Environmental Flow Protection in British Columbia

Water Sustainability Act, received Royal Assent on May 29, 2014.

Presenter from IFC Region 5

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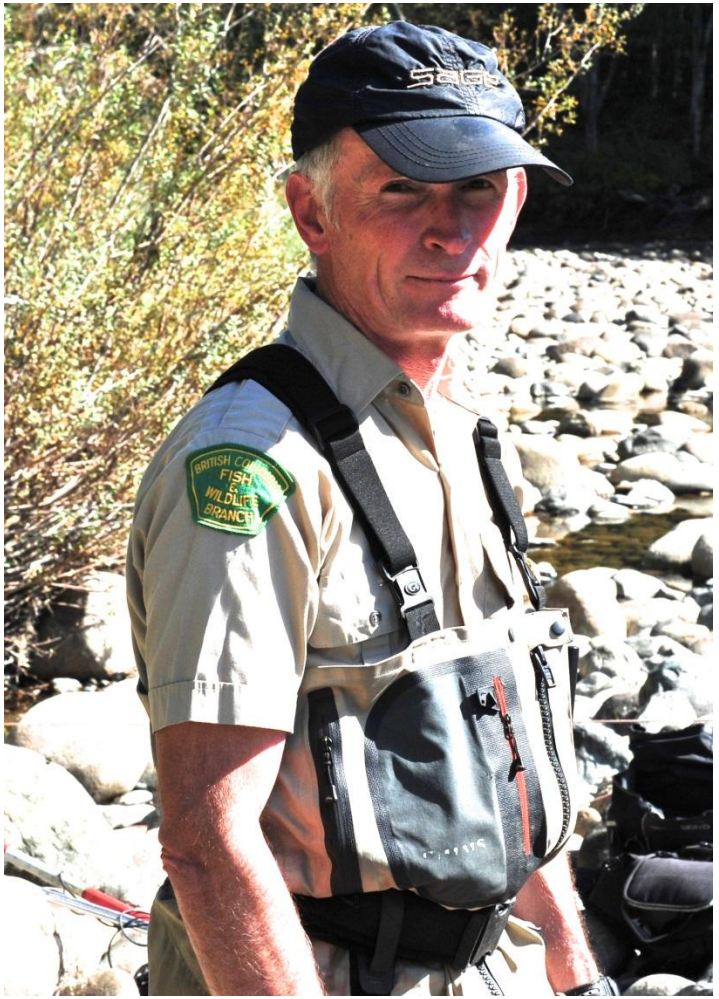


Organization of Presentation---the Path Forward

- Setting the Stage and Context
- What is “uncertainty”?
- Five desired riverine components
- Considerations for maintaining or restoring seasonal patterns of flow, etc.
- Case example (brief)
- Tools, models, allocation rules, data standards
- Questions

Setting the Stage for B.C.

- Extreme variation in annual unit runoff (11 to 6342 mm/yr)
- British Columbia's population was estimated at **4,659,272** as of January 1, 2015 (say about 5 million)
- Size of Province is very large at **944,735 km²** (364,800 sq mi). This is **1.4X size of Texas**. Contains nine terrestrial ecoprovinces.
- Prior appropriation
- 44 thousand surface water licences plus lots of groundwater wells
- Agriculture, water works, and industry consume 99% of the total allocation. Domestic use about 1% of the volume.

Uncertainty

- Defined here as **Uncertainty**: The lack of certainty. A state of having limited knowledge where it is impossible to exactly describe the existing state, a future outcome, or more than one possible outcome.
- Certainty in future water allocations maybe improved through various legislation (Water Sustainability Act, Canada Fisheries Act, Fish Protection Act) and supporting regulations.
- Scientific certainty is improved through monitoring and learning.
- Implementation uncertainty is not knowing how consistent water managers will consider environmental flows throughout all regions.

Five desired riverine components

- Environmental flows “can” consider hydrology, biology, geomorphology, water quality, and connectivity
- Considerations are sensitive to the degree of flow alteration with variations from low impact domestic licensing to high impact major hydro projects.
- Where there is a strong imperative to consider all five components, there is a requirement to follow a systematic, problem-solving process using all available IFN tools.

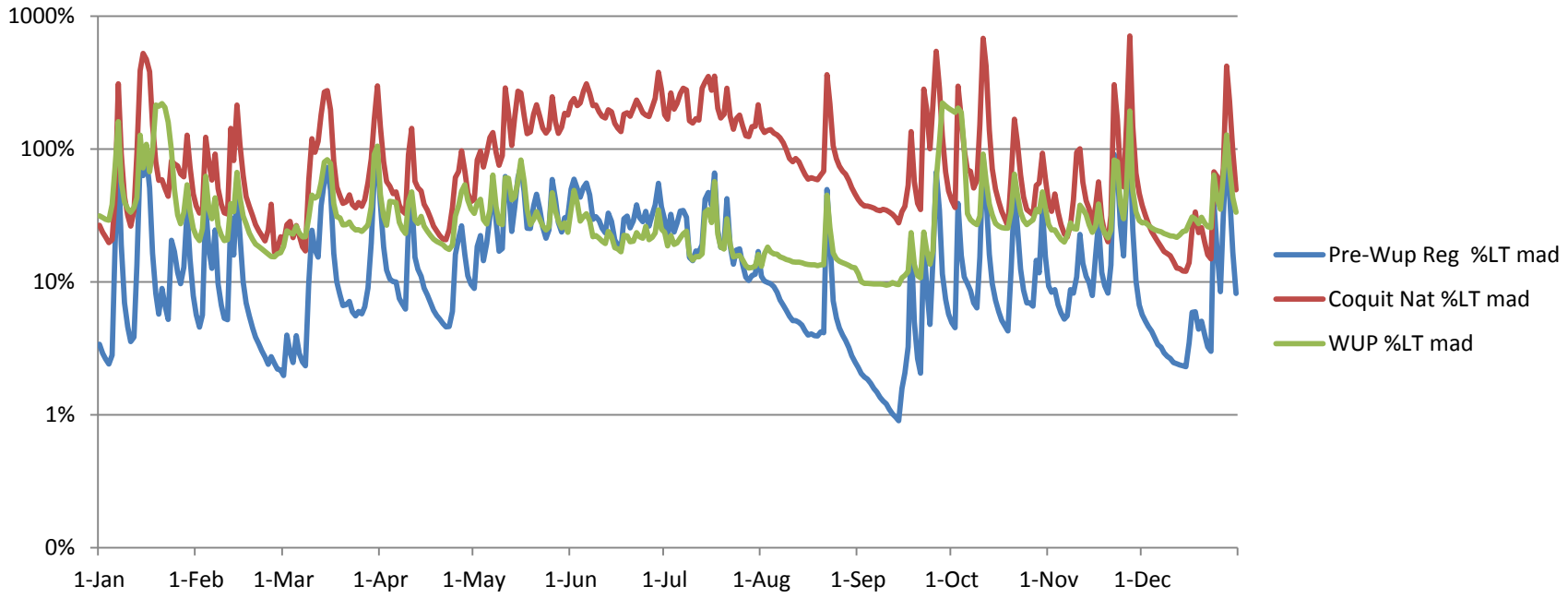
Considerations for maintaining or restoring seasonal patterns of flow, etc.

- Most significant environmental flow problems are associated with seasonal water demands such as summer-fall irrigation.
- High runoff periods and flow magnitude-duration on the Coast (winter) or Interior (summer) are not affected by typical licensing except for large developments such as IPPs, BC Hydro, and Municipal Water Works.
- Restoration or protection of summer baseflows remains the main issue particularly in drought years.

Example case of partial flow restoration—Coquitlam River near Vancouver

- All five river components apply to this major water supply and hydro-development.
- The natural LT mad was 26 cms near the mouth; post-regulation (pre-WUP) mean annual discharge was 4.6 cms; flows reduced by 82%
- Learning from adaptive management continues on 8 monitors over a 15 year period. This is 1 of 19 WUPs. $25 million bio-monitoring/yr.
- Zero flow releases from the dam for fish prior to Water Use Plan ; typical of the old Water Act treatment of “fish”.
- Remarkable increase on steelhead parr/smolt production since staged flow improvements (variable flow targets over the year)
- Inability to manage sediment flushing flows a major uncertainty in achieving full benefits of improved steelhead spawning and rearing

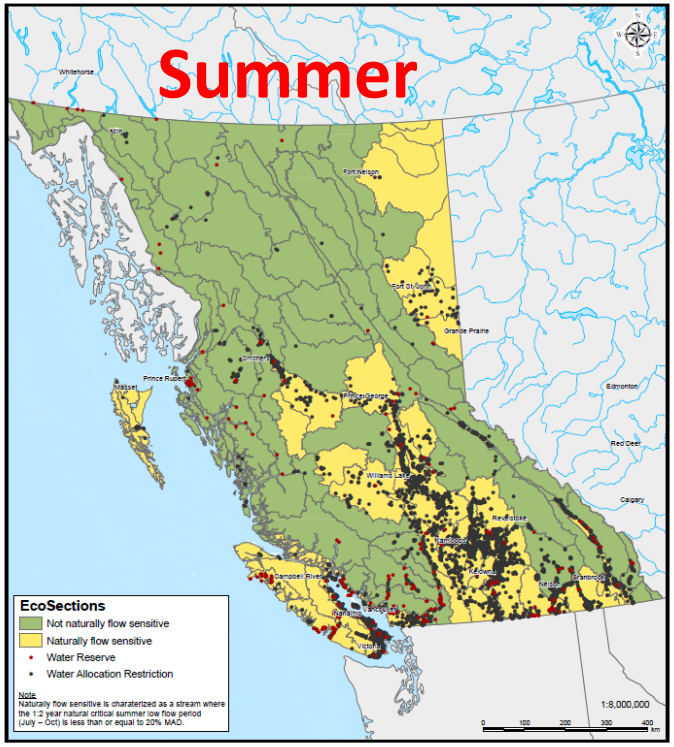
2011 Flow regime of the lower Coquitlam River under various scenarios

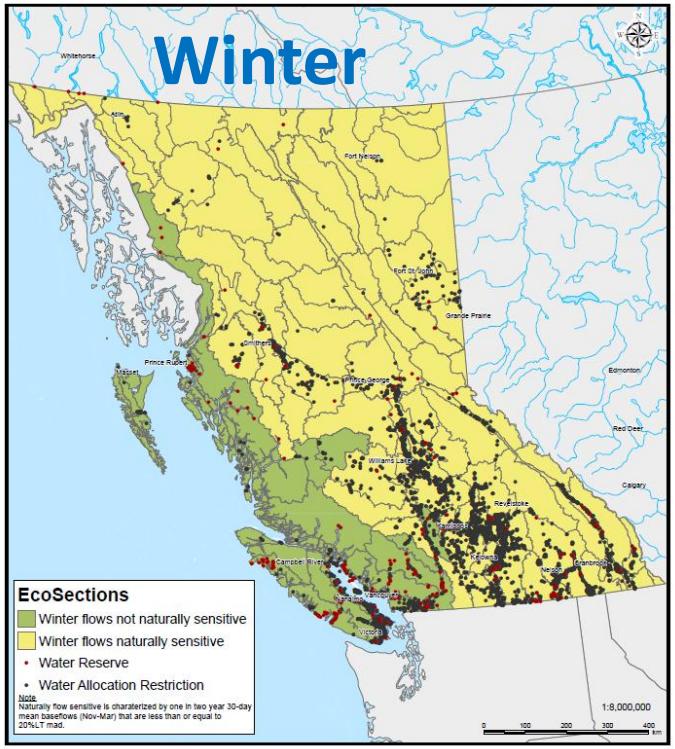


Applied tools

- Use of regionalized fish periodicity schedules per species and life-stage as per Estes; include channel maintenance flows, riparian and connectivity flow
- Systematic problem-solving process with public and First Nations involvement
- Rationalizing what parts of the natural hydrograph to preserve
- Use of presumptive flow standards (%LT mad) derived from fish observations or channel geomorphology studies
- Using PHabSim or River2D models with appropriate HSI curves and inventory protocols (Registered professionals only)
- Use of landscape maps showing flow-sensitivity in Tennant terms (%LT mad)
- Use of a very large hydrometric network (>1000 stations)
- Water Allocation Plan reports for Vancouver Island and Okanagan

EcoRegion-Based Flow Sensitivity





British Columbia Instream Flow Standards for Fish

- Attempt to form a simple rule protecting the annual hydrograph without specialized inventories (PHabSim, others) or knowledge of fish community
- Very conservative hydrologic model ("black box") based on percentile flows with zero biology inputs; similar to Alberta model
- Rarely used as proponents use more refined methods to rationalize a bigger rate of diversion
- Method does not work on the thousands of ungauged streams since it requires 20 years or more of continuous **natural** daily flows

Presumptive Flow Standards

Biological or Physical Requirement	Percent Mean Annual Discharge	Duration per Annum
Short-term Biological Maintenance	10	days
Juvenile summer-fall rearing	20	months
Over-wintering	20	months
Riffle Optimization	20	months
Incubation	20	months
Kokanee spawning	20	days-weeks
Smolt Emigration	50	weeks
Gamefish Passage at Partial Barriers	50 to 100	days
Large Fish Spawning/Migration	148*MAD^-0.36	days-weeks
Off-channel Connectivity/Riparian Function	100	weeks
Channel Geomorphology/Sediment Flushing	>400	1 to 2 days

Use of monitoring and adaptive management to partially address uncertainty

- $25 Million/yr BC Hydro bio-monitoring of all Water Use Plans
- 2015 Clean Energy Aquatics Effects Monitoring Workshop
- Predictors of Stream Carrying Capacity…what is a healthy stream?
- Development of Presumptive Flow-standards using modified Tennant Rules (%mean annual discharge) through empirical data
- 2012 Winter Flows Project---recognition of PHabSim limitations for icing conditions and over-wintering fish survival

Provincial Water Stewardship

Living Water Smart

Living Water Smart provides government's vision for sustainable water stewardship. This vision will be achieved through actions and targets that include:

- Keeping water in mind when we develop our communities, protecting sources of drinking water and strengthening flood protection to adapt to climate change.
- Ensuring wetlands and waterways will be protected and rehabilitated and land activities will not negatively impact our water.
- Modernizing B.C.'s Water Laws to ensure adequate stream flows, ecosystem health, more community involvement, and protection of groundwater.
- Setting strong water efficiency targets and working with all sectors to reduce water consumption.
- Improving science and information so British Columbians can better prepare for the impacts of climate change.


Questions?