Ron Ptolemy

RON: Thank you, Claire. It's a pleasure being here. And thanks very much to the Instream Flow Council's support, financial support for my travels from BC to Oregon. So today I'm going to dwell on our new legislation, which is the [New] Flow Protection measures under the Water Sustainability Act, which was given a Royal assent about a year ago. But I'm also going to make reference to the fact that we have a long history of water allocations that go back to 1890 that link to the Gold Rush era under the ole Water Act. I'm essentially a River Stock Assessment Biologist with a background over 40 years of doing fieldwork integrating highly detailed habitat surveys along with fish abundance information for quite a variety of sports fish species and other species.

So the organization of the presentation, this is Part IV in the next 14 or so minutes. Setting the stage and the context: what is uncertainty? I'm going to give this one sort of a light [duty] since we've heard a lot about it throughout much of the day, although I will provide a little bit of a BC spin. The five desired riverine components, which Claire and others have spoken to, and an example of that are the considerations of maintaining or restoring seasonal patterns of flow, et cetera. And a case example, which will be very, very brief. There are many examples to draw reference to. And of course the tools, models, the allocation rules, and data standards, and of course we'll be fielding questions at the end of our panel.
So setting the stage for BC, we have extreme variation in annual **[unit** runoff ranging from 11 millimeters per year to over 6,000 millimeters per year. The human population is fairly light by state standards. We're in the magnitude of five million. Folks, the size of the province over was large as Claire referred to. It's about 1.4 times the size of Texas. The allocations are based on prior appropriation. And essentially, there are about 44,000 surface water licenses, and we're still developing a database of the groundwater sites throughout the province and we're well along that line.

Agriculture water works and industry has consumed 99 percent of the total allocation. Domestic use is in the magnitude of one percent. Uncertainty. I did say that I'm going to give this a very light reference to, and so essentially, all the things that you've heard this morning certainly apply to BC. Certainty in my opinion is certainly better constrained in Canada and certainly in BC through various existing legislations despite what you heard regarding the alterations to the Canada Fisheries Act, which is a major instrument. And we also have a provincial Fish Protection Act. And of course, the reference to the brand new Water Sustainability Act and the supporting regulations.

Uncertainty, you've got a mess. Five desired riverine components, environmental flows can but not necessarily will, depending on the circumstance, consider all five components. The considerations are sensitive to the degree of flow abstractions or alterations with variations from low-impact domestic water licenses to very high impacts regarding major hydro projects.

Where there's a strong imperative to consider all components, there is a requirement to follow a regimented, systematic problem-solving process using all available IFM tools. We don't restrict ourselves to any single one. And so, in the considerations of maintaining or restoring seasonal patterns of flow, the most significant environmental flows problems that we're dealing with are seasonal water demands, such as summer and fall irrigation through the drier portions of the province. The high runoff periods and flow magnitude duration on the coast, they're in [winter] weather or the interior, the early summer period, are generally not affected by typical water licensing except for a large development such as small hydro, IPPs, municipal waterworks, and other water purveyor systems that are being developed in the interior of the province.

An illustration or protection of the summer base flows remains the main issue, particularly in drought years. So the case example I'm going to draw your attention to is the Coquitlam River near Vancouver. It's an urban environment,

for the most part. All five components were the major focus of a water use plan involving the public and First Nations. The natural long-term mean annual discharge in cubic meters per second near the mouth was 26 cubic meters per second and under post-regulation but pre- water use plan, the mean annual discharge was 4.6 cms, showing a very large reduction. The learning from adaptive management continues as eight monitors or drivers with consideration of environmental flows are being assessed through very detailed surveys and well funded to a 15-year period. This is only one of 19 water use plans province-wide and a ballpark figure right now for expenditures per annum on biological monitoring is in the magnitude of $25 million.

There was essentially zero flow releases from the dam for fish prior to the water use plan, which is typical of the old water act and treatment of fish. And since we've started these experimental flows and there are variable flows through the year, there's been quite a remarkable increase and still at par and small production that's actually being measured. And in fact, the number of individuals counted per unit area of space appears to be getting quite close to what we would expect in a pristine state, which is quite remarkable.

And generally, to date, because we're dealing with Metro Vancouver area that has seen a lot of developments within the various sub-basins of the Coquitlam River, forestry, there's gravel mining and so on, so there's this ongoing issue of whether or not we may not be able to get full benefit of the partly restored flows for riverine and spawning purposes because we haven't provided the channel and sediment flushing flows that are really quite key. This is a general view of looking downstream in a rapid cascade **[meso-habitat -]** habitat. This is the home of the highest densities of steelhead parr. These are fish about that are the size that you find in the mainstream Coquitlam.

So this is a very detailed annual hydrograph specific to the year 2011. And so we have natural flows being monitored coming into the reservoir. We’re monitoring

flows continuously near the mouth, and then we have a simulation value of the flows under the old water license. And so, just drawing your attention to the central band of lines here that relate to the -- we're into the intermediate stage between the extreme of the old regime, and this is the natural regime, so we're getting something which is -- we're still getting variability throughout the entire year, but we're actually meeting certain flow standards. So the applied tools using regionalized fish periodicity schedules per species in life stage as per Christopher Estes, I'm a really fond follower of Christopher's work and use of fish charts to actually rationalize why you want to protect certain flow magnitudes throughout the entire year.

Systematic problem solving with the public and First Nation's involvement, really attending to what parts of the natural hydrograph we're really concerned with. And using the presumptive standards, which you're about to see in a table form and then also applying other methods such as PHABSIM or River 2D models with support of appropriate HSI curves, which I'm quite often the author of. And of course the use of landscape map showing flow sensitivity and then Tennant terms, in terms of percent MAD, we're not really concerned with 7Q10. And these are very large hydrometric data sets, so we're quite fortunate in BC that we have historic discontinued stations plus active stations. We have over -- in fact, we have something in the magnitude of 1,200 stations scattered throughout the province.

Unfortunately, some landscape units are poorly served, but others are very well served. Water allocation plan reports for Vancouver Island and the Okanagan are also tools. This is a graphic that essentially looks at two different flow conditions, and so these are color -- green code is basically flow insensitive depending on the type of water license decision that will be made. The yellow areas are caution areas in terms of fish flow conflicts. So that's a summer one. So again, the only parts of these polygons are we have traditional fish flow conflicts. And this is the winter situation. So whether we're both concerned with how low the flows are

getting along with icing conditions. So the BC instream flow standards for fish essentially was a simple mathematical rule that didn't really require much in the way of detailed specialized fish information or fish-producing information. It's a very conservative model, sort of black-box approach using percentile flows with -- essentially zero biology behind why flows are so high in some time periods and flows are still really high in other periods.

It's relatively limited used by proponents as -- typically they default to more refined methods of rationalizing a bigger rate of diversion. And method does not work on thousands of ungaged streams since it requires 20 years of hydrometric data, natural flow information. These are presumptive standards. We won't dwell on them, but essentially they're premised on the observed fish response to known-flows, could involve regulated flow information. And it does actually address channel geomorphology in sediment flushing flows where we're supposed to have something in magnitude of or in excess of 400 percent of long-term mean annual discharge. So we use a lot of monitoring and adaptive management to partly address uncertainty. And in fact, recently, we had the 2015 clean energy aquatics effect monitoring workshop. And it basically was a forum for people that had been involved with flow alterations that are actually looking at the biological response.

There's lots to learn. The predictors -- the stream carrying capacity are being developed, and this essentially addresses the issue of if you're doing your job properly in terms of water management, what does that look like in terms of fish response or fish population? And the development of presumptive flow standards using the modified Tennant rules are quite crucial. And we have a 2012 winter flows project in recognition that PHABSIM doesn't answer all our questions. You can read about this on the provincial water stewardship site in terms of the all of the good things that the province wishes to achieve. These are the animals that quite often form part of the argument regarding maintaining certain riverine flows, and this is a steelhead parr captured in this case from the Dean River.

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