



Reply to Comment on “Applying a science-forward approach to groundwater regulatory design”: Paper published in *Hydrogeology Journal* (2023) 31:853–871, by Deborah Curran, Tom Gleeson and Xander Huggins

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The Comment on the subject article “Applying a science-forward approach to groundwater regulatory design (Curran et al. 2023)” is welcomed. The original paper developed an interdisciplinary language for and approach to examining the design of groundwater regulations and applied it to the subnational jurisdiction and new groundwater regime of British Columbia (BC), Canada. Building on the scholarly literature that identifies the failure of groundwater governance as a primary threat to groundwater sustainability, the authors of the original paper (two hydrogeology and one legal scholars) sought to promote interdisciplinary collaboration towards better legal scaffolding for groundwater by identifying characteristics of groundwater itself and applying those to necessary regulatory design.

The scope of the Comment is limited to the application of the science-forward regulatory design principles to BC. The Comment authors agree with the value of science-forward regulations and did not call into question the primary purpose or approach. The insider perspective put forward by the authors of the Comment, two of whom were involved in the development of the BC groundwater regulatory regime, is appreciated, and their understanding of the political and

operational realities of implementation provides additional and useful context for the article. The intent was not to unfairly dismiss political realities and the historical regulatory context that posed significant challenges to the science-forward approach. It is also important to acknowledge the principal research and programs that laid a foundation for a science-forward approach. Yet with respect, the Comment’s focus on the pragmatic design of new groundwater regulation in BC challenges the long-term term necessity of a science-forward approach. This Reply addresses three aspects of the Comment: the assertion that legislation is required for data collection, flexibility within the new legal regime for groundwater, and Indigenous water rights.

First, the Comment authors assert that there was an “understanding of the varied and complex nature of hydrogeology of BC” prior to regulation, but that regulation (that would lead to better quantification of groundwater use through licensing) was needed to better understand environmental and cumulative impacts. However, a science-forward approach would ensure licensing meets groundwater sustainability objectives that are set based on the best available science at the time. It is acknowledged that government budget resources are directed towards topics that involve the exercise of regulatory jurisdiction; however, both in authority and behaviour, the Province of BC acted on groundwater long before it established a statutory scheme in 2016 for its use. Without detailing the Crown prerogative or powers of the executive branch of government to act pursuant to the common law in Canada (Banfield and Flynn 2015; Government of Canada 2015), the Comment notes 1960 as the year that state law vested groundwater in BC when amendments to the *Water Act* included groundwater in the definition of a stream. In the following year, the Province of BC initiated its

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groundwater program following a science-forward approach to study, map and monitor aquifers, and it demonstrated both its interest in and jurisdiction over groundwater as part of the entire hydrologic cycle.

Second, the Comment identifies a range of legal mechanisms in the regulatory regime for groundwater that are characterized as providing flexibility in the regulatory system. The Comment cites, for example, the ability to make emergency orders to cease taking water and identification of priority areas. However, in designing the new groundwater regulation, the new regulatory regime did not take advantage of any of that enabled flexibility and applied groundwater licensing uniformly across the varied hydrogeology of the province. A science-forward approach would enable a consistent water rights system across the province but prioritize regulatory action of “groundwater licensing and planning attention to those areas identified as having the highest priority aquifer and connected surface-water stress” (Curran et al. 2023). In addition, the automatic recognition of an entitlement to take groundwater based on past use without an assessment of environmental-flow needs means that the regulatory flexibility relies on real-time administrative responsiveness to drought conditions rather than establishing a regulatory apparatus tailored to the specific conditions of a watershed. With over half of BC regions facing the highest possible drought rating in summer 2023 (Province of BC 2023a), there is no possibility of sufficient government resources to adequately respond. Prior to 2019 there had only ever been one watershed within which emergency orders had been made, a number that increased to five between 2019 and 2023. Using a science-forward approach would require watershed or basin assessments and planning. These features are enabled but unused in BC, save for the scenario in the Xwulqw’selu (Koksilah) watershed, where a water sustainability planning process started in 2023 (Province of BC 2023b). Note also that 7 years post-enactment, not a single area- or topic-specific regulation has been enacted.

Third, the Comment questions the observation that the new *Water Sustainability Act* did not acknowledge Indigenous rights and points to the application of Sect. 35 of the *Constitution Act, 1982*, which affirms aboriginal and treaty rights in Canada. During consultation on amendments to the *Water Act*, the end-point of which was the enactment of the groundwater regulation and new legislation, Indigenous organizations called on the Province of BC to act beyond the colonial legal construct of Sect. 35 and acknowledge their jurisdiction and stewardship responsibilities for water (BC Assembly of First Nations 2010, 2013; Cowichan Tribes 2010; Union of British Columbia Indian Chiefs undated). Even prior to this recent era of state implementation of the United Nations Declaration on the Rights of Indigenous Peoples, the Province of BC had entered into unique governance arrangements—such as for the regions of Haida

Gwaii and the Great Bear Rainforest—that go far beyond court-mandated aboriginal rights recognition and amended provincial law to accommodate those expressions of Indigenous authority (Curran 2017; Curran and Napoleon 2020).

Finally, it is important to acknowledge the Comment’s concluding observations calling on the regulator to vest all water (not just water in streams and groundwater) in the state government, require monitoring and reporting of some water uses, and consider licence term limits. The original article has discussion and support for the latter two recommendations (see the subject article section *Implications for Future Regulatory Design and Recommendations: Assessing the current regulatory design in British Columbia* and Table 1). In addition, the first recommendation’s gesture towards capturing all water within legal arrangements is important for a science-forward approach to law because treating rainwater, for example, separately from surface water in streams and groundwater leads to fragmented regulation. However, the Comment’s focus on “vesting” water ownership and regulatory authority with the state government does not acknowledge the operation of Indigenous legal orders within BC. Indigenous governing organizations are already establishing legal structures and making operating orders that affect all water users within their traditional territories—for example, Gitanyow Hereditary Chiefs established their Gitanyow Aks Ayookxw (water policy) to create water quantity and quality parameters for waters within the six governing house group’s Gitanyow Lax’yip (territories) (Gitanyow Hereditary Chiefs 2023). Building on the decade-old agreement between the Province of BC and Gitanyow Hereditary Chiefs implementing the Gitanyow land use plan, the Aks Ayookxw takes an explicitly ecosystem-based approach and requires proponents to obtain consent from the Indigenous community. Unlike state water law, the Water Policy “uses a system of water classification to provide a proactive, structured approach to establishing water quality and quantity standards...based on ecological, cultural and/or hydrological significance, protection status, presence of sensitive, ecologically or culturally valuable species, resilience to climate change impacts, and other characteristics or risk factors within the watershed”. (Gitanyow Hereditary Chiefs 2023 at 5). In addition, mirroring the emergency order powers available to the Provincial government to address critical low flows, amidst summer 2023 historic low flows, the Penticton Indian Band issued a fish protection order. Noting “that the survival of Syilx fish populations is threatened”, the Penticton Band’s order restricted surface-water extraction in Shingles Creek pursuant to its authority as the rights holder responsible for water within its traditional territory (Dacre 2023).

Returning to the definition of regulatory design in the original article as the sum total of choices of legal approaches and strategies that result in a regulatory

infrastructure intended to meet specific policy outcomes, noncompliance by more than half of required users is an indication of failure by most measurements of regulatory success. This is the case for BC, where more than half of existing groundwater users did not apply for a licence within an extended 6-year period for compliance (MacLeod 2021; Forsyth et al. 2022; CBC News 2023). That failure many more factors—both historic and contemporary—than just the regulatory design; however, an analysis of BC’s regulatory approach in the context of the prominent international literature on groundwater regulation directing a science-forward approach is warranted. Undoubtedly more nuanced legal arrangements implicating multiple legal orders for water governance will emerge in the future. In conclusion, groundwater regulations are still relatively new to BC and there is still time to course correct by: (1) defining sustainability goals and ecological thresholds; (2) regionalizing and prioritising; and (3) planning for the long term and adaptively.

Declarations

Conflicts of interest The authors declare no conflicts of interest.

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