the partnership
for water sustainability in bc

Waterbucket eNews on November 16, 2021
https://waterbucket.ca/wscblog/

Living Water Smart in British Columbia:

Water Allocation, Irrigation, and Food Security

Note to Reader:

Waterbucket eNews[1] celebrates the leadership of individuals and organizations who are guided by the vision for Living Water Smart in British Columbia[2].

The edition published on November 16, 2021 featured the Agricultural Water Demand Model. With longer and drier summers being the new reality for water management, this tool is a game-changer for achieving food security.

The umbrella for Partnership initiatives and programs is the Water Sustainability Action Plan for British Columbia[3]. In turn, the Action Plan is nested within Living Water Smart, British Columbia's Water Plan.

[1] https://waterbucket.ca/wscblog/
[2] https://waterbucket.ca/wcp/wp-content/uploads/sites/6/2017/11/livingwatersmart_book.pdf
[3] https://www.waterbucket.ca/cfa/sites/wbccfa/documents/media/81.pdf

Editor's Perspective

Living Water Smart was a catalyst for action. As the Senior Engineer in the Ministry of Agriculture, Ted van der Gulik had a mandate that allowed him to put his ideas into practice through province-wide implementation of the Agriculture Water Demand Model (AWDM). The power of the tool is found in the provincial 500-metre gridded climate dataset, a North American first.

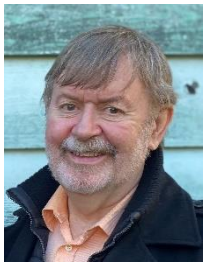
Because it generates solid data on agricultural water need, the AWDM is the tool of choice for doing a Water Sustainability Plan. Work is required in other sectors, notably fisheries, to similarly apply a science-based approach and in so doing generate solid numbers to quantify their needs. To quote Ted van der Gulik, "you cannot come up with a plan unless you have all the numbers for all the sectors."

Having solid numbers for all sectors would ensure that water allocation decisions are informed and balanced, and reflect a whole-system understanding that there is only ONE WATER. Two concepts underpin a whole-system approach - **water balance pathways** (how precipitation reaches streams) and **time scales** (how long the water takes to reach streams).

The three pathways are surface runoff, interflow (shallow horizontal flow), and deep groundwater. Their time scales range from minutes to hours for surface runoff, from days to seasons for interflow, and from years to decades for deep groundwater. The role of groundwater in sustaining flow in streams is more important than ever. A generation ago, for example, water supply managers could reasonably plan for a 3-month drought. Today, however, a 6-month drought is a very real likelihood, and on a repeating basis.

Although now retired from government, Ted van der Gulik continues to make a difference as program delivery manager for the ongoing province-wide AWDM program. It is the springboard for development of additional tools by the Partnership for Water Sustainability, notably the BC Agriculture Water Calculator, which supports groundwater licensing by the provincial government.

As senior government employees have retired, the history of how **water allocation for irrigation** was done in the past has been lost. Knowing this history is fundamental to understanding how irrigation allocation has evolved over time as better climatic data has become available. It allows the baton to be passed from the past to the present and future. Continue reading to learn more about the history of water allocation in British Columbia.



Kim A. Stephens, MEng, PEng,
Executive Director
Partnership for Water Sustainability in BC
November 2021

Agriculture Water Demand Model

"With longer and drier summers being the new reality for water management, the Agriculture Water Demand Model is a game-changer for achieving food security in British Columbia. We have downscaled climate data to a 500-metre grid across the province. This means we can reliably estimate the total water need for agricultural irrigation. This further means that the Province can align water allocation and water use. This is a powerful outcome."

- Ted van der Gulik, Partnership for Water Sustainability in BC

Adjusting to Longer and Drier Summers in B.C.

Almost two decades ago, the Partnership for Water Sustainability's Ted van der Gulik had a vision for a science-based approach to management of irrigation water demand in BC. In June 2008, the stars aligned when the provincial government embarked on Living Water Smart, British Columbia's Water Plan.

This provided the framework for a new era of water management. It also allowed the provincial government to leverage what Ted van der Gulik and his colleagues were already doing to put bold ideas into practice on a provincial scale.

The *Water Sustainability Act* (WSA), passed in 2016, is the governance and regulatory component of Living Water Smart. The WSA made it a legal requirement that all non-domestic groundwater users be licenced or otherwise authorized. Until then, only water users drawing from surface sources had been regulated.

One Water

Now, non-domestic groundwater users are required to play by the same set of rules as surface water users.

Now, groundwater users are required to play by the same set of rules. The majority use groundwater wells for agricultural irrigation.

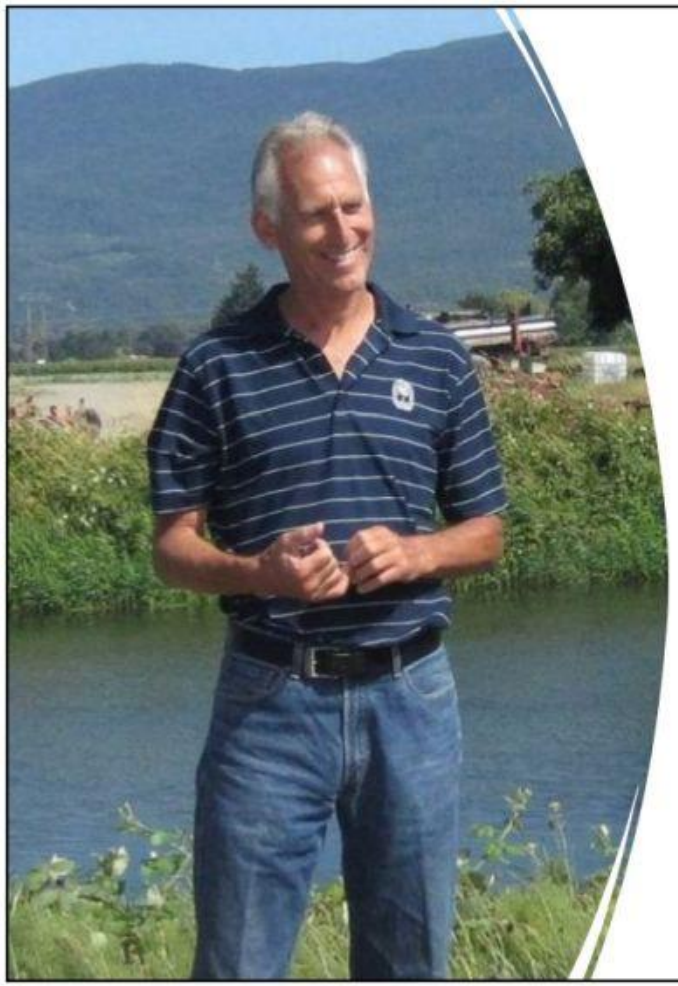
Over-arching everything is the new climate reality - longer, drier summers and warmer, wetter winters. In 2015, the West Coast of North America crossed an invisible threshold into a different hydro-meteorological regime. And it happened faster than anyone expected. This new reality has far-reaching implications for the provincial government's decision process for allocation of water for agriculture and fisheries in British Columbia.

Groundwater licensing is a cornerstone for successful implementation of the WSA, in part because groundwater sustains flow in streams. There is just "one water". Groundwater and surface water are connected.

Whether we are talking about historical or new groundwater licences, or surface water licences, all water comes out of the same system. At the end of the day, what is licensed must be based on what is available. Thus, it is material that the methodology for irrigation allocation has evolved over time as better climatic data has become available.

Viewed through this lens, there are three key messages. First, put the science in water licensing. Secondly, it is all about food security. And thirdly, give people only what water they need today.

THE OVER-ARCHING TAKEAWAY MESSAGE IS TO LINK WATER ALLOCATION AND WATER LICENSING TO MAKE BETTER DECISIONS:



"For irrigation water use, it is important to link water allocation and water licensing. The takeaway message is that we must continually strive to improve the licensing system by taking advantage of all the science as it comes along. And that is what BC has been doing over the last 15 years with a science-based approach. We have much better information today to make licensing decisions. That's the bottom-line."

Ted van der Gulik
Partnership for Water Sustainability in BC
Chair, BC Agricultural Water Demand Model

Water Allocation, Irrigation and Food Security

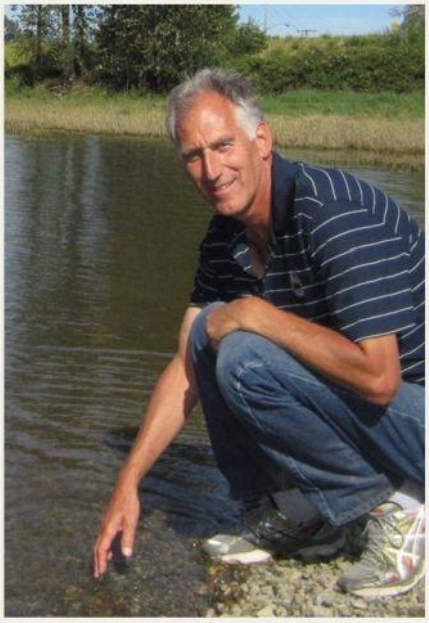
Irrigation for agriculture is a dominant use of water in British Columbia, the need is seasonal, and use peaks when water supply is at its lowest. For the first 100 years of water licensing, provincial water managers did the best they could with some very rudimentary climate data and guesstimates for allocating water for irrigation. By the late 1970s, an early science-based approach emerged.

By 2006, the provincial government's response to a changing climate culminated in development of a powerful tool called the Agriculture Water Demand Model (AWDM). This tool puts the science front-and-centre in water management, The AWDM is the vital link between water allocation and water licensing. Having better information on water need allows provincial water managers to make informed decisions when adjudicating water licence applications.

By 2024, the AWDM program will be fully implemented across British Columbia. The AWDM provides the technical foundation for achieving this provincial goal: **Irrigate as much land as possible across the province to achieve food security over time**.

Ted van der Gulik
Partnership for Water Sustainability in BC
Chair, BC Agricultural Water Demand Model

"The Partnership is program delivery manager for the Agriculture Water Demand Model (AWDM), a multi-year and province-wide program. This water management planning tool calculates current and future agriculture water demands in British Columbia, and accounts for climate change. Inputs for the AWDM include land use, soil and climate information. The field component of the AWDM program centres on compilation of land use inventories for all regions of the province."



The Story Behind the Story of the Agriculture Water Demand Model (AWDM)

The genesis for the AWDM was the 2003 "teachable year". In the Okanagan, for example, the response by local governments and others to the drought crisis was to look to reallocation of agricultural irrigation as a solution to water woes in urban areas. Agricultural irrigation accounted for some 80% of total water use in the region. Surely, their thinking went, unused agricultural irrigation water could simply be reallocated for residential use in cities.

"The contribution by the research team members at the Summerland Research Centre was huge! It was basically two components that we had to do. We had to survey all the farms. We had to know exactly what they were going. And what kind of irrigation system they had. Then we incorporated soils from the soils database."

Ted van der Gulik

Role of Summerland Agriculture and Research Centre: "That's when I started thinking that we don't even know how much we need or how much we have," recalls Ted van der Gulik, the former Senior Engineer with the Ministry of Agriculture. "So how could we start going down that path? And that was the genesis for the AWDM. I had no idea at the time as to what it was going to look like or what it was going to be. I was thinking that it would be something very simple."

"But I was working with researchers, notably Denise Nielsen, a research scientist with the Summerland Agriculture and Research Centre for Agriculture and Agri-Food Canada. Denise and her colleagues go beyond simple. They said no, we can get this down to an exact science."

"And then came the biggest challenge. It wasn't the most money, but it was the hardest job, and that was to downscale climate data to a 500m climate grid. That was the game-changer. Because then we had daily data and when you have daily data you can calculate crop water use every day throughout the entire growing season."

“The model did that for all the climate cells in the Okanagan. For all the crops on every property. And it did it in about 3 minutes. You’re talking billions of calculations. We could then run a whole series of years. We did all that and compared years."

“We matched up the model results with an irrigation district that had meters. And the two sets of data tracked very closely. Our tool is doing a pretty good job calculating agricultural water demand, we concluded. And that led us from the Okanagan to do the rest of BC."

A Look Ahead to Future Water Allocation

“We are running out of water. Because we won’t have as much in the future, it becomes very important to start allocating water to people based on what they actually need. And what they can get by with in a drought year. That is what we are doing with the AWDM tool," continues Ted van der Gulik.

“That’s the message for water allocation. Use the science and information that has become available in the last 10 to 15 years. Put it into the water licensing system, which is what we have done.”

“We want to divvy up the water as equitably as possible to irrigate as much land as we can to grow as much crops as we can to achieve food security in the province of BC. It is all about food security. If we want to make the most beneficial use of that water, we only want to allocate as much water as each farm needs to grow their crop."

“That is the bottomline. That is message when we say it is about ONE WATER. It is also about allocating water fairly to farmers so that they have sufficient water to grow their crops TODAY. In the future, they are going to have to manage use more efficiently. The solution is NOT to give them more water today to use in the future."

Story of Water Allocation for Irrigation Use

"The earliest licence that we can find for irrigation purposes in British Columbia goes back to November 1859. For the first 100 years, licences were based on flood irrigation as sprinkler irrigation did not become available until about 1950. The early licences often included an allowance for conveyance losses in the ditches transporting water to the farm and used a vague determination of climate requirements," states Ted van der Gulik.

"Most of these licences are still on the books today, and where the conversion to sprinkler irrigation has been made, and with improvements to conveyance systems through pipelines, many of the early licences may be in excess of what is required today."

1950 to 1980

"In the 1950's with the advent of sprinklers and piping systems, the conveyance allocation may have been reduced or eliminated entirely for many new applications. Since sprinkler systems were also more efficient than flood irrigation, the licence volumes would have been reduced even further."

"The process was still subjective but slightly refined as climate data became more readily available. This process continued until around the late 1970's."

1980 to 2016

"In the late 1970's Sly and Coligado from the Ministry of Environment developed an algorithm that determined water allocation by using crop, soil and Climate Moisture Deficit (CMD) information. The term Maximum Soil Water Deficit (MSWD) was developed. The MSWD determined how much water could be stored in the soil profile for the crop's rooting depth."

"The algorithm also incorporated the Climate Moisture Deficit from a climate station during the irrigation season. The number of climate stations at that time was quite limited, usually restricted to Environment Canada stations."

"The information provided by this methodology was incorporated into the BC Sprinkler Irrigation Manual published by the Ministry of Agriculture in 1979. Although provincial government water managers had access to this information, they usually contacted the Ministry of Agriculture to help determine a water allocation. While this was an improvement it was still a bit of a guess when a farm was not located close to a climate station."

"This methodology did allow some capability of licensing to a particular crop and soil type. What it did not do was incorporate crop coefficients or irrigation efficiencies for systems other than sprinkler. While it was much better than earlier estimates, improvements could still be made."

The Game-Changer: "In 2006, the Ministry of Agriculture developed the Agriculture Water Demand Model (AWDM) in response to the need to secure water to BC's agricultural land. Originally developed for the Okanagan region in 2009, it has since been expanded to cover the entire province. Work is still ongoing but most of the province is expected to be completed by 2024."

"Since the AWDM could be run for any crop, soil and irrigation system combination across the province, we used it to determine agricultural water demand across the province."

"With longer and drier summers being the new reality for water management, the AWDM is a game-changer for achieving food security in British Columbia. We have downscaled climate data to a 500-metre grid across the province. This means we can reliably estimate the total water need for agricultural irrigation. This further means that the Province can align water allocation and water use."

2016 to 2021

"The AWDM program led to development of the BC Agriculture Water Calculator, which supports groundwater licensing by the provincial government, and the BC Landscape Water Calculator. The power of these tools is that they are linked to the provincial 500 metre gridded climate database that was built for the AWDM."

"When the Water Sustainability Act coming into force in 2016, the BC Agriculture Council asked the province to develop a tool help producers determine how much water they should be applying for. The province turned to the Partnership for Water Sustainability for assistance. This request was the catalyst for development of the BC Agriculture Water Calculator."

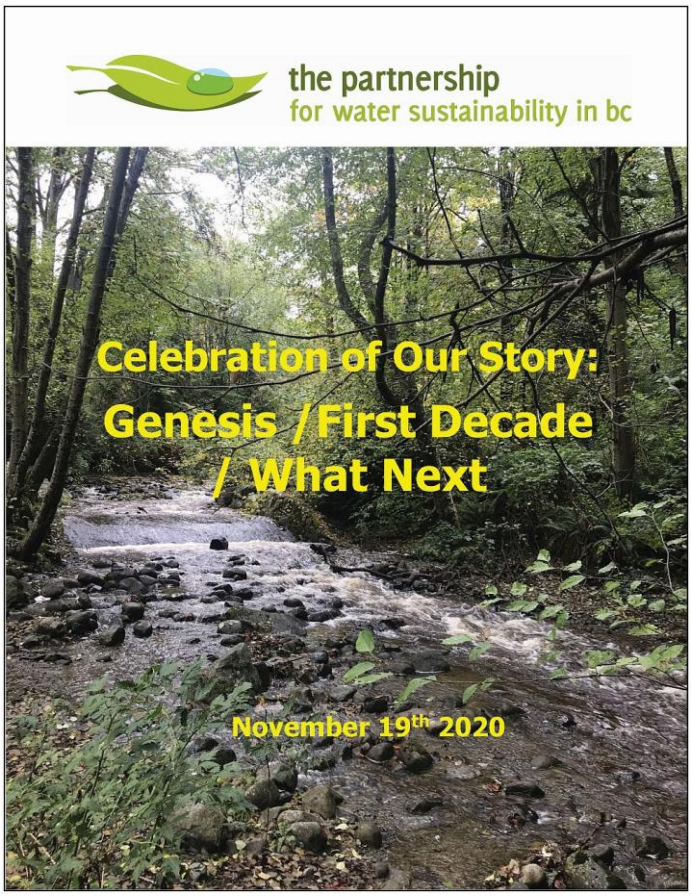
The Next 50 Years

"We will continue to refine the calculator as better data become available. For example, the calculator has the ability to incorporate a climate change factor into the water allocation calculation. But the provincial government has not asked for it. There are three reasons for not doing it."

"First, the beneficial use clause in the WSA states that water must be used within three years. A climate change allocation would not be used for a number of years."

"Secondly, allowing a climate change factor would essentially mean that fewer farmers would be able to secure a licence, especially in regions with a diminishing water supply. Allocating more water to farmers now for future use would mean less area could be irrigated today, which then affects food security."

"Thirdly, and in view of longer, drier summers, it is quite likely that water would not be plentiful in the future anyway."



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https://waterbucket.ca/about-us/

About the Partnership for Water Sustainability in British Columbia

Incorporation of the Partnership for Water Sustainability in British Columbia as a not-for-profit society on November 19, 2010 was a milestone moment. Incorporation signified a bold leap forward.

Over two decades, the Partnership had evolved from a technical committee in the 1990s, to a "water roundtable" in the first decade of the 2000s, and then to a legal entity. The Partnership has its roots in government – local, provincial, federal.

The Partnership has a primary goal, to **build bridges of understanding** and pass the baton from the past to the present and future. To achieve the goal, the Partnership is growing a network in the local government setting. This network embraces collaborative leadership and **inter-generational collaboration**.

The Partnership believes that when each generation is receptive to accepting the inter-generational baton and embracing the wisdom that goes with it, the decisions of successive generations will benefit from and build upon the experience of those who went before them.

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