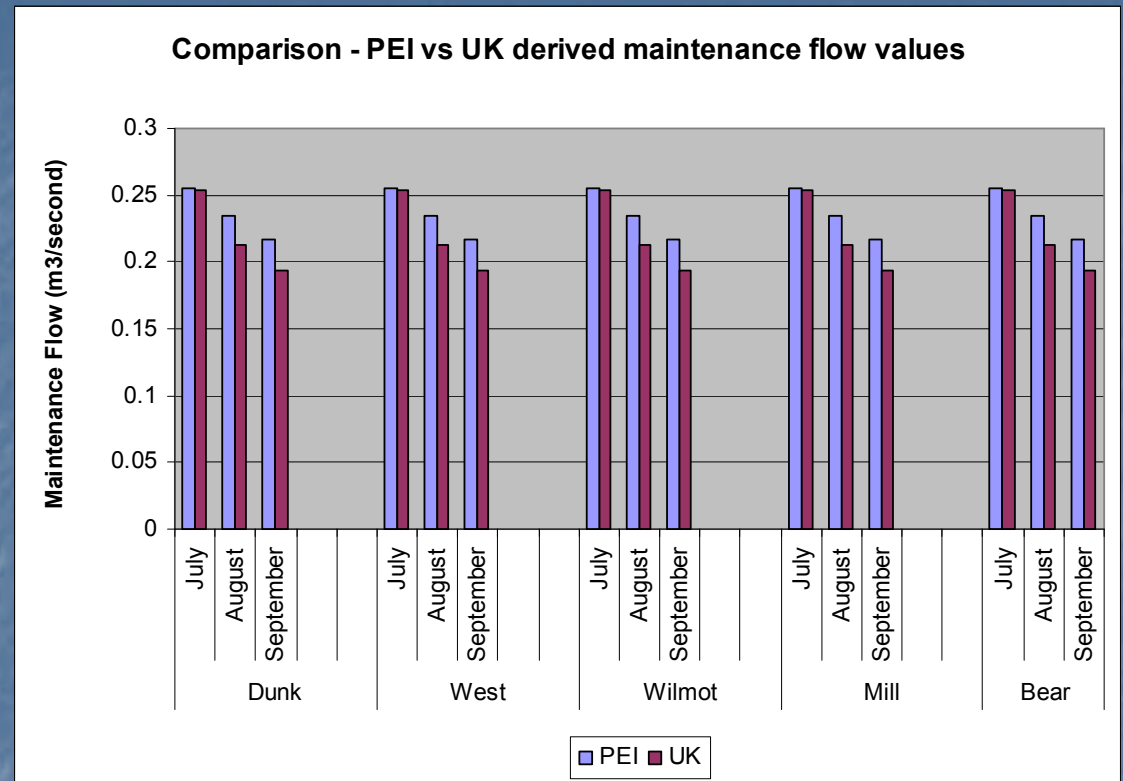
- Asked by the Province to examine the potential effects of extraction on stream ecosystem health on PEI
- Examined response of key indicator species (benthic invertebrates and brook trout) to fluctuating stream flows due to water extraction.
- Goal of defining an appropriate level of stream flow to maintain healthy aquatic habitat
- CRI suggested adopting the recommendations of the UK Technical Advisory Group
 - Study did not include recommendations specifically on the impact of continuous groundwater withdrawals on stream flow, however
 - The UK Environment Agency specifies that groundwater abstraction should not reduce natural summer groundwater outflow (base-flow) by more than 35%, and the same guideline is cited by the UK Technical Advisory Group.

The current policy

- Based on the recommendations of CRI
 - Follows the UK approach
 - Protection of aquatic habitat key focus
 - Measures are still protective of groundwater resources
- Still two separate application/approval processes for groundwater and surface water
 - Differences in overall use patterns
 - Differences in methodology for assessment

Surface Water Extraction

- Existing policy allowed for withdrawals when stream flow was above maintenance flow (maintenance flow = 70% of median monthly flow)
- CRI recommendation (based on UK research)
 - Extract up to 15 – 35 % of natural flow depending on local conditions
 - Calculated on a monthly basis
- Comparison of UK criteria (for PEI conditions) and existing PEI criteria show them to be very similar
- Existing surface water extraction policy is maintained



New Criteria for Extracting Groundwater

- Groundwater withdrawal shall not reduce mean summer base flow in the main branch of streams by more than 35 per cent.
 - mean summer base flow is determined as the median of base flow for the period of August through September.
- Groundwater withdrawal will not exceed 50% of annual recharge
- Groundwater withdrawal will not interfere with other groundwater users (ie well interference)

Some Observations and Challenges

- Numerical groundwater modelling represents the best tool for assessing behaviour of groundwater and groundwater - surface water interaction but:
 - Model and empirical results can vary significantly
 - Groundwater models divide the “world” up into discrete segments often measuring a few tens of metres in scale...Too coarse a grid to judge impacts that might be important on a scale of cm (such as actual stream depth).
 - Some critical parameters for model construction, such as stream bed conductance can be highly variable locally, and may be difficult to obtain
 - Independent verification of impacts may be needed
- Groundwater allocations are made on the basis of average summer stream flow conditions
 - Necessary to provide predictability to proponents
 - Can not account for normal variation in seasonal weather patterns

Some Observations and Challenges

- Impacts on small headwater streams pose a particular challenge
 - Small catchment area and dense network of tributary streams
 - Difficult to find any potential well location that is not in proximity of some small watercourse or spring
 - Development (and water demand) is determined by factors other than topography/watershed configuration
 - How much protection do we provide for small streams
 - Focus on health of entire populations rather than individuals

Some Observations and Challenges

- Data management/administration
 - Accounting for
 - Cumulative effect of water users within the watershed
 - Seasonal variation in demand by different types of users
 - Priority of water uses and users
 - Fire protection
 - Drinking water
 - Environment (maintenance of ecosystems)
 - Industrial use (including irrigation)

Conclusions

- The new policy:
 - Reflects a reasonable balance between human and ecological needs
 - Affords both surface water and groundwater reasonable protection by a process that is:
 - Scientifically sound
 - Focused on long term sustainability of the resource
 - Matches approval requirements to likely impacts
 - Highlights groundwater as a source of water that is
 - Less sensitive to short term changes in availability
 - Has a lower impact on stream flow than direct surface extraction

The end

Questions?



Initial characterization: regional variation & "normalized" reference base flow (NRBF)

Prorated flow < 108 m³/d/km²

- no scientific concern regarding impacts of pumping on stream flow
- Exploration permit issued with standard pump testing conditions

(/s)	NRBF (m³/d/km²)	30% NRBF (m ³ /d/km ²)
	361	108
	717	215
	849	255
	903	271
	553	166

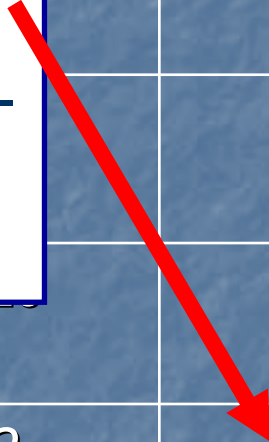
Dunk R. (1961-2005)	114.0	1.120
West R. (1989-2008)	70.0	.7.2
Bear R. (1995-2008)	15.3	.098

Initial characterization: regional variation & “normalized” reference base flow (NRBF)

Prorated flow > 903 m³/d/km²

- 100% of NRBF
- Unacceptable impacts on stream flow highly likely
- Exploration permit denied or re-submission at a lower rate requested

			(/s)	NRBF (m³/d/km²)	30% NRBF (m ³ /d/km ²)
				361	108
				717	215
				849	255
(1961-2005)				903	271
West R. (1989-2008)	70.0	.7.2		903	271
Bear R. (1995-2008)	15.3	.098		553	166



All other cases:

- Proposed pumping rate between the equivalent of 108 and 903 m³/d/km
 - Some impact on surface water flows possible
 - More detailed testing / assessment requirements needed

- Steps
 - Stream flow measurements at representative points on the water course conducted prior to initiation of pump testing
 - Provides background stream flow data prior to testing
 - Determines appropriate local “NRBF” to use in determining acceptable impact

 - Pump testing conducted with water level measurements made in wells and stream.

 - Pump test and water level analyzed and
 - Impact on other groundwater users assessed
 - Impact on stream flow assessed, and if the period of pumping is not representative of low flow conditions, model projections made of impact during these periods

 - If projected impacts are acceptable
 - A **Groundwater Extraction Permit** may be issued with or without conditions
 - Follow-up monitoring of stream flow may be required as a condition of the permits to verify results.